

Opportunities in the US Offshore Wind Energy Market



Offshore wind power generation has been on a constant rise worldwide ever since the first commercial project came online in Denmark in 1991. As of mid-2015, Europe had 10,394 MW of installed offshore wind energy capacity; China 718.9 MW; and Japan 52 MW, according to statistics from the Environmental and Energy Study Institute.

While the United States has just started to invest in offshore wind energy, the potential resource is enormous, estimated to be 4,223 GW by the National Renewable Energy Laboratory. In the near term, 3.6 GW of offshore wind energy capacity is expected to be added to the grid by 2020, through projects which have been issued leases by the Bureau of Energy Ocean Management (BOEM).

U.S. Offshore Wind Energy Pipeline by State

State	Expected total capacity by of projects to be added by 2020 (MW)
Maryland	500
Rhode Island	1,000
Massachusetts	400
New Jersey	1,700
Total	3,600

Source: Environment New Jersey Research and Policy Center, January 2016

Factors to influence the mid-term market

The projected mid-term growth will depend upon a combination of political and economic factors, such as the upcoming presidential elections and compliance with the Clean Power Plan (CPP) from 2022. The CPP establishes carbon pollution standards and emission rates for each state and is projected to reduce emissions from the power sector 32% by 2030 from the 2005 levels.

"The U.S. is amidst its first-ever restructuring of the entire electric generation market, driven by the CPP. In the next two to three years, the CPP will be implemented in all 50 states. That will pave the way for the market to recognize the damaging cost of fossil fuels, so it will immediately value renewable energy," said Chris Wissemann, CEO of Fishermen's Energy.

The take-off of the U.S. offshore wind market will also depend on the next presidential and congressional elections. With the democrats in charge and the democratic congress, the CPP will be implemented.

"I think New York and Massachusetts are going to lead the way with offshore wind over the next five years almost no matter what. New Jersey will depend on the next governor," said Wissemann. "If a democratic gets in, then you can add New Jersey to New York and Massachusetts and you get a 5 GW market that will be implemented over the next 10 years.

Interstate collaboration

A number of U.S. states have been proceeding with offshore wind projects in their own rights through task forces created by the Administration. While the Department of Interior has dedicated financial resources and human capital for offshore wind, and the Department of Energy has developed a 20% wind scenario by 2030 that includes 54 GW of offshore wind, the country still lacks an overarching vision of how to reach this target. As a result, offshore wind development initiatives have been scattered.

"Although well-intentioned, this policy, unfortunately, has been counter-productive, reinforcing competition among states when cooperation is needed...It is thus time for Congress to create incentives for regional cooperation, such as greater sharing of royalties with those states that cooperate," states a paper by the National Academy of Sciences.

Indeed, more effort needs to be devoted to regional planning and interstate collaboration, especially as states can benefit from economies of scale of large regional projects, as well as from sharing the economic development benefits that arise.

According to Bruce Williams, wind energy consultant at Maryland-based Williams Offshore Wind (pictured left), getting enough congressional support for offshore wind federal policy initiatives is difficult as offshore wind only directly benefits a few coastal states. "Delaware, Maryland, New Jersey, New York, and Rhode Island have different policies aimed at supporting offshore wind, but there is not really a big enough, coordinated market to build an offshore turbine factory in the US.



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"That is what it would take to really drive down costs and make it a major job creator," said Williams, whose research at the University of Delaware and University of Maryland over the last four years focused exclusively on offshore wind power development in the Mid-Atlantic Bight.

"Hopefully the presidential elections of 2016 will sweep out much of the unenlightened resistance to renewables and we will see some sort of federal support, or at least better coordination between states," he added. "After studying this market for five years, I believe the answer is to coordinate three or four big offshore projects between different states, in order to obtain economies of scale and standardize the process."

