

GLOBAL OFFSHORE

The state of play of the global offshore market

Twenty-two years have passed since the world's first offshore wind farm was built in Denmark, Vindeby (5 MW). Today, 5,415 MW of offshore wind power has been installed globally, representing about 2% of total installed wind power capacity. More than 90% of it is installed off northern Europe, in the North, Baltic and Irish Seas, and the English Channel; and most of the rest is in a number of demonstration projects off China's east coast. However, there is also great interest elsewhere: Japan, Korea, the United States, Canada, Taiwan and India have shown enthusiasm for developing offshore wind in their waters. According to the more ambitious projections, a total of 80 GW could be installed by 2020 worldwide, with three quarters of this in Europe.

In 2012, 1,296 MW of new offshore capacity was added, a 33% increase from the 2011 market. The majority (90%) of the installations were in Europe, led by the UK (854 MW) and followed by Belgium (185 MW), Germany (80 MW) and Denmark (46.8 MW). Most of the rest was in inter-tidal and near shore demonstration projects in China (127 MW), in one project located in Jeju Island in Korea, and Japan's floating turbine near Goto Island off Nagasaki with a capacity of 100 kW.

Global offshore wind power in the end of 2012

	2012 (MW)	Cumulative (MW)
UK	854	2,947.9
Denmark	46.8	921
China	127	389.6
Belgium	185	379.5
Germany	80	280.3
Netherland	0	246.8
Sweden	0	163.7
Finland	0	26.3
Japan	0.1	25.3
Ireland	0	25.2
Korea	3	5
Norway	0	2.3
Portugal	0	2
Total	1,296	5,415

Offshore wind has a number of advantages, such as higher wind speeds and less turbulence than on land and fewer environmental constraints. Offshore is particularly suitable for large scale development near major demand centers represented by the major port cities of the world, avoiding the



Thornton bank, Ostend, Belgium © EWEA

need for long transmission lines to get the power to demand centers, as is so often the case onshore.

Although offshore development has passed the 5 GW mark, it still is lagging behind expectations. Actual installations in the EU member states in 2012 were 14% lower than the 5.8 GW target set in the National Renewable Energy Action Plans (NREAPs) for the end of 2012. The Chinese target of 5 GW by 2015 seems increasingly unlikely to be met.

