LAUTEC

Vessel Logistics for US Offshore Wind

Written by Nick Zenkin, Research & Development Manager
nze@lautec.com

US Offshore Wind Summary

With the Biden Administration's recently announced plans of installing 30GW of offshore wind capacity by 2030, the US offshore wind (OSW) market will be experiencing significant growth over the coming decade. With some reports projecting the United States' OSW market to be $70 billion by 2030[1], there is a massive opportunity for OSW to play an important role in the United States' clean energy economy.

One of the setbacks that the US OSW industry has faced in previous years is the delays in the federal permitting process. There are currently 11 Construction & Operation Plans under review by the Bureau of Ocean and Energy Management (BOEM).[2] However, the Biden Administration has announced its intentions of speeding up the federal process, and with BOEM's recent completion of its Final Environmental Impact Statement (FEIS)[3] for the Vineyard Wind I project and commitment to start the environmental review for the Ocean Wind project, signs are pointing in the right direction for progress.

Vessels Play a Big Role

One of the key elements of success for an OSW development is the successful deployment of vessels during the lifespan of the project. In the United States' one of the main constraints on vessel decision making is the 1920 Jones Act, which requires goods shipped between two US points to be transported on vessels that are built, operated, and owned by US permanent residents[4].

While there was some discussion on if OSW projects would receive an exemption to the Act, this speculation was put to rest in January of this year when Section 9503 of the National Defence Authorization Act for Fiscal Year 2021[5] was passed. This decision to commit to the Jones Act has left OSW developers with some important and costly decisions to make in regard to the vessels they plan on using for their projects.

Vessels, Vessels, and More Vessels

Unsurprisingly, OSW projects require a lot of vessels. Most projects on the US East Coast are projected to utilize more than twenty vessels, with some estimates being closer to fifty.[6]

---

[1] Stephanie A McClellan, "Supply Chain Contracting Forecast for U.S. Offshore Wind Power" (Special Initiative of Offshore Wind, 2019), pp. 6-32.
[2] "2021 U.S. Offshore Wind Market Report and Insights"(Business Network of Offshore Wind, 2021), pp. 1-2.
[3] "Vineyard Wind," Bureau of Ocean Energy Management, 2021, https://www.boem.gov/vineyard-wind.
[4] Keiron Greenhalgh, "Jones Act Quandary Fails to Slow US Offshore Wind Momentum," IHS Markit, January 14, 2021, https://ihsmarkit.com/research-analysis/jones-act-quandary-fails-to-slow-us-offshore-wind-momentum.html.
[5] Keiron Greenhalgh, "Jones Act Quandary Fails to Slow US Offshore Wind Momentum," IHS Markit, January 14, 2021, https://ihsmarkit.com/research-analysis/jones-act-quandary-fails-to-slow-us-offshore-wind-momentum.html.
[6] Justine Calma, "The US Offshore Wind Boom Will Depend on These Ships," The Verge (The Verge, February 23, 2021), https://www.theverge.com/22296979/us-offshore-ships-wind-boom-installation-vessels.

While the wind turbine installation vessels (WTIVs) are pivotal elements of successful development, many different types of vessels are required for a project's success. Including, but not limited to:

- Feeder barges
- Installation
- Tugboats
- Service Operation Vessel (SOV)
- Cable installation
- Survey
- Crew Transfer (CTV)
- Supply
- Heavy Lift & Jack-up
- Spotter
- Inspection

Although the US has an existing fleet of vessels from the oil and gas sectors that can handle some aspects of an OSW project, many vessels are being, and will continue to be, constructed to handle the increasing demand for OSW.[7]

So, How Are We Going to Build Them?

While the Jones Act's constraints impact all vessels on an OSW project, it perhaps has the greatest impact on the wind turbine installation vessels (WTIVs). As shown in Figure 1, there are four likely scenarios to how OSW development in the US will occur.

