

# Offshore wind continues strong growth, bolstered by new floating projects

As spending on renewable energy, particularly offshore wind, accelerates, floating projects will make up a growing share of activity.

■ PAUL HILLEGEIST, Quest Offshore

Environmental, Social and Governance (ESG) are drivers influencing our energy transition. In line with that, 2020 has been the year of aggressive commitments to Net Zero carbon emissions by 2050 for a large swath of companies. This group has been led by Europe’s largest integrated oil companies—Shell, BP, Total and Equinor. This group remains at the forefront of their peers, and they are transparent about transitioning to cleaner energy in the future.

Shell aims to make power a significant part of its business and emphasized that offshore wind is critical to that mission, with a current opportunity pipeline of 5 GW and expanding. Equinor has made no secret of its high ambitions and restated a goal of becoming a global major within offshore wind. The firm has equity ambitions of 12 to 16 GW by 2035, as well as accentuating their determination to maintain a world leadership position in floating offshore wind.

## ACCELERATED RENEWABLES SPENDING

According to BP’s *Statistical Review of World Energy*, wind has grown to represent about 50% of renewable-generated energy over the last several years. Renewable energy, led by wind and solar power, increased by a record amount in 2019, accounting for over 40% of the growth in primary energy. In 2019, wind was the largest contributor to growth in electricity generation, outpacing solar.

Over the next decade, offshore wind (bottom-fixed and floating) will become one of the most competitive sources of electricity, commensurate with fossil fuels, solar PV and onshore wind. Offshore wind provides higher capacity factors than other renewables, and floating wind’s resources are even more prolific. Climate ambitions, coupled with attractive regulatory frameworks and lower cost of capital, are lifting renewable spending to potentially \$1 trillion to \$2 trillion per annum.

This will be the first time that renewables will outpace oil and gas spending. Accelerated spending for green energy will lead to stronger job growth. A recent McKinsey study highlights the creation of 75 jobs for every \$10 million in renewables spending, compared to 27 jobs in oil and gas.

## OFFSHORE WIND MARKET REVIEW

The offshore wind segment is projected to become a \$10 trillion industry. Projections point to 566 GW of installed offshore wind capacity additions to 2040, in a sustainable development scenario. Europe, China and the U.S. are the fastest growth areas and, together, represent about three-quarters of the total, according to the IEA’s *Offshore Wind Outlook*. These capacity additions signal exponential growth in offshore wind, and Quest Floating Wind Energy (Quest FWE) predicts significant contributions from floating wind, long-term, where Europe and Asia-Pacific will play a key role.

Quest FWE’s proprietary Q Vision database projects that total offshore wind CapEx, from 2020 to 2034, will exceed \$437 billion, spread proportionally, with under-development projects representing \$142 billion, planned projects comprising \$138 billion, and possible projects totaling \$153 billion. Bottom-fixed wind projects represent an 80% share, and floating work accounts for 20%.

The *Quest Offshore Wind Turbine Index (QOWTI)*, a key monthly indicator that tracks the Total Addressable Market (TAM) for offshore wind, shows a gain of seven projects for June 2020 (Fig. 1), comprising 14,641 individual turbine units, representing a CapEx of \$408 billion. QOWTI sees 61,871 MW in Europe (a net gain of 2,533 MW) followed by 41,549 MW in Asia/Pacific (a modest gain

**Fig. 1.** The Total Addressable Market for offshore wind shows a gain of seven projects for June 2020, comprising 14,641 individual turbine units, representing a CapEx of \$408 billion.

	June 2020			Total number of projects			Total number of turbines			Total MW			Economic indicators				
	Total	This month	Last month	Change	This month	Last month	Change	CapEx/unit	CapEx/MW	Substructure CapEx	Turbine CapEx	Mooring CapEx	Installation CapEx	Cabling CapEx	Other CapEx		
Global	Total	Total	Total	Total	Total MW	Total MW	Total MW	Avg. \$M	Avg. \$M	Total \$M	Total \$M	Total \$M	Total \$M	Total \$M	Total \$M		
Global total	264	14,641	14,348	293	131,503	126,959	4,544	\$27.90	\$3.30	\$92,567	\$178,445	\$8,848	\$32,249	\$57,308	\$38,853		
Global fixed	197	12,519	12,248	271	111,329	107,046	4,283	\$27.10	\$3.20	\$78,001	\$149,973	-	\$30,489	\$48,702	\$32,591		
Global floating	67	2,122	2,100	22	20,175	19,913	262	\$32.30	\$3.50	\$14,566	\$28,472	\$8,848	\$1,760	\$8,606	\$6,262		

