# OFFSHORE WIND

Hitachi 5MW floating offshore wind turbine
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2017 was a spectacular year for the offshore wind sector: the cratering prices with first zero bids for offshore in Germany; and a full 'zero subsidy' tender in the Netherlands; larger and larger turbines whose size boggles the mind; a plan for building an offshore wind island with more than twice today's total installed offshore wind power in Europe; and the number of markets expanding rapidly – including newcomers India, Australia, Brazil and Turkey. The rapid maturing of the technology has meant that offshore wind is taking shape as a mainstream energy source.

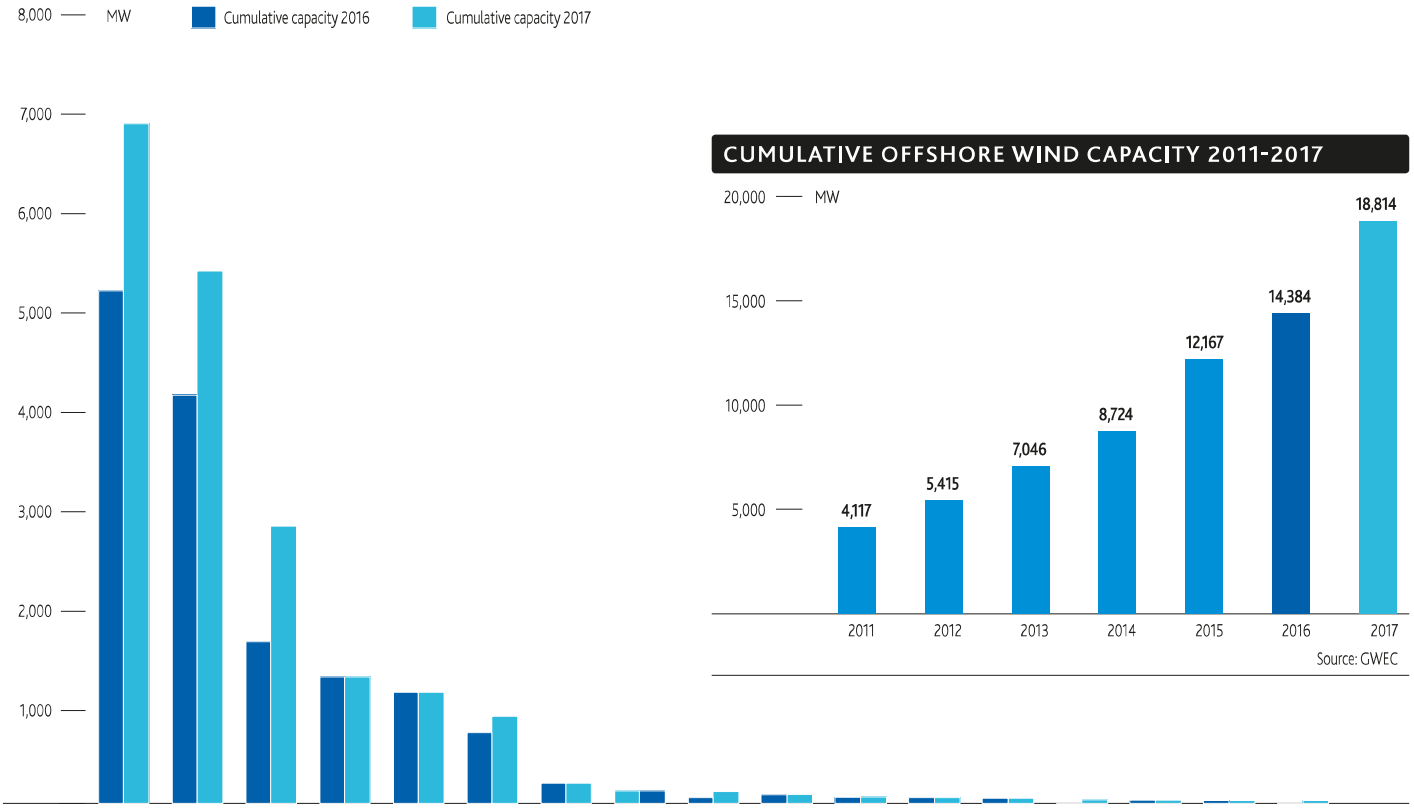
A historical record of 4,334 MW of new offshore wind power was installed across nine markets globally in 2017. This represents a 95% increase on the 2016 market. Overall, there are now 18,814MW of installed offshore wind capacity in 17 markets around the world.

At the end of 2017, nearly 84% (15,780MW) of all offshore installations were located in the waters off the coast of eleven European countries. The remaining 16% is located largely in China, followed by Vietnam, Japan, South Korea, the United States and Taiwan.

The UK is the world's largest offshore wind market and accounts for just over 36% of installed capacity, followed by Germany in the second spot with 28.5%. China comes third in the global offshore rankings with just under 15%. Denmark now accounts for 6.8%, the Netherlands 5.9%, Belgium 4.7% and Sweden 1.1%. Other markets including Vietnam, Finland, Japan, South Korea, the US, Ireland, Taiwan, Spain, Norway and France make up the balance of the market.

