EWEA
THE EUROPEAN WIND ENERGY ASSOCIATION

The European offshore wind industry - key trends and statistics 2012

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A report by the European Wind Energy Association

Contents

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Executive summary

Offshore wind power market in 2012

- 293 new offshore wind turbines, in 9 wind farms, representing investments of around €3.4 bn to €4.6 bn, were fully grid connected between 1 January and 31 December 2012, totalling 1,166 MW, 33% more than in 2011.
- 369 turbines were erected during 2012, an average of 3.9 MW per day. 76 of these turbines are awaiting grid connection.
- Work is on-going on five projects and foundation installation has started on a further nine new projects.
- 2012 saw Siemens as the leading turbine supplier, Bladt as the leading substructure supplier, Nexans and JDR as the leading inter-array cable suppliers, Prysmian as the leading export cable supplier, and DONG Energy as the leading developer.

Cumulative offshore wind power market

- 1,662 turbines installed and grid connected, totalling 4,995 MW in 55 wind farms in ten European countries: up from 1,371 turbines, totalling 3,827 MW, at end 2011, an increase of 31%.
- Overall, EU Member States are lagging behind their offshore wind energy NREAP objectives.
- 73% of substructures are monopiles, 13% jackets, 6%, tripods, 5% tripiles and 3% gravity based foundations. There are also two full scale grid-connected floating turbines, and two down-scaled prototypes.

Market outlook for 2013 and 2014

- Once completed, the 14 offshore projects currently under construction will increase installed capacity by a further 3.3 GW, bringing cumulative capacity in Europe to 8.3 GW.
- Preparatory work has started on seven other projects, which will have a cumulative installed capacity of 1,174 MW.
- 2013 installations could be around 1,400 MW and 2014 installations around 1,900 MW.

Trends: turbines, foundations, water depth and distance to shore

- The average size of offshore wind turbines installed in 2012 is 4 MW; it is expected that average wind turbine size will not increase significantly over the coming two years.
- Average offshore wind farm size was 271 MW in 2012, 36% more than the previous year. The trend towards larger projects is expected to continue over the coming years.
- The average water depth of wind farms completed, or partially completed, in 2012 was 22 metres (m) and the average distance to shore 29 km. Both average water depth and distance to shore are expected to increase over the coming years.

Installation vessels	• During 2012 a number of new generation installation vessels were delivered featuring innovative technologies, capable of operating in deeper waters (up to 75 m) and in harsher sea conditions (higher waves).
Financing highlights and developments	• Financing activity grew faster than the sector itself during 2012. The financing pipeline for 2013 is also considerable. • In 2012, four non-recourse debt financing transactions were closed, involving almost 20 banks. • Seven equity deals were struck during 2012 and the year saw a broader pool of companies buying into the sector. • 4 GW of capacity changed hands during 2012, 30% more than during the previous year.
New turbine announcements	• 31 companies have announced plans for 38 new offshore turbine models. • 52% of new offshore turbine models announced are from European companies. • Almost three-quarters of all announcements are for turbines of a rated capacity of 5 MW or more.

Annual market in 2012

Offshore wind installations

During 2012, work[1] was carried out on 18 offshore wind farms in Europe:

- Four utility-scale wind farms were completed.
- Work went on and several wind turbines were erected and connected in five further wind farms.
- Work has started but no turbines are yet connected in nine other wind farms.

TABLE 1: SUMMARY OF WORK CARRIED OUT AT EUROPEAN OFFSHORE WIND FARMS DURING 2012.

Wind farm name	Status
Ormonde	Fully grid connected
Walney 2	Fully grid connected
Greater Gabbard	Fully grid connected
Sheringham Shoal	Fully grid connected
Thornton Bank (phase 2 and 3)	Partially completed
Lincs	Partially completed
London Array	Partially completed
Anholt	Partially completed
BARD Offshore 1	Partially completed
Global Tech 1	Foundations installed
Nordsee Ost	Foundations installed
Meerwind sud/ost	Foundations installed
Riffgat	Foundations installed
Borkum West II	Foundations installed
Teesside	Foundations installed
Gwynt y Mor	Foundations installed
Gunfleet Sands 3 Demonstration	Foundations installed
Karehamn	Foundations installed

Additionally, preparatory work has begun at five more sites: Belwind Phase 2 and 3 (Belgium), Vertiwind (France), Dan Tysk, EnBW Baltic 2 (Germany), West of Duddon Sands (UK).

1 Defined as where a foundation or turbine was installed, erected, or grid connected during the year.

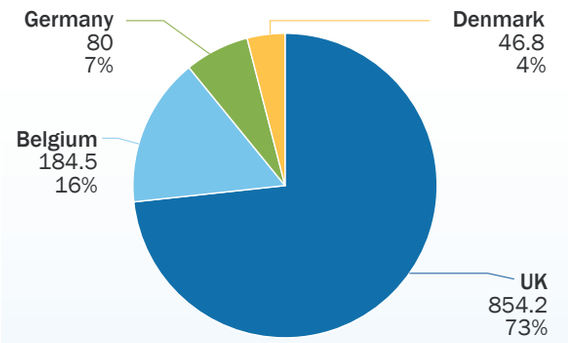


FIG 1: SHARE OF ANNUAL OFFSHORE WIND CAPACITY INSTALLATIONS PER COUNTRY (MW).

1,166 MW of new offshore wind power capacity were connected to the electricity grid during 2012 in Europe, 33% more capacity than the previous year. Over 73% of all new capacity was installed in the UK (854 MW). The second largest amount of installations were in Belgium (185 MW or 16%), followed by Germany (80 MW, 7%) and Denmark (46.8 MW, 4%).

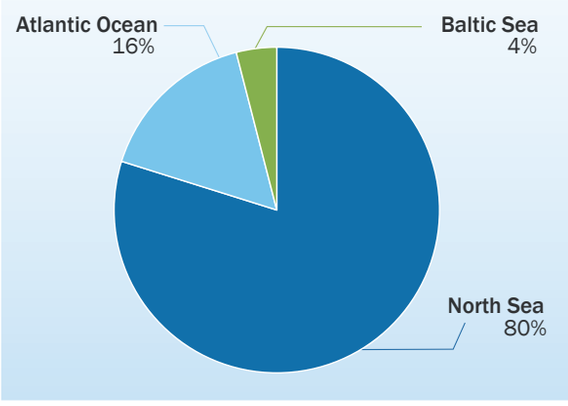


FIG 2: SEA BASIN SHARE OF 2012 ANNUAL INSTALLATIONS

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.

TABLE 2: NUMBER OF TURBINES AND MW FULLY CONNECTED TO THE GRID DURING 2012 PER COUNTRY (MW).

Country	Belgium	UK	Germany	Denmark	TOTAL
No. of farms	1	6	1	1	**9**
No. of turbines connected	30	234	16	13	**293**
MW fully connected to the grid	184.5	854.2	80	46.8	**1,165.5**

Annual market share in 2012 - wind turbine manufacturers

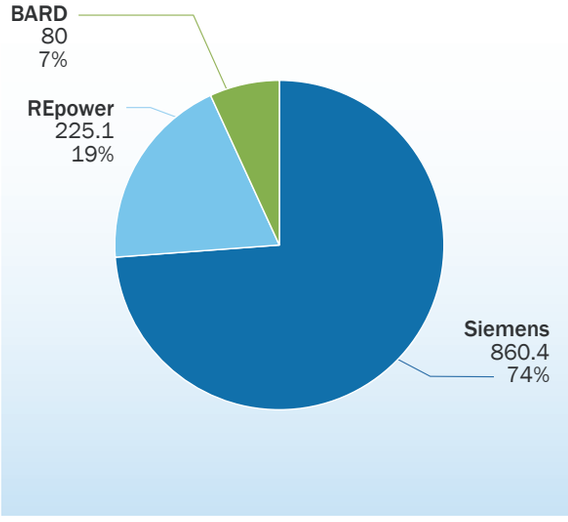


FIG 3: WIND TURBINE MANUFACTURERS' SHARE OF 2012 ANNUAL INSTALLATIONS IN MW.

Siemens continues to be the top offshore turbine supplier in terms of annual installations. With 860 MW of new capacity installed, Siemens accounts for 74% of the market. REpower (225 MW, 19%) and BARD (80 MW, 7%) are the other two turbine manufacturers who had turbines grid connected during 2012.

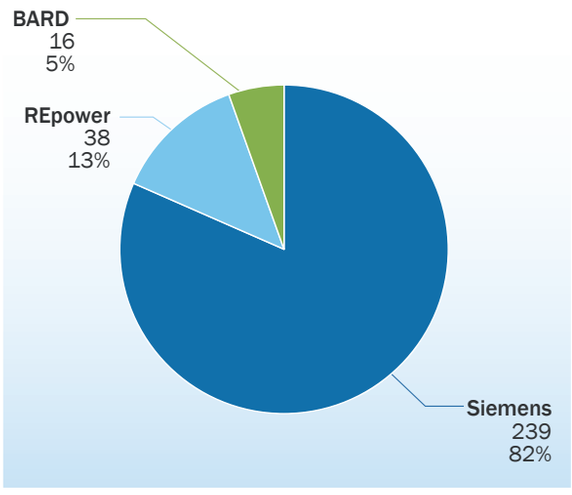


FIG 4: WIND TURBINE MANUFACTURERS' SHARE OF 2012 ANNUAL INSTALLATIONS IN TERMS OF UNITS CONNECTED.

Also in terms of units connected, Siemens remains on top with 239 offshore wind turbines, all 3.6 MW (82%), connected in European waters during 2012. Siemens is followed by REpower (30 turbines, 6.15 MW and eight 5 MW wind turbines, 13%) and by BARD (16 5 MW wind turbines, 5%).

Annual market share in 2012 - wind farm owners[2]

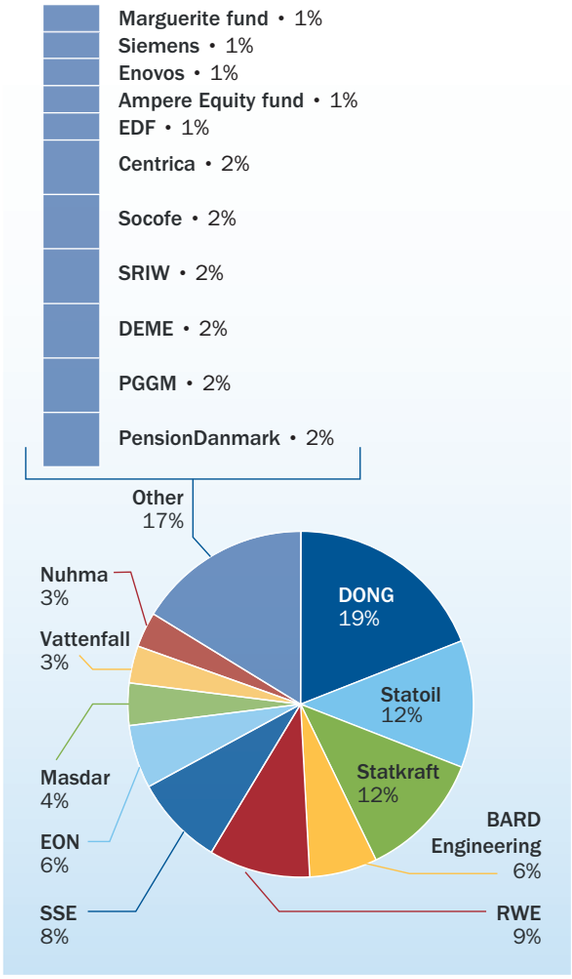


FIG 5: DEVELOPERS' SHARE OF 2012 ANNUAL INSTALLATIONS

DONG remains 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%) have installed over 70% of the capacity that went online during 2012. Other developers that connected capacity to the grid in 2012 were BARD Engineering (6%), Siemens (1%, investing in the Lincs wind farm to which it supplies turbines), Enovos (1%) and marine contractor DEME (2%). The sovereign fund Masdar (4%) and the Marguerite Fund (1%) also have stakes in offshore wind power projects.

