United States Government Accountability Office

Report to Congressional Committees

December 2020

OFFSHORE WIND ENERGY

Planned Projects May Lead to Construction of New Vessels in the U.S., but Industry Has Made Few Decisions amid Uncertainties

GAO-21-153

GAO Highlights

Highlights of GAO-21-153, a report to congressional committees

December 2020

OFFSHORE WIND ENERGY

Planned Projects May Lead to Construction of New Vessels in the U.S., but Industry Has Made Few Decisions amid Uncertainties

Why GAO Did This Study

Offshore wind, a significant potential source of energy in the United States, requires a number of oceangoing vessels for installation and other tasks. Depending on the use, these vessels may need to comply with the Jones Act. Because Jones Act-compliant vessels are generally more expensive to build and operate than foreign-flag vessels, using such vessels may increase the costs of offshore wind projects. Building such vessels may also lead to some economic benefits for the maritime industry. A provision was included in statute for GAO to review offshore wind vessels.

This report examines (1) approaches to use of vessels that developers are considering for offshore wind, consistent with Jones Act requirements, and the extent to which such vessels exist, and (2) the challenges industry stakeholders have identified associated with constructing and using such vessels to support U.S. offshore wind, and the actions federal agencies have taken to address these challenges.

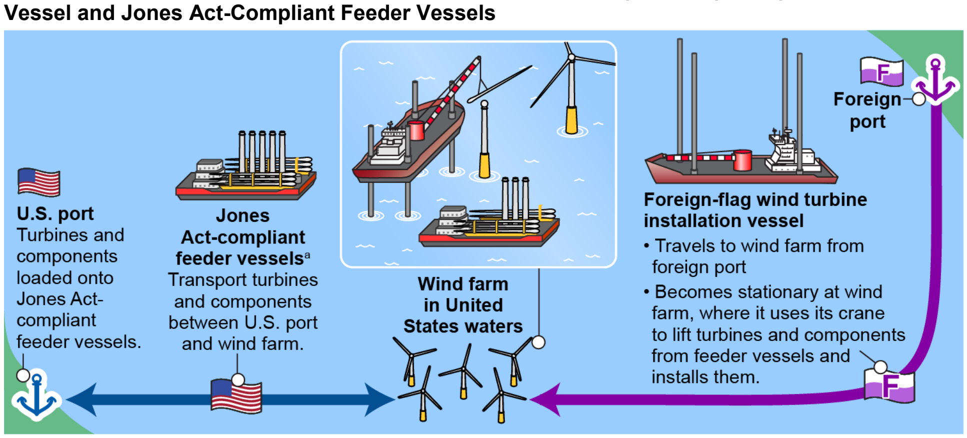
GAO analyzed information on vessels that could support offshore wind, reviewed relevant laws and studies, and interviewed officials from federal agencies and industry stakeholders selected based on their involvement in ongoing projects and recommendations from others.

View GAO-21-153. For more information, contact Andrew Von Ah at (202) 512-2834 or vonaha@gao.gov.

What GAO Found

Under the Jones Act, vessels carrying merchandise between two points in the U.S. must be built and registered in the United States. Developers are planning a number of offshore wind projects along the U.S. east coast, where many states have set targets for offshore wind energy production. Stakeholders described two approaches to using vessels to install offshore wind energy projects in the U.S. Either approach may lead to the construction of new vessels that comply with the Jones Act. Under one approach, a Jones Act-compliant wind turbine installation vessel (WTIV) would carry components from a U.S. port to the site and also install the turbines. WTIVs have a large deck, legs that allow the vessel to lift out of the water, and a tall crane to lift and place turbines. Stakeholders told GAO there are currently no Jones Act-compliant vessels capable of serving as a WTIV. One company, however, has announced a plan to build one. Under the second approach, a foreign-flag WTIV would install the turbines with components carried to the site from U.S. ports by Jones Act-compliant feeder vessels (see figure). While some potential feeder vessels exist, stakeholders said larger ones would probably need to be built to handle the large turbines developers would likely use.

Example of an Offshore Wind Installation in U.S. Waters Using a Foreign-Flag Installation Vessel and Jones Act-Compliant Feeder Vessels



Source: GAO. | GAO-21-153

Stakeholders identified multiple challenges—which some federal programs address—associated with constructing and using Jones Act-compliant vessels for offshore wind installations. For example, stakeholders said that obtaining investments in Jones Act-compliant WTIVs—which may cost up to $500 million—has been challenging, in part due to uncertainty about the timing of federal approval for projects. According to officials at the Department of the Interior, which is responsible for approving offshore wind projects, the Department plans to issue a decision on the nation's first large-scale offshore wind project in December 2020. Some stakeholders said that if this project is approved, investors may be more willing to move forward with vessel investments. While stakeholders also said port infrastructure limitations could pose challenges to using Jones Act-compliant vessels for offshore wind, offshore wind developers and state agencies have committed to make port investments.

Contents

Abbreviations

BOEM	Bureau of Ocean Energy Management
CBP	U.S. Customs and Border Protection
COP	Constructions and Operations Plan
MARAD	Maritime Administration
MW	megawatt
SAP	Site Assessment Plan
WTIV	wind turbine installation vessel

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
441 G St. N.W.
Washington, DC 20548

December 8, 2020

The Honorable Roger Wicker
Chairman
The Honorable Maria Cantwell
Ranking Member
Committee on Commerce, Science, and Transportation
United States Senate

The Honorable Lisa Murkowski
Chairman
The Honorable Joe Manchin
Ranking Member
Committee on Energy and Natural Resources
United States Senate

The Honorable Peter A. DeFazio
Chairman
The Honorable Sam Graves
Ranking Member
Committee on Transportation and Infrastructure
House of Representatives

Offshore wind has the potential to be a significant source of energy for the United States. As of September 2020, only one small offshore wind project was operational in the United States and one small demonstration project was nearing completion. However, the federal government had issued leases for offshore wind projects along the east coast that could power millions of homes, and developers had submitted plans for the construction and operation of 10 projects to the Department of the Interior's Bureau of Ocean Energy Management (BOEM)—the federal agency responsible for permitting offshore wind—for approval. Developing and maintaining offshore wind projects requires the use of several types of oceangoing vessels. Some vessels are large and complex and, in the developed European offshore wind market, have typically been purpose built specifically for offshore wind projects. For example, because of the size, weight, and dimensions of wind turbines, offshore wind developers have typically used large, purpose-built "jack-up lift vessels"—which have a large crane and legs that can be lowered to the ocean floor so that the vessel can be lifted out of the water— to lift and accurately set into place turbine components during installation.

The Jones Act generally requires that vessels carrying merchandise between any two points in the United States be owned and crewed by U.S. citizens, registered under the U.S. flag, and built in the United States.[1] The extent to which Jones Act-compliant vessels must be used to carry equipment between U.S. ports and offshore wind sites therefore depends, in part, on whether an offshore wind turbine is considered a point in the United States. While many in the offshore wind industry consider an offshore wind turbine to be a point in the territorial waters of the United States for purposes of the Jones Act, the U.S. Customs and Border Protection (CBP)—the federal agency responsible for determining what activities fall under the Jones Act—has not made such a determination.[2] CBP issues rulings on the application of the Jones Act in response to requests from industry. As of October 7, 2020, there were some requests related to offshore wind development pending before CBP, but the agency had issued only one ruling regarding the use of vessels to install offshore wind turbines.[3] According to CBP, the agency expects to address the issue of whether an offshore wind turbine is a point in the United States under the Jones Act in these pending ruling requests.

For most offshore wind projects in Europe, an installation vessel carries turbines from a European port to the offshore wind project site, where the vessel installs them. However, some industry stakeholders have reported that this approach may not currently be an option in the United States, due to the lack of purpose-built wind turbine installation vessels (WTIV) built in the United States and an expectation that vessels going back and forth from a U.S. port to a U.S. offshore wind site would need to be Jones Act-compliant. Using Jones Act-compliant vessels for offshore wind

[1] Section 27 of the Merchant Marine Act of 1920, Pub. L. No. 66-261, 41 Stat. 988, 999 (1920) (codified as amended at 46 U.S.C. § 55102). Vessels that meet these requirements are referred to in this report as "Jones Act–compliant."

[2] 19 C.F.R. § 177.1(a)(1). CBP may make determinations on the applicability of the Jones Act to an activity at the request of a party engaging in activities that may be subject to such laws. Such rulings by CBP can only be applied to other projects with identical circumstances as the one in the ruling.

[3] In 2011, CBP responded to a ruling request regarding the use of vessels to install wind turbines for the first offshore wind project in the United States, the Block Island project in Rhode Island. The developers for this project requested that CBP rule on their plan to transport turbines from a U.S. port to the offshore project site using Jones Act–compliant vessels, where the turbines would then be installed by a foreign-flag wind turbine installation vessel. CBP ruled that this plan did not violate the Jones Act. CBP, HQ H143075 (Feb. 24, 2011).

projects in the United States would likely cost more than using foreign-flag vessels, as Jones Act-compliant vessels are generally more expensive to build and operate. At the same time, the construction of more Jones Act-compliant vessels for offshore wind projects could have economic benefits for the U.S. maritime industry, such as increased shipbuilding and mariner jobs.

Section 3518 of the National Defense Authorization Act for Fiscal Year 2020 included a provision for GAO to review vessels for offshore wind projects.[4] This report examines:

- the approaches to use of vessels that developers are considering for planned offshore wind projects in the United States, consistent with Jones Act requirements, and the extent to which vessels exist to support those approaches, and
- the challenges industry stakeholders have identified associated with constructing and using Jones Act-compliant vessels to support U.S. offshore wind and the actions industry stakeholders and federal agencies have taken to address these challenges.

To examine the approaches to the use of vessels that developers are considering for planned offshore wind projects in the United States and the extent to which vessels exist to support these approaches, we conducted a literature search and reviewed publications including industry literature; documents submitted to the Department of the Interior's BOEM as part of its offshore-wind-permitting process; U.S. Customs and Border Protection (CBP) documents regarding the applicability of the Jones Act to offshore wind; and relevant statutes.