The spread of the offshore industry beyond its northern European home to North America, East Asia, India and elsewhere has begun. The first US offshore wind farm came online in 2016, China's offshore wind industry has finally taken off, and Taiwan has an ambitious programme lined up. The number of countries planning pilot projects or full-scale

## GLOBAL CUMULATIVE OFFSHORE WIND CAPACITY IN 2017




### CUMULATIVE OFFSHORE WIND CAPACITY 2011-2017




Source: GWEC

| | UK | Germany | PR China | Denmark | Netherlands | Belgium | Sweden | Vietnam | Finland | Japan | South Korea | United States | Ireland | Taiwan | Spain | Norway | France | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total 2016 | 5,156 | 4,108 | 1,627 | 1,271 | 1,118 | 712 | 202 | 99 | 32 | 60 | 35 | 30 | 25 | 0 | 5 | 2 | 0 | 14,483 |
| New 2017 | 1,680 | 1,247 | 1,164 | 0 | 0 | 165 | 0 | 0 | 60 | 5 | 3 | 0 | 0 | 8 | 0 | 0 | 2 | 4,334 |
| Total 2017 | 6,836 | 5,355 | 2,788 | 1,271 | 1,118 | 877 | 202 | 99 | 92 | 65 | 38 | 30 | 25 | 8 | 5 | 2 | 2 | 18,814 |

Source: GWEC

development of commercial-scale offshore wind farms is rapidly growing.

Meanwhile, offshore wind had its first 'subsidy-free' bids for offshore projects in Germany and an entire subsidy free tender in the Netherlands, with winners of new offshore capacity receiving no more than the wholesale price of electricity. Overall, offshore prices for projects to be completed in the next 5 years or so are half of what they were for the last five years; and this trend is likely to continue.

The reasons for this are many: the maturing of the industry, the improvement and maturation of the technology and management thereof, growing investor confidence, and the introduction and deployment of a new generation of turbines, with enormous swept area and tremendous output.

### RECORD YEAR FOR EUROPEAN OFFSHORE WIND

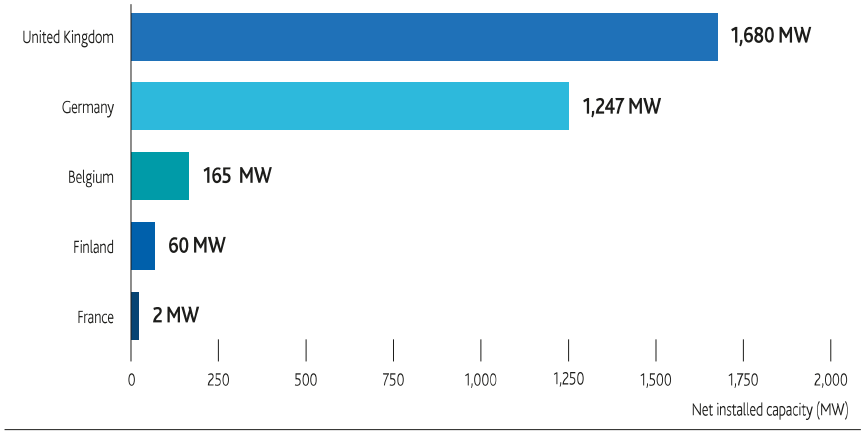
The European offshore wind industry had an all-time record year adding 3,148 MW in 2017, corresponding to 560 new offshore wind turbines across 17 wind farms. This is double the size of the 2016 market and represents a 13% increase on the previous record set in 2015. During 2017, fourteen projects came online, including Europe's first floating offshore wind farm. 2017 also saw Final Investment Decision (FID) on six new offshore wind projects to be installed in the coming years. The new investments total € 7.5bn and cover 2.5 GW of capacity.

Just over half of all capacity (53%) brought online in 2017 was in the United Kingdom, including the commissioning of the first floating offshore wind farm: Hywind, in Scotland. The second largest market was Germany with 40% of overall European capacity, largely realised through the commissioning of the Veja Mate and Wikinger projects.

