



Memorandum

To: Honorable Mayor and Members of the City Council

From: Wally Bobkiewicz, City Manager
Carolyn Collopy, Sustainable Programs Coordinator

Subject: Request for Information (RFI) to Develop Power from an Offshore Wind Energy Facility in Lake Michigan off the Northern Shore of Evanston

Date: April 5, 2010

Recommended Action:

Staff recommends City Council approval to issue a RFI for the development of power from an offshore wind energy facility in Lake Michigan off the northern Shore of Evanston.

Funding Source:

N/A

Summary:

The Evanston Climate Action Plan (ECAP), accepted by City Council in November 2008, recommends [the City] “Investigate the feasibility of offshore wind power generation in Lake Michigan”. The development of renewable power at this scale has great potential for reducing Evanston’s greenhouse gas (GHG) emissions.

To facilitate action on this strategy, the Citizens for a Greener Evanston (CGE), an advocacy group of community members instrumental in developing the ECAP, has done extensive research on offshore wind generation and the suitability of Lake Michigan as a wind power generation site. After two years of compiling research, CGE has concluded that the lake shore off of Evanston is a viable site for wind power generation.

While many have proposed and studied the prospect of wind power generation in the Great Lakes, currently, no precedent exists for the development of this type of project. Without specific procedures and policies in place, many hurdles and uncertainties will need to be faced before a project of this scope could be implemented.

A report produced by Northwestern students in the spring of 2009, “Constructing an Offshore Wind Farm in the Great Lakes”, recommends three basic steps for moving forward with this project. The first step recommended in the Northwestern report is for

the City or State Government to assume leadership, as local mayor or state governor will most likely be the government officials consulted. The report then recommends issuing a Request for Information (RFI). After the RFI is issued and responses are collected, if the entity were still interested in moving forward, it would then issue the RFP. The RFP would be followed by the final step, the selection of a developer to implement the project.

Based on the extensive research done by CGE and the report produced by Northwestern students, the recommended next step to determining the feasibility of offshore wind power generation off Evanston's Lake Michigan border is to direct staff to issue an RFI. This process will allow the City of Evanston to identify potential partners, determine the City's role and gain a comprehensive understanding of the steps required for the development of a renewable energy facility off Evanston's Lake Michigan shore.

Legislative History:

Evanston Climate Action Plan, November 2008

Alternatives:

N/A

Attachments:

City of Evanston Request for Information (RFI) to Develop Power from an Offshore Wind Energy Facility in Lake Michigan off the Northern Shore of Evanston
Citizens for a Greener Evanston Proposed Evanston Offshore Wind Farm FAQ
2009 Northwestern Report Constructing an Offshore Wind Farm in the Great Lakes



**REQUEST FOR INFORMATION (RFI)
TO DEVELOP POWER FROM AN OFFSHORE WIND ENERGY FACILITY
IN LAKE MICHIGAN OFF THE NORTHERN SHORE OF EVANSTON**

**ISSUED: XXX XX, 20XX
RESPONSE DUE DATE: XXX XX, 20XX**

I. INTRODUCTION

The City of Evanston IL is seeking information from interested partners on the development of an offshore wind energy facility off Evanston’s Lake Michigan border. The City’s intent in issuing this RFI is to identify potential partners, determine the City’s role and establish a process for the development of a renewable energy facility off Evanston’s Lake Michigan shore.

II. PROJECT DESCRIPTION

Proposed Project Location and Size – A proposed project area has been identified by the City that is in relatively close proximity to Evanston and has the potential to accommodate large-scale wind energy development. The proposed site has an area of approximately 1.5 square nautical miles and is located approximately 6-9 miles off the Evanston shore. This location is directly east of the center of Northwestern University (see map below). Annual average wind speeds within the proposed area are expected to exceed 8 m/s at a height of 65m above the water. Water depths range from approximately 13 m to 30 m.



Responders to this RFI are welcome to consider and suggest alternative locations, along with the reasons why the alternative locations are more appropriate.

Anticipated Roles of the Project Partner – It is anticipated that the developer(s) would assume all responsibility for siting, permitting, constructing, operating and maintaining the offshore wind energy facility, including the interconnection to an onshore receiver station, and would assume all development, construction and operating risks associated with the project.

III. TOPICAL AREAS FOR RESPONDENT FEEDBACK

The City is seeking feedback from interested parties on various aspects of offshore wind development. These aspects include technical, operational, regulatory, commercial, environmental, community and other topics, which are described below. Respondents are requested to provide information on these topics or any other topics that will assist the City in facilitating the development of an offshore wind energy facility in Lake Michigan. Respondents are requested to format their responses to this RFI in the same order as the topics are presented.

A. Proposed Project Scope and Business Plan

1. Project Scope – Please describe the ideal size and capacity of the proposed facility, along with the reasons why the suggested size and capacity would be appropriate for the proposed (or alternative) location.

2. Business Structure – Please describe your recommended business structure for the development and operation of an offshore wind facility. Describe the City’s role, if any.

3. Capital Requirements, Financing & Indicative Pricing – Please describe the anticipated total capital costs, description of cost components, and cost uncertainty factors, sources of capital and availability of financing (short- and long-term), anticipated levels of debt and equity, the developer(s) ability to finance project, projected range of pricing for energy, capacity and ancillary services, anticipated incentives, preference of developer to maintain all or a portion of renewable energy credits (RECs) or other environmental benefits attributable to the project, risks of price changes due to changes in prices for commodities, manufacturer quotations, and other materials and services, strategies to reduce pricing and pricing uncertainty, provisions for decommissioning and removal of turbines and any other issues that should be addressed. Describe the City’s role, if any.

4. Power Purchase Agreement (PPA) – Please describe your interest in maintaining all or a portion of the project output for sale and address the ideal length of a PPA, terms of service, ancillary services, pricing structures, production and availability guarantees, outages, facility operating criteria, curtailment and start-up and shut-down considerations, insurance and indemnification requirements, default provisions, and any additional information or recommendations for PPA terms and conditions that should be considered.

5. Operations and Performance – Please provide information related to the operations and performance including anticipated average turbine availability—first year and long-term—and basis for projections, performance degradation over project life, ability to accurately predict wake effects on production and on component fatigue loads, maintenance plan, facilities, staffing, spare parts, and response time for unscheduled maintenance, scheduled maintenance procedures and frequency (including periodic turbine overhauls or major component replacement/repair), remote communications, control, monitoring and dispatch systems, documented safety and emergency rescue plans and facilities, anticipation of construction and/or operational curtailment due to bird migration, and any additional items to be considered.

6. Timeline – Please identify a timeline for development. Address any uncertainties in scheduling, potential conflicts and associated mitigation strategies. Describe the City’s role, if any.

B. Technical and Infrastructure Considerations

1. Interconnection – Please provide information related to the design of the overall electrical interconnection system. Address the need for one or more offshore substations, the preference for, and viability and availability of, AC or HVDC cables for interconnection, location of converter stations (HVDC option), lake floor, routing and landfall considerations, and strategies for interconnection reliability, security, and energy deliverability. In what ways can the City facilitate the interconnection component of the project?

2. Technology Availability and Limitations – Given the facility’s proposed location, please describe any expectations or concerns about technology-related items, including the size, availability, and suitability of commercial offshore wind turbines, foundation requirements, special logistical or cost considerations, and quality, durability and manufacturer warranties of equipment.

3. Infrastructure for Construction and Maintenance – Please provide information related to the infrastructure required to execute the construction and maintenance phases of the facility. Address specialized equipment needs and availability, availability of skilled labor and trained crews, access of appropriate port facilities, laying of cable interconnection, insurance matters, potential weather and other seasonal impacts on construction, maintenance, production and availability, and any other issues that should be considered.

C. General Planning and Predevelopment Considerations

1. Regulatory Approval Process – Please identify any issues of concern related to the process of obtaining all anticipated permits and approvals for the development of the offshore wind facility. What key uncertainties are known or anticipated in this process at the federal, state and local levels and how would they be overcome? Describe the City’s role, if any.

2. Environmental Issues and Anticipated Studies – Please describe any studies and field data needed to address the parameters required to design and engineer a safe, reliable, efficient, and cost effective offshore wind facility and any potential environmental impacts and characterization of offshore uses, and potential compatibility of those uses, during construction and operations. Provide cost and schedule estimates for these studies and include any accepted advanced technologies or methodologies that might be used to reduce data collection costs or to accelerate the collection of required data for licensing and permitting the project. Describe the City’s role in facilitating these studies and data collection, if any.

3. Public Outreach and Stakeholder Engagement – Please identify the anticipated public impacts, benefits, key stakeholders and affected user groups. Discuss strategies and measures that can allow for the continuation of existing uses and resolve use conflicts with the proposed project during both construction and operation. Address aesthetics, noise, impacts on real estate and property values, impacts on recreation, access to waters around the facility, impacts on commercial fishing, impacts on commercial navigation, impacts on aviation (commercial, private and military), local tourism, public safety and security, assurance of site decommissioning and

restoration at end of useful life, and any pertinent issues not referenced. Describe the City's role, if any.

4. Economic Development Opportunities – Please identify the economic development opportunities that the proposed offshore wind facility could bring to Illinois, and more specifically, to Evanston and the Chicago region. Address procurement of regional products and services to fulfill development requirements, port development and enhancement, job and industry development, and any potential for adverse economic impacts. Describe the City's role in facilitating economic development, if any.

D. Developer Expectations of the City

Please indicate the roles of the City that, if not already defined, are desired or required to facilitate the development of the offshore wind facility.

E. Additional Items

Provide feedback on any other potential issues or considerations that this RFI has not addressed.

V. RESPONDING TO THIS RFI

Submittal Format – Respondents are requested to submit their response to this RFI according to the following outline:

- Description of respondent's company and experience
- Name of primary contact person(s), and contact information
- Provision of information according to the topics identified in Sections II, III and IV above.

Submission of Responses to RFI

Issuance of RFI – XXX XX, 20XX

Deadline for Questions on RFI - XXX XX, 20XX

Deadline for Notice of Intent to Respond - XXX XX, 20XX

Due Date for RFI Response - XXX XX, 20XX

Submit responses to:

Wally Bobkiewicz, City Manager

City of Evanston

2100 Ridge

Evanston, IL 60622

Additional Guidelines and Terms

This RFI is not a contract offer by the City. The City reserves the right to discontinue or modify the RFI process at any time, and makes no commitments, implied or otherwise, that this process will result in a business transaction or negotiation with one or more responders. Responders are advised that the City will not pay any cost incurred in response to this RFI. All costs associated with responding to this RFI will be solely at the responder's expense.