We also analyzed information collected by Tufts University researchers in 2020 on currently available or under-construction Jones Act-compliant and foreign-flag vessels that could support key aspects of offshore wind turbines' installation. Tufts University collected this information as part of a study on the implications of the Jones Act for the U.S. offshore wind industry. Using the information Tufts University researchers had assembled, we compiled a list of Jones Act-compliant vessels that either roughly matched or exceeded the capabilities of the vessels used to construct the first offshore wind project in the United States in 2016. We verified that the U.S. vessels we included in our list were Jones Act-compliant by using July 2020 data from the Coast Guard's *Merchant Vessels of the United States* database. We assessed the reliability of the

[4] Pub. L. No. 116-92, § 3518, 113 Stat. 1198, 1986 (2019).

Tufts University information and Coast Guard data by comparing the Tufts University information to publicly available information from vessel operators; interviewing the Tufts University researchers, and the Coast Guard officials responsible for updating and maintaining the database; and reviewing the Tufts University information for missing data, outliers, and obvious errors. We determined that these data were sufficiently reliable for the purposes of presenting information on the vessels that exist in the United States and on selected vessels in foreign fleets and on their general capabilities.

Finally, we interviewed 37 offshore wind industry stakeholders—including developers, turbine suppliers, vessel owners and operators, industry experts, and industry associations—regarding approaches to offshore wind development and vessels. We included turbine suppliers because project developers and turbine suppliers told us that, while it varies by project and the preferences of different developers, turbine suppliers are often responsible for arranging the vessels for installation of turbines. To select relevant stakeholders, we reviewed BOEM documents, news stories, and industry publications to identify industry participants actively engaged in offshore wind projects that already existed, were under development, or were planned for the future and asked other stakeholders for recommendations. We also interviewed officials from BOEM, the Department of Energy, the Department of Transportation's United States Maritime Administration (MARAD), CBP, and United States Coast Guard. The Department of Energy's Wind Energy Technologies Office conducts research on the development of offshore wind energy, and we interviewed officials in that office to understand its role and to understand the status of the industry. With respect to industry interviews, we analyzed stakeholders' responses to our questions and identified common themes.

To determine the challenges industry stakeholders have identified associated with constructing and using Jones Act-compliant vessels to support the U.S. offshore wind industry and the actions that industry stakeholders and federal agencies have taken to address these challenges, we reviewed industry documents as well as documentation of relevant federal programs, such as those administered by MARAD. We also interviewed the industry stakeholders and the officials from federal agencies described above. For a more detailed description of our scope and methodology, see appendix I.

We conducted this performance audit from February 2020 to December 2020 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Current and Planned Offshore Wind Projects

While many offshore wind projects have been operational in Europe for years, as of September 2020, only one offshore wind project had been completed in the United States—five turbines constructed off the coast of Block Island, Rhode Island, in 2016. In addition, a small demonstration project of two turbines off the Virginia coast had largely completed construction and was expected to be operational by the end of 2020. Offshore wind projects may be in either state or federal waters. Generally, waters off the coast of the United States are considered state waters up to 3 nautical miles offshore, and federal waters from 3 to 200 nautical miles offshore. The turbines for the Block Island project were installed in state waters and, therefore, according to BOEM, the federal agency responsible for overseeing the development of offshore wind in federal waters, most of the project was not required to go through the federal-permitting process that proposed offshore wind projects in federal waters must undergo.[5] The demonstration project in Virginia, built about 27 miles off the coast, is the first offshore wind project fully subject to the federal-permitting process.

BOEM's responsibilities for overseeing offshore wind in federal waters include identifying areas suitable for offshore wind projects, issuing

[5] A portion of this project's export cable was located on submerged lands under the jurisdiction and control of the federal government. Projects may also be built in other state waters, such as the Great Lakes; for example, Icebreaker Wind is a planned six-turbine project on Lake Erie offshore of Cleveland, Ohio.

leases in those areas, and reviewing and approving proposed projects.[6] These leases, which BOEM usually awards through competitive bidding, give the leaseholder the exclusive right to seek BOEM's approval for the development of offshore wind in the area. A given leaseholder may develop multiple projects in one lease area. Offshore wind developers that obtain these leases enter into agreements with entities such as utility companies to sell the power they generate.[7]

To date, BOEM has issued 16 commercial leases in the United States to offshore wind developers for projects in federal waters; wind power in these leases totals over 21 gigawatts of potential capacity.[8] While BOEM is currently considering potential leases in other areas, including the Pacific Coast, all existing leases are in the mid-Atlantic and Northeast areas. In these areas, many states have set targets for offshore wind

[6] BOEM is responsible for issuing leases, easements, and rights-of-way for renewable energy projects on the Outer Continental Shelf. 43 U.S.C. § 1337. BOEM is generally required to issue leases and grants them on a competitive basis. The overall process for issuing leases for offshore wind projects comprises four steps: (1) BOEM works with stakeholders to identify offshore areas that appear suitable for offshore wind; (2) BOEM engages in a process to lease the area to an offshore wind development and awards the lease; (3) the leaseholder submits a Site Assessment Plan that BOEM reviews and approves and then conducts a site assessment; and (4) the leaseholder submits a Construction and Operations plan, which BOEM reviews and approves and then begins construction of the project.

[7] In some states, such as Massachusetts, offshore wind developers enter into Power Purchase Agreements with entities like utility companies; under these agreements, the developer commits to the volume of energy to be provided over the life of the contract. In other states, such as New York, offshore wind developers bid for offshore wind renewable energy certificates, which represent the environmental benefits of one megawatt-hour of electric generation and which are used to comply with that state's offshore wind requirements. The offshore wind developer generally then sells the energy generated by offshore wind into the wholesale electricity market and sells the certificates to an intermediary at an agreed-upon price. The cost of the certificates is generally ultimately added to ratepayers' bills. According to a report by the National Renewable Energy Laboratory, both Power Purchase Agreements and renewable energy certificates are generally awarded on a competitive basis and set a fixed price for the offshore wind power delivered. U.S. Department of Energy National Renewable Energy Laboratory NREL/TP-5000-76079, *Comparing Offshore Wind Energy Procurement and Project Revenue Sources Across U.S. States* (Washington, D.C.: June 2020). Setting a fixed price for energy may protect electricity ratepayers from higher-than-expected costs of offshore wind projects by requiring the developer to take on any cost overruns.

[8] One gigawatt of power running at full capacity has approximately enough energy potential to power over 800,000 homes at a specific point in time.

production and many projects are planned and expected to be operational this decade, some of which will help states meet those targets.[9]

As shown in table 1, as of September 2020, plans for a number of these projects were with BOEM for review, but BOEM had approved only one project to date—the demonstration project in Virginia. The developer of that project, Virginia Electric and Power Company, an affiliate of Dominion Energy (Dominion), planned to follow the demonstration project with a larger commercial project. BOEM had planned to make a decision on Vineyard Wind in Massachusetts—expected to be the first large-scale offshore wind project in the country—in August 2019. However, BOEM then deferred its plans to make this decision until December 2020 to allow for additional analysis.[10] Once constructed, offshore wind projects are generally expected to operate for about 25 to 30 years.

Table 1: Planned Offshore Wind Projects in Lease Areas Awarded by the Bureau of Ocean Energy Management (BOEM), as of September 2020

Project	Location	Expected capacity (MW)[a]	Expected beginning date of operation	Status of BOEM review as of September 2020[b]
Atlantic Shores Offshore Wind	10-20 miles off the coast of NJ	Up to 2,500	Mid-2020s	Developer submitted Site Assessment Plan (SAP) in December 2019.
Bay State Wind	15 miles off the coast of Martha's Vineyard, MA	800	2024	Developer submitted Constructions and Operations Plan (COP) in March 2019.
Beacon Wind	20 miles off the coast of Nantucket, MA	2,000 – 3,000	Mid-2020s	Developer had not yet submitted SAP.
Coastal Virginia Offshore Wind Demonstration Project	27 miles off the coast of Virginia Beach, VA	12	2020	Developer largely completed construction; not yet operational.
Coastal Virginia Offshore Wind Commercial Project	27 miles off the coast of Virginia Beach, VA	2,600	2026	Developer had not yet submitted COP.
Empire Wind	20 miles off the coast of Long Island, NY	2,000	Mid-2020s	Developer submitted COP in January 2020.
Garden State Offshore Energy	Off the coast of NJ and DE	1,100	2024	Developer had not yet submitted COP.

[9] For example, New York enacted legislation in 2019 requiring 9 gigawatts of offshore wind capacity to be installed by 2035, and Connecticut enacted legislation in 2019 requiring the state to buy 2 gigawatts of offshore wind capacity by 2030.

[10] Specifically, BOEM conducted analysis to support a Supplemental Environmental Impact Statement to consider the cumulative effects of offshore wind on issues such as fishing and transit lanes for vessels through offshore wind areas.

Project	Location	Expected capacity (MW)[a]	Expected beginning date of operation	Status of BOEM review as of September 2020[b]
Kitty Hawk Offshore	27 miles off the coast of NC	Up to 2,500	2026	Developer had not yet submitted COP.
Mayflower Wind	30 miles off the coast of Martha's Vineyard, MA	1,200	2026	Developer had not yet submitted COP.
Ocean Wind	15 miles off the coast of Southern NJ	1,100	2024	Developer submitted COP in August 2019.
Park City Wind	23 miles off coast of MA	804	2025	Developer submitted COP in July 2020.
Revolution Wind	15 miles off the coast of RI	704	2023	Developer submitted COP in March 2020.
Skipjack Wind Farm	19 miles off the Delmarva coast	120	2023	Developer submitted COP in April 2019.
South Fork Wind Farm	35 miles off the coast of Long Island, NY	132	2022	Developer submitted COP in June 2018.
Sunrise Wind	At least 30 miles off the coast of Long Island, NY	880	2024	Developer submitted a COP in September 2020.
US Wind	17 miles off the coast of MD	270	2023	Developer submitted COP in August 2020.
Vineyard Wind	14 miles off the coast of Martha's Vineyard, MA	800	2023	Developer submitted COP in December 2017. BOEM expected to make a decision on COP in December 2020.

