

Public Opinion and the Environmental, Economic and Aesthetic Impacts of Offshore Wind

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Highlights

- Early Cape Wind advocates and opposition use impacts to sway uninformed public.
- “Extremist” arguments perpetuate uncertainties about impacts in public's mind.
- Expert elicitation compares stakeholder understandings of impacts with scientists.
- We find “non-extremist” stakeholder attitudes converge with scientists over time.
- We hypothesize scientific education at outset may improve planning process.

Abstract

During ten-plus years of debate over the proposed Cape Wind facility off Cape Cod, Massachusetts, the public’s understanding of its environmental, economic, and visual impacts matured. Tradeoffs also have become apparent to scientists and decision-makers during two environmental impact statement reviews and other stakeholder processes. Our research aims to show how residents’ opinions changed during the debate over this first-of-its-kind project in relation to understandings of project impacts. Our methods included an examination of public opinion polls and the refereed literature that traces public attitudes and knowledge about Cape Wind. Next we conducted expert elicitations to compare trends with the level of understanding held by small groups of scientists and Cape Cod stakeholders. Our review found that Massachusetts residents became more supportive of the project while our research demonstrated the gap between scientific and lay knowledge diminished late in the debate. To facilitate planning for other offshore energy projects, we recommend steps to move the public to an informed position more quickly.

Keywords: Wind power; Public opinion; Uncertainty; Expert elicitation

1. Introduction

1.1. Cape Wind

The Cape Wind Project off Cape Cod, Massachusetts (shown in *Figure 1*) encountered a major roadblock when two utilities terminated their power purchase agreements with it in February 2015. The developer has not officially discontinued this 130-turbine project that would generate 420 Megawatts of energy off the coast of the popular tourist destination, Cape Cod. But a popular narrative argues the abrogated agreements were the last skirmish in a decades-long battle between a well-connected and wealthy elite and a politically naïve developer (Williams & Whitcomb, 2007). In this view, a well-organized opposition promoted classic not-in-my-back-yard (NIMBY) sentiment to prevent this groundbreaking project from actually breaking ground.

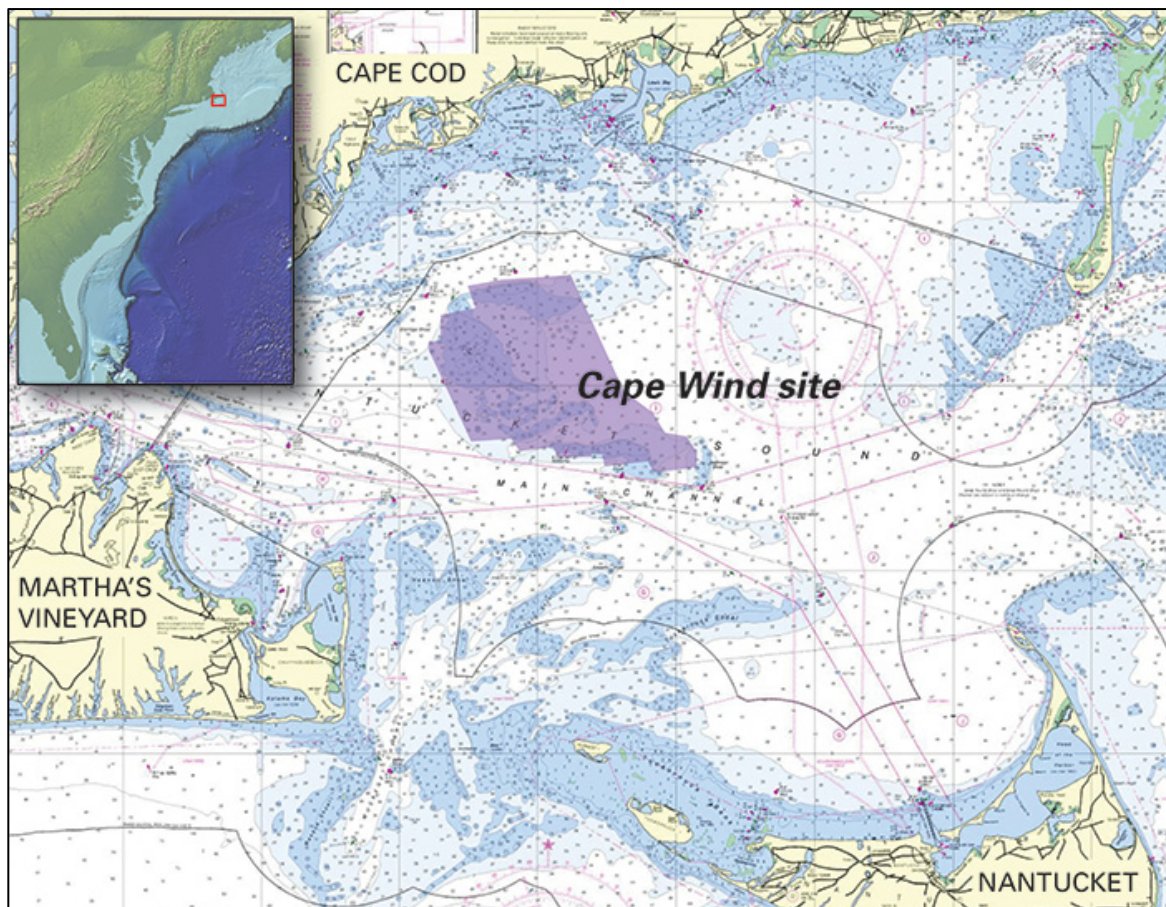


Figure 1. Map of Cape Wind's Location. A map of Nantucket Sound off Cape Cod,

Massachusetts with the Cape Wind Project's footprint highlighted by a shaded area. (Photo courtesy of the Woods Hole Oceanographic Institution's *Oceanus Magazine*.)

Recent research suggests the role attributed to public opinion in this narrative may be inaccurate. In the early years, most citizens who opposed Cape Wind were well informed (Petts, 1997; Devine-Wright, 2005) but many undecided residents did not initially understand the project's effects on air quality or the climate (Firestone et al., 2012). Opinions have also shifted in the nearly ten-plus years of debate from a minority to a majority of Cape Cod residents supporting the project (Firestone et al., 2012).

