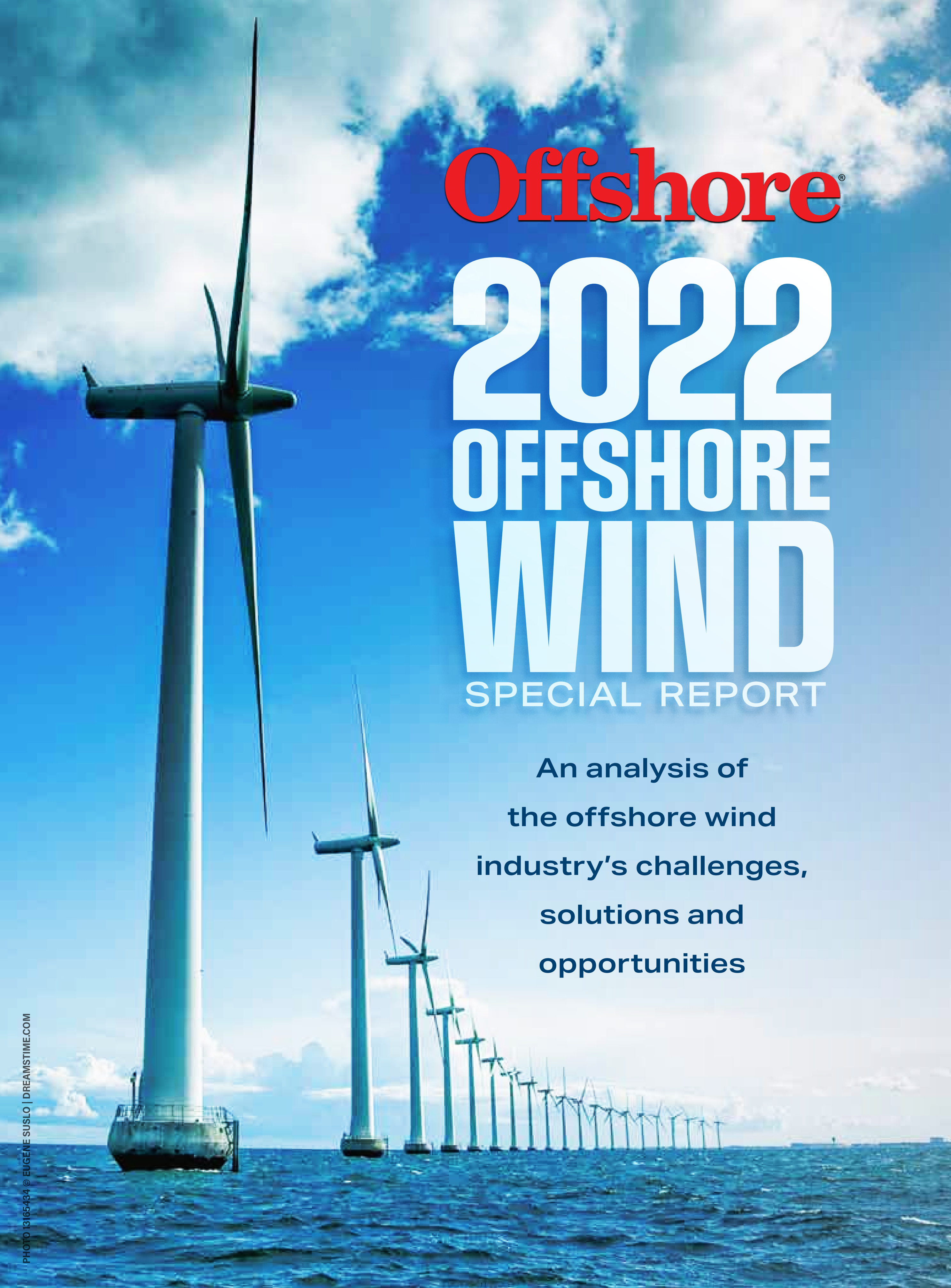

Offshore®

2022 OFFSHORE WIND

SPECIAL REPORT

An analysis of the offshore wind industry's challenges, solutions and opportunities

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Globalization of offshore wind

Advancing the blue economy and energy transition agendas

JAIDEV DHAVLE, FRANCISCO BOSHELL and **ROLAND ROESCH,** International Renewable Energy Agency (IRENA)

Offshore renewables, including offshore wind, wave and tidal energy, and floating PV, are emerging as a key energy resource to support a rapid energy transition. The benefits of offshore renewables go beyond the decarbonization of the energy sector. Oceans are an abundant source of energy for countries with coastal areas, which deployed at scale reduces the dependency on generation linked to the volatility of fossil fuel prices as experienced in the current energy crisis in Europe. Offshore renewables can also drive a vigorous global blue economy for a variety of end-use applications, including aquaculture, shipping, cooling and water desalination, among others. Offshore renewables are expected to provide significant socio-economic benefits and to improve the livelihoods through job creation, local value chains and enhanced synergies with other blue economy activities. Among offshore renewables, offshore wind power is the most mature technology and is already commercialized.

According to IRENA, the cumulative installed capacity of offshore wind increased more than 11-fold between 2010 and 2021, from 3.1 GW to 55.7 GW. The leading market has been Europe, but recently China is rapidly picking up with about 17.4 GW of additional capacity installed in just 2021.

To meet a 1.5 C Paris Agreement aligned scenario, IRENA's analysis indicates that global cumulative capacity of offshore wind would need to reach 380 GW in 2030 and 2,000 GW in 2050. This translates to required annual installations of 70 GW per year and annual investments of US$150 billion to 200 billion per year. These projections indicate the magnitude of the challenge ahead to upscale offshore wind deployment, but also the business opportunities for the wind sector.

In 2021 offshore wind continued to enhance its cost competitiveness supported by technology development and targeted policy instruments like technology auctions, contracts for difference and other types of premium tariffs. The global weighted average levelized cost of electricity of offshore wind declined 60% between 2010 and 2021, from $0.188/kilowatt hour (kWh) to $0.075/kWh. In 2021 alone, there was a 13% reduction year on year, with record prices of $0.043/kWh at a recent auction in the UK.

While there have been positive trends in the offshore development market, there are important challenges faced by the offshore wind industry. One particularly impactful in the last couple of years concerns supply chain disruptions and increases in transportation and materials costs. According to IRENA's latest analysis, higher materials prices contributed to a $145/kW increase in materials costs for wind turbines alone. Wind turbine manufacturers' margins were therefore squeezed in 2021, as their ability to pass through cost increases was limited.

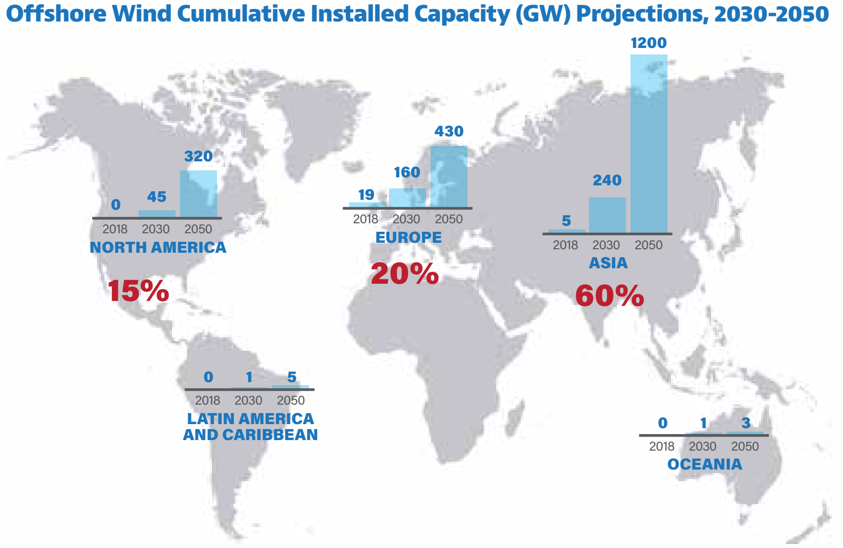
Risk mitigation instruments to address global value chains are crucial, also looking at the expected increase in the demand for critical materials such as copper, nickel, neodymium and dysprosium, which are key components in generators of wind turbines.