Source: GAO analysis of industry and BOEM information. | GAO-21-153

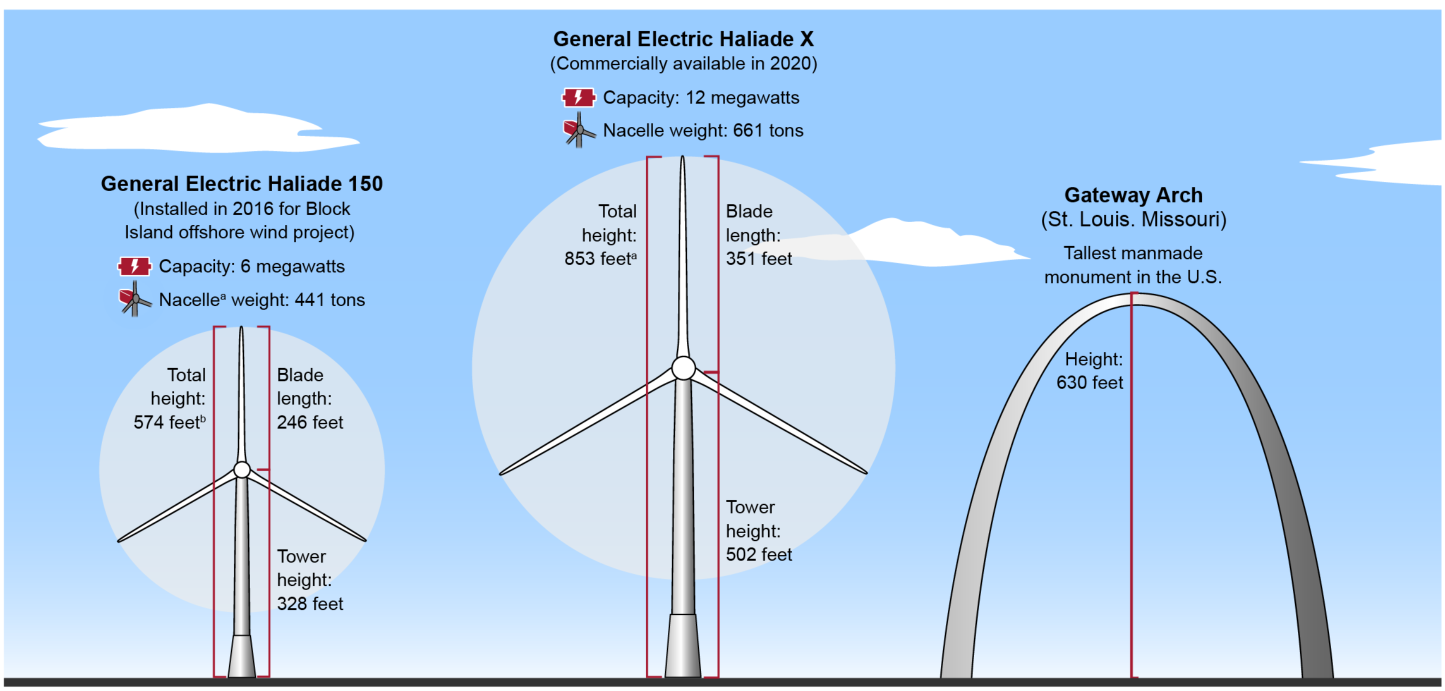
[a]1,000 megawatts (MW) could potentially power over 800,000 homes at a specific point in time.

[b]BOEM's overall process for issuing leases for offshore wind projects comprises four steps: (1) BOEM works with stakeholders to identify offshore areas that appear suitable for offshore wind; (2) BOEM engages in a process to lease the area to an offshore wind development and awards the lease; (3) the leaseholder submits a Site Assessment Plan that BOEM reviews and approves and then conducts a site assessment; and (4) the leaseholder submits a Construction and Operations Plan, which BOEM reviews and approves and then begins construction of the project. Because lease areas may have multiple projects in them there may be additional planned projects in existing lease areas in early stages of planning by developers that are not included in this table. Unless noted in this table, projects listed as not yet having submitted a Construction and Operations Plan have already had a Site Assessment Plan approved by BOEM.

Vessels Used for Offshore Wind Projects

Vessels used for offshore wind project installation need to have the capacity to handle large wind turbine components. Turbines comprise a foundation set into the ocean floor, a tower rising out of the foundation into the air, and rotor blades that are connected into and provide power to a hub at the top of the tower called the "nacelle."[11] Offshore wind turbines now on the market are larger than those used for the Block Island project, the Coastal Virginia Offshore Wind demonstration project, and for existing European offshore wind projects, due to technological advances. (See fig. 1.) According to the Department of Energy, using larger turbines can reduce overall system costs and lead to energy production improvements.[12] Developers are generally planning to use these larger turbines in projects currently with BOEM for review. For example, for the larger-scale Coastal Virginia Offshore Wind commercial project, the developer plans to use 14-megawatt turbines, as compared to the 6-megawatt turbines used for the demonstration project and for the Block Island project.

Figure 1: Increasing Size of Offshore Wind Turbines over Time



Source: GAO analysis of offshore wind industry information. | GAO-21-153

[11] The offshore wind industry is currently exploring the use of floating turbines, which do not have a foundation set into the ocean floor. No projects for which the developer has submitted a Constructions and Operations Plan to BOEM to date plan to use floating turbines.

[12] United States Department of Energy, Office of Energy Efficiency and Renewable Energy, DOE/GO-102019-5192, *2018 Offshore Wind Technologies Market Report* (August 2019).

[a]The nacelle is the hub that sits on the top of the turbine tower and contains components used to generate electricity.

[b]Height can vary by project site.

Offshore wind projects generally have four main phases, each of which requires specific types of vessels. (See table 2.) Some of these vessels may need to be Jones Act-compliant, depending on their use. Project developers may request a ruling from CBP, the agency responsible for enforcing the Jones Act, on the extent to which planned vessels' uses comply with the Act. Developers for the Block Island project requested and received a ruling from CBP that their planned approach—which used a variety of vessels for turbine installation, including some that were Jones Act-compliant and some that were not—would not violate the Jones Act.[13] In addition, while CBP later revoked the ruling because of uncertainty as to whether the project was in U.S. territorial waters, CBP initially ruled that the plan to use a similar approach to vessels for the Vineyard Wind project complied with the Jones Act.[14] While CBP encourages such ruling requests, they are voluntary, and CBP has not issued any other rulings in recent years regarding the use of vessels for installing offshore wind turbines. While rulings are only applicable to the circumstances of that request and identical circumstances, developers may be able to use past CBP rulings to inform vessel decisions. Dominion did not request a ruling for its demonstration project constructed in 2020.

[13] CBP, HQ H143075 (Feb. 24, 2011). Ruling requests generally include a description of the proposed operation, the vessels the party plans to use, and what items are being transported, and asks CBP to determine if that activity is compliant with the Jones Act. To date, there have not been any CBP rulings that definitively state that an offshore wind project is considered a "point" in the territorial waters of the United States. Parties that do not seek a ruling request may be subject to CBP enforcement actions, such as financial penalties, if their actions violate the Jones Act.

[14] CBP, HQ H309672 (July 15, 2020). CBP noted that the agency has previously ruled that the use of a crane on a vessel that is not Jones Act-compliant to construct a marine structure does not violate the Jones Act if the movement of merchandise is conducted by the crane and not the vessel itself. HQ 116111 (Jan. 30, 2004). CBP subsequently revoked the July 15, 2020, ruling because the request did not contain the exact location of the project. CBP, HQ H312773 (Aug. 3, 2020). As of October 7, 2020, CBP has not issued another ruling on this project. In addition, in September 2020, legislation was passed in the House of Representatives that, if enacted, would generally provide that the Jones Act applies to vessels installing offshore wind turbines in federal waters. H.R. 4447, 116th Cong. § 12303 (2020).

Table 2: Selected Vessels Used in Offshore Wind Projects, by Development Phase

Development phase	Vessel type	Purpose	Key features	Vessel(s) used for Block Island project[a]
Pre-Construction	Survey vessel	Conducts surveys to assess site conditions and determine where to place turbines.	Has survey equipment. Can either be purpose-built for offshore wind or a multi-purpose vessel with survey equipment?	Several vessels, including one Jones Act-compliant vessel.[b]
Construction	Foundation installation vessel	Places turbine foundations on ocean floor.	Depends on type of foundation; a heavy-lift crane is generally required to lift the foundation off the vessel.	A combination of a Jones Act–compliant heavy-lift floating crane and a Jones Act–compliant jack-up vessel (a vessel with legs to plant itself on the ocean floor and raise itself out of the water to provide a stable platform).[b]
	Scour protection vessel	Lays rocks around the site and turbine foundations to prevent erosion.	Ability to carry a large number of rocks and place them precisely on the ocean floor.	U.S.-flagged vessels.
	Cable-laying vessel	Lays cables along the ocean floor to carry electricity from site to shore.	Has cable-laying equipment. Does not need to be specialized for offshore wind.	U.S.-flagged barge retrofitted specifically for the project.
	Wind turbine installation vessel (WTIV)	Installs turbines on top of foundations.	Typically a jack-up vessel. Needs a large amount of clear deck space and a tall, heavy capacity crane to install turbine components.	Foreign-flag WTIV.
	Feeder vessel	Transports turbine components from port to site.	Ability to transport heavy turbine components.	Two Jones Act-compliant jack-up feeder vessels.
Operations and Maintenance	Crew transfer vessel	Transports turbine crew from port to turbines.	Small, fast vessel. Ability to push up against turbine so crew can climb onto turbine.	One purpose-built Jones Act-compliant vessel[b] and one small vessel not purpose-built for offshore wind.
	Service operations vessel	Houses technicians and transports them between turbines.	Ability to house a large number of technicians for several weeks and transfer them to turbines.	None used for operations; one Jones Act-compliant vessel[b] used during construction.
Decommissioning	Decommissioning uses the same variety of vessels as construction to take turbines apart.			Not yet used, project still operational.