Second, studies at the University of Delaware on the value of information in siting large-scale industrial projects in the ocean revealed a shift towards favorable attitudes about offshore wind as new facts emerge. To engage fully in the debate over offshore wind, the public must understand both the impacts and intangible benefits. But wind power solves invisible problems while also causing unavoidable, visible impacts (Firestone et al., 2009). The availability heuristic that causes the public to weight the tangible impacts more highly may be overcome only through a deliberate process of public discussion and education.

Our research aimed to show how residents' opinions changed during the debate over this first-of-its-kind project in relation to understandings of project impacts. As a novel project that has undergone years of debate, Cape Wind provided an ideal case for studying the long-term evolution of public attitudes toward offshore wind in the United States. We believe our work contributes a unique perspective to the literature discussing public acceptance of offshore energy projects. This paper begins by establishing the scientific findings on offshore wind's impacts—a topic that has only recently become

clearer (Russo, 2014; Snyder & Kaiser, 2009)—and general public opinion on offshore wind. In section two, we examine public opinion of Cape Wind specifically to trace how public opinions have evolved. We then move, in section three, to reporting our results on how Cape Cod stakeholders understand Cape Wind’s impacts compared to scientists. Our analytical framework included a literature review and expert elicitation process (Aspinall, 2010; Knol et al., 2010) both to trace public opinion and to provide a snapshot of understandings of Cape Wind’s impacts by examining disparities between scientist and stakeholder opinions late in the debate. Further details on this framework can be found in our materials and methods section. Finally, we conclude with a discussion of our results and their implications for energy projects sited in offshore waters.

1.2. The Impacts of Offshore Wind

Respondents differ in their opinions of wind power’s impacts between towns within Massachusetts (Petrova, 2014) as well as between residents of Delaware and other states (Firestone et al., 2009, 2012). On Cape Cod, this confusion led early opponents to galvanize political opposition using misstated claims about impacts to the environment and economy (Williams & Whitcomb, 2007).

New research provides better understandings of wind power’s economic impacts. A study on the economic impacts of terrestrial turbines in Ontario, Canada that examined 5,414 residential and 1,590 farmland sales (Vyn & McCullough, 2014), and one in the United States that examined 7,500 residences (Hoen et. al., 2011) both found no impacts on property values. And a report tracking property with turbine views in the United States concluded that property value “increased faster in the viewsheds of eight of the ten

projects" (Sterzinger et al., 2003, p. 2). Yet offshore wind's economic impacts are more uncertain given that no such projects have been built in the United States. Internationally, researchers found through interviews that neither tourists nor summer rental prices had decreased in Denmark (Kuehn, 2005) while the British Wind Energy Association noted that 30,000 individuals visited one United Kingdom wind farm within its first six months (2006). Research at multiple offshore project sites in Scotland found opinions split on the economic and aesthetic tradeoffs (Riddington et al., 2008), but studies on 2,141 property sales in Germany found asking prices dropped when properties had significant impacts from offshore wind (Sunak & Madlener, 2014).

A study of offshore wind as a visual disamenity similar to "pollutants from the burning of fossil fuels" or "accidents from the storage of nuclear wastes" offers a more nuanced perspective on economic impacts (Krueger et al., 2011, p. 4). Using stated preference data from 949 Delaware households, the economic value associated with the visual disamenity from 500 440-foot turbines located 0.9, 3.6, 6.0, and 9.0 miles offshore was estimated. The authors' results call into question the conventional wisdom that wind farms should be located outside the viewshed. Savings associated with siting a facility nearer to shore were roughly comparable to the calculated disamenity costs. However, studies conducted by stakeholders in the Cape Wind debate reported both economic losses in terms of tourism and property value (Haughton et al., 2003; Giuffre et al., 2004) and gains in terms of jobs and new industries (Global Insight, 2003; Charles River Associates, 2010).

Assessments of environmental impacts contain less uncertainty. Impacts to species, such as bird fatalities, have been well documented, but possible changes in avian

behavior can take years to be revealed (Bennett, 2006; Drewitt & Langston, 2006; Strickland & Johnson, 2006). Only recently, after several years of research on Cape Cod, the Massachusetts Audubon Society concluded that impacts on roseate terns (*Sterna dougallii*), migratory songbirds, and sea ducks were little cause for concern (Russo, 2014). Without measures to prevent harm to marine mammals, a wind farm's construction phase also has been found to impact seals and porpoises negatively due to underwater noise (Dong et al., 2006; Edrén et al., 2004; Thomsen et al., 2006). Yet some researchers found that seals often visit operating turbines to feed on fish attracted to these artificial reefs (Inger et al., 2009; Dahne et al., 2013; Russell, 2014).

So how does the public understand the nuanced research on offshore wind's impacts? In section two, we detail how public understandings of Cape Wind's impacts evolved as much of the above research took place. First we briefly examine public perceptions of offshore wind in other states.

1.3. Public Opinion of Offshore Wind in the United States

Many factors influence wind power siting, including the availability of a wind resource or a state's renewable energy laws. These factors, along with resistant public attitudes, have resulted in unequal distribution of wind power across the United States, with more than 60 percent located in only six states (Fischlein et al., 2014). Studies in Maine, New Jersey, and Delaware, where offshore wind projects have been proposed, captured the factors that influence public acceptance of offshore wind.

First, in New Jersey, Doug Mills and Harvey Rosen conducted 4,026 personal interviews in Monmouth, Ocean, Atlantic, and Cape May counties. They found that

people who were presented with pictures of what a proposed wind farm would look like were in favor of its development (at a rate of 2 to 1), with distance offshore an important factor (2006). Residents more familiar with wind turbine technology also were more supportive, at 29% above average. Second, a regression analysis was applied to 1,410 responses to a Maine survey that asked about the costs and benefits of offshore wind (Teisl et al., 2014) This research found that increased energy prices, degradation of views, and lowering of property values were the most important factors impacting acceptance of offshore wind (Teisl et al., 2014). Finally, 995 respondents in Delaware preferred offshore wind power when it was priced the same as energy generated from coal or gas (Firestone et al., 2008). Respondents also accepted a project more readily when they understood its benefits to air quality, the economy, and electricity prices (Firestone and Kempton, 2007; Firestone et al., 2009, 2012).