Other key challenges to be addressed are long permitting times, the necessity to incorporate offshore wind projects in national marine spatial planning initiatives and the lack of relevant digital skills.

Moving forward, to support catalyzation of offshore wind initiatives, IRENA, with its 168 member countries, will be expanding the work of its Collaborative Framework on Offshore Renewables and Ocean Energy, a government-to-government cooperation platform to foster offshore wind deployment. Finally, IRENA, together with Denmark and the Global Wind Energy Council, will be launching at the COP27 the Global Offshore Wind Alliance to catalyze targeted actions to achieve a total global offshore wind capacity of 380 GW by 2030.

The ongoing fossil fuel price crisis demands a response; renewables such as offshore wind and energy efficiency provide the answer, bringing unprecedented benefits for the environment and the global economy. ●

Offshore Wind Cumulative Installed Capacity (GW) Projections, 2030-2050



The IRENA outlook for global installed capacity (GW) shows Asia taking the lead in the forthcoming decade. COURTESY IRENA 2021

References available upon request.

Innovative solutions give boost to US offshore wind projects

Innovation will be key to meeting ambitious wind targets

CINNAMON EDRALIN and **SARAH MCLEAN,** Esgian

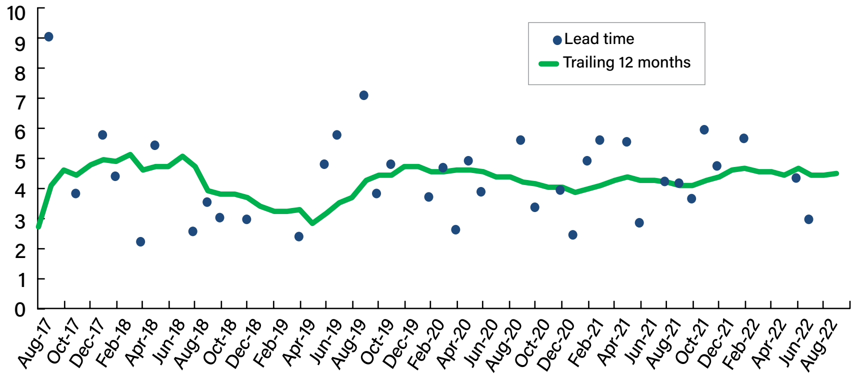
The US offshore wind industry is facing some challenges and opportunities unlike those seen in other parts of the world. Currently, Asia-Pacific has the most operational wind farms at 146, followed by Europe with 114. The US has only two—Rhode Island's 30-MW Block Island project and the 12-MW Coastal Virginia Offshore Wind pilot project. In terms of installed generation capacity, Europe edges out Asia-Pacific with 27 GW versus 25.7 GW. The US comes in at only 0.042 GW.

In March 2021, US President Joe Biden established a national target for offshore wind of 30 GW by 2030. To meet this ambitious goal, rapid expansion is needed. However, the Jones Act, which is intended to protect US jobs, has led to some unintended consequences that will put added pressure on the burgeoning offshore wind industry.

One option would be to construct Jones Act-compliant vessels in the US. However, few US shipyards are equipped to build the specialized vessels needed for offshore wind farm installation. At present, the only wind turbine installation vessel (WTIV) being built in the US is the Dominion Energy-owned *Charybdis*, which is under construction at Keppel AmFELS in Brownsville, Texas, at an approximate cost of $500 million. It is scheduled for delivery by year-end 2023 and will be operated by Seajacks.

To give some context to the cost to build a Jones Act-compliant vessel, newbuild costs for WTIVs in other locations, such as China, run about $350 million. This difference significantly raises the cost of US projects. When added to the high costs for being paid for acreage, this potentially places pressure on developer margins and puts a squeeze on other suppliers to try to keep overall rates of return up.

Global turbine lead times



Data as of 9 September 2022 — *Source: Esgian WindAnalytics*

Lead times are defined as the duration between contract award details being made public and the date of operation of the wind farm.

Meeting installation targets

Given the current state of the global economy, costs are on the rise, and lead times for parts and equipment are growing. This means any new vessel orders are likely to come at a higher price tag and longer delivery schedule. With Esgian's Wind Analytics database reporting 34 US offshore wind projects in the planning stage, project operators will need innovative solutions to meet their installation targets.

One out-of-the-box option for navigating Jones Act compliance comes from Maersk Supply Service, which now has two turbine installation contracts for the Equinor and bp joint venture (JV) projects, Empire Wind and Beacon Wind. This vessel is designed to work using a feeder method in which this vessel will remain on location while support vessels transit between it and the shore. Delivery is expected in 2025. In conjunction, Kirby Offshore Wind will build and operate the associated tugs and barges in the US, thus ensuring Jones Act compliance.

California floating wind tech

Because of the California's steep descent into deepwater, floating technologies will need to be adopted earlier on than other locations that have more shelf area to use fixed technologies. One floating project under consideration is the 150-MW Redwood Coast Offshore Wind project. The proposal anticipates five to 15 turbines anchored to the seafloor by synthetic mooring lines in water depths of 2,000 ft to 3,600 ft. A challenge for floating projects off California is the ports will need to be reconfigured to handle massive structures.

Equipment lead times

Besides growing lead times for installation and related service vessels, manufacture of the foundations, turbines and cables will be a challenge due to lack of sufficient US factories. Importing these items will add to the project time and costs, besides increasing emissions by transporting the equipment from farther away. Also, converting US facilities or building new ones will mean a delay before production starts.

Despite the challenges being faced by the global industry, there are plenty of opportunities for new players and new ideas. ●

Offshore wind projects booming across the globe

Windfarm Status	Country Name	Wind Farm	Sea Name	Offshore Construction Starts	Full Commissioning	Owners	Capacity MW (Max)	Foundation	Water Depth Max (m)
Consent Application Submitted	UK	Erebus	Celtic Sea	1/1/27		TotalEnergies (80%), Simply Blue Energy (%)	100	Floating: Semi-Submersible Platform - Steel	75
		Pentland	Scottish Continental Shelf (Fair Isle)	4/1/26	6/1/27	CIP (90%), Hexicon (10%)	100	Floating: Semi-Submersible Platform - Steel	76
	US	New England Aqua Ventus	Atlantic Ocean	8/1/24	1/1/25	University of Maine (25%), Advanced Structures and Composites Center (25%), RWE (25%), Mitsubishi (25%)	12	Floating: Semi-Submersible Platform - Concrete	110
Consent Authorised	France	Nénuphar test site - MISTRAL - Golfe de Fos	Mediterranean Sea			EnBW	10	Floating: Not Specified	63
		Groix & Belle-Île	Atlantic Ocean	1/1/24	6/1/25	Caisse des dépôts et consignations (49%), CGN (25.5%), Shell (25.5%)	28.5	Floating: Semi-Submersible Platform - Steel	71
	Japan	Goto City	Goto-nada sea	12/1/23	6/1/24	TODA (16.75%), ENEOS (16.65%), Osaka Gas (16.65%), Kansai Electric Power Co. (16.65%), INPEX (16.65%), Chubu Electric (16.65%)	16.8	Floating: Spar Floater - Hybrid	0
	UK	TwinHub	Celtic Sea (Lundy)	7/2/10	12/31/25	Hexicon	32	Floating: Semi-Submersible Platform	53
		Pentland Floating Offshore Wind Demonstrator	Scottish Continental Shelf (Fair Isle)	1/1/25	12/1/25	CIP (90%), Hexicon (10%)	12	Floating: Semi-Submersible Platform - Steel	76
		Blyth Offshore Demonstrator - Phase 2	North Sea, Northern North Sea (Tyne)		4/1/25	EDF (51%), Tenaga Nasional (49%)	58.4	Floating: Semi-Submersible Platform	54
Development Zone	China	Qingdao Shenyuanhai Demonstration - Phase 1	East China Sea				1000	Floating: Semi-Spar	
		Qingdao Shenyuanhai Demonstration - Phase 2	East China Sea				1000	Floating: Semi-Spar	
	France	Sud de la Bretagne I	Atlantic Ocean	1/1/28	1/1/29		250	Floating: Not Specified	104
		Méditerranée I	Mediterranean	1/1/29	1/1/30		250	Floating: Not Specified	1
		Méditerranée III	Mediterranean				500	Floating: Not Specified	
		Méditerranée II	Mediterranean	1/1/29	1/1/30		250	Floating: Not Specified	1
		Sud de la Bretagne II	Atlantic Ocean				500	Floating: Not Specified	1
		Méditerranée IV	Mediterranean				500	Floating: Not Specified	
	Taiwan	Xinfeng Offshore Wind Power Project	Taiwan Strait			RWE, Far Eastern Group	900	Floating: Not Specified	95
		Haian Offshore Wind Power Project	Taiwan Strait			RWE, Far Eastern Group	2500	Floating: Various	70
		Laizhong Offshore Wind Power Project	Taiwan Strait			RWE, Far Eastern Group	600	Floating: Various	60
	UK	Scottish Sectoral Marine Plan - NE1	North Sea			Scottish Government	00	Floating: Not Specified	132
		Celtic Sea - Early Commercial Floating Lease 3	Celtic Sea				350	Floating: Not Specified	
		Celtic Sea Search Area 2	Celtic Sea				1000	Floating: Not Specified	84
		Celtic Sea Search Area 4	Celtic Sea				1000	Floating: Not Specified	110
		Celtic Sea Search Area 3	Celtic Sea				1000	Floating: Not Specified	109
		INTOG (Ea)	North Sea			Crown Estate (The)	633	Floating: Not Specified	105
		INTOG (Eb)	North Sea			Crown Estate (The)	633	Floating: Not Specified	115

