OFFSHORE WIND

2015 was a huge year for offshore wind installations. New capacity additions totalled nearly 3.4 GW across five markets globally. This brought total offshore wind installed capacity to over 12 GW.

At the end of 2015, more than 91% (11,034 MW) of all offshore wind installations were located in waters off the coast of eleven European countries. The remaining 9% of the installed capacity is located largely in China, followed by Japan and South Korea.

Globally the UK is the largest offshore wind market today and accounts for over 40% of installed capacity, followed by Germany in the second spot with 27%. Denmark accounts for 10.5%, Belgium for almost 6%, Netherlands 3.5% and Sweden 1.6%. Other European markets including Finland, Ireland, Norway, Spain and Portugal make up about 0.5% of the market. The largest market outside of European waters is China, which accounts for approximately 8.4% of the global market in the sector.

However, governments outside of Europe are setting ambitious targets for offshore wind, and development is starting to take off in some of these markets. Japan and South Korea have put actual turbines in the water. The US saw the first commercial project start construction in 2015. The GWEC-led FOWIND consortium is developing an offshore wind roadmap for India.

Relatively higher costs and installation complexity compared to onshore wind are a big challenge for offshore wind development. However, according to a study[1] commissioned by E&Y in 2015, offshore wind costs could be reduced to EUR 90 per MWh (USD 94) by 2030. The report says that the sector will have nearly reduced the LCOE to EUR 100 per MWh by 2020, by which time cumulative installed capacity in European waters is expected to have reached 23.5 GW.

Key cost reduction steps include: deploying larger turbines to increase energy capture (a 9% saving); encouraging greater competition (7%); keeping the volumes up (7%) and tackling supply-chain challenges (3%). The offshore industry is on its way to meeting the goal of getting the LCOE down to EUR 100 per MWh. At present, the average offshore wind turbine size is 4.2 MW in European waters, average water depth 27.1 meters and average distance from shore 43.3 km.

EUROPE CROSSES 11 GW MARK

In 2015, an astounding 3,035 MW of new offshore wind capacity came online in Europe, a 108% increase over the 2014 market. Offshore wind accounted for 24% of total EU wind power installations in 2015, up from 13% share of annual additions in 2014.

Three underlying factors enabled this growth: effective policy, the grid connectivity of large amounts of offshore capacity installed but not grid-connected in 2014, and the industry's rush to complete installations before the German market switches to market-based arrangements in 2017.

Overall 419 new turbines were erected in 2015. Also, for the first time, offshore turbines were decommissioned. A total of 7 turbines in the UK and Sweden were decommissioned, resulting in a net addition of 412 turbines. A total of 14 projects were completed in 2015.

Over 75% of all net capacity brought online was in Germany (2,282.4 MW), a four-fold increase in its grid-connected capacity compared to 2014. This was in large part due to the delay in grid connections finally coming online in 2015.

The remaining installations in the EU took place in just two markets. The second largest market was the UK with 572 MW, and an 18.7% share of total installations. The Netherlands followed with 180 MW, a 5.9% share of the market.

Overall, 3,230 turbines are now installed and grid-connected, bringing the cumulative total to just above 11 GW in Europe, capable of producing 40.6 TWh in a normal wind year.

The UK has the largest amount of installed offshore wind capacity in Europe at over 5 GW, representing almost 46% of all European installations. Germany follows with 3.2 GW with almost 30% of all installations. Denmark stands third with 1.2 GW installed capacity accounting for 11.5% of total European installations. By the end of 2015 Belgium had 712.2 MW with 6.5% market share, the Netherlands had 426.8 MW with 3.9% market share, Sweden had 201.7 MW with 1.8% market share. Finland had 26 MW installed and Ireland had installed 25.2 MW. Spain, Norway and Portugal each have one wind turbine operating offshore.

Siemens is the lead offshore wind turbine supplier in Europe with 63.5% of total installed capacity. MHI Vestas (18.5%) is the second biggest turbine supplier, followed by Senvion (7.4%), Adwen (5.7%), and BARD (3.6%).

In terms of the total number of wind turbines connected to the grid at the end of 2015, Siemens remains the top supplier with 2,059 turbines, accounting for 63.6% of the market.

MHI Vestas has 750 grid-connected turbines representing 23.2% of the total, followed by Senvion (140 turbines, 4.3%), Adwen (127 turbines, 3.9%), BARD (80 turbines, 2.5%), WinWind (18 turbines, 0.6%), and GE Renewable Energy with 15 turbines (0.5%).

