Netherlands Enterprise Agency

Offshore Wind in Massachusetts

May 2018

Holland Innovation Network Boston
Walter de Wit
Tonatiuh Belderbos
Marloes Jongewaard

Introduction

Due to technological developments, sustainability trends and declining costs, the offshore wind industry in the United States is rapidly expanding. This document outlines the offshore wind initiatives and key players in Massachusetts, one of the main offshore wind hubs in the country. This document is structured as follows: section 1 provides an introduction to offshore wind and its global potential. Section 2 and 3 outline offshore wind initiatives and the development of the offshore wind industry in the United States and Massachusetts respectively. Subsequently, section 4 provides an overview of the key stakeholders in the offshore wind sector in Massachusetts, including governmental organizations (4.1), research and academic institutions (4.2), trade associations (4.3) and offshore wind developers (4.4). Section 5 lists upcoming offshore wind conferences and events in the Northeast of the United States. Lastly, section 6 provides a summary of the paper and presents a conclusion.

1. Offshore Wind and its Global Potential

Fossil fuel scarcities, climate change, and volatility in oil prices call for a transition from a current fossil fuel-based energy system towards an energy system based on renewable energy sources. Offshore wind energy is a term referring to energy that is harvested by the kinetic energy of the wind into electricity by wind turbines located in bodies of water. This type of energy is expected to become a significant and important source of electricity generation across the globe. Offshore wind farms are able to provide cheap and reliable energy at a massive scale, do not emit greenhouse gases or environmental pollutants, and provide a domestic energy source.[1]

Over the last years, offshore wind technology's costs have decreased substantially due to significant technical developments, such as the development of a new generation of wind turbines

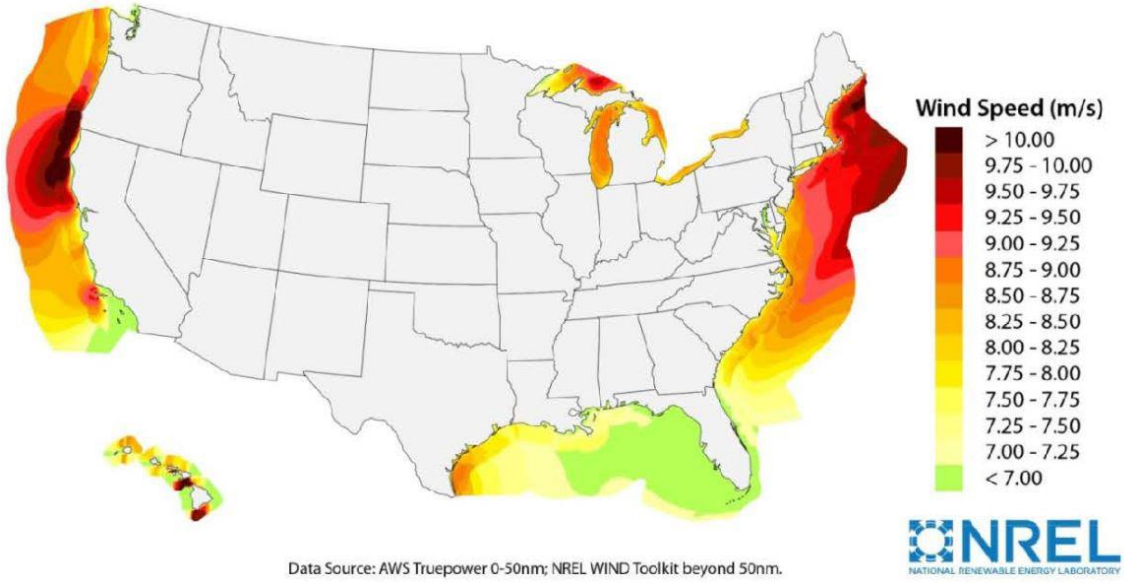
and longer blades that capture more energy from the wind.[2] In Europe, the price of building an offshore wind farm has dropped 46 percent over the last five years. As a result, offshore wind is becoming increasingly cost-efficient and is now able to compete with conventional fossil fuels.[3]

The global offshore wind market is rapidly expanding because of the cost reductions mentioned above, scale advantages of new wind turbines, improved national and regional regulatory frameworks, and sustainability trends. Currently, the total global offshore wind power capacity is 14 gigawatts. This capacity is expected to increase to more than ninefold its current capacity, amounting to 130 gigawatts, by 2040.[4] While the main offshore wind markets are currently located in Europe, a strong growth is expected in countries such as China, South-Korea, and the United States.