Proposed Evanston Offshore Wind Farm FAQ

Version 3.0

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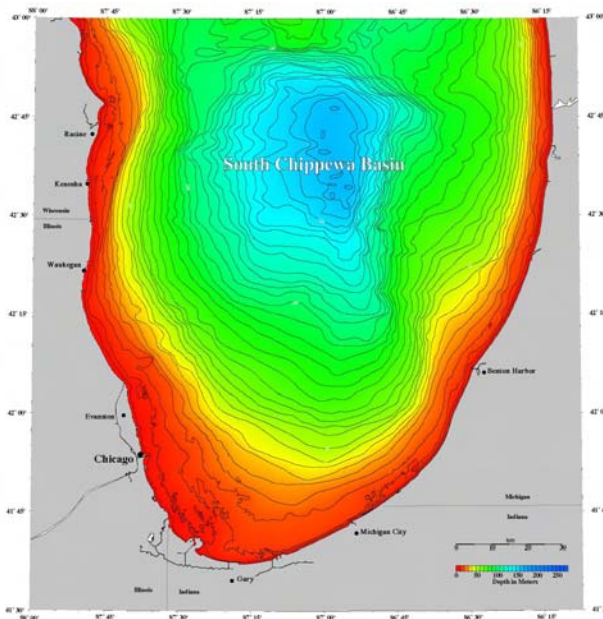
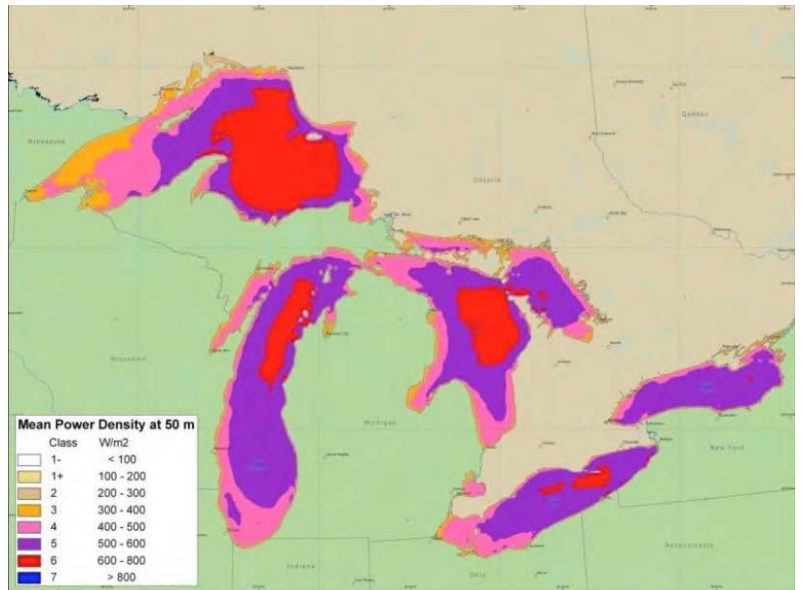
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Why is Evanston a good choice for an offshore wind farm?

We have good wind. It is estimated that the average annual winds are approximately 18mph directly offshore. Offshore wind speeds tend to be higher and the wind is steadier. This means that turbines built further offshore will capture more wind energy. Because wind power goes up with the *cube* of wind speed (doubling the wind speed produces *eight* times the power!), locating a wind farm in the lake will potentially be the most productive location in all of Illinois.

Offshore wind typically produces its maximum power in the middle of the day when the power is most needed and can therefore offset fossil fueled peak power plants (coal and natural gas) that produce the most CO2 emissions.



The lakebed in front of Evanston is relatively shallow (less than 100') for several miles from the waterline. Thus, construction costs will be cheaper than other deeper water sites. Erecting the turbines farther from the shore will improve their performance as the wind is more consistent.

The further from the shore the less visual disruption from the shoreline.

The area offshore of Evanston has no significant water use conflicts. There are no islands, river mouths, reefs and other natural configurations that might be harmed.

Evanston is a good access point to bring the electricity ashore. One of the major problems with many wind farm proposals is they are too far from the consumers of electricity.

The vast majority of offshore sites being considered in the U.S. are working in close partnership with nationally renowned engineering schools. Having the wind farm located adjacent to Northwestern would seem to foster a natural partnership opportunity with the McCormick Engineering School.



How many jobs will come to Evanston?

Directly, probably not many but indirect benefits are possible. Wind farms do not need a lot of manpower for ongoing maintenance. Since the wind farm is tentatively located 4 miles offshore, access by boat may come from the industrial harbor of Chicago or possibly Waukegan.

Northwestern has expressed interest in the wind farm via the related research that it could bring to the University.

There could be significant tourism dollars and related jobs created by the wind farm.

Since turbines of this size are difficult to transport long distances, the wind industry has brought many manufacturing jobs to the Midwest.



How many wind turbines will there be?

The current idea is 40 or more turbines, but this number can go up or down depending on the results of the feasibility study. The goal is to produce more than 200MW of power.

Where exactly are the wind turbines to be located?

The exact location depends on the results of a feasibility study which will take into account the contours of the lakebed, the wind profile, and other technical and aesthetic considerations.

The working concept places the turbines approximately four miles off the Evanston shore stretching between Northwestern's northern boundary to the southern edge of Dawes Park. The current notion for the layout



of the wind farm is to have the turbines arrayed in rows slightly angled from the northwest to the southeast. This will limit the visual impact of the turbines both to the north and south of the site.



How much electricity will be produced

The proposed turbines will produce enough electricity to power approximately 40,000 homes, which would provide power for all the residences of Evanston (there are approximately 30,000 homes in Evanston).. The extra capacity can be used for commercial and industrial needs or sold to neighboring towns, such as Skokie, Wilmette and Chicago.

Where will we get power if the wind isn't blowing?

Wind power is another source of electricity, just like natural gas, coal and nuclear. When the wind isn't blowing, the other sources will be used. Offshore wind tends to be more consistent than land based wind farms, and also produces its maximum power during the middle of the day when it can help offset dirtier forms of power generation.

Don't wind turbines kill birds?

Birds occasionally collide with turbines, as they do with any tall structure. A few older wind projects have raised concerns about bird impacts because they were built in areas with sensitive raptor populations. Careful siting and wildlife studies make it possible to avoid most wildlife problems.

Detailed studies and monitoring following construction of other wind farms indicate that this is a site-specific issue that will not be a problem at most potential wind sites. Also, wind's overall impact on birds is low compared with other human-related sources of avian mortality—no matter how extensively wind is developed in the future, bird deaths from wind energy are unlikely to ever reach as high as 1% of those from other human-related sources such as hunters, house cats, buildings, and autos. (House cats, for example, are believed to kill 1 billion birds annually in the U.S. alone.) Wind is, quite literally, a drop in the bucket. Still, areas that are commonly used by threatened or endangered bird species should be regarded as unsuitable for wind development. The wind industry is working with environmental groups, federal regulators, and other interested parties to develop methods of measuring and mitigating wind energy's effect on birds.

Onshore, wind energy can also negatively impact birds and other wildlife by fragmenting habitat, both through installation and operation of wind turbines themselves and through the roads and power lines that may be needed. This has been raised as an issue in areas with unbroken stretches of prairie grasslands or of forests. More research is needed to better understand these impacts.

Offshore wind turbines may affect migratory birds. Citizens for Greener Evanston have already had a series of discussions this with the local branch of the National Audubon Society.

...or bats?

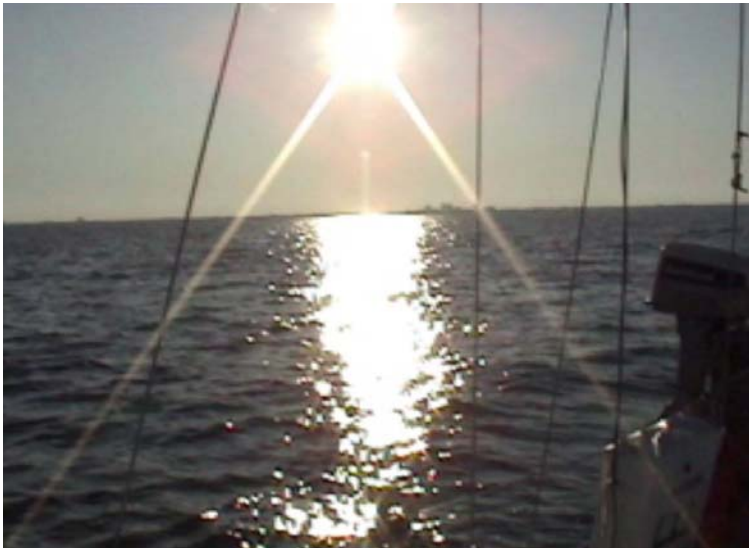
Bat deaths at wind plants generally tend to be low in number and to involve common species which are quite numerous. Human disturbance of hibernating bats in caves is a far greater threat to species of concern. Still, a surprisingly high number of bat kills at a new wind plant in West Virginia in the fall of 2003 has raised concerns, and research at that plant and another in Pennsylvania in 2004 suggests that the problem may be a regional one. The wind industry has joined with the U.S.



Fish and Wildlife Service, the U.S. Department of Energy's National Renewable Energy Laboratory, and Bat Conservation International to form the Bats and Wind Energy Cooperative (BWEC), which funded the 2004 research program and is continuing to explore ways to avoid or reduce bat kills. One simple yet effective method is to shut down the turbines for a short period of time when conditions for bat deaths exist. Since this occurs only briefly and in low wind situations, overall power output is not greatly affected. It is believed that bats generally are not out on the lake at the location of the proposed wind farm. As with the birds, bat studies will need to be done to determine what issues will have to be taken into account.

What will I see from the beach in Evanston?

Obviously, this depends on the size of the turbines, exactly how close they are to the shore, and weather conditions. The short answer is that turbines four miles offshore will be barely visible. Here is a picture taken from four mile offshore looking back at the Evanston skyline. The visual impact is very small.



Visual impacts can be minimized through careful design of a wind farm. Using turbines of the same size and type and spacing them uniformly generally results in a wind plant that satisfies most aesthetic concerns. Computer simulation is helpful in evaluating visual impacts before construction begins. Public opinion polls show that the vast majority of people

favor wind energy, and support for wind plants often increases after they are actually installed and operating.

Aren't wind turbines noisy?

On a windy day, the sound of the turbine is drowned out by the wind even just a short distance from the turbine. Current technology makes noise almost a non-issue at most wind farms. Aerodynamic noise has been reduced by changing the thickness of the blades' trailing edges and by making machines "upwind" rather than "downwind" so that the wind hits the rotor blades first, then the tower (on downwind designs where the wind hits the tower first, its "shadow" can cause a thumping noise each time a blade passes behind the tower). A small amount of noise is generated by the mechanical components of the turbine. To put this into perspective, a wind turbine 300 meters away is no noisier than the reading room of a library.

Remember, the Evanston offshore wind farm will be at least four miles away. It is unlikely to ever cause disruption by noise.



Will I be able to boat/sail near the turbines?