Incentives: Production Tax Credit (PTC) and Investment Tax Credit (ITC)

The US Congress voted in December 2015 to phase out the \$0.023/kWh PTC and the 30% ITC over five years, the longest uninterrupted period with federal incentives since the PTC first expired in 1998. While the PTC expired at the end of 2014 and was extended through the end of 2020, the ITC, set to expire at the end of 2016, was stretched until 2022.

The new policy extends both tax credits at their current levels for projects that begin construction in 2015 and 2016. After that, the credits will plummet to 80% of today's value in 2017, 60% in 2018, and 40% in 2019, with the last projects completing by 2021.

The five-year extension of the PTC is considered by many as a bridge to 2022, when the CPP is scheduled to be enforced. With coal retirements on the horizon, utilities will be attempting to take advantage of wind-energy subsidies while they are still available, especially at the full \$0.023/kWh. Similarly, the extension of the ITC is anticipated to attract investment to U.S. offshore wind projects, although the tight schedule means only a few will be in a position to capture the full 30% value. Larger scale projects are more likely to capitalize on lower ITC levels later this decade.

Return on Investment

In a nascent market where offshore wind is seen as risky territory, return on investment (ROI) on projects is naturally lucrative. "My understanding is that investors generally command in the neighborhood of 12% return since the perceived risk of offshore is very high in the U.S.," explains Bruce Williams of Williams Offshore Wind. "Power purchase agreements and other offtake agreements can reduce the perceived risk, which should reduce the ROI. There is more talk recently of two novel funding mechanisms - municipal green bonds and master limited partnerships. I would look into those more closely."

According to Chris Wissemann, CEO of Fishermen's Energy, the return on equity in the U.S. offshore wind market is currently higher than Europe's. "This is to a great extent because the large projects in Europe are now common, the risks are mitigated, and you have long-term demonstrated government support. U.S. projects are currently perceived as a bit riskier, so it requires a higher rate of ROI in order to attract investment." Both Wissemann and Paolo Sammartino, COO of US Wind, concurred that offshore wind projects in North America can yield a double-digit internal rate of return.

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Recent developments

March 2015

BOEM signed its first wind energy research lease, with Virginia's Department of Mines, Minerals and Energy (DMME). Under this lease, DMME will design, develop and demonstrate a grid-connected, 12 MW offshore wind test facility off the coast of Virginia – adjacent to the Virginia Wind Energy Area (WEA). The data obtained and lessons learned from the project will be made publicly available.

July 2015

Deepwater Wind began construction of North America's first offshore wind project, the 30 MW Block Island off the coast of Rhode Island. The windfarm is expected to become operational by the end of 2016.

November 2015

On 9 November, BOEM completed the first-ever auction of offshore wind energy areas off the coast of New Jersey. Totalling 344,000 acres, the areas resulted in two lease auction winners: U.S. Wind Inc. and RES America Developments Inc. While RES Americas bid \$880,715 for 160,480 acres (South Lease Area), U.S. Wind Inc. bid \$1,006,240 for 183,353 acres (North Lease Area). If developed, these areas can produce 3,400 MW of wind energy.

Each lease will have a preliminary term of one year, during which the lessee will submit a Site Assessment Plan to BOEM. Once this plan is approved, the lessee will have four and a half years to submit a Construction and Operations Plan (COP) to BOEM for approval. Upon receiving the COP from a lessee, BOEM will conduct an environmental review of that proposed project. If the COP is approved, the lessee gets an operations term of 25 years.

