

Delaware Opinion on Offshore Wind Power

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Background

This interim report summarizes initial analysis of survey work undertaken in response to a November 30, 2004 Green Energy Fund Request For Proposals issued by the Delaware Department of Natural Resources and Environmental Control (DNREC), Delaware Energy Office. The Energy Office made the award to Jeremy Firestone and Willett Kempton, College of Marine and Earth Studies, University of Delaware, in 2005; however, the project did not commence until February 1, 2006, when matching funds were secured.¹ The project has two principal components: (a) a survey of Delaware residents' opinions regarding offshore wind development and (b) an analysis of Delaware's present regulatory regime for offshore wind power and options/recommendations for amendments to the same. This Interim Report provides preliminary analysis of the survey data,² and where useful, draws comparisons to other recent surveys of public opinion regarding wind power development off the US coast.

Survey Development

In February 2006, we commenced development of a semi-structured interview protocol. An initial interview protocol was developed from the experience gained in Cape Cod, Massachusetts (Kempton, et al. 2005) and in New Jersey. The Cape Cod interviews were conducted with the controversial Cape Wind Nantucket Sound Wind Farm proposal as a backdrop while the New Jersey interviews occurred in parallel with a series of lightly publicized public meetings convened by the NJ Blue Ribbon Panel on Offshore Wind Power. In contrast, until the fall 2006, there had been little, if any, public debate on offshore wind power in Delaware. As a result, the semi-structured interview protocol was modified from those earlier efforts. More specifically, it was designed to assess not only the state of knowledge and existing views, but in addition, how the provision of factual information on offshore wind power might affect views.

¹ This survey was thus conceived of prior to current proceedings in Delaware that have resulted in a bid for offshore wind. The semi-structured interviews were carried out entirely prior to these proceedings. Further, all surveys were sent out, and almost all returned, before this bid became widely covered in the media.

² Under funding from Delaware/NOAA Sea Grant, a related tourism impacts survey of out-of-state residents will be undertaken during summer 2007.

Between March 23, 2006 and May 15, 2006, twelve in-depth, semi-structured interviews were conducted. Interviews were transcribed and transcripts were analyzed to discover common themes and areas of agreement and disagreement.

Based on the earlier Cape Cod survey instrument and the findings of the semi-structured interviews (Firestone and Kempton, 2007), a set of 49 survey questions was developed. In order to permit comparison with the results from the Cape Wind survey, some specific questions from that survey instrument were incorporated. A draft survey instrument was pilot tested at the Department of Motor Vehicles (DMV) office in Wilmington, Delaware on June 29-30, 2006. The DMV was selected as the pilot location because the individuals who frequent the office represent a wide cross-section of the population. Individuals were surveyed coming in and out of the entrance to the building and while waiting in the inspection line and were queried regarding survey comprehension, length and potential bias. Eighty-two pilot-test surveys were completed. Based on the queries during the pilot test, the survey instrument was modified slightly. In all, between May and September 2006, the survey went through eighteen iterations before the final survey instrument was produced.

Survey Instrument

The survey has four sections, with questions: (1) seeking attitudes and opinions concerning wind power and the possibility of having offshore wind power in Delaware; (2) asking respondents to choose among a status quo option of coal or natural gas and different offshore wind power scenarios; (3) concerning beach habits and how they might change with the presence of an offshore wind farm; and (4) requesting demographic data for statistical analysis of the survey responses.

In the second section, the scenarios can differ in five basic characteristics: the location; distance from shore; the amount of rent/royalty payments made to Delaware; where those payments would be funneled (e.g. Green Energy Fund, Beach Nourishment Fund); and the amount of a fee, if any, that would be added to monthly electricity bills for three years. To provide a range of scenarios, respondents were asked to “vote” among the options three times, with the wind farm attributes varying each time. To accomplish sufficient variation among attributes for statistical analysis, while at the same time keeping the survey short, twenty-five different versions of the survey were prepared. In this Interim Report, only broad comparisons between wind power and the status quo option are reported; the more detailed analysis of these questions will be provided in a later report. The survey was printed in booklet form, with a cover depicting a coastline and lighthouse with the words “What will the future hold?”, intended to avoid any explicit reference to the subject matter (to reduce self-selection sampling bias), yet to engage the recipient to open the booklet and to begin.