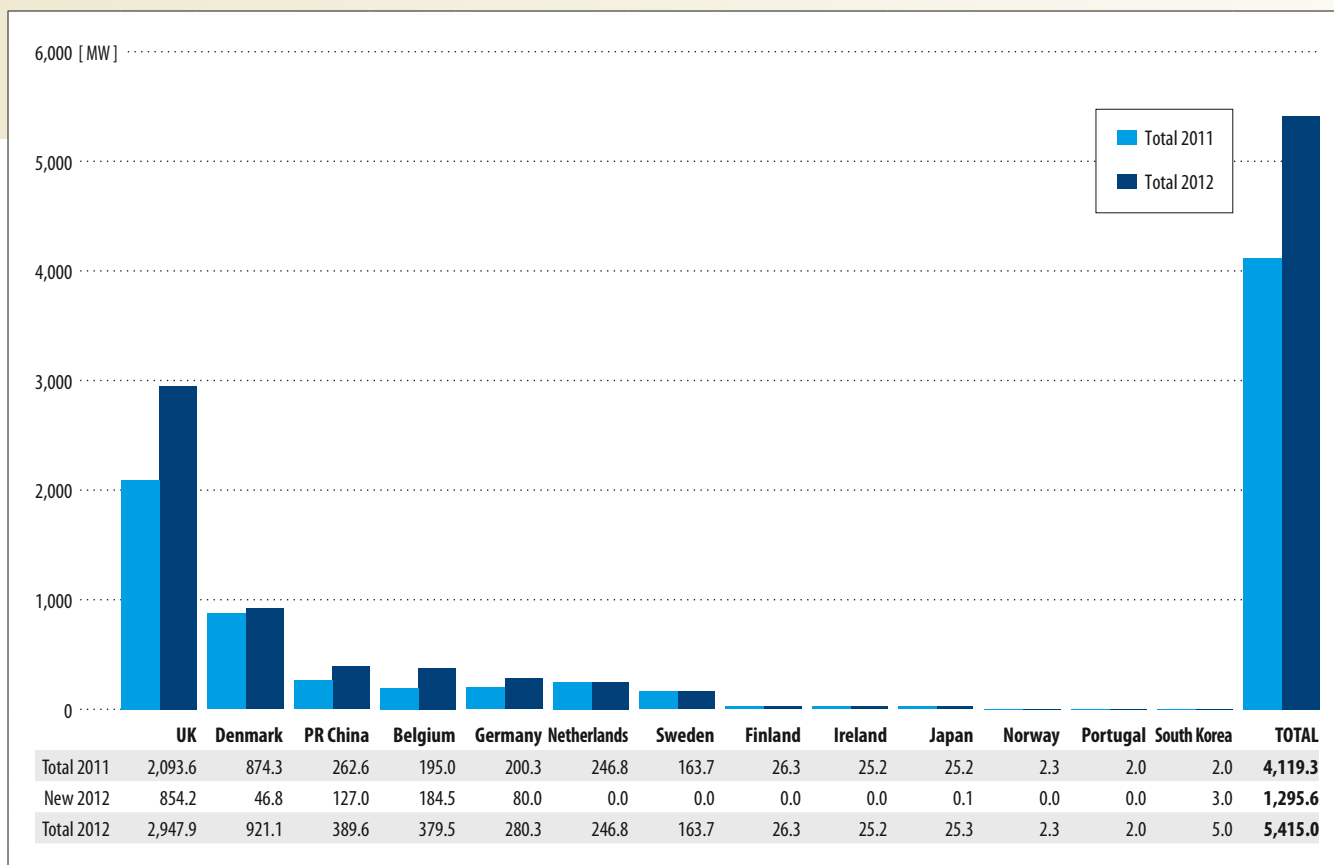
The major challenge for offshore wind development today is to continue to bring down costs. Selection of sites in deeper waters, further from shore, with more difficult bottom conditions and higher waves, have all contributed to driving the costs up faster than the improvements in the technology has been able to drive them down. However, technology cost reductions continue to be achieved, and this is one of the main reasons for confidence regarding offshore wind. It is expected that the cost of energy from offshore wind will come down substantially as the mass roll-out of the next generation of offshore wind turbines begins to take place.

EU offshore wind energy sector posts solid 2012

1,166 MW of new offshore wind power capacity were connected to the electricity grid during 2012 in Europe, bringing the total to 4,995 MW. Over 73% of all new capacity was installed in the UK (854 MW), followed by Belgium (185 MW or 16%), Germany (80 MW, 7%) and Denmark (46.8 MW, 4%). Of the total 1,166 MW installed in European waters, 80% were located in the North Sea, 16% in the Atlantic Ocean and the remaining 4% in the Baltic Sea.

The turbines installed in 2012 represent investments of around 4 billion euros. Offshore prospects for 2013 and 2014 are positive with 14 projects under construction, due to increase

Global Cumulative Offshore Installed Capacity in 2012



Source: GWEC

installed capacity by a further 3.3 GW, and bring total offshore capacity in Europe to 8.3 GW.

Offshore industry development in Europe

Despite the majority of European offshore wind farms being still owned by utilities (70%), the developers of offshore projects are becoming more diversified. DONG remained the biggest developer in the European offshore sector representing 19% of total installations in 2012. DONG, Statoil (12%), Statkraft (12%), RWE (9%), SSE (8%), E.ON (6%), Vattenfall (3%), Nuhma (3%), Centrica (2%), and EDF (1%) installed more than 70% of the capacity that came online during 2012.

UK leads the way

The UK is the world leader in offshore wind, with 2,948 MW. The UK government's Renewable Energy Road map, which was updated in December 2012, indicates that offshore wind could contribute up to 18 GW by 2020.