1) *The European Model:* With Europe being the birthplace of OSW, many new markets have used their experience to model their own developmental process. In terms of construction, this means the reliance on large jack-up vessels, which need to be used during construction. However, there are currently no US-flagged jack-up vessels that are capable of handling the scope of current OSW projects.[8]

2) *1st Generation US Model:* Due to the mentioned restrictions on the availability of the jack-up vessels, early US offshore wind development plans to rely on a new installation methodology. This methodology utilizes a combination of both EU jack-up vessels and US feeder barges during construction.

3) *US adapts EU Model:* One solution to mitigating the Jones Act constraints is to construct Jones Act compliant jack-up vessels in the US. This solution is the path that Dominion Energy has chosen to pursue, as they have announced the beginning of construction of their "Charybdis." The Charybdis will be one of the largest jack-up vessels in the world and is estimated to cost over $500 million.[9]

[7] Eric Haun, "You're Going to Need a Bigger Fleet," Main E-mag page (New Wave Media, February 2021), https://www.maritimemagazines.com/marine-news/202102/youre-going-to-need-a-bigger-fleet.
[8] Eric Haun, "You're Going to Need a Bigger Fleet," Main E-mag page (New Wave Media, February 2021), https://www.maritimemagazines.com/marine-news/202102/youre-going-to-need-a-bigger-fleet/.
[9] Rich Griset, "Dominion Announces Construction Has Begun on Offshore Wind Vessel," Virginia Business, December 18, 2020, https://www.virginiabusiness.com/article/dominion-announces-construction-has-begun-on-offshore-wind-vessel/.

4) *The Floating Model*: While there are currently no major floating projects in the US, it is projected that floating OSW will be the majority of OSW development on the US West Coast. During a floating project, floating foundations and platforms are towed out to the desired location. This system eliminates the need for large jack-up vessels and instead relies more heavily on tugboats[10]

Figure 1

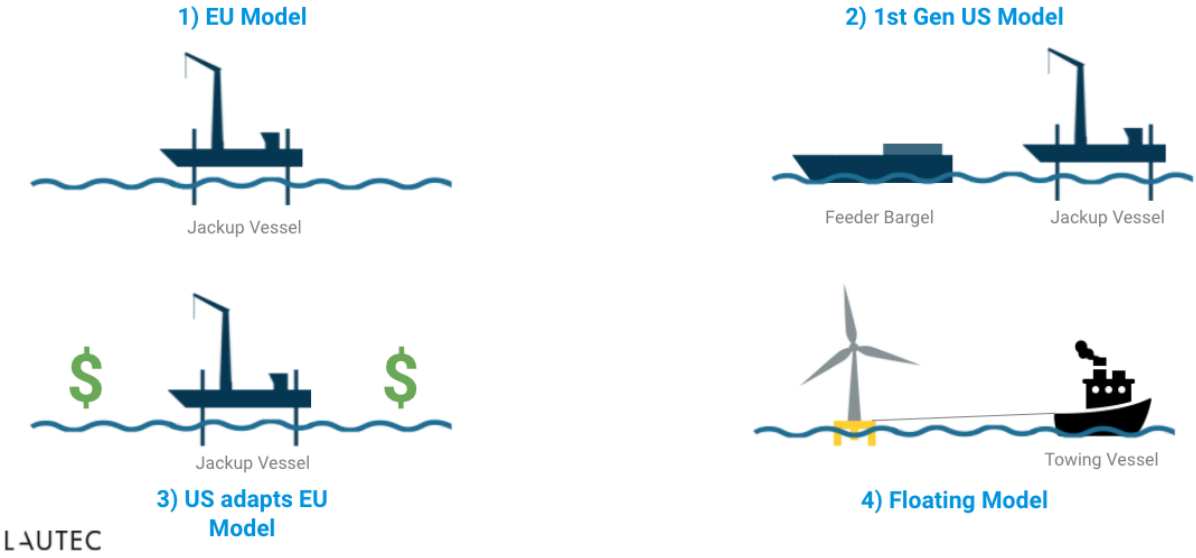

Figure 1 shows the varying installation methodologies that can be used on an OSW project. While most projects will utilize a jack-up vessel to some extent, floating projects rely more on towing vessels.

In order to make the smart decisions on vessels during an OSW project, a lot goes into understanding the constraints and benefits of a certain project. Two key factors that go into determining a project's vessel logistics are the turbine size and foundation, alongside the location of the project.

