

# Offshore Wind Vessel Needs


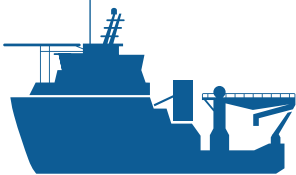
Over 25 different types of vessels are expected to be used to construct, operate, and maintain an offshore wind project. Multiple vessels will be needed for each offshore wind project, but the exact number and types will be dependent on project size, distance from shore, environmental conditions, and other factors. The majority of these vessels will be coastwise qualified (i.e. U.S.-flagged vessels with American crews that are built in the U.S).

The chart on the following pages describes the different types of vessels projected to be needed during the different offshore wind project stages, including Surveying, Cable Lay, Component Transfer, Turbine Installation, Development, Construction, Decommissioning, and Operations and Maintenance (O&M). The first two vessels, Service Operation Vessels (SOVs) and Crew Transfer Vessels (CTVs) will be the workhorses of the industry. These vessels will be coastwise qualified vessels, used across the lifetime of the project in both the construction and O&M phases. The remainder of the chart covers the large variety of vessels that could be used during 2-3 year construction and surveying stages, many of which will be coastwise qualified. The number of coastwise qualified vessels used during construction will grow as factories and supply chains are built in the U.S. The number of vessels estimated for each class of vessels (each row) is for an average U.S. 800 MW offshore wind project. However, vessel spreads will vary greatly between projects depending on the most successful installation techniques, distance from shore, the rate of construction of the domestic supply chain, and other factors. As the U.S. offshore wind industry goes from 42 MW to 30,000 MW by 2030, the industry will hire hundreds of U.S.-flagged vessels and thousands of American mariners.

Deploying 30 GW of offshore wind by 2030 means shipbuilding opportunities for the U.S.-flagged fleet and jobs for American mariners.

# Project Lifetime Vessels

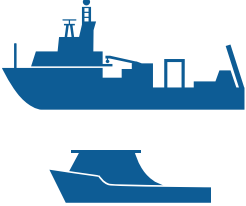


These vessels are used daily throughout the 35 year lifetime of the project including both construction and operations & maintenance.

Project Stages	Type	What activities will the vessel conduct?
<p><b>Project Lifetime</b></p>	 <p><b>Crew Transfer Vessel (CTV)</b></p> <p>During Construction: 1-4 vessels During O&amp;M: 0-3 vessels</p>	<p>Transfers personnel and light equipment in support of construction and operations. Construction: During construction, both the developer and turbine manufacturer are likely to hire 2 CTVs respectively.</p> <p>O&amp;M: For nearshore projects (less than ~1.5 hours from port) CTVs will be primary for O&amp;M; further offshore projects will use SOVs.</p>
<p><b>Project Lifetime</b></p>	 <p><b>Service Operation Vessel (SOV)/ Walk to Work (W2W)/ Commissioning Support vessel</b></p> <p>During Construction: 0-2 vessels During O&amp;M: 0-3 vessels</p>	<p>A Dynamic Positioning (DP2) vessel with motion compensated gangway allowing turbine technicians to “walk to work” directly from the vessel to the turbine. The use of these vessels vs CTVs depends mostly on distance of the project from shore. Most, but not all, projects will utilize SOVs.</p> <p>Construction: Used for assisting with wind turbine installation and commissioning (bringing turbine and cables online). Developers and turbine manufacturers are likely to hire one SOV each.</p> <p>O&amp;M: wind turbine servicing and operation.</p>









# Construction Vessels

These vessels will be used during the approximately 2-3 years of surveying and construction of offshore wind projects.








Project Stages	Type	What activities will the vessel conduct?
1 Surveying	 2-4 Vessels	<b>Environmental Survey</b> Conducts fisheries and benthic surveys on export cable routes and in the Lease Area. And Places LIDAR buoys for various environmental assessments. A variety of vessels do this work, nearshore work tends to be smaller vessels; offshore work utilizes larger vessels.
	 1-6 Vessels	<b>Geotechnical Survey</b> Physically samples & tests seabed characteristics to optimally place turbines and cables, typically by conducting borings or sampling to specific depths below the mean seabed.
	 1-6 Vessels	<b>Geophysical Survey</b> Acoustically maps seabed features, surface and sub surface, to determine Export Cable Routes and within the Lease Area. Detects and charts unexploded ordnances (UXO).





