Frequently Asked Questions (FAQs)
Potential Offshore Wind Developments in Delaware and Maryland

Prepared by the University of Delaware's Center for Research in Wind

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The purpose of these FAQs is to provide some fact-based information for the public regarding the two proposed offshore wind sites off the coast of Maryland and Delaware. It was written based on extensive research and study by the authors, Bonnie Ram, Jeremy Firestone, and Willett Kempton, all of UD Center for Research in Wind.

1. How does the developer get access to the ocean spaces (i.e., leases)?

ANSWER: BOEM (Bureau of Ocean Energy Management), which is part of the US Department of the Interior, is the federal entity that is responsible for issuing leases, easements and right-of-way for renewable energy projects on the Outer Continental Shelf (OCS) (farther than 3 nautical miles (which is about 3.5 miles) from shore along the east coast). In consultation with a host of federal agencies that have authority over ocean uses and management, state and tribal governments, competing industries such as commercial fishing and commercial shipping and a number of stakeholders, BOEM delineates a lease for commercial or research activities. Qualified offshore wind developers bid for this lease area typically with an auction, with the highest bidder winning the lease. The winning bidder must also provide financial bonds and prove the ability to build a project. Subject to BOEM approval and oversight, the winning bidder is responsible for all the permitting, environmental documentation, and site surveys, as well as securing power sales, financing, and construction, operation, and assuring decommissioning.[1] The lease auction does not sell-off the ocean site, it only allows the development of the site, and production of electricity over a specified lease term, if payments and other conditions are met. After approval of several regulatory steps by BOEM, including determining a Construction and Operation Plan is 'complete and sufficient' and completing environmental reviews and consultations with other federal and state agencies, the developer may install wind turbines in the lease area and bury power lines under the sea floor to a power station on land. According to the official BOEM timeline, the entire leasing process and project development may take an estimated 8-10 years. After 25-30 years of operation, the developer is responsible for decommissioning.

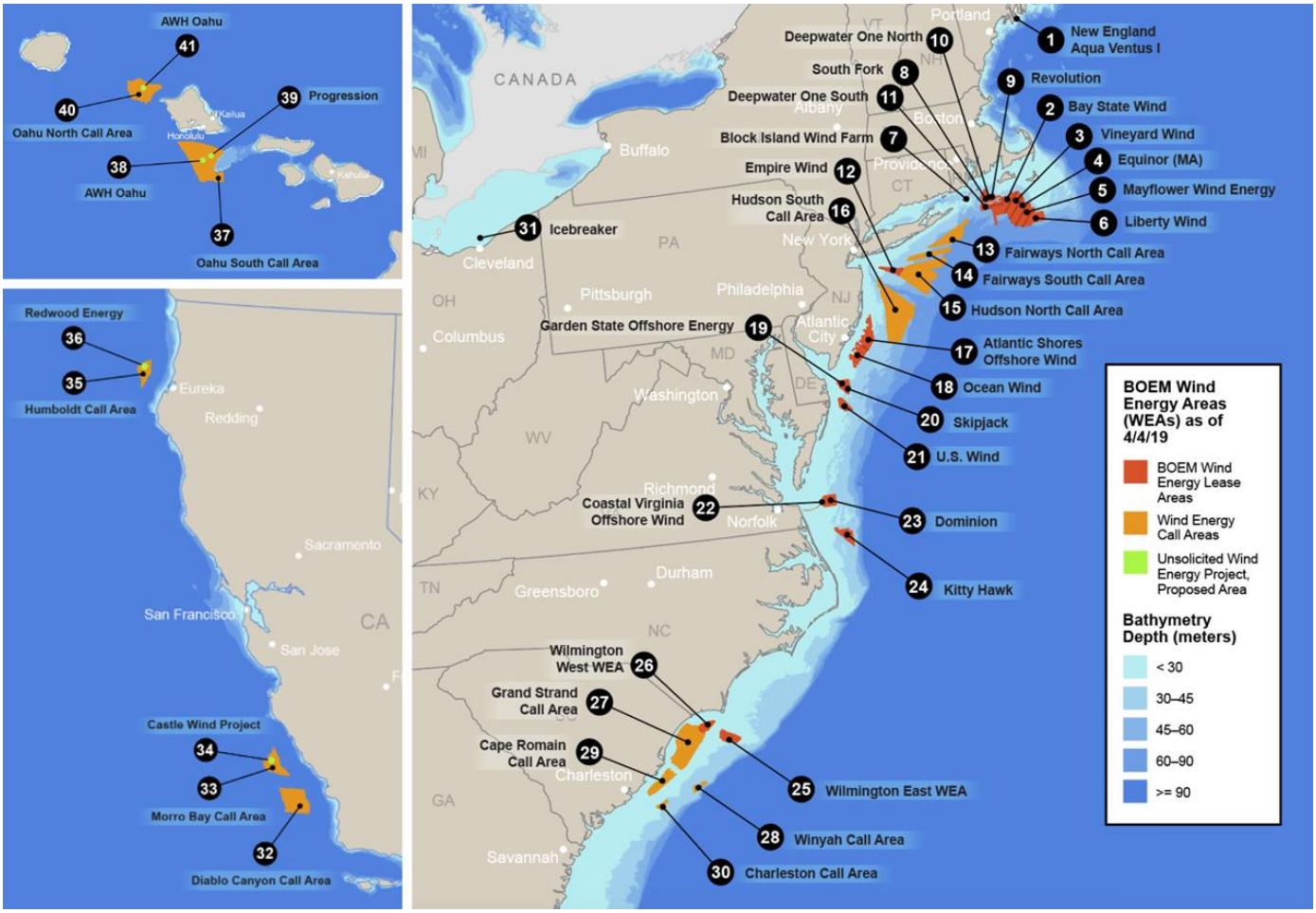
2. Why are state governments driving the commitments for offshore wind power?

ANSWER: State governments create the public policies that regulate electric utilities as well as requirements for renewable energy, such as offshore wind power. Northeastern states additionally have requirements for CO_2 reductions. As a result, developers now have 16 active leases and expect 8 more competitive lease sales; a total of 26,000 megawatts (MW) (there are 1,000 kilowatts in a megawatt) to sell into those states.[2] To date, seven states along the Atlantic coast (MA, RI, CT, NY, NJ, MD, VA) have committed to buy power from offshore wind projects and/or are in the process of doing so, together amounting to some 6,500 MW, a regulated electric utility is seeking to develop an additional 2,500 MW and states have plans to buy an additional 16,000MW. The retail sale of power to consumers from an electric utility is regulated by the state government. See Figures 1 (US) and 2 (East Coast) for the current lease locations and project names.

[1] See BOEMs Citizen Guide for additional details about BOEM authority and the legal process here.