There will be boundaries for boaters to observe for safety. The U.S. Coast Guard authorizes wind turbine locations for navigational concerns and determines the markings, lights, and fog signals needed. Should a ship inadvertently go off course, its radar will readily detect the wind turbines, which are excellent radar reflectors. Wind turbines are also equipped with warning devices to alert ships in foul weather.



What are the steps needed to have an operating wind farm?

The first step is to invite a wind developer to do a feasibility study. This study would include a thorough economic analysis, geotechnical analysis of the proposed site, wind studies, etc.

After determining that the project is feasible, the developer will begin the process to secure approvals from the various agencies in the city, county, state and federal governments. During the approval cycle detailed environmental studies will be undertaken. Financing will be arranged. Community outreach will need to be an ongoing event to keep the local stakeholders informed on key decisions. Contract discussions with the power purchasers will begin.

Then the construction phase begins (see below for more details) and finally the operating phase. The time from the start of the project until the wind farm becomes operational is approximately seven years.

What happens during the feasibility study?

The most important factor to consider in the construction of a wind energy facility is the site's wind resource. A site must have a minimum annual average wind speed in the neighborhood of 11-13 mph to even be considered (initial research suggests Evanston's wind is comfortably above the minimum). To study the wind, a temporary tower may be set up on site to gather wind data at various altitudes over the course of many months or even years.

Further, the fact that a site is windy does not mean it is suitable for wind power development. A developer needs to consider many factors in a project. Is there any migratory bird activity in the area that the wind farm might interfere with? Are there endangered or protected species that could be jeopardized by the presence of the facility? Is the site's geology suitable and appropriate for industrial development? Will noise and aesthetics be issues for the local community? Will the turbines obstruct the flight path of local air traffic? There are quite a few environmental and social issues that will need to be addressed in the siting of a wind power facility. Wind farms can make great neighbors, but it is the obligation of the developer to ensure that a project proceeds in a fashion that is acceptable to regulators and the local community.

What permits are required to build a wind farm?

This list is not exhaustive. For the Feasibility Study approvals are likely needed from:



- City of Evanston (and preferably from Northwestern University)
- Cook County
- Illinois EPA
- Federal Aviation Administration
- US Coast Guard

For construction and operation of the wind farm:

- State of IL: Submerged land lease
- US Army Corps of Engineers Construction approval
- US Fish and Wildlife
- Department of Defense
- City of Evanston
- Cook County
- Illinois EPA
- Federal Aviation Administration: Air hazard navigation
- US Coast Guard:

Will construction affect the lakebed?

Any proposed wind farm will involve a full investigation of wave and coastal processes prior to construction. However, the turbine structures and distance offshore are such that it is very unlikely they would significantly affect the lakebed, wave patterns or water quality. There is no evidence from the European experience with offshore wind farms of any detrimental effects on coastal processes. The installation of the foundation for the each wind turbine would be similar to how a bridge support is installed, which is not an uncommon element in the waters in the area.

What about affecting the lake's water quality and our drinking supply?

The turbine structures and distance offshore are such that it is very unlikely they would significantly affect our water quality. There is no evidence from the European experience with offshore wind farms that water quality is degraded.

How much will it cost?

There are many factors contributing to the cost and productivity of a wind plant. For instance, the power a wind turbine can generate is a function of the *cube* of the average wind speed at its site, which means that small differences in wind speed mean large differences in productivity and electricity cost. Financing methods can make a major difference in project economics as well. Securing significant investment capital or joint ownership of a project can cut costs significantly. Furthermore, there are federal and state incentives for which a project may qualify and which could reduce costs and encourage more favorable investment.

Early very rough estimates are \$10 million for each turbine erected in waters depths of approximately 180' or less. Beyond that depth, the construction costs become prohibitive.



Where will the financing come from?

This is a highly capital intensive project and financing will likely be complex and involve many parties. There are no plans at this time for financing to come from the City of Evanston.

Who will do the feasibility study?

A wind developer will lead the study. The developer may join with Northwestern and other research groups for assistance. The developer will also likely work with the City of Chicago to obtain the detailed meteorological data from Chicago's water intake cribs.

Having the water intake cribs in Chicago is a tremendous advantage that other sites in the Great Lakes typically do not have. One thought is to locate an additional wind speed test tower on the Wilson Avenue water intake crib. Because of the crib, expensive structures to support temporary data gathering equipment would not be necessary. Other, more site specific wind testing can be done with other methods such as buoy mounted wind anemometers and LIDAR, a type of radar to track wind speeds.



Who will do the construction?

The wind developer will contract a specialist in offshore construction. The construction work requires very specialized crane ships and other support vessels that are located in the Great Lakes.



Because other cities such as Toronto and Cleveland (and others) are already

moving forward with their plans for offshore wind farms in the Great Lakes, this equipment will already be in place.





Who will maintain and operate the wind farm?

The wind developer may continue as the operator, or they may sell the wind farm to an operator. The developer may also subcontract the operational work.

Operation and maintenance includes regular inspection, replacement of wear items, periodic adjustments, etc. Wind turbines require relatively little maintenance and the operating staff will likely be quite small.

Who will own the wind farm?

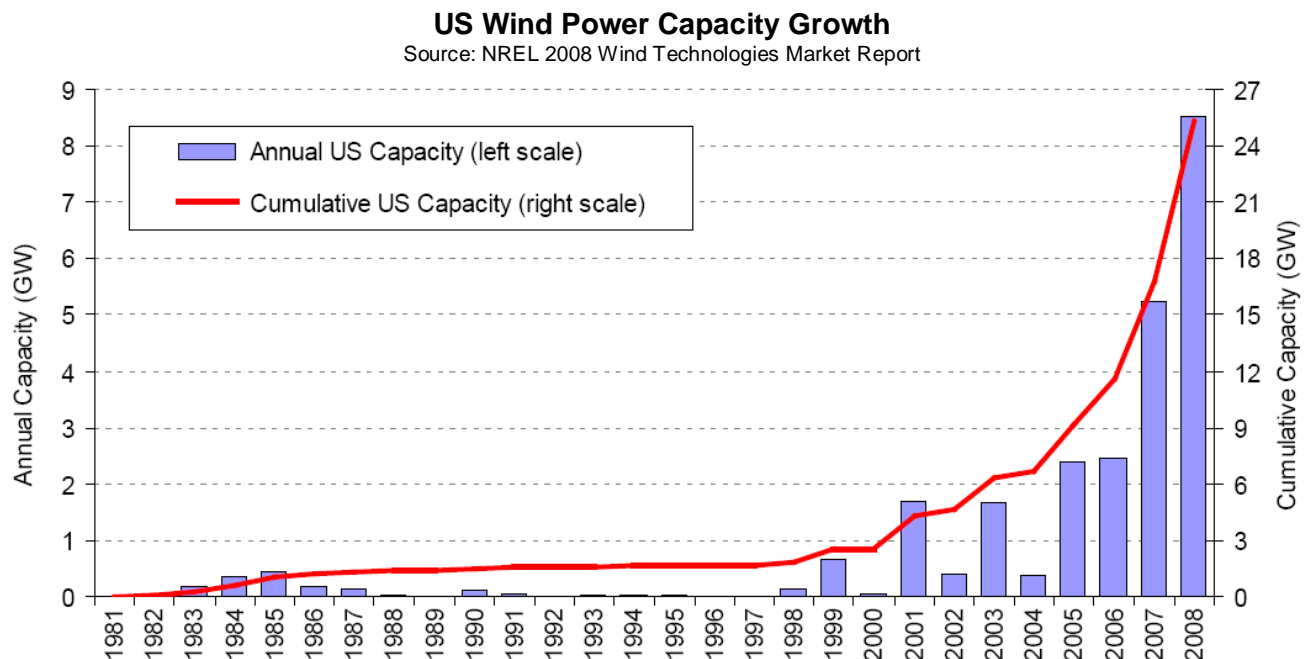
The wind developer may be the owner, or after construction, they may sell or lease the farm.

Is wind energy expensive?

Wind energy is the cheapest form of new electricity generation available today. Wind power is more expensive than power from old, established power plants (in particular cheap dirty coal plants), but is cost competitive with any new power plant.

What is the status of the wind energy market in the United States?

The U.S. wind energy industry shattered all previous records in 2008 by installing over 8,500 megawatts (MW) of new generating capacity (enough to serve over two million homes), increasing the nation's total wind power generating capacity by 50% to over 25,300 MW and channeling an investment of some \$17 billion into the economy.



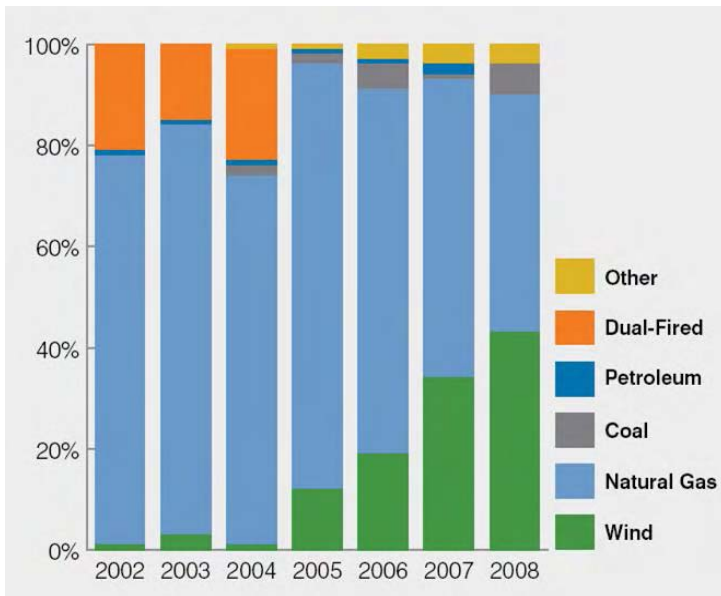


For the fourth year in a row, wind power was second only to natural gas in terms of new capacity added. 2009 will most likely be a slower year in terms of new installations than 2008, yet at least 5,000 MW of new wind installations are expected to be commissioned in 2009.

Texas leads the nation in installed wind power capacity, with Iowa ranked second and Illinois eighth.