Floating wind facilities trending worldwide

OFFSHORE STAFF and **4C OFFSHORE,** a TGS company

Windfarm Status	Country Name	Wind Farm	Sea Name	Offshore Construction Starts	Full Commissioning	Owners	Capacity MW (Max)	Foundation	Water Depth Max (m)
Development Zone	UK	INTOG (NEd)	North Sea			Crown Estate (The)	633	Floating: Not Specified	116
		INTOG (NEc)	North Sea			Crown Estate (The)	633	Floating: Not Specified	100
		INTOG (NEb)	North Sea			Crown Estate (The)	633	Floating: Not Specified	100
		INTOG(NEa)	North Sea			Crown Estate (The)	633	Floating: Not Specified	5
		INTOG(WoSa)	North Sea			Crown Estate (The)	633	Floating: Not Specified	1648
		INTOG(WoSc)	North Sea			Crown Estate (The)	633	Floating: Not Specified	788
		INTOG(WoSb)	North Sea			Crown Estate (The)	633	Floating: Not Specified	7
	US	Oahu South - Call Area	Pacific Ocean					Floating: Semi-Submersible Platform	1298
		Oahu North - Call Area	Pacific Ocean					Floating: Not Specified	1141
		Humboldt SW	Pacific Ocean			BOEM	1000	Floating: Not Specified	10003
		California - Future Call Area	Pacific Ocean					Floating: Not Specified	
		Central Atlantic Call Area F	Atlantic Ocean					Floating: Not Specified	.33
		Brookings	Pacific Ocean			BOEM	3478	Floating: Not Specified	1051
		Bandon	Pacific Ocean			BOEM	2881	Floating: Not Specified	1243
		Gulf of Mexico Option M (Draft WEA)	Gulf of Mexico			BOEM		Floating: Not Specified	24
		Future Floating Project					300	Floating: Not Specified	
		Gulf of Maine RFI Area	Atlantic Ocean			BOEM		Floating: Not Specified	375
	Japan	Goto Sakiyama Oki Oki Huangdao - Development Area	Goto-nada sea			Chubu Electric, ENEOS, INPEX, Kansai Electric Power Co., Osaka Gas, TODA	500	Floating: Not Specified	
	UK	Celtic Sea Search Area 1	Celtic Sea				1000	Floating: Not Specified	114
		Celtic Sea Search Area 5	Celtic Sea				1000	Floating: Not Specified	83
	US	Humboldt NE	Pacific Ocean			BOEM	800	Floating: Not Specified	940
		Morro Bay NW	Pacific Ocean			BOEM	1000	Floating: Not Specified	1054
		Morro Bay C	Pacific Ocean			BOEM	1000	Floating: Not Specified	1063
		Morro Bay E	Pacific Ocean			BOEM	1000	Floating: Not Specified	1087
		Gulf of Mexico Option I (Draft WEA)	Gulf of Mexico			BOEM		Floating: Not Specified	47
		Central Atlantic Call Area E	Atlantic Ocean					Floating: Not Specified	25.14
		Coos Bay	Pacific Ocean			BOEM	10597	Floating: Not Specified	1241
Pre-Construction	France	Golfe du Lion	Mediterranean Sea	4/1/21	6/1/24	Ocean Winds (80%), Caisse des dépôts et consignations (%)	30	Floating: Semi-Submersible Platform - Steel	82
		EolMed	Mediterranean Sea	1/1/24	12/1/26	Qair (75%), TotalEnergies (%), BW Ideol (5%)	30	Floating: Barge - Steel	72
	France	Provence Grand Large	Mediterranean Sea	10/1/22	12/31/23	EDF (50%), Enbridge (25%), CPPIB (25%)	25.2	Floating: Tension Leg Platform - Steel	99
	France	EOLINK 5 MW Demonstrator	English Channel/ Atlantic Ocean	3/1/22	1/1/23	EOLINK	5	Floating: Semi-Submersible Platform - Steel	33
Under Construction	China	Zhanjiang 6.2 MW floating demo	South China Sea	5/27/22	8/31/22	CSIC	6.2	Floating: Semi-Submersible Platform	66

This table provides an at-a-glance view of the global offshore floating wind facilities that are in concept, pre-construction and construction phases as well as development zones. Fixed foundations and fully commissioned projects are not included in this overview. The information provided is courtesy of 4C Offshore, a TGS company, and is accurate as of Aug. 26, 2022.

Floating offshore wind projects sprouting up worldwide

Hot spots of the floating offshore wind sector are heavily focused near the UK, but emerging projects are ramping up globally

JEREMY BECKMAN, Editor, Europe

Global concerns over energy security have added impetus to offshore wind expansion initiatives this year, with greater urgency to extend activity to locations farther out at sea. Technology developers are responding by advancing studies and testing for new concepts, many targeting the floating offshore wind sector.

Earlier this year, Norway's government announced plans for the country's first floating offshore wind auction, covering 1.5 GW in the Utsira Nord lease area of the Norwegian North Sea.

Cerulean Winds, one of the UK's leading advocates of floating offshore wind linked to green hydrogen, aims to develop three 1-GW floating wind projects at locations west of Shetland and in the UK central North Sea to support decarbonization of oil and gas operations in these areas. Under a memorandum of understanding announced last April, Lamprell would provide fabrication, assembly and outfitting of the NOV-designed tri-floaters, featuring steel floater bases that could be floated offshore (unlike alternative cement floating wind structures).

Crown Estate Scotland's current Innovation and Targeted Oil and Gas leasing round (INTOG) includes four 1.5-GW sites for floating wind power. The round is designed specifically for small-scale, innovative offshore wind projects that will directly reduce emissions from offshore oil and gas production and help boost further innovation. Additionally, the UK Crown Estate plans to issue a competitive tender next year for areas in the Celtic Sea off western Britain suitable for floating offshore wind energy generation combined with green hydrogen production.

TLPs should reduce power generation costs because the high stability of tension mooring to a seafloor foundation enables installation of large 15-MW-class wind turbines on compact floating platforms. COURTESY MODEC

Companies that have publicly expressed interest include Source Energie, which aims to deploy its Dolphyn technology to produce large-scale low-carbon green hydrogen from floating offshore wind in the Celtic Sea, with the hydrogen exported to shore via a pipeline. Dolphyn would be used to develop the 300-MW Dylan wind farm by 2028, expanding to gigawatt scale in the 2030s.

