WIND ENERGY update

NewEnergyUpdate

A NEW CHAPTER BEGINS FOR THE U.S. OFFSHORE WIND MARKET

JANUARY 2017

The last 12 months have seen remarkable developments in North America's offshore wind industry. From the start-up of the nation's first offshore wind farm, to the announcement of unprecedented commitments by Massachusetts and New York, the market is finally starting to take off.

Several projects in Atlantic states are now in advanced stages of development and are scheduled to begin commercial operations by 2022, while North Carolina's first offshore wind auction is set to take place in March this year.

Moreover, the Department of Energy (DOE) has deployed two AXYS WindSentinel buoys off the coasts of New Jersey and Virginia to collect meteorological and oceanographic data. The information produced by the buoys will be the first publicly available multi-seasonal hub-height data to be collected in U.S. coastal waters and is meant to support the offshore wind industry.

Reaching 10 cents/kWh

Cost reductions will be crucial for the growth of America's offshore wind market, and it is widely believed across the industry that the U.S. can benefit from Europe's experience.

The latest example is Vattenfall's winning bid of $53/MWh for the 600 MW Kriegers Flak, which was 58% lower than the cap price for the Danish offshore wind tender. This record-low bid proves that the European Union's goal for an offshore wind levelized cost of energy of $112/MWh by 2020 is possible.

VATTENFALL'S SANDBANK OFFSHORE WIND FARM IN THE GERMAN NORTH SEA. SOURCE: VATTENFALL

In the U.S., cost reductions will depend on near-term deployment as well as sustained investment in offshore wind technology and the supply chain.

"Reducing the cost is a challenge to the industry. In Massachusetts, we did not set a price but we did require that any subsequent project be a of lower cost than the previous one," said Bill White, senior director for offshore wind sector development at Massachusetts Clean Energy Center (MassCEC).

"We understand the first projects will be a bit more expensive because we do not have a supply chain yet in the U.S. As an emerging market, we're excited to see the beginnings of cost reductions in Europe – some significant with the more recent tenders. It's very positive for the U.S. market," said White.

Future cost reductions will come through technology advancements, as well as streamlining the construction and installation process, he said. "I think we're on a path for that to happen in the northeast, potentially benefitting from 25 years of European experience."

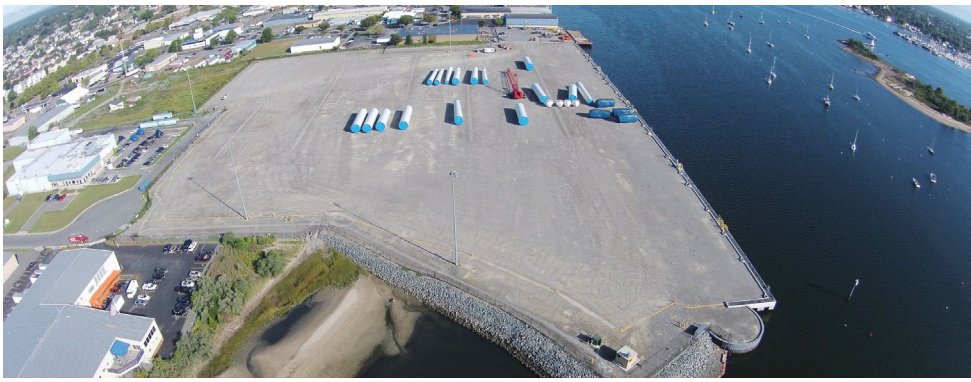
The newly released National Offshore Wind Strategy suggests that offshore wind sites in the northeast region are the most likely to be cost-competitive among U.S. coastal areas within the next 10-15 years.

State by state developments

Massachusetts

Massachusetts' technical potential for offshore wind energy exceeds 200 GW, according to Northeast Wind Resource Center. In addition, the state has the infrastructure to support deployment of projects, primarily the New Bedford Marine Commerce Terminal, the only purpose-built offshore wind terminal in the country.

Managed by MassCEC, the 26-acre, $113 million-facility was designed to sustain the heavy loads that accompany offshore wind components and will support the construction, assembly, and deployment of upcoming projects.