Together, 10 power producers developed 75% of the offshore wind energy capacity that came online during 2012. In 2011 a mere five power producers were responsible for over 90% of installations.

2 The grid-connected market shares are indicative only. Projects owned or developed by several companies have been split according to the respective shares. Where the shares are not known, they have been split in equal parts between the partners.

Annual market share in 2012 - substructures

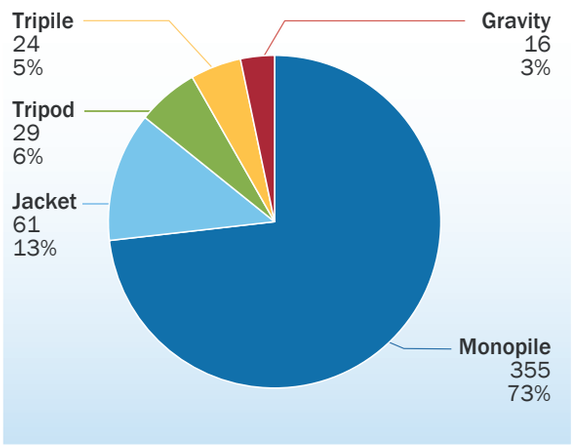


FIG 6: FOUNDATION TYPES SHARE OF 2012 ANNUAL MARKET

Monopile substructures remained the most popular substructure type with 355 installed (73%) in 2012. 61 jacket foundations were installed, representing 13% of all newly installed substructures, followed by tripods (6%) and tripiles (5%). Finally 16 gravity based foundations were installed representing 4%.

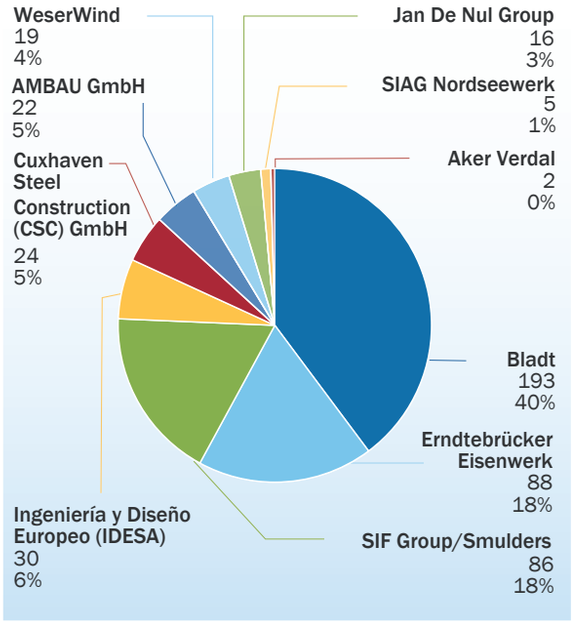


FIG 7: SHARE OF FOUNDATIONS INSTALLED IN 2012 BY MANUFACTURING COMPANY[3]

The continued growth of offshore wind has created significant opportunities across its supply chain. Substructures represent major construction projects for construction companies. Seven companies supplied foundations to offshore wind energy projects during 2012: Bladt (193 foundations: 40% of all foundations installed) EEW (88 foundations: 18%) and SIF group (86 foundations: 18%) were the market leaders, followed by IDESA (30 foundations: 6%), CSC (24 foundations: 5%), AMBAU (22 foundations: 5%), WeserWind (19 foundations: 4%), Jan De Nul Group (16 foundations: 3%), SIAG Nordseewerk (five foundations) and Aker Verdal (two foundations).

3 The shares are calculated according to the actual number of individual foundations installed in 2012.

Annual market share in 2012 - cables[4]

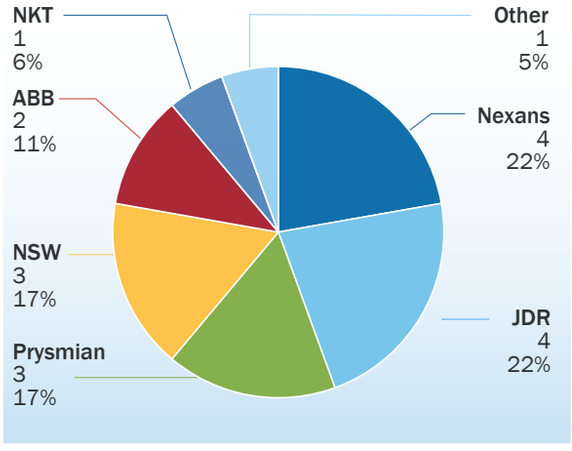


FIG 8: SHARE OF INTER-ARRAY CABLE SUPPLIERS TO OFFSHORE WIND FARMS IN 2012 (NUMBER OF FARMS SUPPLIED)

Cables – both inter-array and export – make up another significant part of the offshore wind energy supply chain.

In 2012, Nexans and JDR supplied four wind farms with inter-array cables, representing respectively 21% each of the 18 wind farms. Prysmian was contracted to supply inter-array cables to three wind farms (16% of total), as was NSW (three wind farms: 16%) followed by ABB (two wind farms: 10%) and NKT (one wind farm: 5%).

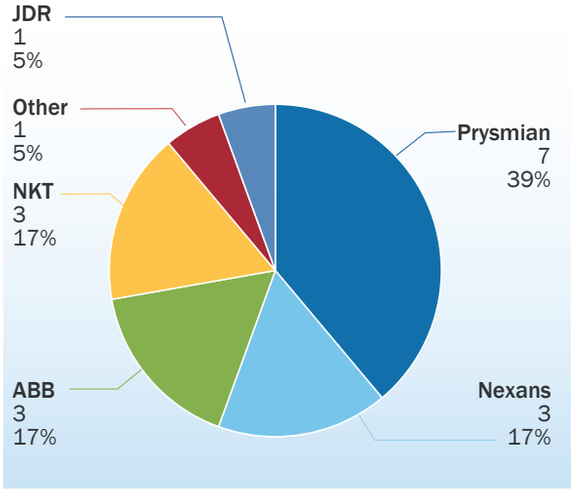


FIG 9: SHARE OF EXPORT CABLE SUPPLIERS IN 2012 (NO. OF FARMS)

In terms of export cables, in 2012 Prysmian was the lead supplier, supplying 37% of wind farms under construction. Nexans, NKT and ABB (three wind farms, 16% each) supplied the second largest number of wind farms, followed by JDR (one wind farm).

4 The shares are calculated taking into account the 18 farms where offshore work was carried out to which a company has supplied cables. The size of the farm or length of cable are not accounted for.

Wind turbine capacity and wind farm size

The average capacity rating of the 293 offshore wind turbines connected to the grid in 2012 was 4 MW, 11% bigger than in 2011. The continued dominance of Siemen's 3.6 MW turbine explains why the average size of turbines remains around the 4 MW mark.

The average size of the 18 wind farms being constructed during 2012 was 285.6 MW, 43% more than 2011. This confirms the sector's trend towards larger turbines and bigger wind farm projects.

Water depth and distance to shore

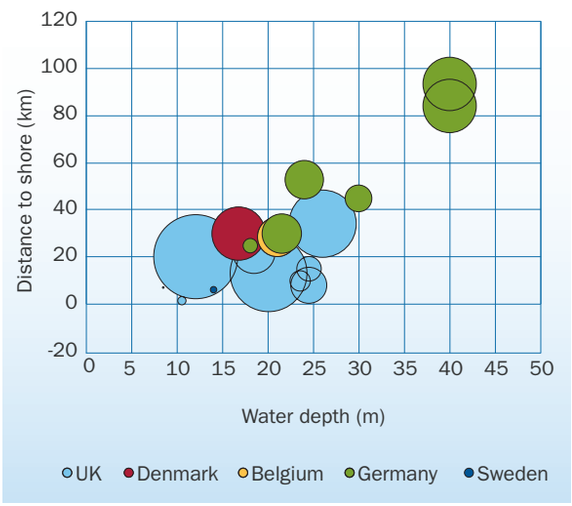


FIG 10: WATER DEPTH, DISTANCE TO SHORE AND SIZE OF OFFSHORE WIND FARMS UNDER CONSTRUCTION DURING 2012

The average water depth of offshore wind farms where work was carried out in 2012 was 22 m, slightly lower than in 2011. The average distance to shore for those same projects was 29 km, almost 24% more than in 2011 (23.4 km).

Installation vessels

During 2012 a number of new installation vessels were delivered, including.