2. Offshore Wind in the United States

Given the average high wind speeds at the US coasts and the country's gentle and sloping continental shelf, the US has tremendous opportunities for offshore wind.[5] The total gross offshore wind resource potential of the US is more than 4,000 GW, which is four times the current capacity of the electric power system in the United States.[6] However, the offshore wind industry in the United States is still in a very early stage. Offshore wind developments have been delayed and hampered by several factors.[7] Until recently, there were no clear federal and state regulations on offshore wind energy, nor were there any frameworks in place to provide economic incentives and political support to this industry. Also, it has proven to be very difficult and time consuming to obtain the necessary permits to build an offshore wind park. Furthermore, offshore wind developments have been slowed down by public opposition being concerned about wind farms. An example of this can be found in the dispute over Cape Wind, a proposed offshore wind farm in Massachusetts that was projected to generate electricity for 200,000 homes. Eventually, the proposal was rejected because of local opposition to the turbines by the tourist industry and citizens, as well as because of legal hurdles and the high cost of energy.

Figure 1: Offshore wind potential in the US



Retrieved from: https://www.boem.gov/uploadedImages/BOEM/Renewable_Energy_Program/Renewable_Energy_Guide/Wind-Resource-Data2.jpg

Nonetheless, after years of delay, the offshore wind industry in the US has recently taken on new life. The installation of the 290 million dollar Block Island Wind farm, the first offshore wind park in the United States, has created momentum in the country. This park consists of five turbines, together producing electricity for about 17,000 homes. The Block Island Wind park started operating in December 2016 and was built 3 miles off the shore of Rhode Island.[8] Accompanied by the decreasing building costs of wind parks and by stronger commitments from individual US states, the completion of this project has spurred confidence in offshore wind in the United States.[9]

Over the last two years, many states located in the US have caught on to offshore wind, hoping to boost economic development while also meeting clean energy goals for addressing climate change impacts. Many states realize that offshore wind can create investments and new demand for skilled jobs and factories within their territories. Offshore wind also diversifies the energy supply, which is currently heavily reliant on natural gas and oil. Most of the states promoting offshore wind are located in the North East Coast of the United States. Contrary to the Californian seabed, which is very deep and rocky and hence unsuitable for current offshore wind technologies, the US North East seabed provides a solid basis for building wind turbines.[10]

A number of states have set ambitious offshore wind targets and have established incentives and pools of funds for the offshore wind industry[11]. New York State announced the commitment to develop 2,400 MW of offshore wind by 2030, enough to power 1.25 million homes. New York has also started a process to enable the procurement of 800 MW of offshore wind in 2018 and

2019.[12] Massachusetts aims to be home to 1,600 MW of offshore wind by the year 2027. Last year, the state issued a request for proposals aiming at procuring 400-800 MW. The state of Maryland announced contracts for 386 MW of offshore wind. In 2014, it also mandated a Renewable Energy Portfolio Standard (RPS), which requires 25% of all electricity consumed in the state to be from renewable energy by the year 2020. New Jersey is betting on offshore wind too. In January 2018, the governor of New Jersey signed an executive order to solicit bids for 1,100 MW of offshore wind contracts – which would be the largest auction to date in the US – and start the process of moving towards New Jersey's goal of generating 3,500 megawatts of offshore wind by 2030.[13] Finally, offshore wind is on its way in Connecticut, Maine, and North-Carolina.[14] In total, the US offshore wind project development pipeline currently includes over 25 projects with a potential installed capacity of more than 24,000 megawatts.[15]

