Churning Waters: Creating a Framework for the Implementation of Offshore Wind Farms in the United States

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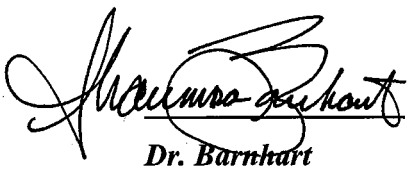
March, 2014

Submitted in fulfillment of the senior thesis requirements of the Department of Environmental Science at Allegheny College and approved by the senior thesis committee.



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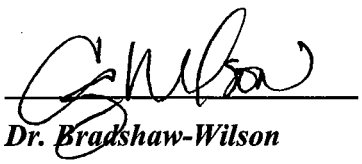
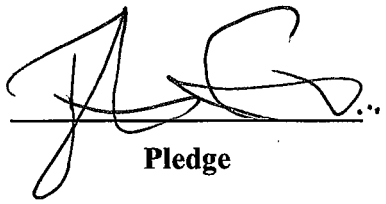


Dr. Bradshaw-Wilson **Date** 4/30/14



Pledge

Tyler Chilcott

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Abstract

In order to keep up with global markets and thrive in a renewable future, the United States needs to invest in renewable energies and begin to dramatically change the way we consume nonrenewables. In order to offset the massive amounts of energy that our country needs, a number of renewable resources must be tapped into. One such resource that has yet to be implemented in the U.S. is offshore wind. Because there are no current projects here, there is no precedent for what a wind project developer should do. Using case study research and firsthand accounts, a list of best management practices has been compiled. These best management practices were then applied to the Pennsylvania State waters of Lake Erie. While not all-encompassing, these strategies have been implemented successfully in other places and can be adjusted for different regions.

Introduction

Energy usage is prevalent in practically every aspect of life in the developed world. Whether it is driving to work, mowing your lawn, cooking food for you family, or turning on your computer, energy resources are necessary for the fast paced world in which we live. At roughly 98 quadrillion British Thermal Units (Btu), the United States is currently the largest consumer of energy in the world (EIA, 2013). With a world total at 511 quadrillion Btu, the United States accounts for nearly 19 percent of global energy consumption (EIA, 2013). This is a striking figure when one considers that the United States encompasses just ten percent of the

world's population (Census, 2013). Supplying this much energy comes with environmental, monetary and social expenses. Widespread globalization and increased industrialization of developing countries have the potential to amplify the environmental problems that we see today (Bang, 2010).

The price volatility and uncertainty about future global energy consumption, along with the limited availability of various nonrenewable energy resources, are causing skepticism about the longevity of our primary energy sources (Bang, 2010). Due to increased consumption in energy across the globe and increases in world population, projections show that the world's energy demands could increase by 56 percent by the year 2040 (EIA, 2013). Thus, the world as a whole, but specifically the United States, must find new and abundant sources of energy to ensure that we will have sustained energy for our future. Offshore wind energy is something that has yet to reach its full potential in the United States (DOE 2013). This study will attempt to come up with a framework in which the United States will be able to utilize its offshore wind potential in order to expand its energy portfolio. This will be done by compiling a list of best management practices for the implementation of an offshore wind farm, which can be applied to the Pennsylvania State waters of Lake Erie.

Why Renewable Energy?

Fossil fuels such as coal, natural gas and oil make up around eighty percent of the world's primary energy consumption (EIA, 2013). The heavy reliance on these sources of energy was spurred by the Industrial Revolution, and has been growing at an alarming rate ever since (Sims, 2003). At face value, the low prices and short term abundance of these fossil fuels are undeniable, the negative environmental impacts, such as carbon dioxide (CO_2) emissions,

and lack of long term availability are growing concerns that are becoming more prevalent in scientific research (Turner, 1999; Bader et al. 2006; Fershee, 2008; Shi, 2010). CO_2 emissions are of concern to the general population because carbon dioxide is the primary greenhouse gas emitted by anthropogenic activities. These excessive emissions contribute considerably to global climate change. Along with that, CO_2 emissions also lead to air pollution and ocean acidification (EPA, 2013)

This reliance on energy sources that are nonrenewable, along with their negative environmental impacts, led to the adoption of the Kyoto Protocol in 1997. This was drafted by the United Nations in order to create a framework in which participating parties reduce greenhouse gas emissions by an average of five percent, compared to 1990 levels, and inevitably promote renewable energy growth (UNFCCC, 2013). Targets were set for 2012, but because of a lack of concrete framework as to how these targets would be met, it was not as successful as was initially planned (UNFCCC, 2013). This led to the agreement's Doha amendments. In 2012 the parties met in Doha, Qatar to reestablish emission benchmarks (Chen et al. 2013). While some countries are making a strong push towards the reduction of greenhouse gas emissions, the United Nations (UN) continues to push back target dates. In the Doha amendments it was determined that a universal climate agreement will be reached by 2015 and that it will be implemented by 2020 (UNFCCC, 2013).

Alongside the environmental problems, our dependence on, and consumption of nonrenewable fossil fuels will eventually lead to their depletion. There have been talks of an impending crisis after "peak oil" is reached. Peak oil occurs when the global production of oil peaks and slowly decreases thereafter (Schneider-Mayerson, 2013). According to Murray and King (2012), we have already reached peak oil. Because of the speculation that is involved in

estimating oil reserves, there are others who believe that oil may not reach its peak until sometime in the distant future (Jefferson, 2008). Regardless of when this might occur, there is an undeniable need for safe, renewable and economically feasible energy alternatives for future generations (Jefferson 2008).

Renewable energies include wind, solar, biomass, and hydroelectric. These differ from their fossil fuel counterparts in that they are generally an infinitely renewable and comparatively low emissions source for our energy needs (Painuly, 2001). The emissions that do come from renewable energies are minor and include things such as the installation of infrastructure and emissions from the burning of biofuels (Firestone and Kempton, 2006). A problem with renewable energies is that they are sometimes not feasible in specific locations. It is hard for solar panels to reach maximum capacity in a location that has limited sunlight, and it doesn't make sense to put a wind turbine in a spot that experiences low wind speeds. This can be remedied by the utilization of specified siting (Painuly, 2001). Specified siting of renewable energies is simply the construction of said renewables in a location that has been verified, using wind speeds, amount of sunlight, water flow etc., as suitable for optimal output (Painuly, 2001).