Number of wind farms, turbines and MW fully connected to the grid in Europe (2015)

Country	Belgium	Germany	Denmark	Spain	Finland	Ireland	Netherlands	Norway	Portugal	Sweden	UK	Total
No. of farms	5	18	12	1	2	1	6	1	1	5	27	**80**
No. of turbines	182	792	513	1	9	7	184	1	1	86	1,454	**3,230**
Capacity installed (MW)	712.2	3294.6	1,271.3	5	26.3	25.2	426.8	2.3	2	201.7	5,066.5	**11,034**

Source: EWEA, 2016; Rounding and decommissioning of 16 MW affect the sums

1 Offshore Wind in Europe: Walking the Tightrope to Success, Ernst & Young, 2015.

Stiftung OFFSHORE-WINDENERGIE © Jan Oelker

2015 also marked a significant year for offshore wind financing. Ten projects worth EUR 13.3 billion (USD 15 bn) in total reached final investment decision in 2015, compared to EUR 6.5 bn (USD 7.3 bn) in 2014. In total, 3 GW of new capacity were financed across four countries, 66% of which was in the UK.

Total investments in offshore wind in 2015 were more than EUR 18 bn (USD 20.3 bn); this includes investments in construction of offshore wind projects, transmission assets and refinancing. This makes 2015 a record year in terms of total committed funds.

An estimated financing of EUR 11 billion (USD 12.4 bn) will be needed for just over 3 GW of new capacity in 2016. Several transactions are already under appraisal or expected to go through final investment decision in 2016.

Projects under appraisal include the Otary Rentel (294 MW) wind farm, Hornsea Phase 1 (1,200 MW), Hohe See (492 MW), Dudgeon (402 MW), Beatrice (664 MW), and the refinancing of Luchterduinen (129 MW).

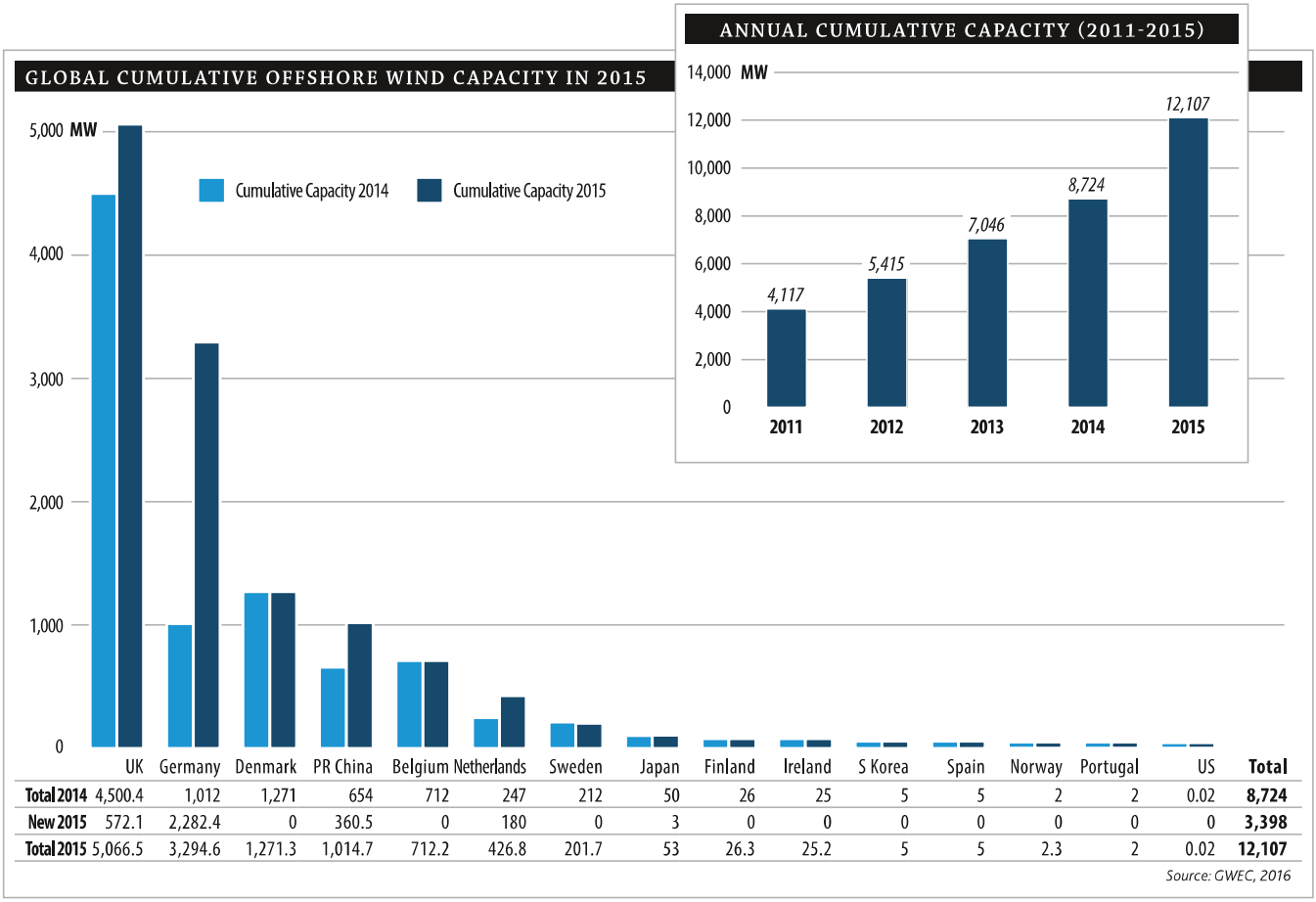
Additionally, reduced risk perception for offshore wind projects has led to the emergence of project bonds as a means of financing. For the first time in 2015, EUR 1.5 bn (USD 1.7 bn) was raised through project bonds for the construction and refinancing of offshore wind farms.