Survey Sample

In order to permit us to analyze how both Delaware residents as a whole and coastal residents feel about offshore wind power, coastal areas of Kent and Sussex Counties were over-sampled (using 2000 census tract and block data). A random stratified sample was drawn from three areas

(strata), which were denominated “Bay,” “Ocean” and “Inland.” Table 1 provides the particulars. Names and addresses were then supplied by the firm, Survey Sampling International.

Each individual was asked if he or she owned a house in a beach community as a second home as well as the closest distance from that individual’s house or beach house to the nearest ocean or bay beach. As can be seen in Table 1, the strategy to break Delaware into areas resulted in an Ocean area that has individuals who live on average less than a mile to the beach, and a Bay area, with individuals on average living four miles to the beach. Finally, post-sampling, we bifurcated the Inland sampling area into two areas for further analysis: (a) those individuals who indicated that they owned a beach house or that the closest distance to the beach was less than 4 miles (“Second Home”) and (b) those inland residents who did not own a coastal home (“No Coastal Home”).

Table 1. Sampling Size by Area

Area (Strata)	Sample Size (n)	Completed Surveys Analyzed	Census Tracts/Blocks	Description	Average Distance to Beach (miles)
Bay	400	203	501.03 509 (1) (2)	Slaughter Beach; Fowlers Beach; Prime Hook Beach; Broadkill Beach	4
Ocean	400	182	511 512	Rehoboth Beach; Dewey Beach; Bethany Beach; South Bethany; Fenwick	0.6
Inland	1200	564	All remaining census tracts and blocks in Delaware	All of Delaware, excluding the above.	NA
Post-Stratification of Inland					
Second Home	1200	111	Varies	Own Second Home	2.47
No Coastal Home		453	Varies	Inland	47.15

Survey Mechanics

Between September 18th and 20th 2006, a survey packet was mailed to 2000 members of the Delaware population. Each survey packet contained a cover letter, the survey instrument, photo simulations of what an offshore wind farm might look like at various distances from shore, and a map broadly depicting three potential wind farm locations [Bay, Ocean (north) and Ocean

(south)]. Each survey instrument was marked with an identification number. Three weeks later, reminder postcards were sent to the entire sample, and then, between October 28th and 30th, approximately 1250 survey packets were re-sent to those individuals who had not yet returned their completed surveys. Of the 2000 mailings, 161 were undeliverable or the addressee had deceased or was otherwise incapacitated while 955 were returned completed, for a response rate of 51.9% (this compares favorably to the 38.5% response rate achieved with the Cape Cod survey). See Table 1 for a breakdown of survey responses analyzed by area (strata).³

Survey responses were coded and surveys entered into a database by two coders during October to December. Each coder cross-checked the data entered into the database for fifty survey questionnaires by the other coder and then the entire database was cleaned of any errors or inconsistencies. The data was analyzed using the STATA 9.0 statistical software. STATA 9.0 was selected because it can account for complex survey design (stratification and cluster sampling) in computing standard errors of estimates.

Survey Response, Over-sampling and Weighting

As noted above, we over-sampled the Ocean and Bay regions. As a result, when examining Delaware opinion statewide, we weighted each response by the inverse of the probability that it was included. We also weighted the sample due to response biases. Survey respondents were more likely to be male, older, and wealthier than the population being studied (those members of the Delaware population who are over 19 years of age). These biases are not uncommon in survey research (Firestone and Kempton, 2007). After adjusting the weights, statewide sample demographics mirror population demographics.

When looking at individual areas, we do not need to account for over-sampling; however, corrections for demographics biases are still needed. We weighted the three areas in the following manner.

- We weighted the Inland sample so that it would match the age, sex, and income demographics of the State, as the Inland area includes eighty-nine percent of Delaware households, and thus likely follows statewide demographics closely.
- We individually weighted the Ocean and Bay samples to match statewide gender demographics only. Because these areas represent such a small percentage of the Delaware population and because age and income demographics of these areas may be significantly different than the state as a whole, we only weighted based on sex.

Survey Results

Here, we report on answers to several survey questions, not necessarily in the order asked. We detail answers to questions regarding (1) the placement of wind turbines in the ocean and/or Delaware Bay; (2) support or opposition for the Cape Wind facility should it be built off the

³ Six completed surveys were postmarked after the date that bids for additional power in the State were filed and were not received until after January 1, 2007. They are not included in the statistical analysis presented here.