NEW BEDFORD MARINE COMMERCE TERMINAL. SOURCE: MASSCEC

Massachusetts made the largest-ever state commitment to offshore wind in the U.S. on August 1, 2016, when it passed H.4568, The energy bill includes a requirement for utilities to contract 1,600 MW of offshore wind power by 30 June, 2027.

"The adoption of this legislation is a landmark for Massachusetts' clean energy future," said Thomas Brostrøm, general manager for North America at Dong Energy. "It creates the right environment for competition between the developers, allowing the best value for ratepayers for any offshore wind contracts awarded."

Similarly, Vineyard Power president Richard Andre said that without the state mandate, there would be no offshore wind farms, emphasizing the importance of utility contracts in getting the industry off the ground.

"In Massachusetts, there are a total of five wind energy areas designated by the government for offshore wind development," said Bill White, senior director for offshore wind sector development at MassCEC. "Three of these areas have been leased out to developers, including Dong Energy, Deepwater Wind, and Copenhagen Infrastructure Partners through their subsidiary Vineyard Wind. The other two areas could be leased in 2018."

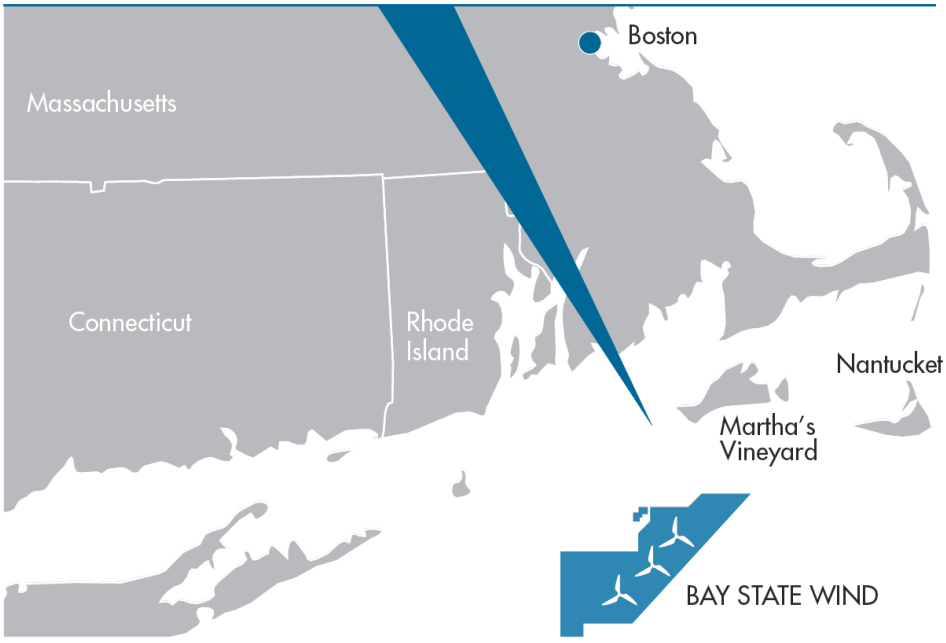
The first tender round to obtain a long-term power offtake agreement is anticipated to take place on June 30, 2017, leading to first power from the winning project about four years later. The contract would be for a minimum capacity of 400 MW, according to White.

"In 2017, the focus will be on the implementation of the legislation and the procurement process. MassCEC has issued an RFP to bring on a team of expert engineers to analyze other sites in the state where the industry could establish itself and do ancillary work, O&M and future manufacturing," said White.

Three utility-scale projects

Deepwater Wind is currently developing a utility-scale wind farm of up to 200 turbines offshore Massachusetts, supplying power to both southern New England and eastern Long Island. The project, Deepwater One, is the largest offshore wind farm ever planned in the U.S., with more than 1,000 MW of capacity. The company won the exclusive rights to develop the 164,000-acre site in 2013, after submitting a bid of $3.8 million.