UK remains largest global market

The UK has the highest share of consented offshore wind capacity today. It continued to lead the world's offshore industry in terms of cumulative installations in 2015.

Out of the 22 offshore wind farms where work was carried out in Europe last year, five were in the UK. At four offshore wind sites – Gwynt y Môr, Westernmost Rough, Humber Gateway and Kentish Flats 2 Extension –153 turbines were connected in 2015, for a total annual market of 572 MW. At one offshore wind farm – Robin Rigg – two turbines of 3 MW each were decommissioned.

At the time of writing over 4 GW of projects are fully contracted and will be delivered over the next four years, with a further 1 GW anticipated to reach financial close within weeks.



	UK	Germany	Denmark	PR China	Belgium	Netherlands	Sweden	Japan	Finland	Ireland	S Korea	Spain	Norway	Portugal	US	Total
Total 2014	4,500.4	1,012	1,271	654	712	247	212	50	26	25	5	5	2	2	0.02	**8,724**
New 2015	572.1	2,282.4	0	360.5	0	180	0	3	0	0	0	0	0	0	0	**3,398**
Total 2015	5,066.5	3,294.6	1,271.3	1,014.7	712.2	426.8	201.7	53	26.3	25.2	5	5	2.3	2	0.02	**12,107**

Source: GWEC, 2016

In November 2015, Amber Rudd, UK's Minister for Climate and Energy stated that based on current plans the country expects to see 10 GW of offshore wind installed by 2020. However, this is linked to the industry meeting its obligation of bringing offshore costs to under GBP 100 (EUR 125) per MWh by 2020. The UK industry is well on its way to meeting this condition. The Minister further said that the government will make funding available for three auctions and intends to hold the first of these auctions by the end of 2016[2].

Germany had an exceptional year

The offshore wind industry in Germany had a record year. A total of 546 offshore wind turbines came online bringing offshore capacity in Germany up to 2,282 MW. Over 75% of all net capacity brought online in Europe was in Germany, a four-fold increase in its grid-connected capacity compared to 2014. Cumulatively, Germany accounts for about 30% of the offshore capacity installed in Europe.

The German offshore wind market had surpassed the one-gigawatt mark in 2014, more than doubling both 2013's annual market and the country's cumulative offshore capacity. At the end of 2015, Germany accounted for almost 26% of all consented projects in Europe. Sites in Germany are an average of 52.6 km from shore. 792 offshore turbines were connected to the grid by 31 December 2015, with a combined capacity of 3,295 MW.

In 2015 Germany saw 41 wind turbines with a total capacity of 246 MW fully erected, but not yet connected to the grid. 122 foundations were constructed offshore in 2015 for wind turbines to be installed in 2016.