- Northwind Installer by NorWind
- Pacific Orca by Swire Blue Ocean
- Seajacks Hydra and Zaratan by Seajacks
- Seafox 5 by Seafox Group
- Friedrich Ernestine by RWE Innogy
- Innovation by HGO InfraSea Solutions

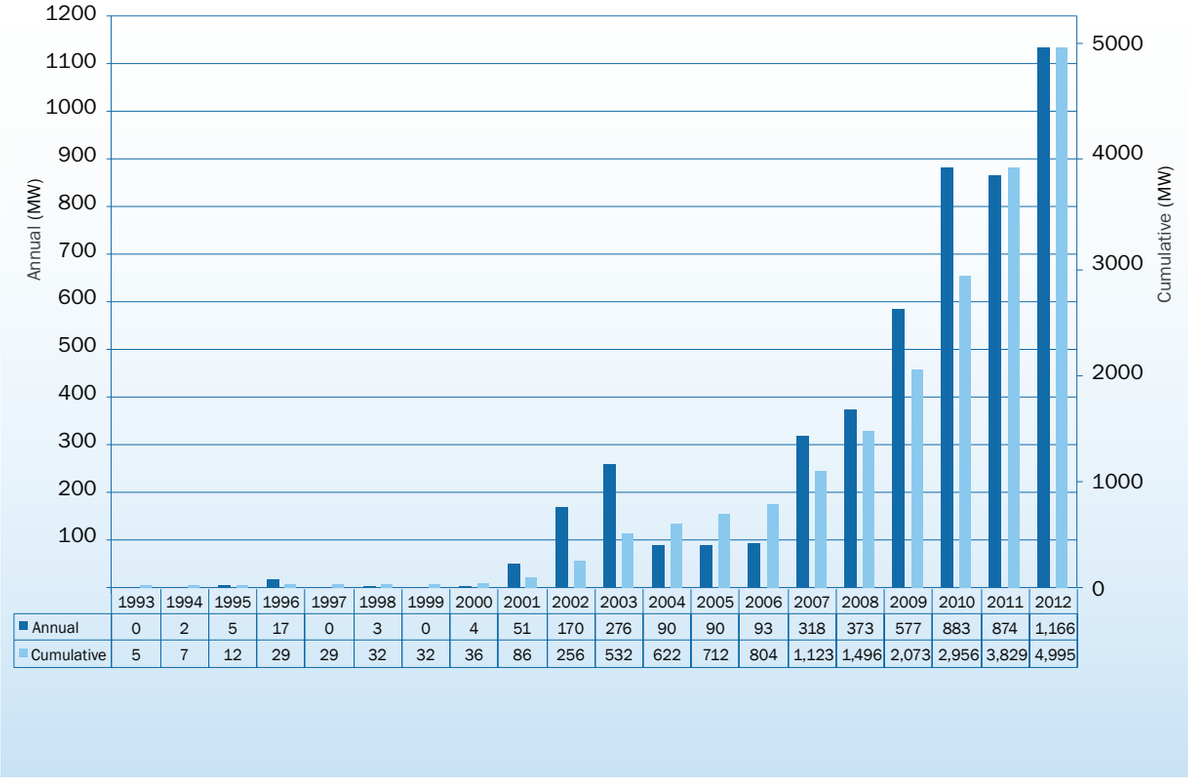
These new generation installation vessels feature innovative technologies. They are capable of operating in deeper waters (up to 75 m) and in harsher sea conditions (higher waves). Moreover, they can carry a larger number of foundations and turbines and are equipped with stronger cranes capable of lifting and installing wind farm components with enhanced precision. These purpose-built vessels, therefore, both reduce the number of harbour to wind farm site trips required during the installation process and increase the "weather window" during which offshore work can be carried out. Ultimately, this increased efficiency will be an important driver in reducing offshore wind farm installation costs.

Cumulative market

A total of 1,662 wind turbines are now installed and connected to the electricity grid in 55 offshore wind farms in 10 countries across Europe. Total installed capacity at the end of 2012 reached 4,995 MW, producing 18 TWh in a normal wind year, enough to cover 0.5% of the EU's total electricity consumption[5].

The UK has the largest amount of installed offshore wind capacity in Europe (2,947.9 MW): 58.9% of all installations. Denmark follows with 921 MW (18.4%). With 380 MW (7.6% of total European installations), Belgium is third, followed by Germany (280 MW: 5.6%), the Netherlands (246.8 MW: 4.9%), Sweden (163.7 MW: 3.3%), Finland (26.3 MW: 0.6%), Ireland (25.2 MW), Norway (2.3 MW) and Portugal (2 MW).

FIG 11: CUMULATIVE AND ANNUAL OFFSHORE WIND INSTALLATIONS (MW).



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Annual	0	2	5	17	0	3	0	4	51	170	276	90	90	93	318	373	577	883	874	1,166
Cumulative	5	7	12	29	29	32	32	36	86	256	532	622	712	804	1,123	1,496	2,073	2,956	3,829	4,995

Country	UK	DK	BE	DE	NL	SE	FI	IE	NO	PT	Total
No. of farms	20	12	2	6	4	6	2	1	1	1	**55**
No. of turbines	870	416	91	68	124	75	9	7	1	1	**1,662**
Capacity installed (MW)	2,947.9	921	379.5	280.3	246.8	163.7	26.3	25.2	2.3	2	**4,995**

5 According to Eurostat's latest figures (2010), the EU's gross domestic consumption of electricity was 3,349.07 TWh.

FIG. 12: INSTALLED CAPACITY - CUMULATIVE SHARE BY COUNTRY, (MW).

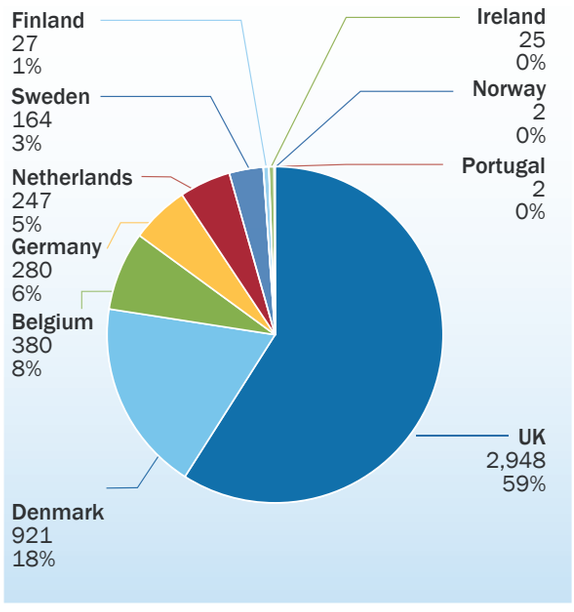


FIG. 13: INSTALLED WIND TURBINES - CUMULATIVE SHARE BY COUNTRY.

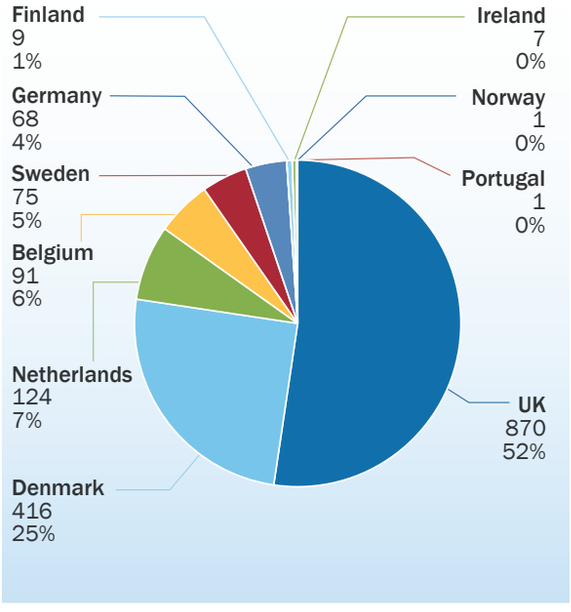
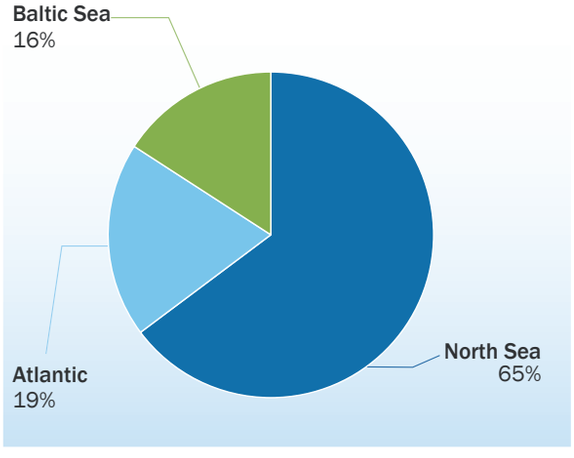


FIG. 14: INSTALLED CAPACITY, CUMULATIVE SHARE BY SEA BASIN

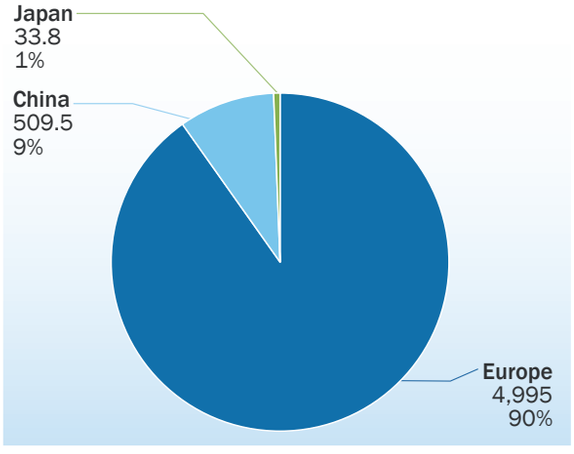


In terms of the number of wind turbines installed in Europe, the UK is leading with 870 (52.3%), followed by Denmark (416 wind turbines: 25%), the Netherlands (124 turbines: 7%), Belgium (91 turbines: 5.5%), Sweden (75 turbines: 4.5%), Germany (68 turbines: 4%), Finland (nine turbines: 0.6%) and Ireland (seven units), Norway and Portugal both have one wind turbine each.

The 4,995 MW of offshore wind capacity are mainly installed in the North Sea (3,236 MW: 64.7%), 966 MW or 19.3% are in the Atlantic Ocean and 793 MW (15.9%) in the Baltic Sea.

Global cumulative installations

FIG. 15: GLOBAL CUMULATIVE OFFSHORE WIND ENERGY CAPACITY



There are 5,538 MW of offshore wind energy capacity installed world-wide, 90% of which is in Europe, making the region by far the world leader in offshore wind. At the end of 2012, 509.5 MW of offshore wind energy capacity was installed in China, mainly in shallow intertidal areas, and 33.8 MW in Japan, mostly near-shore.

12 countries across the world have offshore wind energy capacity. With almost 510 MW, China is the third biggest market behind the UK (2,948 MW) and Denmark (921 MW). Japan (34 MW) is still only beginning to exploit its offshore potential and is the eighth biggest market, still significantly behind the top seven.

Offshore wind energy targets

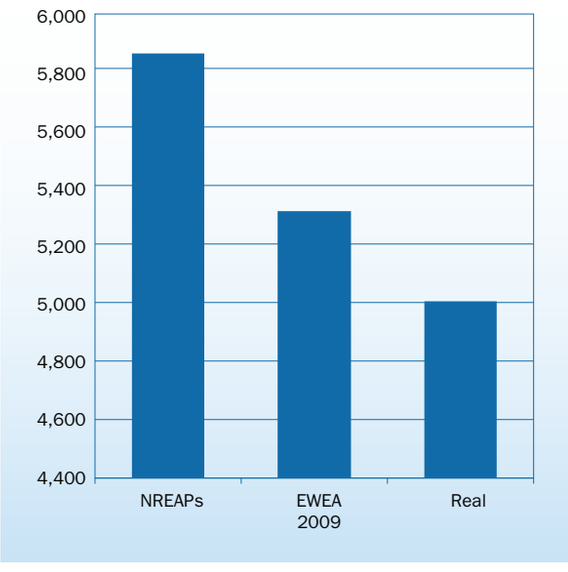


FIG. 16: EU MEMBER STATES' OFFSHORE WIND CAPACITY TARGETS (NREAPS), EWEA 2009 FORECAST AND REAL INSTALLATIONS (MW).