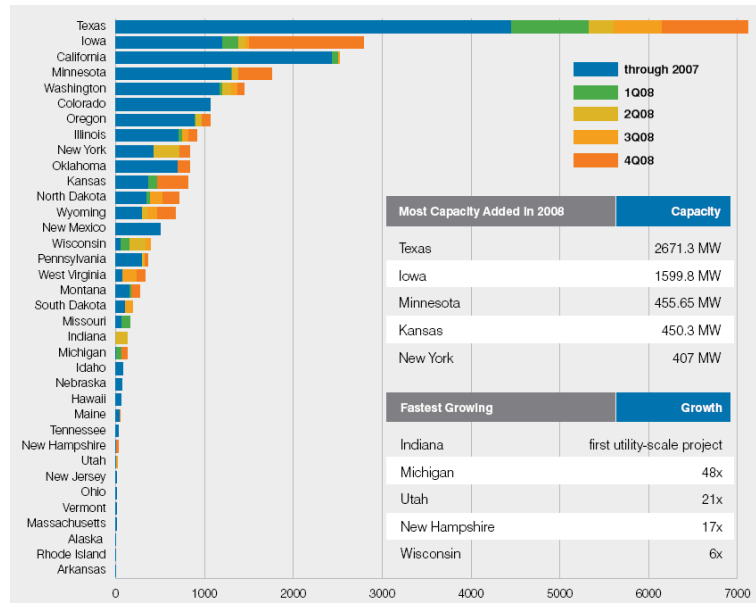
Percentage of New Capacity Additions

Source: AWEA Annual Wind Industry Report 2008



US Wind Power Capacity By State

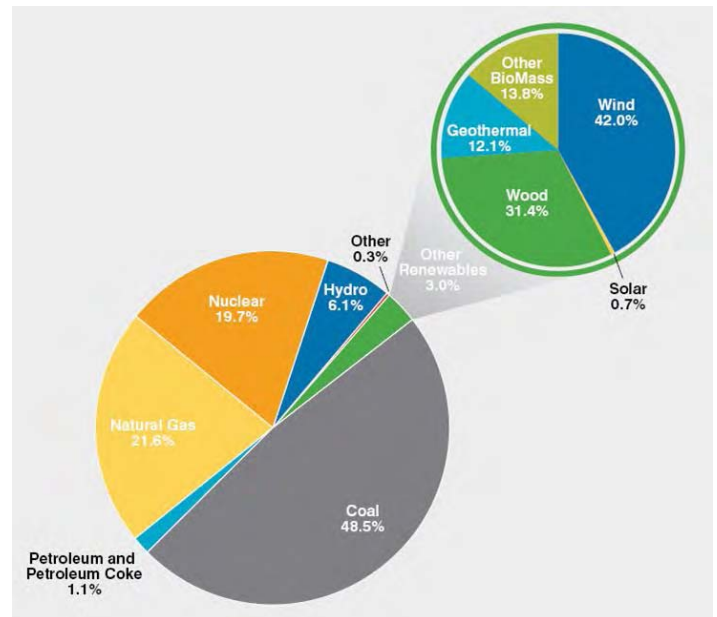
Source: AWEA Annual Wind Industry Report 2008



The new wind projects completed in 2008 account for about 42% of the entire new power-producing capacity added nationally last year, according to initial estimates, and will avoid nearly 44 million tons of carbon emissions, the equivalent of taking over seven million cars off the road.

Renewable energy represents only 3% of all US electrical generation, of which wind power account for 42%. Although the US leads the world in terms of installed wind power capacity, we rank 12th in terms of wind energy as percentage of total electric generation.

Approximately 85,000 people are employed in the wind industry today, up from 50,000 one year ago. The recent growth of the wind power industry has also accelerated job creation in manufacturing, where the share of domestically



Sources of US Electricity Generation

Source: AWEA Annual Wind Industry Report 2008



manufactured wind turbine components has grown from under 30% in 2005 to about 50% in 2008. Wind turbine and turbine component manufacturers announced, added or expanded 70 new facilities in the past two years, including over 55 in 2008 alone.

What is a wind turbine and how does it work?

Wind turbines, like windmills, are mounted on towers to capture the most energy. At 100 feet (30 meters) or more above ground, they can take advantage of faster and less turbulent wind. Turbines catch the wind's energy with their propeller-like blades. Usually, two or three blades are mounted on a shaft to form a *rotor*.

A blade acts much like an airplane wing. When the wind blows, a pocket of low-pressure air forms on the downwind side of the blade. The low-pressure air pocket then pulls the blade toward it, causing the rotor to turn. This is called *lift*. The force of the lift is actually much stronger than the wind's force against the front side of the blade, which is called *drag*. The combination of lift and drag causes the rotor to spin like a propeller, and the turning shaft spins a generator to make electricity.

Turbine subsystems include:

- a rotor, or blades, which convert the wind's energy into rotational shaft energy;
- a nacelle (enclosure) containing a drive train, usually including a gearbox and a generator;
- a tower, to support the rotor and drive train; and
- electronic equipment such as controls, electrical cables, ground support equipment, and interconnection equipment.
- Other features on current turbines include monitoring systems, aviation markings on the blades, aviation lights, service personnel lift, smoke detectors, fire extinguishing system in nacelle, Low temperature operation, Ice detection system,

How big is a wind turbine?

Offshore turbine designs have larger rotors—at the moment, the largest has a 110 meter (360 foot) rotor diameter and the hub (nacelle) sits 100 meters above the water line.

In terms of power generation, the largest offshore wind turbines are rated up to 5 megawatts.

How many homes can one megawatt of wind energy supply?

An average U.S. household uses about 10,655 kilowatt-hours (kWh) of electricity each year. A one megawatt wind turbine can generate from 2.4 to more than 3 million kWh annually, enough for 225 to 300 households. It is important to note that since the wind does not blow all of the time, it cannot be the only power source for that many households.

It is estimated that the proposed turbine array would be able to provide enough power annually for nearly all Evanston households plus some portion of the power needed for commercial and industrial uses. For reference, Evanston has about 32,000 residences.



This would offset approximately 112,500 tons of CO₂, 80% of the City of Evanston's goal for CO₂ abatement as outlined in the Evanston Climate Action Plan.

Will turbines interfere with fishing?

Given the relatively small area of seabed that is required there is no evidence to suggest that total fish catch will decline as a result of wind farm developments; if anything the opposite is true. Many environmental groups believe that wind farms will provide welcome sanctuary for fish spawning.

The wind industry is working actively with the fishing industry to ensure that the fishing industry is not disadvantaged by the growth of offshore wind farms.

What if there's a storm in the Lake?

As with onshore turbines, offshore turbines are warranted and tested to withstand extreme wind conditions. In the event of severe weather, the blades turn out of the wind and will slow down for safety reasons when wind speeds reach 50 miles per hour and above.

Will turbines affect marine life?

There are three significant stages of a wind farm from the point of view of marine life: construction, operation and decommissioning. Construction and decommissioning have the potential to generate the most amount of disturbance, and the wind industry, as well as several marine conservation groups, is currently investigating these impacts on marine life.

However, it is important that such impacts be considered in the context of other marine activities such as fishing, shipping, oil and gas extraction, etc. Also, it should be noted that the duration of the construction and decommissioning will be about 6 months only. For the 20-year operational period there are no known impacts on marine life.

It has been suggested that the noise from wind turbines will travel underwater and could disturb sea life. However, studies carried out on the impact of noise from existing offshore turbines note that the noise is very low frequency, and many species are actually unable to hear it.

As with any other local impact issues, these concerns will be addressed while a wind farm project is going through the permitting process.

What are the environmental benefits of wind power?

Wind energy system operations do not generate air or water emissions and do not produce hazardous waste. Nor do they deplete natural resources such as coal, oil, or gas, or cause environmental damage through resource extraction and transportation, or require significant amounts of water during operation. Wind's pollution-free electricity can help reduce the environmental damage caused by power generation in the U.S. and worldwide.



In 1997, U.S. power plants emitted 70% of the sulfur dioxide, 34% of carbon dioxide, 33% of nitrogen oxides, 28% of particulate matter and 23% of toxic heavy metals released into our nation's environment, mostly the air. These figures are currently increasing in spite of efforts to roll back air pollution through the federal Clean Air Act.

Sulfur dioxide and nitrogen oxides cause acid rain. Acid rain harms forests and the wildlife they support. Many lakes in the U.S. Northeast have become biologically dead because of this form of pollution. Acid rain also corrodes buildings and economic infrastructure such as bridges. Nitrogen oxides (which are released by otherwise clean-burning natural gas) are also a primary component of smog.

Carbon dioxide (CO₂) is a global warming pollutant --its buildup in the atmosphere contributes to global warming by trapping the sun's rays on the earth as in a greenhouse. The U.S., with 5% of the world's population, emits 23% of the world's CO₂. The build-up of global warming pollution is not only causing a gradual rise in average temperatures, but also seems to be increasing fluctuations in weather patterns and causing more frequent and severe droughts and floods. The World Meteorological Organization (WMO) warned in July, 2003, that extreme weather events appear to be increasing in number due to climate change.

Particulate matter is of growing concern because of its impacts on health. Its presence in the air along with other pollutants has contributed to make asthma one of the fastest growing childhood ailments in industrial and developing countries alike, and it has also recently been linked to lung cancer. Similarly, urban smog has been linked to low birth weight, premature births, stillbirths and infant deaths. In the United States, the research has documented ill effects on infants even in cities with modern pollution controls.

Toxic heavy metals accumulate in the environment and up the biological food chain. A number of states have banned or limited the eating of fish from fresh-water lakes because of concerns about mercury, a toxic heavy metal, accumulating in their tissue.

Development of just 10% of the wind potential in the 10 windiest U.S. states would provide more than enough energy to displace emissions from the nation's coal-fired power plants and eliminate the nation's major source of acid rain; reduce total U.S. emissions of CO₂ by almost a third; and help contain the spread of asthma and other respiratory diseases aggravated or caused by air pollution in this country.

If wind energy were to provide 20% of the nation's electricity -- a very realistic and achievable goal with the current technology -- it could displace more than a third of the emissions from coal-fired power plants.

Will wind energy hurt tourism?

We think it will help tourism in Evanston. An offshore wind farm will bring publicity to our community and enhance Evanston's image. There is no evidence that wind farms reduce tourism, and considerable evidence to the contrary. For example, in late 2002, a survey of 300 tourists in the Argyll region of Scotland, noted for its scenic beauty, found that 91% said the presence of new wind farms "would make no difference in whether they would return." Similar surveys of tourists in



Vermont and Australia have produced similar results. Many rural areas in the U.S. have noted increases in tourism after wind farms have been installed, as have scenic areas in Denmark, the world's leader in percentage of national electricity supplied by wind. Other telling indicators: local governments frequently decide to install information stands and signs near wind farms for tourists; wind farms are regularly featured on post cards, magazine covers, and web pages.

Will wind energy negatively impact my real estate values?

A recently completed study by the Lawrence Berkeley National Laboratory titled "The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis" concludes that neither the view of the wind facilities nor the distance of homes to those facilities was found to have any consistent, measurable, and significant effect on the selling prices of those homes.

Why is there sometimes opposition to wind energy projects?

Local opposition to proposed wind farms usually arises because some people perceive that the development will spoil the view that they are used to. It is true that a large wind farm can be a significant change, but while some people express concern about the effect wind turbines have on the beauty of our landscape, others see them as elegant and beautiful, or symbols of a better, less polluted future.

The visual effect of wind farms is a subjective issue, but most of the other criticisms made about wind energy today are exaggerated or untrue, and simply reflect attempts by particular groups to discredit the technology, worry local communities, and turn them against proposed projects. In the electronic age, myths and misinformation about wind power spread at lightning speed.