New development & grid roadmap in Germany

Offshore wind energy in Germany grew to 280.3 MW in 2012, and a further 2.7 GW are under construction. Most German offshore wind projects are 20-60 km from the coastline in

waters 20-40 meters deep. To date, 29 projects have been licensed by the national maritime authority and the federal states, bringing the overall capacity to 9,000 - 10,500 MW depending on turbine sizes.

Belgium and Denmark moving on strongly

Belgium, despite its very small offshore area continues to hold third place in Europe in terms of installations. Denmark's ambitious target to increase the penetration of wind energy in its electricity mix to 50% by 2020 depends to a great extent on new offshore projects.

Slow progress in China

China installed 127 MW of offshore wind in 2012, of which 113 MW was in inter-tidal projects (projects in the shallow inter-tidal zone which dries out at low tide, unique to China) and the remaining 14 MW were near shore demonstration projects. The majority (67%) of the Chinese offshore projects are inter-tidal projects, accounting for a total of 261 MW. In 2012, China maintained its 3rd position in offshore wind development with a total of 389.6 MW, after the UK and Denmark.



Offshore wind farm in Baltic Sea off Copenhagen, Denmark © Tony Moran

2012 New offshore wind projects and manufacturers in China

	Unit		Turbine Size (MW)	Project size (MW)	Project type
ShanDong Binhai 1st Phase	United Power	1	3	3	Near shore
Shan Dong Weifang Demonstration	United Power	1	6	6	Near shore
FuJian Fuqing Offshore Demonstration Project	XEMC	1	5	5	Near shore
Jiangsu Rudong Longyuan 150MW Intertidal	CSIC	2	5	10	Intertidal
Jiangsu Rudong Longyuan 150MW Intertidal	Goldwind	20	2.5	50	Intertidal
Jiangsu Rudong Longyuan 150MW Intertidal second phase	Goldwind	20	2.5	50	Intertidal
Jiangsu Xiangshui Intertidal Project	Goldwind	1	3	3	Intertidal
	Total	46	27	127	

China has ambitious national targets of 5,000 MW offshore by 2015 and 30 GW by 2020, although progress has been slow. The main bottleneck is caused by lack of coordination between different government agencies relevant to marine development. Currently, only small scale demonstration projects are under way to test the waters for the 'real' offshore development.

3 GW by 2030 plan in Taiwan

The Taiwanese government has set a target of 600 MW of offshore wind capacity by 2020 and 3 GW by 2030. To reach this goal, the Bureau of Energy launched a support scheme for offshore wind projects in July 2012, covering 50% of the capital costs of two pilot offshore turbines and up to TWD 250 million (EUR 6.5mn / USD 8.4mn) for the development of a large wind farm of 100-200 MW capacity.

As of January 2013, three projects had been awarded the grant: the 100.8 MW Fuhai offshore wind farm, which is expected to be finalised by the end of 2016; a 108 MW project off the coast Miaoli county by Formosa Wind Power; and another 108-150 MW wind farm owned by Taiwan Power. In the meantime, a feed-in tariff for offshore wind has been set at TWD 5.56 per kWh (EUR 0.151 / USD 0.186), which is twice the level of the onshore wind tariff. The FIT is valid for twenty years.

Focus on offshore in Japan

Japan is an island country with a very large EEZ and excellent offshore resources, and following the Fukushima disaster in 2011, a strong appetite for renewable energy. The Ministry of Environment (MOE) estimates Japan's theoretical offshore potential at 1,573 GW.