Box 1: Barriers for the Development of Offshore Wind in the United States

Despite current optimism in the US about offshore wind, there are still several questions that need to be answered before offshore wind can truly become an important and significant source of energy generation in the country (see U.S. Department of Energy, 2016). It is uncertain whether the United States will be able to replicate the cost reductions accomplished in Europe. The United States' offshore wind project pipeline is not as large as the European pipeline, hence US projects will likely be more expensive because of economy of scale. Compared to European countries, the US' shores also have greater water depths. In addition, the US market is characterised by more fierce competition from conventional energy sources: fossil fuels are cheaper in the United States than in Europe. Lastly, an important factor that may hamper the offshore wind industry is the Jones Act, which requires vessels transporting merchandise between two points in US waters to be US owned and US flagged. Since the United States lacks specialized US built and flagged offshore wind vessels, many consider this law to hold back the development of the offshore wind industry.

3. Offshore Wind in Massachusetts

3.1 The Development of Offshore Wind in Massachusetts

Massachusetts is one of the main offshore wind markets in the United States. Although the offshore wind industry in this state has had a rocky time over the past years, especially with the rejection of the Cape Wind Farm in 2015 (see section 2), Massachusetts is expected to become one of the main suppliers of offshore wind energy in North-America.

Off the coast of Massachusetts blows a very strong and reliable wind. When compared to other states in the North Atlantic, Massachusetts has the largest amount of technical offshore wind resources available. Off the coast of this state, there is in total 286,508 square kilometers of ocean

area with minimum average wind speeds of 7 meters per second.[16] Hence, Massachusetts has been called the 'Saudi Arabia of wind.' In addition, contrary to other states such as California, in Massachusetts the seabed provides a solid basis to build wind turbines.

The state of Massachusetts is very committed to offshore wind. The state has introduced several state-level policies to promote offshore wind, provide long-term market certainty, accelerate research and development, and minimize developers' (financial) risks. In 2016, Massachusetts signed 'The Act to Promote Energy Diversity' (H.4568). This act requires electric distribution companies in the state to procure 1,600 MW of offshore wind capacity by 2027, enough to power one third of the homes in Massachusetts. It also requires state electricity providers to competitively solicit long-term offshore wind offtake agreements at least every 24 months to seek proposals for offshore wind energy generation.[1] In June 2017, as part of the Act to Promote Energy Diversity, Massachusetts issued a request for proposals for a procurement of 400-800 MW at a Bureau of Ocean Energy Management (BOEM) lease area off the coast of Massachusetts and Rhode Island. Three companies – Bay State Wind, Vineyard Wind, and Deepwater Wind – submitted bids to this request (see here for the summary of the three bids).[17] On May 23, 2018, the state of Massachusetts announced that Vineyard Wind was selected as the winner of the competition, and will build an 800-megawatt offshore wind farm.[18] This represents the largest single procurement of offshore wind by any state in the United States to date.[19] Vineyard Wind is currently negotiating long term power purchase contracts with Massachusetts utilities and plans to start constructing the farm in 2019. The turbines are planned to be operational by 2021.[20]

The state of Massachusetts has also incentivized the development of offshore wind by investing in critical offshore wind infrastructure. In 2016, the Massachusetts Clean Energy Center upgraded the New Bedford Marine Commerce Terminal located in the south of Massachusetts to a multi-purpose facility. The terminal is now able to support the construction and deployment of offshore wind projects.[21] The commerce terminal was redesigned to handle wind turbine installation vessels, lifts, and specialty barges. It can also accommodate large cranes that are able to lift large and heavy turbine components.[22] Another milestone for the offshore wind industry in Massachusetts was the construction of the Wind Technology Testing Center (WTTC) in Boston. The WTTC allows to test, improve, and commercialize offshore wind blades, and to validate wind blade designs. This testing center is the largest blade testing center in North-America and can test turbine blades up to 90 meters in length.[23] The WTTC started operating in 2011 and was financed by the Massachusetts Clean Energy Center and the US Department of Energy.

