



The European offshore wind industry

Key trends and statistics 2016

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Published in January 2017

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This report summarises construction and financing activity in European offshore wind farms from 1 January to 31 December 2016.

WindEurope regularly surveys the industry to determine the level of installations of foundations and turbines, and the subsequent dispatch of first power to the grid. The data includes demonstration sites and factors in decommissioning where it has occurred, representing net installations per site and country unless otherwise stated. Rounding of figures is at the discretion of the author.

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Clean Energy Pipeline, IJ Global.
All currency conversions made at EUR/GBP 0.8194 and EUR/USD 1.1069
Figures include estimates for undisclosed values

PHOTO COVER:

Courtesy of ScottishPower Renewables
Offshore Wind Farm: West of Duddon Sands, a joint venture between
ScottishPower Renewables and DONG Energy

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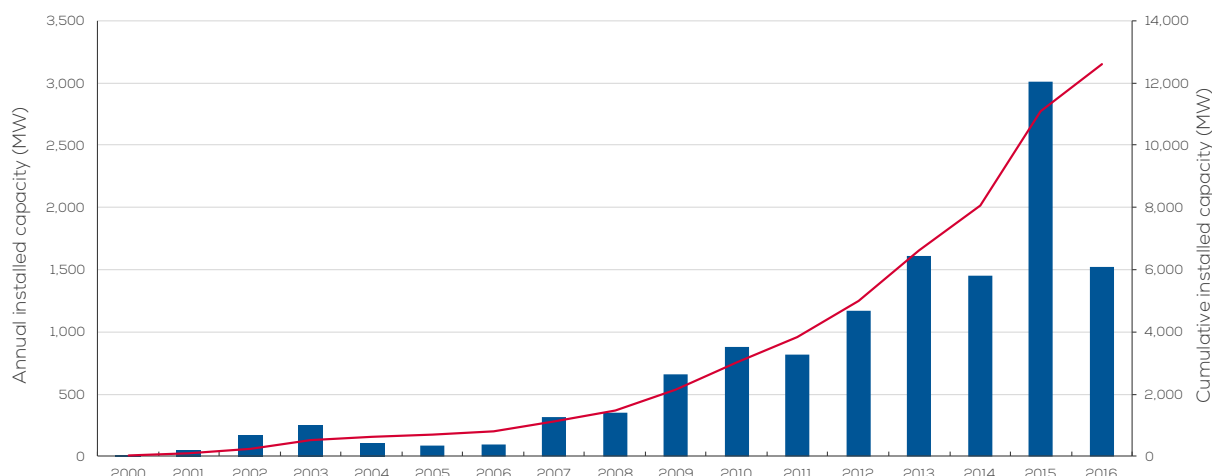
EXECUTIVE SUMMARY

Offshore wind in Europe saw a net 1,558 MW of additional installed grid-connected capacity in 2016. This was 48% less than in 2015. A net addition of 338 new offshore wind turbines across six wind farms were grid-connected from 1 January to 31 December 2016.

Europe now has a total installed capacity of 12,631 MW from 3,589 grid-connected wind turbines in 10 countries.

11 projects, worth €18.2bn, reached Final Investment Decision (FID), a 39% increase over 2015. This represents 4,948 MW of new capacity.

FIGURE 1
Cumulative and annual offshore wind installations 2000-2016



Source: WindEurope

Offshore wind power construction in 2016

- 1,558 MW of additional net installed, grid-connected capacity was added in 2016, 48% less than in 2015. A net addition of 338 grid-connected offshore wind turbines across six wind farms were added from 1 January to 31 December 2016.
- 367 new turbines were erected in 2016. Six turbines were decommissioned in Germany, Portugal and the Netherlands, resulting in a net addition of 361 turbines.
- 69 turbines equivalent to 399 MW are awaiting grid connection.
- Four projects were completed in 2016. Work is on-going on 11 projects in Belgium, Germany, the Netherlands and the UK.

Cumulative offshore wind power market

- 3,589 turbines are now installed and grid-connected, making a cumulative total of 12,631 MW.
- Including sites with partial grid-connected turbines, there are 81 offshore wind farms in 10 European countries.
- The annual load factors of offshore wind in Europe range from 33%-43%.
- 81% of substructures are monopiles, 7.5% are gravity foundations, jackets account for 6.6%, tripods account for 3.2% and tripiles account for 1.9%.

Market outlook

- Once completed, the 11 offshore projects under construction will increase total installed grid-connected capacity by a further 4.8 GW, bringing the cumulative capacity in Europe to 17.4 GW.
- By 2020, offshore wind is projected to grow to a total installed capacity of 24.6 GW.

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

- The average installed offshore wind turbine size was 4.8 MW, a 15% increase over 2015. The first 8 MW turbines to be installed have been grid-connected at sea in 2016.
- The average size of a grid-connected offshore wind farm in 2016 was 380 MW, 12% more than the previous year.
- The average water depth of wind farms completed, or partially completed in 2016 was 29 m and the average distance to shore was 44 km.