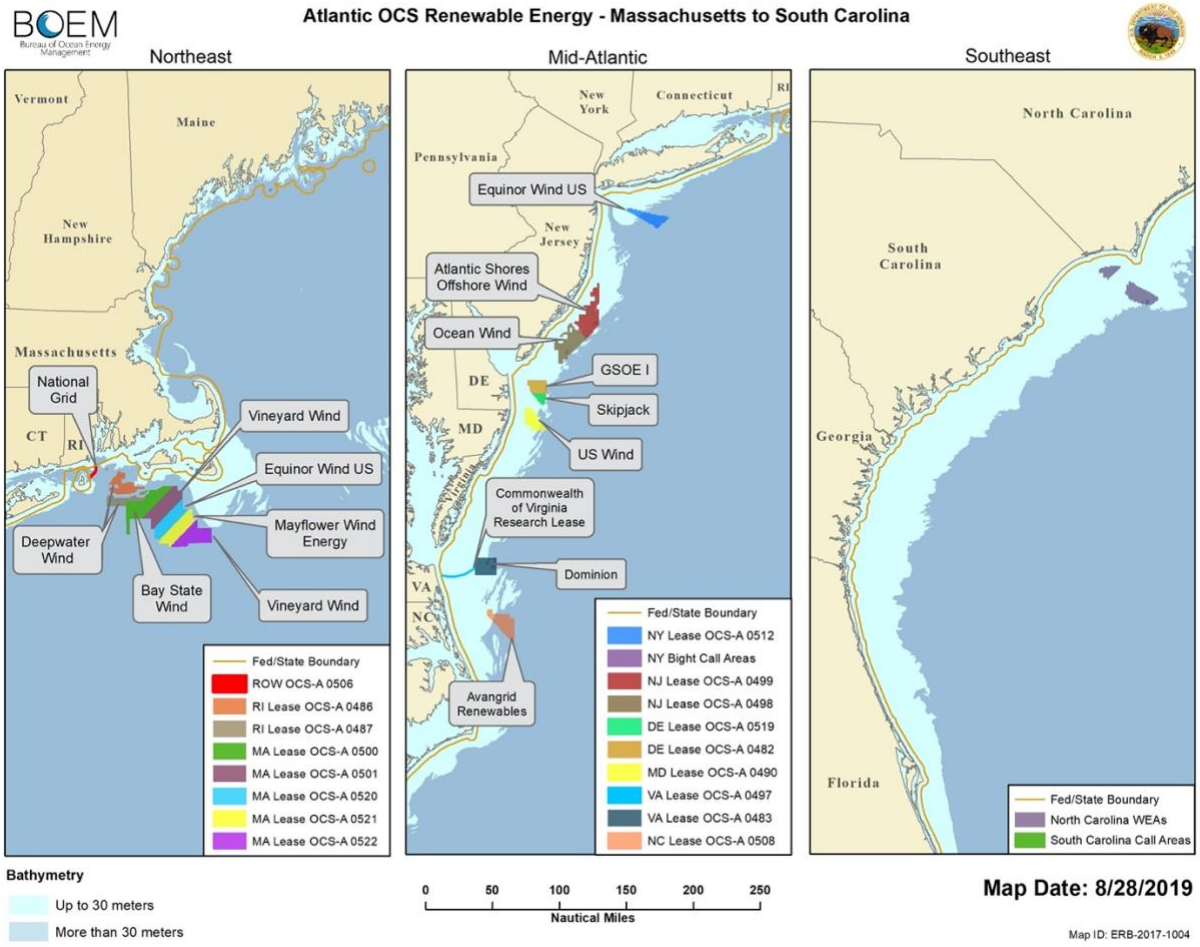
[2] These lease activities and MW commitments do change over time. These figures were presented by Walt Musial at NAWEA/WindTech 2019 Conference. October 2019. 25,824 MW is in the regulatory pipeline for 2030 or 2035.

Figure 1. BOEM LEASE AREAS AND PROJECT NAMES (US)[3]



[3] Reference for Figures 1 and 2 source: These maps are from the US Bureau of Ocean Energy Management showing areas already leased to offshore wind developers as of August 2019. https://www.boem.gov/renewable-energy/mapping-and-data/renewable-energy-gis-data

FIGURE 2. BOEM LEASE AREAS AND PROJECT NAMES (East Coast)



3. Who are the developers in MD and VA today, and what are the project sizes?

ANSWER:

US Wind (MarWin project) is the Maryland branch of an Italian construction company (Renexia S.p.A. a subsidiary of Toto Holding Group) and is the leaseholder on the Maryland Wind Energy Area (WEA) and developer of 248 MW off the coast of Ocean City[4]. BOEM estimates installation and operation of this project by 2022.[5]

Ørsted (Skipjack project) is the lease holder of the southern portion of the Delaware WEA for a total of 120MW. Ørsted is a Danish-based company, the global leader in offshore wind developments (greatest number of MWs built), with US headquarters in Boston and a MD office in Annapolis. The Delaware WEA lease[6] was first entered into by Bluewater Wind,[7] subsequently bought by NRG, then

[4] The lease is about 80,000 acres (125 square miles) across two lease sites for a total bid of $8,701,098.

[5] See the BOEM Maryland site here for details about the lease history, public comments, and updates and the developer site here: http://www.uswindinc.com/maryland-offshore-wind-project/

[6] The lease is 96,430 acres or about 150 sq. m.

[7] This was the first commercial lease for renewable energy offshore in the US. See original announcement here.

sold to Deepwater, and then in 2018, Ørsted acquired Deepwater Wind[8]. BOEM estimates that the project will be operational by 2023.
There are many other offshore wind power developers working in the US, some building projects near other states.

4. How many turbines will these projects install?

ANSWER: Although the total MWs of these projects has not changed, the estimated number of turbines for both projects has decreased because the size of the turbines has changed over time. Public announcements indicate that both of the developers want to use the largest turbine available which is the GE Haliade-X 12MW. Since 2019, this turbine is undergoing formal testing and certification and is expected to be in mass production by 2022. The developer motivation for using larger turbines is that larger turbines will reduce the capital costs (purchase of the turbines and construction) resulting in lower-cost electricity (doubling turbine size is estimated to reduce electricity costs by 30%).[9] If costs are reduced, the MD PSC contracts require that 80% of these savings be passed on to the ratepayers via lower electric rates. However, larger turbines are taller and thus more visible from shore (see below for potential impacts on viewshed and tourism). To solicit public input on this change, in January 2020 MD PSC held a public hearing in Ocean City to address the proposed visual impacts as well as the costs and saving for the ratepayer.[10]

As of February 2020, the US Wind project (248MW) is projecting to install about 20 of the 12 MW turbines and Skipjack (120MW) is proposing to install a total of about 10 turbines. Those two add to 368MW, which should be considered a Phase 1 of these developments as the wind energy area (or lease area) could accommodate more than this number of turbines. US Wind has stated that it would be able to build up to 750MW turbines on this lease site.[11] But neither company would likely build more without state (which could, e.g., include New Jersey) and/or utility agreement to purchase more power than the current total of 368 MW.