## SUMMARY OF WORK CARRIED OUT AT EUROPEAN OFFSHORE WIND FARMS DURING 2017

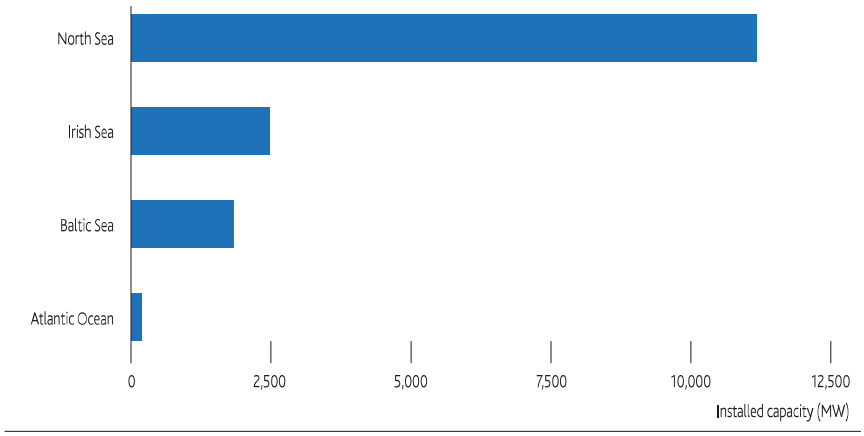
| Wind Farm | Capacity connected in 2017 (Mw) | Country | Status |
|---|---|---|---|
| Race Bank | 498 | UK | Partially grid-connected |
| Dudgeon East | 402 | UK | Fully grid-connected |
| Walney 3 (Extension Phase 1 - West) | 256 | UK | Partially grid-connected |
| Burbo Bank Extension | 200 | UK | Fully grid-connected |
| Rampion | 179 | UK | Partially grid-connected |
| Galloper | 72 | UK | Partially grid-connected |
| Blyth | 42 | UK | Fully grid-connected |
| Hywind Scotland | 30 | UK | Fully grid-connected |
| Veja Mate | 402 | Germany | Fully grid-connected |
| Wikinger | 350 | Germany | Fully grid-connected |
| Nordsee One | 332 | Germany | Fully grid-connected |
| Nordergründe | 111 | Germany | Fully grid-connected |
| Sandbank | 52 | Germany | Fully grid-connected |
| Nobelwind (Belwind II) | 165 | Belgium | Fully grid-connected |
| Pori Tahkoluoto 2 | 36 | Finland | Fully grid-connected |
| Kemi Ajos 1+2 | 24 | Finland | Fully grid-connected |
| Floatgen | 2 | France | Fully grid-connected |

## ANNUAL OFFSHORE WIND CAPACITY INSTALLATIONS PER COUNTRY




Source: WindEurope

## NET ANNUAL INSTALLATIONS BY SEA BASIN (MW)




Source: WindEurope

Belgium represented 5% of the total share and Finland commissioned its first offshore wind farm specifically designed for icy conditions at Pori Tahkuoloto 2. Moreover, France's first offshore wind turbine, the 2 MW Floatgen demonstrator came online. In Denmark, 5 MW were decommissioned at Vindeby. Overall in 2017, work was carried out across 26 wind farms including grid connections, wind turbine erections and foundations installed.

In cumulative terms, Europe now has a total installed offshore wind capacity of 15,780 MW. This corresponds to 4,149 grid-connected wind turbines across eleven countries.

The UK has the largest offshore wind capacity in Europe, with 6,836 MW, followed by Germany (5,355MW) and Denmark (1,271MW). The Netherlands is in fourth place with 1,118MW, and Belgium fifth with 877MW. Combined, the top five EU countries represent 98% of all grid-connected offshore wind installations in Europe.

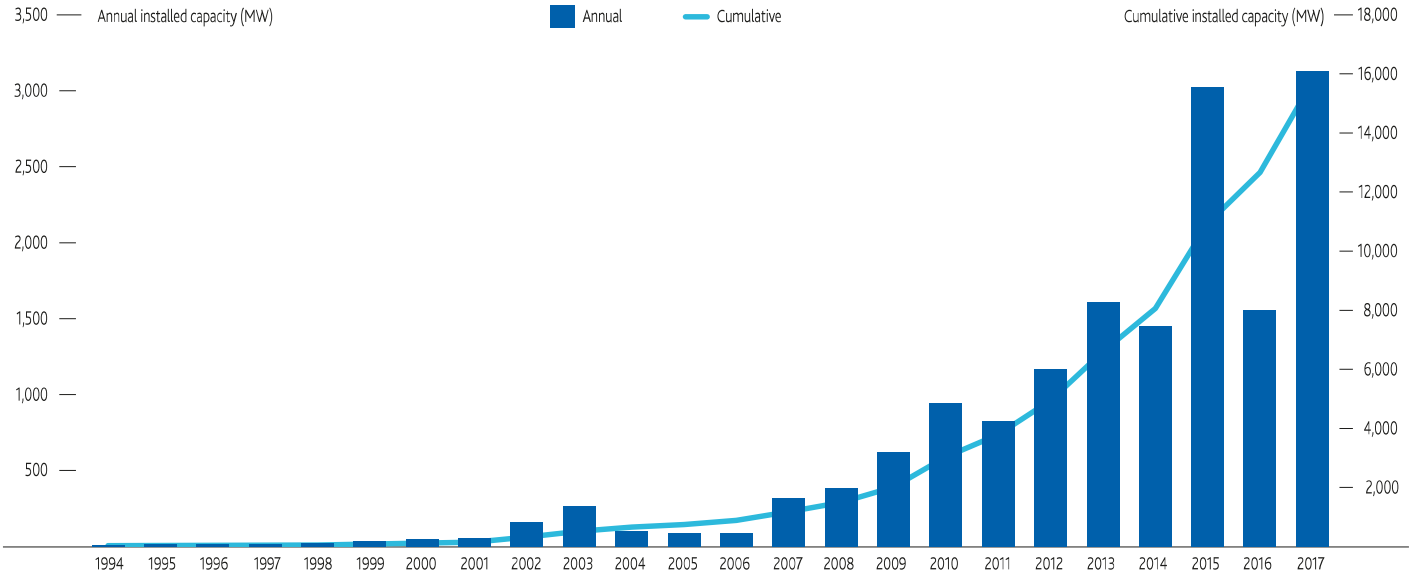
Installations in the North Sea account for 71% of all offshore wind capacity in Europe. The Irish Sea has 16% of installed capacity, followed by the Baltic Sea with 12% and the Atlantic Ocean 1.2%.