Source: GAO analysis of offshore wind industry information. | GAO-21-153

[a]The Block Island project was the first offshore wind project installed in the United States and was constructed in 2016. The project was developed by Deepwater Wind, which has since been acquired by Ørsted.

[b]We describe a vessel as “Jones Act-compliant” in this table if it is identified as licensed to engage in coastwise trade in the Merchant Vessels of the United States, a database of merchant and recreational vessels documented under U.S. law by the U.S. Coast Guard.

Stakeholders Described Two Likely Approaches to Offshore Wind Installation, Either of Which May Require New Jones Act-Compliant Vessels due to Few Existing Vessels

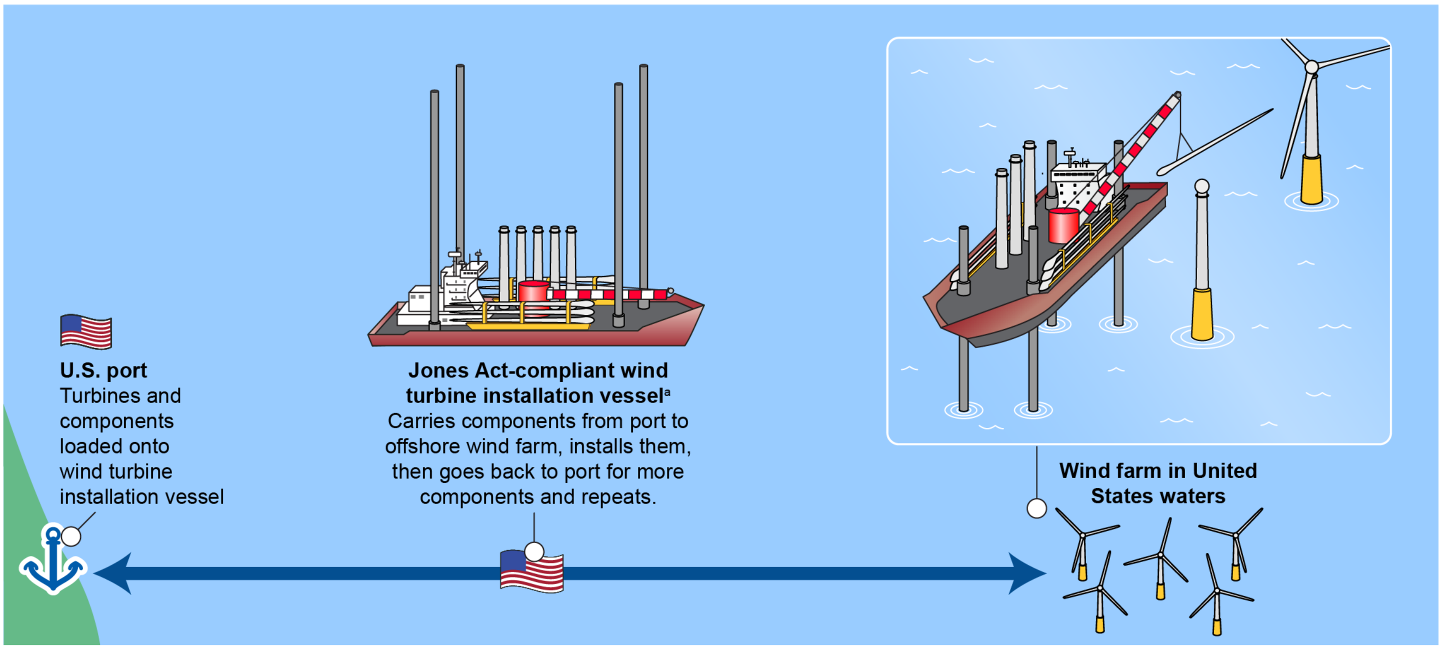
Industry stakeholders we interviewed told us there were two likely approaches to the use of vessels to install offshore wind turbines in the United States in compliance with the Jones Act, one using a Jones Act-compliant WTIV and one using a foreign-flag WTIV supported by Jones Act-compliant feeder vessels. Project developers and turbine suppliers said they expect to decide between these two approaches for each project based on factors such as project location, cost, and vessel availability. Generally speaking, project developers, turbine suppliers, and vessel operators told us that based on their understanding of the Jones Act and CBP’s past rulings, they believed that either of these approaches could be done in compliance with the Jones Act. While a few industry stakeholders have requested rulings from CBP, none of the developers or turbine suppliers that we interviewed said that the lack of additional rulings from CBP on this issue has prevented them from moving forward with projects. In addition, CBP officials told us that they are not aware that CBP’s pending reviews of submitted ruling requests have prevented any offshore wind projects from moving forward as planned.

A range of stakeholders told us that regardless of which approach the developer chose, a project would most likely need a single WTIV for its construction phase. While the amount of time it takes to complete a project’s construction varies based on the size of the project and the installation approach used, project developers said they generally expected each project to require an installation vessel for several months, out of a work season that lasts from spring through fall.[15]

Installation Approach 1: Use of a Jones Act-compliant WTIV. In this approach, one generally used by projects in Europe, a WTIV would carry turbine components from a port to the site and install them. For projects in the United States, a Jones Act-compliant WTIV would operate based from a U.S. port. (See fig. 2.)

[15] A range of stakeholders told us that weather conditions make it difficult to install turbines during the winter, as vessels cannot jack up in bad weather, and cranes cannot operate in high winds.

Figure 2: Example of Offshore Wind Installation in U.S. Waters Using a Jones Act-compliant Installation Vessel



Source: GAO. | GAO-21-153

[a]The Jones Act generally requires that vessels carrying merchandise between any two points in the United States be owned and crewed by U.S. citizens, registered under the U.S. flag, and built in the United States.

According to a range of stakeholders we interviewed, developers could not use this approach currently, or for the next few years, as there are no Jones Act-compliant vessels with sufficient capacity to function as a WTIV to install the larger turbines that offshore wind developers plan to use (see table 3).

Table 3: Comparison of Largest Identified Jones Act-Compliant Jack-Up Vessel with Foreign-Flag Vessels Used to Install U.S. Offshore Wind Projects as of May 2020

	Name	Crane capacity (U.S. tons)	Clear deck area (square feet)
Largest identified Jones Act-compliant jack-up vessel[a]	*Robert*	500	15,403
Foreign vessel used in 2016 to install turbines for Block Island Wind Farm (RI)	*Brave Tern*	882	34,445
Foreign vessel used in 2020 to install turbines for Coastal Virginia Offshore Wind	*Vole au Vent*	1,654	38,050

Source: GAO analysis of data from Tufts University researchers. | GAO-21-153

[a]We describe a vessel as "Jones Act-compliant" in this table if it is identified as licensed to engage in coastwise trade in the Merchant Vessels of the United States, a database of merchant and recreational vessels documented under U.S. laws by the U.S. Coast Guard.

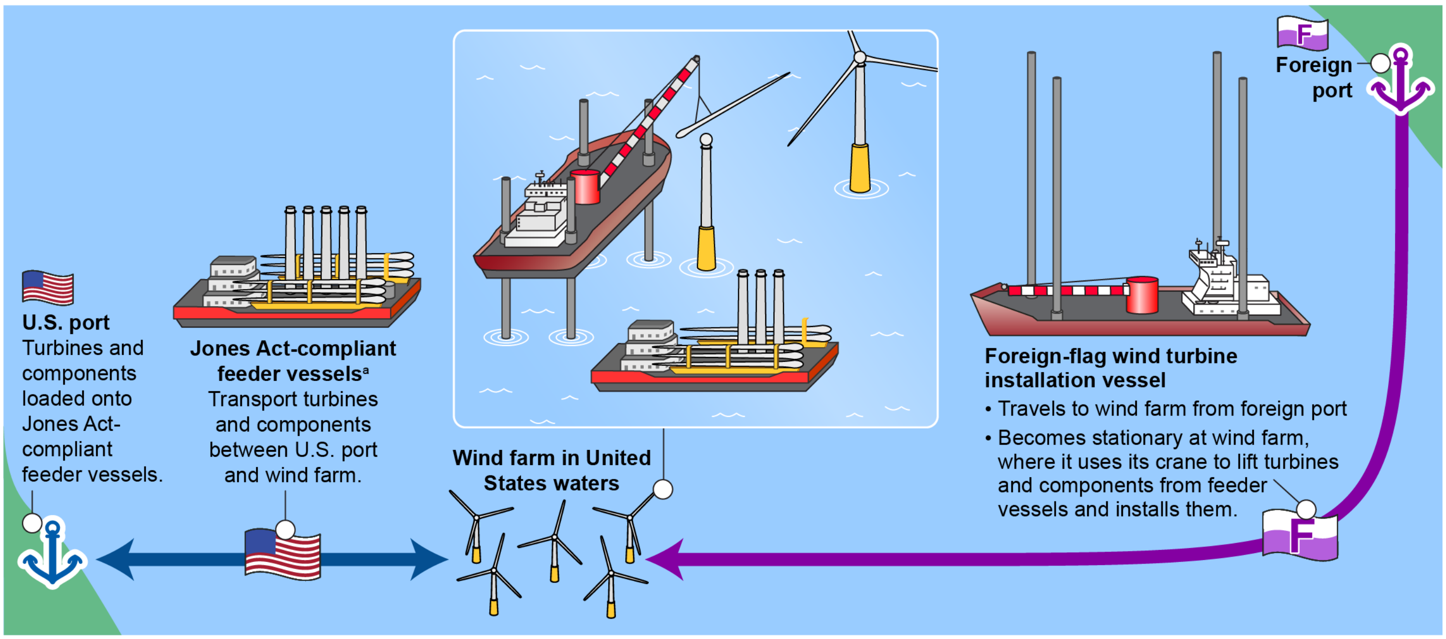
Dominion has announced plans to build a Jones Act-compliant WTIV. An official with Dominion we spoke with said the vessel will cost about $500 million and take about 3 years to build. However, this vessel alone would likely not be able to meet the WTIV needs of the U.S. offshore wind market if all proposed projects proceed as scheduled. As a result, even if a Jones Act-compliant WTIV becomes available, some developers may decide to use the second approach described below.