5. Why is the project off of the DE coast selling power to Maryland?

ANSWER: The current project proposed off of the DE coast originated from state commitments from the Maryland governor and legislators to meet their clean energy goals and reduction of greenhouse gases (GHGs). The MD Public Service Commission (PSC)] approved ratepayer subsidies or Offshore Renewable Energy Credits (ORECs) to support the 368 MW of offshore wind power. Skipjack, off the Delaware coast, is one of these two offshore wind projects; the other –US Wind--is off the Maryland[12] coast[13].

As a general rule, under the US Constitution one state cannot prevent another state from buying power from a permitted energy project. For example, Delmarva Power has contracts to buy wind energy from land-based projects located in Delaware and Pennsylvania. The Delaware Wind Energy Area is in federal waters (more than 3 nautical miles[14] from the coast) and therefore are under the jurisdiction of

[8] The lease history is a bit more complicated: After Bluewater Wind acquired the lease, in 2016 this lease was assigned to GSOE I, LLC, and in 2018 the southern portion was further assigned to Skipjack Offshore Energy, LLC, a subsidiary of Deepwater Wind, the developer of the only US offshore wind power project, located off of Block Island, Rhode Island.

[9] Kempton et al, 2017, "Industrializing Offshore Wind Power", CReW, U Delaware report, https://crew.udel.edu/industrializing-offshore-wind-power-generation/

[10] https://www.psc.state.md.us/wp-content/uploads/MD-PSC-Schedules-Hearing-on-Offshore-Wind-Projects-Turbine-Sizes_01182020.pdf

[11] See the Public Service Commission case decision (Order No. 88192, Case No 9431) on US Wind for more details.

[12] The Maryland Wind Energy Area extends as far north as Fenwick Island, Delaware; US Wind's current development plans call for its project to be located in the southern portion of the WEA.

[13] See more details at MD Public Service Commission (PSC) and the Maryland Energy Authority.

[14] 1 nm = 1.15 miles

the federal government (BOEM).[15] As a result, the case for allowing a non-adjacent state to purchase power is even stronger in federal offshore waters. Delaware could have offered to purchase all of the potentially available electricity that could be generated in the Delaware Wind Energy Area, but did not try to do so. Similarly, a future Delaware project could hypothetically be off the coast of MD or NJ, for example.

6. Why were those clean energy commitments made in MD rather than DE?

ANSWER: The state of MD made the decision to commit to low carbon electricity sources to meet their renewable portfolio standard (RPS) goals[16] and to address one of the underlying causes of climate change --- emissions of GHGs from the burning of fossil fuels for the production of electricity, primarily carbon dioxide (CO_2). MD was actually following Delaware's lead, as the MD action started when the Delaware Bluewater Wind project was viable. MD's underlying motivations were to reduce emissions as well as to create new potential industrial job opportunities, including port redevelopments. After evaluating the various clean energy options to meet their RPS goals, (such as MD's ongoing efforts on solar and land-based wind), offshore wind was added as one of the largest and readily available sources in the region. The decision to proceed was approved by the MD legislature and the PSC. As noted above, many states have taken this path.

Maryland's legislature enacted a renewable portfolio standard (RPS) in 2004 and has amended it several times since then. The RPS also requires that the state's offshore wind generating capacity reach 400 megawatts in 2026 and increase to at least 1,200 megawatts in 2030.[17]

7. Who is paying for these projects?

ANSWER: Ultimately, MD ratepayers pay as with any electric power investment. The developer, as a typical business, has decided that the incoming electricity sales are enough to justify the cost of building the project. Thus, they invest the development company's own money (equity), along with borrowing from investors (debt). The developer (and to a lesser extent the debt lender) are putting their money at risk in expectation of a profit, like any business. The financials and electricity cost of both projects have been reviewed by MD PSC in May 2017 and found to be consistent with the law and prudent. Details of the PSC's review and approval are documented as part of Docket 9431, which is publicly available online. The price of electricity was above market rates, but it was approved based on the obligation to meet the RPS goals, the expected emission reductions, and the job benefits. Since the power is being purchased by MD, there is little direct price impact to DE ratepayers.

8. Has the state of Delaware considered purchasing offshore wind power and what are some of the current issues?

ANSWER: Delaware accepted a contract from Bluewater Wind to develop an offshore wind project (2007-09),[18] but that company was not able to complete the project (due to a number of factors including the financial crisis and end of the Federal loan guarantee program).[19] There is currently no

[15] BOEM is the same agency that oversees oil and gas developments.

[16] The latest update on Maryland's RPS goals came in May 2019, when the Maryland legislature required that 50% of the state's electricity retail sales come from renewable sources by 2030, in addition to the existing 20% requirement by 2020. The state will also study the possibility of obtaining 100% of its electricity from renewables by 2040. As part of the updated RPS, 14.5% of an electricity supplier's retail sales must come from solar power by 2030. Source: https://www.eia.gov/state/analysis.php?sid=MD

[17] Department of Legislative Services, Maryland General Assembly, 2019 Session, House Bill 1158, Clean Energy Jobs, p. 2

[18] The state of DE approved the Bluewater Wind project at a cost of 14¢/kWh with a cost escalator; that was known to be above the cost of power at the time, but the state judged the other benefits to be worth it. Significantly, this offshore wind project won the competition ahead of a natural gas plant and a coal power plant.

[19] A December 2011 article in the Cape Gazette provides some historical context. https://www.capegazette.com/article/new-owner-sought-bluewater-wind-farm/20870

Delaware consideration of offshore wind power by the state. Please see the BOEM site for historical information on Delaware leasing and permitting.

Delaware's Governor, John Carney, organized an offshore wind working group (2017-2018) to consider purchasing offshore wind, but the working group decided to wait on any purchase until the price of offshore wind power was reduced further below the price Maryland was paying.[20] Since that time, the price for offshore wind has dropped in half.[21] Although there are no power purchase agreements for DE, the DE state regulators have the authority to review and pass on and the communities have the opportunity to review and comment in public hearings, if any offshore wind project affects Delaware's Coastal Zone (both may). Delaware has the power to approve any transmission cable that either traverse state oceanic waters and/or comes ashore on the Delaware coast (as Skipjack proposes to do at Fenwick Island State Park and US Wind proposes to do at Indian River).

Delaware may decide in the future to take state actions to buy offshore wind to meet its clean energy goals as there is additional space in the existing WEA off of the coast of DE[22] (As of March 2020, this is not under discussion).