Siemens Gamesa Renewable Energy is the leading offshore wind turbine supplier in Europe with 64% of the total installed capacity. MHI Vestas Offshore Wind (18%) is second, followed by Senvion (8%) and Adwen (6%). The top 4 represents 96% of the total number of turbines connected.

In terms of ownership, Ørsted is the largest owner of offshore wind power in Europe with 17% of cumulative installations at the end of 2017, a slight increase from last year. E.ON is the second largest owner with 8% of installed capacity, followed by Innogy (7%), Vattenfall (7%), and Northland Power (4%). The top five owners represent 42% of all installed capacity in Europe, a slight decrease compared to the end of 2016.

The average installed offshore wind turbine grid-connected in 2017 was 5.9 MW, a 23% increase over 2016. The average size of a grid-connected offshore wind farm in 2017 was 493 MW, 34% larger than the previous year. The average water depth of offshore

## CUMULATIVE AND ANNUAL OFFSHORE WIND ENERGY INSTALLATION IN EUROPE




Source: WindEurope

wind farms where work was carried out in 2017 was 27.5 m, slightly less than in 2016 (29.2 m). The average distance to shore for those projects was 41 km, a small decrease on the previous year (43.5 km). Hywind Scotland, the first floating offshore wind farm in the world, has an average water depth more than twice (95-120m) that of the bottom-fixed offshore wind farms where work was carried out in 2017.

### Outlook for 2018 and beyond

Looking ahead, projects expected to achieve FID in 2018 are estimated to have a combined capacity of 3.9 GW. This includes a number of projects in the UK, Denmark and the Netherlands, as well as floating offshore wind projects in Portugal and France. Financing needs could top € 9bn based on disclosed transaction costs.

In 2019 Europe expects to see another record year for offshore wind power. This is mainly due to the delay of consenting Round 3 projects in the UK in 2016. There are 400 MW currently under construction, which are expected to be connected to the grid throughout 2018. Germany will connect turbines from Merkur and Borkum Riffgrund projects in 2018 and Belgium will connect turbines in the Rentel and Norther wind farms. Winning projects of recent tenders in Denmark and the Netherlands are expected to start to connect capacity towards the end of 2018.

However, the number of grid-connected projects are expected to fall towards 2020 as EU member states will reach the end of their National Renewable Energy Action Plans (NREAPs) under the current Renewable Energy Directive, which covers the period up to 2020. However, significant construction activity will continue. By 2020 WindEurope expects a total European offshore wind capacity of 25 GW. The offshore market will concentrate mainly in the UK, with 3.3 GW of new grid-connected capacity in the period between 2018 and 2020, followed by Germany with 2.3 GW, Belgium with 1.3 GW, the Netherlands with 1.3 GW and Denmark with 1.0 GW.

## CHINA OFFSHORE FINALLY TAKING OFF

With all the focus on the dramatic success in the offshore sector in Europe, it's worth noting that China's offshore industry is finally taking off. 1,164 MW of new installations in 2017 brought the cumulative total to 2,788, putting China in third place globally, behind the UK and Germany.

The new installations in 2017 are spread across 18 offshore wind farms, and nine of them (totalling 968 MW) are in Jiangsu Province, which continues to be the major focus of offshore development. There were

© Alpha Ventus

four projects totalling 65 MW in Fijian Province, and the remaining five were spread across Guangdong, Zhejiang and Hebei Provinces. The market leaders in terms of turbines were Shanghai Electric (50%), followed by Goldwind (18%), Envision (17%) and CSIC (9%).

Unlike China's onshore targets, which have been regularly exceeded, we have come to expect the offshore targets not to be met, especially the very ambitious ones set nearly a decade ago. Now, however, it seems the industry is on track and it will easily meet the national 2020 target of 5 GW, probably well ahead of time.

In addition to the national target, Jiangsu has set itself a 2020 target of cumulative installations of 3,500 MW, Guangdong has a 2020 target of 2,000 MW, as does Fujian province. These alone would exceed the national goal.

The Offshore FIT was set three year ago at RMB 0.85/kWh for near shore, and RMB 0.75/kWh for inter-tidal. In the past two years, the development of the offshore has been mainly been focused on near shore development, where previously the focus was on inter-tidal projects.

### JAPAN INSTALLS ANOTHER FLOATER IN 2017

Despite Japan's favourable conditions and abundant offshore wind potential, the sector has developed at a slow pace. Japan added 5MW in 2017, which brought the country's total installations to 65MW, spread over 29 turbines and 11 projects. Japan has been experimenting with both fixed and floating foundations, with the floating installations accounting for 16MW in two projects.