Installation Approach 2: Use of a Foreign-Flag WTIV with Jones Act-Compliant Feeder Vessels. In this approach, which was used to construct the Block Island project, [16] a foreign-flag WTIV would travel to the offshore wind site in the United States from a foreign port and install the turbines. The turbine components would be transported to the installation site from U.S. ports on Jones Act-compliant feeder vessels. (See fig. 3.) A range of stakeholders told us that feeder vessels would need to be Jones Act-compliant, because they would transport supplies from a U.S. port to the project site. For the Block Island project, two Jones Act-compliant jack-up vessels, the *Caitlin* and the *Paul*, carried wind turbine components from a port in Rhode Island out to the project site, where a Maltese-flag WTIV, the *Brave Tern*, installed the components. CBP ruled that this approach did not violate the Jones Act because the WTIV only moved components with its crane, which CBP has held is not considered movement of merchandise under the relevant statutes.[17]

[16] The two-turbine demonstration project in Virginia used a different approach to install major components. A foreign-flag WTIV picked up turbine components in Canada and transported them to the project site off the coast of Virginia. Jones Act-compliant vessels transported other components from U.S. ports. However, this demonstration project only involves the installation of two turbines, meaning the WTIV only needed to make two round trips to Canada. It installed the turbine foundations on the first trip and the wind turbines on the second trip. Some project developers and vessel operators said this approach may not be economically feasible for full-scale projects, although it did work for installing a small project of two turbines. Other project developers did not discuss this option as a possibility.

[17] CBP, HQ H143075 (Feb. 24, 2011).

Figure 3: Example of Offshore Wind Installation in U.S. Waters Using a Foreign-Flag Installation Vessel and Jones Act-compliant Feeder Vessels



Source: GAO. | GAO-21-153

[a]The Jones Act generally requires that vessels carrying merchandise between any two points in the United States be owned and crewed by U.S. citizens, registered under the U.S. flag, and built in the United States.

There are a limited number of foreign-flag WTIVs that could support offshore wind installations in the United States. According to our analysis of information from Tufts University researchers, as of September 2020, we identified about 50 foreign-flag WTIVs in the world in operation or under construction that have a crane capacity equal to or greater than that of the vessel used to install the Block Island turbines.[18] (See app. II.) However, according to project developers, turbine manufacturers, and a vessel operator, most of these existing foreign-flag WTIVs likely have limited capacity to install the new, larger turbines that developers are considering. A vessel operator and a turbine supplier told us that it may be possible to upgrade some existing vessels with larger cranes.

[18] The *Brave Tern*, used to install the Block Island project, has a crane capacity of 882 tons. We used this vessel as a standard and included in our list vessels from the Tufts University information with a crane capacity of 882 tons or greater.

Some stakeholders, including developers, a turbine supplier, a vessel operator, and a state agency, expressed concern that competition for WTIVs from foreign markets would affect the development of the U.S. offshore wind industry. Because these stakeholders expect there to be increasing demand from European and Asian markets for vessels that can install larger turbines, they expressed concern that the number of such vessels available to the U.S. market may be limited. Conversely, one turbine supplier suggested that the use of the feeder method in the United States may mean that WTIVs considered obsolete in the European market because they have too little deck space to carry components for modern turbines could still be used efficiently to install turbines for U.S. projects that are carried on Jones Act-compliant feeder vessels. According to project developers and turbine manufacturers, they are considering using either jack-up vessels or floating barges as feeder vessels:

- **Jack-up feeder vessels.** According to project developers and vessel operators, Jones Act-compliant jack-up vessels exist that have served as feeder vessels. While their crane capacity and clear deck area are not sufficient to install turbines, they can carry components out to be installed by a WTIV. By jacking up, these vessels provide a stable platform for components to be lifted by the WTIV's crane. This also allows jack-up vessels to work in a wider range of weather conditions than floating barges. For that reason, project developers told us that they prefer to use jack-up feeders. Based on our analysis of the data from Tufts University researchers, there are roughly 20 such vessels as large as, or larger than, those used in 2016 as jack-up feeder vessels for the Block Island project.[19] (See app. II.) However, according to a project developer, a vessel operator, and a turbine supplier, future U.S. offshore wind projects are expected to use significantly larger turbines than those installed at Block Island, and there may not be any existing Jones Act-compliant jack-up vessels that can carry all the components of a current generation turbine. As a result, several stakeholders, including a project developer, turbine suppliers, and a vessel operator said that if the industry were to generally use a feeder approach with jack-up vessels, more of these vessels would likely need to be built to accommodate the larger turbines.

[19] In our analysis, we compared the Paul, which was used for the Block Island project and has a clear deck cargo area of 6,200 square feet, with existing U.S. jack-up vessels. We counted Jones Act–compliant vessels that have a clear deck cargo area of 6,000 square feet or more.

- **Floating barge feeder vessels.** Some project developers, turbine suppliers, and vessel operators said that existing Jones Act-compliant floating barges could potentially be used as feeder vessels. This approach has not been used before, and turbine suppliers and a developer noted that it has risks, as a floating barge could shift while heavy components are being lifted. Developers, turbine suppliers, and vessel operators told us that they are considering several possible solutions for the use of floating barges, such as using technologies to maintain the barge's position while components are being lifted. According to several stakeholders including developers, a turbine supplier, and a vessel operator, the advantage to using floating barges is that there is an already-existing supply of Jones Act-compliant floating barges in the U.S. that are larger and can carry heavier components than existing U.S. jack-up vessels.

A project developer and a turbine supplier told us that for efficient operations, a project developer would use two to three sets of feeder vessels—depending on the site's distance from port—to keep the WTIV continuously supplied with turbines and other components, allowing the WTIV to operate with minimum downtime. Each feeder set would have sufficient capacity to carry the components for one turbine. If large feeders were used, a set could consist of a single vessel. However, because turbine components may be too heavy or too large for all the components of one turbine to be transported on one feeder vessel, a set may need to consist of multiple smaller vessels. Had construction begun in 2019 as initially planned, stakeholders involved in planning the Vineyard Wind project told us the developer and turbine supplier for this project planned to use the two largest Jones Act-compliant jack-up vessels, the Jill and the Robert, accompanied by two or three smaller Jones Act-compliant jack-up vessels, as feeders.

Project developers told us that they intend to rely on the feeder approach until a Jones Act-compliant WTIV is constructed and will then decide which approach to use on a project-by-project basis. Project developers and a turbine supplier told us that if a Jones Act-compliant WTIV were built, they might prefer this approach. A developer and an industry association told us that using a Jones Act-compliant WTIV may result in operational efficiencies and reduced risk compared to the feeder method. However, a range of industry stakeholders told us that, for some projects, the ability to make full use of a Jones Act-compliant WTIV may be limited by factors such as port infrastructure, as discussed further below. Also, according to one study, under some circumstances, the use of a feeder method could allow projects to be installed more quickly by reducing the amount of time that the WTIV spends in transit; this could make the feeder method preferable even if a Jones Act-compliant WTIV were available.[20]

As noted earlier, in addition to installation and feeder vessels, a range of vessels with capabilities specialized to certain functions but not necessarily to offshore wind are required to install, operate, and maintain offshore wind projects. Project developers and vessel operators we interviewed generally told us that they are confident that they will be able to find vessels to fill these roles, and that in some cases it is likely that new Jones Act-compliant vessels will be built to support the industry.

- **Survey vessels.** Project developers told us that they were confident they could find survey vessels as needed.
- **Foundation installation vessels.** Vessel operators and a developer said that the vessels needed to install turbine foundations are generally available and can vary depending on the types of foundations the project uses. A developer told us WTIVs are also generally capable of installing foundations and may be used in this role for some projects. However, project developers said that installing foundations usually does not require as much precision or specialized equipment as installing turbines.
- **Cable-laying vessels.** Project developers and a vessel operator told us that cable-laying vessels are generally available and do not need to be purpose built for offshore wind projects as undersea cables are used in other industries.
- **Operations and maintenance vessels.** Turbine suppliers, vessel operators, and developers told us there is a need for purpose-built, Jones Act-compliant vessels to perform operations and maintenance work on turbines. Vessel operators, a turbine supplier, and a developer told us that they had explored the possibility of using existing vessels to fill these roles and may do so in the short term for the first several projects. However, due to the special requirements of servicing offshore wind projects, these stakeholders said they expect almost all of these vessels to be built new for the offshore wind industry in the long term. There are two general types of operations and maintenance vessels that developers and turbine suppliers are

[20] Kenneth Maloney, David Bourg, Kenneth Humphreys, Christopher Townsend, “An Analysis of Alternatives for the Development of Jones Act Compliant Windfarm Construction Vessel Fleets,” *Proceedings of the ASME 2018 1st International Offshore Wind Technical Conference* (November 2018).

considering: service operations vessels and crew transfer vessels (see table 2).[21] A developer, a vessel operator, and a shipbuilder told us that given their large size, service operations vessels are likely to be the preferred approach for offshore wind projects that are farther from shore, but projects may use a mix of the two vessel types.[22] One crew transfer vessel was built for the Block Island project, and another has been ordered to support the Coastal Virginia Offshore Wind demonstration project. Developers and turbine suppliers said these two types of vessels are relatively easy and inexpensive to build in the United States, and they expect more will be built as needed. One shipbuilder we interviewed said that there are a number of shipyards on both the East Coast and Gulf Coast that are capable of building these vessels. As a result, the need for these vessels is unlikely to delay planned offshore wind projects. Industry stakeholders including developers and vessel operators told us that one to three of these vessels are needed for the life of each project, with more likely also needed on a short-term basis during the construction of the project.