The location of the proposed wind farm has been selected to minimize visual impacts. At its closest, the wind farm would be at least four miles from shore. That location would be inline with Northwestern University's shore. Other locations to the north or south of this point would be further away.

I've heard that wind energy doesn't really reduce pollution, because other, fossil-fired generating units have to be kept running on a standby basis in case the wind dies down. Is this true?

No. It is true that other generating plants have to be available to the power system's operator to supply electricity when the wind is not blowing. However, the wind does not just start and stop. Typically, wind speeds increase gradually and taper off gradually, and the system operator has time to move other plants on and off line (start and stop them from generating) as needed--the fluctuations in wind plant output change more slowly than do the changes in customer demand that a utility must adjust to throughout the day. Studies indicate that for a 100-megawatt wind plant, only about 2 megawatts of conventional capacity is needed to compensate for changes in wind plant output.



Also, and potentially most importantly, whenever the wind is blowing, it displaces the most expensive conventional power plant that is generating. Typically, this tends to be the oldest and dirtiest gas plants on a utility system; wind power may displace coal. Offshore wind turbines produce their peak power in the middle of the day when peak power demand is at its highest and therefore offshore wind farms reduce the need for these dirtier forms of energy production.

Is wind energy dangerous to the public?

It has been estimated by a number of reliable sources that 50,000 Americans a year die from air pollution, of which about one-third is produced by power plants. By contrast, in 20 years of operation, the wind industry (which emits no pollutants) has recorded only one death of a member of the public--a German skydiver who parachuted off-course into an operating wind plant. Blade failures were more common in the industry's early years, but are very rare today because of better turbine design and engineering. Ice drops can occur but are of little danger because setbacks are sufficient to protect against danger to the public, and because ice buildup slows a turbine's rotation and will be sensed by a turbine's control system, causing the turbine to shut down. Given that the wind farm is no closer than four miles to shore, this is not an issue to be concerned about.

Will a wind project interfere with electromagnetic transmissions such as radio, television, or cell-phone signals?

Large wind turbines, such as those typically installed at wind farms, can interfere with radio or TV signals if a turbine is in the "line of sight" between a receiver and the signal source, but this problem is unlikely to arise from an offshore wind farm.

Will a wind project interfere with radar?

Yes. Radar is basically designed to filter out stationary objects and display moving ones, and moving wind turbine blades create radar echoes. It is possible to modify a radar installation to eliminate this problem, according to a consulting firm that has studied it for the British government--see http://www.bwea.com/aviation/ams_report.html. According to the study: "This study concludes that radars can be modified to ensure that air safety is maintained in the presence of wind turbine farms. Individual circumstances will dictate the degree and cost of modification required, some installations may require no change at all whilst others may require significant modification."

The interference is generally limited to objects (airplanes) that are physically shadowed by the turbines (that is, very low-flying aircraft). The Federal Aviation Authority has approval on this subject and radar disruption (or lack of it) will be carefully studied before construction authorization is given.

Are there any other offshore wind farms in the Great Lakes?

Not yet, but they're on the way. A feasibility study has been completed for a proposed wind farm in Lake Erie near Cleveland. Additional projects are being considered in Lake Ontario near Toronto and on the New York side as well as Lake Michigan near Muskegon and Ludington.

Here is a list of offshore wind projects(not a complete list) in North America:



CANADA (Ontario)

- Ontario is leading offshore wind development due to their feed in tariff
- Offshore wind guaranteed CDN 0.19/kWh (currently USD 0.18) for 20 yr PPA
- Streamlined approvals process administered by Ontario Power Authority
- Trillium Power Wind Corp. has several projects in development
- Trillium Power Wind I, 710 MW E. end of Lake Ontario near US border, construction to begin 2011
- 1600 MW Great Lakes Array (location not announced)
- 650 MW Superior Array (location not announced)
- 740 MW Trillium Power II, location not announced
- Toronto Hydro is also active with 100 MW project near Toronto
- Southpoint Wind working on 30MW project in Lake Erie near Leamington

OHIO

- Cuyahoga County (Cleveland), 20 MW by 20112
- This is the only US Great Lakes Project mentioned in the article

OCEANIC PROJECTS

- New Jersey: leases have been granted for four 350 MW projects, strong support of the governor. Construction to begin 2011.
- Delaware: lease awarded for 450 MW project. Online 2014.
- Rhode Island: 424 MW project in development.
- Massachusetts: Cape Wind 468 MW permitted, construction to begin 2010.
- New York: preliminary studies underway for 350 to 700 MW project
- Maryland: looking for developers
- Texas: construction on 150 MW project to begin 2010, leases issued for two other 750 projects

by contrast Europe has:

- 1500 MW offshore wind installed since 1991
- 100 GW additional projects proposed or in development
- expect 2000 MW by end of 2009, 3000 MW by end of 2010

Wind Resources Link

National Renewable Energy Laboratory: *Wind Resource Atlas of the United States*
<http://rredc.nrel.gov/wind/pubs/atlas>

Illinois Wind Energy Association
<http://www.windforillinois.com/>

American Wind Energy Association
<http://www.awea.org>

Constructing an Offshore Wind Farm in the Great Lakes



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Executive Summary

Various offshore wind projects in the Great Lakes have been proposed and studied. However, there is no precedent for a completed offshore project in the Great Lakes. In this report, we present research on current methods used to propose and initiate such a project. This report attempts to answer important questions such as:

- What is the first step?
- What authorities are involved, at what points in the process, and what are their tasks?
- What agencies and regulating bodies are involved?
- Is there a definite set of procedures to follow?
- Who takes leadership of the project throughout its development?

It is important that a city consider two primary points before attempting to build an offshore wind farm. First, the process outlined in this report is not definite for offshore wind development in the Great Lakes because no precedent currently exists. Thus, specific procedures and policy channels have in many places not yet been established. Hurdles, delays, and uncertainties as to who exactly is the proper authority to handle a particular step are likely to occur even with careful research and planning. Second, the scale of offshore wind projects currently undergoing development tends to be fairly large in order to compensate for the increased construction and maintenance costs associated with offshore projects. The trend in recent offshore wind projects features production capacities in upwards of 90MW and construction costs in the hundreds of millions of dollars.

This study identifies a number of action steps for a city, community, or organization to take if it wishes to propose and pursue the installation of an offshore wind project in the Great Lakes.

- The parties involved turn the matter over to the city and state governments. Most likely, the state governor and local mayors will be among the first government officials consulted.
- The state and/or city governments then prepare a request for information (RFI) and a request for proposal (RFP) and submit them to the developer community.
- Upon feedback and dialogue with developers, the city or state chooses a developer to oversee the project.
- Over a matter of years, the developer then secures the relevant permits and clearance and conducts the necessary studies, submitting his or her plans and progress periodically to the city or state governmental review board.



Introduction

The Great Lakes region of America is rich in wind energy potential. A recent study by Cristina L. Archer and Mark Z. Jacobson at Stanford University identified the Great Lakes Region as one of six places in the world most suited for wind power generationⁱ. Offshore wind energy in the Great Lakes is appealing for several reasons. First, as figure 1 shows, the lakes generally have class 3 winds and above (within or above the economical level for wind generation). Second, many major cities including Chicago, Detroit, Cleveland, Milwaukee, and Buffalo, are located on or near the lake shores. Thus, substantial infrastructure and demand is already in place. Third, the lakes are not located on federal

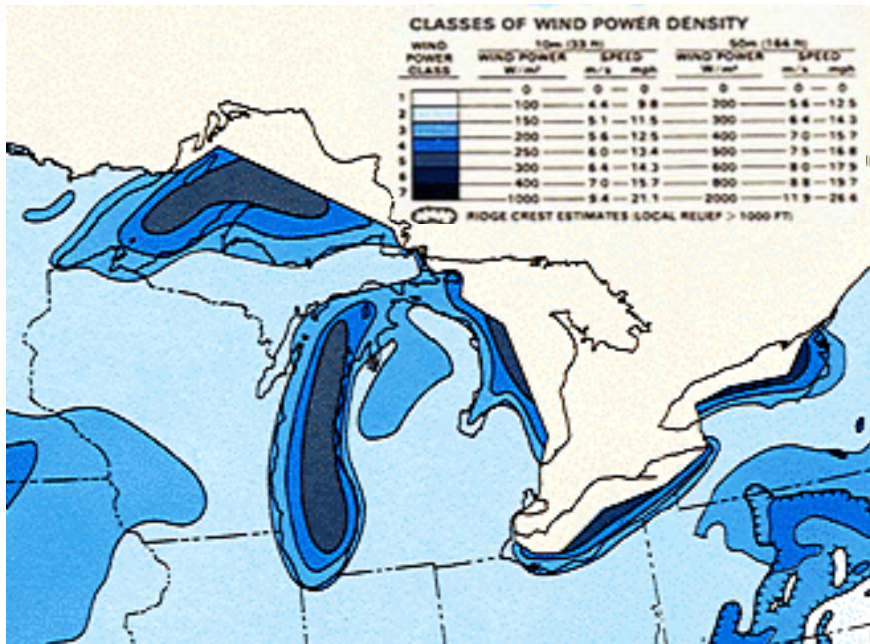


Figure 1: Annual average wind power in the Great Lakes region. Wind developers generally do not consider a site worthy of a wind farm unless its wind power potential is at least class 3 or greater. As one would expect, the greatest wind potential is at the center of the Lake. Unfortunately, the water is too deep for conventional turbines in most of those locations, but sites closer to shore still have class 3 winds or better.

land, meaning that wind farms will not have to deal with many of the bureaucratic obstacles that have held up projects like Cape Wind in Massachusetts. Finally, every state but Indiana that borders the Lakes has a renewable energy portfolio standard, making the sites ever more attractive to utility companies trying to keep pace with government-mandated levels of renewable energy.

Various offshore wind projects in the Great Lakes have been proposed and studied. However, there is no precedent for a completed offshore project in the Great Lakes. In this report, we present research on the current standing of proposal and initiatory processes for projects of the sort. In some cases, developers themselves see potential for a project and pursue it, without being prompted by an outside proposal. For example, Cape Wind in Martha's Vineyard.

The objective of this project is to determine the steps a group, community, or city must take in order to construct an offshore wind farm in the Great Lakes. In the sections that follow, we will outline the process of developing an offshore wind farm from the perspective of what a wind developer

ⁱ Evaluation of Global Wind Power

requires in order to further the process of development. Next, we will attempt to answer the many frequently asked questions that arise during the development process.