9. How are the coastal communities in DE and MD consulted about the two offshore project decisions?

ANSWER: The public engagement process for these two Maryland projects is driven by federal and state environmental and safety requirements. For state-level power purchases, there are public hearings organized by the MD PSC, including a hearing on January 18, 2020 in Ocean City and the newly decided evidentiary hearings about the selection of the turbines.[23] Federal requirements for engaging the public relate to ocean leasing and environmental permits, primarily driven by the National Environmental Policy Act (NEPA) compliance.[24] Early on, BOEM requested that Governors organize state task forces in order to involve state and local agencies as well as NGOs and other citizen groups. Although the task forces have met in both DE and MD, they have not been active over the last several years.[25] Once BOEM deems the developer's Construction and Operation Plan (COP) is "complete and sufficient," the developer is required to prepare either an Environmental Assessment (EA) and/or an environmental impact statement (EIS) through a third party contractor that reports to BOEM. Thereafter a Notice of Intent (NOI) is filed and the public engagement process begins again around the preparation of the Draft and Final environmental documents.[26]

Public engagement is primarily in the form of public hearings that are organized by BOEM from site selection through to project development, along with separate private developer discussions and

[20] See DE Offshore Wind Working Group discussions and public testimonies here.

[21] Vineyard Wind contracts at $65/megawatt-hour (MWh) (Levelized Costs of Energy (LCOE) and Mayflower are $57/MWh, both with well-structured price competition. Prices were more expensive in Maryland because of various factors, including that these projects were decided earlier, they are smaller sizes, and economic development was built into the costs. In 2019, New Jersey approved a contract at $98.10/MWh for the 1100 MW Ocean Wind project, but it still significantly below the Maryland project prices and also included economic development commitments. Also see industry-wide prices from https://www.rechargenews.com/transition/offshore-wind-power-price-plunges-by-a-third-in-a-year-bnef/2-1-692944 and here: https://www.mckinsey.com/business-functions/sustainability/our-insights/winds-of-change-why-offshore-wind-might-be-the-next-big-thing

[22] To provide perspective on these prospects: The average load in DE is about 1.2 GW (1200 MW). Therefore, a commercially-viable and economic project of 1,000MW, (as NJ has contracted for), running at a 50% capacity factor, could provide almost half of the electricity needs of DE. Based on experience in other states, co-author Kempton believes that any future bid solicitations in Delaware could be written to ensure that the price would be near the bottom of the current offshore wind price range. That would result in a power contract at a cost approximately the same as existing power prices, but with the substantial potential health and environmental benefits noted herein.

[23] Notice of Intent to Conduct Evidentiary Hearings for Skipjack and for US Wind.

[24] See the public participation roadmap developed by UD-SIOW and AWEA here: https://www.awea.org/Awea/media/Resources/Fact%20Sheets/AWEA_Engagement-Process-FINAL_1-24.pdf

[25] See the agendas and attendees for Maryland (most recent meeting in 2014) and Delaware (2009 & 2011).

[26] https://www.boem.gov/sites/default/files/renewable-energy-program/Environmental-Review-and-Compliance-of-Offshore-Wind-Energy-Projects.pdf

informal stakeholder exchanges. Public hearings, although mandated by law, are somewhat limited in terms of how the public is engaged—as the publics attend the hearings and/or testify and provide comments, without receiving the government's response at that time. In other words, there is not really a back and forth or exchange of information. Typically, citizens attending hearings are opposed or in favor, but do not necessarily reflect overall community perspectives or concerns. In addition, there are long periods of time where there are no federal requirements for public input (e.g., from lease entry to seeking public input on the scope of an EIS).

Other informative public exchanges have been organized by the developers, the state(s) and local stakeholder exchanges funded by the University of DE (2017-18).[27] In 2019, the Delaware Department of Natural Resources and Environmental Control (DNREC) attended a Fenwick Island Town Council meeting and organized stakeholder meetings on a proposed Memorandum of Understanding between it and Ørsted on the transmission cable and state park improvements[28] (see more details below).

10. Why connect power from the Skipjack Project to Delaware rather than to Maryland?

ANSWER: Offshore wind projects are connected to the electricity system with a cable connection between the turbines and the land-based electrical grid. There are various potential connection points for the Maryland projects and they depend upon existing power lines and substations owned and operated by entities such as Delmarva Power and overseen by the regional transmission system operator PJM. Connection points are being considered along the Delmarva Peninsula, including Bethany Beach, Indian River, Ocean City and Fenwick Island. The US Wind project identified the Indian River Inlet in its application to MD PSC, although that could change. Ørsted has said that the closest and most economical point to connect is in the area around Fenwick Island, where a large Delmarva power line already runs. Recently, DNREC, on behalf of its Division of Parks and Recreation and Ørsted entered into a Memorandum of Understanding (MOU) for Ørsted to be able to use space for a substation in exchange for paying for upgrades to the park facilities, valued at $18M, including additional parking and other amenities.[29] An MOU is a statement of "intended common action" by both parties, which is not legally binding. Even if DNREC's Parks Division enters into a legally binding agreement with Ørsted, DNREC will have to separately determine that the wind project is consistent with DE's coastal zone management plan, and that the transmission cable is in compliance with state law, or it would not be approved.

The proposed point of connection at Fenwick Island is the closest point to the Skipjack project lease and there is already a power line running along Highway 1 in the area. The option of running a separate, new transmission line just for Skipjack to connect into the MD grid would add to their project costs, labor, and use of materials. Thus, the DE connection was proposed by the Skipjack developer to lower the overall cost of the project.

11. What is the substation proposed on Fenwick Island?

ANSWER: Any power plant, including offshore wind power, requires a "substation" to match the power from the turbines to the power on the electric grid. Substations are also used to link from transmission lines to towns or neighborhoods, to provide the power we use in our buildings. There are now two substations in the area near Fenwick, both of which have been there many years--Midway Substation at 18200 Coastal Highway in Lewes, and Bethany Beach Substation in the SW corner of Fresh Pond State Park (accessed from Coastal Highway and Heron Road). Each converts

[27] Access to several UD presentations to local Delawarean stakeholders can be found here. Delaware Sea Grant also has collaborated on these offshore wind stakeholder exchanges.

[28] See https://www.capegazette.com/article/fenwick-officials-frustrated-skipjack-proposal/192182

[29] See more details here, the diagram of the park plan here and details of the MOU here.

power from the overhead Delmarva transmission line to small power (distribution) lines that distribute electricity to buildings in Lewes and Bethany.

The proposed Ørsted substation would receive power from an underground cable coming from the offshore wind power project. Its function is to match power from the wind turbines to the local grid. The substation connects to the grid at the existing overhead Delmarva power line mentioned above. Since the Ørsted substation is proposed to be built in the State Park, they designed it to be a compact, a self-contained building of 4,000 sq. ft. (0.9 acre versus the existing Bethany substation with open equipment in a fenced yard of 2.8 acres). It will be about 42 feet high, which is only 2/3 the height of the poles of the existing Delmarva lines that it would connect to. But the substation building would be taller and substantially larger than the existing park buildings. Ørsted has committed to making the rooftop accessible to park visitors, which would offer a good view of the ocean to the East and Little Assawoman Bay to the West.