A study by Sims (2003) compared carbon emission and mitigation cost between different future sources of electricity compared to baseline fossil fuels. These alternative energy options

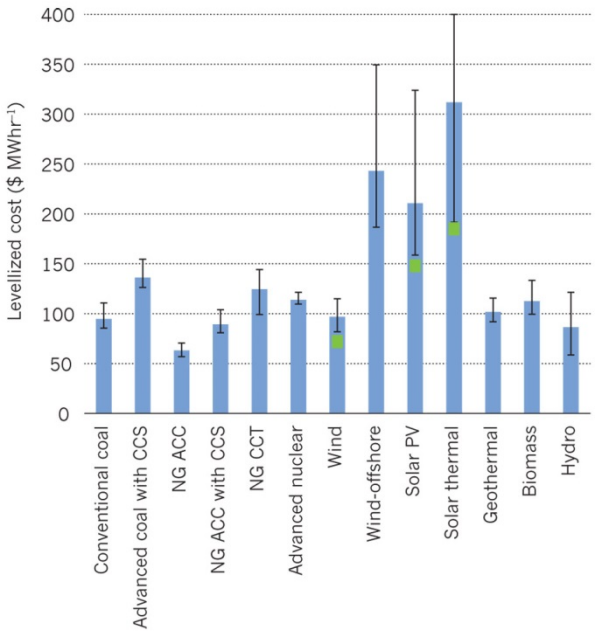

Figure 1. Projections by the US Energy Information Administration made in 2010 of the 2016 average cost and range of the levellized cost of electricity from various sources.

included wind, biomass, nuclear, solar, and hydro, with all but nuclear being renewable. A study done by Chu and Majumdar (2012) showed the projected prices for various energy sources in 2016 (Figure 1). Similar studies were performed by the World Energy Council and the U.S. Department of Energy, but a major component was missing in their analysis. (WEA, 2013; DOE, 2013) This crucial variable was the potential for technological advance, not only with the renewable options, but also with fossil fuels (Sims, 2003). One alternative that was determined to be feasible in reducing emissions and mitigation costs was wind power. In locations with high annual wind speed, this particular renewable source of energy could be competitive with coal and gas power generation (Sims, 2003).

Wind Energy

The wind has been utilized to generate power for at least 3000 years. These early windmills were used for grinding grain and pumping water and were important tools in early civilizations (Burton et al. 2011). The first ever wind turbine, used for electricity generation, dates back to the late nineteenth century but was only used to charge batteries, and the idea was eventually overlooked when grid access became readily available (Burton et al. 2011). This turbine had a 12 kW capacity. To put this into perspective, today's windmills average around 2-3 MW (EIA, 2013). This means that turbines today are roughly 2000 times as powerful as the initial late nineteenth century design.

Wind energy stems from both onshore and offshore wind farms and, from 2007 to 2012, wind energy as a whole had a global annual growth rate of over 17 percent. This increasingly important form of renewable energy currently only supplies around one percent of global energy needs (Krogsgaard et al. 2013). According to the U.S. Department of Energy's 2012 Wind

Technologies Market Report, wind power represented the fastest growing source of U.S. generating electric sources in 2012 along with 25 billion dollars in new investments (DOE, 2013). Advances in this new technology and increased efficiency in the citing of projects has led to consistent drops in its cost per kilowatt hour (Elliot, 2000).

Wind energy seems to be a viable option for the replacement of fossil fuels on the way to a more sustainable future, but it is met with stringent opposition by some. When it comes to the potential environmental impacts of wind energy, there are ongoing studies of how these wind turbines will affect terrestrial and aquatic life and are subject to opposition. It lies with these studies to explore all of the relevant environmental and social associations that are connected to wind energy development. These studies are essential in not only assessing impacts and relevant mitigation techniques but are also pivotal in deciding if wind energy is a viable and safe option for the diversification of energy portfolios and the movement towards a more sustainable future.

When dealing with the environmental impacts of wind energy there are several specific aspects that are being researched. Special attention is being paid to bird and bat populations, marine and terrestrial mammals, fish and other aquatic species, and the various ways that these animals can be affected by both onshore and offshore wind farms. In order to assess the effects of bird and bat populations, Camphuysen et al. (2004) used aerial and ship-based surveying in order to find spatial and temporal paths in seabirds. Using a different method, Desholm et al. (2006) found that avian surveillance for single wind farm studies was most effective using low-powered marine surveillance.

Discrepancies in methods used and the inherent variability in bird species and distribution has led to skepticism of definite results and need for additional studies (Camphuysen et al. 2004). In a study done by Ahlen et al. (2007), bat populations were observed to hunt and rest on the turbines and the amount of bat fatalities increased. Similarly, Kunz et al (2007) found that large numbers bat populations were killed by onshore wind turbines along forested ridge tops. With regards to birds it was observed that some were attracted to the turbines and in some cases, with poor visible conditions, certain species collided in large numbers (Huppop et al. 2006). While these studies have shown that bird and bat populations can be affected by wind turbines, it was described by Leung and Yang (2012) that the amount of birds that are affected by the turbines is negligible compared to other anthropogenic processes including deforestation and urbanization. Drewitt and Langston (2006) acknowledge that there are appropriate and inappropriate places for wind farms with regards to vulnerable bird populations. This study explains that collisions and displacement have been observed in bird populations, but if a project is placed in the correct location, effects will not play a role in significant mortality rates (Drewitt and Langston 2006).

Bird and bat populations have been heavily researched and, because of the number of studies done and publicity, it remains a highly debated topic. Although birds and bats are important in the scientific research surrounding wind farms, there are several environmental impacts that are simultaneously being studied. The study done by Leung and Yang (2012) found that, with offshore wind farms, salmon can perceive the pulses from pile driving during construction at a considerable distance and could potentially have behavioral effects. Alongside these perceived effects on marine animals, the electromagnetic currents that run in underwater cable networks could potentially interfere with animal navigation (Tabassum et al 2014). It was also posed by Tabassum et al (2014) that the construction of these offshore platforms could lead

to re-suspension of polluted sediments. In a study done by Madsen et al. (2006), it was found that the initial pile driving that occurs during the construction of offshore wind turbines will likely affect the way that marine mammals use sound for foraging, orientation and communication. Disruption was evident during construction but there was no significant noise impact that was related to the operational turbines (Madsen et al. 2006). Also, offshore platforms, such as oil platforms and offshore wind farms in Europe can lead to artificial reefs that promote increased biodiversity (Tabassum et al. 2014).

Along with the environmental impacts linked to wind turbines, there is also a public perception aspect involving aesthetic degradation. In a study done by Firestone and Kempton (2006), wind turbines were seen as a potential eyesore that would detract from otherwise scenic landscapes that the local community has grown accustomed to seeing. This may not seem to be a pivotal factor in the progress of wind power, but public perception is integral to the process of propelling a new sector of the energy market forward. According to Devine-Wright (2005) people were more likely to oppose wind farm projects if the projects were in close proximity to their homes than if the project was somewhere else. This follows the theory of NIMBYism, meaning Not In My Back Yard, which involves the reluctance of people to support some sort of change, such as a wind farm, if it is in their locality (Devine-Wright, 2005).

Why Offshore?

One way to combat the effects of NIMBYism is placing turbines offshore. In the United States, there are currently no offshore wind turbines. While the United States has been lagging behind in the offshore wind world market, it has been operational in Europe since 1991 which currently has more than 830 offshore wind turbines in nine countries (Musial and Ram, 2010).

Countries like Germany, China and Denmark have been pursuing offshore wind development for two decades now and have lofty goals for future production (Portman et al. 2009).