[21] Operations and maintenance vessels require specialized equipment to transfer technicians to turbines. Crew transfer vessels do this by pushing against the turbine so the technicians can cross. Service operations vessels use a motion-compensated gangway to transfer technicians.

[22] Project developers, a shipbuilder, and a vessel operator told us that projects can also use helicopters to transport technicians for some maintenance tasks.

Stakeholders Cited Multiple Challenges Related to Jones Act-Compliant Vessels for Offshore Wind which Some Industry Actions and Federal Programs Address

Stakeholders Cited Investment Uncertainty and Other Challenges Associated with Using and Constructing Jones Act-Compliant Vessels

A range of industry stakeholders, including one project developer, one turbine supplier, and multiple vessel owners, identified uncertainty in the offshore wind industry as a challenge to obtaining investments for the construction of Jones Act-compliant WTIVs and, to a lesser extent, feeder vessels. These vessels may cost about $500 million and over $150 million, respectively, and may take a few years to build. A number of factors contribute to this uncertainty:

- **Permitting Delays.** BOEM's delay in approving the first large-scale offshore wind project, Vineyard Wind, has led to uncertainty regarding the timeline for approvals of future offshore wind projects. However, industry stakeholders, including vessel owners, one project developer, and one industry supplier, added that if and when BOEM does approve Vineyard Wind, this approval may give vessel owners the confidence in the future growth of the offshore wind industry they need to undertake such an investment. As described previously, as of September 2020, BOEM planned to make its decision on permitting Vineyard Wind in December 2020.
- **Vessel Contracting.** Several vessel owners stated that they would need to line up multiple years' worth of contracts for future work to establish sufficient business certainty to support the financing of a WTIV. Therefore, greater certainty about the development of the market overall, and not just for an individual project, might be important for increasing support for WTIV investments. In addition, because the daily rate charged to use U.S.-built vessels would likely be higher than that of foreign-flag vessels, some stakeholders noted a Jones Act-compliant WTIV would not likely be able to compete for use in other countries. As such, a Jones Act-compliant WTIV would likely need to support its cost of construction solely on the basis of

expectations for future use on U.S. projects. Dominion's position as an energy company planning to build a WTIV is unique in that such a vessel will serve Dominion's commercial project's installation, for which the project developer, Virginia Electric and Power Company, is an affiliate of Dominion. In addition, Dominion is a utility company charged by the state with producing offshore wind energy.[23] As a result, Dominion has more certainty on the vessel's use in its future portfolio of projects. The WTIV will also provide a Jones Act-compliant asset to support other developer's projects.

- **Potential Obsolescence.** Vessels constructed based on current wind turbine sizes could become obsolete as the industry moves to larger turbines. For example, according to some project developers and turbine manufacturers, many of the existing foreign-flag WTIVs cannot support installation of the 12-megawatt or larger turbines now coming onto the market. However, two stakeholders we interviewed noted that while turbine sizes have increased considerably in recent years, this trend is likely to slow in future years. BOEM officials noted that a range of factors, including costs, available materials and constraints in transporting components may affect the future sizes of turbines.
- **Installation Approach and Vessel Needs.** As discussed earlier, it is not clear at this time which approach to turbine installation offshore wind developers will use for their projects. Should industry stakeholders invest in Jones Act-compliant WTIVs, feeder vessels may be rendered unnecessary if project developers largely choose not to use the feeder approach. On the other hand, if developers successfully use a feeder model and do not choose to contract for a Jones-Act compliant WTIV, it may be more difficult for potential ship owners to justify building such a vessel.

Industry stakeholders we interviewed also cited other potential challenges to constructing and using installation vessels:

- **Shipyard Capacity and Building Expertise.** Some stakeholders, including one project developer, two vessel owners, and one state agency, said there are a limited number of shipyards in the United States with the capacity to construct purpose-built WTIVs given their large size. One vessel owner and one state agency noted that these shipyards may also be busy constructing other large vessels and, therefore, not able to take on WTIV construction. In addition, one vessel owner and operator and one project developer noted that a

[23] In January 2020, Virginia enacted the Virginia Clean Economy Act, under which Dominion has a target to install 5,200 megawatts of offshore wind energy by 2034.

lack of competition may increase the price to vessel owners. Most stakeholders did not cite any significant technical challenges to constructing WTIVs. However, due to U.S. shipyards' lack of experience building these vessels, there may be a learning curve that could result in the first new vessels being more expensive to build.

- **Port Limitations.** In addition, most stakeholders discussed potential challenges with ports in using Jones Act-compliant vessels for offshore wind. These stakeholders added that many U.S. ports close to planned offshore wind projects, particularly in New England, have limited ability to support offshore wind vessels because they lack the necessary space or infrastructure or are behind bridges that large WTIVs or jack-up feeder vessels could not pass underneath. As a result, project developers may need to use ports that have drawbacks—such as limited space or a less-than-ideal location or make their vessel usage decisions based in part on port limitations. For example, the Port of New Bedford, Massachusetts is behind a hurricane barrier that may be too narrow for large WTIVs to pass through. In addition, one state government representative said the industry would likely need to use the feeder vessel approach, given the inability of most ports to service large WTIVs.
- **Vessel Workforce.** One industry stakeholder said it may be challenging to find a workforce to crew WTIVs, given that this is a type of vessel that has not yet been used in the United States. However, no other stakeholders expressed a similar concern. In addition, some state officials we interviewed noted that their states and industry should be able to work to address workforce-training needs.

Stakeholders did not identify any significant challenges associated with building operations and maintenance vessels. According to some stakeholders, including one shipbuilder, one vessel owner, and one turbine manufacturer, these vessels can be built relatively quickly and inexpensively. Moreover, their smaller size means that more shipyards can build them, resulting in greater potential competition for contracts to build these vessels, potentially lowering their prices. Their smaller size also means that port limitations may not pose a challenge to their use. In addition, because maintenance and operations vessels are typically contracted for up to 20 years, there is little uncertainty about their future pipeline of work once they are contracted for and constructed.

Industry Stakeholders Have Taken Some Actions to Address Certain Offshore Wind Vessel Challenges, and Some Federal Programs Could Support Needed Investments

According to some vessel owners we interviewed, potential Jones Act-compliant WTIV owners have conducted outreach to other industry stakeholders, such as shipyards, regarding contracting for new vessels. However, they have generally not made any decisions, with the exception of Dominion discussed earlier. The lack of further investment decisions to date is in large part due to the uncertainties discussed above.

Stakeholders, including offshore wind developers and state agencies, have begun taking steps to address port infrastructure challenges and make investments. For example, New York State has committed to investing $200 million in port infrastructure improvements to support offshore wind. In another example, Massachusetts has conducted an assessment to identify ports suitable for offshore wind and investments needed for these ports to be able to support offshore wind. Some offshore wind developers have also committed to future port investments. For example:

- The Sunrise Wind project has announced that it plans to invest $11 million in port infrastructure upgrades in New York to support offshore wind.
- Ørsted and its partner Eversource have committed to invest $77.5 million of a $157 million public-private partnership with the State of Connecticut and the Connecticut Port Authority to re-develop the New London State Pier.
- Ørsted's Skipjack Wind Farm project includes a $38 million investment in fabrication and port upgrades in Baltimore.

In addition to industry and state actions, some MARAD programs, intended to ensure a robust maritime industry and marine transportation system, could help with needed vessel and port investments. The offshore wind industry has shown some interest in taking advantage of these programs. MARAD's Federal Ship Financing Program and Capital Construction Fund could help fund the construction of vessels.[24] According to MARAD officials, the builder of the crew transfer vessel for the Block Island project used the Capital Construction Fund program to

[24] The Federal Ship Financing Program provides loans for vessel construction with terms that generally include longer repayment periods and lower interest rates than those available from the commercial lending market. The Capital Construction Fund encourages construction, reconstruction, or acquisition of vessels through the deferment of federal income taxes on certain deposits of money or other property placed into a Capital Construction Fund. Vessels built with any amount of Capital Construction Fund funding must be built in the United States and documented under the laws of the United States.

help finance its construction. MARAD officials added that while the Federal Ship Financing Program has not been used to support WTIV construction, the agency has talked to some industry participants that indicated that they are likely to apply for such support. Two vessel owner-operators we interviewed, both of whom were considering investing in offshore wind installation vessels, said that they would look into using MARAD financing if they decided to proceed. A Dominion official said that the company did not plan to use MARAD programs to finance its WTIV.

MARAD's Port Infrastructure Development program—whose goal is to improve port infrastructure by providing financing and other support to ports to improve their capacity and efficiency—could also be used to support offshore wind. However, according to MARAD officials, while several ports applied for grants to support offshore wind-related projects, none of the applications were selected for funding.

Department of Transportation officials noted that ports could use the Department's larger grant programs, such as the Infrastructure for Rebuilding America and the Better Utilizing Investment to Leverage Development programs, for investments needed to support offshore wind. The Department has received several grant applications under the Better Utilizing Investments to Leverage Development program to help fund such investments. For example, DOT received one application from a port in Rhode Island for funds to support an infrastructure investment to develop a terminal, in part to support offshore wind operations.

Agency Comments

We provided a draft of this report to the Department of Energy, Department of Homeland Security, the Department of the Interior, and the Department of Transportation. The Department of Homeland Security and the Department of Transportation provided technical comments via email that we incorporated as appropriate. The Department of Energy and the Department of the Interior told us that they did not have any comments on the draft report.

We are sending copies of this report to the appropriate congressional committees, the Secretary of the Department of Energy, the Secretary of the Department of the Interior, the Secretary of the Department of Homeland Security, the Secretary of the Department of Transportation, and other interested parties. In addition, the report is available at no charge on the GAO website at https://www.gao.gov.

If you or your staff have any questions about this report, please contact me at 202-512-2834 or vonaha@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix III.