In France, momentum is building for floating offshore wind power, especially in the deeper waters off the southern (Mediterranean) coast. SBM Offshore expects to commission Provence Grand Large, its first pilot floating offshore wind project, in 2023, 17 km off Port Saint Louis du Rhone in the Golfe de Fos. This is a joint venture between EDF Renewables and Maple Power. The floaters, co-designed by SBM and IFP Energies Nouvelles for the three Siemens 8-MW wind turbines, will feature tension-leg mooring technology, designed to minimize motions and disturbance to the seabed, with the footprint limited to a few dozen meters, as against several hundred meters for other floating technologies. And the dynamic cables exporting the power to shore are capable of adapting to motions generated by the swell and currents.

Work should have started on NextFloat, a project recently approved for financial support from the European Commission, under a consortium between Technip Energies, Barcelona-based X1 Wind and various European technical institutes and specialist technology developers, and Tersan Shipyard. It will include the deployment of a full-scale 6-MW prototype and installation procedures at the Mistral test site in the French Mediterranean Sea. The concept, based on X1 Wind floating offshore wind technology, is targeting a lighter floater design, a reduced steel requirement and a more compact, efficient mooring system.

Among other technology initiatives advancing in Europe is Odfjell Oceanwind's Deepsea Semi floating wind foundation design for floating wind farms and temporary electrification of oil and gas installations in harsh environments (to complement power from shore). Deepsea Semi is dimensioned for wind turbine generators up to 15 MW, including Siemens Gamesa's SG 14.0-236 DD. The design basis is said to cover all areas for floating wind farms currently planned for the North Sea, Norwegian Sea and Barents Sea, in water depths from 60 m to 1,300 m.

Another semisubmersible platform concept for floating wind is INO12, under development by Inocean, a Norwegian subsidiary of Technip. This is designed to accommodate a 12-MW wind turbine, with a life span of 25 years without dry docking.

East Asia innovations

Across the eastern hemisphere in Southeast Asia, a 50:50 partnership between TotalEnergies and Macquarie's Green Investment Group plans to develop five floating offshore wind projects in South Korea with a potential combined capacity of more than 2 GW, at locations off the eastern and southern coasts in Ulsan and South Jeolla Provinces. The co-venturers aim to initiate construction of the 500-MW Bada project by year-end 2023.

California-based Principal Power Inc. said earlier this year that it was seeking feedback from developers and contractors on its next-generation WindFloat design, which it said is ready to support the 15-MW to 20-MW wind turbines for future floating wind projects in Korea and Scotland. The WindFloat is a permanently moored semisubmersible, three-column stabilized floating platform for offshore wind turbines, with performance-enhancing features such as damping plates and a smart hull trim system.

In South Korea, the company has partnered with Wind Power Korea to drive forward the 1,000-MW Korea Floating Wind (KFWind) project in 250 m of water, 65 km from the coast of Ulsan in the East Sea, and which will employ the WindFloat technology.

Among the Japanese giants, a consortium of MODEC, JERA, Toyo Construction and Furukawa Electric Industry recently started a subsea ground survey in Ishikari Bay, Hokkaido province ahead of verification testing of power generation using tension-leg platform (TLP) floating offshore wind turbines. MODEC claims that TLPs can reduce the cost of power generation because the high stability that tension mooring provides to a seafloor foundation enables installation of large 15-MW-class wind turbines.

In Singapore, Sembcorp Marine has a joint research project with the Technology Centre for Offshore and Marine to further develop, validate, test and improve the SWACH (Small Waterplane Area Cylindrical Hull) design created by Semcorp subsidiary Sevan SSP. This is said to be a cost-efficient floating foundation solution that could house the world's largest wind turbines, providing good motion characteristics in harsh conditions and suited to modularized fabrication and assembly. The shallow draft allows the unit to be fully assembled onshore with a wet tow to final location. ●

Editor's note: Read an extended version of this article at offshore-mag.com/14282576.

Offshore wind in the US a once-in-a-generation opportunity

Society will soon experience economic, environmental and energy system benefits from offshore wind

KRIS OHLETH, Special Initiative on Offshore Wind

It is a rare and special thing to witness the birth of an industry. Imagine being there to watch the first Model T roll down the streets of your town or to be the first one with an electric light bulb hanging over your kitchen table.

Offshore wind energy presents just that opportunity: a once-in-a-generation opportunity to bring enormous economic, environmental and energy systems benefits to the US.

Offshore wind is a technology that has been delivering energy and other positive attributes to countries around the world for more than 30 years. Right now, thousands of wind turbines are spinning in numerous countries in Europe and Asia. In addition to generating more than 55 GW of electricity worldwide—which is powering millions of homes—offshore wind is also delivering tens of thousands of good-paying jobs and a skilled workforce, all while providing environmental benefits and energy security.

Currently, the US has only seven wind turbines offshore, which comprise two demonstration-scale projects. Compared with the development of offshore wind globally, this is a paltry sum. However, the future is bright for US offshore wind and will bring energy independence to the nation.

For the first time in history, the US has set a national target for developing offshore wind: 30 GW by 2030. This is an exciting and ambitious goal that has provided a beacon for those in the sector. This level of development will provide tens of thousands of jobs and millions of dollars in economic activity.

Indeed, the economic benefits of building out to the 30-GW goal is clear. A recent report by the Special Initiative on Offshore Wind provides analysis that shows that the level of economic activity available through private investments to the supply chain is $109 billion. This is an incredible opportunity, providing an injection to the US economy equal to nearly half the size of the budget for the entire state of Louisiana.

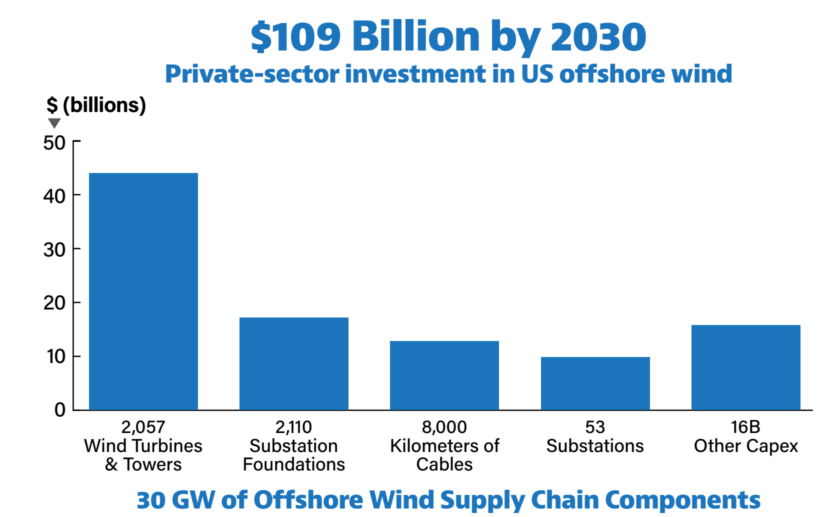
Leasing activity

The areas off the coast that are needed for offshore wind development are leased by the Bureau of Ocean Energy Management (BOEM), an agency in the US Department of the Interior. While one of the lesser-known agencies of the federal government, they are one of the largest revenue-generating agencies for the US Treasury, as it collects revenues from offshore oil and gas generation as well as from renewable energy projects, like offshore wind.

The majority of the leasing activity for offshore wind has been on the Atlantic Coast. However, in July of this year, BOEM released a request for comments on two draft Wind Energy Areas (WEAs) in the Gulf of Mexico (GoM). The first WEA would be located about 24 miles off the coast of Galveston, Texas, covers a total of 546,645 acres and has the potential to power 2.3 million homes with clean wind energy. The second WEA would be located about 56 miles off the coast of Lake Charles, Louisiana, covers a total of 188,023 acres and has the potential to power 799,000 homes.

These new areas proposed in the GoM are another important indicator that the nation is on the precipice of an energy transition.