Offshore wind turbines have many distinct advantages over their onshore counterparts. For one, winds tend to be more consistent and have higher speeds offshore. One of the main problems that onshore wind energy faces is that there are few locations that can sustain a high average wind speed. In moving offshore, long stretches of open water could prove to be ideal locations for a wind farm. (Musial and Ram, 2010)

In the United States, the coastal and Great Lakes states use 78 percent of the nation's electricity (AWEA, 2011). In these dense coastal areas, there is a need for a more efficient and economically beneficial form of electricity. Current electricity prices are high and there is little room for new land based facilities (AWEA, 2011). By placing wind farms off these coasts, the transmission lines that will need to connect them to the grid will not be far and will be more likely to be able to compete with their nonrenewable counterparts by reducing the scale of infrastructure needed (AWEA, 2011).

Key offshore wind projects

Cape Wind Associates initially proposed a 130 turbine wind project in Nantucket Sound. Significant amounts of funding were necessary to carry out environmental impact studies and assessments of public opinion. The people of Nantucket Sound were left out of the initial process of coming up with a plan and tended to feel that they were going to have to deal with all of the negative aspects of having a wind farm in their waters and that they would receive none of the economic benefits (Musial and Ram, 2010).

After many setbacks, Cape Wind is now on track to be the first offshore wind project in the United States. Energy Management Inc. picked up the project as the developers and has secured all of the Federal and State permits necessary to put the project into motion. Although the Cape Wind project is ready to be constructed, it has not yet started. Once construction begins, it will be two years before it is operational (Cape Wind, 2012).

Samso is a small island in Denmark with a population of around 4,000 people (Udall, 2009). In 1997, using a project plan that was submitted into a renewable energy contest ran by the Danish Energy Authority, Samso was named the "Renewable Energy Island," (Hermansen et al. 2007). Within ten years, this small island became 100 percent renewable (Kolbert, 2008). This project is important because of the active engagement of the community in the implementation of the project. With ten offshore wind turbines, around 450 private investors and members of the community owned shares (Kolbert, 2008). This investment accounted for 250 million dollars (Kolbert, 2008).

Another important player in the advancement of offshore wind energy in the United States is the Lake Erie Energy Development Corporation (LEEDCo). LEEDCo is in the process of obtaining the necessary permits and leases to propel the Cleveland area to be the first freshwater offshore wind farm in the United States. In 2005, AWS Truewind, a renewable energy consulting firm, was hired to assess wind energy potential in Lake Erie (LEEDCo, 2013).

The initial report stated that the area was a viable option for an economically beneficial wind farm, and a more in depth study was proposed. A more in depth study done by the Great Lakes Wind Energy Center reinforced the idea that this is indeed a feasible location. General Electric was selected to be the supplier of the turbines for the project. Since then, the project has

obtained a lease from the Ohio Department of Natural Resources giving LEEDCo exclusive rights to the proposed site. Currently, the project is at a standstill with more tests needed to ensure that this is the best location for an offshore wind farm (LEEDCo, 2013).

Obstacles of Offshore Projects in the U.S.

The reasons for lack of offshore wind projects in the United States are important in understanding how the potential regulatory process will work. In order to understand this, one must first look towards European development. There are fundamental differences between the United States and certain countries in Europe, such as Germany and Denmark, when it comes to the regulatory processes involved with offshore wind. Europe's financial incentives and subsidies make it so that offshore wind energy is a part of framework that promotes renewable energy infrastructure. Some of the largest energy companies in Europe, who also work with oil and gas, are also developing and creating these projects (Snyder and Kaiser, 2009).

When it comes to regulatory processes, European countries have set up ways to expedite these projects so that they are being approved by a specific federal agency. By doing this, individual projects can be evaluated in a more efficient way that could prevent them from being hung up for too long. On the other hand, in the U.S., it was not until 2006 that it became clear which federal agency even had jurisdiction over the authorization process for proposed projects in federal waters (Portman, 2009). This confusion discouraged potential firms and created situations in which there was unnecessary and painstakingly long waits to find out if they were even able to do studies for a project in a certain area (Snyder, 2009).

When dealing with regulatory processes in the United States, the community is included in the Environmental Impacts Assessment. This assessment is conducted after feasibility studies

and other such preliminary procedures, including obtaining rights to land and environmental impact tests etc. are already done. Also, the assessment is composed of strictly the parts of the project that will have a negative impact which could create an immediate bias for those who are involved in the community. These assessments can include a broad set of topics which may not necessarily have to do with the project approval or the environment, including personal opinions and public perception. This is detrimental to the project because in this stage, permits are supposed to be granted strictly on the positive and negative aspects of economic and environmental impacts (Portman, 2009). This poses a problem because it takes away from the objective and scientific nature that should be inherent in permitting processes.

Offshore Wind in the Pennsylvania State Waters of Lake Erie

The major population centers that surround Lake Erie, such as Cleveland, Buffalo and Erie are economically depressed regions (Forbes, 2011). These cities are a part of the Rust Belt that specialized in manufacturing and saw a 30 percent decline in employment between the years of 1965 and 1996 (Kahn, 1999). Bringing offshore wind energy to Lake Erie would create jobs and economic growth (Saidur et al. 2011). Becoming the frontrunners in the offshore wind sector in the United States would provide these areas with innovative technological advancements along with educational and tourist opportunities (Saidur et al. 2011). Lake Erie, specifically, is the shallowest of the Great Lakes. This leads to reductions in raw material and construction costs and could serve as the ideal place for a pilot project in the region (Saidur et al. 2011).

Currently, Pennsylvania is still in the early stages of investigating the feasibility of an offshore wind farm. There have been a few articles written in the Erie Times News about a

potential offshore wind farm in Pennsylvania State waters. One article described a hearing that was held in March of 2011 that simply involved opening discussions. At this meeting hosted by several state Senators, a representative from Apex Offshore Wind outlined a preliminary proposal for a potential project. This was met with opposition from the public regarding fish habitats and migratory bird paths. According to the article, the meeting wrapped up with a general consensus from the community that we should simply "Wait and see how Ohio does it" (Myers, 2011). This is vital when dealing with this project because, as the previous article suggests, a need for there to be some sort of comprehensive look at what others are doing would be a valuable resource for those who may be interested in pursuing an offshore wind project.

Offshore wind energy is a specific form of renewable energy that has yet to be fully exploited. Coastlines bring in difficult problems, with greater depths, high prices, and blurred regional boundaries, while the Great Lakes pose an option that could be both feasible and economically beneficial. By researching some of these current projects in the United States, along with the Samso project in Denmark, and interviewing some of the people that have played a role in them, I have distilled a set of best management practices. The resulting framework is site specific to Lake Erie while still being relevant to potential offshore wind farms throughout the United States.

Methods

In this study, a list of best management practices for the implementation of an offshore wind farm in the Pennsylvania State waters of Lake Erie was compiled. This was done using two methods: collective case study research and key informant interviews.

Collective Case Study Research

The collective case study research design is used when a number of elements must be observed that are dispersed amongst different studies. While each individual study must be synthesized separately, they are studied as a part of a collection. By collecting the information from several studies, with different points of view, the list of best management practices will attempt to avoid any shortcomings of each individual study. According to Yin (2009), a case study should be used when a researcher is trying to figure out how or why a phenomenon occurs. The phenomenon at hand is how offshore wind farms are implemented. The case studies that used are the LEEDCo project in Cleveland, Ohio, the Cape Wind project in Nantucket Sound and the Samso project in Denmark.