A feed-in tariff for offshore wind has been set at JPY 36/kWh. However, the Japanese Ministry of Economy, Trade and Industry (METI) has proposed moving to a new system of auctions for fixed foundation offshore wind. The current level of FIT will be maintained for floating projects up to a cumulative total of 820MW, after which the auction system will be applied for all projects.

The next floating turbine is expected to come online during summer 2018 at Kitakyushu as NEDO's (New Energy and Industrial technology Development Organization) new national project. The 3.5MW two bladed turbine is designed by Germany's Aerodyn, using a moon-pool type foundation from France's IDEOL.

There are a further 12 GW of offshore wind projects currently under various stages of development, of which 22 projects totalling 5,079MW are at an advanced stage. The remaining 7 GW of projects are at pre-EIA (environmental assessment) stage and waiting for a 'proposal rush' for a transmission auction which will be organised by Tohoku Electric

Power Co. The first commercial project is expected to start operation in 2021.

Although Japan's *Port and Harbor Act* was amended to better enable offshore wind development, the amendments only apply to limited areas of Japan's coast, leaving the majority of waters surrounding Japan outside the legislation's scope. The lack of clear rules has been the subject of increasing industry frustration and calls for reform. As a result, the government now designates special zones for offshore wind development in a new law on the promotion of offshore wind power in general common sea areas, which is expected to enter into force in September 2018.

After that, it will take about a year to prepare detailed rules for the bidding system, meaning that the first auctions for offshore wind in the general common sea area are likely to be held in 2019. At least five areas including Aomori, Akita and Nagasaki are expected to be nominated, with a 30-year lease for the winners.

While the new bill will reduce investment risk, uncertainties still remain in the grid connection and EIA process. Some conflicts may arise when bid winners for offshore sites and for grid connection are different. The Japanese Wind Power Association (JWPA) has requested that the Japanese government apply a so-called *centralised system,* which is in use for example in the Netherlands. Another concern is METI's intention to introduce a price based auction system for the fixed bottom type offshore wind development for general common sea areas after the new law takes force. This is likely to cause another type of business risk due to PPA price uncertainty. JWPA has also requested to maintain the FIT for fixed bottom offshore wind sites.

Japan's wind industry has a target to reach 10 GW of offshore wind by 2030.

### TAIWAN'S AMBITIOUS TARGET SET AT 5.5 GW BY 2025

Taiwan has become one of the offshore wind power hotspots in Asia. International offshore developers and OEMs are attracted by the government's generous feed-in tariff and strong wind resources, as well as the government's ambitious targets and policies to promote the clean energy industry.

**OFFSHORE WIND POWER IN JAPAN AT THE END OF 2017**

| Type | | Location | Distance (km) | Depth (m) | Rated (MW) | No. of WTG | Total (MW) | Start operation |
|---|---|---|---|---|---|---|---|---|
| Fixed | Hokkaido | Setana Port | 0.7 | 13 | 0.6 | 2 | 1.2 | Dec. 2003 |
| | Akita | Akita Port | 0.1 | - | 3.0 | 1 | 3.0 | Feb. 2015 |
| | Yamagata | Sakata port | 0.05 | 4 | 2.0 | 5 | 10.0 | Jan. 2004 |
| | Ibaraki | Kamisu | 0.04 | 4 | 2.0 | 7 | 14.0 | Feb. 2010 |
| | | Kamisu | ~0.05 | 4 | 2.0 | 8 | 16.0 | Feb. 2013 |
| | Chiba | Choshi* | 3.1 | 12 | 2.4 | 1 | 2.4 | Mar. 2013 |
| | Fukuoka | KitaKyushu* | 1.4 | 14 | 2.0 | 1 | 2.0 | Jun. 2013 |
| Floating | Nagasaki | Fukuejima | 5.0 | 100 | 2.0 | 1 | 2.0 | Apr. 2016 |
| | Fukushima | Iwaki city | 20 | 120 | 2.0 | 1 | 2.0 | Dec. 2013 |
| | | Naraha* | | | 7.0 | 1 | 7.0 | Mar. 2016 |
| | | | | | 5.0 | 1 | 5.0 | May 2017 |
| | | | | | **Total** | **29** | **64.6** | |