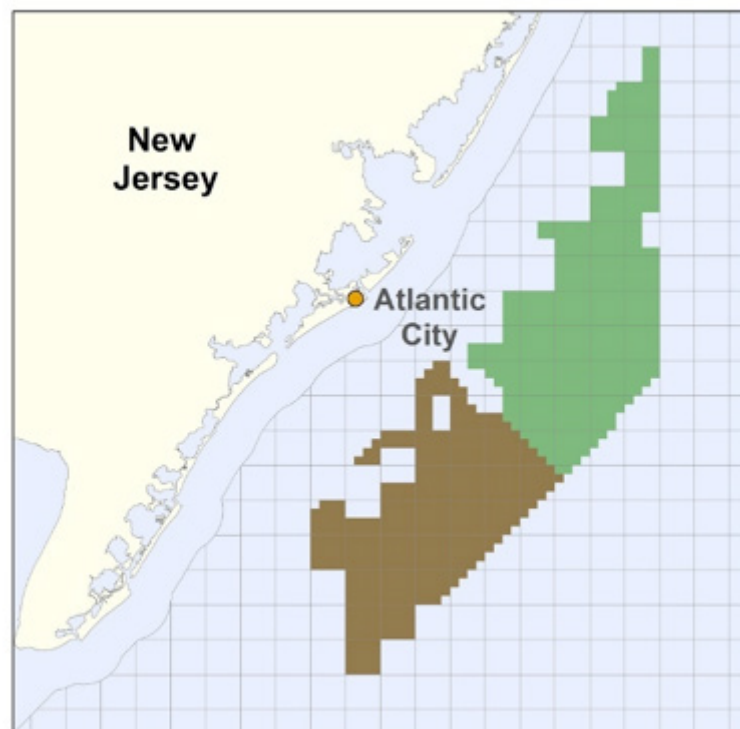


Figure 1: New Jersey Wind Energy Area starts about seven nautical miles offshore and extends roughly 21 nautical miles seaward.

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On 23 November, BOEM issued a Call for Information and Nominations to gauge the offshore wind industry's interest in acquiring commercial wind leases in four areas offshore South Carolina totaling more than 1,100 square miles. The Call Areas are: Grand Strand, Cape Romain, Winyah and Charleston.