Many variables influence local opinions on offshore wind, but only sparse evidence exists to examine how knowledge of a project impacts these opinions. Complicating such research even more, the public often may experience angst about rapid changes to valued natural landscapes (Devine-Wright, 2005).

2. Public opinion of Cape Wind

Scientists, wind energy experts, and local citizens have become increasingly more knowledgeable about the technology involved in building Cape Wind during a more than decade-long debate. In fact, some of the discord that arose when the project was first proposed now has begun to subside with most environmental groups supporting the project after the Cape Wind developers signed a 2012 agreement to mitigate the impacts

of underwater sound and ship traffic. Further, the US Department of the Interior's Bureau of Ocean Energy and Management (BOEM) approved the project in April 2010.

At the same time, public understanding of the Cape Wind project increased despite organized opposition. Two surveys conducted in 2005 and 2009 indicate that public attitudes evolved to better grasp the negative effects and that more people now support the project (Firestone et al., 2012). This change took place after years of planning, community meetings, the completion of a second extensive environmental impact statement (EIS) (Firestone et al., 2012), and six Massachusetts Technology Collaborative (MTC) led meetings where residents worked "to achieve a better shared understanding of the Cape Wind project's potential benefits and environmental impacts" (Watson & Courtney, 2004, p. 274).

In this literature review, we trace public opinion concerning Cape Wind through time to determine whether attitudes became more favorable as more has been learned about the impacts of the project. Here we intentionally trace public opinion but not other factors (such as the media, planning processes, or advertising) that might influence it. *Figure 2* graphically represents changes in attitudes through time.

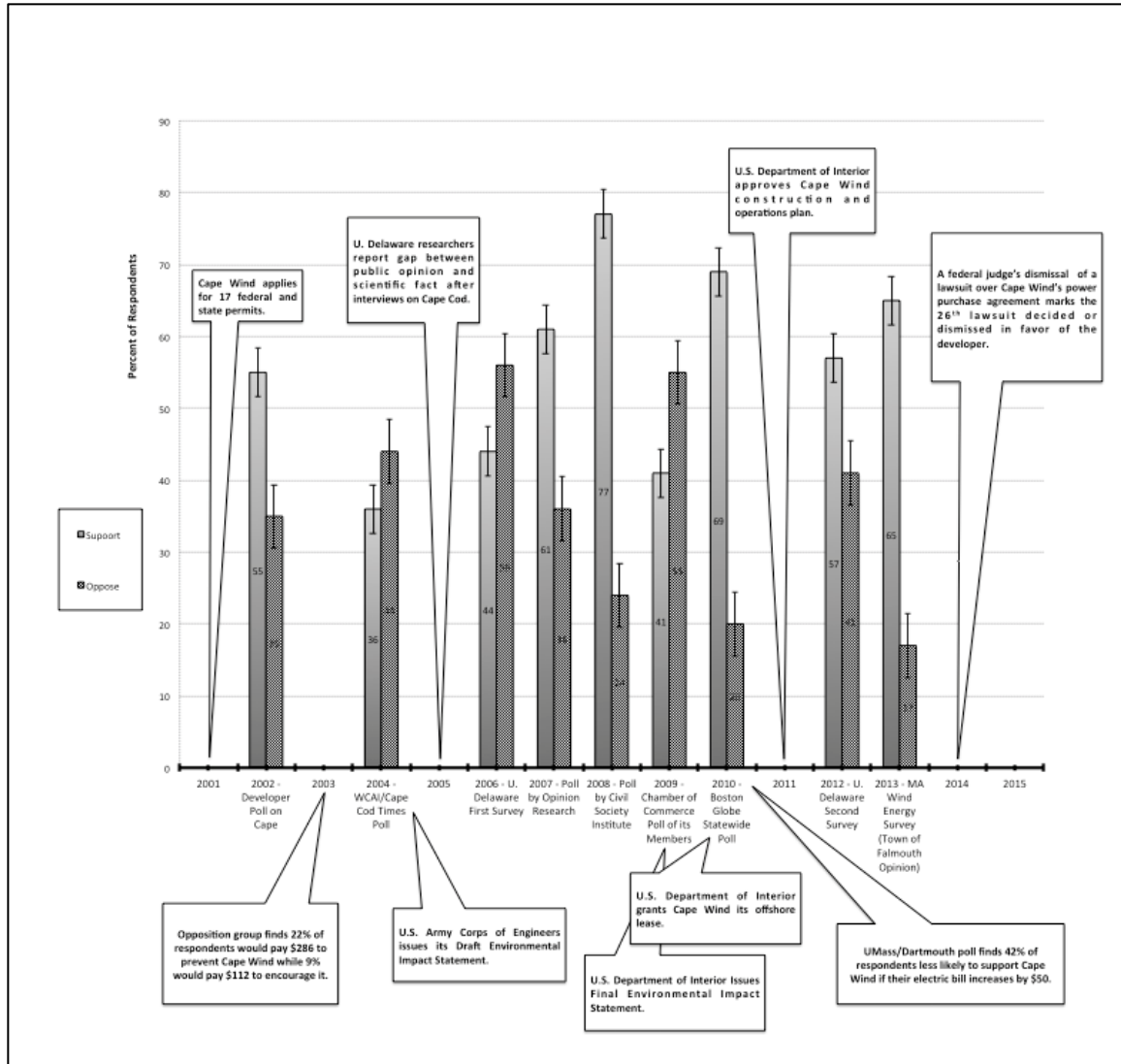


Figure 2. Public Opinion of Cape Wind Through Time. The above timeline shows how the percentage of respondents who “support” and “oppose” the Cape Wind Project has varied through time along with findings from other research into public attitudes. These results are presented along with a partial timeline of project events that influenced public knowledge of the project. Variations between the polls may reflect bias in either their methods or the organizations that conducted them. All of the polls report on responses solely from Cape Cod residents unless otherwise noted.

2.1 The Early Polls

Three surveys conducted by the developer, an opposition group, and the media each included certain biases or problems, but, taken together, these surveys provide a useful starting place for assessing public opinion after the project was first proposed in 2001.