According to the working group AG Energiebilanzen, offshore wind power produced over 8 TWh of electricity in 2015. This was enough to cover the power consumption of over 2 million households or around 1.4% of the gross electricity generation in Germany that year[3].

In 2016, the German government is expected to adopt a revision to the Renewable Energy Sources Act (EEG), which will lay the foundations for a stable domestic market. The German offshore sector under the EEG 2016 will see an intermediate expansion target of 11 GW by 2025. This will limit the annual market to approximately 700 MW over the next 10 years.

The industry considers reliable, continuous expansion more important in the long term than any one-off records. To achieve such continuity it is necessary that the Renewable Energy Sources Act (EEG) 2016 and the Offshore Grid Development Plan (O-NEP) 2025 are properly coordinated. The industry has asked for the annual market to be at least 900 MW so as to be able to achieve economies-of-scale and long-term certainty

2 https://www.gov.uk/government/speeches/amber-rudds-speech-on-a-new-direction-for-uk-energy-policy
3 https://www.wind-energie.de/en/press/press-releases/2016/offshore-wind-energy-germany-figures-2015-record-achieved-due-catch

for investing in further cost-reductions. It is expected that Germany will add approximately 700 MW of new offshore capacity in 2016.

Netherlands: Fourth largest market in 2015

In 2015, Netherlands added 180 MW of offshore capacity, installing 60 turbines, which make it the world's sixth largest offshore market. Netherland's total installed capacity reached 427 MW by the end of last year.

The Netherlands has a 15% renewable energy goal out to 2020. It has a plan to expand the country's offshore wind power capacity by 3.5 GW by 2023.

In March 2016, the Dutch Senate approved a law that will allow the government to move ahead with an offshore wind tender. This amendment to the Dutch Electricity Act allows transmission operator TenneT to start construction of grid infrastructure required for the new wind farms off the country's coast and at Borssele (Zeeland). This amendment also clarifies for wind farm developers the damage liability from delays and disruption to the grid.

A key challenge for the sector is to ensure a smooth running of the planned tenders for offshore wind energy. The first tender is expected to be held during spring 2016, a second one before the end of the year, and a further 1,400 MW are planned to be auctioned in the Borssele area.

The industry has also a goal to reduce costs by 40% over the next five years. Over the longer term, the Dutch North Sea has huge potential to further develop large scale wind after the 2023 targets have been achieved; to start with the already designated area of *Ilmuiden Ver* could accommodate 6,000 MW of offshore wind power.

France gearing up to deliver

Six offshore wind farms totalling 3 GW are currently under construction in France. *From Round 1* projects: Courseulles (500 MW), Fécamp (500 MW), Saint-Nazaire (500 MW), Saint-Brieuc (500 MW); and from *Round 2 projects:* Dieppe-Le Tréport (500 MW) and Iles d'Yeu et de Noirmoutier (500 MW). The industry expects the third tender for offshore wind power to be launched by the end of 2016.

The key challenges faced by the sector are the need for cost reductions, defining areas for offshore wind development due to conflicting interests over maritime areas and increased competition in the market. A public debate focusing on offshore wind power development in France is likely to be held during the summer of 2016. The French wind industry has set ambitious goals to reach 12 GW of bottom-fixed and 6 GW of floating offshore wind capacity by 2030.

CHINA CROSSES THE 1 GW MARK

By the end of 2015, China added 360.5 MW of new offshore capacity. This was a 57% increase over last year. At the end of 2015 cumulative installed capacity reached 1,014.68 MW, making China the 4th largest market globally.

China's Offshore Installations 2007-2015

Year	New Installed Capacity (MW)	Cumulative Installed Capacity (MW)
2007	1.5	
2009	14.0	15.5
2010	135.5	151
2011	109.58	260.58
2012	127.0	387.58
2013	39.0	426.58
2014	227.6	654.18
2015	360.5	1,014.68

The new offshore projects are spread across sites along the coasts of Guangdong, Fujian and Jiangsu provinces. The majority of Chinese offshore projects are installed in the shallow waters close to shore, called *inter-tidal* projects, where the sites dry out (or nearly so) at low tide. Most of the projects in deeper waters, such as those granted under the first round of tenders, are either still in development or have just started construction. See details of the newly added offshore projects in the table below. Most of these projects are inter-tidal.

In China, offshore development is accelerating slowly and is expected to pick up steam this year. An ever increasing number of developers are 'testing the waters' with inter-tidal offshore projects.