Process

Figure 2: Detailed Graphic Description

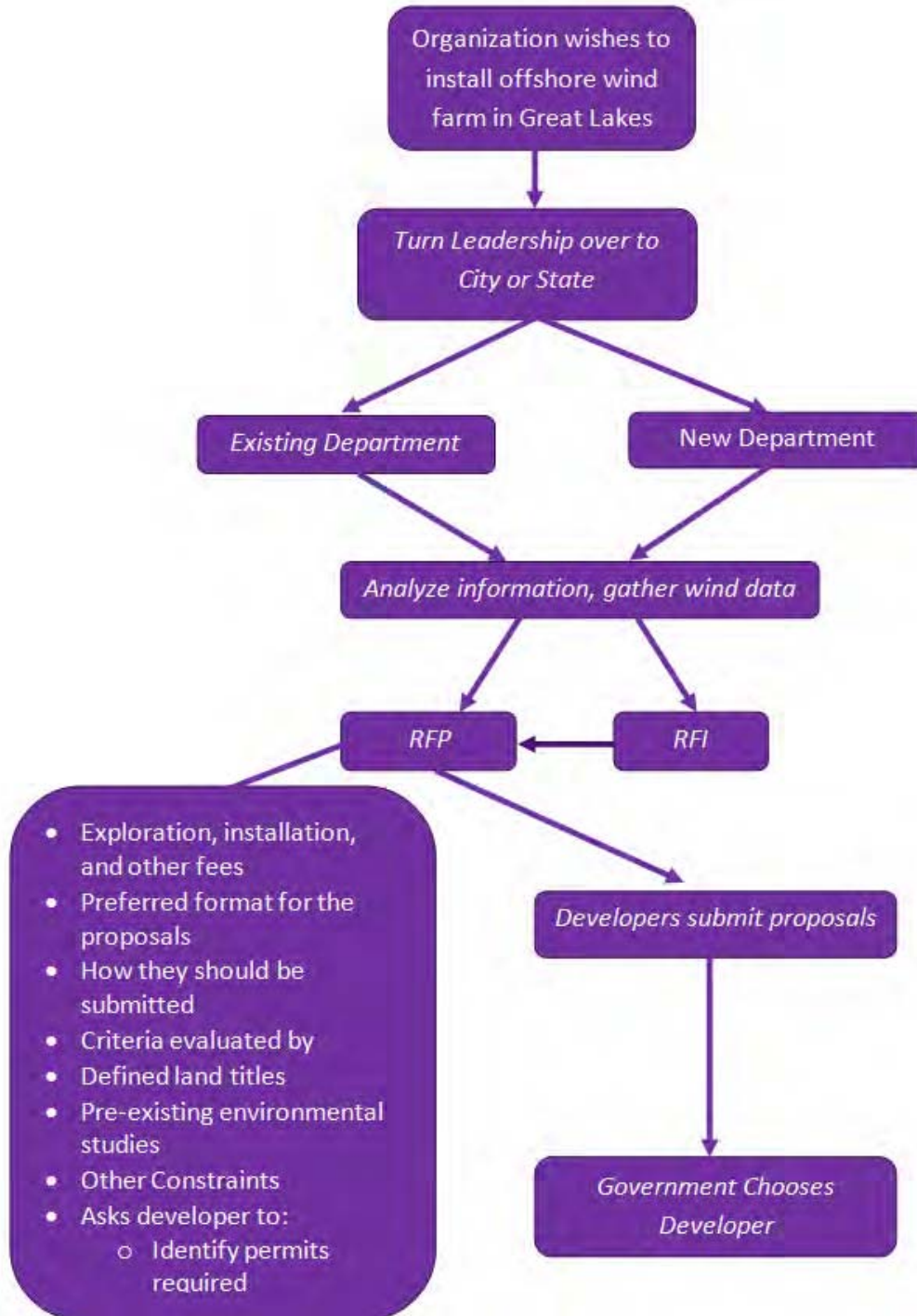
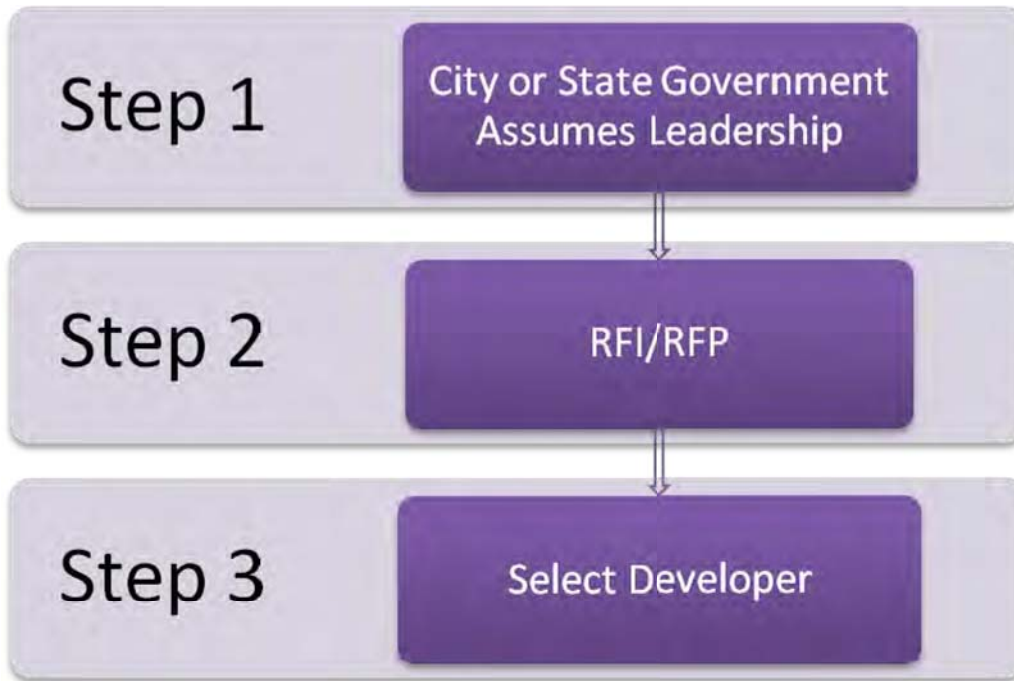


Figure 3: Flow Chart



The Process

Introduction

The developer is the party that takes ownership of a wind project. During the process, developers collaborate with local communities and with regulatory and governmental authorities, conduct the major studies, and gather most of the permits and regulatory clearances. They also serve as the party who manages the financing of the operation.

In some cases, developers themselves see potential for a project and pursue it, without being prompted by an outside proposal. This was the case for Cape Wind.¹ However, a community, citizens' group, or government may wish to propose a project site. This section of the report addresses the proper course of action taken to recruit a developer to a project.

Step 1: City and State Governments Assume Leadership

If a city or community wishes to propose and pursue an offshore wind project in the Great Lakes, the first action item is to direct the project to the city and state government, and more specifically, to the state governor and local mayor. For the wind industry, developers desire to be contacted by government representatives that represent the interests of the communities involved.² Community groups do not offer the traction and resources necessary for large-scale project proposals to be sent to potential developers.

Assuming Project Authority

According to Joseph J. Graham at BlueSkyWind, the governor of the state may defer the project to the mayor of the city nearest to the proposed project location. This will especially be the case when the project is within a few miles of the city's coastline. The mayor may then make a decision. The mayor

may choose to accept responsibility for the project in order to guide the project along a path believed to generate the greatest community support. Alternatively, the mayor may decline and suggest the state government handle the oversight of the project.³

It is also likely that the state and/or city government will assign a specific acting authority for the project.⁴ This specific department or office is responsible for gathering the relevant information, possibly submitting a request for information (RFI), and preparing a request for proposal (RFP).⁵ Both the RFI and RFP are highlighted in Step Two. If the city has planning and building departments or a shoreline management group concerned with waterways and underwater construction, these groups likely receive the authority.⁶ Planning and building departments may amend current policies to account for zoning for wind development.⁷

Step 2: The Government Acting Authority Prepares an RFI (Optional) and an RFP

According to Graham, after the government determines which department or collaborative committee assumes leadership on the wind development proposal, that acting authority extends a bid for project development to the developer community by preparing an RFP. If the acting authority feels it requires more information in order to write an RFP, it may first prepare an RFI.⁸

Example RFPs

- In 2004, the State of Rhode Island signed a development agreement with Deepwater Wind Rhode Island, LLC, whom they selected from among seven developers that submitted responses to the state's RFP regarding offshore wind development.⁹
- In Northern Ontario, according to developer David Boileau of Superior Wind Energy, the government must prepare an RFP that initiates bidding for wind projects.¹⁰ He believes that without such a document, renewable wind energy will lack development under leadership of the McGuinty government.¹¹
- A third example is an RFP by the Bonneville Power Administration of Portland, Oregon. The administration used an RFP to request proposals for 1,000 MW of new wind development for the city.¹²

Based on other RFPs, particularly a sample RFP for wind development in Montana,ⁱⁱ the RFP would likely notify the developers of exploration, installation, operating, and other fees, the preferred format for the proposals, how proposals should be submitted, and the criteria by which proposals will be evaluated in selecting a developer for the project.¹³ The city may also define title conditions and demonstrate to the developer that the city controls the area and would offer clear title to the developer.¹⁴ The Montana sample RFP requires developers to submit copies of pre-existing environmental studies considered relevant to the project.¹⁵ It also requires developers to identify the permits they will need, discuss the developer's plans to connect the project to the existing electrical grid, and demonstrate the developer's financial capability to handle the project.¹⁶ In the RFP, the city will specify certain constraints on the project but leave many of the details to the developer. For

ⁱⁱ This sample RFP may be found at dnrc.mt.gov/trust/wind/GenericWindRFP.pdf. Although it is presumably not a finished, officially submitted document, it is available from their server.

instance, the city will specify the boundaries and water depth of the area being proposed for project development; however, the developers' proposals would detail the type and layout of turbines and other specifications they envision for the project.¹⁷

To find further examples of government RFPs, databases such as the following may be helpful:

- State and Federal Bids: <http://www.stateandfederalbids.com/index.html>
- FindRFP : <http://www.findrfp.com/rfp/>
- GovernmentBids.com: <http://www.governmentbids.com/>

RFI: Timing and Submission

The government may not feel it possesses adequate information to write an RFP. It may wish for more input in deciding what locations are reasonable to propose, what considerations the developer has in selecting an appealing project, and what information a developer needs in order to write a successful proposal. In this case, the acting authority may produce an RFI first.ⁱⁱⁱ The RFI provides less information than an RFP and serve as a general inquiry posed to developers.¹⁸ Developers are motivated to respond with detailed feedback because their help may be remembered when the city reviews proposals later to decide on a developer.¹⁹ Developer responses to an RFI about offshore wind development in the Great Lakes or off the shore of Lake Michigan, for instance, may indicate why the authoritative party may prefer one location over another, what problems the developer thinks the local government should address, and what remaining information the developer wants to know about a proposed project in order to generate further interest.²⁰ The acting authority can then use this information to write an RFP.²¹ Thus, the RFI is a formal means of communication between the city and state governments and developers, and it promotes both parties' interests in the project. The RFI provides guidelines for developers' responses and may even suggest the developer conduct site visits before writing a response.²² However, the RFI generally provides fewer and more general guidelines, encouraging respondents to choose their own approach and be creative.^{23, 24}

For both an RFI and an RFP, the government must gather wind data. Wind must be assessed at approximately 60m to 100m (180-300ft).²⁵ The city generally uses preexisting data, most often data from airport anemometers; if airport data is not an option, sometimes ferries contain installed anemometers.²⁶ Airport data is typically collected at much lower heights than the desired 60m to 100m, but since wind is a function of height, the city may consult a meteorologist to obtain an estimate for the wind speed at 60m to 100m.²⁷ Developers understand these figures are merely estimates and plan to construct anemometers to collect on-site data if chosen to oversee the project.²⁸ They typically prefer to conduct this initiative and all the other studies themselves, particularly because banks wish to see calculations and studies have been performed by independent, prominent sources.²⁹ Additionally, anemometers in the desired height range may require FAA approval.³⁰

See Figure 1 for general wind data in the Great Lakes.