Delaware coast rather than off of Cape Cod; (3) support or opposition of a “test facility” of two or three turbines; (4) the effect of wind turbines on beach visitation behavior; (5) whether the respondent would vote for offshore wind or “expansion of coal or natural gas power”; and (6) to the extent any rents or royalties are generated, the preference for where those funds should be dedicated and deposited.

1. Placement of wind turbines in the ocean or Delaware Bay

As seen in Table 2, there is strong support for offshore wind power among Delaware residents. More than ninety percent want the state to either encourage and promote or allow in appropriate circumstances offshore wind power development in the ocean while less than one percent desire wind turbines be prohibited in all instances in the ocean. Very strong support for a state policy advocating wind turbines in the ocean is found among ocean area residents as well, although opposition increases to 6.4 percent. There is also strong support for offshore wind development in Delaware Bay, although the support is somewhat less than in the ocean. When asked their preference between the ocean and the Bay, the majority of Delawareans expressed no preference, with 31.6 percent preferring the ocean and 16.3 percent preferring the Bay. Other factors such as distance from shore and the amount of rents and royalties that Delaware ultimately might receive should it enact a rent and royalty scheme for wind power projects located in Delaware Bay, which is state waters, or in state oceanic waters (a scheme is already in place for federal waters, although the rents and royalties inuring to Delaware are likely to be less in those waters than in state waters), may affect the preference for the ocean given in this simple question. More detailed analysis of these tradeoffs will be reported in a supplemental report.

Table 2. Placement of Wind Turbine in the Ocean or Bay

Turbine Placement	Out on the Ocean		In Delaware Bay	
	Statewide (%)	Ocean (%)	Statewide (%)	Bay (%)
Policy				
Encouraged and Promoted	55.3	49.1	47.3	40.4
Allowed in Appropriate Circumstances	36.7	33.3	39.1	38.4
Tolerated	3.1	6.6	5.3	1.7
Prohibited in all instances	0.7	6.4	2.7	11.4
Not Sure	4.2	4.6	5.2	8.0

2. A Delaware “Cape Wind” Offshore Wind Facility

In order to provide a close comparison to our prior study of Cape Cod, we matched questions and provided visual information in the Delaware survey that most Cape Cod residents would have received as part of public debate. Delaware respondents were presented the following description of the “Cape Wind” project:

“A private developer has proposed to place 130 wind turbines that stand 423 feet high out on the ocean off of Cape Cod, Massachusetts for electricity generation. The project would be approximately 6 miles from the nearest coastal town. *For questions 9-13, suppose this project were instead developed off the Delaware coast.*”

The respondents were then asked to examine an enclosed page of ocean photo simulations to see what the project might look like from different distances from shore, including from six miles. They were then asked whether they would support or oppose this project if it were in Delaware. In this question, respondents were thus asked to choose between this project and no energy development of any kind. The results, which are provided in Table 3, indicate that an offshore wind farm is likely to garner significant support throughout the state. Statewide, support registers 18.5 times as much as opposition, and even in the ocean area (where respondents live on average approximately 0.6 miles from the coast), support outnumbers opposition 3.33 to 1. And of those individuals who live in the Inland portion of the state, “Second Home” owners are as supportive as those individuals who do not own a beach house (labeled “No Coastal Home” in Table 3). Because respondents were also asked who supplied their electricity (Delmarva Power and Light, Delaware Electric Cooperative, or City/Town municipal utility), we are able to analyze the results by electric supplier. Here, we find no significant difference among electric suppliers—with support ranging between 77 and 80 percent (not reported in the Table).

Table 3. Support for 130 turbine wind farm 6 miles from the Coast

	Areas/Populations of Delaware				
	Statewide (%)	Ocean (%)	Bay (%)	Second-home (%)	No Coastal Home (%)
Support	77.8	65.0	73.5	79.0	77.9
Oppose	4.2	19.5	9.0	3.5	4.0
Unsure	18.0	15.5	17.5	17.5	18.1

We then presented a list of possible impacts of a wind farm and for each, asked if they thought this project would have positive impacts (improve), negative impacts or no impact at all. Table 4 gives the results, divided by supporters and opponents. This table includes only the ocean area, as the Ocean sub-sample had the most divergence of opinion, and thus an analysis of that opponent group is potentially more policy relevant. A large majority of the Ocean area opponents perceive negative impacts to aesthetics (100%), tourism (85%), property values (85%), navigation, bird life, recreational boating and fishing, and the local fishing industry. A much smaller percentage believe there will be an improvement in electricity rates. Somewhat puzzling, more opponents see the wind farm as having negative impacts on air quality and climate change than positive impacts. A smaller, but still large majority of Ocean area supporters believe the wind power project would have positive effects on electricity rates (78%), air quality (68%), and job creation (57%) and climate change (39% positive, 0% negative), but negative impacts on aesthetics (41% negative to 3% positive).