As for Dong Energy, its Bay State Wind project will be developed about 15 miles off the coast of Martha's Vineyard, in an area with a potential for at least 2,000 MW of power. The Danish firm has teamed up with transmission builder Eversource Energy, which acquired a 50% stake in Bay State Wind, to jointly construct and operate the project.



DONG ENERGY'S PLANNED BAY STATE WIND PROJECT. SOURCE: DONG ENERGY

The third company, Vineyard Power (formerly OffshoreMW) will develop a 160,000-acre lease area about 14 miles south of Martha's Vineyard and has already completed the geophysical and geotechnical surveys for the site.

Rhode Island

The small state of Rhode Island is now home to America's first offshore wind project. The 30 MW, five-turbine Block Island Wind Farm started delivering electricity to New England's grid in December 2016. The project took two years to build and involved more than 300 workers.

BLOCK ISLAND WIND FARM DURING SUNRISE. SOURCE: DEEPWATER WIND

"We've made history here in the Ocean State, but our work is far from over," Deepwater Wind CEO Jeffrey Grybowski said during the inauguration. "This is just the start of a new U.S. renewable energy industry that will put thousands of Americans to work and power up communities up and down the East Coast for decades to come."

New York

A day after announcing the planned closure of the Indian Point nuclear power plant by April 2021, New York revealed an unprecedented commitment to build 2.4 GW of offshore wind power by 2030, starting with Deepwater One - South Fork.

On Wednesday 25 January, the Long Island Power Authority signed a power purchase agreement with Deepwater Wind for the 90 MWS south Fork farm, following Gov. Cuomo's earlier call to get it approved). The developer said that construction could start as early as 2019 and commercial operation by 2022.

Statoil Wind US LLC. is also planning to build a wind farm offshore New York. The subsidiary of Norway's largest oil firm won BOEM's lease sale of 79,350 acres in December 2016, after submitting a $42.45 million bid. The area could accommodate more than 1 GW of offshore wind capacity, with a phased development that could start with 400-600 MW.

STATOIL'S NEW YORK WIND ENERGY AREA. SOURCE: STATOIL

"The US is a key emerging market for offshore wind – both bottom-fixed and floating – with significant potential along both the east and west coasts. Statoil is well positioned to take part in what could be a significant build out of offshore wind in New York and other states over the next decade," said Irene Rummelhoff, Statoil´s executive vice president for New Energy Solutions.

New York State Energy Research and Development Authority (NYSERDA) is currently putting together a strategy to develop the state's offshore wind resources. The Offshore Wind Master Plan, to be released in 2017, will identify sites and set targets for capacity and commercial operations dates.

NYSERDA is also making $1.5 million available to expand its pool of consultants to help develop the master plan and execute offshore wind activities.

Maryland

Maryland's wind speeds have made its Chesapeake Bay one of the premier sailing destinations in the country. Data from the NREL shows the state's offshore wind potential at 90 meters' hub height is 53,782 MW.

CHESAPEAKE BAY IN MARYLAND, VIRGINIA. SOURCE: WIKIMEDIA.

Maryland Public Service Commission (PSC) first opened the application period for offshore wind projects in February 2016. This period was extended several times until November, when two project applications were submitted – by U.S. Wind Inc., a subsidiary of Toto Holding, and Skipjack Offshore Energy LLC, a subsidiary of Deepwater Wind Holdings.

The developers' applications are now being considered by PSC over a 180-day period which began on November 28, 2016. According to U.S. Wind, their proposed 750 MW project would comprise up to 187 turbines and supply power to 500,000 homes. It would employ almost 5,000 workers during construction and create 100 long-term jobs.

US Wind believe that their project will ease a long-standing electric power deficiency on the Eastern Shore. Because the state imports much of its electricity, Marylanders pay approximately $250 million per year in congestion fees bundled in their monthly bills, the developer said.

"Injecting 750 MW of new power into the Eastern Shore grid will significantly help alleviate this electricity imbalance, and reduce or eliminate much of this hidden tax," said Paul Rich, director of project development at U.S. Wind Inc. "Maryland ratepayers are projected to see a net decrease of $2 or more in their monthly bills as a result of U.S. Wind's project."