Andrew Von Ah
Director, Physical Infrastructure Issues

Appendix I: Objectives, Scope, and Methodology

This report examines: (1) the approaches to use of vessels that developers are considering for planned offshore wind projects in the United States, consistent with Jones Act requirements, and the extent to which vessels exist to support these approaches, and, (2) the challenges industry stakeholders have identified associated with constructing and using Jones Act-compliant vessels to support U.S. offshore wind and the actions industry stakeholders and federal agencies have taken to address these challenges.

To examine the approaches to use of vessels that developers are considering for planned offshore wind projects in the United States, consistent with Jones Act requirements, and the extent to which vessels exist to support these approaches, we conducted a literature search of databases including Scopus, EBSCO, and ProQuest using search terms such as “offshore wind,” “installation vessel,” “jack-up vessel,” and “crew transfer vessel,” and we reviewed relevant studies, publications, and documents from 2015 to 2020. For example, we *reviewed 2018 Offshore Wind Technologies Market Report,* a 2019 report by Department of Energy; *U.S. Jones Act Compliant Offshore Wind Turbine Installation Vessel Study,* a 2017 study commissioned by a consortium of Northeast state agencies; and *An Analysis of Alternatives for the Development of Jones Act Compliant Windfarm Construction Vessel Fleets,* a 2018 paper prepared for the International Offshore Wind Technical Conference.[1] We limited our literature search to the past 5 years because stakeholders told us that offshore wind technology has changed rapidly and we concluded that older information may be out of date.

We also reviewed documents prepared by industry stakeholders, including those submitted to the Bureau of Ocean Energy Management (BOEM) as part of the permitting process. We reviewed relevant statutes including Section 27 of the Merchant Marine Act of 1920 and the Outer Continental Shelf Lands Acts.[2] We also reviewed Customs and Border Protection (CBP) rulings regarding the extent to which specific past

[1] Department of Energy, *2018 Offshore Wind Technologies Market Report* (August 2019); GustoMSC, *U.S. Jones Act Compliant Offshore Wind Turbine Installation Vessel Study: A Report for the Roadmap Project for Multi-State Cooperation on Offshore Wind* (October 2017); Kenneth Maloney, David Bourg, Kenneth Humphreys, Christopher Townsend, “An Analysis of Alternatives for the Development of Jones Act Compliant Windfarm Construction Vessel Fleets,” *Proceedings of the ASME 2018 1st International Offshore Wind Technical Conference* (November 2018).

[2] Section 27 of the Merchant Marine Act of 1920, Pub. L. No. 66-261, 41 Stat. 988, 999 (1920) (codified as amended at 46 U.S.C. § 55102); 43 U.S.C. § 1337.

vessel activities for offshore wind have been found to comply with the Jones Act. We limited our review to projects that planned to be operational in the next 10 years for which a project developer had entered into a lease with BOEM. We did not consider proposed projects for areas that had not yet been opened to federal leasing.

We also analyzed information that Tufts University researchers provided to us in May 2020 on currently available or under-construction Jones Act-compliant and foreign-flag vessels that could support offshore wind turbine installation. The researchers collected this information from publicly available databases and industry sources, and verified it through discussions with industry stakeholders, as part of a project to assess the implications of the Jones Act for the U.S. offshore wind industry. We compared currently available and under-construction U.S. and foreign-flag vessels to the vessels used in 2016 in the construction of the Block Island Wind Farm, the first offshore wind project in the United States, to compile a list of vessels with key characteristics needed for these projects.

We used the amount of clear cargo area as the key characteristic to identify U.S. jack-up vessels that could support offshore wind installation. According to stakeholders we interviewed, these vessels would most likely be used to transport turbine components to the installation site and clear deck area was the most consistently available specification related to cargo transport. In our analysis we used the vessel *Paul,* which was used for the Block Island project and has a clear deck cargo area of 6,200 square feet, as a point of comparison. We therefore included Jones Act-compliant vessels with a clear deck cargo area of 6,000 square feet or more in our list.

To verify that U.S. jack-up vessels listed in the Tufts University information were Jones Act-compliant, we consulted July 2020 data from the Coast *Guard's Merchant Vessels of the United States* database. We matched vessels from the Tufts University information with vessels in the Coast Guard database by several parameters. If a vessel's official number or International Maritime Organization number was available publicly on the operator's website, we used that number to find the vessel in the Coast Guard database. If the vessel's number was not available, we used the vessel's name to search the database. We then verified that the vessel's dimensions and owner listed in the Coast Guard database matched the information provided by the vessel operator. In the case of one vessel without a unique name, we used dimensions to determine which of the two vessels in the database was the relevant vessel. We then verified that all vessels we identified had required valid, current Coast Guard documentation.

We used crane capacity as a key characteristic to identify foreign-flag installation vessels that could support offshore wind projects, as industry stakeholders we interviewed said these vessels would generally install turbines without transporting turbine components. The Brave Tern, used to install the Block Island project, has a main crane capacity of 882 tons. We used this vessel as a standard and included in our list vessels from the Tufts University information with a crane capacity of 882 tons or greater.

To assess the reliability of the Tufts University information, we confirmed vessel specifications by reviewing publicly available data on operator websites; interviewed the Tufts University researchers to understand how they collected and verified the information; and reviewed the data for missing data elements, outliers, and obvious errors. We determined that this information was sufficiently reliable for the purposes of presenting information on the vessels that exist in the United States and in foreign fleets, and on their general capabilities, although our list should not be considered exhaustive. To assess the reliability of the Coast Guard's *Merchant Vessels of the United States,* we interviewed Coast Guard officials about how they updated and maintained the database. We determined that the data were sufficiently reliable to enable us to verify the Tufts University vessel information.

Finally, we interviewed 34 offshore wind industry stakeholders—including offshore wind developers, offshore wind turbine suppliers, vessel owners and operators, industry experts, and industry associations—regarding approaches to offshore wind installation and vessels that exist to support these approaches. We included turbine suppliers because project developers and turbine suppliers told us that while it varies by project and the preferences of different developers, turbine suppliers are often responsible for arranging the vessels for installation of turbines. To select relevant stakeholders, we reviewed BOEM documents, news stories, and industry publications to identify industry participants actively engaged in offshore wind projects that already existed, were under development, or were planned for the future, and we asked other stakeholders for recommendations. With respect to industry interviews, we analyzed stakeholders' responses to our questions and identified common themes. See table 4 for a summary of the stakeholders interviewed.

Table 4: Offshore Wind Industry Stakeholders Interviewed

Stakeholder type	Number interviewed
Offshore Wind Developer	5
Industry Association	4
Industry Expert/Observer	3
Labor Organization	3
Ship Broker	1
Shipbuilder	1
State Agency	5
Turbine Supplier	2
Vessel Owner/Operator	10

Source: GAO. | GAO-21-153

To determine the challenges stakeholders have identified associated with constructing and using Jones Act-compliant vessels to support the U.S. offshore wind industry and the actions that industry stakeholders and federal agencies have taken to address these challenges, we reviewed information on relevant United States Maritime Administration (MARAD) programs and the industry publications discussed above. The Department of Energy's Wind Energy Technologies Office conducts research on the development of offshore wind energy, and we interviewed officials in that office to understand their role and the status of the industry. We also interviewed officials from BOEM, MARAD, CBP and United States Coast Guard as well as the industry stakeholders listed above.

Appendix II: Existing and Under-Construction Vessels That May Be Able to Support Offshore Wind Installation

Table 5: Selected Foreign-Flag Wind Turbine Installation Vessels as of September 2020 (Sorted by Main Crane Capacity)

Vessel Name	Flag (Country)	Owner	Year built (or projected to be built)	Main crane capacity (U.S. tons)	Cargo deck area (sq. ft.)	U.S. offshore wind project experience[a]
Voltaire	Luxembourg	Jan De Nul Group	2022	3,307	75,347	— (Data not available)
[Unnamed]	Japan	Shimizu Corporation	2022	2,756	—	—
[Unnamed] – Triumph 1	—	Triumph Subsea Services	2023	2,756	49,514	—
[Unnamed] – Triumph 2	—	Triumph Subsea Services	after 2023	2,756	49,514	—
Long Yuan Zhen Hua 4	China	Jiangsu Longyuan Zhenhua Marine Engineering Co.	planned	2,756	—	—
[Unnamed] – SBO NG-20000X-G	—	Swire Blue Ocean	2023	2,756	—	—
Luctor Et Emergo	Netherlands	OOS International	planned 2020	2,646	36,597	—
[Unnamed]	Netherlands	OOS International	2021	2,646	36,597	—
Long Yuan Zhen Hua 3	China	Jiangsu Longyuan Zhenhua Marine Engineering Co.	2018	2,205	32,292	None
Aeolus	Netherlands	Van Oord	2014	1,764	40,634	None
[Unnamed]	Japan	Penta-Ocean Construction Co., Kajima Corporation, and Yorigami Maritime Construction Ltd.	2022	1,764	40,903	—
Innovation	Germany	DEME	2012	1,654	36,597	None
Vole au Vent	Luxembourg	Jan De Nul Group	2013	1,654	38,050	Installed turbines for Coastal Virginia Offshore Wind demonstration project.
Scylla	Panama	Seajacks	2015	1,654	49,514	None
Scorpio	—	Scorpio Bulkers	2023	1,654	—	—