Despite the growth of annual wind energy installations in 2012 and cumulative capacity almost reaching the 5 GW milestone, offshore wind deployment is lagging behind the objectives the EU Member States set themselves in their National Renewable Energy Action Plans (NREAPs), and to a lesser extent EWEA's expectations.

In 2009, the European Wind Energy Association published a growth scenario[6] that expected cumulative capacity in the EU to overtake the 5 GW mark during 2012. Eight EU Member States indicated in their NREAPs - submitted to the European Commission as required by the Renewable Energy Directive[7] - offshore deployment objectives that, taken together, add up to over 5.8 GW at end 2012.

TABLE 3: MEMBER STATES' NREAP CUMULATIVE OFFSHORE WIND INSTALLATION TARGETS FOR 2012, AND REAL INSTALLATIONS (MW).

Member State	NREAP target	Real installations	Difference
Belgium	503	380	**-24.5%**
Denmark	856	921	**+6.4%**
Finland[7]	0	26	-
France	667	0	**-100%**
Germany	792	280	**-64.6%**
Ireland	36	25	**-30.6%**
Netherlands[9]	228	248	**-0.8%**
Portugal	0	2	-
Sweden[10]	97	164	**+69.1%**
United Kingdom	2,650	2,948	**+11.2%**
Total	5,829	4,994	**-14.3%**

Most Member State NREAPs overestimated their offshore build-out by the end of 2012. Overall, EU Member States are over 14% below their NREAP targets.

It should be noted, however, that comparing build-out to NREAP targets does not take into account any subsequent changes to national objectives, e.g. as in the case of the UK, or realistic expectations, e.g. as in the case of France.

6 Pure Power, wind energy targets for 2020 and 2030 – a report by the European Wind Energy Association.
7 Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources.
8 A near shore project in Finland was not taken into account in the drafting of the NREAP.
9 The Netherlands did not expect any growth in offshore wind energy by 2012, the discrepancy with the installation figures reported here is due to two near-shore projects not being taken into account in the NREAP.
10 There has been no offshore wind development in Sweden since the NREAP was submitted, it is unclear, therefore, why the NREAP cites the 97 MW figure that does not seem to correspond to real installations at the time.

Cumulative market share: wind turbine manufacturers

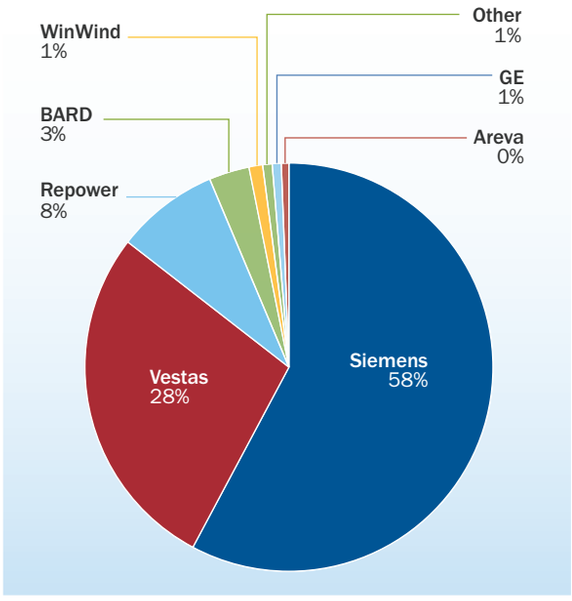


FIG. 17: WIND TURBINE MANUFACTURERS' SHARE AT THE END OF 2012 (MW).

Siemens remains the lead offshore wind turbine supplier in Europe with 58% of total installed capacity. Vestas (28%) is the second biggest turbine supplier, followed by REpower (8%), BARD (3%), WinWind and GE with 1% each and AREVA Wind with 30 MW connected.

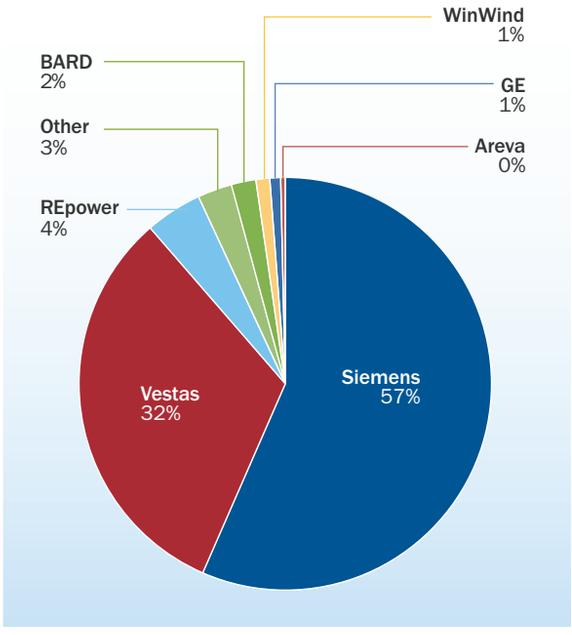


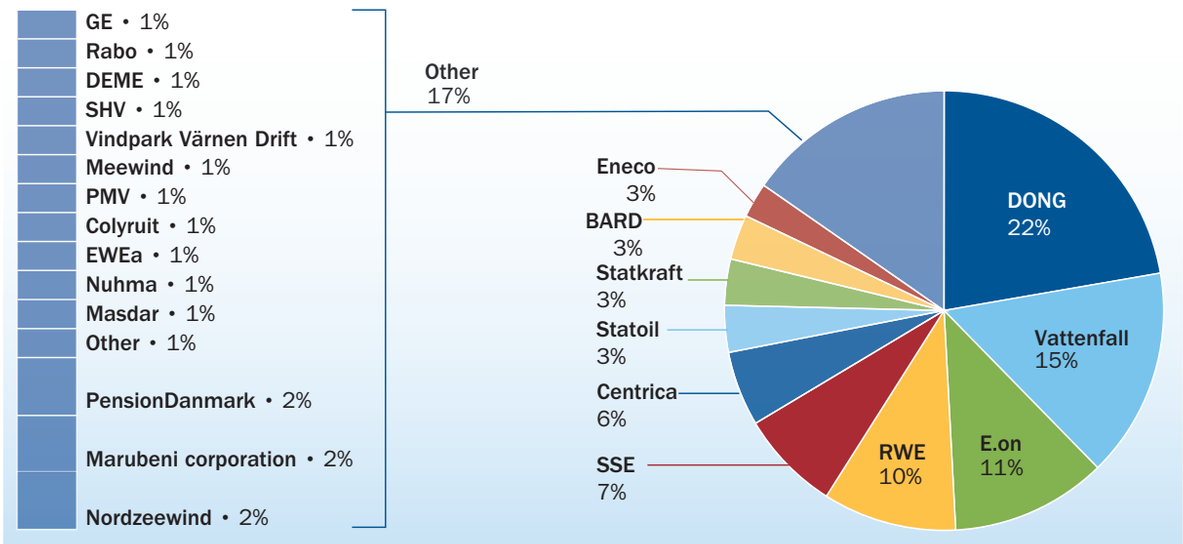
FIG. 18: WIND TURBINE MANUFACTURERS' SHARE AT THE END OF 2012 (UNITS).

In terms of number of wind turbines installed at the end of 2012, Siemens remains the top supplier with 940 turbines. Vestas has installed and grid connected 533 turbines representing 32% of total installations, followed by REpower (74 turbines: 4%), BARD (32 turbines: 2%), WinWind (18 turbines: 1%), GE (14 turbines: 1%) and Areva with six wind turbines.

Cumulative market share: wind turbine owners

As in 2011, DONG remains the biggest owner of offshore wind power in Europe with 22% of the cumulative installations at the end of 2012. Vattenfall (15%), E.On (11%), RWE (10%) and SSE (7%) follow.

FIG. 19: OWNERS SHARE OF INSTALLED CAPACITY IN MW[11].



Substructures

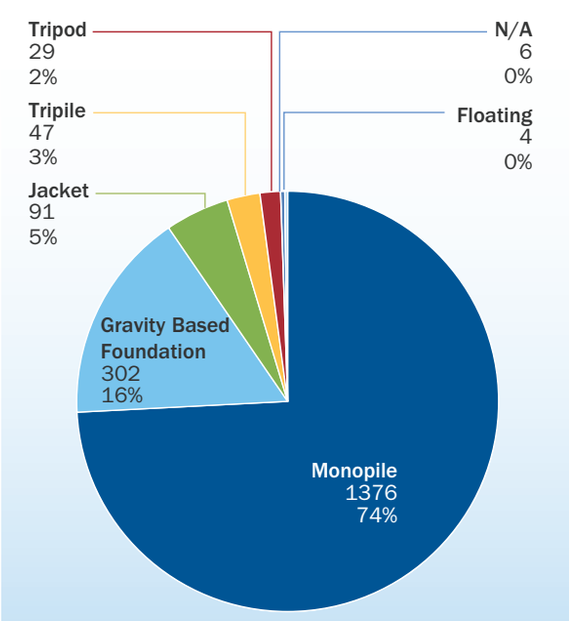


FIG. 20: WIND TURBINE MANUFACTURERS' SHARE AT THE END OF 2012 (MW).

There were 1,855 substructures fully installed at European offshore wind farms at the end of 2012. The most common substructures used are monopiles: 1,376 such foundations were fully installed at the end of 2012 (74% of all installed foundations). Gravity based foundations are the second most common with 302 units installed (16%), followed by jacket foundations (91 units: 5%), tripiles (47 units: 3%) and tripods (29 units: 2%). There are two experimental and two full scale floating substructures.

11 Market shares are indicative only. Projects owned or developed by several companies have been split according to the respective shares. Where the shares are not known, they have been split in equal parts between the partners.

Market outlook for 2013 and 2014

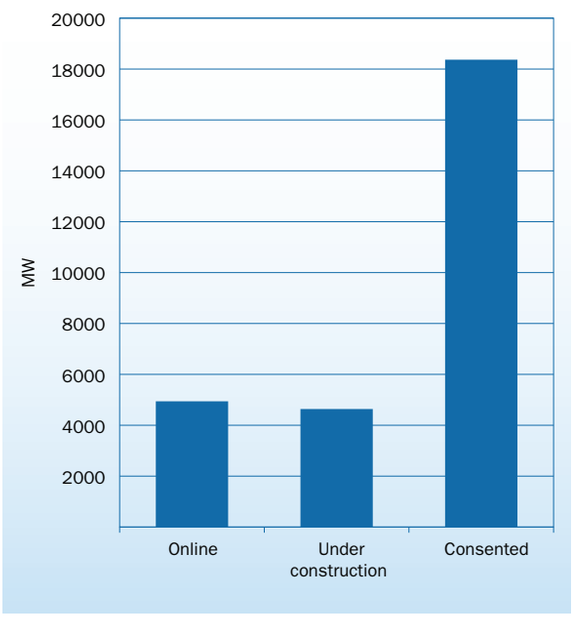


FIG. 21: OFFSHORE MARKET: PROJECTS ONLINE, UNDER CONSTRUCTION AND CONSENTED (MW).