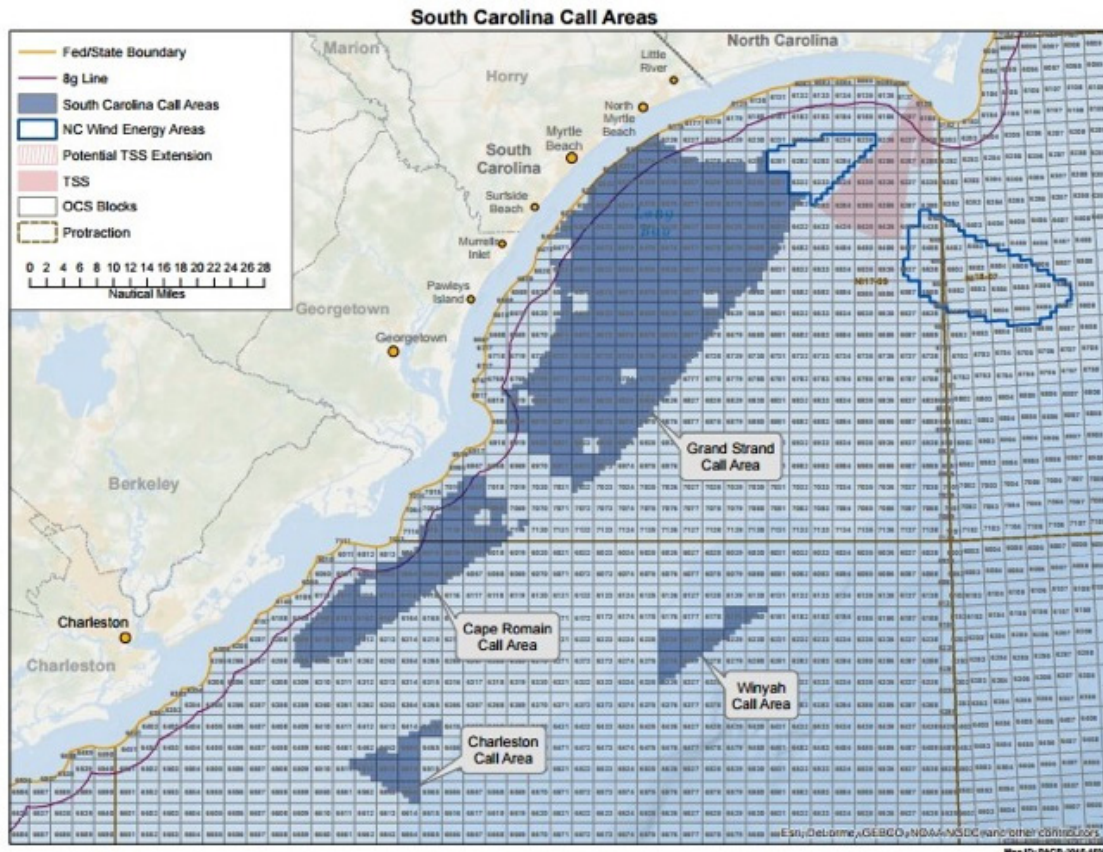


Figure 2: South Carolina Call Area. Courtesy Bureau of Ocean Energy Management

January 2016

The Governor of New York Andrew Cuomo said that his state will be engaging community members, environmental advocates, and government partners to create the New York Offshore Wind Master Plan, which will be supported with \$5 million and serve as a blueprint for offshore wind development in the state. New York is also advancing a 10-year, \$5 billion Clean Energy Fund that will be funded by surcharges on utility bills.

U.S. Wind Energy Market Ecosystem

Until recently, the lack of offshore wind projects in the U.S. meant that there was little demand for a domestic supply chain. However, with the recent awarding of offshore wind lease areas and the entry of international developers, an ecosystem is rapidly building up to encompass local and international contractors, suppliers, financiers, and consultancies.

Moreover, the presence of a strong domestic supply capacity for the U.S. onshore wind market suggests that potential also exists to supply sizable portions of the future offshore market domestically. The following table lists the main government agencies and companies currently involved in the U.S. offshore wind energy market.

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U.S. Wind Energy Market Ecosystem

GOVERNMENT AGENCY	ROLE
Bureau of Ocean Energy Management (BOEM)	<i>A federal DOI agency responsible for determining offshore areas where wind farms may be built on the Outer Continental Shelf, and sells leases for qualified bidders.</i>
Department of Energy (DOE)	<i>Invests in wind research and development projects, both on land and offshore, to advance technology innovation, create job opportunities, and boost economic growth.</i>
Department of Interior (DOI)	<i>Approves wind energy areas off U.S. coasts and auctions offshore lease areas through BOEM.</i>
NOAA Coastal Services Centre	<i>Provides coastal communities with specialized tools and services, such as interactive maps that illustrate the suitability of seaboard areas.</i>
Developers	
Convalt Energy (U.S.)	<i>Subsidiary of ACO Investment Group that acquires and develops solar, onshore and offshore wind projects.</i>
DONG Energy (Denmark)	<i>Danish energy developer planning for an offshore wind project off the coast of Massachusetts with a potential of 1,000 MW.</i>
EDF Renewable Energy Development	<i>San Diego based renewable energy developer and O&M service provider.</i>
Energy Management Inc. (U.S.)	<i>Renewable energy developer behind the proposed Cape Wind project in Massachusetts</i>
Fishermen's Energy (U.S.)	<i>Offshore wind energy developer. Proposed a 24 MW project off Atlantic City that was awarded a \$47 million grant from DOE.</i>
Garden State Offshore Energy (U.S.)	<i>Joint venture between PSEG Global, a diversified energy group, and Deepwater Wind.</i>
Green Sail Energy LLC (U.S.)	<i>Development company working along the Eastern Seaboard of the U.S., bidding offshore wind energy projects.</i>
Lake Erie Energy Development Corporation (U.S.)	<i>Building North America's first offshore freshwater wind project in Ohio.</i>
Offshore MW LLC (U.S.)	<i>New Jersey based developer and the sister company of WindMW, which developed & constructed a 288 MW offshore wind project in the German North Sea.</i>
Principle Power (U.S.)	<i>Building WindFloat Pacific in Oregon, the country's first floating offshore wind project, expected to be operational by the end of 2017.</i>
RES America Developments Inc. (U.S.)	<i>A subsidiary of Renewable Energy Systems Americas., which has a project portfolio of 7.5 GW in North America. Bid for an offshore wind area off the coast of New Jersey, which it was awarded in November 2015.</i>
U.S. Wind Inc. of Renexia (Italy)	<i>U.S. Wind Inc. won two offshore wind leases off the coast of the Maryland and another off the coast of New Jersey.</i>