Indeed, it is an exciting thing to witness the birth of an industry. While most of the offshore wind turbines in the US will be too far to see from shore, there is no doubt that everyone will experience the profound economic, environmental and energy system benefits that follow. ●



SIOW recently published a study highlighting the $109 billion supply chain opportunity from the private sector for offshore wind in the US. The graphic illustrates the level of spend and on which components. COURTESY SIOW

Kris Ohleth *is director with Special Initiative on Offshore Wind (SIOW), an independent policy think-tank devoted to the development of offshore wind in the US.*

Busy years ahead in Western Europe

Is the supply chain ready?

ALEXANDER FLØTRE, Rystad Energy

Russia's invasion of Ukraine in late February has thrown the spotlight on energy independence in Europe, with several countries setting new and ambitious offshore wind targets for 2030 to replace Russian gas in the power mix. While such targets can help bring certainty to the market, the planned growth would entail a rapid ramp-up in manufacturing and installation capacities.

In this article, Rystad Energy assesses how much of the planned growth in Western Europe is expected to materialize, what the current outlook would entail for the supply chain and what challenges lie ahead.

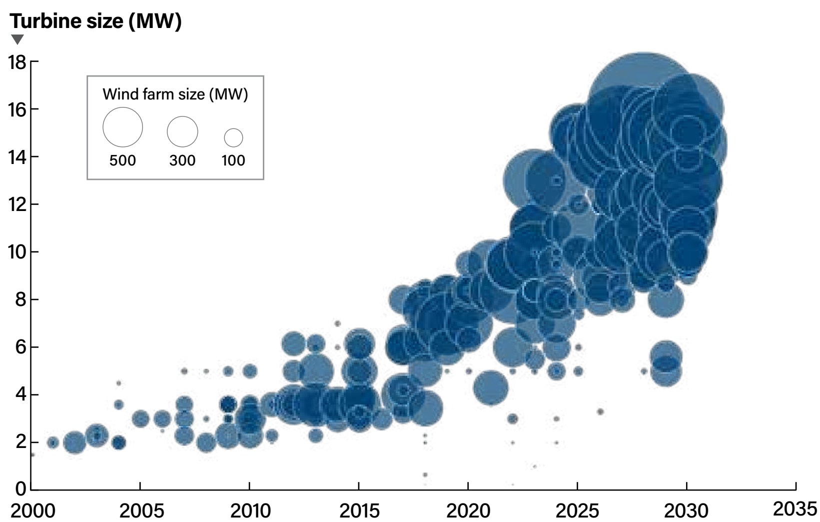
Rystad Energy expects operational offshore wind capacity in Europe to grow from 26.1 GW at year-end 2021 to about 135 GW by year-end 2030. The largest capacity additions are expected during the second half of the decade, where new annual capacity is expected to surpass 25 GW in 2030. While a large portion of the growth is expected to come from the most established countries in Western Europe, other countries such as France, Ireland, Sweden, Spain and Portugal are expected to add to this, along with Eastern European countries, primarily in the Baltic and led by Poland. Additional upside could be unlocked if the Netherlands and Germany, among others, were to fully reach their ambitious targets for 2030, following the Esbjerg Declaration in May 2022.

With the strong growth in activity, demand for turbines, foundations, transmission infrastructure and capable vessels to install the respective components is expected to grow rapidly. Rystad Energy forecasts a need of about 8,000 turbines and foundations for projects expected to start up between 2023 and 2030, along with about 140 offshore substations and about 33,000 km of inter-array and export cables in the same period.

Adoption of the largest turbines in the market is expected to be rapid, with almost half of the turbines added between 2023 and 2030 forecast to be larger than 12 MW, and almost three-quarters above 10 MW. While floating wind has gained much momentum in recent years, limited capacity is expected to come online before 2030. About 90% of the capacity additions will come from bottom-fixed offshore wind.

The general component size increase is primarily driven by the race between turbine manufacturers, where Vestas, Siemens Gamesa and GE are competing to have the largest and most efficient offshore wind turbine in the market. This carries with it a need for larger foundations, higher-voltage cables and increased crane capacities. As current supply setups need to be altered to accommodate changing demand, every large-scale change leads to a new investment decision for the suppliers. Moreover, the rapid size growth leads to uncertainty around where sizes will be in the medium to long term and for how long their current or planned specifications will be relevant in the market, and this uncertainty prolongs investment decisions and makes them riskier.

Certain voices in the market, also among turbine manufacturers, have expressed a need to stop the turbine size race. A temporary pause in size development could provide the necessary certainty for the supply chain to expand capacities to support the ambitious growth plans in Western Europe toward 2030. ●



COURTESY RYSTAD ENERGY OFFSHOREWINDCUBE

Western European wind farms are organized by startup year, turbine size and capacity. The size of the bubbles corresponds to project sizes (MW).

With a growing list of developers aiming to commission offshore wind farms this decade, the race is on to secure the necessary supply. Suppliers such as foundation and cable manufacturers and next-generation wind turbine installation vessel operators are reporting full order books through—and often beyond—2025, and developers have started to lock in supply at an increasingly earlier point in time. Rystad Energy expects the growing demand to lead to project delays during the second half of the 2020s, despite a ramping up of the supply chain. This means that the new and ambitious national targets are unlikely to be fully met by 2030.

One key challenge for the supply chain is the combination of rapidly growing demand and continuously growing component sizes.

Alexander Fløtre is Rystad Energy's vice president and head of offshore wind.

Asia emerging as offshore wind supply chain powerhouse

Significant potential in Asia's offshore wind supply chain with $294B EPCI spend forecast from 2026 to 2030

RUTH CHEN, Westwood Global Energy Group

Asian markets have some of the most ambitious offshore wind development targets, including Japan targeting 10 GW and South Korea 12 GW by 2030. While supply chain maturity levels vary across the region, they are marked by a growing self-sufficiency, localization and potential to supply to the world.

Component level supply chain dynamics

Home-grown expertise and localization of international contractors means Asia has the capability to supply a significant portion of its offshore wind components and installation needs. Of the top five turbine manufacturers in Asia (excluding China), three are Asia-based: Goldwind and Ming Yang Smart Energy with 7% of ordered capacity each and Hitachi with 2% in 2018-2022.

Mainland China boasts 17 home-grown offshore wind turbine manufacturers such as Goldwind and Shanghai Electric. Siemens Gamesa has opened an offshore wind regional hub in Taiwan alongside a nacelle assembly facility in Taichung port, the company's first outside Europe.

Though recently cancelled, Vestas initially planned to develop a nacelle facility in Japan, encouraged by a government subsidy program. Despite government help, Vestas commented publicly that it is a challenge to cost efficiency, after initially pursuing plans to build several nearby manufacturing facilities within Japan and South Korea, to meet local content requirements.

Local content

Asia's offshore wind supply chain is characterized by local content policies like those in the US and Poland.

In late 2021, Taiwan announced a localization policy for Phase 1 of Round 3 auctions for wind farms operational from 2026-2027, set at 60% local content with the remaining 40% on a bonus point mechanism for engineering service segments, which usually has limited local content. According to some, this policy is stymying progress in offshore wind development.

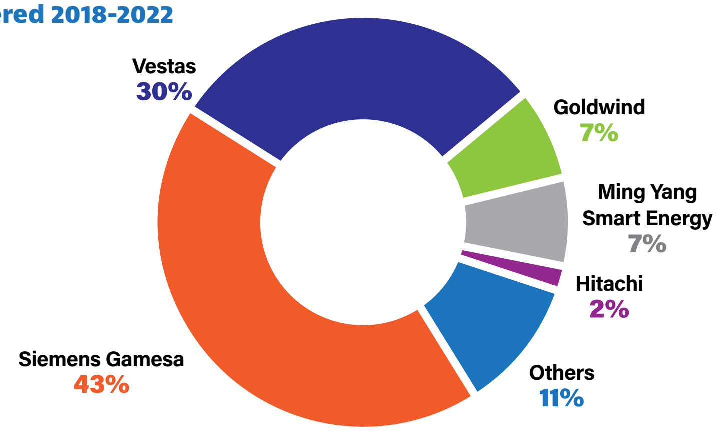
Japan hopes to achieve 60% Japanese content by 2040, while South Korea has an informal preference for local contractors. It remains to be seen if these will limit the ambitious capacity goals.