ⁱⁱⁱ For a sample RFI prepared by the city of Chicago, please see www.cityofchicago.org/CivicNet/civicnetRFI.pdf

Step 3: The Acting Authority Chooses a Developer

The RFP serves as a bid, and from among the developers who submit proposals, the acting authority chooses one developer for the project.³¹ From here, the developer secures clearance to erect anemometers at the appropriate height and collect more accurate data, generally for a period of 12-18 months.³² The developer also continues with the rest of the wind development process, including conducting the necessary studies and securing permits.³³ For this work, the developer finances the project or secures the financing from other sources (please see Financing in the Questions to Consider section of this report). Throughout the process, the developer submits all studies, data and progress to a designated review board.³⁴ The government constructs the review board for this purpose; it may involve the planning and/or building departments of the nearest city.³⁵ For more information on the steps of the wind development process a developer pursues, please see the “Questions to Consider” section later in this report.

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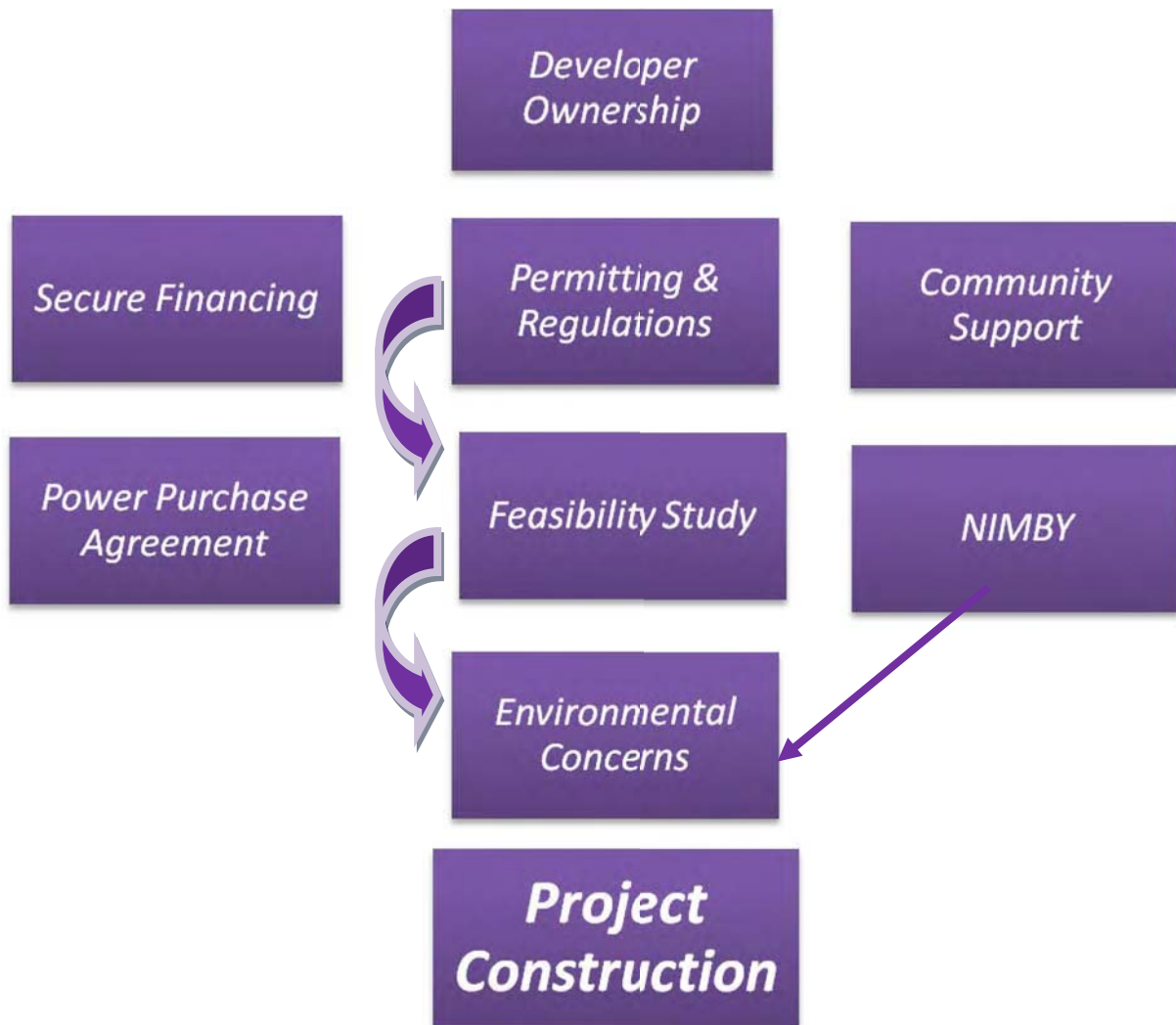
³⁴ Graham, Joseph J.

³⁵ Graham, Joseph J.

Questions to Consider

What is the process after the developer takes ownership of the project?

Figure 4: Future Considerations



Introduction

Once the developing company is chosen, it will then be responsible for managing the rest of the process. This process includes securing financing and attaining the necessary permits for feasibility studies and construction. This is not a step by step process as many of these actions occur simultaneously and overlap during the project time table. In the following sections, details concerning the following processes for the developer are highlighted and common questions are answered.

Financing

Is the city responsible for financing?

The sole purpose of this report is to provide Great Lakes cities with the necessary information to begin the offshore wind farm planning process. Once the city completes the beginning three steps listed in this report, it is the responsibility of the developer to lead the project. Securing financing is of utmost importance for developers to begin the construction portion of the process. Although the city is not responsible for the financial aspect of the project, it is vital the city shows support for the project. Lenders will likely exhibit a much greater willingness to work with developers when local citizens demonstrate a greater degree of support for the project.

What is the financial process?

Financing an offshore wind farm is not a single track course. Developers possess the freedom to take multiple varied routes to finance a project, some more feasible than others based on project siting, outside investor interest, and interest by a wind developer. The financing route most often taken by wind developers features the developing company borrowing from lenders who either desire equity or a guaranteed return on an investment. Banks, wealthy individuals, and investment firms all serve as potential lenders to wind development firms. Once the developer manages to arrange the financing component of the process, it will then work with the utility company for all other agreements. This section provides insight from Tom Stanton, a Michigan Delegate who helped create a Wind Working Group and Howrey LLP, a Litigation Law Firm and Construction Practice focused on the subject of offshore wind farm finance.

According to Mr. Stanton, offshore wind is financed the same way as on-shore wind. Wind developers create a “paper asset” that includes all preliminary studies and most importantly, the proof of the developer’s ability to sell the output from the facility to the utility company under a long term contact for the “off-take” of the electricity produced.

These contracts, namely power purchase agreements such as permit applications, can take several months or even years to finalize. These arrangements include definitions and details on the operation of the wind farm, financing of the wind farm, guarantees of performance, penalties, payments, and other such related sections.

Financiers desire that these contacts are long-term, fixed price contracts that ensure that all generated electricity can and will be sold to someone. The contract must last long enough in order to pay back all of the financing of the original project. Paying back the original financing can take upwards of fifteen to thirty years depending on the full cost of the project. Without the long term power purchase agreement between a utility company and the financier of the offshore wind farm, the project is typically not viable.

Howrey LLP analyzed the participants, risks, and options involved in financing an offshore wind farm. According to Howrey, the PPA is ideally made with a utility company that has a strong investment grade or one that has an incentive to work with wind energy as a result of a renewable energy portfolio standard. The company also explains that owners of the project and equity lenders prefer to have “take-

or-pay”¹ requirements, obligating the utility company to pay for electricity on a regular basis even if the company is not using the electricity produced by the offshore wind farm.

Once the agreement is in place, construction and maintenance agreements must be settled. These contracts, like the PPA, are fixed-price contracts. Lenders to the wind developer desire to ensure the construction contractor does not possess flexibility during construction due to the fact that costs generally increase during production. Lenders also require contractors to agree to pay for damages in the case that a wind farm does not meet the performance standards originally set under the power purchase agreement and the original fixed-price contract.

The final agreement Howrey LLP deems an appropriate measure in the financial planning of an offshore wind farm is the Loan and Security Agreement. The wind developer must negotiate a loan agreement with the lenders that will align terms such as maturity, interest rate and fees, and all abiding documents that protect the lenders.

What is the expected cost of an offshore wind farm?

In Delaware, a Delaware utility and Delmarva Power agreed upon a contract in 2008 for the construction of an offshore wind farm. The project planned to build 150 wind turbines off the coast of Rehoboth Beach.² The estimated total cost of this project was estimated at \$1.6 billion which equates to about \$10.6 million per wind turbine. This cost is above the actual per turbine cost as some of the total cost is directed towards feasibility studies and is allocated to the operational budget. We estimate wind turbines in Lake Michigan would cost less on average than turbines in the ocean because both operations and design are less costly. Lake Michigan turbines do not have to be structured to handle hurricane force winds or the destructive salinity of ocean waters.

Financing the pre-feasibility study is normally minimal if an academic group serves as a resource. However, the feasibility study incurs a significant cost; though it should also be financed by the lenders to the project.

Summary of Finances

- Offshore Wind Farms are financed the same as onshore projects in the United States (even though an offshore site has yet to be completed.) We can learn from the mistakes and successes of such projects.
- Lending is not feasible without a guaranteed return on investment. This often means developers must reach long-term Power Purchase Agreements with utilities to reduce lenders’ risks and increase profitability for all involved parties.
- Depending on design, depth, and bathymetry of a location, individual offshore wind turbines will range in cost from \$3-\$8 million. Economies of scale are present as the size of the wind farm increases.

Permits

What Permits are likely to be required?

One of the parallels interested parties must take into account with regards to offshore wind farm implementation is the management of the permit process. In addition to addressing finance issues, feasibility studies generally target the complete disclosure of the regulatory obstacles that potentially stand in the way wind development projects.

Who has regulatory jurisdiction in the Great Lakes?