12. What was the public reaction to the Fenwick Island State Park proposal?

ANSWER: Given the perceived lack of public engagement before the announcement and the mixed reactions from local town councils, DNREC prepared a survey to understand better public responses. DNREC also extended the public comment period around the proposal,[30] but those results are not available as of yet. Although the Fenwick Island Town Council does not have a say in this decision making process, the Council voted to oppose the plan for park improvements because of the potential impacts to the community and the vulnerability of the site to flooding.[31] This state park is on a barrier island ---from South Bethany to Ocean City ---- protecting the coastline from severe storm damage and providing refuge for wildlife. The state park site, however, already floods from the bay side thereby raising concerns about vulnerability during future, more severe storms and expected sea level rise. Also with the park improvements some community residents were concerned about the influx of additional tourists and traffic. Additional public engagement about this proposal is ongoing (as of March 2020).

13. A subsea cable at the first operating offshore wind project --- Block Island Wind Farm (BIOWF) --- was exposed recently.[32] Is this likely to happen at Fenwick or other coastal areas? If so, what are the expected consequences?

ANSWER: There are numerous cables under the world's oceans; most are telecommunications cables, but also many electricity cables. Such cables are occasionally exposed by seafloor sand motion or snagged by dragging nets, anchors or trawling. Block Island Wind Farm (BIOWF) is the first US offshore wind project; it is off the coast of Rhode Island. In that area of the ocean, cable burials were near bedrock (solid rock). The cable contractor used the jet plow method, which uses high-pressure water jets to dig trenches. That method may not be suitable for areas composed of bedrock given the dynamic coastal environment (sedimentation and waves). If an undersea power cable is uncovered and sitting above the seafloor, there is a risk that the cable could be snagged (e.g., on an anchor). Because ratepayers only pay for the cost of electricity actually delivered, that is an expensive error that the developer of the wind project is responsible for. It costs in both shutdown time and repair cost. To date (March 2020), no injuries or damage to ocean users have been reported.

The proposed cable route for the Skipjack project is on the Mid-Atlantic seafloor, composed of sands and muds, amenable to both jet plow and directional drilling. Undersea power cables that come ashore from the lease areas are installed typically 6 to 10 feet below the seafloor. The last section of cable,

[30] https://news.delaware.gov/2019/12/10/dnrecs-division-of-parks-recreation-extends-deadline-for-fenwick-island-state-park-improvements-survey/

[31] https://mdcoastdispatch.com/2019/12/10/fenwick-council-officially-opposes-state-park-partnership-with-wind-farm-developer/

[32] See articles in Providence Journal article here and Block Island Times here.

under the beach, will be buried using directional drilling 10 to 30 feet down (according to a public hearing), avoiding cable exposure even in the surf area. Installation costs, and repairs if any errors are made, are the responsibility of Skipjack's developer, Ørsted. There are not any expected safety issues for humans, wildlife (see below), or boats from the subsea cable. Any cable problems that may arise would also have no effect on the already-approved cost of electricity. All planned construction activities that involve the coastal environment will need permitting approval from the appropriate state agencies--- and in the Skipjack case---that would be DNREC.

14. Are there effects to humans or wildlife from the subsea cables?

ANSWER: There are low-level electromagnetic fields (EMF) from existing and proposed underground transmission lines and the proposed substation in Fenwick Island State Park. The cables are protected by metal sheathing, then are insulated and buried under the seafloor. Existing substations with similar characteristics are also fenced in to keep the public some distance away. These substations are located in Lewes (Midway, at 18200 Coastal Highway, adjacent to residences and stores) and Bethany Beach (in the SW corner of Fresh Pond State Park). Both tie into the same transmission line that Ørsted is proposing to use. EMF exposure from transmission lines is considered a low-level risk. Ongoing scientific studies find that cell phones, household appliances, and overhead power lines expose people to much stronger electrical and magnetic fields than buried transmission lines and substations. According to the World Health Organization (WHO), none of those other sources have been shown to have clear health effects.[33] In short, the project is no different from other substations in the area, it is not expected to have any measurable increase in human exposure from EMFs, and there is no evidence of any health effect from that low-level of exposure. EMF issues are addressed by standards for minimizing exposure of EMFs to humans (by distance or barriers, such as having power lines on tall poles).

In terms of exposure impacts to underwater wildlife, low level effects could be observed for certain species from anecdotal information. A number of European offshore wind studies have, to date, found no significant risks from undersea cable EMFs, although uncertainties around certain species remain. A study of 18 EU offshore wind plants, for example, concluded that "EMF monitoring should not ordinarily be required for post-consent monitoring (PCM) at offshore wind farms (OWFs).[34]

15. How are visual representations of the view of the turbines created?

ANSWER: Visual impact can be estimated before construction by creating accurate visualizations, say, from the perspective of a nearby beach. Poor quality visual representations may either obscure wind turbines making them harder to see or distort them to the extent they appear more prominent and industrial than they will appear in reality. It also is important to consider time of day and conditions (such as clear days, hazy days, and nighttime). On the east coast, particularly in the summer, the sun rises very early, so while a view of the wind turbines at sunrise is in one sense informative, it is a view that few Ocean City or Southern Delaware tourists will see. Sunrise views may not influence the decisions of tourists. It is also important to view a given visual representation at a specified distance[35].

16. Could either project be moved farther offshore?

ANSWER: The two lease site locations took a number of years to identify as BOEM conducted technical studies and engaged with a variety of ocean users who commented on these locations at the time. For example, BOEM is prohibited from siting in or too near to shipping lanes or in marine sanctuaries, and

[33] https://www.who.int/peh-emf/about/WhatisEMF/en/index1.html

[34] See selected Belgium and UK studies here: https://a6481a0e-2fbd-460f-b1df-f8ca1504074a.filesusr.com/ugd/78f0c4_52be3e158cfa467bb5e73bc2625f81dc.pdf and https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/389392/MMO_response_to_independent_OWF_PCM.pdf

[35] Just as it is easier to read the letters at the optometrist's office when they are brought in close and more difficult when they are further away, a wind project photomontage must be viewed at the correct distance from one's eyes.

seeks to avoid essential fish habitat or sand and gravel borrow sites. No developer is allowed to move turbines outside of the area of their lease. Therefore, even if a developer were willing to write off all their cost to get to this point and accept a multi-year project delay (perhaps five years), they must go to BOEM to request leasing ocean space beyond the current leases. Leases are competitive and they well might not get another lease or might pay much more for it, invalidating their agreed upon price of power to Maryland ratepayers. The cost of delivering power generated further from shore would also increase given greater water depths, and costs of transmission and operation and maintenance. Given the careful process as described above, re-starting and moving the project is not practical, realistic, timely or cost effective.