The LEEDCo project was chosen because of its proximity to the potential project in the Pennsylvania and the inherent similarities that are associated with its location. This project is still in its early stages and has ongoing studies and activities that can be easily accessed by the public. The Cape Wind project was used because of the prolonged opposition that it faced. This opposition led to extensive literature on the project's progression throughout the years. These studies are readily available and can be accessed by the public. The Samso project, from Denmark, is necessary because neither of the prior two projects are operational. This project shows what a completed project looks like and will have information on problems that may occur both after initial steps have been taken and once the farm is operational.

Key Informant Interviews

I communicated with key informants from Environment Erie, Northwest Pennsylvania Green Economy Task Force (NWPAGE), and the Great Lakes Wind collaborative (GLWC) in order to enact chain referral sampling or "snowball sampling." Snowball sampling is a technique that begins with initial informants that introduce the interviewer to future informants through their professional connections (Biernacki and Waldorf, 1981). I was unable to get into contact with anyone outside of the initial groups described.

A representative from Environment Erie was used as one of the key informants because this group has prepared for a potential offshore project in the past i.e. holding forums and starting interest groups. Environment Erie is a group whose primary role is environmental education. Along with this, the group is involved in the promotion of the sustainability of natural resources within the community. They hold workshops and seminars for multiple environmental subjects including composting and storm water collection, among others. Their 2013-2014 initiatives include such things as alternative energy technology and climate change education.

NWPAGE is an organization that serves as a vehicle to promote green initiatives in Northwest Pennsylvania. This is achieved by activities such as sponsoring roundtables and public events with speakers in the environmental field brought in to keep an open dialogue with the community. This group exists so that there is a venue for the communication of sustainability efforts among leaders of the local green economy. They are currently involved in the promotion of an onshore wind project in the Borough of North East in Erie County, but they are currently looking for ways to keep the discussion about offshore wind as active as possible.

GLWC is a multi-sector coalition in the Great Lakes region that exists to facilitate development of wind power. These interdisciplinary wind energy stakeholders exist to identify and address the issues surrounding wind energy resources. The GLWC has recently held workshops highlighting current research that they are involved in and initiatives that are forthcoming.

I set out with a few key informants and a semi-structured interview format with the intent to distill as much information from a large number of individuals involved in offshore wind energy. Unfortunately, most of the people that I tried to get into contact with never got back to me or were consistently unreachable. I was able to speak with three professionals in the field of renewable energy. What resulted were open ended interviews and casual dialogue.

Analysis of primary documents

By analyzing these primary documents, I have compiled a list of best management practices. This was then applied to the Pennsylvania State waters of Lake Erie. I was able to do this by identifying commonalities between projects that either led to successes or failures. This information will be relayed to Environment Erie and will be published in the Erie Times News newspaper. Along with this, NWPAGE will be able to relay the findings to the public.

Results

These results include an overview of each individual project, a description of some of the social or environmental impact testing that were involved, any kind of opposition or backlash, and what the current status of the project is. At the end of the section is a summary of specific

things that were done that can be applied to other projects and will be the basis for the recommended best management practices.

Case Studies:

Cape Wind

Project Overview

In 2001, Cape Wind Associates LLC submitted a project application for the very first offshore wind farm in the United States. Cape Wind would consist of 130, 3.6 megawatt (MW) wind turbines covering a total of twenty-five square miles (BOEM, 2013). The maximum blade height of these turbines is 440 feet and the total capacity of the farm is 468 MW (Cape Wind, 2012). The proposed project was to be set in the federal waters of Cape Cod, Massachusetts, in Horseshoe Shoal of Nantucket Sound.

This area was chosen because of its high potential for electricity generation and also, according to The American Lung Association, Cape Cod has the worst air quality in Massachusetts (Cape Wind, 2012). This stems from New England's heavy dependence on the burning of fossil fuels for electric energy generation. The region's dependence on natural gas exceeded 41 percent in 2004. This was compared to the national reliance which only accounted for 19 percent for generation of electricity (Cape Wind, 2012). An offshore wind project in this region could not only offset nonrenewable energy consumption, but would also increase air quality and assist in the mitigation of climate change.

As the first proposed offshore wind project in the United States, the process leading towards the eventual construction of Cape Wind has been anything but simple. First and

foremost, because of the nonexistent regulatory framework regarding offshore leasing and permitting, this project has had to navigate its way around several regulatory bodies including the Army Corps of Engineers, the Minerals Management Service and the Bureau of Ocean Energy Management (BOEM, 2013). This lack of a concrete process, along with many other reasons discussed below, plays an enormous factor as to why the project is not yet operational.

A 28 year lease was finally granted in 2010 after years of environmental review and assessment. This lease consisted of 46 square kilometers, including both the project area and a necessary buffer zone (BOEM, 2013). This lease will cost the Cape Wind Associates 88,278 dollars in annual rental payments with a two to seven percent operating fee once production commences (BOEM, 2013).

With policy difficulties aside, it was very important that Cape Wind was not rushing into something that could potentially have a negative impact on both environmental and social aspects of our lives. Because this was the first project of its kind in the U.S., it was imperative that a sufficient amount of studies were done to ensure that this was the correct option. Cape Wind underwent the permitting processes of seventeen federal and state agencies requiring a number of environmental and social impacts testing (BOEM, 2013).

Environmental and Social Impact Testing

In order for this project to obtain the necessary leases and permits needed to move forward, Cape Wind Associates were required to go through a number of studies to ensure that the project would not have any significant negative environmental or social impacts. These primary documents were performed by the various regulatory agencies involved in the permitting process and are described in Appendix I. Alongside these mandatory studies, other peer

reviewed studies were completed to ensure the safety of the project and to confirm that replicated studies align with the outcomes of their governmental counterparts. These studies range from public perception, marine animal impacts, bird impacts, and construction disturbances that are described below.

Both environmental and social impacts tests have been performed outside of government agencies for this Cape Wind project. Most of the environmental studies being done revolve around marine animals and birds. The various studies mentioned have established that there were no lasting negative impacts that would result from the erection of the Cape Wind project. In accordance with these studies, Madsen et al. (2006) found that the sound pollution coming from the construction process would not have a lasting effect on cetacean populations. It was found that even though temporary disturbances could affect whale populations in the short run, long term effects would not be seen at a significant level (Madsen et al. 2006). Counterintuitive to most oppositional points, Inger et al. (2009) argues that the turbines themselves could potentially serve as artificial reefs for all kinds of aquatic animals. It is stated that the operational sounds of the turbines could be at low frequencies that would attract marine animals and larvae creating a potential benefit (Inger et al. 2009). Understanding these potential outcomes regarding aquatic animals is hard to predict, so Mooney et al. (2013), has established baseline sound levels and will continue to monitor biological activity once the project is operational in order to see if prior expectations were correct.