First, a 600-person phone survey of voters conducted with funding from the Cape Wind Project on the Cape and Islands found 55 percent in favor of the project and 35 percent opposed (ODC, 2002). In Massachusetts overall, it was supported by a wider margin, by 64 to 22 percent. Second, the main opposition group, the Alliance to Protect Nantucket Sound, conducted a survey where 998 homeowners and tourists were shown visual simulations and asked to consider potential economic impacts. Twenty-two percent of respondents would pay \$286 each to prevent construction, while nine percent would pay an average of \$112 to encourage construction (Haughton et al., 2003). Finally, a Cape Cod Times/WCAI poll of 588 residents of Cape Cod and the surrounding islands found 44 percent opposed and 36 percent in favor of development. More than 20 percent declined to answer—the highest for any question—suggesting that many respondents lacked enough knowledge to evaluate the project (DeSantis & Reid, 2004).

At the same time, leaders of stakeholder processes run by the MTC found many residents “still forming opinions of the project and many were frustrated by the lack of objective information available” (Watson & Courtney, 2002, p. 272).

2.2 Interviews on the Cape and Martha's Vineyard in 2005

Researchers from the University of Delaware conducted interviews with 24 people on Cape Cod and Martha's Vineyard and found a dichotomy between public opinion and scientific fact. For example, when researchers compared the likely impacts of Cape Wind against the impacts of fishing caused by the six boats in Barnstable's trawling fleet, they found far more impacts (by two to four orders of magnitude) on the marine ecosystems of Nantucket Sound from the trawlers (Kempton et al., 2005). Yet respondents in these

interviews believed that Cape Wind would have a larger impact.

This gap between scientific and lay opinions explains, in part, the oft-argued perception that Cape Wind would result in severe environmental impacts (Kempton et al., 2005). It also may have reflected the early timing of the research, which took place before the developer had adequately explained a rationale for the project's location and when some residents had been excluded from early planning (Kempton et al., 2005; Jami & Walsh, 2014; Williams & Whitcomb, 2007).

2.3 A First Social Survey in 2007

Researchers from the University of Delaware returned in 2005 and conducted a mail survey of local residents in order to better gauge the factors underlying opposition and support. All but one of 504 respondents had heard of the project but more than half of respondents (52 percent) thought the facility would have no impact on air quality and only 24 percent thought it would have a positive impact (Firestone & Kempton, 2007). Forty-one percent expected the project to have no impact on stabilizing the climate.

Opponents were more likely to shift their opinions if they knew that electricity rates would decrease, marine life would not be harmed, air quality would be improved, the fishing industry would not be harmed, jobs would be created, and Cape Cod would receive the actual electricity produced—all of which are now understood to be partially true (Firestone & Kempton, 2007). For supporters, the potential harms to bird life and the project's visibility from shore (also partly true) would change their opinion.

2.4 A Poll by Opinion Research in 2007

In a second round of telephone surveys of 501 Cape Cod and surrounding island residents, Opinion Research found that more than three out of five (61 percent) favored Cape Wind, including 42 percent who supported it strongly (ORC, 2007). Only a quarter of respondents opposed it strongly. The project had also grown in recognition with 96 percent of respondents aware of Cape Wind, an increase from 75 percent awareness in 2007 and 72 percent in 2006 (ORC, 2007). Residents said more information about impacts to fishing, sailing, and tourism would make them likely to support the project.

2.5 Researching Delaware and Cape Cod in 2009

Researchers summarized both the Cape Wind and Bluewater Wind projects as exhibiting noticeable shifts to higher levels of support through time as the public acquired more information. In further examining research from 2005 and 2007, the authors found that respondents believed that offshore wind power would have positive impacts on electricity rates, job creation, and air quality (Firestone et al., 2009).

In both locations, those who expected negative aesthetic impacts greatly exceeded those who expected positive. The researchers conjectured a lower overall acceptance of Cape Wind versus Bluewater Wind might have reflected stronger beliefs on Cape Cod about the negative effects on property values (48% to 29%) and tourism (42% to 27%) as revealed in earlier surveys (Firestone et. al., 2009).

2.6 Comparing Public Opinion Surveys in 2009

In 2009, researchers from the University of Delaware found a third of Cape Cod and surrounding island residents still had yet to make a firm decision (33 percent) about

the Cape Wind Project. This finding was striking, given “more than eight years” since the announcement of Cape Wind and “extensive analysis, press coverage, and controversy” (Firestone et al., 2012, p. 15).

Overall support had grown, with 57 percent who supported the project in a 570-person mail survey in 2009, in contrast to the 44 percent in a 500-person mail survey in 2005. Yet a sizeable number of respondents only leaned to a position in 2009, with an additional two percent still completely undecided (Firestone et al., 2012).

Researchers also found a strong pattern showing that those with polar opinions (in supporting or opposing the project) had hardened their positions, a finding consistent with cognitive psychological research suggesting that individuals who hold strong opinions at the outset of a proposed development would be unlikely to change such views through further debate and information provision (Firestone et al., 2012).

2.7 Sustainable Wind Communities in Massachusetts in 2013

In 2012, Maria A. Petrova sought to determine how community input in the planning process of terrestrial wind projects in Hull, Kingston, and Falmouth, Massachusetts impacted public opinion. She surveyed 1,051 people by mail in these three towns (Petrova, 2014), of which only Kingston participated in a Green Communities planning program. Included here, her research covered Falmouth, a town on Cape Cod nearby to the Cape Wind Project, which at 65 percent had the lowest favorable response. In Hull and Kingston, respondents favored turbines at 87 and 77 percent, respectively. Her finding indicated that only 50 percent of Falmouth respondents had even heard of the terrestrial turbine during planning with one-quarter finding out

about it after construction. Similar survey work examining the role of public participation in terrestrial turbine planning processes on Vinalhaven, Maine and Falmouth and Hull, Massachusetts published in 2015 has shown lack of engagement by developers can turn some members of the public into opponents (Kuman, 2015).

2.8 Putting Together the Pieces

This review of polls and refereed literature shows a clear evolution in public attitudes. Those who lacked information or who did not take a strong opinion in the early and middle years of the debate over Cape Wind have gravitated slowly to support it as the impacts became better understood (Firestone et al., 2012).

In contrast, those who firmly opposed or firmly supported the project from the outset always possessed a better understanding than the general public of its impacts on a particular area of interest (Petts, 1997; Devine-Wright, 2005; Firestone et al., 2012). These more informed and more polar respondents appeared to have only hardened their positions as the debate continued.