Total Addressable Market (TAM), the competitive landscape of Global Offshore Projects stages of “under development”, “planned” and “possible”. Counts exclude non-competitive areas such as China. Online projects excluded.

of 17 MW). The U.S. sees 26,782 MW (a net gain of 1,995 MW) representing Equinor's 133-unit Beacon Wind project off the coast of Massachusetts, which will deliver renewable power to more than a million households in the Northeast.

The United Kingdom added 199 turbines, representing a net CapEx increase of \$3.4 billion. At present, the total distribution of projects between Asia-Pacific and Europe is about equal. However, total CapEx and MW densities are much higher in Europe at \$207 billion and 68.1 GW, respectively, compared to \$138 billion and 42.2 GW in Asia-Pacific.

Total capital spending for bottom-fixed wind stands at \$352 billion on 205 projects, comprised of 13,026 turbines, **Fig. 2**. These projects represent 115,288 MW of future global nameplate capacity. Projects with status under development reveal capital spending of \$136 billion, followed by \$122 billion for planned projects, while possible projects total \$89 billion. By region, Europe is the largest market, comprising \$179 billion, followed by Asia-Pacific at \$110 billion and the U.S. Atlantic at \$58 billion. Ranked by volume of projects, Asia-Pacific is the most active market for bottom-fixed wind, comprising 90 projects totaling 4,664 turbines. This market is led by Japan with 11,957 MW, followed by Taiwan (7,959 MW), Vietnam (6,590 MW) and South Korea (3,662 MW). Europe ranks second, with 78 projects comprising 5,721 fixed turbines. Leading this market

is England (25,043 MW), followed by the Netherlands (7,165 MW), Sweden (5,025 MW), Poland (4,637 MW), and France (3,590 MW).

Total projected CapEx for floating wind stands at over \$85 billion, allocated to 74 projects containing 2,378 turbines, **Fig. 2**. These projects represent a global nameplate capacity of 22,968 MW. Projects with status under development reveal capital spending of \$5.6 billion, while planned projects represent \$16.3 billion, and possible projects total \$64 billion. As represented in turbines, Europe leads globally in floating wind activity with 951 turbines across 39 projects. Leading this group is England (5,022 MW), followed by Ireland (1,696 MW), France (857 MW), Spain (786 MW) and Norway (716 MW). Asia-Pacific ranks second with 768 floating turbines on 22 projects. Leading the group is Japan with 2,549 MW, followed by South Korea (2,202 MW) and Taiwan (2,000 MW). Currently, the USA's Pacific Coast represents 4,922 MW across eight large projects, totaling 500 floating turbine units.

An analysis of upcoming contract awards (bottom-fixed and floating) reveals about \$200 billion in contract awards (**Fig. 3**) over the next five years, with a 43% share to turbines, 31% to substructures, 13% to subsea power cables, 8% for installation and the balance allocated to engineering, project management and contingencies.

On the developer front, the last five

years have seen numerous initiatives by new companies, joint ventures and other collaborations. The survivors are the experienced utilities, such as Iberdrola and EDPR Engie jv; leading developers, such as Orsted; and increasingly oil and gas companies (Equinor, Shell and Total).