Additionally, bird safety is an important factor when dealing with offshore wind turbines. According to Burger et al. (2011), it was determined that, during migratory and breeding season, rare birds such as piping plovers, red knots and roseate turns may be exposed to risk. Depending on a turbine's distance from shore, these birds' migratory patterns may be close enough to the

shore to avoid the farms completely (Burger et al. 2011). It is acknowledged that more information is needed to determine exact routes and behavioral avoidance of the turbines (Burger et al. 2011). A different study done by Burger et al. (2012), using geolocators on red knots determined that migratory paths do cross the path where the potential wind farm will be located on the Atlantic Coast and that additional testing is necessary. Similar findings were shown by Furness et al. (2013), in that there needs to be constant monitoring of specific bird species that may come across wind farms off of the Atlantic Coast. As stated before, the governmental studies have all concluded that there are no significant impacts involved in the Cape Wind project and have resulted in all of the necessary leasing and regulatory stipulations. Therefore, any study, given above, that argues that impacts are significant would lead to discrepancies that may need to be addressed. When these discrepancies arise and the opposing studies are publicized, public skepticism and outright opposition can increase.

This leads to the social impact side of the Cape Wind project. The environmental impact statements, mandated by the government, that were done by the Minerals Management Service (MMS) on the project have established factors such as employment and regional income, fishing, tourism and recreation, and visual as the social issues involved in the Cape Wind project; finding them all to be minor or negligible (BOEM, 2013). When dealing with these social impacts of wind energy as a whole, a number of studies have been done that deal with visual aspects. There are a number of these studies done for Cape Wind that point out aesthetic degradation as the primary reason for public opposition (Pasqualetti et al. 2011; Saito, 2004; Firestone et al. 2012). It is heavily stated in these studies that those who are in close proximity to the project or those who will be able to view it on a day to day basis will experience NIMBYism. It is proposed in these readings that the further away the projects are, the less visible they will be and will result in

more public support. This phenomenon is trivialized by Saito (2004) when he describes the "belching black smoke from factories" and "strip mining," that is entrenched in our society as critical to our everyday lives as necessary and justifiable. Instead of challenging these kinds of aesthetic degradation, we instead focus on demonizing technological advancement and energy related innovation.

A study done by Firestone and Kempton (2006) adds an extra dynamic to the conversation gauging public opinion by surveying local residents near the proposed development of the Cape Wind project. The members were chosen by random stratified sampling. They found much of what was found in earlier studies, but they came across something that had been previously overlooked. Responses given for opposition still talked about environmental impacts and visual dilapidation but they added a set of alternative options at the end of their survey. They proposed a macro view of what this individual project could do for a very real problem with our world: climate change. Firestone and Kempton (2006) found that if the project were framed as one of up to 300 other projects, the support increased by 36 percent and even by 19 percent from those who were previously opposed. This suggests that if the project were to be a part of a countrywide initiative with hundreds of other projects, people would be more likely to support it. This highlighted the inadequacies that are inherent in the proponents' push for these wind farms. Initial conversations in the region were unable to communicate that offshore wind farms are being successfully implemented all over the world. Firestone and Kempton (2006) have found that opposition, typically thought of as primarily based on aesthetics, could be addressed as nearsightedness.

Backlash

The Alliance to Protect Nantucket Sound is a nonprofit organization that was formed in 2001 in response to Cape Wind's proposal for an offshore wind farm (Save Our Sound 2014). The Alliance consists of high profile individuals such as Robert F. Kennedy and Mitt Romney, who are residents of Nantucket Sound (Shanahan, 2011). Bill Koch is another supporter and has made much of his 3.8 billion dollar net worth in oil and investments (Forbes, 2011). All of these high powered and wealthy backers are heavily invested in fossil fuels and have enabled The Alliance to throw millions of dollars at, what Bill Koch explains as, "Delay, delay, delay" (Seelye, 2013). A study done by Shanahan et al. (2011) on narrative policy framework would explain this grassroots organization is trying to undermine the macro-level positive environmental implications that were discussed by Firestone and Kempton (2006) by keeping the local community focused on the immediate human "victims." This meaning that the main opposition of the project is trying to inhibit public education in order to prevent the understanding of a broader context. The "Save Our Sound" website is riddled with buzz words and anti-wind language that McCombs and Shaw (1972) might consider to be "agenda-setting." Agenda-setting is when the mass media determines what we think and worry about (McCombs and Shaw, 1972). In 1963, Bernard Cohen stated that the press "may not be successful much of the time in telling people what to think, but it is stunningly successful in telling its readers what to think about," (McCombs and Shaw, 1972). On the website, the Cape Wind project is described as being on an "industrial scale" and as a "massive energy plant." The turbines themselves are explained as having "synchronized flashing lights" being "marked with fog horns" (Save Our Sound, 2014). In using this language, the website is not able to scientifically discuss potential problems, but it is able to paint the project in a negative light. According to

Soroka (2002), individuals obtaining media information about environmental problems are typically not experiencing those problems on a daily basis. Thus, there exists a venue for the media to highlight an environmental issue and increase public concern (Soroka, 2002). From what I have found, this organization has no peer reviewed studies that have supported any of the claims made on their website about the detriments of this project.

Current Status

Cape Wind is continuing to fight legal battles with The Alliance, but developer Jim Gordon isn't ready to give up any time soon. In an interview with *The New York Times*, Gordon is quoted in saying "It's just sad that somebody who has the means to spend millions of dollars can hold something up that's going to produce a lot of benefits for Massachusetts and this region," (Seelye, 2013). This has been an ongoing process for 12 years and doesn't have a definitive ending in sight. Only time will tell if this project will become operational before 2038 when its 28 year lease runs out.

Samso

Project Overview

The story of Samso Island in Denmark is quite different than the other case studies. Samso is a small island of 112 square kilometers with about 4,000 inhabitants comprised almost entirely of farmers and manual laborers (Udall, 2009). The events that led this island to become one of the faces of renewable energy started with a contest held by the Danish Energy Authority. This contest, spurred by a countrywide push for renewable energy, provided funding for the formation of plans for individual islands that could potentially transition to 100 percent self-sufficiency with renewable energy (Hermansen et al. 2007). In 1997, Samso was named,

"Denmark's Renewable Energy Island" (Saastamoinen, 2009). While offshore wind turbines were a part of this project, they are not the sole focus. What makes this case study important is the way in which the residents of this island were engaged in order to implement an entire set of renewable energies. The island of Samso was tasked with this transition to renewables within ten years with a rough timeline designed by PlanEnergi, which is an independent consulting firm (Saastamoinen, 2009). The project was to incorporate biomass, offshore and onshore windmills, and solar heating, among other individual efforts (Saastamoinen, 2009).

Environmental and Social Impact Testing

At the time of this project in the late 1990s, Denmark was spending a significant amount of money on research and development of renewable energies and making readily available capital grant schemes, investment incentives and purchasing agreements (Saastamoinen, 2009). At this time, Denmark's government was pro renewable energy which led to the licensing process being straightforward and dealt with only one governmental agency. This allowed potential projects to avoid the drawn out processes that are found in the U.S. In order to implement an offshore wind farm in Denmark, only three licenses and an environmental impact statement are needed (Danish Energy Agency, 2013). These include a license to carry out preliminary investigations, a license to establish offshore wind turbines, and a license to exploit wind power for a given number of years (Danish Energy Agency, 2013).