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GOVERNMENT AGENCY	ROLE
Manufacturers / Suppliers	
AMSC	<i>Massachusetts-based supplier of power convertors for wind turbines. Serves the offshore market.</i>
GE Power Conversion	<i>Global supplier of power convertors for turbines. Present in the USA through its Pittsburgh office.</i>
Gulf Island Fabrication	<i>Texas-based fabricator of offshore drilling and production platforms and other specialized structures. Fabricated Block Island's steel jacket foundations.</i>
MOOG	<i>New York-based supplier of pitch and yaw systems for wind turbines. Serves the offshore market.</i>
Timken	<i>Ohio-based manufacturer of bearings, transmissions, gearboxes, chain, and related products. Serves the offshore market.</i>
TPI Composites	<i>Arizona-based manufacturer of wind blades. Serves the offshore market.</i>
Woodward	<i>Colorado-based supplier of power convertors for wind turbines. Serves the offshore market.</i>
Financiers	
Export Bank of Denmark	<i>Denmark's official export credit agency. Committed funding to Cape Wind project.</i>
KeyBank National Association	<i>An American regional bank headquartered in Ohio. Funding Block Island project</i>
Natixis	<i>A French corporate and investment bank. Committed mezzanine debt to Cape Wind project.</i>
PensionDanmark	<i>Danish pension fund. Committed mezzanine debt to Cape Wind project.</i>
Rabobank	<i>Dutch multinational banking and financial services company focused on food, agri and sustainability-oriented banking. Committed mezzanine debt to Cape Wind project.</i>
Societe Generale	<i>A French multinational financial institution. Funding Block Island project.</i>
Tokyo-Mitsubishi UFJ	<i>Japan's largest bank. Provides global banking and financial services. Committed mezzanine debt to Cape Wind project.</i>
Constituencies	
AWS Truepower	<i>New York based renewable energy consultancy. Supported Cape Wind project.</i>
K2 Management	<i>Denmark based consultancy, serving wind developers and utilities. Supported Cape Wind project.</i>
PMSS America	<i>U.S. division of global renewable energy consultancy and technical & engineering services firm TÜV SÜD PMSS. Supported Cape Wind project.</i>
SgurrEnergy	<i>Scotland based renewable energy consultancy. Supported Cape Wind project.</i>
Williams Offshore Wind	<i>Consulting firm led by Bruce Williams, an engineer with over 20 years' experience in planning, permitting, and engineering large civil works projects in coastal and marine environments.</i>
Woods Hole Group	<i>Massachusetts based environmental, scientific, and engineering consultancy. Supported Cape Wind project.</i>

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Project Case Studies



1 *Deepwater Wind's Block Island Project*

Deepwater Wind's 30 MW Block Island project is the first offshore wind project in the U.S. and the most advanced. Located three miles from Block Island off the coast of Rhode Island, the project will produce enough electricity to power 17,000 homes. GE, which recently completed its acquisition of Alstom's offshore wind unit, is supplying the 6-megawatt Haliade 150 offshore wind turbines for the project.