*National projects

**OFFSHORE WIND PROJECT PIPELINE IN JAPAN**

| Type | | Location | Area | WTG (MW) | No.of WTGs | Total (MW) | Start Operation |
|---|---|---|---|---|---|---|---|
| Fixed | Hokkaido | Wakkanai port | Port | | | 10 | |
| | | Ishikari new port | Port | 4.0 | 24 | 96 | 2020~ |
| | Aomori | Mutsuogawara port | Port | 2.0 | 40 | 80 | 2019~ |
| | | Mutsu | Gen. | | | 800 | |
| | | Yokohama | Gen. | | | 80 | |
| | | Tsugaru | Gen. | | | 1,000 | |
| | | Tsugaru East | Gen. | | | 480 | |
| | Akita | Noshiro port | Port | 3.3-6.0 | 20 | 100 | 2021 |
| | | Happo Noshiro | Gen. | | | 180 | |
| | | Akita port | Port | 3.3-6.0 | 14 | 70 | 2022 |
| | | Akita North | Gen. | 3.3-5.0 | 120 | 455 | 2023 |
| | | Yurihonjo | Gen. | | | 1,000 | |
| | Yamagata | Sakata port | Port | | | 15 | |
| | Toyama | Toyama | Gen. | | | 7.5 | |
| | Ibaraki | Kashima port | Port | 5.2 | 36 | 187 | 2021 |
| | Yamaguchi | Yasuoka, Shimonoseki | Gen. | 4.0 | 5 | 60 | |
| | Fukuoka | Kitakyushu port | Port | | | 220 | |
| | | Kitakyushu | Gen. | | | 300** | |
| | Nagasaki | Saikai Enoshima | Gen | | | 240 | |
| Floating | Fukuoka | Kitakyushu* | Gen. | | 1 | 3.5 | 2018 |
| | Nagasaki | Fukuejima | Gen. | 2.0-5.0 | 10 | 22 | |
| Test Field | Niigata | Awashima | Gen. | | | | |
| | Nagasaki | Kabashima | Gen. | | | | |
| | | | | | Planned projects (location defined) | 5,079 | |
| | | | | | Grid connection request (locations are disclosed) | 7,000 | |
| | | | | | | **12,000** | |

*National projects
**Estimated by JWPA

Taiwan's initial offshore wind target of 3 GW by 2025 was quickly exceeded by over-subscription of projects proposed by developers, which led to an upward adjustment of the target in 2017 to 5.5 GW by 2025. The target of 520MW by 2020 was maintained, while the target for 2030 was raised to 10-17 GW.

The adjusted target is closely linked to a mixed-tariff system. Projects fitting into the original 3 GW capacity target will stay within the FIT regime; the submission of projects to qualify for the 3 GW list is expected to be finalised by end of March. The remaining projects amounting to 2.5 GW will have to compete to sell power at a lower price in a tender held by the national utility Taipower. Taiwan's feed-in tariff is one of the highest in the world. Developers can either choose NT$ 5,740 ($ 187/€ 175) per MWh for 20 years, or NT$ 7,108/MWh (US$ 244.2/€ 198.2/MWh) for the first 10 years and NT$ 3,459/MWh (US$ 118.9/€ 96.4/MWh) for the following ten.

Taiwan's major development hotspot is located off Changhua County, where the 128MW Formosa project is located. There is a great deal of activity laying the groundwork for future development, and nearby Taichuang Harbour is becoming a main port to provide support for offshore development. Taipower has signed a deal to build what it says will be Southeast Asia's largest offshore wind port facility in Taichung. State-controlled Taipower will invest about $ 100m in the facility in a link up with Taiwan International Ports, according to the Taiwanese government, which is pursuing an ambitious offshore wind expansion programme. Siemens Gamesa has also signed an MOU to set up an offshore wind supply chain at Taichuang Harbour.

### SOUTH KOREA READIES FOR OFFSHORE WIND EXPANSION

South Korea aims to triple the share of renewables in the country's power mix by 2030 which translates to adding about 47 GW of new wind and solar capacity, according to the government's latest draft policy roadmap.

The East Asian nation will also cut back the shares of coal and nuclear in its electricity supply – although not as sharply as expected – under the Ministry of Trade, Industry and Energy's (MOTIE) draft of the *Eighth Basic Plan for Electricity Supply and Demand,* which provides Korea's power development roadmap for the next 15 years.

According to the plan, renewables will account for 27.3% of Korea's total power capacity in 2030, increasing nearly threefold from 9.7% this year. The share of renewables in power generation will increase accordingly from 6.2% now to 20% in 2030.

Although the draft does not mention specific sector targets, analysts have estimated that South Korea will be looking to reach 5 GW of onshore wind by that date, about five times the total in place now, and balloon its offshore base to 13 GW from a negligible level now.

MOTIE's plan aims to reduce complex steps for renewable projects to seek permits. It also promises to build transmission infrastructure "preemptively", including grid connections and substations to spur wind and solar development.

Coal and nuclear will still account for 60% of Korea's power generation under the roadmap. The new targets to cap coal and phrase out nuclear are less ambitious than those previously advocated by the newly-elected President Moon Jae-in, who had pledged to ditch all nine new coal projects and eight reactors to be built in the coming years.

The surge of renewable energy will help South Korea to cut 237 million tonnes of GHG emissions and limit particulate pollution, according to the roadmap.

Besides laying out power generation targets, the plan also proposes measures to limit consumption increases. It estimates power demand growing by only 1.3% by 2030.

### US OFFSHORE DEVELOPMENT LED BY NEW YORK

While there were no new offshore installations in the US in 2017, a lot of activity took place, ensuring solid development for the next few years. There are ambitious plans at the state level up and down the East Coast, and great interest from European manufacturers, developers and investors in this potentially huge new market segment.