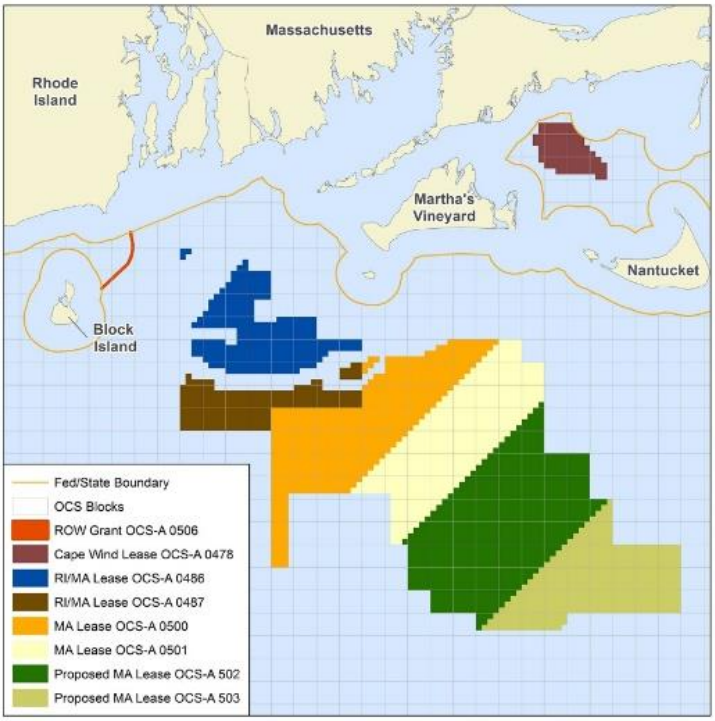
[1] In addition, the act prohibits electric distribution companies from entering into a long-term Purchase Power Agreement if the offshore wind generator's levelized price of energy is higher than the previous procurement. Also, the act establishes that state regulators will allow electric distribution companies to receive remuneration from their rate base up to 2.75 percent of the annual Power Purchase Agreements payments. (See U.S. Department of Energy, 2016, 'Offshore Wind Technologies Market Report' p.46).

Furthermore, the state of Massachusetts actively supports research on offshore wind. In 2016, Massachusetts awarded $700,000 in funding to nine research and academic institutes to advance studies on offshore wind in the state.[24] By funding this research, Massachusetts aims to drive down the costs of offshore wind, identify opportunities for offshore wind workforce training and safety requirements, and improve current techniques to monitor wind blades.

3.2 Offshore Wind Sites in Massachusetts

Currently, five lease areas in Massachusetts are allocated to the construction of offshore wind parks. These areas are located in the south of Massachusetts, beginning 14 miles south of the island Martha's Vineyard. These sites were chosen after extensive stakeholder consultation and analyses of the marine habitat and fishing grounds. The offshore wind areas in Massachusetts are depicted below:

Figure 2: Offshore wind sites in Massachusetts (MA) and Rhode Island (RI)



As can be seen in table 1 below, three out of the five Massachusetts lease areas - OCS-A 0487, 0500, and 0501 - are currently controlled by offshore wind developers. The lease sale for the two unleased sites - OCS-A 0502 and OCS-A 0503 – started in April 2018. The winner of the auctions of these sites will be announced later in 2018.[25]

Table 1: Offshore wind sites in Massachusetts

Lease Area	Owner	Current status	Project Pipeline (MW)	Developer Announced Capacity (MW)	Potential Generating Capacity (MW)	Area in square km	Price winning bid	Date lease issued	Average wind speed: meters per second
OCS-A 0478	Cape Wind Associates	Developer Suspended Lease	468	468	357	119	N/A	October 2010	8.7
OCS-A 0500	Ørsted & Eversource (Bay State Wind)	Site Control	2,000	2,000	2,277	759	281,285 dollars	January 2015	9.3
OCS-A 0501	Vineyard Wind	Site Control	1,600	1,600	2,025	675	150,197 dollars	January 2015	9.3
OCS-A 0502	Unleased Area	Proposed Sale Notice (PSN) issued in April 2018	3,012	N/A	3,012	1,004	N/A	N/A	9.4
OCS-A 0503	Unleased Area	Proposed Sale Notice (PSN) issued in April 2018	1,707	N/A	1,707	569	N/A	N/A	9.2