However, the major bottleneck for large-scale offshore development is the low FIT. This is currently set as RMB 0.85/kWh (EUR 0.12/USD 0.13) for 'near-shore' offshore projects and RMB 0.75/kWh (EUR 0.10/USD 0.12) for inter-tidal projects.

Offshore wind projects in China at the end of 2015

Province	Project Name	Developer	Manufacturer	Installation (MW)
Fujian	Long Yuan Nanri Island 4.0	Long Yuan	Shanghai Electric	12
	Ping Haiwan Wind Farm	Zhong Min	XEMC	50
Guang Dong	Huaneng Zhejiang Haimen	Huaneng	Dongfang	1.5
Jiang Su	Jiangsu Dafeng	Tianrun Goldwind	Goldwind	3
	Jiangsu Dafeng	Tianrun (Goldwind)	Goldwind	6
	Longyuan Rudong 4.0	Longyuan	Shanghai Electric	100
	Three Gorges 4.0	Three Gorges	Shanghai Electric	32
	CPIBinhai	China Energy Investment	Shanghai Electric	20
	CGN Rudong 4.0	China Guangdong Nuclear	Shanghai Electric	56
	Sinohydro Rudong 2.5	Sinohydro	Shanghai Electric	80
Total (MW)				**360.5**

Choshi © NEDO / Tepco / MHI

For projects to get this tariff there is a cut-off date of 2017. This is complicating matters and also making it difficult for some developers to make a decision given the uncertain course of the FIT.

Another bottleneck is the difficulty in getting all the necessary licenses, as the offshore projects are controlled by multiple government agencies. In some cases, the EIA has been particularly difficult to conduct and finish.

China's offshore wind progress will continue but at a much slower pace than the onshore growth. Local developers are seeking to gain experience and expertise in this sector. Major changes to this market are expected after 2017, when the existing tariff is set to expire and a new FIT for offshore will kick in.

DOMESTIC INDUSTRY MOVES JAPAN FORWARD

By the end of 2015 Japan had 53 MW of offshore wind power, including two 2 MW floating wind turbines. A Siemens semi-offshore 3MW wind turbine was installed at the Eurus Akita port in 2015. The Japanese government fixed the FIT at JPY 36/kWh (EUR 28/USD 33) for offshore wind power in March 2014. The offshore FIT is 1.6 times higher than the onshore tariff (JPY 22/kWh), which improves investment confidence in the sector.

12 MW of floating offshore turbines will start to operate in 2016. Several projects are expected to start construction within a couple of years; Kashima Port Project1-Phase1 will be the first. Overall there are 1,407 MW of offshore wind power projects currently under planning.

Offshore wind power in Japan at the end of 2015

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
	Ibaragi	Kamisu	0.04	4	2.0	7	14.0	Feb.2010
			~0.05	4	2.0	8	16.0	Feb.2013
	Chiba	Choshi*	3.1	12	2.4	1	2.4	Mar.2013
	Fukuoka	KitaKyusyu*	1.4	14	2.0	1	2.0	Jun.2013
Floating	Nagasaki	Kabashima*	1.0	100	2.0	1	2.0	Oct.2013
	Fukushima	Iwaki city	20	120	2.0	1	2.0	Dec.2013
		Naraha*			7.0	(1)	(+12.0)	2016
					5.0	(1)		2016
*National projects: Under commissioning/construction			**Total**			**27**	**52.6**	

Offshore wind projects in the pipeline in Japan

Type	Location		Area	WTG size	No.of WTGs	Total (MW)	Start Operation
Fixed	Hokkaido	Wakkanai port	Port			10	
		Ishikari new port	Port	2.5MW	40	100	2020
	Aomori	Mutsuogawara port	Port	2.0MW	40	80	
	Akita	Noshiro port	Port	5.0MW	16	80	2021
		Akita port	Port	5.0MW	13	65	~2022
	Yamagata	Sakata port	Port			15	
	Ibaragi	Kashima port1, 1st	Port	5.0MW	20	100	
		Kashima port1, 2nd	Port	5.0MW	5	25	~2017
		Kashima port2	Port	5.0MW	25	125	
	Fukuoka	Kitakyusyu port	Port			200**	
		Kitakyusyu	Gen.			300**	
	Niigata	Iwafune, Murakami	Gen.	5.0MW	44	220	2025
	Yamaguchi	Yasuoka, Shimonoseki	Gen.	4.0MW	15	60	
Floating	Fukushima	Iwaki city	Gen.	7.0MW	1	7	2016
		Naraha*		5.0MW	1	5	~2016
	Fukuoka	Kitakyushyu*	Gen.		2	7.5	2017~
		No data*	Gen.		2	7.5	
Test Field	Niigata	Awashima	Gen.				
	Nagasaki	Kabashima	Gen.				
		Total				**1,407**	