Table 4. Believed negative and positive impacts of the Delaware Cape Wind project for the Ocean Area by Support and Opposition

Item	Opponents			Supporters		
	Improve	No Impact/ Not Sure	Negative	Improve	No Impact/ Not Sure	Negative
Local Fishing Industry	2%	39%	58%	19%	76%	5%
Tourism	0%	15%	85%	5%	88%	8%
Job Creation	11%	81%	8%	57%	42%	2%
Air Quality	2%	92%	6%	68%	32%	0%
Electricity Rates	26%	66%	8%	76%	23%	1%
Aesthetics of view	0%	0%	100%	3%	56%	41%
Property Values	0%	15%	85%	9%	81%	10%
Marine Life	11%	44%	45%	20%	76%	4%
Bird Life	6%	26%	68%	6%	79%	15%
Recreational Boating/fishing	0%	39%	61%	8%	77%	14%
Reduce Climate Change	2%	87%	8%	39%	61%	0%
Navigation Safety	0%	24%	76%	6%	72%	22%

We then asked individuals to write-in the three most important issues in deciding whether they would support or oppose the project. In this task, unlike the prior one, they could write in any issue of concern they wanted, not limited to our categories. In Table 5 we present the statewide results by supporters only (given the very small percentage of opponents ~4%, we do not present the data here) and, the results for the Ocean area by both supporters and opponents.

Delawareans’ strong support for offshore wind power appears to be based primarily on concerns over electricity rates and air quality. Ocean area opponents are primarily driven toward opposition based on aesthetic grounds and concerns over marine life impacts, while Ocean area supporters identify air quality and electricity rates as the prime factors affecting their support for wind power. Interestingly, aesthetics ranks a strong third (15%) for Ocean area supporters, however to the extent they find offshore wind turbines to have a negative impact on aesthetics (41% negative; only 3% positive, Table 4), they remain supporters of offshore wind power for other reasons; presumably they believe that offshore wind power’s potential positive impacts on electricity rates, climate change and air quality outweigh its anticipated negative impact on aesthetics.

Table 5. Factors reported to most affect decision to support or oppose “Delaware Cape Wind Project, (open-ended, ordered by overall statewide rank of Top)

Issue	Statewide	Ocean Area	
	Supporters' Top (%)	Opponents' Top (%)	Supporters' Top (%)
Electricity Rates	29	6	18
Air Quality	18	0	19
Marine Life/Environmental Impacts	14	23	6
Jobs/Economic Concerns	7	0	6
Recreational Boating and Fishing/Boat Safety	6	3	6
Alternative/Renewable Energy	4	0	8
Foreign Oil Dependence	4	0	8
Aesthetics	3	53	15
Global Warming/Climate Stability	2	0	4
Fishing Impacts	2	0	1
Distance From Shore	1	0	<1
Tourism	1	6	1
Property Values	1	6	1
Private Use of Public Lands	< 1	0	0
Other	8	4	5
Total	100	101	98

The support and opposition found in Delaware for offshore wind are directly comparable to the results from a probability sample of Cape Cod residents (for which the question asked and sampling methods were the same) and to a lesser extent are comparable to a non-probability convenience poll⁴ by other researchers of New Jersey beachgoers (Mills and Rosen, 2006). As can be seen in Table 6, Delaware residents are stunningly more supportive of offshore wind farm development than either residents of Cape Cod or of New Jersey. Most telling, is a comparison among those Delaware residents who can see the ocean from their home (55.9 percent supportive⁵) to the much more diverse populations of New Jersey beachgoers (41 percent supportive) and Cape Cod residents who believe that they will have a view of the Cape Wind project (22.2 supportive or leaning toward support).

⁴ Individuals were approached on the beach, in parking lots, and on boardwalks and asked to fill out a questionnaire. This approach can result in a skewed sample (e.g., those that seem approachable or that on their own approach the examiner), leading to a non-probability sample. In addition, the researchers did not present, nor may they even have, any data on rates of refusal, thus raising concerns about non-response bias. Finally, the sample included New Jersey residents and non-residents alike, but excluded non-U.S. residents and individuals employed in tourism-related industries, by the State of New Jersey, by a public utility or by an environmental organization. For this reason, it was not a random poll of the entire population.