Table adapted from U.S. Department of Energy. (2016). Offshore Wind Technologies Market Report. Retrieved from: https://www.energy.gov/sites/prod/files/2017/08/f35/2016%20Offshore%20Wind%20Technologies%20Market%20Report.pdf

Following table 1, the first developer which gained control over an offshore wind site in Massachusetts was Cape Wind Associates. This developer bought the rights to site OCS-A 0478 in 2010. However, as the company struggled to secure a purchase power agreement partner, it suspended its lease in 2015. The project continues to look for partners for long term offtake agreements. Two other sites in Massachusetts – OCS-A 0500 and 0501 – were auctioned by BOEM in 2015. Bay State Wind won the auction for OCS-A 500, an area of 759 square kilometers which has a potential generation capacity of more than 2,000 MW. Currently, it is conducting on-site testing and completing feasibility studies.[26] Vineyard Wind bought the rights to OCS-A 0501, a 675 square kilometre area with 2,025 MW of wind generation capacity. In June 2017, it opened an office in New Bedford to conduct further testing and analyses of the area.

4. Massachusetts' Offshore Wind Landscape

This chapter provides an overview of the key stakeholders in the offshore wind sector in Massachusetts. It outlines governmental organizations, universities and research institutes, trade associations, and developers operating in this state.

4.1 Governmental Organizations

In the United States, individual states are in large part responsible for their own energy management. However, state regulators only have the right to lease offshore wind areas located 0 to 5.6 kilometer off the coast. The rights to sites located 5.6 km to 370.4 kilometer off the shore are issued by the Bureau of Ocean Energy Management (BOEM).[27] Hence, BOEM, along state agencies, is a very important actor in the American offshore wind industry.

Bureau of Ocean Energy Management

The Bureau of Ocean Energy Management (BOEM) is a federal governmental agency that manages the development of offshore renewable energy and mineral resources in the US federal waters. BOEM issues offshore wind leases and also conducts research on renewable energy. Their website offers a wealth of information on regulatory frameworks, research, and current offshore wind projects.

Massachusetts Clean Energy Center

The Massachusetts Clean Energy Center (MassCEC) is a publicly-funded state agency dedicated to accelerating the success of clean energy technologies, companies, and projects in the Commonwealth of Massachusetts. Since it started operating in 2009, MassCEC has helped clean energy companies to grow, has supported municipal clean energy projects, and has

invested in commercial renewable energy installations. MassCEC has also conducted a wide range of studies on offshore wind in Massachusetts.

United States Department of Energy
The US Department of Energy (DOE) addresses energy and environmental challenges through transformative science and technology solutions. The DOE funds grants, research, and cooperative agreements in the field of offshore wind.

Massachusetts Department of Energy Resources
The Massachusetts Department of Energy Resources (DOER) develops and implements policies, programs and regulatory measures aiming at creating a clean, resilient and affordable energy future for Massachusetts.

New Bedford Port Authority Organization
The New Bedford Port Authority Organization (NBPA) is the governing body of the New Bedford's harbor. The NBPA has jurisdiction over all of the coastal waters in New Bedford and is responsible for upgrading the port's resources and infrastructure, operating the facilities, and promoting the port to expand the New Bedford economy.

New Bedford Economic Development Council
The New Bedford Economic Development Council (NBEDC) is a non-profit organization consisting of 250 leaders in business, education, and government. The NBEDC aims to accelerate economic development in the New Bedford area and plays an important role in setting the economic development agenda for the area.

New Bedford Wind Energy Center
The New Bedford Wind Energy Center (NBWEC) is part of the NBEDC and was established to fully integrate the offshore wind industry into New Bedford's economic agenda. The NBWEC aims at serving as a platform for the offshore wind sector and at connecting the different stakeholders in the area. The NBWEC works closely together with the Bristol Community College.[28]

4.2 Research and Academic Institutions

In Massachusetts, there is a large number of research institutes and universities conducting research on a wide range of topics related to offshore wind.