In January 2015, Gulf Island Fabrication began fabrication work at its facilities in Louisiana on the windfarm's five steel jacket foundations. By March 2015, Deepwater Wind reached close on more than \$290 million in project financing from Societe Generale of Paris and KeyBank National Association of Ohio. The financing was in addition to more than \$70 million in equity funding provided by Deepwater Wind's owners, principally an entity of the D.E. Shaw Group.

Construction on the windfarm began in July 2015, and in December, all five foundations were installed. Submarine cable installation is now scheduled to begin in the spring of 2016, with erection of the turbines set for the summer of the same year. The developer notably divided the offshore construction schedule into two main windows – the summer and fall of 2015 and the summer and fall of 2016, incorporating plenty of potential weather breaks.

Moreover, much of the work is being done domestically. For example, fabrication of some of the foundation components was completed by local welders at Specialty Diving Services in Quonset, Rhode Island, and the area will also host the project's long-term operations and maintenance facility. The project is scheduled to come on-line in the fourth quarter of 2016, and will be entitled to Investment Tax Credit.

"Deepwater Wind's multi-million-dollar payment [to Alstom in December 2013] to begin manufacturing our project's 15 blades ensures that our project will qualify for the federal Investment Tax Credit. When combined with engineering and permitting work we already completed, we're confident this payment puts us significantly over the required 5 percent 'safe harbor' for the ITC," said Deepwater Wind CEO Jeffrey Grybowski.

2 *US Wind Inc.'s proposed project offshore Maryland*

Boston based U.S. Wind Inc., a subsidiary of Renexia, which itself is part of Italy's conglomerate Toto Holding, is currently planning for offshore wind projects in Maryland and New Jersey. In Maryland, the developer won the rights in 2014 to lease two sites totaling 80,000 acres. The leases, for which the developer agreed to pay \$8.7 million, allow for 25 years of operation. The project involves the installation of 85 to 125 turbines, monopole frame turbines at 20-30 meters deep, and will have a power output between 850 and 1,450 MW, producing 1,824 GWh annually. Construction is scheduled to begin in 2018, with completion slated for 2020.

"In Maryland we are more advanced. We submitted the site assessment plan; filed our offshore renewable energy credit application to the state; completed the preliminary design and made the geological and geophysical evaluation," said Paolo Sammartino, COO of U.S. Wind Inc. (pictured left). "We are now working on the construction and operations plan that will be submitted for the final permit this year. We are on schedule."



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According to Sammartino, one of the key differences observed between the European and U.S. markets relates to the offtake mechanism. "In Europe, there used to be Feed-in-Tariffs (FiTs); in the UK, there's an auction system in place, but in the U.S. you have to find your own offtaker, so that was quite different. We looked at Maryland because they have a FiT system – the Offshore Renewable Energy Credits (OREC)- a system that allows us to recover taxes from revenue."

Maryland is set apart from other states with the funding of the OREC, which offers the prospect of a \$1.9 billion subsidy, to be paid by consumers after the turbines are built. To secure the credit, U.S. Wind had to convince Maryland Public Service Commission that the project will provide an economic benefit to the state that would outweigh the subsidy.

"The aim of the project is to build on the ground as much as possible in Maryland. As the turbine cannot be built in the U.S., it will have to come from Europe. However, the foundations can definitely be built in the U.S. What we're trying to do is to have a US flagged vessel to complete the installation; to produce our foundation in the country; and to build the ancillary parts of the turbine like the blades domestically."

Speaking about the project's financing, Sammartino explains that they have been approached in the last year by several institutions and are now in discussions with an investment fund to structure project financing.

As for New Jersey, U.S. Wind had participated in an offshore wind auction in the state and won together with RES America, signing the contract in January 2016 to build projects off the coast of Atlantic City. "We are just starting in New Jersey; this is our next mid-term project. The auction was different from Maryland as BOEM decided to divide New Jersey's auction into lots and you could only win one lot; the other one was awarded to RES America. We envisage at least 600 MW there."