Internationalizing Asian supply chain

Asian offshore wind supply chain providers face challenges when competing globally. An Asian cable manufacturer has shared with Westwood that its pricing is not as competitive in Europe due to expensive sea transportation costs. Strategic partnerships, however, may be a factor in winning tenders. In March 2022, TenneT awarded a consortium between Boskalis and Mainland China's Orient Cable a cable contract for the Hollandse Kust West Alpha/Beta offshore substations.

Another Asian turbine manufacturer that has developed long-term strategic plans is Ming Yang Smart Energy. Besides having supplied turbines for Renexia's Taranto/Beleolico project off Italy, Ming Yang has just listed on the London Stock Exchange and plans to build manufacturing facilities in the UK.

Turbine manufacturers market share in Asia (ex-China) by capacity ordered 2018-2022



COURTESY WESTWOOD GLOBAL ENERGY GROUP

There is tremendous potential in Asia's offshore wind supply chain with $294 billion forecast EPCI spend 2026-2030, of which $194 billion or 66% is to be spent on turbines. Much of this growth comes from emerging markets like Japan, South Korea and Australia, besides mature markets like Mainland China. This spells a promising future for Asia's offshore wind supply chain, if it can navigate local content rules developing depth and maturity while hitting the ambitious targets set forth. Beyond Asia, the rest of the world's offshore wind markets beckon. ●

Ruth Chen is a senior analyst with Westwood Global Energy Group.

Rising to the challenge of a new industry

Construction and fabrication sectors face issues as they work toward delivering for an energy future led by offshore wind

JON ONGLEY, Xodus

The world is on the cusp of a boom in global offshore wind construction and fabrication. The development of this renewable, sustainable form of energy brings an unprecedented scale of opportunities and an almost equal scale of challenges.

Governments have set ambitious targets as they move toward net zero, while also addressing an increasing need to ensure security of supply and greater in-country benefit. That is creating huge pressure for a substantial acceleration and increase in the role that local content will play in delivering those targets. The industry is seeing such pressures in the UK following the ScotWind leasing round and plans for new windfarms in the Celtic Sea. However well intentioned that is, there are concerns that there are simply not enough suitable fabrication or marshalling sites in the UK to meet the increased demand, exacerbated by the complexities of mobilizing floating substructures.

With that caveat in mind, however, the projected exponential growth of offshore wind is good news, sparking considerable discussion and excitement about the huge investment that is expected to come into the UK fabrication supply chain.

The upsurge in interest in floating wind will be a real democratizer in terms of where these substructures can be fabricated. Structures for floating wind, assembled relatively simply for some concepts (for example by bolted connections), as opposed to oil and gas or fixed wind assets, which need space and a large labor presence, bring opportunities for yards that traditionally wouldn't have been considered for such work. Suddenly, these smaller, geographically scattered sites that have not seen much benefit from offshore wind in the past will be in demand, placing them very firmly in the crosshairs of developers targeting as much local content as possible.

Recent bottom-fixed UK North Sea windfarms have favored large-scale fabrication in Asia and the Middle East. The emerging narrative in the UK that prioritizes local content will be a challenge to address. With little evidence of that happening now, there is an expectation that a foundations and turbines. To enjoy healthy margins from such large serial fabrication scopes, UK and US yards must prioritize investment in modernization and training.

Identifying ways to get costs down will become a priority, and it is likely that pressure for greater automation and robotics will be considered when upgrading existing infrastructure. Striking a balance between innovation and expected job creation and economic opportunity will be a critical conversation as the offshore wind

The Aberdeen Offshore Wind Farm is located about 3 km off the coast of Aberdeen, UK. With its 11 wind turbines, it has a total capacity of 93.2 MW. COURTESY RICHARD CRIGHTON, BIG PARTNERSHIP

clear roadmap needs to develop within the next five years.

As the US ramps up its offshore wind activity, it is in many respects coming from a very strong position in terms of offshore construction. It already has a pedigree of fabrication for offshore oil and gas, which should be readily transferable to offshore wind. Nevertheless, the requirement to scale up onshore infrastructure, training and marine assets to meet the needs of serial fabrication will play a factor into how palatable the investment implications will be. Furthermore, the North Sea market has so far demonstrated that for such serial offshore windfarm fabrication, risks are higher and margins lower than previously seen in oil and gas. North Sea windfarms under construction can have up to 100

industry continues to grow and expand.

Furthermore, the current lack of standardization in floater design creates a huge challenge for fabricators looking to optimize their manufacturing capabilities, and consequently fabricators may be wary to invest early.

Developers must focus on early supply chain engagement, providing support on the identification of investment priorities.

Opportunity on a massive scale awaits. Responding to those opportunities will be a challenge, but not an unassailable challenge, provided the industry can successfully mobilize the assets and workforce for this exciting new sector. ●

Jon Ongley is the renewables construction lead with Xodus.

Supply chain under pressure from rapidly expanding wind market

There are question marks over the longevity of older, less capable vessels in a market where foundation sizes and weights are rapidly increasing

CATHERINE MACFARLANE,
S&P Global Commodity Insights

With annual offshore wind installation expected to double over the next four years, reaching 1,300 newly commissioned turbines in 2026 and more than 1,900 units in 2028, it is little surprise that the supply chain has responded rapidly over the last four years.

With demand coming from the mature Northwest Europe market, as well as the emerging APAC and US regions—and potential demand from other regions opening up—vessel owners and financial institutions have bet big on offshore wind. The rapid development of turbine technology, with average turbine sizes expected to increase from 8 MW in 2022 to about 18 MW in 2030 in developed markets, has also put the onus on vessel owners to keep pace by either ordering newbuilds capable of installing next-generation turbines or extensively upgrading existing units so they can remain working in the market.

According to IHS Markit's ConstructionVesselBase, the wind turbine installation fleet (WTIV) currently has 16 vessels, excluding the Mainland China fleet. Of these vessels, seven are expected to undergo upgrades to remain in the market, with a 1,600-tonne crane upgrade on Fred Olsen Windcarrier's *Bold Tern* already complete earlier this year. Meanwhile, there are 12 further newbuild WTIVs underway, including Cadeler's *F-Class* jackup, which although primarily aimed at the foundation installation market, has also been designed to be capable of turbine installation. All of the newbuilds are expected to deliver between this year and 2025, with two—*Blue Wind* and the *CP-16001*—specifically to meet demand in the emerging Japan market, and a further two—*Charybdis* and Maersk Supply Service's newbuild—contracted in the US market. However, the size of the future fleet will be tempered by the fact that six of the current fleet are expected to become obsolete by 2030 at the latest, due to their technical inability to install turbines larger than 10 MW.

Meanwhile, the foundation installation market and the fleet currently servicing it has come under the spotlight. WTIVs units is likely to be turbine installation, with several already contracted. Meanwhile, excluding the aforementioned Cadeler *F-Class*, a further four specialist foundation installation vessels are on order, all to be delivered between 2022 and 2025. However, delays to several current foundation installation campaigns have highlighted that there are already difficulties in accessing suitable vessels for this work.

However, there are question marks over the longevity of older, less capable vessels. With nine of the fleet considered to be mainly oil and gas vessels and five straddling both markets, there could also be potential issues with meeting demand

FOUNDATION INSTALLATION FLEET (EXCLUDING MAINLAND CHINA)

Lift capacity	<1,000	>1,000 to 1,600	2,000 to 3,000	>3,000 to 5,000	>5,000	Grand Total
In Service	4	7	4	7	4	26
Under construction		1	12	2		15
Grand Total	4	8	16	9	4	41

SOURCE: DATA TAKEN FROM IHS MARKIT PETRODATA CONTENT (CONSTRUCTIONVESSELBASE) © 2022 IHS MARKIT

have traditionally played a large part in this market, augmented by floating heavy-lift crane vessels mainly from the oil and gas market. ConstructionVesselBase has a fleet of 26 vessels in the foundation installation market, excluding Mainland China, with 13 of these vessels also capable of installing turbines, if Heerema's semisubmersibles *Thialf* and *Sleipnir* are included. XXL monopile foundations are defined by the GROW reach project SIMOX (Sustainable Installation of XXL Monopiles) as having a diameter bigger than 7.5 m and up to 11 m and weighing between 1,000 and 2,400 tonnes. With the increasing use of XXL monopile foundations, at least 10 of these vessels are likely to become obsolete in this market.