Vessel Name	Flag (Country)	Owner	Year built (or projected to be built)	Main crane capacity (U.S. tons)	Cargo deck area (sq. ft.)	U.S. offshore wind project experience[a]
Tie Jian Feng Dian 01	China	CRCC Harbour and Channel Engineering Bureau Group Co., Ltd.	2019	1,433	26,910	None
Hasty-W I	possibly Japan	Achai Co., Natural Power Corp., Tokyo Electric Construction Corp., and Yoshida and Wakdiba Construction Co.	planned 2020	1,433	—	—
Pacific Orca	Cyprus	Swire Blue Ocean	2012	1,323	46,285	None
Blue Tern (formerly Seafox 5)	Malta	Fred. Olsen	2012	1,323	40,365	None
Gang Hang Ping 9 (Port and Channel 9)	China	Tianjin Port & Channel Engineering Co.	—	1,323	—	None
Hai Long Xing Ye Hao	China	China Guangdong Nuclear Power Group (CGN)	2019	1,323	—	None
Haihangping 9 (Port 9)	China	Tianjin Port & Channel Engineering Co.	2018	1,323	—	None
KOE-02	China	Keen Offshore Engineering	planned	1,323	29,601	—
San Hang Feng He	China	CCCC Third Harbor Engineering Co.	—	1,323	25,833	None
Pacific Osprey	Cyprus	Swire Blue Ocean	—	1,268	46,285	None
Taillevent	Luxembourg	Jan De Nul Group	2011	1,102	38,750	None
MPI Adventure	Netherlands	Van Oord	2011	1,102	38,750	None
Guo Dian Tou 0001 (formerly Friedrich Ernestine, Tuo Peng, Torben, and Sea Breeze II)	China	ZPMC Profundo Wind Energy / SPIC Ronghe International Financial Leasing Co.	2011	1,102	—	None

Vessel Name	Flag (Country)	Owner	Year built (or projected to be built)	Main crane capacity (U.S. tons)	Cargo deck area (sq. ft.)	U.S. offshore wind project experience[a]
Da Qiao Fu Chuan (Bridge Fu Ship)	China	China Railway Fu Chuan Marine Engineering Co.	—	1,102	26,910	None
Fu Chuan San Xia	China	China Railway Fu Chuan Marine Engineering Co.	—	1,102	26,910	None
JB-117	Bahamas	Jack-Up Barge	2011	1,102	26,910	None
JB-118	Bahamas	Jack-Up Barge	2013	1,102	26,910	None
[Unnamed] – Obayashi Corporation & Toa Construction SEP	likely Japan	Obayashi Corporation and Toa Construction Industry	planned	1,102	—	—
[Unnamed]	—	Ocean Installer and VARD	planned	1,102	—	—
San Hang Feng Hua (Elegance)	China	China Communications Construction Company	—	1,102	—	None
Zhong Chuan Hai Gong 101 (W1000-1)	China	CSIC Offshore Wind Power Engineering & Technology	—	1,102	—	None
Sea Challenger	Denmark	DEME	2014	992	36,059	None
Sea Installer	Denmark	DEME	2012	992	36,059	None
Apollo	Luxembourg	DEME	2018	882	21,528	None
Brave Tern	Malta	Fred. Olsen	2012	882–planned upgrade to 1,764 in 2022	34,445	Installed turbines for Block Island wind farm.
Bold Tern	Malta	Fred. Olsen	2013	882	34,445	None
Zaratan	Panama	Seajacks	2012	882	21,528	None
CP-8001	Japan	Penta-Ocean Construction Co.	2018	882	18,837	None
Hyundai Steel	potentially Korea	Hyundai Engineering & Steel Industries	2021	882	—	—
Jing Yin 01 (KOE-01)	China	Keen Offshore Engineering	2017	882	23,681	None

Vessel Name	Flag (Country)	Owner	Year built (or projected to be built)	Main crane capacity (U.S. tons)	Cargo deck area (sq. ft.)	U.S. offshore wind project experience[a]
Long Yuan Zhen Hua Er Hao 2	China	Jiangsu Longyuan Zhenhua Marine Engineering Co.	—	882	—	None
Wind Enterprise (formerly MPI Enterprise)	Denmark	ZITON (formerly DBB Jack-up Services)	—	882	30,677	None
Sea Jack	Greece	—	2003	882	26,910	None

Source: GAO analysis of data collected by Tufts University researchers. | GAO-21-153

Note: This list of vessels is based on a larger list collected by Tufts University researchers from vessel specification sheets and the 4C Offshore vessel database, a commercial database collected by an offshore energy consulting and market research company. Some data points for some vessels are unavailable because, for example, Tufts University researchers were unable to collect such data or the vessels have not yet been built. This is not a comprehensive list of all offshore wind installation vessels, but includes information regarding the fleets of some of the major operators and provides a snapshot of the lift capacity and cargo deck area of the existing offshore wind installation fleet as well as vessels publicly known to be contracted for construction through 2023. We selected vessels from the Tufts information to include on this list by comparing them with the vessel used to install the Block Island project wind turbines. That vessel, the Brave Tern, has a crane capacity of 882 tons. We used this vessel as a standard and included in our list vessels from the Tufts University information with a crane capacity of 882 tons or greater.

[a]Many of these vessels have played a role in foreign offshore wind developments.

Table 6: Selected Existing U.S.-Flag Jack-Up Vessels as of September 2020 (Sorted by Main Crane Capacity)

Vessel Name	Owner	Manufacturer (State)	Year built	Main crane capacity (U.S. tons)	Cargo deck area (sq ft)	U.S. offshore wind project experience
Robert	Seacor Marine	Gulf Island Fabrication (Louisiana)	2011	500	15,403	Laid the Block Island Wind Farm foundations. Was contracted as feeder vessel for Vineyard Wind until the project was delayed and the contract was canceled.
Jill	Seacor Marine	Gulf Island Fabrication (Louisiana)	2014	500	11,754	None to date. Was contracted as feeder vessel for Vineyard Wind until the project was delayed and the contract was canceled.[a]
Great White	All Coast	SEMCO (Louisiana)	2015	350	6,262	None
Brazos	Laredo Group	SEMCO (Louisiana)	2014	200	6,480	None
Power	Seacor Marine	SEMCO (Louisiana)	2002	175	9,010	None
Legacy	Seacor Marine	SEMCO (Louisiana)	2001	175	8,084	None

Vessel Name	Owner	Manufacturer (State)	Year built	Main crane capacity (U.S. tons)	Cargo deck area (sq ft)	U.S. offshore wind project experience
Kayd	Seacor Marine	Bollinger Shipyard (Louisiana)	2006	175	6,555	None
RAM XIX	Aries Marine	Halimar Shipyard-Hull Marine Fabrication-Assembly (Louisiana)	2015	175	6,300	None
Michael Eymard	Offshore Marine Contractors	Halimar Shipyard-Hull Marine Fabrication-Assembly (Louisiana)	2012	175	6,000	Worked on Block Island Wind Farm cable connections
Tobie Eymard	Offshore Marine Contractors	Halimar Shipyard-Hull Marine Fabrication-Assembly (Louisiana)	2013	175	6,000	None
Raimy Eymard	Offshore Marine Contractors	Halimar Shipyard-Hull Marine Fabrication-Assembly (Louisiana)	2013	175	6,000	None
Jaime Eymard	Offshore Marine Contractors	Halimar Shipyard-Hull Marine Fabrication-Assembly (Louisiana)	2013	175	6,000	None
Lacie Eymard	Offshore Marine Contractors	Halimar Shipyard-Hull Marine Fabrication-Assembly (Louisiana)	2013	175	6,000	None
Myrtle	Seacor Marine	Bollinger Shipyard (Louisiana)	2002	150	6,555	None
Influence	Seacor Marine	Boconco, Inc. (Louisiana)	2008	150	6,388	None
Respect	Seacor Marine	Boconco, Inc. (Louisiana)	2009	150	6,388	None

Vessel Name	Owner	Manufacturer (State)	Year built	Main crane capacity (U.S. tons)	Cargo deck area (sq ft)	U.S. offshore wind project experience
Caitlin	Seacor Marine	Rodriguez Shipbuilding (Alabama)	2009	150	6,200	Transported Block Island Wind Farm blade and tower sections.
Paul	Seacor Marine	Rodriguez Shipbuilding (Alabama)	2009	150	6,200	Transported Block Island Wind Farm blade and tower sections.

Source: GAO analysis of data collected by Tufts University researchers. | GAO-21-153

Notes: Tufts University researchers collected these data from publicly available databases; vessel data sheets; news sources; open source ship tracking; and interviews with shipbuilders, designers, operators, and offshore wind maritime professionals. The list is not exhaustive, but includes the largest U.S. jack-up vessels. In our analysis, we compared the Paul, which has a clear deck cargo area of 6,200 feet and was used as a feeder for the Block Island project turbines, with other existing U.S. jack-up vessels. To identify the number of vessels roughly the same size and larger, we included U.S.-flag vessels that have a clear deck cargo area of 6,000 square feet or more. We confirmed that these vessels are Jones Act-compliant by matching them to data in the Coast Guards Merchant Vessels of the United States database and verifying that they possess the required, current Coast Guard documentation.

This table only includes existing vessels and therefore does not include the wind turbine installation vessel that Dominion plans to construct.

[a]Employed on geotechnical tasks on Thor Offshore Wind Farm in Denmark.

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

Andrew Von Ah at (202) 512-2834 or vonaha@gao.gov.

Staff Acknowledgment

In addition to the contact named above, the following individuals made important contributions to this report: Alwynne Wilbur (Assistant Director); Matthew Rosenberg (Analyst-in-Charge); Amy Abramowitz; Nathan Anderson; Dawn Hoff; Christine Kehr; Paul Kinney; Andrea Levine; Diana Moldafsky; Joshua Ormond; A. Maurice Robinson; Frank Rusco; Erin Stockdale; Laurel Voloder; and Elizabeth Wood.

(104090)

GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through our website. Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. You can also subscribe to GAO's email updates to receive notification of newly posted products.

Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, https://www.gao.gov/ordering.htm.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

Connect with GAO

Connect with GAO on Facebook, Flickr, Twitter, and YouTube.
Subscribe to our RSS Feeds or Email Updates. Listen to our Podcasts.
Visit GAO on the web at https://www.gao.gov.

To Report Fraud, Waste, and Abuse in Federal Programs

Contact FraudNet:

Website: https://www.gao.gov/fraudnet/fraudnet.htm

Automated answering system: (800) 424-5454 or (202) 512-7700

Congressional Relations

Orice Williams Brown, Managing Director, WilliamsO@gao.gov, (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov, (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, DC 20548

Strategic Planning and External Liaison

Stephen J. Sanford, Acting Managing Director, spel@gao.gov, (202) 512-4707
U.S. Government Accountability Office, 441 G Street NW, Room 7814, Washington, DC 20548