17. What are the largest environmental or health benefits of offshore wind projects?

ANSWER: In our region, the development of renewable resources like offshore wind power would displace coal-fired and natural gas-fired generation.[36] The largest two environmental benefits of that displacement are: (1) a reduction in morbidity and mortality associated with air pollutants (e.g., carbon dioxide) thus improving human health; and (2) mitigation of climate change impacts, including sea level rise, storm surge and coastal flooding, and ocean acidification. A 2017 peer reviewed study by US Department of Energy's (DOE) Lawrence Berkeley National Laboratory estimates the health plus climate benefit of wind in the mid-Atlantic to be 14.3 ¢/kwh-of-wind. For comparison, a 14.3¢lWh benefit is more than most wind projects charge for their power. The benefit can also be expressed in reduction in premature deaths from pollution. A Harvard School of Public Health study modelling found that a 200 MW offshore wind farm for Maryland would save 7 lives per year[37].

18. What is the scope of other potential environmental impacts from offshore wind?

ANSWER: Fortunately, the Europeans have been deploying offshore wind for the last 20+ years and have created an extensive peer-reviewed scientific record of the effects. Also BOEM, DOE and state agencies have funded dozens of studies across the spectrum of environmental effects.[38] A useful resource on the effects of offshore wind projects can be found in the database from the Pacific Northwest National Laboratory where many European and US reports can be found.[39] Also BOEM has been investing extensively in environmental studies and their completed and ongoing reports are available here.

A report from Belgium[40] examines all environmental effects over many years and a recent Dutch report summarizes their expected monitoring program from 2017-2021[41]. An earlier report (2006) from Denmark is also a good resource as it lays out some of the potential concerns they considered around the first utility scale projects in Europe. Notably, an 80 turbine project (Horns Rev) was sited in a bird migratory corridor to assess the effects. The primary concerns related to offshore wind in both Europe and the US relate to wildlife impacts, including potential bird collision risks, habitat displacement, and impacts of sound during construction on marine mammals and other animals, including fish.

[36] See GE Energy Consulting (2014), PJM Renewable Integration Study, Executive Summary, available at https://www.pjm.com/-/media/committees-groups/subcommittees/irs/postings/pris-executive-summary.ashx?la=en.

[37] Jonathan J Buonocore *et al* 2016 *Environ. Res. Lett.* **11** 074019

[38] BOEM, DOE - NY and MA Clean Energy Center.

[39] https://tethys.pnnl.gov/knowledge-base-wind-energy

[40] Degraer, S., Brabant, R., Rumes, B. & Vigin, L. (eds). 2019. Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea: Marking a Decade of Monitoring, Research and Innovation. Brussels: Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management, 134 p.,

[41] Dutch Governmental Offshore Wind Ecological Programme. 2016. Offshore wind energy ecological programme (WOZEP): Monitoring and research programme 2017-2021. Rijkswaterstaat. 69 pp. https://a6481a0e-2fbd-460f-b1df-f8ca1504074a.filesusr.com/ugd/78f0c4_52be3e158cfa467bb5e73bc2625f81dc.pdf

In the US, the North Atlantic Right Whale (NARW) is one of the iconic and endangered species that migrates along the Atlantic Coast. Environmental groups and developers are working together to avoid any potential impacts, particularly during construction. Management proposals involve halting construction during whale passages. More importantly, extensive environmental regulations, including the Marine Mammal Protection Act and the Endangered Species Act, will require that developers comply with these laws. Given the construction season (primarily during the summer and bridge months) and the migratory patterns of NARW and other great whales, the marine mammal of greatest concern is likely to be the Bottlenose Dolphin, which can often be seen from Delaware beaches. Endangered turtles are also a concern along the Atlantic Coast.[42].

Extensive studies were conducted in Europe before offshore wind projects were sited, including ongoing species analysis after construction to understand whether some birds and bats adapt to and/or avoid the turbine structures. "How habitat displacement effects impact individual fitness, reproductive success and survival remains yet unknown, hampering a reliable assessment of the actual and cumulative ecological consequences of extensive offshore wind farm installations.[43]" Bird collisions are difficult to avoid entirely, but are expected to be limited. In the US, state and federal agencies are funding extensive research, including the state-of-the art satellite studies to understand the migratory corridors and species at risk.[44] Decades of studies were funded and voluntary guidelines developed for US land-based wind.[45] But caution is warranted in comparing land-based findings to the offshore wind ocean spaces, due to differences in habitats and species type and behaviors.

In a nutshell, the environmental effects in Europe and the one project in RI are primarily temporal --- displacement of wildlife during construction as the most significant potential effect. The Delaware Bay, being an important stopover point on one of the world's international flyways, would particularly benefit from careful scientific study before and after operation of any offshore wind projects in the bay or within the main flyways within 3 nm of the Atlantic shore. The environmental context must weigh any new activity operating in already threatened ocean spaces against the impacts to wildlife from climate change. Indeed, climate change impacts on bird life have led organizations such as Delaware Audubon to support development of offshore wind power off Delaware's coast. In order to minimize any long term environmental effects, responsible siting up front and scientific monitoring of anticipated risks by the government agencies responsible for environmental compliance will be beneficial.

For further reading beyond the European studies, some of the BOEM environmental studies and research can be found here. The Department of Energy (DOE) and their national laboratories have compiled some reader friendly slides about wind and environmental effects here and a list of references here. Maryland DNR has also funded some environmental studies in and around the lease area, including benthic ecosystems and marine mammal acoustic monitoring.

19. How does the government oversee the developers regarding potential environmental effects?

ANSWER: Environmental impacts are evaluated before permitting the project by the federal lead entity (BOEM), federal wildlife agencies [e.g., US Fish and Wildlife Service (FWS) and the National Marine

[42] Research Framework Workshop: Potential Impacts to Marine Mammals and Sea Turtles from Offshore Wind.

[43] Quote from footnote 33, page 9

[44] See NYSERDA studies here: https://www.nyserda.ny.gov/All-Programs/Programs/Offshore-Wind/Studies-and-Surveys

[45] National average adjusted fatality rates reported in recent peer-reviewed national reviews vary from approximately three to six birds and four to seven bats per MW of installed wind energy capacity per year. The range of reported fatality rates can vary substantially among projects both within and among geographic regions. For example, reported adjusted fatality rates of small passerines vary across avifaunal regions in the U.S. ranging from about 1.2 to 1.4 fatalities per MW per year in northern forests, to 2.6 to 3.8 in the eastern U.S See Erickson,W.P., M.Wolfe, K. J. Bay, D..H. Johnson, and J.L.Gehring (.2014). A comprehensive analysis of small- passerine fatalities from collision with turbines at wind energy facilities. *PLOS ONE* **9:** e107491 as cited in Issues in Ecology: https://www.esa.org/wp-content/uploads/2019/09/Issues-in-Ecology_Fall-2019.pdf

Fisheries Service (NMFS)] and state agencies through the NEPA process and federal CZMA. An environmental evaluation is prepared and there is an extensive list of potential effects and regulatory requirements that must be complied with. Separately, the federal and state agencies are consulted to ensure that the project adequately takes into account and evaluates environmental considerations and will be in compliance with applicable laws and regulations. For review, developers must prepare and submit environmental evaluations, site assessment plans (SAPs) and construction and operation plans (COPs). These documents provide environmental and engineering specifications for any activity on or near the lease. For example, the SAP has been approved for the US Wind Maryland project to conduct environmental surveys to install a meteorological tower (now delayed). See the US Wind SAP here.