⁵ 69.2 percent in the Ocean area without an ocean view support the project, with 17.0 percent opposed and the remainder undecided. The difference in support between those with and without a view, however, is not statistically significant (p=.13) given the size of the sample in the Ocean area.

Table 6. Support for Offshore Wind at Six Miles from Shore in Delaware, Cape Cod and New Jersey

	Sample Area						
	DE State	DE Ocean	DE Ocean View	Cape Cod	Cape Cod (including those leaning)	Cape Cod View of Wind Farm (w/leaners)	New Jersey Ocean Beaches
Researchers	Firestone, Kempton and Krueger			Firestone and Kempton			Mills and Rosen
Study Date	Fall 2006			January 2005			July-Aug 2006
Method	Mail Survey			Mail Survey			Personal Interviews
Sample Type	Probability			Probability			Convenience
Respondents	Delaware Residents			Cape Cod, Martha's Vineyard and Nantucket Island Residents			Resident beachgoers at 20 beaches in 4 ocean counties
Scenario	6 mile clear day simulation			Project in the news, closest town about 6 miles			6 mile clear & hazy day simulations
Responses (N)	949	178	55	504	504	18	~500*
Support (%)	77.8	65.0	55.9	24.6	43.8	22.2	41
Oppose (%)	4.2	19.5	24.2	42.4	55.5	77.9	27
Unsure** (%)	18.0	15.5	19.9	32.3	0.7	0	32

*Overall there were 4,026 New Jersey respondents; however, each interviewee was shown pictures depicting wind turbines at one of four distances. Here, we use the results from six miles for comparison purposes. There also were approximately equal numbers of residents and out-of-state visitors. In this table, we report only resident responses.

**The Delaware survey used “unsure”; the Cape Cod survey used “I have not yet made up my mind”; the New Jersey survey used a 5 point scale and then collapsed 1 and 2 into support, 4 and 5 into opposition, and called 3 “neither favor nor oppose.”

Several factors may account for these differences. First, Cape Wind may be an aberration given the well-financed opposition. Second, the New Jersey results may be biased given sampling methods. Third, attitudes toward offshore wind and/or knowledge of and concern regarding global warming may have changed in the last two years. Fourth, factors such as concern over environmental effects of conventional means of electricity generation and desire for electric rate stability may be greater in Delaware than in Cape Cod or New Jersey given long-standing air quality issues and their related health impacts in Delaware and the recent electricity price shock for Delmarva customers. Fifth, Cape Cod residents may feel a greater sense of place attachment to Nantucket Sound, the proposed location of the Cape Wind project, than Delaware residents do to the Delaware coast. The difference in place attachment could arise because people feel differently about more enclosed seas (sounds and bays) than open-ocean, because of the historical prominence and traditions of the Nantucket area, and/or because of differences in the length of home ownership on Cape Cod versus the Delaware coast. Place attachment also may

have more resonance in Cape Cod than Delaware because Cape Cod survey respondents were expressing their opinion on a live, concrete example while Delawareans were judging a hypothetical project. We will try to sort out the causes among these hypothesized reasons as we conduct more detailed analysis.

Offshore wind development has been hampered in the US due to the prominent opposition in Massachusetts. Therefore, whatever the causes, the strikingly higher support for offshore wind development in the mid-Atlantic, and especially off Delaware, suggests economic and policy opportunities for the state. In a related study on the size of the offshore wind resource in the Mid-Atlantic Bight, Kempton, et al. (2007) find a very large wind resource off the coast, including Delaware. Even after excluding areas such as shipping lanes, bird flyways, near view of tourist beaches, etc, the resource available from already-demonstrated wind technology is over four times the electrical load of the coastal states. Those findings, in conjunction with substantial support for offshore wind registered here (as evidenced by the overwhelming statewide support for a 130 turbine offshore wind turbine project and majority support for Delaware to not only allow offshore wind power development but to “encourage and promote” it in the Ocean), suggests that Delaware policymakers might consider proactive policies. Such policies might include both Delaware offshore wind power development, and encouraging Delaware locations for industries to serve this potential market.