Four offshore wind farms were fully completed in 2012 and 14 others were still under construction or only partially grid connected. Once fully completed, the latter will connect to the grid a further 3,326 MW of capacity, taking total installed offshore wind capacity in Europe to 8,321 MW.

During 2012, preparatory work started on a further seven wind farms for a total capacity of 1,174 MW. Together with the 14 wind farms under construction, 4,460 MW of offshore wind capacity will come online in European waters over the next few years. Once completed, Europe's total installed offshore wind capacity will reach 9,455 MW, an increase of 89% on the 2012 end of year total.

With the completion of the wind farms that were not fully grid connected during 2012, around 1,400 MW of new capacity is due to come online in 2013. The forecast for 2014 is even higher, as completion of wind farms already under construction, and not completed in 2013, would lead to 1,900 MW of new installations. Moreover, EWEA has identified 18.4 GW of consented offshore wind farms in Europe and future plans for offshore wind farms totalling more than 140 GW.

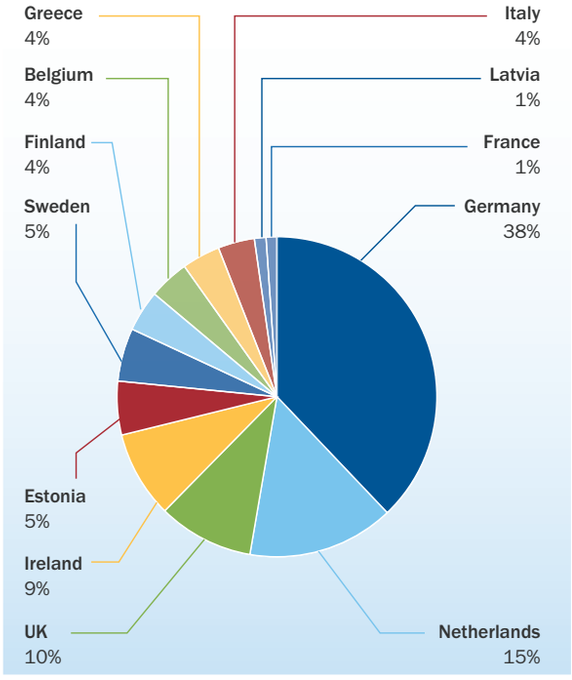


FIG. 22: SHARE OF CONSENTED OFFSHORE CAPACITY PER COUNTRY (MW).

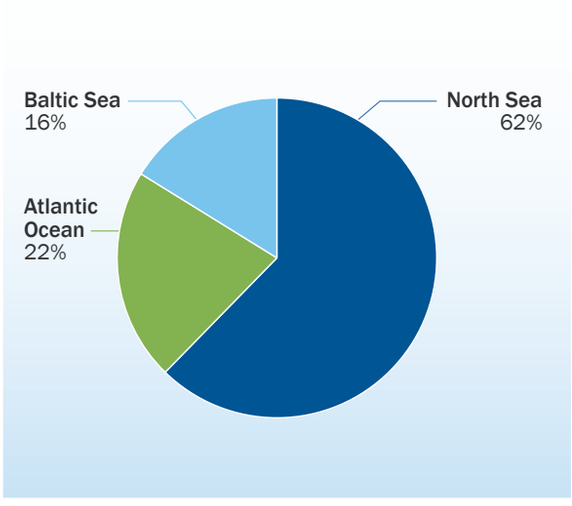


FIG. 23: SHARE OF OFFSHORE WIND FARMS UNDER CONSTRUCTION BY SEA BASIN.

When looking at wind farms currently under construction per sea basin, it is clear that the North Sea will continue to be the main region for offshore deployment (63% of total capacity). The Atlantic Ocean (22%) and the Baltic Sea (15%) will, however, continue to attract important developments. No significant developments are expected in the Mediterranean Sea in the short term.

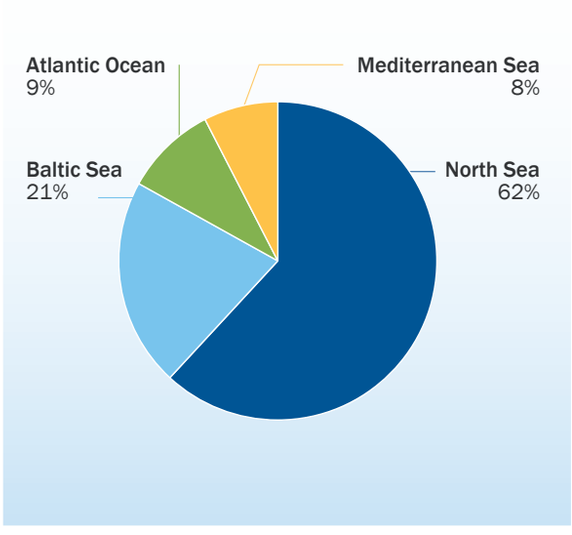


FIG. 24: SHARE OF CONSENTED OFFSHORE WIND FARMS BY SEA BASIN.

In the medium term, an analysis of consented wind farms shows that the North Sea will remain the main region for offshore deployment (62% of total consented capacity), but the Mediterranean could begin exploiting its offshore potential (8% of consented capacity). Significant developments are also foreseen in the Baltic Sea (21% of consented capacity). Currently, only 9% of consented offshore wind capacity is in the Atlantic Ocean, a situation that could change, however, due to offshore tenders in France or with the commercialisation of deep water substructures unlocking the vast potential off the Atlantic Coast.

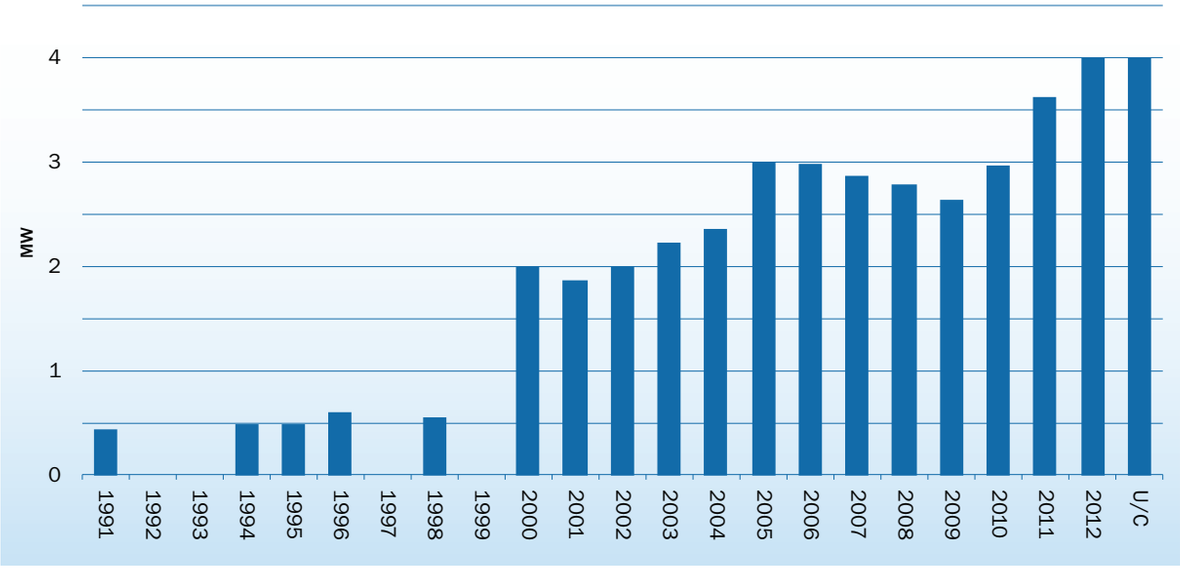
Trends: turbines, water depth and distance to shore

Wind turbine capacity

Since 1991 the average size of wind turbines installed in European waters has continuously increased. During 2012, the average capacity of new wind turbines installed was 4 MW, 11% higher than in the previous year.

Looking at the wind farms under construction, it is expected that average turbine capacity will remain around 4 MW in 2013, due to the market dominance of the Siemens 3.6 MW model.

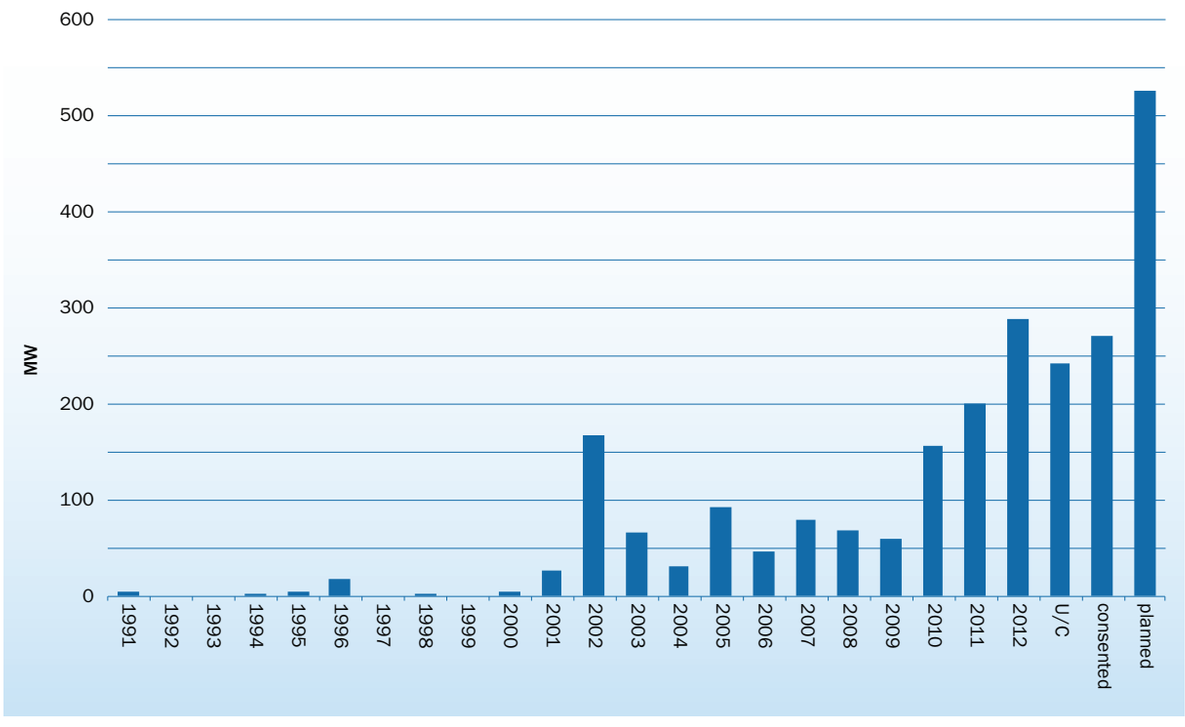
FIG. 25: AVERAGE OFFSHORE WIND TURBINE RATED CAPACITY.



