

Offshore Wind — What Britain’s North Sea and the Northeastern Atlantic Have in Common

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Of the most innovative ideas for sources of sustainable energy, wind is historically the most prevalent. Humans have been harnessing the power of wind for more than 2,000 years. Sailors have used wind to propel their boats, ranchers have used it to power water pumps for livestock, and farmers have used it to power windmills to grind grain.

For the past 40 years, wind farms — groups of wind turbines in one location that produce electric power — have been one of the answers for rural America’s electricity needs. In fact the world’s first wind farm consisting of twenty 30kW wind turbines was installed in New Hampshire in 1980. But while onshore wind has proven to be a viable solution inland where there is

enough physical space for the volume needed for them to be effective, when it comes to cities, onshore wind is a solution that has a very limited reach.

The versatility of wind as an energy source is proving itself once again — now with the utilization of offshore wind farms. There are many advantages to offshore wind, but the most appealing to us here at USGRCO is its urban compatibility. Offshore wind developments are located in water rather than on land and can thus be positioned closer to coastal cities. Logistically, that has the potential to simplify many of the transportation and transmission issues that are problematic for onshore wind farms.



Figure 1. Hornsea Project One, North Sea. Reprinted from *Power Technology*, retrieved from <https://www.power-technology.com/projects/hornsea-project-one-north-sea/>.

Hornsea Project One, currently under construction in the North Sea off the coast of England, will be the world’s largest offshore wind farm when it begins official operation in 2020. We look to Great Britain to learn more about the potential of offshore wind and what the success of Hornsea could mean for the future of offshore wind in the United States. We’re spotlighting this particular wind farm not only because of its massive size and impressive scalability but because the date of completion is right around the corner. Offshore wind energy is no longer a concept worth considering for the future. It is already a competitive and compelling solution. Let’s look at three facts about the groundbreaking Hornsea Project One wind farm that piqued our interest.



Figure 2. Hornsea Project One, North Sea Location Map. Reprinted from *OffshoreWind.biz*. <https://www.offshorewind.biz/2016/02/03/video-how-big-is-hornsea-project-one/>.

Far Out and Shallow — Prime Conditions for Offshore Wind

Hornsea Project One, the newest addition to the British wind farm portfolio, is located 75 miles off Britain’s Yorkshire coast. It is expected to produce enough energy to supply a million UK homes with clean electricity by 2020.¹ That means it will generate nearly twice as much power as the Walney Extension, currently the largest offshore wind farm in the world and located in the Irish Sea.

According to scientists, one of the key factors behind Great Britain’s success in harnessing wind energy offshore is the country’s great wind resource and shallow seabed. Jerome Hajjar, professor of civil and environmental engineering at Northeastern University, believes the coastal waters off the US East Coast share similar traits and potential. According to Hajjar, the East Coast has “supreme wind conditions” in shallow as well as deep water.² According to an article by Molly Callahan of Northeastern University, “Massachusetts in particular, which has shallow water further from the coast than other states, is prime real estate for ocean wind turbines.”³

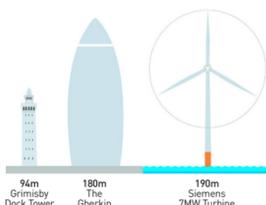


Figure 3. How big is Hornsea Project 1. Reprinted from *OffshoreWind.biz*. <https://www.offshorewind.biz/2016/02/03/video-how-big-is-hornsea-project-one/>.

Partnering Doesn’t Always Mean Selling Out

There is a sheer magnitude and impressive height to the turbines and mastery of technical ingenuity that will allow Hornsea Project One to operate so far out at sea. We are especially impressed with the way Great Britain has managed to find a balance between partnering with outside developers who have the expertise to accomplish the task and ensuring that as many jobs as possible are carried out domestically. A web of UK-based suppliers is responsible for building the turbines, towers, and structures that connect the foundation to the towers. It is estimated that roughly half of the components for the massive project are locally sourced.⁴ Since job loss is a huge concern for Americans, the prospect of partnering this way makes the possibility of offshore wind energy an increasingly popular and plausible source of energy.

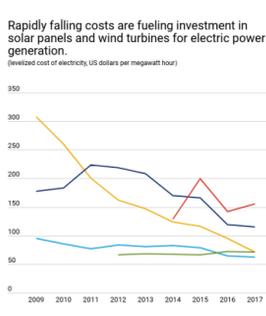


Figure 4. Cheaper power. Reprinted from *IMFBlog*. <https://blogs.imf.org/2019/04/26/falling-costs-make-wind-solar-more-affordable/>.