They Keep Getting Bigger!

Both a turbine's size and its respective foundation play a major role in what vessels are used in an offshore wind project. Many US developers have begun committing to different turbine designs, such as the GE Haliade-X, which are larger (12-14MW) than any turbines ever before utilized for an OSW project.[11] These larger turbines offer developers a new set of challenges in regard to vessel selection, as not many vessels are currently capable of carrying structures that large.[12] As turbine sizes are expected

[10] Zhiyu Jiang, "Installation of Offshore Wind Turbines: A Technical Review," Renewable and Sustainable Energy Reviews 139 (January 27, 2021), https://doi.org/https://doi.org/10.1016/j.rser.2020.110576.
[11] Sam Worley, "Big Win(d): GE's Powerful Haliade-X Offshore Wind Turbine Gets A Major U.S. Customer," GE News, December 3, 2020, https://www.ge.com/news/reports/big-wind-ges-powerful-haliade-x-offshore-wind-turbine-gets-a-major-us-customer.
[12] Justine Calma, "The US Offshore Wind Boom Will Depend on These Ships," The Verge (The Verge, February 23, 2021), https://www.theverge.com/22296979/us-offshore-ships-wind-boom-installation-vessels.

to rise, with 15MW turbines expected to be launched in the near future, vessels are going to need to get larger to accommodate this exciting growth.[13]
Turbine foundation type is also an important factor to consider when developers are choosing their installation fleet. While there are many types of foundations proposed for OSW, the most common tend to be either monopile, gravity base, jacket, or floating (as seen in Figure 2).

Monopiles, which are the most common type of foundation found in OSW projects, require incredibly large vessels for installation as they must be pile-driven into the seabed. There are several areas, however, on the US Coast that monopiles are not feasible foundations due to extreme water depth. These areas include the Gulf of Maine, the US Pacific Coast, and the areas around Hawaii. For these areas, floating foundations will likely be utilized.

Since floating foundations are anchored to the sea floor, rather than pile-driven, these projects may not require as large of vessels as a project with monopile foundations might need.[14] Instead, floating projects rely heavily on towing vessels that bring platforms to a site location.[15]

Figure 2

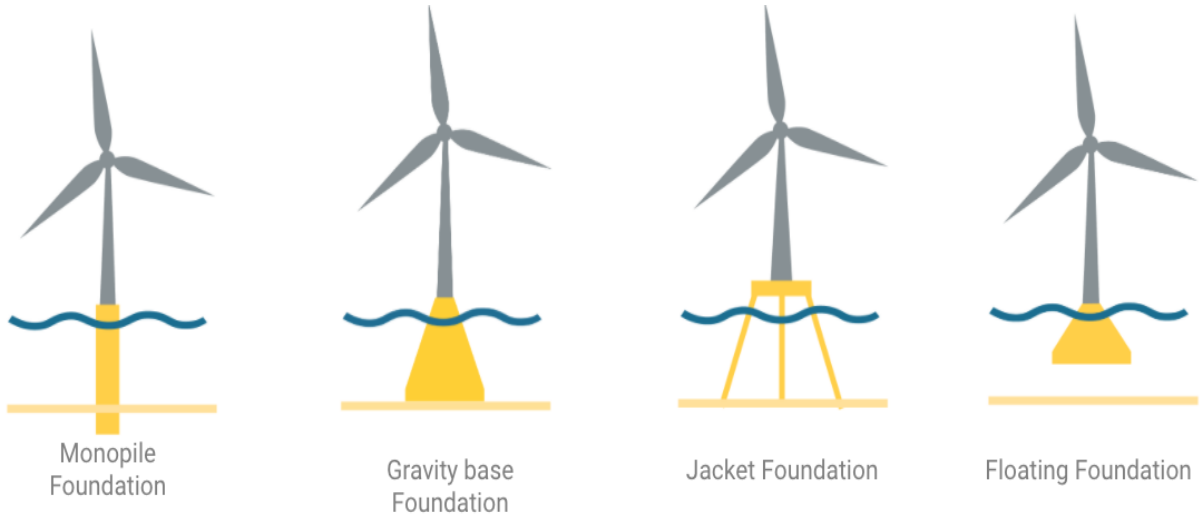

Figure 2 showcases the four most common types of foundations utilized on OSW projects. Currently, in the United States, most OSW projects are planned to be installed with monopile foundations.