While the WTIV newbuilds all have a lift capacity of at least 2,000 tonnes, with the exception of one vessel, the focus for these across the rebounding oil and gas market. Commitments in the decommissioning and pipelay market especially are likely to mean several of these vessels will not be fully available in the offshore wind market.

An Equinor and bp joint venture has already moved early to secure long-term supply of suitable foundation installation units and avoid delays to turbine installation and subsequent first power, with its seven-year agreement with Heerema for the Empire Wind and Beacon Wind projects. It may be that other developers follow suit with similar arrangements, with such agreements perhaps also opening the door to the financing of future newbuilds. ●

Catherine MacFarlane is the ConstructionVesselBase manager and technical research principal with S&P Global Commodity Insights. Note, IHS Markit is now a part of S&P Global.

US initiatives assess current wind challenges, future opportunities

The development of fixed and floating offshore wind infrastructure presents vast opportunities

WEI HUANG, LARS SAMUELSSON and **ELIZABETH KRETOVIC,** ABS

From a commercial standpoint, there are interesting statistics and data evolving from the global opportunities in the offshore wind market.

According to an Intelatus Global Partners' article released June 1, "The US offshore wind segment shows no signs of slowing on its journey to deploy 30 GW of offshore wind by 2030 and 110 GW by 2050." Based on some state's recently announced goals, Oregon is expected to achieve 3 GW by 2030 and California is expected to deploy 25 GW by 2045. The US offshore wind market capacity pipeline has 41,562 MW pending.

To date, there have been two projects announced to go to construction and another nine in the queue as they submitted construction and operations plans (COPs). The US Bureau of Ocean Energy Management (BOEM) plans to advance new lease sales and complete a review of at least 16 COPs by 2025, enabling a total of 19 GW of capacity, and is seeing reviews such as the recent submissions by the new owners of the New York Bight Lease Areas. State goals and power purchase agreement schedules are driving the initial spend toward initially fixed and eventually floating offshore wind as the industry moves into deeper water to 60 m or more.

Hurdles are being addressed such as the designs of suitable floating substations, which is a key consideration. Developments in port infrastructure, transmission connectivity and sourcing original equipment manufacturer equipment are all key challenges in the early development phase of floating offshore wind, but smart thinking across the supply chain is supporting the conceptual approach to this market sector.

The first Jones Act-compliant wind turbine installation vessel is Dominion Energy's Charybdis. COURTESY GUSTOMSC; NOV

Key initiatives in the US include tax incentives to support wind component manufacturing, port enhancements as well as workforce development through labor agreements and university partnerships.

At ABS, the team has seen several US maritime training facilities join the Global Wind Organization to help ensure training is timely and successfully delivered for the offshore wind workforce to support construction goals.

Developers and engineering, procurement and construction companies are establishing different levels of internship programs with universities targeting career paths for the future growth of the industry. All these initiatives are coming together to establish a trained workforce targeting lower costs and to establish an industry focused on minimizing risk.

Progress in the newbuild and retrofit of crew transport vessels (CTVs) through to wind turbine installation vessels (WTIVs) is being supported by ABS Class across all vessel sizes. Challenges exist in availability of vessel construction materials along with long lead time machinery components, which could potentially contribute to project schedule delays. However, incentivizing domestic production of critical materials that have complementary applications may relieve supply chain challenges. The creation of designated regional economic hubs for vessel construction, retrofit and maintenance in locations in close proximity to lease clusters will help in the early adoption of clean or alternative fueling infrastructure.

Recent developments include a subsea rock installation vessel, which was awarded by the Great Lakes Dredge and Dock Co. to the Philly Shipyard in Pennsylvania. The first Jones Act compliance service operation vessel is to be engineered, constructed and operated by Edison Chouest Offshore and will be built in the Gulf Coast. It will become an integral part of the operation and maintenance of Ørsted and Eversource's projects of Revolution Wind, South Fork Wind and Sunrise Wind offshore wind farms in the northeast US.

The *Charybdis* WTIV is the first Jones Act-compliant vessel and is under construction at Keppel AmFels Shipyard in Brownsville, Texas, for Dominion Energy's Virginia lease area. However, it will be chartered first to Ørsted for its Revolution Wind project in the northeast. Another solution contracted for Equinor and bp's Empire Wind project will use two new feeder barges and two diesel-electric hybrid tugboat units by Kirby Offshore Wind to supply a Maersk-owned WTIV with towers and turbines for installation off the coast of New York. All these vessels are being built to ABS class. ●

Wei Huang is ABS' director of global offshore vessels, **Lars Samuelsson** is head of global floating wind and **Elizabeth Kretovic** is director of North America offshore wind.

Developers face challenges with data management and driving innovation

The top operations and maintenance strategies are developing data-driven tech and driving down costs and time

ARIANA HURTADO, Editor and Director of Special Reports

In the offshore wind sector, the operations and maintenance (O&M) phase covers a breadth of services, such as inspections of turbines, foundations, cables and other components of the wind farm as well as making repairs or replacements. O&M costs are a large part of the total costs of offshore wind power, so new innovations for the O&M of turbines and wind farms are critical in ensuring a cost-effective sector.

The main O&M challenge for the offshore wind industry is data management, according to Wouter Maas, Fugro's solution director of O&M offshore wind. The company can support all offshore renewables projects from initial site appraisal and design through to installation and O&M. Fugro focuses on supporting the development, construction and extension of offshore wind farms. The data Fugro has collected during the site characterization phase has almost doubled in recent years, and those data are accessible within hours rather than several weeks.

"The number of sensors and high-resolution cameras being incorporated into the design of offshore wind farms are increasing to enable preventive maintenance strategies," Maas told *Offshore*. "Interpreting and leveraging the data acquired during all phases and translating the data into actionable insights presented in a 3D model of the asset can help reduce the levelized cost of energy."

Fugro also aims to help developers save on maintenance costs. "Failure of an element of the offshore wind farm can cause a reduction or even a shutdown in the power production, which will lead to significant economic losses," Maas said. "By combining our geotechnical and geophysical knowledge of the offshore wind farm site with accurate insights from structural monitoring, we help our clients create an optimized inspection plan allowing them to focus their attention on the right asset at the right time. This preventive maintenance strategy helps reduce the number of failures and associated maintenance costs."

Noting another hurdle, Peter Sutton, Ocean Winds' O&M and assets management director, stressed the core issue developers are facing are with driving innovation (including hydrogen integration) and keeping the costs and time down. Ocean Winds is the 50:50 joint venture dedicated to offshore wind from EDPR and ENGIE.

Another challenge during O&M strategy planning and execution is going into deeper water, he added.

"Some projects we are developing, like KF Wind, a 1.3-GW floating wind farm in Korea, are planned at an 80-km distance from shore," Sutton told *Offshore*. "We are getting our O&M strategy ready for the road ahead, anticipating not only the distance but also the challenging climate."

He also said it's important to analyze the data from the O&M control center and work on prediction with the gathered information.

"The main objective is to keep the turbines running and have a smart approach to anticipating alarms," Sutton said. "History, put together thanks to adequate data, helps you plan better. Planning will always be the answer to optimizing time and cost, and in our case, maximizing the generation of clean energy."

Looking ahead

Sutton said O&M strategies will continue to evolve and lessons learned from proven technologies can be applied to floating wind.

"The fixed monopiles or jackets are a mature system that we know how to operate and maintain," he said. "The strategies will be evolving for floating wind, with technology ready for commercial scale. We need to keep on working to drive operational cost down, and drive time down for O&M. However, learning from fixed technologies, we can transfer expertise into floating."

Maas added that O&M strategies will become more data driven with a focus on lifetime extension.