* *National projects* ** *Estimated by JWPA* *** *3GW is offered at Akita Farm offshore by NGO, in addition to the details listed here*

Currently there is no law or regulation for offshore wind power development in Japan for undesignated areas. A marine area in Japan is categorized into two kinds, either as a *Port associated area* or as a *General common sea area*. The former is controlled by port authorities, therefore the entity from whom official permissions are needed is clear. Unfortunately, there is no law or regulation for the latter area. Hence, there is a significant business risk for projects planned under the *General common sea area* at present.

All of the four projects installed up until 2013 were government-led investments and were mainly developed for testing different technologies. 2014 saw commercial development begin and bring a positive change echoing the introduction of the offshore FIT.

Ten commercial projects with a total capacity of 800 MW are being considered for the *Port associated area* and three projects with 580 MW are being considered for the *General common sea area*.

As for national projects, the Japanese Ministry of Environment (MOE) is conducting a *Floating Offshore Wind Turbine Demonstration Project* (GOTO FOWT) at Kabashima in the Goto islands in the Nagasaki prefecture. A Hitachi 2 MW downwind rotor wind turbine on the spar type floater has been in operation since October 2013. The electricity produced by this wind turbine was used for producing hydrogen in 2015. This turbine will soon be moved from Kabashima to Fukue Island, which has a bigger population and electricity demand.

As for METI's FukushimaFORWARD project, the second floating offshore turbine (7 MW) was anchored in August 2015 and is expected to be commissioned soon. The third floating offshore turbine (5 MW) is being manufactured at Hitachi's factory. This will be installed on the Japan Marine United Corporation's (JMU) advanced spar type floater and will start operation in 2016. A total of 3 floating turbines with 12 MW capacity will start operation in 2016.

Japan's New Energy and Industrial Technology Development Organization (NEDO) started a feasibility study for a new advanced floating offshore wind power demonstration project in 2015. Two groups are nominated as potential candidates. Each group will try to develop 2 floating offshore wind turbines within the rated capacity of 7.5 MW in total with the intention to achieve cost reduction compared to the former projects. The long coast line and high cost for onshore development, makes offshore wind an attractive option for the Japanese wind industry.

UPCOMING MARKETS

US set to deliver the first commercial project

No offshore wind capacity is installed in the United States, with the exception of the University of Maine's 0.02 MW VolturnUS floating turbine project. The first wind farm will be commissioned 3 miles off the coast of Block Island, Rhode Island.

Construction began on the 30 MW, USD 290 million (EUR 255 mn) project in early 2015 and Deepwater Wind, the developer responsible for building the farm, says it's on track to be generating power by the fourth quarter of 2016. A construction milestone was celebrated in July 2015 when five steel foundation jackets and deck platforms were placed in the water.

According to the company's website, the five-turbine farm will connect Block Island to the mainland for the first time with an underground cable and is expected to supply power to 17,200 Rhode Island homes by generating approximately 125,000 MWh per year[4]. Block Island will receive about 90% of its energy needs from this project. Whenever the wind farm is under maintenance or not producing enough power, the mainland grid will

4 http://dwwind.com/project/block-island-wind-farm/

serve the island. Diesel power is the current source of the island's energy.

The National Renewable Energy Laboratory (NREL) estimates that the US has 4,200 GW of developable offshore wind potential, compared to its estimate of 11,000 GW of onshore wind potential. Wind resources are classified on a scale of zero to seven based on their power density, and more than 66% of offshore wind in the United States is in wind power class six or seven.

Developers have proposed building nearly 4.9 GW of offshore wind capacity off the coasts of nine different states mostly along the northeast coast. But some challenges remain even for projects that have progressed through key regulatory and market milestones.

Demonstration projects supported by the US Department of Energy – the Virginia Offshore Wind Technology Advancement (VOWTAP[5]) Project, Fisherman's Energy Wind[6] of New Jersey and WindFloat of Oregon – face development hurdles despite making significant progress in project development.