Location, Location, Location!

Perhaps no factor contributes larger to a project's vessel logistics than the project's location. Every project has different supply chain constraints, environmental restrictions, and workforce, which all play a major factor in deciding where a project should be built and what vessels will be used.

[13] Justine Calma, "The US Offshore Wind Boom Will Depend on These Ships," The Verge (The Verge, February 23, 2021), https://www.theverge.com/22296979/us-offshore-ships-wind-boom-installation-vessels .
[14] Zhiyu Jiang, "Installation of Offshore Wind Turbines: A Technical Review," Renewable and Sustainable Energy Reviews 139 (January 27, 2021), https://doi.org/https://doi.org/10.1016/j.rser.2020.110576.
[15] Zhiyu Jiang, "Installation of Offshore Wind Turbines: A Technical Review," Renewable and Sustainable Energy Reviews 139 (January 27, 2021), https://doi.org/https://doi.org/10.1016/j.rser.2020.110576.

Port selection is an important piece of this process, as a port's design can significantly impact which vessels are optimally suited. Factors such as a port's water depth, bridge clearance heights, proximity to projects, and hurricane barriers all impact what vessels are used on a project.

A location's weather is a critical element to planning vessel logistics. Criteria like wind speed, wave height, tidal velocity, water depth, and seafloor type, etc. all factor into how a developer decides what installation methods they will utilize during construction. For example, understanding wave height, period and direction is used to determine vessel placement during construction, which can be an extremely complicated process. It is also critical for project developers to understand the extent of weather downtime, (i.e. how long a vessel must wait due to adverse weather), and how that will impact a project's overall schedule.

As seen in Figure 3, weather patterns often vary in different locations, which in turn impact when and how a project is constructed.

Figure 3

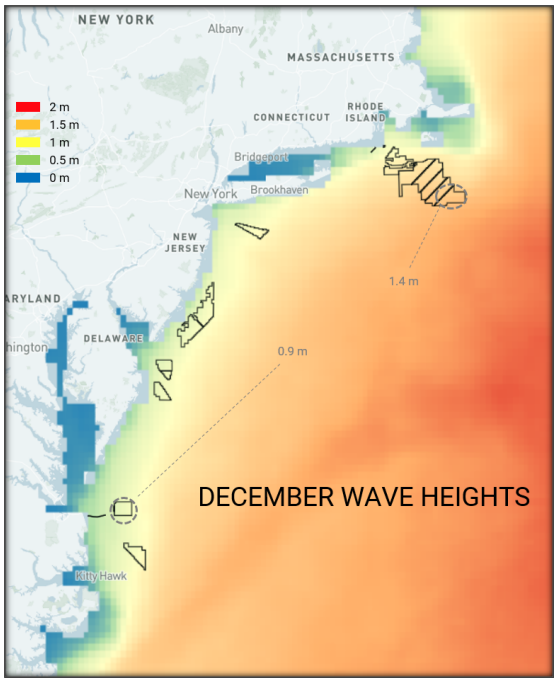

Figure 3 shows the average wave heights on the US East Coast during December 2020.
As shown, different lease areas experience differing wave heights during the same month.

The OSW industry is entering a defining moment in the United States. As states are continuing to escalate their OSW targets every year, we must continue to research and develop our nation's vessel fleet to accommodate this exciting and impressive growth.

About LAUTEC

LAUTEC is a project management consultancy and software provider for the renewable energy sector.

As a company, we want to make the daily work in the industry easier and smarter for everyone. That's why we provide specialist consulting and intelligent software for the realization of renewable energy.

With diverse backgrounds and a never-ending passion for large-scale wind, our specialists support EPCI projects worldwide. Coming with expertise through years of experience, LAUTEC has provided consulting and software for most of the large offshore wind developers as well as for onshore wind projects.

For more information, visit www.lautec.com.