Wind farm size

Offshore wind farms are growing in terms of total project capacity as well as the size of individual turbines. In 2011, the average size of offshore wind projects was 199 MW; in 2012 it was 271 MW - a 36% increase. The average size of wind farms is not expected to increase in the short term – the average size of projects currently under construction or consented is, in fact, slightly smaller than those completed in 2012. However looking at planned projects, in the medium term the average size of offshore wind farms could be over 500 MW.

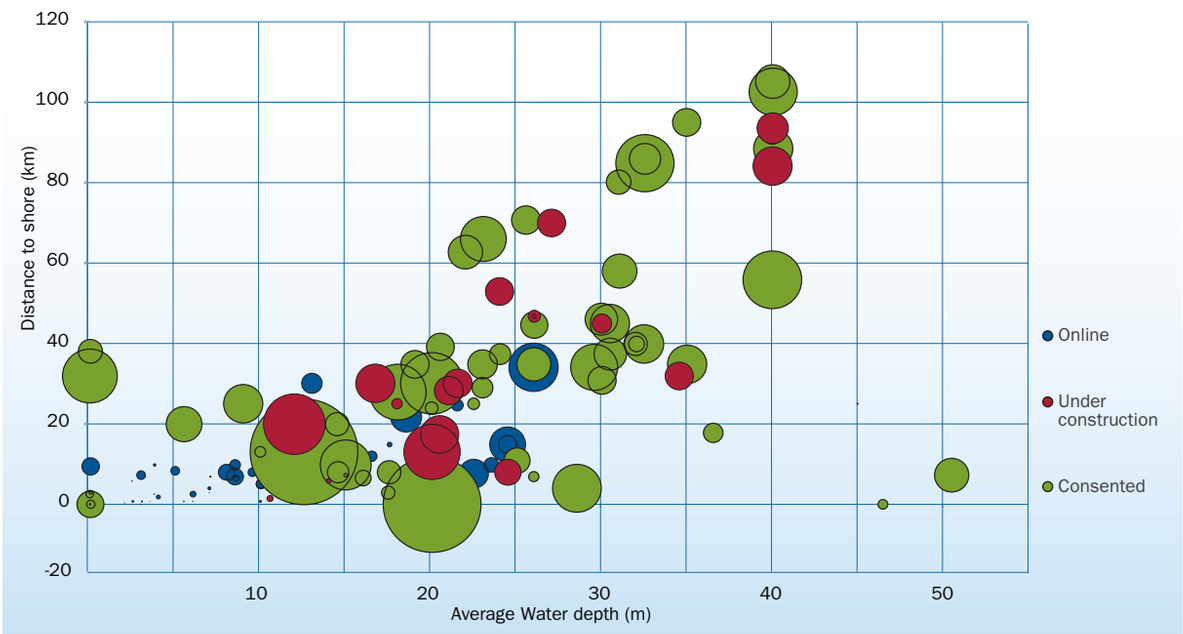
FIG. 26: AVERAGE SIZE OF OFFSHORE WIND FARM PROJECTS.



Water depth and distance to shore

Over the years, offshore wind farms have moved further from shore and into deeper waters. At the end of 2012, the average water depth of wind farms was 22 m and the average distance to shore 29 km. Looking at projects under construction, consented or planned, it is clear that average water depths and distances to shore are likely to increase, with projects announced up to 200 km from shore and in water depths of up to 215 m.

FIG. 27: AVERAGE WATER DEPTH AND DISTANCE TO SHORE OF ONLINE, UNDER CONSTRUCTION AND CONSENTED WIND FARMS.



Financing

Financing highlights and developments in 2012, and outlook for 2013

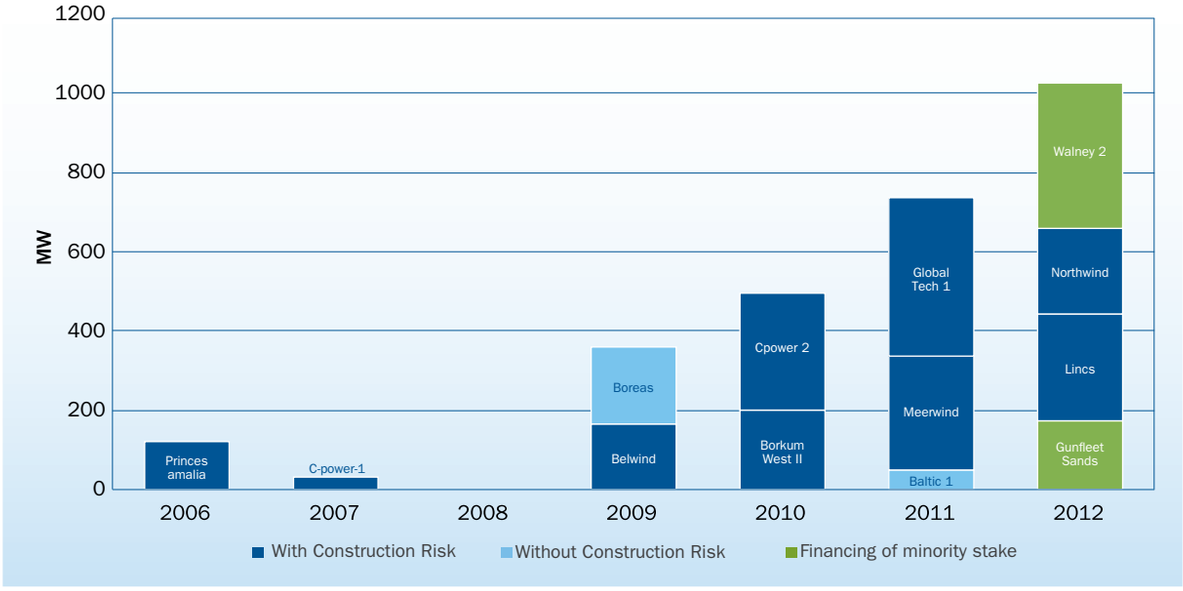
Financing activity in the offshore wind energy sector continued to grow faster than the sector itself on both the debt and equity sides during 2012, with an active pipeline for 2013.

Non-recourse debt

Four transactions (Gunfleet Sands, Lincs, Northwind, Walney) were closed in 2012, one more than in 2011 and two more than in 2010. Almost 20 commercial banks were involved (as many as in 2011), as well as five different multilateral financing institutions, including the first transaction for the UK Green Investment Bank (GIB) (Walney).

- Lenders agreed to take construction risk in two of the projects, Northwind and Lincs, the latter being the first such transaction in the UK.
- Most of the financing activity this year was in the UK, following the high levels of construction activity in that country.
- Two transactions (Gunfleet Sands and Walney) involved the refinancing of minority stakes in projects, unlocking a potentially large new source of funding for the sector, as such structures could make it easier for utilities to sell partial stakes in projects to financial investors who require leverage.

FIG. 28: FINANCING OF OFFSHORE WIND FARMS 2006 TO 2012 (MW).



Between 2011 and 2012, non-recourse debt financing for offshore wind farms (excluding the Offshore Transmission Owner (OFTO) transactions described below) increased in MW by 39% - from 736 MW to 1,025 MW. However, it decreased slightly in volume, by 10%, from €2.05 billion to €1.85 billion[12] (a difference linked to the financing of minority stakes on two projects).

Despite the Eurozone crisis and continuing banking market jitters throughout the year, the offshore wind sector has continued to be seen as a core sector of activity for project finance banks and multilaterals, with many newcomers joining the pool of active institutions in the course of the year and more expected in 2013. Three of the four transactions in 2012 involved 15 to 18 year debt maturities, demonstrating the sector's ability to attract long-term financing despite the banks' professed difficulties in procuring it.

The participation of PensionDanmark as a lender to the Northwind project is also worth highlighting, as it was the first time an entity other than a bank provided a loan to the sector.

Offshore Transmission Owner (OFTO) transactions[13]

In 2012, two large transactions involving the sale and non-recourse refinancing of offshore cables previously built and disposed of by their owners were closed: Ormonde (July) and Walney 2 (September), for an aggregate amount of £225 million (€270 million). This is a small decline in volume compared to the four transactions closed for £250 million (€300 million) in 2011, allowing for continued recycling of capital to developers. Several large transactions are pending and expected to close in 2013.

Policy-driven lenders

EKF and the EIB continued to support non-recourse lending to the sector (in the Northwind transaction), and were joined this year by GIB and new export credit agencies, including ONDD of Belgium and GIEK of Norway. The EIB also continued to be active in the OFTO transactions.

The GIB closed one of its first loans via its participation in the Walney refinancing, where its role was critical in making the transaction happen, in line with its mandate to be a catalyst for project lending, and its policy to focus on the financing of operational assets.

Equity finance

DONG Energy was again the most active player this year, both in acquisitions and sales, continuing and expanding its policy to "recycle" minority stakes in existing assets to finance new investments.

The market for development stage assets continued to be active both in Germany and in the UK, with several Round 3 zones seeing transactions.

- The Hochtief/Ventizz joint venture announced the purchase of four early stage German projects from Enova (February);
- DONG Energy sold 50% of the Borkum Riffgrund 1 project (Germany, 277 MW) to Danish companies Oticon Foundation and KIRKBI A/S, the LEGO Group's parent company (February) - this was another market precedent as the buyers were corporations with no direct activity in the energy sector;
- DONG Energy purchased a 50% stake in the UK Round 3 Rhiannon development zone (up to 4,200 MW) from Centrica (March);
- EDF Energy purchased 50% of the UK Round 3 Navitus Bay development zone (up to 1,200 MW) from ENECO (April);
- DONG Energy purchased the Gode Wind projects (up to 900 MW, Germany) from developer PNE Wind (August);
- Statkraft and Statoil jointly purchased the Dudgeon project (up to 560 MW, UK) from developer Warwick Energy;
- Highland Group Holdings, a financial investor, purchased the Deutsche Bucht project (Germany, 210 MW) from Windreich (November).

Overall, more than 4 GW in net planned capacity changed hands during the year: an increase of close to 30% over 2011. As expected at the beginning of 2012, the buyers into the sector are increasingly diverse, ranging from large power producers to financial investors to contractors and corporations with no direct energy sector experience or exposure.

12 Using a rate of £1.25:€1.

13 An additional sub-sector of activity for investors and financiers related to offshore wind is the OFTO process in the UK, whereby the offshore transmission cables need to be owned and operated by an entity distinct from the wind farm owners - and are then subject to specific regulation.

Conclusion

In 2012, despite the negative headlines over European finance, there was an increase in the number of transactions and in the overall amount of financing committed to the industry. A number of useful new precedents were set, including non-recourse financing of minority stakes, the first transaction by the GIB, investment by non-financial and non-utility players in addition to the continued activity by the established players, both on the debt and the equity side.

The market will continue to be active in 2013 (and likely move back to Germany, following the resolution of the grid issues, which discouraged new transactions in 2012) with a number of transactions expected in the coming months, including Butendiek, Nordergrunde and MEG1. Other activity in 2013 is expected at Gemini in the Netherlands and London Array in the UK. The USA may also see its first transaction with work progressing on the Cape Wind, Fishermens Energy and Deepwater projects.