At the time of writing this report, GE announced the world's first 'double-digit' turbine, the Haliade-X 12MW. Other manufacturers are expected to follow soon to develop the next generation of huge offshore turbines.

In terms of the development plan, the north-eastern states are still the hotspot

China © Siemens Gamesa

of offshore wind development in the US. The high wholesale electricity price, high electricity demand along with the state governments backing for the renewable energy industry are the main drivers of offshore wind development. The states on the forefront of offshore wind power development are Rhode Island, New York, New Jersey and Massachusetts.

New York State has become the new climate leader in the US, after California, with a series of government measures and targets being introduced to boost the clean energy industry. An offshore wind target has been set at 2.4 GW by 2030. In January 2018, New York State also released its long-awaited *Offshore Wind Master Plan,* encompassing 20 in-depth studies on a variety factors that will affect the state's ability to reach its 2.4 GW offshore wind target by 2030.

Rhode Island is home to the first US offshore wind farm, the 30MW Block Island project which was completed in 2016. The state now plans to issue a request for proposals (RFP) for up to 400MW of renewable energy, including offshore wind, in the course of 2018. Rhode Island has a target to reach 1 GW of renewable energy by the end of 2020.

The offshore wind industry in Massachusetts is driven by the state's RPS requirement especially for offshore, where utilities that serve Massachusetts are required by law to procure 1.6 GW of offshore wind capacity by 2027. A new lease sale for two additional areas off the coast of Massachusetts for commercial wind energy development is scheduled for the end of September 2018 by the US Bureau of Ocean Energy Management (BOEM).

# PROJECTIONS FOR OFFSHORE WIND DEVELOPMENT GLOBALLY OUT TO 2030

**BY OUR MEMBER BVG ASSOCIATES**

Offshore wind has reached maturity in Europe, both technically and commercially. It is now seen as an attractive investment opportunity for pension funds, investment houses and banks. Costs have fallen decisively, with committed projects scheduled to start generating in the early 2020s likely to produce at a levelised cost of energy (LCOE) below € 70/MWh (at 2017 prices), including the cost of offshore to onshore grid connection.

This has lead to increased confidence in the deployment offshore wind around the world. We now forecast 120GW total installed capacity by 2030, with an installation rate of over 10GW per year being achieved before then.

Much of this growth will come in Europe, building on the establish capability and proven low cost. We will also see significant capacity in China and US, with smaller but significant volumes in Japan, Taiwan and S Korea.

By 2030, LCOEs below € 60/MWh will be achieved by many newly installed offshore wind farms, which could be well below the average wholesale power price in many electricity networks, driving higher levels of deployment and the spread to currently uncharted waters.

Floating offshore wind has seen the first multi-turbine demonstration project (Statoil's Hywind in 2017), but floating is likely to remain a niche sector throughout the 2020s. It will become cost-competitive (or nearly so) by the end of the decade, giving it strong potential in the 2030s, especially through enabling new markets.

Early deployment of floating offshore wind projects needs support mechanisms in multiple markets specifically targeted at enabling commercial-scale floating deployment. France and Japan are the most likely candidates, assuming governments are able to see clear long-term benefits.

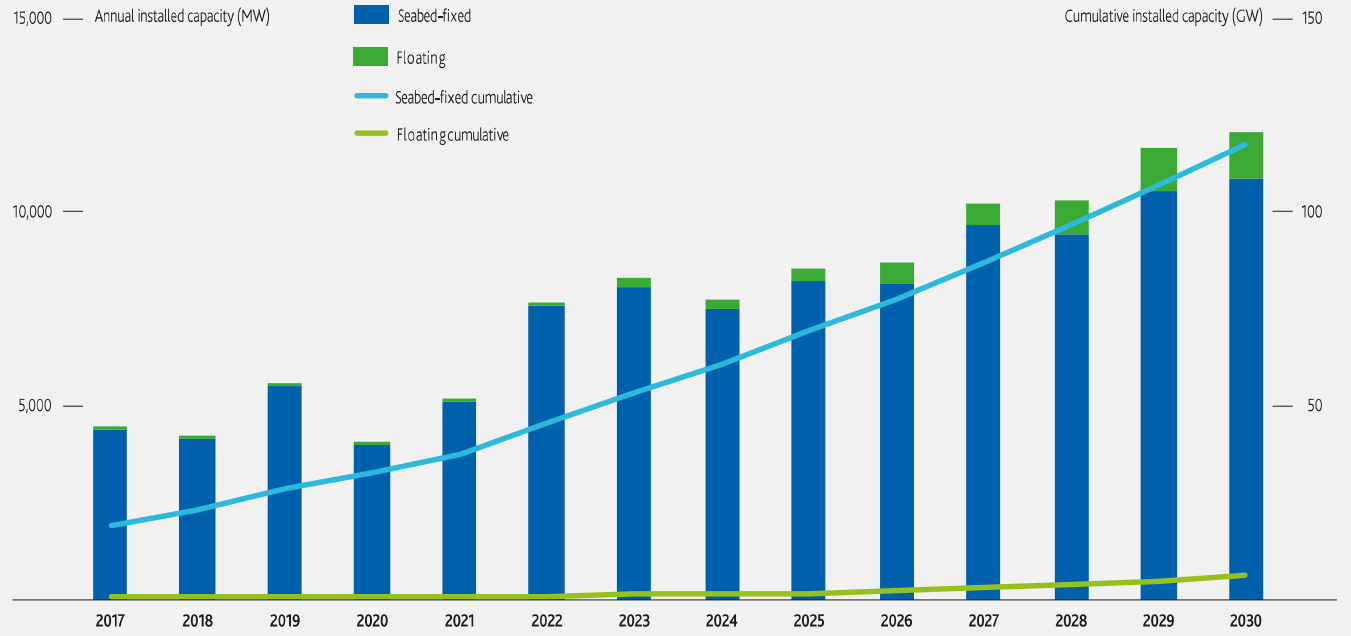
On this basis, we expect floating deployment to exceed 500MW a year by 2026, increasing to over 1GW a year by 2030 to give a total installed capacity of over 5GW by 2030, 5% of the offshore market. In addition to France and Japan, commercial floating projects are also likely in Korea, Taiwan, the UK and the US by 2030.