With regards to the EIS, Denmark followed European Commission guidelines (European Commission, 2014). The developer must pose the project; they must notify the public that they will perform the EIS; the authoritative body will decide whether or not to approve the project; the public is to be informed of the decision; the public has the chance to challenge the decisions

in court (European Commission, 2014). An EIS was performed, but no record of the one used in the Samso project was to be found. The project was approved and no court hearing came into play. The only opposition came from conservative islanders who were unwilling to make a first move and from Birdlife Denmark (Hermansen et al. 2007). Community involvement will be discussed further but the issue with Birdlife Denmark was resolved without any kind of additional assessments or studies (Hermansen et al. 2007).

Why it Worked

Immediately after the project, which was proposed by a man who was not even from Samso, there were no sudden implications. There were no tax breaks, no prize money and no government assistance. The hype generated from the contest soon faded. It wasn't until one individual took it upon himself to recognize the potential and spearhead a revolution. That man was Soren Hermansen. Soren was born on Samso and, besides his time away at university, has lived there for his entire life (Kolbert, 2008). Limited government money was obtained by Samso from winning the contest and Soren became the first government funded position for the project (Saastamoinen, 2009). This position put Soren in charge of initiating the steps that were laid out in the plan that won Samso the energy contest. According to Hermansen et al. (2007), Soren understood the dynamics of the small island and knew that the only way to get people on board with his cause was to work from the bottom-up. He attended every local meeting that came about, regardless of the subject, and gave his pitch on why Samso should implement their renewable energy plan. The opinion leaders of the community were the ones that he needed to convince and allow for a domino effect (Hermansen et al. 2007). It didn't hurt that he would frequently bring free beer to these meetings to lighten the mood (Hermansen et al. 2007).

Once Hermansen was able to get the first movers to support the project, more and more islanders followed. The local community that Soren was finally able to attract became actively involved in the continuous decision making. By doing this, the local community obtained a sense of ownership in the process. Instead of outside contractors coming in and telling these people what was best for them, the people who were directly being affected by the project had influence in some of the major stages of the project (Saastamoinen, 2009). From there, the people were able to engage in the project as active stakeholders. It was described by Kolbert (2008) that monetary benefit was the main driver of the project. The fact that they were doing their part to mitigate climate change and set precedent for a global change was almost entirely on the backburner (Kolbert, 2008). The residents were then given the opportunity to invest in these turbines with somewhere around 450 community members owning shares (Kolbert, 2008). Ultimately, after only eight years, Samso became 100 percent energy self-sufficient (Hermansen et al. 2007). While some projects failed and others did not do what they set out to do, Samso was producing so much renewable electricity that they were able to offset the energy consumption of the transport sector (Hermansen et al. 2007). Compared to large cities in developed countries that consume a large amount of energy, Samso's switch to renewables may seem trivial. While this renewable energy island may not be doing much for the total offset of carbon emissions, the fact that they become self-sufficient in less than a decade allows others to learn from their experiences and potentially implement them on a larger scale.

Current Status

Samso island is now a huge tourist attraction with half a million guests staying overnight annually (Saastamoinen, 2009). It is frequented by politicians, businessmen, scientists and university students from all over the world who come to see how the Danish energy policies have been implemented on a small community scale (Saastamoinen, 2009). Instead of being seen as a detriment to the aesthetic landscape of Samso, these turbines are looked at as an innovative look at a renewable future. The Samso Energy Academy was founded in 2007 as is a community hall that provides renewable energy education and communication. The Energy Academy provides workshops, conferences and tours designed to tell the story of Samso's rise to energy independence (Kolbert, 2008).

LEEDCo

Project Overview

The Lake Erie Energy Development Corporation (LEEDCo) was formed in 2009 as a nonprofit organization in Cleveland, Ohio dedicated to putting an offshore wind farm in Lake Erie (LEEDCo, 2013).



Figure 2. Proposed location for Icebreaker offshore wind project in Lake Erie. http://www.leedco.org/icebreaker/maps

Stemming from the passing of Ohio legislation in 2008 requiring 25 percent of electricity generated to come from clean energy sources by 2020,

LEEDCo came up with their project called "Icebreaker." Icebreaker is to have nine 3.0 MW turbines around seven miles offshore, seen in Figure 2 (LEEDCo, 2013). This project was proposed as an initial step that could prove to be a catalyst for future offshore wind development in the Great Lakes (LEEDCo, 2013).

Environmental and Social Impact Testing

LEEDCo has been in collaboration with Case Western Reserve University in order to better understand some of the environmental implications of this project (LEEDCo, 2013). One thing that has been a major concern in the Great Lakes region is the prevalence of thick ice buildup due to harsh winters. The Great Lakes Energy Institute team at Case Western has been tasked to explore these potential problems and come up with ways to which they can be avoided (LEEDCo, 2013). Also, in 2010, LEEDCo conducted wildlife studies with the guidance of Ohio Department of Natural Resources, lake-bottom studies, and began assessing the capacity and infrastructure of Ohio's ports (LEEDCo, 2013). According to an article written by Dvorak (2013), a study by well-known biologist Paul Kerlinger found that there are no biologically significant impact on birds and bats in the area. This information was released on November 18, 2013 drawing on data collected at the project location beginning as early as 2008 (Dvorak, 2013). Alongside these initial environmental tests, an economic impact analysis was performed by Kleinhenz (2010). In this study, several assumptions had to be made i.e. involvement of certain firms, future costs of installation and wind farm expansion by 2030. According to Kleinhenz (2010), if manufacturing companies in the area supply most of the components, which they have the capacity to do so, by 2027, eight thousand offshore wind jobs could be created.

Backlash

As far as the public goes, there has not yet been a combined effort in opposition of the project. Although, the project is young and just had its first state-mandated public announcement as a proposed project last year (Funk, 2013). Nearly 50 people attended the meeting with most of the outspoken guests being those in disagreement of the wind farm (Funk, 2013). While this may seem like a setback for the project, everyone's concerns are very important for the success of the project. Some people may bring up points that had been previously overlooked and environmental attorney David Nash went on to say that "We are doing a very small project to learn about the risks. We are sacrificing financial sustainability to gain environmental sustainability," (Funk, 2013). Another thing that LEEDCo has been actively pursuing is a Power Pledge which is simply something that you can sign on their website stating that you "pledge to buy a portion of your electricity from the Great Lakes' first offshore wind project," (LEEDCo, 2013). This is a very simple gesture that not only gauges the interest level in the project, but also forces people to really think about how this potential project may affect them in their everyday lives.

Moving Forward

LEEDCo plans on moving forward with everything that they have been doing including continuing environmental and social impact studies and securing permits. Also, the Icebreaker project was one of seven that was chosen as a "demonstration project" by The Wind Program. The Wind Program is a part of the Department of Energy (DOE) that is "committed to developing a portfolio of innovative technologies for clean domestic power generation targeted at producing 20 percent of our nation's electricity by 2030." This program announced funding in

2012 for seven projects that will total 168 million dollars over six years. The initial seven projects in Texas, New Jersey, Virginia, Ohio, Maine and Oregon, each received four million dollars. Later on this year (there is no set time as to when) the DOE will chose three of the seven projects to receive 47 million dollars each for siting, construction and installation (DOE, 2013). The DOE has declined to discuss the evaluation process surrounding this funding (Turkel, 2014). Many stakeholders are waiting on this decision to make any moves because without this money, the project could be set back yet again (EcoWatch, 2013).