20. Is offshore wind harmful to commercial or recreational fishing?

ANSWER: Although fishers are wary of this new industry in ocean spaces, there is no evidence of negative impacts to either commercial or recreational fishers from either peer reviewed scientific studies or from installed offshore wind in Europe to date "Because fishing is either prohibited or strictly limited within most European offshore wind projects, the overall surface area available for fishing is decreasing as offshore wind projects are proliferating. In general, a business-as-usual scenario, comparable to the wider area, was seen in the vicinity of the offshore wind projects in both fishing effort and landings of the top 10 species.[46]"

So far, all US offshore wind developers have stated they will try not to restrict fishing or other vessel passage through their developments, as is true with the already-built Block Island Wind Farm. Nevertheless, commercial fishers and other existing ocean users are concerned about potential impacts on fish populations, ability to navigate through projects and to continue dragging fishing gear through projects, and potential for boat-tower collisions or digging up power lines by trawling. Larger turbines will allow greater distances between turbines that may enhance vessel transit through the wind projects, and may facilitate the use of gear with a larger footprint. Offshore developers are discussing such concerns with fishers, working with fishing liaisons, assessing potential mitigation, and identifying additional information needs[47].

On the other hand, recreational fishers have been mostly positive about offshore wind because of the potential artificial reef effects from the creation of biomass around the turbine foundations in the sea. Artificial reef effects are well-known to recreational fishers as states along the Atlantic have been sinking subway cars and ships offshore to create these reef effects.

21. What is the scope of social or community impacts related to offshore wind projects?

ANSWER: In general, the most significant community effects of wind power along the Atlantic are the potential conflicts with other users of the ocean and the coasts. Since this technology is considered new in the U.S., there is limited experience with wind turbines on the coast and risk perceptions in communities are complex, particularly as they relate to visual effects of large structures in the ocean (see question 22 below). There is evidence in Europe and BIOWF that existing users can co-exist with offshore wind turbines, but more public engagement is needed along with social science studies about the attitudes, preferences and risk perceptions related to the low-carbon electricity transition.

22. How do the turbines affect the view of the ocean?

ANSWER: The view of the turbines will depend on various factors, including the size of the turbine, the weather conditions, the distribution and layout of the turbines, the required markings and lighting and last but not least public perceptions of large structures on the horizon. The Skipjack project location is

[46] Degraer, S., Brabant, R., Rumes, B. & Vigin, L. (eds). 2019. Page 8-9 (same as footnote # 33).

[47] Recently, an organization was formed to represent some of these commercial fishers concerns. See https://rodafisheries.org

beyond the main N-S shipping lane off Delaware. The developer estimates that the turbines will be 17-19 miles from the coast (in terms of distance, Cape May is about 19 miles from the wind turbine adjacent to the University of Delaware's Lewes campus). In clear weather, the Skipjack turbines, like most of the other US projects along the Atlantic, will likely be visible from the beach. In hazy weather, they would most likely not be visible. At night, the safety lights will likely be visible from shore (see new BOEM guidelines here).

23. What is the impact on tourism from these offshore wind projects?

ANSWER: In tourism, there could be a small positive or negative effect. Different people may reach different conclusions about these tradeoffs. Some studies on this topic have been done, as summarized below. A report commissioned by BOEM[48] studied beach tourism at beaches from South Carolina to Cape Cod, Massachusetts, and included individuals who reside in nineteen states (which include non-coastal states such as West Virginia), plus the District of Columbia. Efforts were made to show all respondents how projects would appear at various distances on a clear day, on a hazy day, and at night. The report used 6 MW wind turbines, with 100 meter hub heights and 150 meter rotor diameters. Also they used 8x the rotor diameter as the spacing between wind turbines.

Some people told the analysts that the wind turbines would make their beachgoing experience worse; other's better, with better exceeding worse when wind turbines were about 13-16 miles from shore or further, and vice-versa, closer in. The authors also asked if the survey respondents would have gone to a different beach or done something else if the wind turbines were present during their last beach trip. The authors refer to this as trip loss. At 15 miles, 3% stated they would likely switch beaches and another 3% stated that they would do something else. Irrespective of distance, the authors found a trip gain of about three percent—that is, people who went to another beach but would have switched to a beach with wind turbines. Also, the report found that about 11 percent would take a "curiosity trip" if the turbines were 15 miles offshore—that is, instead of staying at home and reading a book, going duckpin bowling or to a movie with friends, for example, they would go to the beach just to see the wind turbines.

Considering only trip loss and trip gain, the authors found if there were a project located fifteen miles off of Rehoboth Beach, it would essentially be a wash, with estimated welfare effects ranging from a loss of $3M and a gain of $2M.[49] Figure 6 from the BOEM Report is reproduced below so that you can see the extent to which another much-discussed study—the Lutzeyer North Carolina study—is an outlier.[50]

[48] Parsons, G. and Firestone, J., Atlantic Offshore Wind Energy Development: Values and Implications for Recreation and Tourism, OCS Study, BOEM 2018-013 (March 2018).

[49] It is important to note that these are gains and losses of consumer surplus and "are not economic impacts (i.e., the ripple effects through various sectors of the economy due a change in spending).[49]" . Indeed, the authors did not analyze how losses or gains would be felt in the marketplace (so-called "second-order" effects). For example, if there were a loss of consumer surplus, rents might decrease somewhat to attract new visitors, so in turn, visitor attendance might not decrease, so other local businesses might experience only limited effects. But as the authors noted, at BOEM-relevant distances, these "second-order welfare effects are likely to be small relative to the first-order effects" (changes in consumer welfare),[49] which again, the authors found to be at most, quite small, in any event. The effects the authors found are in line with most existing studies.

[50] The report assumes that the NC study is an outlier given very poor quality visuals and the fact that they packed wind turbines into their layouts. Had the BOEM study used their spacing it would have placed 25 wind turbines in the same space that the authors placed 16 wind turbines. The NC sample also was dominated by oceanfront detached homes that rent from between $2,000 and $10,000 per week. More detail on the comparison between the North Carolina study and east coast BOEM study is found in the report.