3. Test Facility

Survey respondents were asked whether or not they would support a test facility in coastal waters that would be comprised of two or three wind turbines. Ninety-one percent of the sample supports such a test facility, with only one percent opposed. The remaining eight percent are unsure. Thus, there is overwhelming support for a test facility. Considering only those respondents in the Ocean area who said they were opposed to a Delaware Cape Wind facility, slightly more than 25% percent would support a test facility, while among those in the Ocean area who are unsure regarding a Delaware Cape Wind facility, 89% would support a test facility.

4. Beach Visit or Tourism Effect

Concern has been raised regarding potential tourism impacts, but the debate has generated more heat than light. Tourism was a concern expounded on at length by the New Jersey Blue Ribbon Panel (2006), but without any real analysis. However, in a follow-up to the Blue Ribbon Panel’s report, the New Jersey poll (Mills and Rosen, 2006) found that, if anything, wind farms would increase tourism. First, the vast majority of resident and out-of-state visitors to the New Jersey shore (74.5%) expected that they would be neither more nor less likely to visit a beach with wind turbines located six miles off that beach. Second, while in the New Jersey poll 9.25 percent of respondents said they would be less likely to visit such a beach, a greater percent, 14.5 percent, indicated that they would be more likely to (1.75 percent did not answer).⁶

⁶ The New Jersey poll found as a whole a narrower difference between more and less likely when considering turbines at all distances (3, 6, 12 and 20 miles). We derived the statistics presented here using the tables on pages 24 and 25 of the Mills and Rosen report (2006) based on the assumption that in each county one quarter of respondents were asked about their beach attendance at each of the four distances. The report does not provide a breakdown of New Jersey versus out-of-state U.S. resident visitors in regard to tourism impacts.

We sought to determine the potential effect on beach visitation by Delaware residents if there was a very large 500 turbine wind farm, 6 miles from the coast. Our questions first placed the wind farm off the beach that an individual last visited and asked whether it would cause the individual to switch to another beach. The next question asked whether the presence of a wind farm that was visible from a Delaware beach that the individual did not usually visit or never visited would result in the individual being likely to visit that less/unfamiliar beach at least once to see the wind farm. The results from these questions are set forth in Tables 7 and 8.

Table 7. Effect on Beach Choice of Wind Turbine off the Coast from Last Visited Beach

	Same Beach	Different DE Beach	Different Beach not in DE	No Beach at All [±]
Statewide (%)	88.6	5.6	3.5	2.4

[±]Individuals who previously indicated that they were unlikely to visit any Delaware beach and who selected “No beach at all” were excluded from this analysis.

Table 8. Beach Visit Likelihood if Wind Turbine off the Coast of Less/Unfamiliar Beach

	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely
Statewide (%)	55.8	28.0	6.6	9.6

As indicated in Table 7, almost 90 percent of the weighted sample indicate that they will continue to go to the same beach that they last went to in the event a very large wind farm is constructed off the coast from that beach. Of the approximate eleven percent that would “switch” beaches, approximately half would choose another beach in Delaware. Still, 3.5 percent say they would go outside Delaware, and 2.4 percent say they would visit no beach at all. Expressed intentions are not as reliable as actual behavior and some of these respondents may be those who oppose offshore wind for other reasons. Nevertheless, it might be a concern for tourism if not for the countervailing results presented next.

As shown in Table 8, respondents expect a substantial curiosity effect (almost 84% are likely to visit the beach at least once) that will draw visitors. While we asked only whether they would visit the beach at least once, one can imagine additional visits. For example, those going for curiosity may decide to continue going if they find other amenities attractive, and they may make repeat trips to see the wind farm when, for example, out-of-state guests are visiting.

Although we cannot from this sample of Delaware residents determine the actual tourism effect (nor even the direction of the effect given the two countervailing answers), the much larger numbers wanting to visit than those rejecting a familiar beach do not appear to raise concerns for loss of in-state tourism. In fact, the high numbers expressing curiosity to visit (and higher percentage of individuals embracing beaches with wind turbines than intending to avoid them found in the New Jersey poll) suggest possibilities for new services such as recreational boat trips to tour a wind farm should it be constructed, a substantial visitor center, and new

possibilities for marketing Delaware beaches outside the state. Further insight will be gained through an out-of-state beach tourism survey planned for summer 2007.