"To optimize offshore wind farms' efficiency and effectiveness, the acquisition, management and analysis of big datasets from multiple sources will be at the core of its speed of development and long-term success as the industry matures," he said. "Successful O&M strategies will also have to heavily rely on more remote solutions, which means transferring the skills from offshore to onshore ROCs [remote operations centers] and using more sustainable and lower fuel consumption USVs with greater over-the-horizon capabilities. We will also see island solutions, which allow uncrewed vessels to autonomously refuel at a location near the offshore wind farm or within the offshore wind farm itself."

Maas said the future of offshore wind will be reliant on data management as well as remote and autonomous technologies.

"This requires a big shift in mindset, regulations, training, working procedures and a lot of open conversations within the industry to discuss challenges, such as certification of the USV," he concluded. "Only then we can continue to drive forward the energy transition contributing to a safer and sustainable world running on green energy." ●

Editor's note: Read an extended version of this article at offshore-mag.com/14282524.

US BOEM rapidly ramps up offshore wind development

As BOEM tackles new challenges and the enormity of the tasks before it, litigation may slow the process and frustrate goals to achieve ambitious timelines

LAURA MORTON, AUBRI MARGASON and **KERENSA GIMRE,** Perkins Coie

The US administration's goal of generating 30 GW of power through offshore wind by 2030 has compelled the Bureau of Ocean Energy Management (BOEM) to rapidly ramp up offshore wind development. With high deployment expectations, BOEM faces significant headwinds to deliver projects on time. To meet this ambitious target, BOEM sought more funding in its fiscal year 2023 budget request and is assessing mechanisms to maximize accomplishments, including its June 2022 publication of standard screening criteria for alternatives to be analyzed in future construction and operations plan (COP) environmental impact statements (EISs).

BOEM also is considering a regional approach to evaluating the environmental impact of multiple projects—a major shift in its permitting strategy. As a first step, they have issued a notice of intent to prepare a programmatic environmental impact statement (PEIS) for the New York Bight lease areas. A PEIS allows an agency to assess direct, indirect and cumulative environmental impacts of common issues across multiple proposed actions. Subsequent National Environmental Policy Act documents can then be tiered off the PEIS to avoid duplicative analyses.

The Bight PEIS, which BOEM projects will be published before the lessees' COPs, will allow BOEM to conduct an analysis of a representative project's expected impacts and analysis of programmatic avoidance, minimization, mitigation and monitoring (AMMM) measures and a focused, regional cumulative analysis. BOEM will use the PEIS to identify minor or negligible impacts, so that site-specific review can focus on moderate/major ones, determine how to tier project-specific analyses, and adopt programmatic AMMM measures to use as preconditions for project-specific COP approvals.

Hypothetically, the PEIS would create BOEM process efficiencies, streamline the environmental review process, provide increased transparency and predictability for lessees, and incentivize developers to collaborate on mutual mitigation measures. BOEM should, however, consider making some of the PEIS AMMM measures advisory or subject to modification. As developers obtain more survey data and research on protected species leading to COP submittal, they might present a more efficient or innovative means of mitigating potential impacts than BOEM envisioned. BOEM has opted to use a project design envelope (PDE) to analyze environmental impacts, following the approach of the UK and other European countries. This approach minimizes the need for subsequent environmental and technical reviews at the project stage, and it defines, brackets and analyzes the reasonably foreseeable characteristics of COPs while maintaining a degree of flexibility for individual projects. Developers can submit projects that fit into an approved "envelope" of design parameters, but if their final design is outside the approved range, then further environmental review may be required. BOEM has not embraced the full flexibility a PDE offers and should consider additional methods of granting flexibility. BOEM must consult with the industry to ensure it analyzes a reasonable set of parameters, given the possibility that leaseholders may use different wind turbine technologies and develop their project designs at different paces.

Unfortunately, the PEIS approach is not easily transferrable to other planned lease areas—something BOEM acknowledged during the Bight public scoping meetings. The Bight is unique in its number and proximity of lease areas, uniformity of species, benthic and seafloor environment, and its expectations for timely COP submissions. On the latter point, BOEM noted a PEIS could become too outdated if COPs are expected over a longer period (e.g., five to six years). Offshore wind technology also is evolving rapidly, making it critical that the PEIS process take significant innovation into account—a move toward flexibility that could maximize the clean energy produced per acre. Given current litigation over the designation of the Bight Wind Energy Areas and the challenges to BOEM's decision to approve the Vineyard Wind project, the Bight PEIS will likely attract lawsuits. BOEM should consider whether litigation challenging the PEIS, or individual projects based on tiering to the PEIS, would delay projects with COPs already underway.

The pace and volume of tasks before BOEM is significant. Looking beyond the Bight, BOEM may be forced to find new ways to optimize its environmental reviews. As BOEM tackles these challenges, litigation could slow the process and frustrate goals to achieve ambitious timelines. Although potential efficiency gains through a PEIS are encouraging, only time will tell if BOEM maximizes these potential gains—whether through embracing the full flexibility of the PDE approach or making some AMMM measures advisory or modifiable. ●

Laura Morton (partner), **Aubri Margason** (associate) and **Kerensa Gimre** (associate) are with Perkins Coie's Environment & Natural Resources practice group.
Read the extended version of this regulations article at offshore-mag.com/14282503.

Offshore energy services sector continues to develop innovative technologies

New technology is leading the future in energy resources, including oil, gas and offshore wind

LESLIE BEYER, Energy Workforce & Technology Council

COURTESY ENERGY WORKFORCE & TECHNOLOGY COUNCIL

Today's business enterprise is defined by seeking new and improved methods to operate more efficiently and effectively, including the offshore oil and gas and offshore wind industries. In both of these critical areas of energy production, innovative technologies are leading the way in safety, operations, emissions reduction, and the gathering and processing of data.

One of these drivers, digital technology, is critical to the development of both energy systems and imperative to the future of energy production. Energy service providers have long played an important role in the technical advancement of the upstream oil and gas industry. Digitalization, remote technology and automation are all working together to accelerate the expansion to cleaner energy production. The sector is also implementing technologies like artificial intelligence (AI), automation, cloud computing, digitalized drilling equipment, fugitive emission reduction, machine learning, predictive analytics, remote monitoring and analytics, robotics and ROVs to work more efficiently and reduce emission in both offshore oil and gas and offshore wind projects.

Energy Workforce member company Fugro uses its RAMMS (Rapid Airborne Multibeam Mapping System) to deliver depth penetration and point densities for fast and accurate measures of ocean depth in nearshore and coastal waters via small aircraft or uncrewed aerial vehicles. These systems help improve project safety and sustainability by limiting the number of crews needed in the field and reducing fuel demands.

To gain further insight into seafloor conditions, companies rely on side scan sonar technology, which generates an acoustic picture of the seafloor. Data collected produce a photo-like image of the seafloor. Automated technologies also enhance both offshore wind and oil and gas alike. For example, cloud-based systems enable workers located in offsite command centers to perform offshore survey tasks as if they were physically on board the vessel.

ROV technology from Energy Workforce member Oceaneering International is used in offshore oil and gas and to monitor offshore wind facilities.

Energy Workforce member company NOV is supporting offshore wind with gusto-designed wind turbine installation vessels. A semisubmersible hull has been developed for the offshore floating wind market, and the company works with shipyards to potentially industrialize the technology in much the same manner it has done for floating rigs. NOV also has developed offshore windmill installation vessels and installation systems.

In its June 30, 2021, report, Evercore ISI's James West said, "We believe leaders in the offshore oil and gas industry, such as NOV, will be instrumental in the success of floating wind, which utilizes similar mooring systems and subsea cables, as well as expertise in risk reduction and project execution."

Both industries also require significant investment in manufacturing and large equipment, depending largely on the same supply chain, and requiring maintenance through technology and the energy workforce. The energy services sector will continue to develop new and innovative technologies that reduce emissions and drive efficiencies, supporting energy production across systems that is critical for growing global demand.

Looking to the future and relying on the technology development that has always characterized this sector will serve us well in producing offshore energy across systems and providing energy security for the US and its allies. ●

Leslie Beyer is CEO of the Energy Workforce & Technology Council, the national trade association for the global energy technology and services sector, representing more than 600,000 US jobs in the technology-driven energy value chain. Energy Workforce works to advance member policy priorities and empower the energy workforce of the future.