Skipjack on the other hand proposed a 120 MW project that could be in-service by the end of 2022 and generate more than $100 million dollars in economic benefits for Maryland, the company said.

New Jersey

New Jersey has the highest potential for offshore wind power production in the U.S., according to a 2016 report by the Environment New Jersey Research and Policy Center. NREL data shows that the state could generate 430,000 GWh per year from around 102,000 MW of offshore wind capacity.

In November 2015, BOEM completed the first auction of wind energy areas off the state's coast. The two leasing areas totaled nearly 344,000 acres, with the auction winners, U.S. Wind Incorporated and Res Americas, bidding almost $2 million. The sites could potentially accommodate 3,400 MW of wind capacity.

In May 2016, Dong Energy took over RES Americas' more than 1,000 MW newly assigned development rights, making it the second U.S. lease for the Danish energy giant. U.S. Wind Inc. on the other hand plans to develop at least 600 MW of wind energy in its 183,353-acre North Lease Area.

DONG ENERGY HAS ACQUIRED RES AMERICAS' DEVELOPMENT RIGHTS OFFSHORE NEW JERSEY. SOURCE: DONG ENERGY

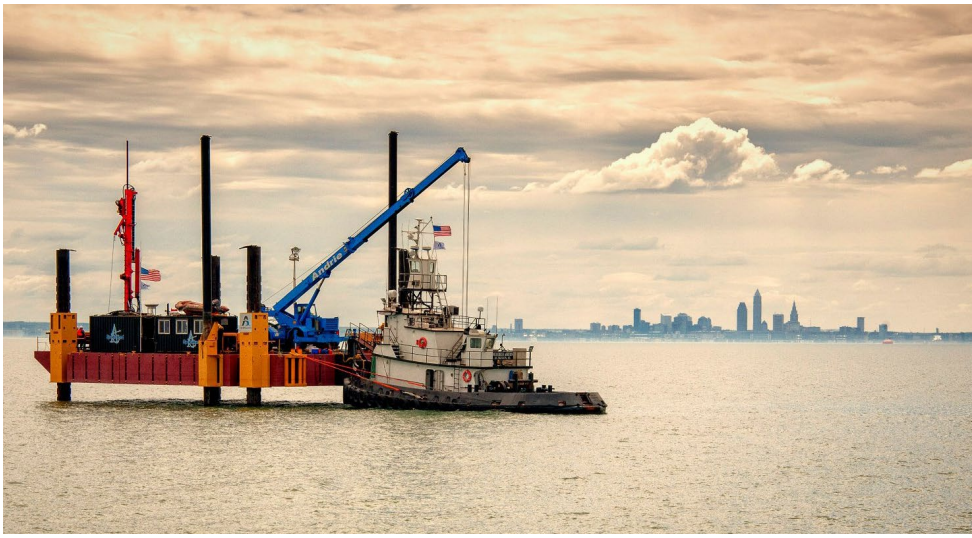
"The U.S. is an interesting market for offshore wind with the potential to become a significant area for future development. The site conditions are quite similar to those we currently work with in North-Western Europe, which means the project could be developed using well-known technology", said Samuel Leupold, CEO of Wind Power at Dong Energy.

Both Dong Energy and U.S. Wind had one year from March 16, 2016, and possibly two if they are granted an extension, to complete site assessments of their locations. Once those plans are approved, the developers have another four and half years to submit their operational plans to BOEM.

Ohio

Ohio will soon become home to the nation's first offshore freshwater wind project. In May 2016, DOE awarded $40 million to Lake Erie Energy Development Corp. (LEEDCo) to help it build the $120 million Icebreaker Wind, which aims to prove that a freshwater wind farm can survive ice floes.

The 20.7 MW project will comprise six turbines located northwest of Cleveland. LEEDCo expects to start construction and installation in spring of 2018 and commission the project by fall of the same year. Around 500 jobs are expected to be created during construction.