Practices Used

Listed in Table 1 are some of the specific practices that were implemented by the given project. These seven categories make up the list of best management practices and will be expanded upon in the Discusussion.

Table 1. List of practices used by each of the projects that are included in the list of best management practices

Practice Used	Cape Wind	Samso	LEEDCo
1. Formation of grassroots organization	X	X	X
2. Governmental requirements and reccomendations for additional impact studies	X	X	X
3. Public education/open dialogue	X	X	X
4. Opinion Leadership	X	X	
5. Stakeholder engagement		X	
6. Framing		X	

Discussion

A list of best management practices was compiled from the collective case study research and key informant interviews. This list includes the formation of a grassroots organization, governmental requirements and additional impact studies, public education and open dialogue, opinion leadership, stakeholder engagement and framing. The practices were then applied to the Pennsylvania state waters of Lake Erie.

Best management practices

Formation of Grassroots Organization

Grassroots organizations stem from the creation of a movement that is of natural origin and grounded in the local community (Chetkovich and Kunreuther, 2006). According to Mitlin (2008), the formation of a grassroots organization enables individuals interested in creating some sort of change to secure otherwise unattainable relationships and resources. This provides the individual with immediate basic needs, as well as setting them up future bargaining power (Mitlin, 2008).

This practice is seen in all three of the case studies. The Cape Wind project was taken on by Cape Wind Associates (BOEM, 2013). This organization came about because an opportunity to capitalize on the offshore wind energy potential of Nantucket Sound was realized. While the Samso project was started by Soren Hermansen, he soon established an organization called the Samso Energy and Environmental Office in order to promote the Renewable Energy Island project (Hermansen et al. 2007). The LEEDCo project is named after the organization that started it, the Lake Erie Energy Development Corporation. LEEDCo describes itself as a

regional non-profit and economic development organization building an offshore wind energy industry in Ohio (LEEDCo, 2014).

According to Chetkovich and Kunreuther (2006), "organizations are important in how they serve the larger movements of which they are a part." Each of these organizations is making or has already made contributions to the movement toward renewables. Because of the influence that these groups have had on their respective projects and the need for the formation of a grassroots organization has been determined to be a best management practice.

Governmental requirements and recommendations for additional impact studies

As has been discussed already, there are regulations, studies and permitting processes that are required in order to implement an offshore wind project. Reverting back to Appendix I, one can again grasp the expansive amount of time and resources that go into this step. In this appendix, there are twelve regulatory documents that are discussed in detail. They are implemented by four different governmental agencies including not only the Minerals Management Service and Bureau of Ocean Energy Management, but also by the U.S. Fish and Wildlife Service and U.S. Coast Guard. This suggests that the regulatory aspect of an offshore wind project is a complicated and far reaching aspect that addresses anything from biological impacts to marine and navigation safety. Applications for permitting and leasing can take a significant amount of time. Also, the mandatory environmental and social impact studies needed to obtain those leases take time and preparation.

Law dictates baseline testing in order to ensure the safety of the environment and the human populations. Aside from the mandatory studies that need to be done, additional or follow-up studies are also beneficial to the project. The studies that are done because they are

required by law can be compared to public opinions and concerns. Once these new concerns are brought about, the organization going through the regulatory process can then go back and reassess the project with a broader perspective. The Cape Wind project is a prime example. Public dialogue led to previously unidentified potential impacts. Those impacts were then looked at and hazardous procedures were potentially avoided (Madin, 2013). In order to transition to offshore wind energy as a clean form of energy, one must first determine if it is truly done in an environmentally friendly way. This step in the management process is in place to do just that.

Public education and open dialogue

Alongside the mandatory studies, public education and dialogue is a staple amongst offshore wind projects. All three of the case studies have established a distinct line of communication with the public in order to inform them about offshore wind and to investigate any feedback that they receive (BOEM, 2013; Hermansen et al. 2007; Great Lakes, 2014). Mentioned in the last section on additional impacts studies, this dialogue is crucial in identifying potentially harmful impacts that may have been overlooked in the regulatory process. I spoke with a representative of the Great Lakes Wind Collaborative (GLWC) about a study done on public opinion of an offshore wind farm in Lake Michigan. After a project was proposed in Michigan, the adjacent counties immediately rejected it. What was found was that these people rejecting the project had little to no basis for their reasoning. The region that was spearheading the project proposal had their skeptics as well, but these people, who had already been exposed to formalized dialogue on the subject, were much more likely to have solidified opinions. Essentially, the interviewee could not stress enough the importance of education. The more that people know, the more likely they will be able to adequately weigh out the pros and cons and,

hopefully, the more likely they will be to support an offshore wind farm. This step has several concrete options that can be utilized. The education process can include public forums, town meetings, workshops, publications, formal presentations, or a combination of them all. Regardless, the public needs to be informed about the facts and current events dealing with the project.

Opinion leadership

Rogers and Cartano (1962) state that individuals will often seek validation with their peers to reinforce their own opinions before making decisions. An opinion leader is someone who exerts an unequal amount of influence on the decisions of others (Rogers and Cartano, (1962). This theory is especially evident in the case of Samso Island. Soren Hermansen was a pivotal opinion leader, but he also understood that he needed to reach out to other leaders within the community (Saastamoinen, 2009).

Opinion leadership is not a strictly one-way relationship. Myers and Robertson (1972) suggest that those people who have the unbalanced influence on others are, themselves, influenced by others. By reaching out to a select few, Soren was able to connect with many. This was easy to see in the Samso project but it was also important in the Cape Wind project. Unfortunately, a large portion of high powered residents and influential opinion leaders were and still are opposed to the project (Save Our Sound, 2014). This could potentially be one of the reasons that the project has taken so long to come into fruition. Personal influence has been widely recognized as being a main driver in the shaping of public opinion (Nisbet, 2005). Allowing existing relationships within a community, in a way that promotes a given project, is an effective way to obtain mass support with limited resource allocation.

Stakeholder engagement

A stakeholder is someone that can affect or is affected by the achievement of an organization's objective (Manuel et al. 2008). This can include employees, stockholders, or, in the case of these offshore wind projects, local communities. This practice does include active engagement with the public and transparency on the side of the grassroots organization and may seem redundant with the already existing public education and open dialogue. Establishing the community as a stakeholder takes this formalized and distanced step to a more personal and relatable level. Acording to Lawrence (2002), in order for stakeholder engagement to be successful, then each side must possess a cultural affinity, recognize the other's legitimacy and dedicate time to building mutual trust.

This practice played a fundamental role in the implementation of the Samso project. As described before, the local community was sought out and actively involved in every aspect of the project. While large scale projects within highly populated cities may not be able to completely replicate the personal connection with the community, a certain level of respect and transparency will enable stronger identification with a given project and promote support and acceptance (Maak, 2007).