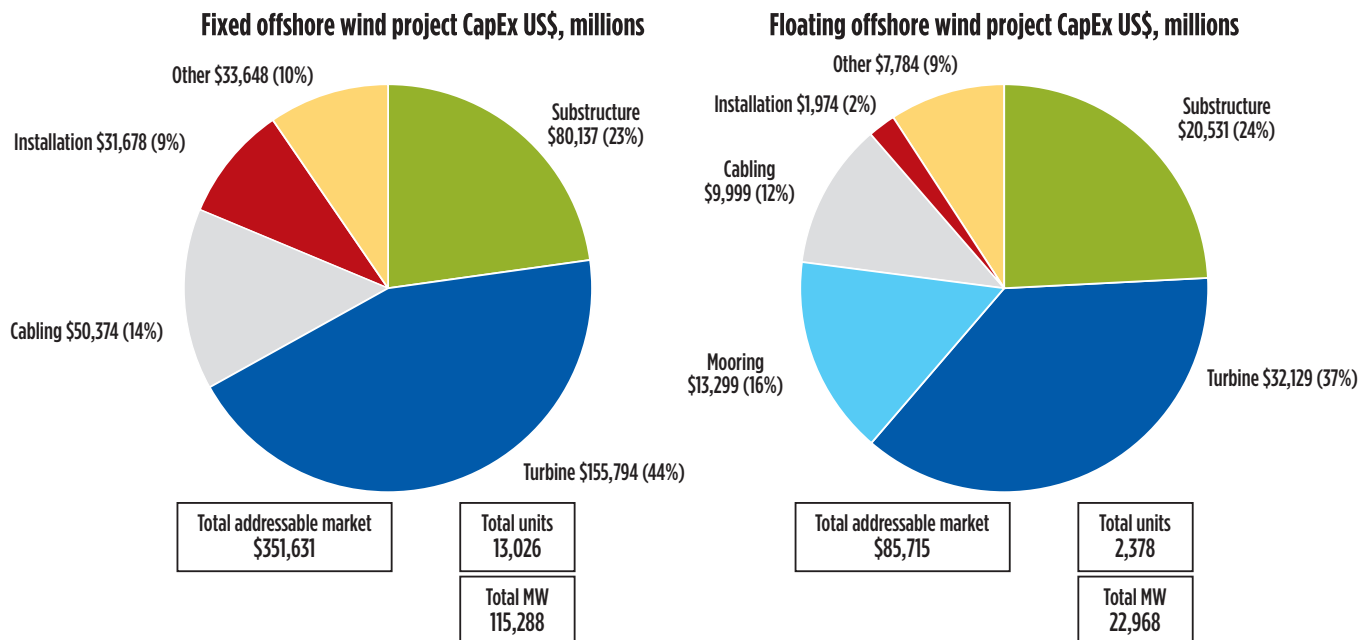
### A DEEP DIVE ON FLOATING WIND

Floating wind is a young industry with 15 units currently online, representing nine projects and a decade of work. Equinor has designed and developed six of these while Aker Offshore Wind Holding/Principle Power have deployed four, IDEOL two, and one design, each, for IHI, Mitsui and Toda, installed offshore Japan. Floating wind is a global opportunity ramping-up for commercialization across six to 10 distinct markets. Near-term, floating wind is a \$33 billion opportunity (**Fig. 4**); highlighted is spending by project status, with \$3.2 billion in contract awards allocated to under development projects. Note the significance of planned and possible projects, which drive the accelerated pace of contract awards, shown quadrupling in ~2023 to \$16 billion, compared to \$4 billion in 2021.

Floating wind is a ripe area to utilize the existing offshore supply chain from deepwater oil and gas, which has extensive experience in large capital projects, mooring technology and installation methodologies.

A major focus and high priority are reductions of "system" costs. Presently, the

**Fig. 2.** Fixed vs. floating offshore wind project CapEx.



industry has a focus on Levelized Cost of Energy (LCoE) as a feasibility benchmark, but one that actually varies considerably between market segments and countries. While bottom-fixed has taken 20 years to achieve an LCoE of €50/MWh, these cost reductions would not have been possible without support from governments; and now, new markets are opening without economic incentives. Floating wind cost reductions are being achieved at a rapid pace. Equinor reduced 40% of the cost between Hywind Scotland and Hywind Tampen, and intends to reduce costs another 30% or more into the next 250-to-500-MW project.

Upcoming tenders for commercial-scale floating offshore wind farms, in a number of key regions, are accelerating the potential for rapid growth. As an example, the recently announced ScotWind seabed licensing round will include a carve-out for floating projects in Scottish waters. ScotWind is expected to be completed by March 2021. It is estimated that 10 new sites will eventually be chosen for wind farm developments.