5. Wind versus Coal and Natural Gas

Respondents were asked to choose among a status quo option of coal or natural gas and two different offshore wind power scenarios. The scenarios differed in five basic characteristics: the location (in two different ocean locations or in Delaware Bay; distance from shore (from 0.9 miles to too far out to see); the amount of rent/royalty payments made to Delaware; where those payments would be funneled (they could be deposited in the State General Fund, the Delaware Green Energy Fund, or a “Beach Nourishment Fund”); and the amount of a fee (\$0, \$1, \$5, \$10, \$20 or \$30), that would be added to monthly electricity bills for three years. Photo-simulations depicting what the wind farm would look like from various distances and a map depicting potential locations were included in the survey packet.

In order to provide a wide enough range of scenarios for complex statistical analysis, each respondent was asked a series of three choice questions. In each of the three choices, the wind farms had different attributes. In addition, twenty-five different versions of the survey with different wind farm attributes were generated and then distributed proportionally across the three sample areas (Inland, Ocean and Bay). As an example, the second of three questions in version 15 is reproduced on the following page.

Some of the levels of the characteristics in the choice tables are not representative of our expectations—rather they were employed to measure how much effect each variable has. For example, we do not expect that any large wind farm would be built within less than one mile from shore, nor do we expect a large wind farm to raise consumer bills by \$30 per month. But the inclusion of these extreme values facilitates the more detailed analysis we will undertake to ascertain the importance of each of the variables and how small change in the variables (e.g., how moving the wind turbines from 5 to 6 miles) affects Delaware residents’ preferences.

In this Interim Report we provide only broad comparisons between wind power and fossil fuel options; the more detailed analysis of individual choice questions will be provided in a later report. Unlike our earlier question that asked for individuals to choose between a wind farm and no wind farm, here the choice assumes that new electrical generation is needed and thus asks individuals to choose wind power or “Expansion of coal or natural gas power”. Although Delaware receives a small percentage of its electricity from Nuclear power, we did not present that as an option, as no nuclear power is generated within the state boundaries nor is it anticipated to be proposed on the Peninsula in the near future.

19) Now for which option would you vote?

Refer to the Delaware map insert for the “wind farm location.” Refer to the ocean photo insert for simulated views of the wind farm at different distances.

	Option A	Option B	Option C
Wind farm location	Bay	Bay	No Wind power
Distance from shore	6 miles	3.6 miles	
Annual rent/royalty	\$1 million to Beach Nourishment Fund	\$8 million to Green Energy Fund	Expansion of coal or natural gas power
Renewable energy fee on your monthly electricity bill for 3 years	\$10	\$30	

I would vote for...

- Option A
- Option B
- Option C

First, we compare only those answers where both the wind power options were said to cost more initially than the coal/natural gas option—that is, we tabulate only choices for which the three year renewable energy fee for both Option A and Option B was between \$1 and \$30 per month. We find that out of approximately 1500 choices (weighted as noted above), 91.1 percent of the responses would vote to expand electricity with offshore wind power rather than coal or natural gas, when told they would pay more for the wind power.⁷ See Table 9. This suggests that Delaware residents value other attributes of wind (such as its ability to provide long-term stable prices or its ability to generate electricity without the emission into the atmosphere of greenhouse gases or conventional pollutants) more highly than its initial price. Second, when one of the two wind options has the same initial price as the coal or gas power (the questions with a \$0 as the added price for one of the wind options), offshore wind power is preferred by 95 percent of the respondents. Interestingly, this stated preference is identical to the percentage of Delawareans who expressed support for wind power when the choice was wind power or no wind power (excluding those who were not sure, 94.9% supported the Delaware Cape Wind project, see

⁷ When weights are not employed to account for the over-sampling of the Ocean and Bay areas or for demographics, 88.8 percent support one of the two wind options where both have greater initial costs than fossil fuels.

Table 3). Third, we also find that among those who expressed support for a wind option, almost 36 percent selected the more expensive wind option. This suggests that for these individuals, initial price is less important than other factors (location, distance, amount of royalty payment and where royalty payments will be applied) combined. As noted earlier, this will be explored in more detail in our subsequent analysis.

Table 9. Wind Power versus Coal or Natural Gas

	\$1-30 Monthly Wind Power Premium	No Premium
Wind (%)	91.1	95.0
Coal or Gas (%)	8.9	5.0

6. Royalty Payments

The Energy Policy Act of 2005 directs the U.S. Minerals Management Service to promulgate regulations setting forth rents and royalties to be paid by developers of alternative energy on the U.S. continental shelf. It also provides for cost sharing with states such as Delaware for any wind farm project in which at least one turbine is within six miles from its ocean coast. Thus, there is the potential for revenues for the state from offshore wind power development in federal offshore waters. Moreover, it is possible that Delaware may adopt a rent and royalty scheme for any wind power development in Delaware oceanic waters or in Delaware Bay. As a result, we asked individuals their preferences among three funds into which the proceeds could be deposited: the Delaware General Fund; the existing Green Energy Fund⁸; and a Beach Nourishment Fund that would be created and that would dedicate its funds toward the addition of sand to any eroded Delaware beach from which the wind farm would be visible. The funds were described in the survey instrument as follows.