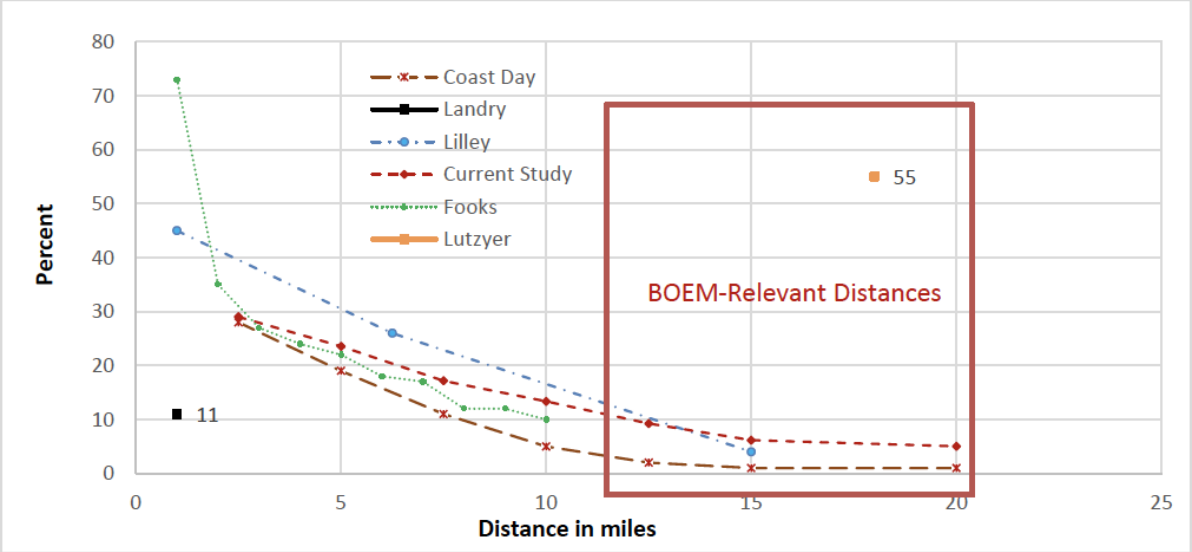


Figure 6. Comparison of Trip-Loss Across Recent Studies

Figure 6 source: Parsons, G. and Firestone, J., Atlantic Offshore Wind Energy Development: Values and Implications for Recreation and Tourism, OCS Study, BOEM 2018-013 (March 2018).

24. What is the evidence of tourism at Block Island offshore wind farm?

ANSWER: At the one actual offshore project installed in the US, local Block Island tourism businesses report there has been a substantial increase in boat tours and fishing near the towers and limited reduction in tourism trips to the island. Recently, there was some news about increased tourism from those wanting to see the turbines up close here: Rhode Island Fast Ferry Inc. recently received up to $30,000 from the Rhode Island Commerce Corporation to expand its offshore wind shuttle services. It appears, in this case, that visiting the offshore wind facility is becoming a tourist destination — at the Port of Quonset and along the East Coast. The grant pays for costs associated with acquiring permits from the Coastal Resources Management Council, the Rhode Island Department of Environmental Management, and the Army Corps of Engineers. Other studies have indicated some potential benefits from these boat tours as well.[51] Finally, a peer reviewed study found increased occupancy and revenues at AirBnb properties during the months of July and August.[52]

25. Apart from the small MD project, what are today's cost of offshore wind?

ANSWER: Because of volume, advances in technology, use of large project sizes, and policies creating a pipeline of projects—recent US power purchase agreements have been very competitive with alternative electricity supply options --- as low as 6.5¢/kWh (Vineyard Wind, MA) and 5.8¢/kWh (Mayflower Wind, MA)—both of those projects lowered consumer costs for electricity, as reported by the Commonwealth of Massachusetts. For comparison, today's wholesale prices are reported for Delmarva Power as 8¢/kWh[53] so a simple analysis would suggest that new wind-powered electricity at 6¢/kWH would lower Delaware's electricity cost. Other US projects have been less price competitive,

[51] In a study of out-of-state beachgoers to Delaware beaches and boardwalks, Lilley et al. 2010, Offshore Wind Energy Development and Coastal Tourism in Delaware: An Examination of Potential Impacts and Opportunities, *Energies 3*, 1-22, found that 44% indicated they were somewhat or very likely to pay to take a boat tour of an offshore wind power project, suggesting there may be economic development opportunities for Ocean City.

[52] Carr-Harris and Lang (2019), Sustainability and tourism: the effect of the United States' first offshore wind farm on the vacation rental market, Resource and Energy Economics,57, 51-67.

[53] This can be seen as the "price to compare" on each Delmarva Power electric bill.

for example, states that required economic development (e.g. steel processing, port construction) to be bundled into the electric price (MD, NJ, NY) and accepted higher power prices refer to footnote 21). The project size, contract terms and competition are important in achieving cost-competitiveness—if the goal is to lower electric rates (as is expected to be achieved with the two projects in MA).

26. How can we balance the total costs and benefits of offshore wind power?

ANSWER: Calculating the costs and benefits of wind energy is complex because of the way analysts define and calculate these terms and the way that subsidies for all energy sources, including fossil fuels and nuclear power, are hidden or revealed[54]. Moreover, we have a limited number of offshore wind contracts approved in the US at this time so there are uncertainties that have yet to be resolved. In environmental terms, analysts may judge that the benefits of a near-zero pollution, zero CO_2, electricity source and saving 7 human lives/year (Buonocore et al 2017) is likely many times greater than the environmental costs (e.g., expected bird mortality and some wildlife displacement during construction and operation). In pure market price per kWh terms, if no credit or value is given to health and climate benefits, the cost of offshore wind power depends on the way in which the state writes the contract (i.e., it can be either greater than or slightly less than the cost of conventional power). If health and environmental benefits and ancillary services to the grid are considered, the overall costs to society are lower regardless of contract terms.[55]

27. Can wind turbines be recycled after their operational use?

ANSWER: Roughly 80% of the turbine blades can be recycled. The only challenge is carbon-based blades. An Electric Power Research Institute study estimates all blade waste through 2050 would equal roughly .015% of all the municipal solid waste going to landfills in 2015 alone.[56] The only offshore wind plant that has been decommissioned was in Denmark – the first installation in the world. See the video here.

[54] For information about subsidies, see, https://www.iea.org/commentaries/fossil-fuel-consumption-subsidies-bounced-back-strongly-in-2018 and here: https://www.eesi.org/papers/view/fact-sheet-fossil-fuel-subsidies-a-closer-look-at-tax-breaks-and-societal-costs#5

[55] To learn about how the electric grid reliability (or ancillary) services are accounted for see: https://www.nrel.gov/docs/fy19osti/72578.pdf

[56] Bloomberg Green Energy. https://www.bloomberg.com/news/features/2020-02-05/wind-turbine-blades-can-t-be-recycled-so-they-re-piling-up-in-landfills?utm_campaign=news&utm_medium=bd&utm_source=applenews