3

Dong Energy's proposed project off Massachusetts

Denmark based DONG Energy is one of the world's largest offshore wind developers, with an installed capacity totaling 3GW across Northern Europe. In April 2015, the company agreed to take over newly assigned development rights for a windfarm south of Martha's Vineyard, off the Massachusetts coast, that could eventually generate more than 1,000 MW of electricity.

The rights were originally assigned through an auction by BOEM to RES Americas Development Inc. which will continue to support the development of the leased area, where water depth is between 40-50 meters.

"The project we are looking at covers an area of 760 square kilometres and is located 40 kilometers from shore. The site conditions are quite similar to those we currently work with in North-Western Europe, which means that the project could be developed using well-known technology and logistics," Thomas Brostrøm, General Manager for North America, DONG Energy, was cited as saying by the American Danish Business Council.

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"The move into the US market is an exciting prospect. It will allow us to broaden our geographical scope and follow the market potential outside our current footprint. But these are early days and this is a long-term business," he added. At present, Dong Energy has a relatively small office in Boston, but Broström envisages his team growing steadily as the project develops. "If things develop to plan, we expect to recruit local people to the team following a pattern which is very much part of DONG Energy's culture."

4 *Fishermen's Energy's offshore demonstration project*

Offshore wind developer Fishermen's Energy is currently seeking approval from the New Jersey Board of Public Utilities (BPU) to build a demonstration scale offshore wind project off the coast of Atlantic City.

Originally comprising 5-MWXEMC wind turbines, the project was reconfigured to six 4-MW Siemens turbines. "That was one of the considerations of BPU; they are fairly conservative and would like to see old proven turbines so we migrated to Siemens 4.0, the most common," explains Chris Wissemann, CEO of Fishermen's Energy (pictured left).

The project was one of three offshore wind demonstrations to be awarded a DOE grant of \$47 million each to deploy their systems over the four years leading to 2017. As per its original plan, Fishermen's Energy intended to initiate construction in 2015 and bring the plant online by 2016. It launched transmission infrastructure construction works in December 2014 to qualify for federal tax credits.

However, the process took longer than anticipated. "Our project is now in a very advanced stage of development - we have the interconnection and leases for the site. The only thing we're missing is approval to sell power. The regulatory agency in New Jersey BPU, which is controlled by the governor [Chris Christie] has denied our application to sell power multiple times and that is despite us, in our view, completely complying with the law."

"It has become somewhat politicized, as New Jersey's republican governor does not what to show his support for renewable energy because he has become a presidential candidate. So we've been caught in the crossfire of politics. The legislature in New Jersey is very supportive, it's a quaint liberal state that happens to have a conservative governor."

Having spent 261 days outside of New Jersey in 2015, according to administration figures, Christie's absence, mostly for his bid for the Republican presidential nomination, has drawn criticism from voters. Should he trail in the polls and exit the presidential race, he would be returning to govern New Jersey, and this is when Fishermen's Energy hopes he will take another look at their proposal and see the economic benefits it will have, including some 400 jobs and \$150 million of investment into the state.

"What we're looking to do is to sell our power at a rate of about 19 cents/kWh; that's an issue because when you look at the market price of power plus the renewable energy certificate in New Jersey, it's a little under 10 cents/kWh, so we are almost double the market price," explains Wissemann.