France is backing 750 MW of floating wind projects in a dedicated tender slated for 2021-2022. Norway recently announced the opening of two areas for offshore wind, offering the possibility of 4,500 MW. In Asia-Pacific, South Korea has demonstrated leading initiatives in floating wind, and neighboring Japan will imminently take far-reaching steps toward large-scale commercial developments. Longer-term, the U.S. West Coast will play a large role in floating wind, with offshore lease auctions from BOEM highly anticipated this autumn, for a possible mid-2021 award.

## MARKET POSITIONING, THE FRONT-RUNNERS IN FLOATING

Floating wind's evolution from demonstrators and pre-commercial projects, as a way to prove up early designs as "proof of concept," have ultimately led to the creation of multiple collaborative partnerships. These partnerships now offer market-ready technologies, favorably positioned to capture a significant share of the global floating wind market. Without doubt, the early movers in floater designs are proving a wise choice for near-term developments, an example being Principle Power. Currently, there is a range of proven floater designs that has attracted heightened attention, and they all have one thing

in common—light weight. Whether steel, concrete, new materials or hybrids, they all apply the design philosophy that weight reduction leads to lower cost.

Equinor, which just announced an 800-MW floating project in South Korea, has developed the Hywind SPAR design, but the firm also will evaluate other "fit-for-purpose" technologies. The joint venture of Principle Power and Aker Offshore Wind Holding is presently working on their third-generation "WindFloat" design. Aker Offshore Wind Holding sees a direct opportunity to apply its extensive deepwater experience in floaters, dynamic cables and large-scale projects. They have become an active developer in several projects, and see their experience and strong technology portfolio as a differentiator. WindFloat will have 10 units in full operation by 2022, and next up will likely be a 504-MW project in South Korea with EDPR Engie *jr*.

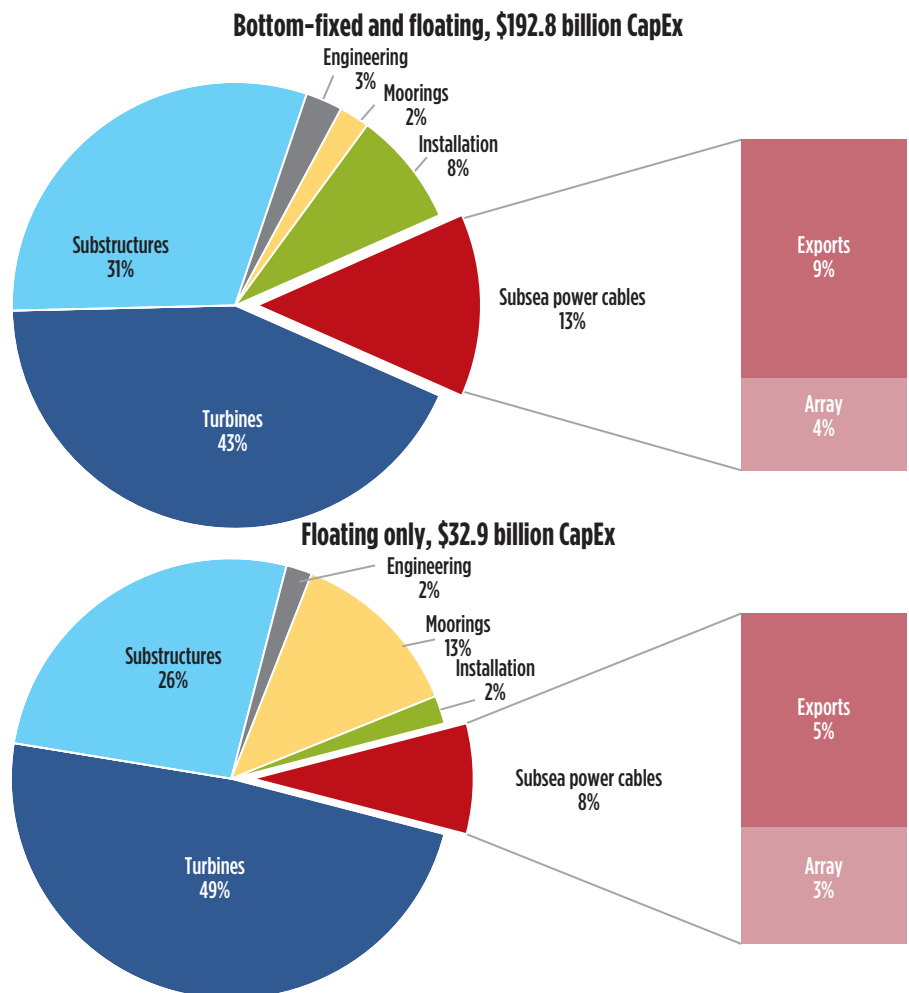
Shell, through its recent EOLFI acquisition, now has a dedicated team of float-

ing wind experts. Shell believes the union of EOLFI's expertise and portfolio with Shell's resources and ability to scale-up will drive their power business.