The above studies also suggested that less-polar respondents, who initially supported, opposed, or were undecided, all could alter their opinions with new information (Firestone & Kempton, 2007). In particular, better inclusion in planning processes that give understanding of a project's impacts to air quality, the climate, electricity rates, and foreign fossil fuel dependence moved undecided residents in favor. Others needed knowledge about the extent of impacts to marine ecosystems, birds, local economies, and views.

3. Materials and Methods

To confirm our analysis of public attitudes about Cape Wind, we designed and conducted expert elicitations to measure scientist and Cape Cod stakeholder opinions about the project's impacts. This process provided a snapshot of the level of understanding about the project's economic, aesthetic, and environmental impacts that was manifest late in the debate over Cape Wind. By examining disparities between scientist and stakeholder opinion, we aimed to identify gaps in stakeholder knowledge as compared with our scientists who held expertise in topics related to wind energy. The finding of such gaps would indicate that space still exists, even after years of debate, to help stakeholders reach expert-level understanding through scientific education.

Researchers in other fields paved the way for expert elicitation methods implemented with small groups of respondents. While not perfect, an elicitation process may uncover gaps in knowledge between two groups of subtly different backgrounds (Aspinall, 2010). Further, following a formal expert elicitation process allowed us to pinpoint assumptions or conceptual models impacting knowledge of Cape Wind, as researchers using expert elicitations in other fields suggest it should (Knol et al., 2010).

3.1. Survey and Interview Design

Our study employed initial telephone interviews and an online survey using Qualtrics Survey Software. In preparing both, we consulted national wind energy experts and leaders in the stakeholder meetings surrounding Cape Wind. During telephone contact, we asked respondents about the most important impacts of Cape Wind and to self-rank their own level of expertise on each topic the survey covered.

The survey included nine demographic questions and 40 open-ended and Likert-scale questions. Our demographic questions included factors that might influence views of impacts, including whether a respondent owned property that would have a view of the project or whether he or she supported or opposed Cape Wind. The bulk of the survey consisted of Likert-scale questions that were broken into the surveys main four topics: impacts to Cape Cod's economy, aesthetics, sea birds and marine mammals. In each section, we asked both how well respondents felt a given impact was understood and their perception of the degree of impact. For marine mammals, we asked these questions for both the construction and operations phase of Cape Wind as the literature suggested relevant differences existed. The survey was piloted with a diverse group of 12 students and staff at the Woods Hole Oceanographic Institution during July 2010.

3.2 Recruitment

Two groups of respondents were recruited to take part in the study. These groups are not intended to constitute a sample of a given population but rather, as is common in expert elicitations, to provide expert level professional and lay opinions on a complex topic. Members of both were selected based on their backgrounds to provide understanding on the specific topics of our research. The first included scientists familiar with offshore wind and chosen based on their education, areas of expertise, and current affiliations in academia, government research labs, and the private sector. The second group consisted of stakeholders selected from organizations identified in the literature and meeting records conducted on Cape Cod and Massachusetts. We sought to ensure all respondents had diverse backgrounds and that there were roughly equal amounts of Cape

Wind detractors and supporters.

Seventy-one people were contacted for this research with 38 completing the initial phone interview and 27 completing the entire online survey. This participation resulted in a response rate of 38 percent with 13 in our scientist group and 15 in our Cape Cod stakeholder group. For the stakeholders, seven out of the 15 respondents opposed the project while all of our scientists supported the project—perhaps due to bias among those intimately involved with research in the field of offshore wind. Our scientists often held expertise in multiple fields with several categorizing themselves as a three or four (out of four) on multiple survey topics. Seven of our scientists self-identified as avian experts, six as marine mammal experts, seven as experts on the aesthetic impacts, and six as holding economic expertise. The stakeholders held diverse backgrounds, such as staff at opposition/support groups, marina owners, real estate agents, Cape Cod chamber of commerce members, town officials, private citizens and others.

3.3 Data Analysis

We analyzed our survey in three steps starting with our Likert-scale questions. First, we averaged each group's response to a question, then we compared averages between groups, and finally we compared averages within groups between individuals who did or did not self-identify as expert on a given topic. Each average corresponds to a given word answer from the Likert question. Second, we performed chi-squared cross tabulations for responses against specific demographic questions of interest (such as whether a respondent supported or opposed the Cape Wind project). Finally, we

examined open-ended responses to gain understanding of how respondents justified their responses, coding similar responses to provide insight on specific questions of interest.

4. Results

4.1 Uncertainty about Cape Wind's Impacts

Our survey assessed uncertainty about Cape Wind's impacts in the four categories mentioned above, and our results reflected differences between the backgrounds of our experts. Most importantly, our research revealed large gaps between those stakeholders who took a strong position against the Cape Wind project and our scientists. Respondents who self-identified as project opponents felt impacts to viewsheds, property prices, marine mammals (during both construction and operation), and seabirds would be more severe than did the rest of our respondents (as detailed in *Figure 3*). In some areas, a smaller gap also existed between Cape Wind supporters and our group of scientists, with supporters describing impacts as less severe.