The Ability to Generate Offshore Wind at Scale Is Key

Major European oil companies are feeling the pressure to publicly demonstrate their willingness to actively align with international efforts to reduce carbon emissions. With the levelized cost of energy for offshore wind power falling 24 percent,⁵ investing in offshore wind is an excellent way for them to do so. Recognizing this, the Crown Estate, which operates the royal family’s property portfolio, has announced its first major auction of offshore wind farm leases in a decade.⁶ In the United States, state governments are proving that they are fully aware of the potential that competition will have on the long-term success of offshore wind by implementing auction processes for the award of state financial incentives.



Figure 5. About Ocean Wind. Reprinted from *OffshoreWind.biz*. <https://www.offshorewind.biz/2019/02/03/video-how-big-is-hornsea-project-one/>.

From Sea to Shining Sea — The Future of Offshore Wind in the US

In a 2018 report on wind energy,⁷ the UK’s offshore wind-generating capacity was measured at 8.2 gigawatts. At that time, the US’s first operational wind farm, Block Island, off the coast of Rhode Island, was generating a modest 0.03 gigawatts. But while the US may be a bit late to the offshore wind party, the benefits of this potent energy source are clearly recognized today. According to the Department of Energy,

“Offshore wind has the potential to generate more than 2,000 GW of capacity per year, nearly double the nation’s current electricity use. Even if only 1% of that potential is captured, nearly 6.5 million homes could be powered by offshore wind energy within the next decade.”

Two examples of Offshore windfarms that are currently underworks stateside are **Ørsted’s Ocean Wind**, and **Equinor’s Empire Wind**. Ocean Wind, located 15 miles off the coast of southern New Jersey is expected to be completed by 2024 and promises to supply enough energy to power 500,000 homes. Empire Wind, located 20 miles south of Long Island has, according to the company, the capacity necessary to produce up to 2,000 megawatts of electricity, enough to power more than 1 million homes.

As we look to transition the current grid towards a decarbonized one, offshore wind is shaping up to look like a very real and exciting part of the solution. As with any innovation, pushing the limit of what is possible also means inevitable compromise and sacrifice which we will continue to explore as well.

In our next offshore wind piece, we will explore the newest advances in offshore wind here at home and continue to shine a light on ways this clean and exciting source of energy will help lead the way for cities’ energy futures.

¹ H. Ziad (Oct. 11, 2019). The world’s largest offshore wind farm is nearly complete. It can power 1 million homes. *CNN Business*. <https://edition.cnn.com/2019/09/25/business/worlds-largest-wind-farm/index.html>.

² M. Callahan. (March 20, 2019). Why aren’t energy companies capitalizing on ‘the Saudi Arabia of offshore wind’? *News@Northeastern*. <https://news.northeastern.edu/2019/03/20/he-us-is-on-the-cusp-of-an-offshore-wind-energy-boom-why-arent-energy-companies-capitalizing-on-the-saudi-arabia-of-offshore-wind/>.

³ Ibid.

⁴ A. Vaughan. (Feb. 11, 2019). Biggest offshore windfarm to start UK supply this week. *The Guardian*. <https://www.theguardian.com/environment/2019/feb/11/biggest-offshore-windfarm-to-start-uk-supply-this-week>.

⁵ D. Broom. (May 7, 2019). The cost of generating renewable energy has fallen – a lot. *World Economic Forum*. <https://www.weforum.org/agenda/2019/05/this-is-how-much-renewable-energy-prices-have-fallen/>.

⁶ J. Garside, and J. Ambrose. (July 17, 2019). Offshore wind auction could raise millions for Queen. *The Guardian*. <https://www.theguardian.com/environment/2019/jul/17/offshore-wind-auction-could-raise-millions-for-queen>.

⁷ Offshore wind in Europe – key trends and statistics 2019. (June 2, 2020). *Wind Europe*. <https://windeurope.org/about-wind/statistics/offshore/>.

⁸ US has only one offshore wind energy farm, but a \$70 billion market is on the way. (Dec. 13, 2019). *CNBC, Business News: Powering the Future*. <https://www.cnbc.com/2019/12/13/us-has-only-one-offshore-wind-farm-but-thats-about-to-change.html>