In Lake Michigan, the regulatory stronghold belongs to the United States Army Corps of Engineers (USACE). Under the Clean Water Act Section 404 and Sections 9 & 10 of the Rivers and Harbors Act, the USACE reviews all plans for construction in Lake Michigan.^{iv, 3}

What are the first steps towards certification?

The feasibility study serves as the first step that requires an application for a permit. When performing a feasibility study, the developing company often places a test tower in the site location to gather wind speed data. This “met” tower, or meteorological tower, often linked with an anemometer, must be approved by the USACE before construction begins.

What are the exact permits needed for each construction project?

For the feasibility study and any other research related construction projects, the USACE requires the submission of a general permit. Once the developer completes the general permit application process, the District Engineer for the area reviews the submitted application. This abbreviated review is generally not opened up for public opinion or outside agency consultations. Therefore, extensive delays generally do not characterize the permitting process associated with the commencement of a feasibility study and construction of a test tower. Please note that the exact location and type of testing must be well documented in order for review by the district engineer.

Upon completion of the feasibility study, the next step for a developer is to submit the standard permit application. Unlike the general permit, multiple agencies are involved in the review of a high impact project such as the construction of an offshore wind farm. The agencies and their abiding acts can be seen in the table below provided by Bonnie Ram of Energetics Corporation. These agencies regulate any impact on navigation, noise, aquatic resources, and other surrounding environments such as migratory bird paths. This process varies in length due to protest and calls for modification by the agencies involved. Please expect the standard permitting process to last a minimum of two years, and more likely, extending to five years.⁴

Who applies for such permits?

According to Gina Nathan of the USACE, one of the following three groups leads the application process: the utility company involved in the power purchase agreement, the project manager of the

^{iv} Please see Table 4, created by Bonnie Ram for all of the regulatory acts that are considered with offshore construction plans

developing company, or a private consulting company. Often the financier of the project will assign an individual or agency the task of submitting all permit applications.

Can the process be expedited?

As recently as May 21, 2009, Cape Wind LLC in Nantucket Sound received approval for a “super permit.” The project, designed to power approximately 400,000 homes in the area, won unanimous approval by the Massachusetts Energy Facilities Siting Board in a 7-0 vote for a "composite certificate" that combines nine state and local permits needed for the project. This permit includes all state and local permitting and overrules a Cape Cod Commission procedural rejection of the project.

The “super permit” would serve as a great benefit as well to cities in the Great Lakes region in their efforts to support energy produced by offshore wind farms. The process will take significantly less time for Cape Wind to pass through its remaining approvals and it eliminates general and standard permit applications by combining them into one cohesive permit. Developers should consider such a permit and propose it to interested cities during the offshore wind farm process.

What is NIMBY?

According to Laura Leonard, an environmental lawyer of Sidley Austin LLP, lack of citizen support may serve as the ultimate setback for offshore wind farm implementation. Even when projects are economically feasible and developers receive approval from the regulatory bodies listed below, citizens displaying “NIMBYism” or Not In My Back Yard feelings towards the project can disrupt project construction. Such resistance remains evident for the Cape Wind project due to the wind farm’s site, in that it lays in direct view of the wealthy resort region of Cape Cod in Massachusetts.

For further questions relating to the permit process, please contact Gina Nathan of the Detroit District of the USACE @ Gina.R.Nathan@usace.army.mil and 313-226-5384.

Table 1: Selected Federal Regulations⁵

Legislative Authority	Major Program/Permit-⁶	Lead Agencies
Rivers And Harbors Act - Section 10	Prohibits the obstruction or alteration of navigable water of the U.S without a permit	U.S. Army Corps of Engineers (District Office)
National Environmental Policy Act (NEPA)	Requires submission of an environmental review for all major federal actions that may significantly affect the quality of the human environment	U.S. Army Corps of Engineers (District) Council on Environmental Quality
Coastal Zone Management Act	Consistency determination with the coastal program of the affected state	State Coastal Zone Management Agencies
Navigation and	Navigation aid permit (markings and lighting)	U.S. Coast Guard

Navigable Waters		
Navigational Hazard to Air Traffic	Determination of the safe use of airspace from construction start (lighting)	U.S Federal Aviation Administration (Regional Administrator)
Migratory Bird Treaty Act	No “taking” or harming of birds determination	Fish and Wildlife Service Migratory Bird Conservation Commission
National Historic Preservation Act	Consultation on the protection of historic resources — places, properties, shipwrecks	Department of the Interior State Historic Preservation Offices
Magnuson-Stevens Fishery Conservation & Management Act	Conserves & manages fish stocks to a 200-mile fishery conservation zone & designates essential fish habitat	National Marine Fisheries Service
Endangered Species Act	Consultation on action that may jeopardize threatened & endangered (listed) species or adversely modify critical habitat	Fish & Wildlife Service National Marine Fisheries Service
Marine Mammal Protection Act	Prohibits or strictly limits the direct or indirect taking or harassment (Permits may be sought for “incidental take”)	Fish & Wildlife National Marine Fisheries Service
Clean Water Act	Regulates discharges of pollutants into the waters of the United States	U.S. Environmental Protection Agency
Estuary Protection Act	Conserves estuarine areas	Fish and Wildlife Services

Citations

¹ "Big U.S. offshore wind farm wins crucial permit."

² Courson, Paul

³ Nathan, Gina.

⁴ Leonard, Laura

⁵ Ram, Bonnie

⁶ United States. U.S. Environmental Protection Agency. *Laws, Regulations, Guidance & Documents.*

Research

Methods

Expert Interviews- We interviewed several experts in several areas of the project. These are covered more wholly in Appendix A

Wind Power 2009- The world's largest wind conference, hosted by the American Wind Energy Association took place in Chicago in May 2009. Companies and researchers from all over the world convened at the conference. All of the group members attended the event, through which we made several vital contacts and obtained a wealth of information.

Internet Research- This served as our least-used resource. Though there exists an astonishing amount of information on the web about wind farms, very little describes the actual step by step process of constructing a wind farm.

Public Documents- The Cape Wind Environmental Impact statement provided us with a great deal of knowledge on how a government organization performs and makes a decision based on the results of the Environmental Impact Statement. Even more beneficial, however, was the contact information given with the document. We were able to utilize those lists of people involved in the Cape Wind project to reach several key, knowledgeable individuals.

Conclusion

Developers ultimately serve as the party that shapes and executes the construction of a wind project. They collaborate with the affected communities and with regulatory and governmental authorities. Developers utilize their experience to handle the process of deciding the feasibility of a project and negotiating it. Furthermore, they serve as the party that manages the project finances. Therefore, the best way to develop a wind farm is to turn over the project as soon as possible in the process to a developer. To do so, it is recommended that the project is assigned to a city or state government, who fills out an RFI or RFP, then chooses a developer. While the process will no doubt not be as easy or straightforward as described in the report, the basic framework will hopefully provide guidance to an organization as they work towards the development of a wind farm.

Acknowledgements

We benefited greatly from meeting with several key individuals throughout the process of researching the report, whose contributions were invaluable in the final product. While we cannot thank them all, we would like to thank the following in particular: the Civil and Environmental Engineering Department at Northwestern University, Citizens for a Greener Evanston, Joseph J. Graham, Gina Nathan, Laura Leonard, Tom Stanton, Mark Rogers, Bonnie Ram, Kate Tomford, and those attending and presenting at the AWEA Wind Conference 2009 in Chicago, IL. Finally, of course, is our adviser, Professor Neal Blair, without whom this project would have never existed.

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Appendix B: Contact List

Theme	Contact	Organization	Email
Technology/Development			
	Lynn Gresock	ARCADIS	lynn.gresock@arcadis-us.com
	Donald Welch, PhD	3U Technologies	dwelch@3utech.com
	Steve Jones	GEC	steve.jones@dnv.com
	Richard Steubi	The Cleveland Foundation	
Finance			
	Elias B. Hinckley	Deloitte	ehinckley@deloitte.com
	Cindy Fang	Ernst& Young	cindy.fang1@ey.com
	Ruth Leistensnider	Nixon Peabody LLP	rleistensnider@nixonpeabody.com
	Thomas Stanton	Michigan Offshore Wind Council	tstanton@michign.gov
Political/Government			
	James M. Ahlgrimm	U.S. DOE	jim.ahlgrimm@ee.doe.gov
	Jeremy Tchou	Stanford University	jeremey.tchou@gmail.com
	Zeke Williams	Ducker, Montgomery, Aronstein & Bess, P.C.	zwilliams@duckerlaw.com
	Rodney Cluck	US Dept. of the Interior	Rodney.e.cluck@mns.gov
Environmental			
	Gary L. Alt, PhD	Normandeau Associates	galt@normandeau.com
	Karen Tyrell, PhD	BHE Environmental	ktyrell@bheenvironmental.com
	Paul Martin	TRC	pmartin@trcsolutions.com
	Caleb Gordon, PhD	Pandion Systems	cgordon@pandionsystems.com
	Todd J. Mabee	ABC inc.	tmabee@abrinc.com
	Laura Leonard	Sidley Austin LLP	lleonard@sidley.com
Illinois			
	Kevin Borgia	Wind for Illinois	kborgia@windforillinois.org
	Eric Schlaf		eschlaf@icc.illinois.gov
	Gabriella Martin	Program Officer of Renewable Energy, IL Clean Energy Community Foundation; manager of environmental commitments for ComEd	
	Jim Hataway	Atlantic Plant Maintenance	

Telephone	Specialty	Notes
(978) 937-9999 ext. 320	Offshore wind	Works with European based wind-development
(936) 441-3043	Offshore wind	Our main man, the Don
(206) 387-4232	Risk Management Reports	Has time lines and other processes
(216) 685-2011	Great Lakes Wind	A lot of work on Lake Erie wind projects-got a test tower up
(202) 879-5649	Regulatory Issues	
(617) 585-1859	Taxes and Tax Credits	Knows the whole subsidy/tax/financial market very well
(518) 461-3368	Due Dilligence	Stong knowledge of financing a wind project
	Michigan Delegate	Sent Email, Advised me that Onshore Wind is the same as Offshore Wind.
(202) 586-9806	Government Policy	For the Energy efficiency and Renewable Energy
(216) 346-9104	The Production Tax Credit	
(303) 861-2828	Wind on Federal Lands	Has knowledge of federal regulations that might be important
(703) 787-1300	Federal Policy	
(610) 705-5733	Regulatory Requirements for wildlife	Specializes in Eastern States
(865) 925-6370	Resolving endangered species conflicts	
(978) 970-5600	Environmental Impact Statements	Great knowledge of the Cape Wind report and lessons from it
(352) 372-4747 ext. 1824	Birds	Developing methods to evaluate locations for bird issues
(503) 359-7525 ext. 110	Environmental Research	Another person working with the bird situation
(312)853-7620		
(773) 787-9463	Illinois policy and development	Zach has been in contact for a while
(217) 782-2743		
(312) 372-5191	Funding, what arrangement a developer wants Developer recommendations	