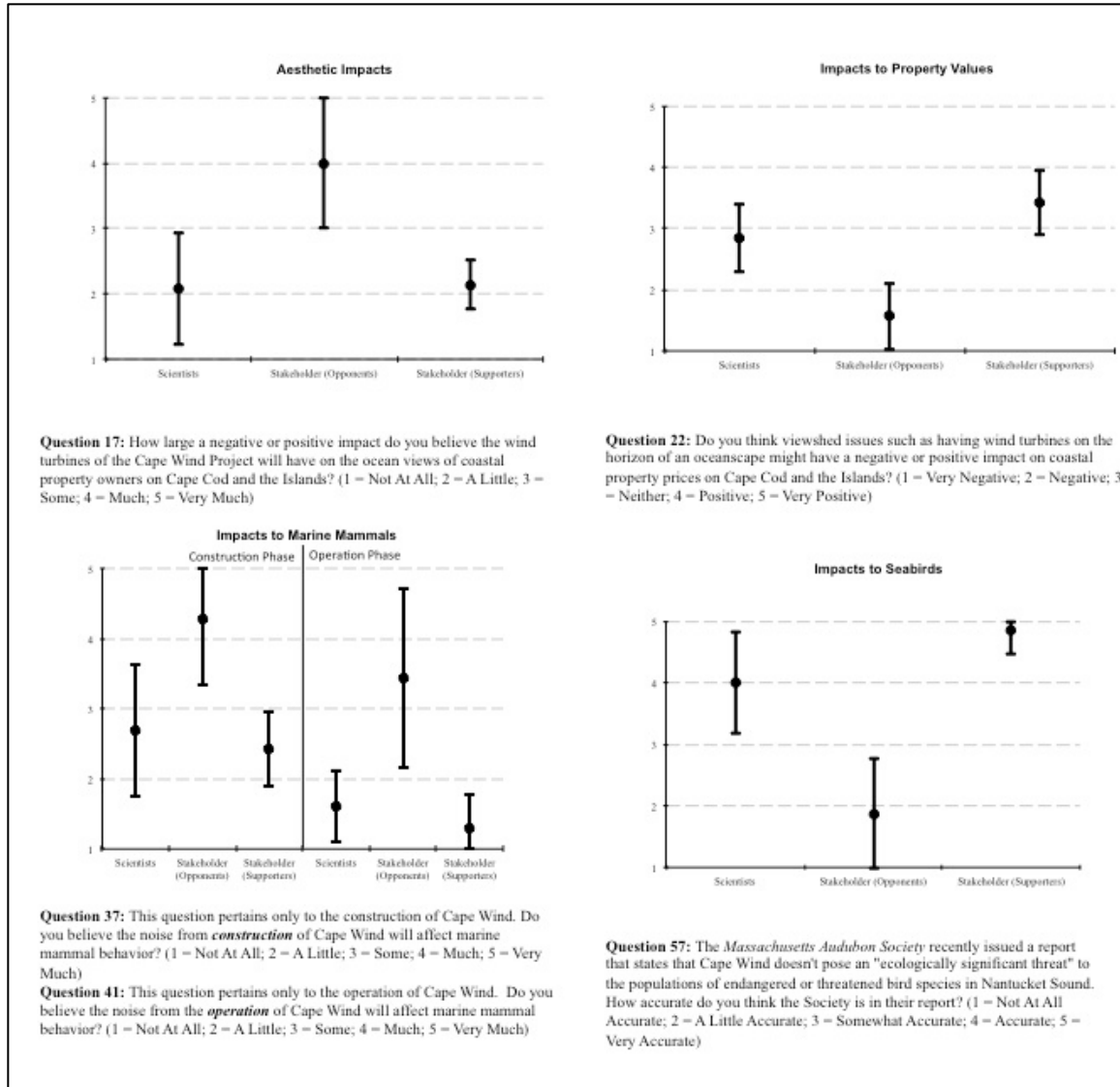


Figure 3. Averaged Opinions on Cape Wind’s Impacts. Averaged responses to the first standard deviation for our Likert scale questions that ask about the severity of impacts to viewsheds, property prices, marine mammals (during construction and operation), and seabirds (with regard to a *Massachusetts Audubon Society* report that found Cape Wind doesn’t pose an ecologically significant threat). In every case, our stakeholders who self-reported as opponents of the Cape Wind project found the impacts more severe than our group of scientists. In a few cases, stakeholders who self-reported as supporters of Cape Wind felt impacts were a bit less severe than our scientists and, as a group, often agreed more readily on their answers (as indicated by the smaller spread of answers).

Our research went a step further in asking each of these groups how well they believed scientists understood these impacts. For some impacts, our scientists and stakeholders agreed, for others they disagreed, and, for a few, those who self-identified as

expert in a given topic felt differently than the whole group. We detail these findings below.

First, our respondents ranked the aesthetic/visual impacts of Cape Wind as “Known,” with a divergence between our self-selected aesthetic experts in each of our groups. Those in the stakeholder group, most of whom opposed the project, felt that the project’s aesthetic impacts were “Little Known.” In contrast, self-selected experts on aesthetics in the scientist group felt that they were “Well Known.”

Second, in terms of impacts to tourism, we found the two groups held very different opinions and had differing familiarity with information about offshore wind’s impacts. A majority of scientists and self-identified experts on tourism felt that domestic tourism spending would increase. Our stakeholders who opposed the project expressed the exact opposite opinion.

Third, the respondents as a whole felt that the impact of underwater noise from Cape Wind’s construction and operation on marine mammals was “Known.” Our self-identified marine mammal experts felt more strongly, responding closer toward “Very Well Known.”

Fourth, most of the respondents felt that the impacts on seabirds were “Known.” When asked how accurate was a recent Massachusetts Audubon report stating that Cape Wind did not pose an “ecologically significant threat” to birds in Nantucket Sound, the respondents found it “Accurate.” In fact, only opponents of the project felt it “Not at all accurate,” in sharp contrast to those who self-identified as avian experts, who found the report “Very Accurate.”

Of the above categories, the impacts that were most well understood and agreed upon by the scientists included those to seabirds and marine mammals. Across three categories (economics, marine mammals, and seabirds), however, our self-identified experts in each of these fields felt that the impacts were better understood than did the rest of the sample.

4.2 Highlights of Respondent Knowledge

Respondents explained their answers and views in a variety of ways throughout our interviews and surveys. On aesthetics, our scientists justified their answers, often by noting it would be “hard to judge” the accuracy of their views with no other offshore wind farms in the United States. Stakeholders, in contrast, felt the project would have “Some” visual impact.

On economics, the scientists felt that the project would improve the regional economy (mentioning green energy, electricity prices, and increased tourism), while the stakeholders emphasized the negative. This included areas where recent research showed that there might not actually be any negative impact, such as to tourism or electricity rates. *Figure 4* summarizes the different responses between the groups, with a slight majority feeling that economic impacts could be positive.