Project Name	Location	Project Owner	Time of installation	Turbine manufacturers	Project size (MW)	Turbine size	Unit of turbines (MW)	Foundation	Type of Project
Setana	Hokkaido	Hokkaido local government	2004	Vestas	1.2	600 kW	2	Dolphin	Near shore
Sakata	Akita	Private investor	2003	Vestas	10	2 MW	5	Dolphin	Near shore
Kamisu	Ibaraki	Private investor	2010	Fuji Heavy Industries (FHI)	14	2 MW	7	Monopile	Near shore
Kabashima	Nagasaki	MOE	2012	Fuji Heavy Industries(FHI)	0.1	100 kW	1	Spar type floating	Offshore

Currently, Japan has four on-going offshore wind projects at four sites totalling 25.3 MW, including both founded and floating types of turbines. The only new installation in 2012 was the floating turbine demonstration project off Goto Island, near Nagasaki, with a capacity of 100 kW.

Due to the lack of historical data, the feed-in-tariff FIT for offshore wind is not fixed; it will take 2 to 3 years in order to get enough of a track record to set the price, which are re-estimated annually by the Ministry for Economy, Trade and Industry (METI). Most of the projects are owned by government agencies testing the water for offshore development, both in terms the economics of the projects, and for testing different foundation and turbine technologies.

METI's floating offshore project, the 16 MW Fukushima project, is located offshore from where the nuclear accident happened two years ago, triggering an energy revolution in Japan. The project may be expanded to up to 1,000 MW if the technology proves to be successful. Another project testing the floating foundation concept is the 2.1 MW Goto Island project, with 0.1 MW already installed in 2012.

The floating turbine technology is still in its early stages of development. However, given the water depths along the Japanese coast (more than 200 meters depth close to the shore) floating technology is an attractive option as bottom mounted turbines are not practical.

Offshore projects in the pipeline in Japan

Project (Conductor)	Operation	Location	Wind turbine model	Foundation / type of floater
Demonstration of Offshore Wind Power Generation by NEDO	Jan. 2013	Chiba (Chioshi)	MHI 2.4MW	Gravity foundation
	Spring 2013	Fukuoka	JSW 2MW	Gravity & hybrid-jacket foundation
Floating Offshore Wind Turbine Demonstration Project by MOE	Aug. 2012	Kabashima Goto island in Nagasaki	FHI 100kW	Spar type floater
	2013		Hitachi 2MW	Spar type floater
Floating Offshore Wind Farm Demonstration Project (Farewinds, by METI)	2013	Fukushima	Hitachi 2MW	Spar type floater
	2014		MHI 7MW	Semi-sub type floater
	2015		MHI 7MW	Advanced spar type floater

MHI: Mitsubishi Heavy Industries, Ltd. JSW: Japan Steel Works, Ltd.

FHI: Fuji Heavy Industries, Ltd. FHI's wind turbine division merged by Hitachi Co. in July 2012

South Korea announcing ambitious offshore targets

South Korea's offshore wind installations, totalling 5 MW, are all located in Jeju Island in a project developed by the Korean Institute of Energy Research. The project consists of one 2 MW STX direct drive turbine installed in 2011 and another 3 MW Doosan turbine, which was installed in July 2012.

The South Korean government set a target for offshore wind power of 2.5 GW in 2010. The plan was modified at the end of 2012 to include a new time line for 100 MW to be operational by 2013, 900 MW by 2016 and 1.5 GW by 2019. According to the plan a total of USD 8.2 billion (EUR 6.4 bn) will be invested in offshore wind sector in the next nine years. Most of the projects under the 2.5 GW plan will follow the private-public partnership (PPP) model, in which the Korea Electric Power Corporation (KEPCo), 51% owned by the government, will be the leading developer, together with Korean turbine manufacturers such as Doosan Heavy Industries, Samsung, Hyundai, and Daewoo. Parallel to this, there is another 4.5 GW of offshore projects being planned by local governments. Jeju Island has some of the most ambitious plans with a target of 380 MW by 2016 and 2 GW by 2030.

The government's ambition in offshore wind development is driven by a goal of generating 11% of the country's total primary energy supply from renewable sources by 2030; and many large and well known Korean companies have entered the offshore market, including Doosan, Daewoo, Hyundai and Samsung. These corporate giants have also expressed strong interest in overseas markets in Europe and North America.