The Massachusetts Research Partnership
The Massachusetts Research Partnership (MRP) is an offshore wind partnership consisting of six universities and research institutes: UMass Amherst, Northeastern University, Tufts University, UMass Dartmouth, UMass Lowell, and Woods Hole Oceanographic Institution. The MRP aims to develop a multi-disciplinary framework for offshore wind and to provide

recommendations on offshore wind regulations, risks and finances. The MRP was funded with 300,000 dollars from the MassCEC.[29]

Bristol Community College

Bristol Community College (BCC) is currently conducting a comprehensive research study on the workforce requirements and economic development associated with the establishment of the projected 1,600 megawatts of offshore wind in Massachusetts by 2027. This study also includes assessments of the existing safety regulations and jurisdictional issues regarding federal oversight. This study will be used as input for the establishment of offshore wind training and safety programs in Massachusetts.[30] Bristol Community College also offers a wind technician curriculum to students.

University of Massachusetts Lowell

The University of Massachusetts Lowell has received a grant of 150,000 dollar to investigate new systems for monitoring the structural health of wind turbine blades. To conduct this research, UMass Lowell works together with the Wind Technology Testing Center.[31]

UMass Amherst Offshore Wind Energy Program

In 2011, UMass Amherst received a 3.2 million dollar grant from the National Science Foundation to set up an interdisciplinary graduate program in offshore wind. This program has trained 30 doctoral students and focuses on economic, social, technological, and regulatory challenges of offshore wind farms.[32] This program is part of the UMass Amherst Wind Energy Center, which has been looking at offshore wind energy since the 1970s.[33]

Wind Technology Testing Center

The Wind Technology Testing Center (WTTC), managed by the MassCEC, is the largest blade testing facility in North-America. The WTTC offers a full suite of certification tests for turbine blades up to 90 meters in length.

National Renewable Energy Laboratory

The National Renewable Energy Laboratory (NREL) is a federal governmental agency playing an important role in showcasing the benefits of offshore wind power. The organization conducts research on the economic impacts of offshore wind farms and on wind speeds in the US.[34]

4.3 Trade Associations

American Wind Energy Association

The American Wind Energy Association (AWEA) is a national trade association that represents the interests of America's wind energy industry. The AWEA consists of hundreds of member organizations and aims to promote wind power through advocacy, communication, and education.

The US Offshore Wind Collaborative

The US Offshore Wind Collaborative is a non-profit organization that aims to promote the offshore wind industry through partnerships and analyses. Their board of directors and partners includes leaders from academia, industry, government, and environmental groups.

4.4 Offshore Wind Developers

In the United States, developers obtain site control of ocean areas. Developers have the right to construct and operate offshore wind facilities and are responsible for ensuring the building of these facilities. Obtaining site control is usually an important step in the establishment of an offshore wind park, as exclusive control allows the developers to conduct further site investigations that are necessary for designing the project.[35] The most important developers operating in Massachusetts include:

Ørsted & Bay State Wind

Ørsted (previously Dong Energy) constructs and operates offshore wind farms, bioenergy plants, and waste-to-energy solutions. It is headquartered in Denmark and has a revenue of 8.2 billion euro (in 2016). In the United States, Ørsted teamed up with Eversource Energy in a 50/50 joint venture called Bay State Wind. Eversource Energy is a transmission builder in the New England area. In 2015, Bay State Wind gained control over site OCS-A 0500, an area with an offshore wind capacity of 2,000 MW.

Vineyard Wind

Vineyard Wind is an offshore wind development company based in New Bedford, Massachusetts. The company is owned for 50 percent by Avangrid Renewables, one of the largest developers in the US, and for the other 50 percent by funds of Copenhagen Infrastructure Partners, a fund management company that manages over 5 billion euro in clean energy investments.

Deepwater Wind

Deepwater Wind is an offshore wind developer that has built Block Island Wind Farm, the first wind farm in the US. The company is planning projects in New York, Massachusetts, Rhode Island, Maryland, and New Jersey.