Floating offshore wind projects will tend to use the same turbine suppliers as bottom-fixed, with balance of plant provided by a mix those involved in bottom-fixed operations and others. The majority of installations will be in locations not suitable for fixed-bottom technology.

If cost reductions are achieved quicker than currently expected and floating becomes cost effective much faster, the market could really 'take off' with up to 12GW installed by the end of 2030, setting the 2030's up for substantial further global offshore wind deployment.

*For more information: www.bvgassociates.com*

**PROJECTIONS FOR OFFSHORE WIND DEVELOPMENT GLOBALLY OUT TO 2030**




Source: BVG Associates

In New Jersey, the state government has an ambitious offshore wind target, led by Governor Phil Murphy who signed an executive order for a 3.5 GW by 2030 state-wide offshore wind target. This order aims at filling in the gaps of the renewable energy certificate (OREC) programme which was delayed and shook investor confidence in the past years in New Jersey.

However, offshore wind development is not only limited to the North East. In March, Avangrid won North Carolina's offshore lease auction, and there is great industry enthusiasm under the new federal administration which has promised a lighter regulatory process and faster project timelines to boost the offshore wind sector.

## UPCOMING MARKETS

### India prepares for its first demonstration projects

The GWEC-led FOWIND[1] (Facilitating Offshore Wind in India) project prepared a roadmap for offshore wind power in India. The project focused on assessing the two key coastal states of Gujarat and Tamil Nadu. As a part of the project a LiDAR unit was deployed off Gujarat in the Gulf of Khambat at the beginning of November 2017. These first offshore measurements will be critical for the future of the sector. Further, FOWIND's pioneering efforts have paved the way for another private LiDAR unit to be deployed in the Gulf of Kutch (also Gujarat) and India's National Institute for Wind Energy (NIWE) plans to deploy a LiDAR in the most promising zone in Tamil Nadu later in 2018. Offshore wind resource assessment is underway, and will need to verify the current estimates of about 35 GW of potential off Gujarat and around 30 GW off Tamil Nadu.

It appears that the next steps going forward will be:

- A call for OEMS to contribute to NIWE's 'test field' which will be established in Tamil Nadu on a spit of land that sticks out into some of the best offshore wind in India at Dhanushkodi. This is envisaged to be a demonstration facility along the lines of the Danish site at Østerild, and will coincide with NIWE's placement of a LiDAR in the same region.
- Autumn of 2018 – a request for proposals for a demonstration project of somewhere between 500 and 1000 MW in the Gulf of Khambat in Gujarat. It is expected that a feed-in tariff/PPA structure will be utilised for this project, although it is not known what the level will be.
- Autumn of 2019 – a request for proposals for a demonstration project of between 500 and 1000 MW off Tamil Nadu in the Gulf of Mannar (south of Dhanushkodi) in our Zone A.

If this all moves forward, then we will be looking at tendering for offshore projects in the year or two following this.

India has the world's 4th largest onshore wind market with a total installed capacity of close to 33 GW. However, India has an acute need for large-scale, clean and indigenous energy generation to fuel its rapidly growing economy. Offshore wind power could play a very important role in India due to the large wind resources available near centers of high energy demand.

### Vietnam takes steps forward

Vietnam's first near-shore/intertidal wind project, the 99.2MW Bac Lieu wind farm, is the first offshore wind farm in the Mekong Delta region, and came online in stages from 2013-2015. Another nearshore wind project, the 800MW Phu Cuong wind farm, also located in Mekong Delta, is now gearing up. The first phase, the Phu Cuong 1 Wind Farm (170 MW), is expected to reach financial close in 2018.

In 2018, new projects, both onshore and offshore, are being developed in Soc Trang Province, which is emerging as the next hot spot for wind development in Vietnam.

Despite slow progress to date, the Vietnamese wind market has started attracting world leading turbine manufacturers and investors. Vietnam may become the next gigawatt sized wind market in Asia, once the regulatory and financial conditions are corrected, which may come during the course of 2018.

1 www.fowind.in