ICEBREAKER WIND PROJECT. SOURCE: LEEDCO

Maine

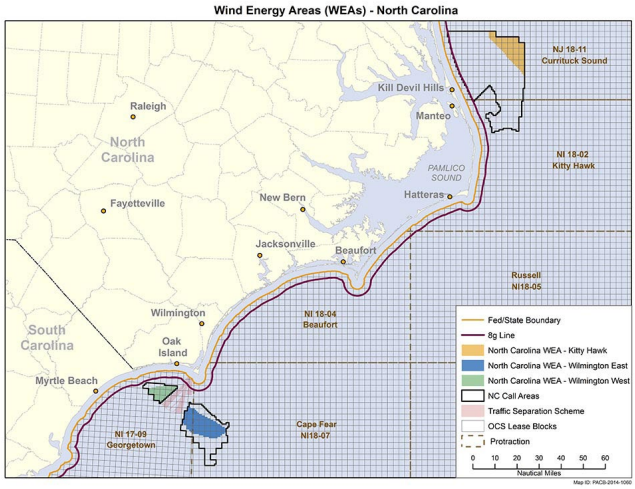
Offshore wind power represents Maine's largest untapped natural energy resource, with about 156 GW waiting to be harnessed, according to the University of Maine.

In May 2016, New England Aqua Ventus I floating offshore wind project, designed by a University of Maine-led consortium, was chosen by DOE to participate in the Offshore Wind Advanced Technology Demonstration program. Aqua Ventus I is now eligible for up to $40 million in funding over the next three years, subject to progress reviews. The consortium expects to start construction in 2019 and operate the project for 20 years.

Aqua Ventus project partners include University of Maine and UMaine Advanced Structures and Composites Center, as well as Nova Scotia Power's parent company Emera, construction firm Cianbro, and French defense contractor DCNS.

North Carolina

North Carolina's first-ever offshore wind auction is scheduled to take place on March 16, 2017. The commercial wind lease sale by BOEM covers more than 122,000 acres offshore the town of Kitty Hawk and is located 24 nautical miles from shore.



NORTH CAROLINA WIND ENERGY AREAS. SOURCE: BUREAU OF ENERGY OCEAN MANAGEMENT

BOEM has selected nine qualified companies to bid for the Kitty Hawk Wind Energy Area: Avangrid Renewables LLC, Enbridge Holdings (Green Energy) LLC, Shell WindEnergy Inc., Northland Power America Inc., Wind Future LLC, Outer Banks Ocean Energy, LLC, PNE Wind USA, Inc., Statoil Wind US LLC, and wpd offshore Alpha LLC.

Due to concerns about coastal viewshed and environmental aspects, BOEM recently moved two proposed wind energy areas from North Carolina to South Carolina, and only the Kitty Hawk area is currently available to North Carolina for offshore wind development.

Virginia

BOEM approved Virginia's first offshore wind energy Research Activities Plan in March 2016, clearing the way for the Virginia Offshore Wind Technology Advancement Project (VOWTAP). The demonstration involves installing two 6 MW turbines and will be developed by Virginia Department of Mines, Minerals and Energy (DMME) in partnership with Dominion Resources.

TETRA TECH SUPPORTED THE SITING, PERMITTING, AND ENVIRONMENTAL EVALUATION FOR THE PROPOSED VOWTAP

Meanwhile, DOE has decided not to fund an offshore wind project by Dominion Virginia Power. DOE was planning to provide Dominion with a grant of $40 million to help it install two 6 MW turbines off the state's coast.

However, the department withdrew its commitment in May 2016 because the utility could not guarantee a startup earlier than 2020. Dominion said there were too many unknowns to meet that request, including the higher-than-project cost, which increased from an initial estimate of $230 million to $380 million.

"Naturally, we are disappointed in the DOE's decision because we still believe that offshore wind has a great potential to deliver clean, renewable energy to Virginia," said Mary Doswell, senior vice president–Dominion Energy Solutions. "However, we also recognize the unique regulatory and cost challenges involved in our project and appreciate the DOE's desire to support other projects that may have an earlier opportunity for fruition."

According to the Virginia Offshore Wind Development Authority, the state has several assets that enable it to participate in the industry's emerging supply chain. These include developed port infrastructure that can serve the entire Mid-Atlantic region, and an extensive shipbuilding capacity which could be diversified into foundation substructure fabrication.