Other important developers in the New England area include Statoil Wind US, US Wind, Dominion, and Energy Management Inc. (EMI).

5. Offshore Wind Conferences in Northeastern United States

This section provides an overview of upcoming offshore wind conferences and exhibitions in the Northeast of the United States.

New England Energy Conference & Exposition (June 4-5, 2018, North Falmouth, MA)
The New England Energy Conference & Exposition brings together more than 300 industry professionals, aiming to lead the charge to a resilient and sustainable energy future in the New England area.

US Offshore Wind 2018 Conference & Exhibition (June 7-8, 2018, Boston, MA)
The US Offshore Wind 2018 Conference & Exhibition is one of the leading offshore wind networking events in the US. The conference aims to connect businesses that are looking to invest, find partners and secure contracts for offshore wind projects in the United States.

Rhode Island Offshore Wind Supply Chain Summit (June 8, 2018, North Kingstown, RI)
Summit for small businesses with capability in electrical services, civil and electrical engineering and marine services, to learn about offshore wind contracting opportunities in Rhode Island.

AWEA Regional Wind Energy Conference 2018 Northeast (June 26-27, 2018, Portland, ME)
The AWEA Regional Wind Energy Conference 2018 in Portland, Maine, aims to provide companies the tools to be successful in the US Northeast offshore wind market. The conference focuses on land-based and offshore wind project developments.

Wind Energy Finance & Investment Conference – East (October 1-2, 2018, New York, NY)
This conference aims to provide insights into how to capitalize on the wind energy finance industry. Key topics include investor timelines, emerging markets, examining how policy impacts wind industry finance, and learning how to maximize growth trends.

AWEA Offshore Windpower 2018 Conference (October 16-17, 2018, Washington DC)
The American Wind Energy Association Offshore Windpower Conference is the largest gathering of offshore wind energy professionals in the United States. It aims to bring together American and international offshore wind experts, businesses and developers.

6. Conclusion

Over the last two years, offshore wind has gained momentum in the United States. The completion of the first US offshore wind farm in 2016, the enactment of state policies incentivizing offshore wind, and technological developments and cost reductions, have led to a strong increase in planned offshore wind projects in the country. Massachusetts is one of the frontrunners in offshore wind in the US. This state has enacted a range of policies promoting the development of the offshore wind industry, such as implementing an act which requires state electricity providers to procure 1,600 MW of offshore wind capacity by 2027. As part of this act, in May 2018 Vineyard Wind was selected to build an 800-megawatt offshore wind farm, which is planned to be operational by 2021. Massachusetts has also invested in critical

offshore wind infrastructure, such as the New Bedford Marine Commerce Terminal and the Wind Technology Testing Center. With the release of two large offshore wind sites later this year, Massachusetts will have four offshore wind areas controlled by developers. Although concerns about the offshore wind industry in the US remain, such as whether the Jones Act will impede the development of this sector, Massachusetts seems to be ready for an era of offshore wind.