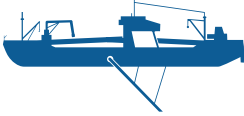




## Construction Vessels

Project Stages	Type	What activities will the vessel conduct?
<p style="font-size: 48pt; font-weight: bold; text-align: center;">2</p> <p style="font-size: 24pt; font-weight: bold; text-align: center;">Cable Laying</p> <p>(continued on next page)</p>	 1-2 Vessels	<b>Export Cable Laying Vessel</b> Large, specialist cable installation vessel equipped with 1-2 high capacity (+ 6,000 T, large diameter) carousels capable of reeling long lengths of large diameter export cables, exporting from cable manufacturing facility and installation on wind farm site. Typically a Dynamic Positioning vessel for installation in water depths >10m. Potential to include cable burial spread.  Physically samples & tests seabed characteristics to optimally place turbines and cables, typically by conducting borings or sampling to specific depths below the mean seabed.
	 1-2 Vessels	<b>Shallow Water Export Cable Lay Vessel</b> Flat bottomed vessel / barge equipped with medium to large carousel(s) and anchor handling spreads for cable installation in water depths ranging from 0m (beached) to approximately 10m. Cable installation from cable landing site / Horizontal Directional Drilling (HDD) exit to water depths for typical DP vessel. Potential to include cable burial spread.
	 1-2 Vessels	<b>Nearshore Export Cable Landing Support Barge</b> Landfall and nearshore support works, support for Horizontal Directional Drilling (HDD) and landfall pull-in operation of export cable.
	 2-6 Vessels	<b>Export and Array Cable Support Vessels</b> A variety of ancillary cable installation support vessels will be used during construction: cable jointing/splicing cables, multicat shallow water anchor handling, spud leg pontoon, liftboat/ jack up for shallow water ops, Pre-lay Grapel Run (PLGR) vessel, and fisheries support vessels. During O&M, these vessels will be used for cable subsea inspection and repairs.
	 1-2 Vessels	<b>Cable Crossing Construction Vessel</b> Crane vessels for installation of cable protection structures (matresses, rock bags, grout bags) in a range of water depths from nearshore (shallow) to offshore wind farm site (deepwater).
	 1-3 Vessels	<b>Array Cable Laying Vessel (CLV)</b> Cable installation between turbines and from turbines to offshore substation. Typically installed with crew transfer facilities and cable pull in equipment for cable installation in to each turbine. Potential to include cable burial spread.

# Construction Vessels

Project Stages		Type	What activities will the vessel conduct?
<p style="font-size: 48px; text-align: center;">2</p> <p><b>Cable Laying</b> (continued)</p>	  2-6 Vessels	<p><b>Anchor Handling Vessels</b></p>	<p>Used to support multi anchor cable installation barge. Cable installation barges can have 8-12 anchors in shallow water.</p>
	 1-2 Vessels	<p><b>Cable Trenching Vessel</b></p>	<p>Creates trench in seafloor in which to lay cable. Nearshore (shallow water) or offshore (deepwater) vessel equipped with cable pre or post lay burial tool, typically A-Frame launched seabed trencher - ROV Jetter / Cutter, Cable plow, Jetting sled. Potential to require bollard pull (cable plow).</p>
<p style="font-size: 48px; text-align: center;">3</p> <p><b>Development, Construction, &amp; Decommissioning</b> (continued on next page)</p>	 1-2 Vessels	<p><b>Floating Heavy Lift Foundation Vessel</b></p>	<p>Utilized in substation, transition piece, and foundation installation, including pile driving. Most are floating, but sometimes a jack up vessel is used.</p>
	 1-2 Vessels	<p><b>Wind Turbine Installation Vessel</b></p>	<p>During construction, utilized in turbine installation. During O&amp;M, utilized for main component exchange, such as replacing nacelles, generators, gear boxes. If not Coastwise- qualified, paired with feeding spread.</p>
	  2-3 Vessels	<p><b>Feeder Spread: Barges and Ocean Going Tugs</b></p>	<p>Feeder spreads are a newer installation concept in the offshore wind industry. Feeder barges supply components to installation vessels from port in compliance with the Jones Act. Feeder spreads are likely to vary depending on the experience of the initial U.S. projects. Feeder spreads include coastwise concepts such as: towed barges, self-propelled vessels, or ultra large lift boats. The number of vessels depends on the feeding concept and the number of WTIVs. A towed barge spread would likely include large deck barges with motion compensation systems, offshore tugs for station keeping, transit tugs towing barges from port to offshore locations, and port tugs for marshalling/port movements. Zero feeding spreads are required with a coastwise-qualified WTIV. Feeding is for installation and not transportation between ports. (See the row on the next page for supply chain transportation.)</p>

## Construction Vessels

Project Stages	Type	What activities will the vessel conduct?
<p><b>3</b></p> <p><b>Development, Construction, &amp; Decommissioning</b></p> <p>(continued)</p>	 2-3 Vessels	<b>Supply chain transportation</b> Coastwise qualified vessels will be required to move components between US manufacturing sites and marshalling areas.
	 1-2 Vessels	<b>Rock Dumping/Scour Protection Vessel</b> Installs protective rock for seabed infrastructure (such as cables and foundations). Utilized in multiple phases: site preparation, scour rock around monopile, application of rock scour on top of cables, etc.
	 2-4 Vessels	<b>Dredging Vessels</b> Levels/lowers seafloor to prepare for construction of cables and turbines. Dredging vessels include Trailing Suction Hoppers, Cutter Suction Hoppers, and Grab Hoppers.
	 1-4 Vessels	<b>Safety/Scout Vessel</b> During Surveying and Construction: Ensures operational safety with ongoing marine traffic, looks out for fixed fishing gear, and interfaces with fishing vessels.
	 1 Vessel	<b>Noise Mitigation Vessel</b> Creates a bubble curtain to mitigate noise from pile driving.
	 0-2 Vessels	<b>Accommodation Vessel</b> Houses turbine technicians and other crew during favorable weather windows, such as the summer months.
	 5-25 Vessels	<b>Construction Support Vessel</b> Carries fuel, supplies, and other support equipment to construction vessels.