California

In August 2016, BOEM issued a Request for Interest to determine whether companies were interested in developing an area offshore California. The bureau received one expression of interest, from Statoil Wind U.S.

Prior to that, BOEM had received an unsolicited request from Trident Winds and determined that the developer was qualified to hold a commercial lease off California's coast.

Trident Winds' 765 MW Morro Bay would consist of around 100 floating offshore wind systems and may be expanded to 1,000 MW if additional transmission capacity and market off-take can be obtained, the developer said. BOEM is currently collecting data and information on the areas offshore California's central coast.

California became the 14th U.S. coastal state to form an intergovernmental renewable energy taskforce in October 2016. The state is already a national leader in terms of installed geothermal, biomass and solar power capacity, and has the technical wind resource to generate at least 100,000 MW off its coast, based on data from the NREL. This resource is especially strong in the northern part of the state.

Hawaii

Hawaii made history when it set a goal of generating 100% of its electricity from renewable resources by 2045, becoming the first U.S. state to adopt such a standard.

In June 2016, BOEM gauged the industry's interest in commercial wind leases in two areas offshore Oahu, the third largest of the Hawaiian Islands. By October, Statoil Wind U.S. had expressed its interest in the entire 485,000-acre lease area.

In addition to this call, BOEM received three unsolicited wind energy lease requests from two developers: AW Hawaii Wind and Progression Hawaii Offshore Wind Inc.

PROPOSED OFFSHORE WIND PROJECTS IN HAWAII

Developer	Project
Statoil	Hawaii Call Area
AW Hawaii Wind LLC	AWH Oahu Northwest
AW Hawaii Wind LLC	AWH Oahu South
Progression Hawaii Offshore Wind Inc.	Progression South Coast of Oahu

Each project proposes a 400 MW offshore floating wind farm, from which power would be transmitted to Oahu via undersea cables. BOEM is currently processing all the applications and identifying areas for environmental analysis.

Offshore installations in Hawaii could be costlier than elsewhere in the U.S. as they would require floating towers due to the depth of the ocean.

"Floating platforms, which have yet to be deployed commercially, will likely need to be anchored to the deeper seafloor if deployed in Hawaiian waters," NREL said in a report. The study found that a 400-MW floating offshore wind farm in Hawaii could create up to 1,700 jobs during construction and $600–$750 million in additional state GDP.

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Major developers, EPC's and service companies involved in offshore wind, oil and gas and other adjacent markets will take part to network, do business and secure market share as the US offshore wind industry comes into commercial fruition.

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- **Getting Under 10C kWh**
  Listen to offshore wind veterans explain the best possible pathway to reduce the "levelized cost of energy" (LCoE) to 10c kWh for offshore wind in the USA, and how to remain competitive against other sources of power
- **State by State Development Plan**
  Understand, state-by-state, where the best possible development opportunities are, what is required to develop them and which developers are going to lead the offshore wind industry into fruition
- **Financing Multibillion-Dollar Offshore Wind Projects**
  Hear from experienced banking and finance institutions share recommendations for multi-party financing involving commercial banks and other institutions for risk-sharing and pooling of resources and expertise
- **Develop supply chains and infrastructure**
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40% Developers	Financing Pre-Conference
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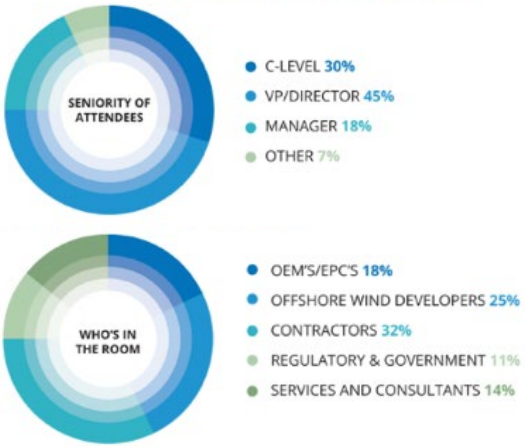
Who you will meet at the 2017 Conference & Exhibition



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