[1]https://www.americangeosciences.org/critical-issues/faq/what-are-advantages-and-disadvantages-offshore-wind-farms
[2] https://www.energy.gov/sites/prod/files/wv_chapter2_wind_power_in_the_united_states.pdf;
GWEC. (2017). Global Wind Report 2016, 76. Retrieved from http://files.gwec.net/files/GWR2016.pdf
[3] Bloomberg New Energy Finance. (2017). Wind Power Blows Through Nuclear, Coal as Costs Drop at Sea. Retrieved from https://www.bloomberg.com/news/articles/2017-03-09/wind-power-blows-through-nuclear-coal-as-costs-plunge-at-sea
[4] Bloomberg New Energy Finance. (2017). Wind Power Blows Through Nuclear, Coal as Costs Drop at Sea. Retrieved from https://www.bloomberg.com/news/articles/2017-03-09/wind-power-blows-through-nuclear-coal-as-costs-plunge-at-sea
[5] Devine-Wright, P. (2011). Renewable Energy and the Public from NIMBY to Participation. London: Routledge
[6] http://usoffshorewind.org/wp-content/uploads/2012/06/national_offshore_wind_strategy2.pdf
[7] Devine-Wright, P. (2011). Renewable Energy and the Public from NIMBY to Participation. London: Routledge
[8] http://dwwind.com/project/block-island-wind-farm/
[9] https://www.energy.gov/eere/articles/4-emerging-trends-us-offshore-wind-technologies
[10] https://www.boem.gov/Renewable-Energy-Program/Renewable-Energy-Guide/Offshore-Wind-Energy.aspx
[11]https://www.forbes.com/sites/energyinnovation/2018/02/06/americas-offshore-wind-boom-is-finally-here-which-state-will-win-the-race-to-the-top/#501b23fd5b07
[12] https://www.nyserda.ny.gov/All-Programs/Programs/Offshore-Wind/New-York-Offshore-Wind-Master-Plan
[13] http://www.nj.gov/governor/news/news/562018/approved/20180131a_eo.shtml
[14] GWEC. (2017). Global Wind Report 2016, 76. Retrieved from http://files.gwec.net/files/GWR2016.pdf
[15] https://www.energy.gov/eere/wind/downloads/2016-offshore-wind-technologies-market-report
[16] U.S. Department of Energy. (2016). Offshore Wind Technologies Market Report. Retrieved from: https://www.energy.gov/sites/prod/files/2017/08/f35/2016%20Offshore%20Wind%20Technologies%20Market%20Report.pdf
[17] https://www.lw.com/thoughtLeadership/three-proposals-signal-new-wave-offshore-wind-law-360
[18] http://www.wbur.org/bostonomix/2018/05/23/vineyard-wind-massachusetts-offshore-farm
https://macleanenergy.com/83c/
[19] https://www.pressherald.com/2018/05/23/massachusetts-and-rhode-island-announce-offshore-wind-projects/
[20] http://www.wbur.org/bostonomix/2018/05/23/vineyard-wind-massachusetts-offshore-farm
[21] Hines, E. M. et al. 2017. American Ports & Infrastructure for Offshore Wind. *Civil Engineering*
[22]U.S. Department of Energy. (2016). Offshore Wind Technologies Market Report. Retrieved from: https://www.energy.gov/sites/prod/files/2017/08/f35/2016%20Offshore%20Wind%20Technologies%20Market%20Report.pdf
Hines, E. M. et al., 2017. *American Ports & Infrastructure for Offshore Wind.* Civil Engineering.
[23] http://www.masscec.com/wind-technology-testing-center
[24]http://www.masscec.com/about-masscec/news/baker-polito-administration-announces-700000-funding-offshore-wind-research
[25] https://www.boem.gov/Massachusetts-Proposed-Commercial-Wind-Leases/
[26] U.S. Department of Energy. (2016). Offshore Wind Technologies Market Report. Retrieved from: https://www.energy.gov/sites/prod/files/2017/08/f35/2016%20Offshore%20Wind%20Technologies%20Market%20Report.pdf
[27] U.S. Department of Energy. (2016). Offshore Wind Technologies Market Report. Retrieved from: https://www.energy.gov/sites/prod/files/2017/08/f35/2016%20Offshore%20Wind%20Technologies%20Market%20Report.pdf
[28] City of New Bedford. (n.d.). The Port of New Bedford Is … Ready for Offshore wind.
[29]http://www.masscec.com/about-masscec/news/baker-polito-administration-announces-700000-funding-offshore-wind-research
[30]http://www.masscec.com/about-masscec/news/baker-polito-administration-announces-700000-funding-offshore-wind-research
[31]http://www.masscec.com/about-masscec/news/baker-polito-administration-announces-700000-funding-offshore-wind-research
[32] https://windenergyigert.umass.edu/
[33] https://www.umass.edu/windenergy/about
[34] http://www.nrel.gov/
[35] U.S. Department of Energy. (2016). Offshore Wind Technologies Market Report. Retrieved from: https://www.energy.gov/sites/prod/files/2017/08/f35/2016%20Offshore%20Wind%20Technologies%20Market%20Report.pdf