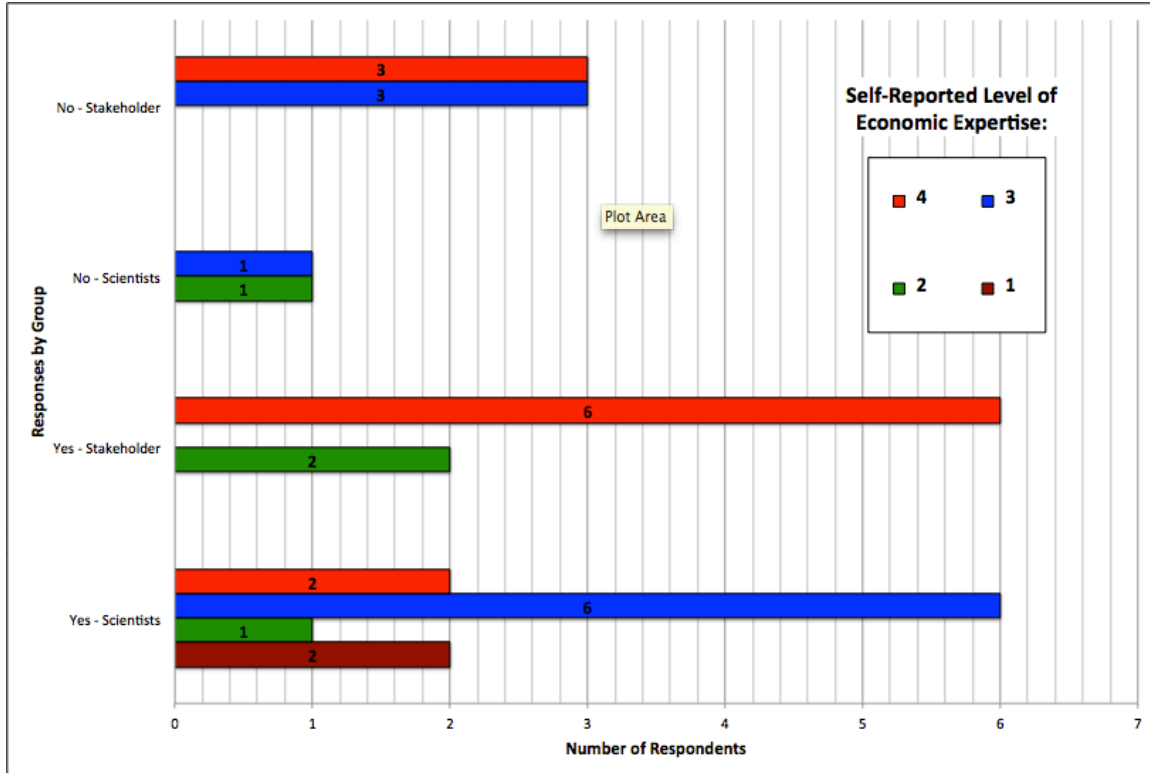


Figure 4. The Economic Impact of Cape Wind. Respondents who answered “Yes” or “No” to question 34 (“Do you believe Cape Wind could have a positive impact on the economy of Cape Cod and the islands?”). During our phone interviews, we also asked respondents to rank their level of expertise on Cape Wind’s impacts to marine mammals, seabirds, aesthetics and the economy on a scale of one to four. Respondents in our stakeholder group ranked their own expertise much higher than did our scientists, with none who oppose the project below three.

On marine mammals, the respondents felt that the feeding habits of marine mammals would be the most affected because the majority of species would avoid the area during construction due to pile-driving sounds and the implementation of preventive measures to deter them. Both groups agreed that the construction phase would hold the most impacts, but the scientists clearly recognized that the operation phase held few impacts for marine mammals—and perhaps might benefit them.

The respondents, as a whole, felt certain that the impacts to seabirds would be minimal, because Massachusetts Audubon had done years of fieldwork and analysis

"before taking a position" on the project that was consistent with many other cases in Europe. Yet the stakeholders did diverge from the scientists in one way, with most finding seabirds' avoidance of wind farms "A Little Significant." Our scientists noted that such an impact to birds would be troublesome only if there were many more offshore wind farms or if Cape Wind's footprint was larger.

4.3 Highlights of Two Elicited Topics

Two other findings from our research are pertinent, due to how they shape public attitudes about offshore wind, as shown in the refereed literature. In particular, many of the stakeholders felt that the planning process leading up to the approval of permits for Cape Wind in April 2010 had only been "Somewhat Adequate," with our scientists not voicing a much stronger opinion at "Adequate."

The respondents also embraced the idea of tradeoffs, with the negative tradeoffs including the rapid change of a cherished landscape into an "industrial zone." Respondents also mentioned the project's ability to produce clean energy, stabilize the climate, and reduce fossil fuel dependence. *Figure 5* captures this sentiment in showing whether respondents felt Cape Wind would alter perceptions of Cape Cod and how.