It is likely that 2013 will continue to see an active equity market with very diverse transactions taking place at all stages of project development (pre-contractual development, prior to construction or as operating assets), and increasingly diverse investors, beyond large power producers, increasingly attracted to the sector and able to commit significant volumes of funds.

Annual investment in offshore wind farms by investor type

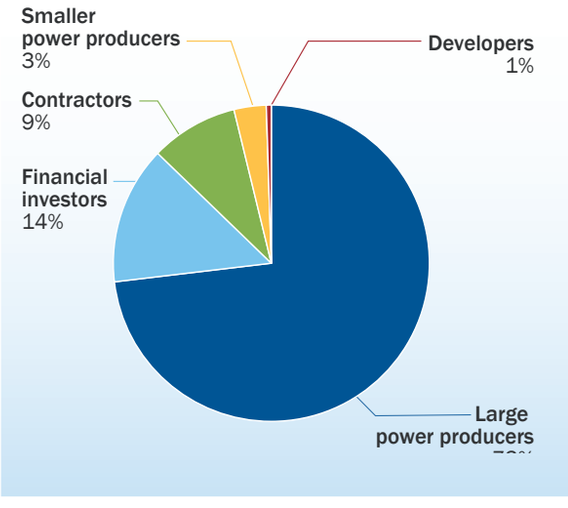


FIG. 29: INVESTMENT IN OFFSHORE WIND FARMS BY INVESTOR TYPE IN 2012.

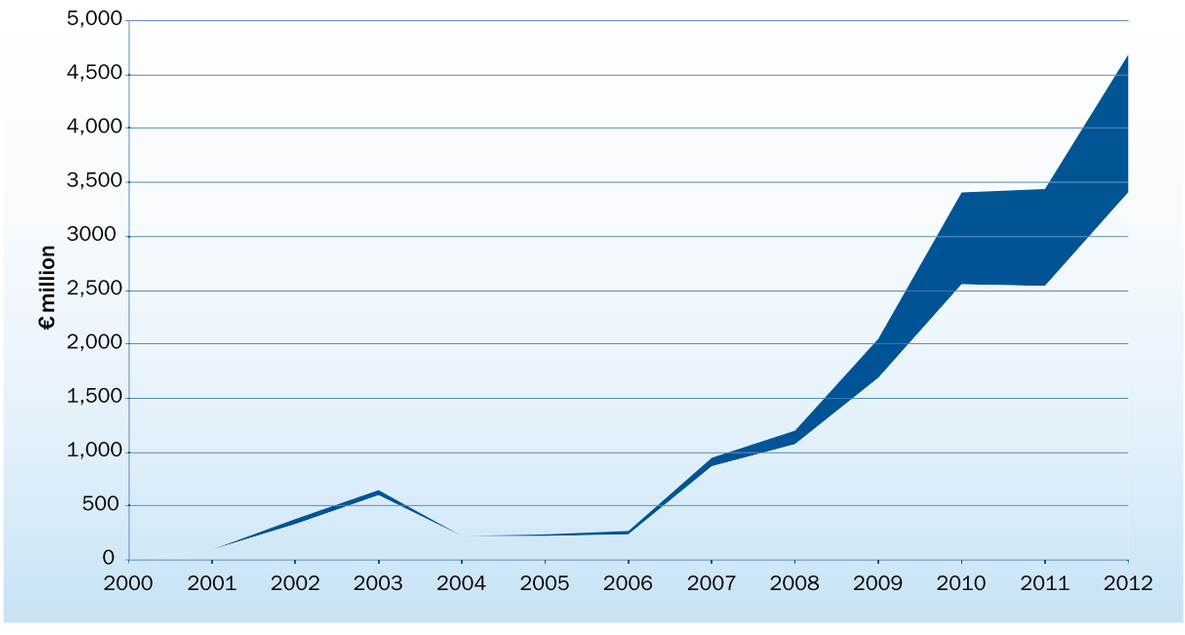
In 2012, 76% of the annual online capacity was financed by power producers (73% large power producers and 3% smaller power producers). Financial investors have been active in financing (14% of the annual online capacity), followed by contractors whose investments represent 9% of total capacity in 2012. Developers financed 1% of new projects in 2012.

Annual investment in offshore wind farms[14]

In 2012, the 293 grid connected turbines, in 17 wind farms, represented investments of around €3.4bn to €4.6bn. A range is given as average project costs can vary significantly depending on size and location of the wind farms.

Taking into account average installation costs per MW, annual investments in offshore wind farms in Europe since 2000 are presented in Figure 30 below.

FIG. 30: ANNUAL INVESTMENTS IN OFFSHORE WIND FARMS.



14 Calculated according to grid connected turbines.

Wind turbine announcements

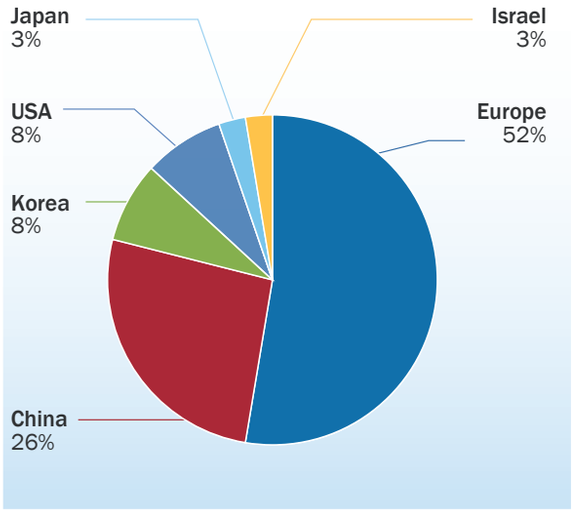


FIG. 31: ORIGIN OF ANNOUNCEMENTS OF OFFSHORE WIND TURBINE MODELS.

By the end of 2012, 31 companies had announced plans for 38 new offshore wind turbine models.

In 2012 most of the already announced wind turbines were delivered as prototypes on time - Enivision Energy (3.6 MW), Dongfang Electric (5.5 MW) and Guodian United Power (6 MW). For the models that were not delivered, the prototype date was moved to 2013.

The EU is well ahead in terms of offshore wind turbine model announcements with 52% of announcements from European companies. Europe is followed by China with 26%, the USA and Korea with 8% and then Japan and Israel with 3% each.

76% of the announcements refer to wind turbines with a rated capacity of over 5 MW. Europe is still the leader, having made 39% of the announcements for large offshore wind turbines.

FIG. 32: SHARE OF ANNOUNCEMENTS OF BIG WIND TURBINES.

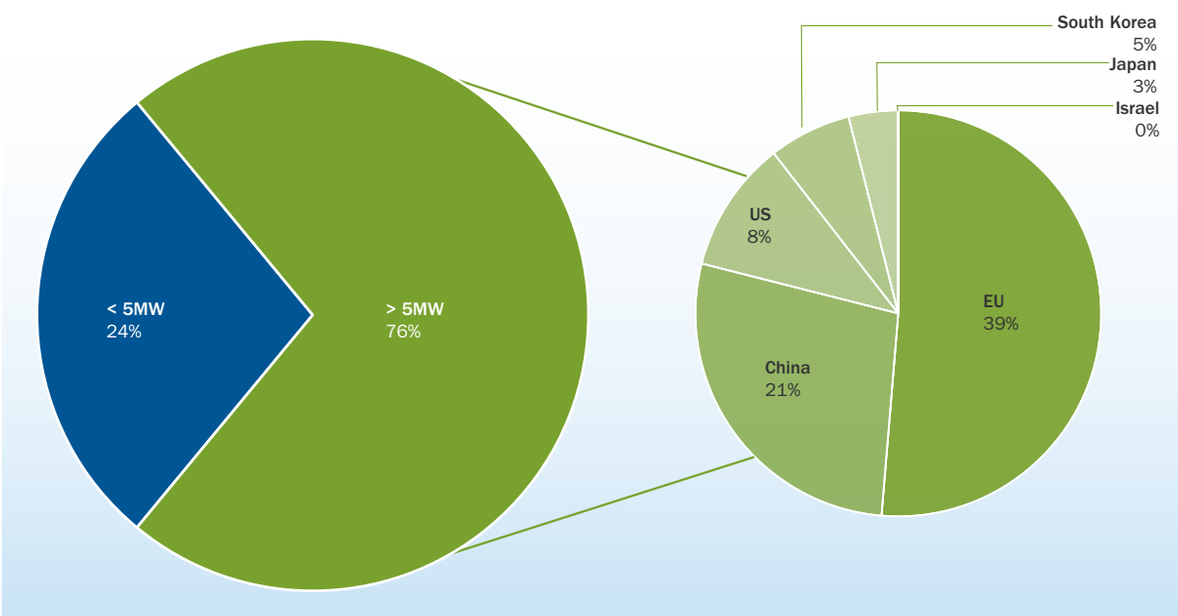


FIG 32: WIND TURBINE ANNOUNCEMENTS

		2012	2013	2014	2015	2016	2017	2018	2019	2020
European	15									Gamesa
	10		WindPowerLimited / Aerogenerator X ○				SWAY ○			
	9									
	8		Vestas							
	7			Gamesa						
	6	Alstom ●	BARD							
			Schuler			2-B Energy				
			Gamesa							
	5		Gamesa							
			SWAY							
			Mervento	Condor ○						
	4				Siemens					
	3		Acciona		WinFlo					
			SWAY/Metcentre							
	2		Acciona	Technip - Vertiwind						
YEARS		**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Non-European	2		Zheijian Windey							
	3		Israel Aerospace Industriel ○							
		Envision Energy (GC-1) ●	DMS ○							
			CSR							
			Tianwei							
	4									
	5		Hyosung	CSIC (Chonqing) CSIC (Chongqing) Haizhuang Windpower Equipment Co						
			DMS ○	Mingyang						
			Zheijian Windey							
		Dongfang (AMSC) ●	Shangai Electric ○							
			Huyndai							
	6			Envision ○						
			Goldwind	Mingyang ○						
		Guodian United Power ●	Huayi Electric & MECAL ○							
	7				Samsung					
			DSME		Mitshubishi					
	8		NPS							
	9									
	10		AMSC Sea Titan ○		Sinovel					
					Goldwind					
	11									
	12			Guodian United Power ○						
	15		GE ○							

Legend

○ *Date not announced*

● *Delivered*

Product

- Europe
- US
- China
- Japan
- South Korea
- Israel

Offshore grid developments

North Seas Countries Offshore Grid Initiative publishes results of two years of intergovernmental deliberations

On 3 December 2012, Ministers of Energy of the North Seas Countries' Offshore Grid Initiative (NSCOGI) and the European Commissioner for Energy presented the results and recommendations of their first two years of cooperation[15]. Both meshed and radial grid designs would be possible for the North Seas area, their analysis found. The Energy Ministers from the ten European countries concerned[16] said they "recognise the opportunities for offshore wind" such a grid would provide, and called for further regional cooperation by stakeholders to come up with different potential grid configurations.