Coinciding with the engagement of the public in the decision making process, breaking down some of the barriers of power relationships will allow for the empowerment of the public as opposed to an organization holding power over the community (Haugaard, 2012). When the public is being engaged in the dialogue discussed earlier as an empowered stakeholder, they will be more likely to relate to the project and connect in a way that will promote forward movement and solidified opinions (Nagda, 2006).

Framing

The idea of framing is one that denotes a conceptual structure that allows an individual to perceive and identify the occurrences in their lives (Benford and Snow, 2000). Framing has been increasingly studied within the environmental field within the last decade (Hindmarsh, 2013). By framing different problems in alternative ways, organizations and the media are able to help guide action (Denzin and Keller, 1981). The last practice that will be discussed in this paper is the implementation of framing offshore wind projects in a broad, environmentally beneficial way and in a narrow, economically beneficial way.

The broad context of offshore wind has been discussed in the Cape Wind project with the study done by Firestone and Kempton (2006). As discussed already, support for an offshore wind farm in Nantucket Sound was found to increase if the project was put into a larger context that involved the mitigation of CO_2 emissions into the environment. Hindmarsh (2013) found that proponents wind farm implementation have found the most success, when talking about environmental concerns, with a globalist perspective. This usage of a general "master-frame" cannot be used alone, but must be coupled with a "movement specific, collective action frame," (Benford and Snow, 2000). This meaning that there needs to be both a macro and micro aspect to the framing of an offshore wind project in order for it to resonate with the public.

The movement specific frame was highlighted in the Samso Island case study. In this case, the potential renewable energy projects were framed in a way that focused on economic opportunities that would directly affect the local community (Hermansen et al. 2007). Not only does the public, that has already been educated and engaged as stakeholders (as described in our previous best management practices), need to fully understand the global context of offshore

wind, but they also need to understand that they can directly benefit within the local community (Hindmarsh, 2013).

Pennsylvania Waters of Lake Erie

While Ohio has a project that is already in motion, Pennsylvania is unable to do anything other than talk about a potential wind farm. In an interview with a member of NWPAGE, it was discussed that the state of Pennsylvania has a lakebed lease limit at 25 acres. This is clearly not enough room for an offshore wind farm and until this is changed, development will not occur. It was stated that in 2010, a bill trying to extend leasing size "passed the House but died in the Senate." Curt Sonney has recently reintroduced the bill in the House and nothing has happened with it as of yet.

While a potential offshore wind project is contingent on Pennsylvania legislature, the strategies previously laid out could already begin to be implemented. In an interview with a panelist from "Great Lakes Off-Shore Wind Power: Update from Cleveland and What is in it for Northwest PA" discussed some of the points that have already been touched on in the paper. He made the claim that those working towards a potential offshore wind farm are currently searching for opinion leaders that will have the ability to open up discussions in a positive and constructive way. Making these basic strategies readily available to environmental groups like Environment Erie and NWPAGE, new initiatives can be sought and public pressure could affect policy debates in Harrisburg.

The most important step that can be taken right now is the beginning stages of public education leading into stakeholder engagement and framing. Involving the local community this

early on, using these best management practices, will ensure transparency and will provide the opportunity for the public to form educated and informed decisions.

Conclusion

The goal of this study was to come up with, using important case studies and firsthand accounts, a list of best management practices for the implementation of an offshore wind farm. This list is not comprehensive and universal, but it sets out to begin a discussion on what needs to be done in order to implement what could be an important form of future energy. All projects are going to be different in one way or another, but these practices can be implemented in a way that fits any given region or population.

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Appendix I.

Regulatory Document	Year and Agency	Relevance	Description
-Scoping Study	-2006 -Minerals Management Service (MMS)	-to determine the scope of Draft Environmental Impact Statement (EIS) by requesting comments by way of public notice	-discussed regulatory processes, construction, operations, decommissioning, geology, oceanography, water quality, air and climate, noise, avian and bar resources, communications and radar, cultural resources, aesthetics and transmission lines
-Draft (EIS) and Report	-2008 -MMS	-initial steps needed in the implementation of Cape Wind Energy Project	-Documents not available but were used as initial steps to obtain feedback and broad concepts needed to be addressed
-Biological Assessment	-2008 -MMS	-done in accordance with Endangered Species Act of 1973 to ensure project will not jeopardize existence of threatened or endangered species	-species looked at were whales, sea turtles and avian species -long term effects determined to be minor -biggest concern involved acoustical harassment and water quality degradation only during construction -mitigation measures were proposed
-Biological Opinion	-2008 -U.S. Fish and Wildlife Service	-done based on information provided by Biological Assessment to ensure information provided is reliable, credible and represents the best data available	-opinion is that the project is not likely to jeopardize the continued existence of given species -required compliance with monitoring, response and reporting requirements
-Finding of Adverse Effect	-2008 -MMS	-analyzed potential adverse effects of project on historic properties for compliance with National Historic Preservation Act	-28 historic structures and districts may suffer adverse visual effects -potential mitigation practices were given
-Marine and Navigation Safety Impact Study	-2009 -U.S. Coast Guard	-assessed severity of impact to marine radar and navigation safety	-looked at navigational safety of commercial fishing, recreational boaters, passenger ferries, cruise ships and other deep draft ships -Coast Guard concluded vessel safety
-General Conformity Determination	-2009 -MMS	-to evaluate project with regards to the Clean Air Act	-included both construction and operational phases -based on information provided, project meets conformity requirements
-Final Environmental Impact Statement	-2009 -MMS	-presented characteristic of the environment within project area -analyzed effects of construction, operation and maintenance, and decommissioning of Cape Wind Energy Project	-720 page document including: -project and site description -operation and maintenance requirements -alternative locations for offshore wind farm -monitoring practices -impacts including regional geologic setting, noise, oceanography, climate, air quality, water quality, electric and magnetic fields, fisheries, urban infrastructure, economics, environmental justice, cultural resources, tourism, avian traffic and vessel traffic

-Environmental Assessment	-2010 -MMS	-to assist agency planning and decision making and to evaluate post-FEIS information	-looked into new concerns with advances in technology, cultural resources, staging area interruption, air quality, avifauna, marine mammals, and airport facilities -finding of no new significant impacts
-Record of Decision	-2010 -MMS	-official documentation of the decision to issue Cape Wind Associates a commercial lease for the Cape Wind Energy Project	-Description of background information involving the project -After consideration of final EIS, MMS describes alternatives pursued, mitigation measures, environmental impacts and monitoring Best Management Practices, lease is granted
-Construction and Operations Plan	-2011 -Bureau of Ocean Energy Management	-provided a description of al proposed activities and planned facilities for the Cape Wind Project	-detailed information on how project will conform to all applicable laws and regulations, not cause undue harm to natural resources, be constructed in a prudent and safe manner, use best available and safest technology, use best management practices, and use properly trained personnel
-Environmental Assessment	-2011 -Bureau of Ocean Energy Management	-following the Construction and Operations Plan, additional environmental assessment in order to determine if there is no new significant impact finding	-some new concerns brought up by locals or other commenters -found no new significant impacts