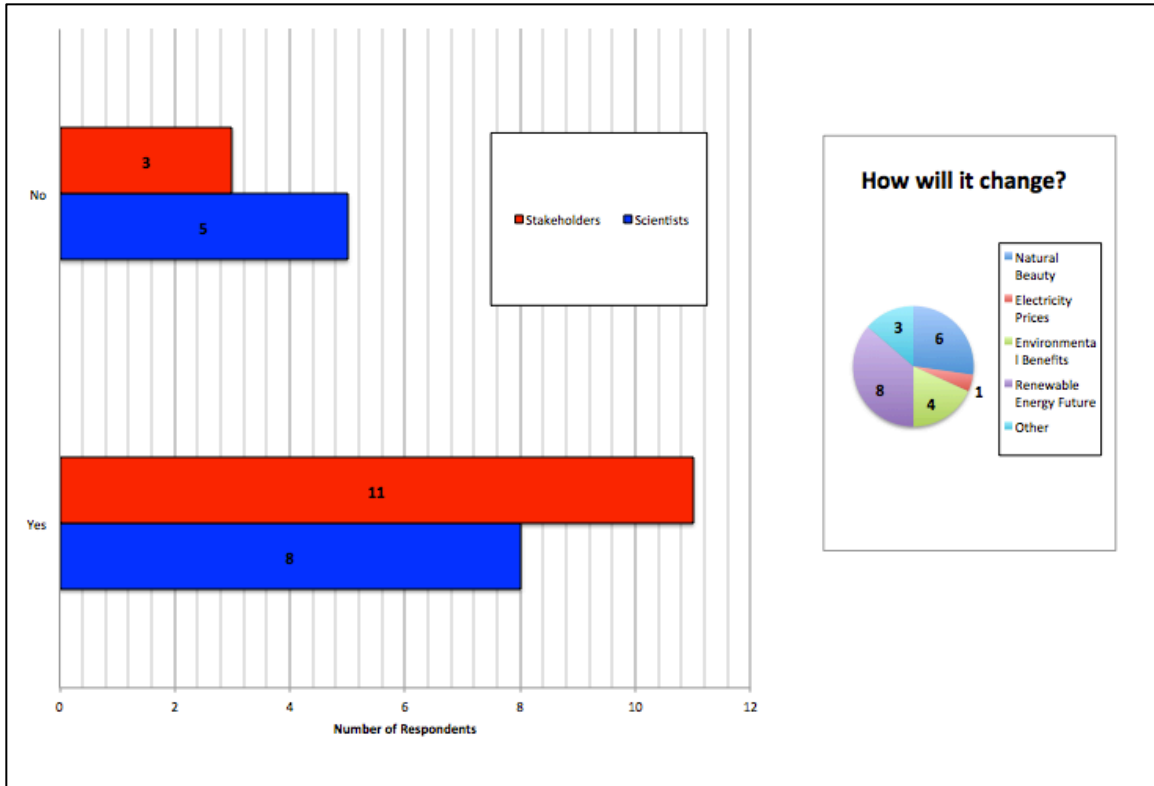


Figure 5. Alterations to Perceptions of the Cape Cod Region. Respondents who answered “Yes” or “No” to question 58 (“Do you believe the construction of the Cape Wind Project will change the way you or others view the Cape Cod Region?”). An open-ended question that followed allowed respondents who answered “Yes” to then specify “In what ways?” Negative and positive responses were coded into the five categories of natural/visual beauty, electricity prices, environmental benefits, the future of energy generation in the United States or other.

5. Discussion

A review of the refereed literature and public opinion polls on Cape Wind demonstrated a clear evolution in both knowledge about the project’s impacts and support for its completion. In particular, our review indicated that "non-extremist" stakeholder attitudes converged over time with those of scientists while, while Cape Cod and Massachusetts residents became more supportive of Cape Wind overall. Some of this shift resulted from increased knowledge of the project’s effects on air quality and climate, while others changed opinions as environmental impacts to birds and marine mammals became better understood.

Our review also indicated that in the early and middle stages of the Cape Wind project, both opponents and proponents adopted arguments that emphasized a particular cost or benefit in order to sway a heretofore largely uninformed public. Even as the MTC stakeholder meetings, the EIS review, and other stakeholder processes began to educate the public, arguments by these "extremist" stakeholders perpetuated uncertainties about impacts in the public's mind, exacerbating the fight over Cape Wind.

We conducted an expert elicitation to gain a snapshot of the differences between scientific and stakeholder opinion of the project's impacts late in the debate. Our research was conducted before the developer's latest financial setbacks at a time when respondents had every reason to believe that the project might be built. Our study confirms that extremists on both sides continued to hold strong opinions about Cape Wind. Opponents in our study continued to oppose the project's location and overestimate the project's negative environmental impacts while supporters who once lagged behind in knowledge agreed much more closely with the scientists in our study.

Our research also demonstrated that opponents have simply ignored new information when it failed to support their views. A qualitative examination of how they justified their answers show that some even called into question the accuracy of reports by organizations like the Massachusetts Audubon Society (which one respondent named as having "sold out" its integrity for a "monitoring contract"). Initial attitudes may have hardened into resistance during an EIS process that many opponents, in our research, found only somewhat adequate. Other researchers have found that such processes are an important factor in determining the nature of wind farm planning debates (Smart et. al, 2014), with poorly orchestrated processes often resulting in long delays from public

opposition (Jami & Walsh, 2014). In particular, more adequate EIS engagement enhances public understanding of how planning decisions are made and facilitates early contact between developers and stakeholders. It's also important to note opponent's concerns about how Cape Wind would alter the natural landscape did coincide with the EIS conclusion that such impacts were major (EIS/EIA, 2010).

We recognize, of course, that a good deal of subjectivity exists on how an individual might rank aesthetic impacts. Further, the international refereed literature on economic tradeoffs due to offshore wind is far from conclusive. Both are factors that shape the dichotomy in opinion on these subjects by the two groups included in our study. Erroneous views of the impacts to marine mammals and seabirds, however, requires a better understanding of both how public opinion is formed and the effects of prominent opponents to Cape Wind on public opinion. In particular, more research would be needed on how local and national media portrayals (including with prominent officials and citizens) impact the formation of opinions.

Our research indicates public education about offshore wind technology could play an important role in acceptance. In sum, our literature review confirmed that the public became more educated on the impacts of Cape Wind on electricity rates, marine mammals, seabirds, air quality, fossil fuel dependence, and climate. It is important to remember that, while a majority also began to support the project over this time period, nearly a third still held no strong opinion. This means that, even late in the debate, efforts to educate the public about the project's benefits and impacts to marine fauna hold the greatest potential for moving residents who lack strong opinions to informed positions on the project. For residents who value the prevention of climate change and air pollution,

educational programs that teach them about the environmental benefits of these technologies also may sway attitudes.

6. Conclusions

To reduce the likelihood of conflict and delay regarding the siting of an offshore wind project, we hypothesize that the public's understanding of the basic tradeoffs could be improved through education about the scientific issues at the outset. Our literature review and research showed that having an educated debate not solely focused on aesthetics means residents located near proposed offshore turbines must fully understand a project's benefits to air quality, fossil fuel consumption, and the climate, as well as any impacts to the local economy, viewshed, and environment.

The implications are clear for those who would plan energy projects in the offshore waters of the United States. In particular, the public values marine and avian lives. Consequently, studies of how such organisms are impacted at existing offshore wind farms in Germany, England, and Denmark should be shared during the planning stages. Further, concerns of early opponents should be weighed against other tradeoffs in making adjustments to a proposed project's design or location. Stakeholders who feel that their opinions have not been adequately considered often end up forming the core of strong opposition against offshore energy projects. Finally, our respondents suggested a more adequate planning process would include project details that have been hammered out with participation from local partners before stakeholders develop any misperceptions of impacts. To avoid protracted debates with wealthy political opponents, such a process must genuinely include stakeholder input.

If nothing else, Cape Wind's abrogated agreements demonstrate that not following some of these steps can result in years of debate and delay, thereby increasing the likelihood that the project in its current form might never break ground.

7. Acknowledgements

A Woods Hole Oceanographic Institution-Duke University Fellowship made this research collaboration possible.

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