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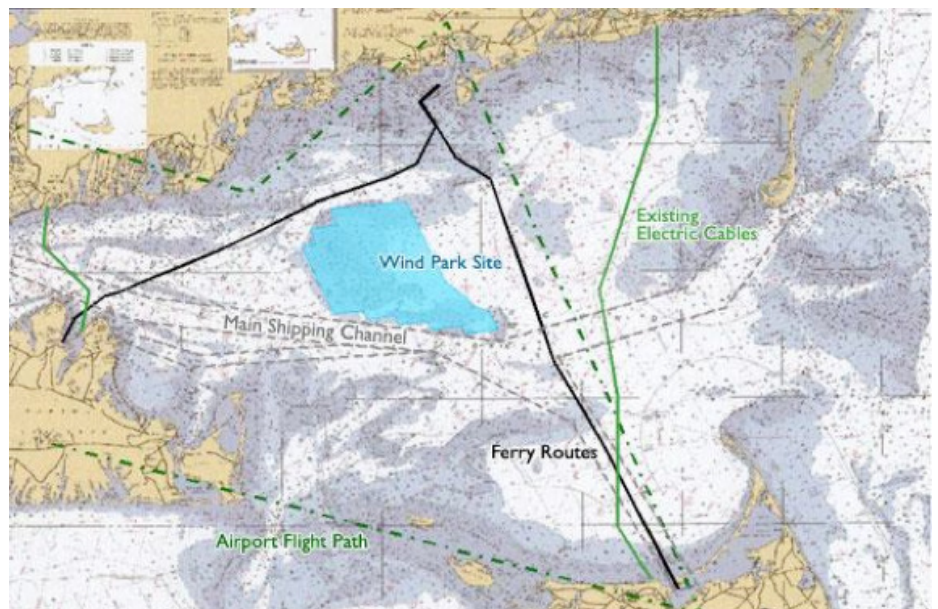
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"The idea is that it's meant to be an economic development project, one that inspires people and shows how many jobs the offshore wind industry can create, and get regulators and the public familiar with offshore wind. The project will only produce one tenth of one percent of the power consumed in the state, meaning it will cost each electric consumer less than a dollar a year. So it doesn't matter what the power costs are, you should just do it because it's a big symbolic gesture on how to capture the industry in 40 years."

5 *Cape Wind's proposed project off Massachusetts*

Cape Wind, a project consisting of 130 Siemens 3.6-megawatt offshore wind turbines with a capacity of 468 MW, is proposed to be built in Nantucket Sound near Martha's Vineyard off the coast of Massachusetts.



The developer, CapeWind Associates, a subsidiary of Energy Management Inc. arranged to borrow \$400 million in commercial debt from the Bank of Tokyo-Mitsubishi UFJ, Natixis, and Rabobank; \$200 million from PensionDanmark in mezzanine debt; and had a \$600 million funding commitment from the Export Bank of Denmark. The project completed federal and state permitting, was issued with the first U.S. commercial offshore wind lease, and received DOI approval for its construction and operation plan.

The developer also signed two 15-year power purchase agreements for 77% of the project output with National Grid and NSTAR. In addition, Siemens agreed to supply the turbines; and some construction began in 2013, thus qualifying the project for the production tax credit. In December 2014, Cape Wind came very close to securing financing for the 364-MW first phase of the 468-MW windfarm, aided by a \$150 million DOE loan guarantee. When financing failed to close by December of the same year, the utilities that agreed to buy the electricity under long-term agreements cancelled the contracts in January 2015.

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According to Cape Wind, the terminations are invalid and it is entitled to an extension of the construction-start deadline due to force majeure, given the prolonged litigation that the project has had to ensure with opponents.

Keith Martin, a transactional lawyer with Chadbourne & Parke, points out that Cape Wind was not expected to come on line until sometime in 2017 if the financing had closed by December 2014. "The longer the development cycle, the more likely the politics are to change and for a smaller developer to run out of money." Offshore wind projects should "move as quickly as possible through the development process," he stresses.

Nevertheless, Jim Gordon, president of Cape Wind, who has invested \$100 million in the 15-year-old project, recently requested a two-year extension from the Massachusetts' Energy Facilities Siting Board on a permit to run an underwater power line between the windfarm and Cape Cod. Gordon is now anticipating an energy bill that's being considered by Massachusetts House and expected to contain a clause for offshore wind power contracts.

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