The analysis found that the two grid design options studied are similar in terms of investment costs and market benefits, with no incompatibilities. Transmission system operators (TSOs) and energy regulators will continue to work together to look at different pathways to a future regional offshore grid design within NSCOGI.

The NSCOGI will continue to work from 2013 onwards as the regional group for the North Sea region for selecting so-called "Projects of Common Interest"[17], as envisaged in the European Infrastructure Package.

Norwegian TSO enters into UK-Norway interconnector plans

Norway's state-owned TSO Stattnet signed a project deal with UK's TSO National Grid in June 2012, confirming plans for a 1.4 GW interconnector. The aim is to have the 700 km link in operation by 2020. A pre-feasibility study has already established that the cable would be commercially viable and contribute to security of supply of both countries involved. The landing points of this TSO-owned project are still to be decided, both in the UK and Norway.

Another Norway-UK interconnector project called "NorthConnect" secured its landing point in Peterhead, Scotland in August 2012. NorthConnect is jointly owned by Vattenfall, SSE and three Norwegian companies, E-CO Energi, Agder Energi and Lyse. NorthConnect is a commercial interconnector also with a capacity of 1.4 GW and is also scheduled to be commissioned in 2020. NorthConnect has been preliminarily recognised as a Project of Common Interest under the TEN-E programme.

Progress on Germany-Norway interconnector

The German TSO, Tennet, and the Norwegian TSO, Stattnet, together with the German bank KfW Ipex signed a project deal in December 2012 on a 1.4 GW subsea power link. The landing points of the interconnector are yet to be specified. A final investment decision will be taken next year, with commissioning envisaged by 2018. Half of this HVDC line will be owned by Stattnet while the other half will be owned by a project company set up by Tennet and KfW.

Energy infrastructure Package: agreement on 3.5 year binding deadlines for permitting phase and priority to offshore grid projects

"Projects of Common Interest" in energy infrastructure must go through the permitting phase in a maximum three years and six months, the EU Parliament, European Commission and Council agreed on 27 November, finalising their "trialogue" negotiations. They also agreed to maintain "priority corridors"[18] for infrastructure, in particular the North Seas offshore grid as well as Electricity Highways and Smart grid projects. These elements were part of the legislative proposal on guidelines for trans-European energy infrastructure (TEN-E). The European Parliament will hold its plenary vote on these TEN-E guidelines most likely in March 2013.

Key to this development will be the EU budget for energy infrastructure under the Connecting Europe Facility (CEF), originally proposed at a level of €9.1 billion.

15 http://www.benelux.int/nscogi
16 Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway, Sweden, United Kingdom.
17 "Projects of common Interest" are projects in electricity and gas infrastructure that have been chosen under the European Infrastructure Package to be of particular relevance for the EU energy policy goals and can profit from accelerated permit and planning procedures as well as from eventual grants for studies and works following a detailed cost-benefit analysis.
18 The "priority corridors" in electricity under the European Infrastructure package comprise the Northern Seas offshore grid, North-South electricity interconnections in Western Europe, North-South electricity interconnections in Central Eastern and South Eastern Europe and the Baltic Energy Market Interconnection Plan in electricity.

National updates

Belgium

In 2012, C-Power started the construction of phases 2 and 3 of the Thornton Bank wind farm with the installation of the jackets for wind turbines of 6.15 MW. The 48 additional wind turbines are expected to be fully operational by the middle of this year.

In 2012, the construction of the onshore grid by the TSO Elia to connect the offshore wind farms was delayed by several environmental constraints. This delay may endanger the further development of the four tendered concession zones that need to be connected to the onshore grid, known as Stevin, by 2014 or 2015.

Furthermore, there have been several calls and proposals to reform the support mechanism for offshore wind energy in Belgium including one by the Belgian Organisation of Entrepreneurs. Discussions on a possible reform are still pending and the federal government is expected to take decisions on this matter early this year.

Denmark

In Denmark the 400 MW Anholt wind farm is under construction. 46.8 MW are already connected and the remaining 352.8 MW will be connected during 2013.

A further 1 GW is expected mid-term on two other wind farms, Kriegers Flak (600 MW) and Horns Rev III (400 MW). These will be tendered in 2013/2014. Moreover, it is expected that in 2014 a tender will be issued for 450 MW near-shore offshore wind farms. The near-shore projects should be of 200 MW maximum each, and the bidders will be able to choose from six different areas. The tenders are politically backed and are a part of fulfilling the Danish renewable energy target of meeting 50% of electricity demand through wind energy in 2020. It is expected that these new offshore wind farms together with considerable onshore repowering will meet the 50% target.

Germany

Half a dozen offshore wind farms, with a combined capacity of close to 2 GW are currently under construction or in operation in German waters. It is expected that construction will commence on a further 1 GW during 2013. Another 3.5 GW are in the pipeline, awaiting final investment decision.

Offshore wind employs around 10,000 people in Germany today.

Grid connection delays dominated the debate in 2012

In 2012 the debate over liability for delays in securing grid connection or interruptions to service dominated offshore wind energy discussions and will continue to do so during 2013. The German TSO TenneT, the operator in charge of connecting offshore wind farms in the North Sea, has not awarded any new contracts for grid connections in Germany since the end of 2011.

The unresolved questions resulted in a climate of uncertainty. Suppliers, ports, shipyards and the whole maritime economy are all in need of follow-up contracts since further investment in offshore wind farms has been put on hold until the legal and financial issues surrounding offshore grid connection in general and liabilities, specifically, have been clarified.

System change: en route to an offshore grid plan

The adoption of the 'Third Act Revising the Legislation Governing the Energy Sector' (EnWG-E) in December 2012 introduced a new grid connection regime for offshore wind which came into force on 1 January 2013.

This is a significant milestone in the evolution of the legal framework governing construction of the electricity grid in the North Sea and Baltic. The new legislation provides for a comprehensive offshore grid development plan, a binding set of roadmaps for its realisation, and a variety of damage mitigation strategies paving the way for an economically efficient expansion of the grid. The offshore grid development plan will be prepared by the transmission grid operators in the first quarter of 2013, and is expected to be officially released by the Federal Network Agency in March.

Until the new framework is fully up and running, the previous framework will apply to wind farms beginning construction. Consequently, there will be a transition period which needs to be approached sensibly. A pressing priority for the transmission grid operator is to commission the three outstanding grid connections in the North Sea (DolWin3 and BorWin3 and 4).

Ireland

2012 saw movement in the offshore wind industry in both the Irish Republic and Northern Ireland. The industry in the Irish Republic has been buoyed by an increased interest in the potential of exporting energy between Ireland and the United Kingdom. A series of policy initiatives, on both sides of the Irish Sea, have all pointed towards the likely creation of a formal trading mechanism between the two islands. A Memorandum of Understanding between the two governments was agreed in January. It is widely agreed that offshore wind could provide the bulk of Irish renewable energy exports to the United Kingdom, either through direct connection or an agreed statistical transfer mechanism.

Following a competitive tendering process, the First Flight consortium comprising B9 Energy, DONG Energy and RES was selected in October 2012 to develop, install and operate an offshore wind facility in the Northern Ireland Offshore Wind Resource Zone. The project has a capacity of 600 MW and it is hoped construction will begin in 2017. This announcement is a major boost for the prospects of early development of the offshore wind industry on the Island of Ireland.

The Netherlands

In September 2012 the Netherlands elected a new government. Its work programme aims to increase the share of renewables in energy consumption to 16% by 2020, where the target set for the Netherlands by the EU is 14%, and the previous government was aiming at 14.5%.

This objective will require both a massive extension of onshore and offshore wind energy. Together a capacity of at least 12,000 MW of installed capacity is projected for 2020. To achieve the ambitious target, the offshore wind sector requires new innovative policies, accelerated deployment and timely government decisions so that the industry can commit to invest in the Netherlands. Work on new offshore capacity should begin early this year.

Offshore grid

As the new Dutch government is considering deploying more offshore wind capacity, the lingering discussion on the offshore grid is flaring up. Major issues that need to be tackled are the responsibility over the grid (TSO or wind farm developers developers) and the way connections are to be paid for (through project development costs, and thus, through the support mechanism, via direct government intervention, therefore through taxes - or by the TSO, thus recovering costs via energy bills).

Offshore wind market

The next project to be completed will be Luchterduinen. Situated 12 miles off the coast near Noordwijk and Zandvoort, it is composed of 43 turbines, totalling 128 MW. It is expected that it will generate power as of 2015. Moreover, two projects north of the Netherlands with a total capacity of 600 MW have secured government support and the project developers expect to build these projects within two to three years.

Further developments are also on the cards. The wind industry is compiling a plan for a test and demonstration site, known as Leeghwater, to be presented to the government. The 300 MW site would allow several test or demonstrate their innovations at the same time.

The UK

During 2012, construction went on at nine offshore wind farm sites, many of which have held the title of the world's largest offshore wind farm with the prize being briefly held by Walney (367.8 MW), before passing to Greater Gabbard (504 MW) and then to London Array (630 MW) where the 175th and final turbine was installed in December. In terms of planning, 1 GW was consented at Race Bank and Dudgeon while just under 7 GW entered the planning system including the first four Round 3 projects. This means that the UK has over 14 GW operational, in construction, consented or in planning.

However, the year in policy was characterised by uncertainty over the market support mechanism - or Renewable Obligation Certificate (ROC) - banding level between 2014 and 2017 (which was eventually confirmed at an acceptable 2 ROCs from April 2014 to 2015, 1.9 ROCs between April 2015 and 2016 and 1.8 ROCs between April 2016 and 2017).

More fundamentally, the whole industry waited anxiously for much of the year for the new Energy Bill and the move from ROCs post 2017 to a type of Feed-in Tariff called Contracts For Difference. The delays and high profile in-fighting in the government unsettled the market and increased uncertainty. Despite this there were some positive supply chain announcements with Gamesa and AREVA announcing their intentions to invest in manufacturing facilities in Scotland, although Siemens delayed the final investment decision for their high profile plans at Hull to 2013 and Vestas announced that it would not be proceeding with its plans for the Port of Sheerness in Kent.

The Energy Bill was finally published in December and overall it has been welcomed by the industry. Despite this, the government faces a challenging timetable for implementation of the Bill and secondary legislation and there remain a number of crucial areas of uncertainty, not least on the strike price for the contracts.

In terms of offshore grid there were four main developments. OFTO investment has reached £470m with up to £8bn potential by 2020. The regulator Ofgem has consulted on investment in a coordinated offshore network looking for economies of scale, anticipatory investment and bypassing onshore bottlenecks with offshore networks. In parallel a number of working groups are considering how offshore networks and HVDC networks will be charged for. Ofgem have also launched Integrated Transmission Planning and Regulation (ITPR)[19] for transmission networks which cross national boundaries and connect generation.

19 Ofgem's ITPR project is an ongoing review of the current arrangements for system planning and investments in transmission infrastructure: http://www.ofgem.gov.uk/Networks/Trans/ElecTransPolicy/itpr/Pages/index.aspx