Each of these projects received USD 4 million (EUR 3.5 mn) in design and planning support. Eventually these three projects were to get as much as USD 47 million (EUR 41 mn) each to help fund construction. The goal was to have the projects up and running in 2017, but both Fishermen's Energy and WindFloat (semi-submersible) – are facing serious challenges[7].

Fishermen's Energy's proposal has a two-phase approach, the first phase a 25 MW project in New Jersey State Waters followed by a 330 MW utility scale project in Federal Waters, for the second phase.

In March 2016, the New Jersey legislature passed a second bill[8] that requires the Board of Utilities to re-open an application window for a 20-25 MW offshore wind project in state waters, a move aimed at providing Fishermen's Energy a final chance to win regulatory approval. The NJ Board of Utilities (BU) has twice rejected Fishermen's fully permitted 24 MW, USD 220 million (EUR 194 mn) project on grounds that it fails to provide the state with sufficient economic and environmental benefits to qualify for Offshore Renewable Energy Certificates[9] (ORECs).

Further the BU disagreed with the developer's proposed OREC price of USD 199.17 per MWh, as this was contingent on Fishermen's Energy receiving about USD 100 million in federal subsidies that it did not have fully in hand last year[10]. In a renewed effort to address these concerns, the project developer switched from XEMC to Siemens turbines, while pledging to utilize traditional project financing along with proven technology[11].

On the other end the US Department of Interior's Bureau of Ocean Energy Management (BOEM) is in charge of the permitting process for offshore projects including planning, leasing, site assessment, construction and operations. It has executed individual lease sales in a number of states including Rhode Island and Massachusetts (2013), Virginia (2013), Maryland (2014), Massachusetts-2 (2015) and New Jersey (2016)[12].

The US will see its first commercial offshore project come online in 2016. The path forward will be challenging, and will be linked to the outcome of the upcoming Presidential election results as well. The level of federal support for offshore wind could come under scrutiny under a new Administration.

India sets the ball rolling

The Indian Ministry of New and Renewable Energy (MNRE) has initiated discussions on promoting a demonstration project in India. In October 2015, it announced *India's Offshore Wind Policy*. The National Institute for Wind Energy (NIWE) is the nodal agency for implementing the policy and creating the necessary ecosystem for the sector.

Facilitating Offshore Wind in India[13] (FOWIND) is a European Union supported four-year project. A GWEC led consortium is implementing this project in Gujarat and Tamil Nadu. NIWE is the knowledge partner for the project in India. FOWIND will undertake the first offshore wind resource measurement in the Gulf of Khambat, off the coast of Gujarat in 2016. FOWIND works in close consultation with the MNRE and state government agencies to establish a roadmap for offshore wind power development in India.

The Offshore Wind Policy outlines an international competitive bidding mechanism for the sector. The first tender is likely to be announced in late 2018.

5 Dominion Power's VOWTAP project include the National Renewable Energy Laboratory; General Electric, which will supply the Alstom-designed turbines; KBR, a global engineering, construction and services firm; Keystone Engineering, the substructure designer; Newport News Shipbuilding, and the Virginia Tech Advanced Research Institute.
6 http://www.fishermensenergy.com/offshore-new-jersey.php
7 http://breakingenergy.com/2015/06/25/oregon-offshore-wind-projects-troubles-leave-the-doe-0-for-3-so-far/
8 The General Assembly voted 53-21 in favour of S988, which the state Senate passed last month. S988 calls for the new application window to be opened within 60 days following enactment of the bill into law. The bill will move to Governor Chris Christie, who allowed the first similar legislation to die earlier this year by declining to sign it. At the time of writing it remains to be seen if he will sign or veto S988. http://www.fishermensenergy.com/pdf/2016/03/letter-to-gov-christie.pdf
9 Electric utilities would be required to purchase ORECs - a revenue guarantee mechanism that would allow developers to finance offshore wind projects. Their developers would obtain one OREC per MWh at a price set by the BU.
10 http://www.rechargenews.com/wind/1427269/nj-legislature-passes-new-bill-to-help-fishermens-wind-pilot
11 http://www.njspotlight.com/stories/15/10/14/its-day-in-court-over-fishermen-s-energy-revamps-offshore-wind-proposal/
12 http://www.boem.gov/Lease-and-Grant-Information/
13 http://www.fowind.in