French specialty floating designer IDEOL, an early mover in floating wind, has quickly evolved its "Damping Pool" floating design, now deployed in demonstrator projects in France (their concrete foundation design) and Japan (a steel version). This barge-shaped floater is built with the slip-concrete construction method and requires huge amounts of material, both concrete and steel, to provide its structural strength.

IDEOL recently joined forces with Japan's largest utility company, JERA, and French-state owned investment company Ademe Investissement. This provided an investment vehicle to finance development of at least 2 GW of floating offshore wind projects over the next five years. The group's business model is centered around IDEOL's Damping Pool technology and

Fig. 3. Offshore wind is a \$200-billion opportunity.



ability to provide full-service solutions, including high local content while serving as project co-developer and co-EPCI contractor.

Swedish floating windfarm developer Hexicon AB recently joined forces with Genesis Eco-Energy Developments, a leading South African wind developer, to jointly develop large-scale floating wind projects for the South African market. Utilizing Hexicon’s “twin-turbine” design, these activities will be managed through GenesisHexicon (Pty) Ltd., a newly cre-

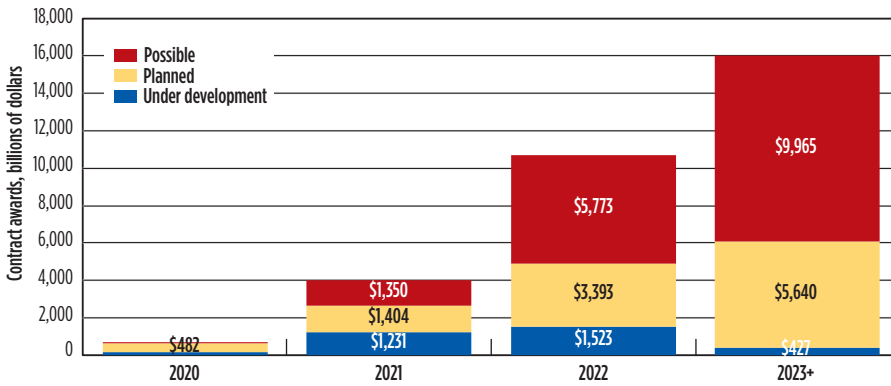
ated joint venture company.

China’s shallow-water areas offshore Guangdong Province show early potential for floating wind. This is due to the challenging, granite-like seabed conditions that are an obstacle for the piling required for bottom-fixed jackets or monopiles. Moreover, China launched its first tender for a floater demonstrator, slated to be operational in 2021. Quest FWE observes that Guangdong Province has a target of 75 GW in deep water.

Increasingly, offshore wind is becoming

a critical component of the energy mix. The pace and rhythm of this nascent market is profound, with upward projections of potentially 180 GW of installed capacity by 2050, comprising over 13,000 floating turbine units. Ultimately, Quest FWE fully expects new markets, like India and China, will have to come into play. As a new industry, floating wind holds the potential to be the largest job creator within renewables. [WORLDWIND](#)

**Fig. 4.** Floating wind is a \$33-billion opportunity.



**PAUL HILLEGEIST** is an entrepreneur and thought leader with expertise in the offshore energy industry, developed during a 29-year career. He began as a market strategist, working for two major companies before launching his own business, Quest Offshore Resources, Inc., with two partners in 1999. While serving as President and COO of Quest Offshore, Mr. Hillegeist developed, and was a partner in, several start-up entities related to the business. Most recently, he co-founded Quest Floating Wind Energy, an innovative start-up delivering market insight, predictive analytics and supply chain insight. He has worked closely with C-Suite leaders of major client companies developing strategic relationships and building collaborative growth initiatives. Mr. Hillegeist holds a BA degree in economics from The University of Texas at Austin.