- Delaware’s existing Green Energy Fund to offset the costs people have to pay to buy renewable energy for their homes
- A Beach Nourishment Fund created to add sand to any eroded Delaware beach from which the wind farm is visible
- Delaware’s General Fund, which is a pool of dollars that finances the majority of state services in Delaware

⁸ Because this survey was financially supported by the Green Energy Fund, we here state explicitly that: 1) questions regarding this fund were generated by the research team to answer questions about factors affecting preferences for offshore wind and the sponsor neither requested nor was it informed regarding the inclusion or wording of this question; 2) the use of this named fund was used because it appears as a small charge on Delaware utility bills and thus was a familiar reference point for the survey recipients, and because of the relationship between the source of such revenues and royalties (from utility-scale renewable energy) and the goal of the Green Energy Fund (subsidizing the home-installation of renewable energy technologies); and 3) there was no mention of this possible question (or the terms “royalty” or “green energy fund”) in our research proposal, so it could not have affected the sponsor’s decision to fund this research.

The results are set forth in Table 10.

Table 10: Rent/Royalty Fund Preference

	Area/Population of Delaware				
	Statewide (%)	Inland (%)	Bay (%)	Ocean (%)	Ocean if Opposed Cape Wind (%)
Green Energy Fund	46.0	46.1	48.5	35.0	17.7
Beach Nourishment	19.0	18.6	26.3	45.0	68.8
General Fund	18.8	19.2	9.5	9.4	4.1
No preference	16.1	16.1	15.6	10.6	9.4

Overall, the Green Energy Fund garners the most support and is supported by a substantial percentage in the three areas of the state that we studied; however, in the Ocean area, the Beach Nourishment Fund has even more support (45 to 35 percent). If we examine separately only those individuals in the Ocean area who were opposed to a 130 turbine wind farm six miles from the coast (“Cape Wind in Delaware”), 68.8 percent prefer the Beach Nourishment Fund. Although, the General Fund receives the same amount of support as the Beach Nourishment Fund in the state overall, it receives substantially less support (less than ten percent) in the Bay and Ocean areas. These findings suggest that the state might facilitate support for wind farm development by dedicating any revenues collected to either the Green Energy Fund or—if beach residents are of particular concern or it is considered important to “compensate” coastal communities for any potential negative effects of offshore wind farm development—a combination of the Green Energy Fund and a new Beach Nourishment Fund.

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www.ocean.udel.edu/windpower

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References

- Firestone, J. and W. Kempton. 2007. Public Opinion about Large Offshore Wind Power: Underlying Factors, *Energy Policy*, 35: 1584-1598, doi:10.1016/j.enpol.2006.04.010, *also available at* www.ocean.udel.edu/windpower
- Kempton, W., C.L. Archer, A. Dhanju, R.W. Garvine, and M. Jacobson. 2007. Large CO₂ reductions via offshore wind power matched to inherent storage in energy end-uses, *Geophysical Research Letters*, Vol. 34: *In press*,
- Kempton, W., J. Firestone, J., J. Lilley, T. Rouleau, and P. Whitaker. 2005. The Offshore Wind Power Debate: Views from Cape Cod, *Coastal Management*, 33(2): 121-151 (2005), *also available at* <http://www.ocean.udel.edu/windpower>
- Mills, D. and H. Rosen. 2006. New Jersey Shore Opinions About Off-shore Wind Turbines, Lieberman Research Group, reported prepared for the New Jersey Department of Economic Growth & Tourism Commission and Brushfire, Inc. (September 14, 2006), *available at* http://njedl.rutgers.edu/NJdlib/details.cfm?RECORD_ID=4497&formKeyword=4497 and http://www.njcleanenergy.com/html/5library/baseline_studies.php?study=wind.
- New Jersey Blue Ribbon Panel on Development of Wind Turbine Facilities in Coastal Waters. 2006. Final Report to Governor Jon S. Corzine (April 2006), *available at* www.njwindpanel.org