Financing highlights and developments

- 11 projects, worth €18.2bn, reached FID, a 39% increase over 2015. In total 4,948 MW of new capacity reached FID during 2016.
- Total investments for the construction and refinancing of offshore wind farms and transmission assets hit a record level of €22.6bn.
- The equity mix continues to diversify with an increased mix of corporate, financial and, in particular, overseas investors coming into offshore wind.

1. ANNUAL MARKET IN 2016

1.1 OFFSHORE WIND INSTALLATIONS

1,558 MW of new offshore wind power capacity was connected to the grid during 2016 in Europe. This is a 48.4% decrease compared to 2015. The level of activity in 2016 is similar to that seen in 2013 and 2014.

- During 2016 work was carried out on 18 offshore wind farms in Europe.
- Four utility-scale wind farms were completed.
- A further four sites saw turbine installations and partial grid-connection.
- Work has started but no turbines are yet erected in seven other wind farms.
- Three sites were fully decommissioned.

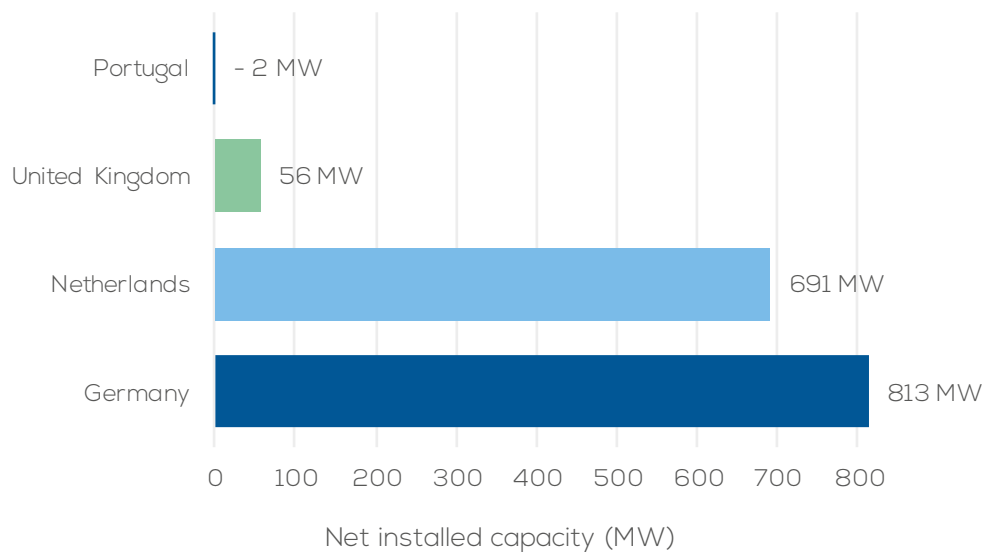
TABLE 1

Summary of work carried out at European offshore wind farms during 2016

WIND FARM NAME	COUNTRY	STATUS
Gode Wind I	Germany	Fully grid-connected
Gode Wind II	Germany	Fully grid-connected
Gemini	Netherlands	Fully grid-connected
Westermeerwind	Netherlands	Fully grid-connected
Sandbank	Germany	Partially grid-connected
Burbo Bank Extension	United Kingdom	Partially grid-connected
Nobelwind	Belgium	Turbines installed
Nordergründe	Germany	Turbines installed

WIND FARM NAME	COUNTRY	STATUS
Nordsee One	Germany	Foundations installed
Veja Mate	Germany	Foundations installed
Wikinger	Germany	Foundations installed
Dudgeon East	United Kingdom	Foundations installed
Galloper	United Kingdom	Foundations installed
Race Bank	United Kingdom	Foundations installed
Rampion	United Kingdom	Foundations installed
Hooksiel	Germany	Decommissioned
Lely	Netherlands	Decommissioned
WindFloat phase 1	Portugal	Decommissioned

FIGURE 2
Annual offshore wind capacity installations per country (MW)



Source: WindEurope

52.1% of all net capacity brought online was in Germany. The second largest market was the Netherlands with 44.3% of total European capacity, largely realised through the commissioning of Gemini. The UK represented 3.6% of total share. Belgium had construction activity in 2016, but turbines achieved first power only in January 2017.

Portugal's 2 MW WindFloat demonstrator was decommissioned as scheduled. This temporarily removes Portugal as a country with installed capacity in offshore wind. However the commercial deployment WindFloat Atlantic in Portugal will occur before 2020¹. 5 MW was also decommissioned at Hooksiel in Germany, as was 2 MW at Lely in the Netherlands.

1. From the communication of the Portuguese Council of Ministers 24 November 2016

TABLE 2

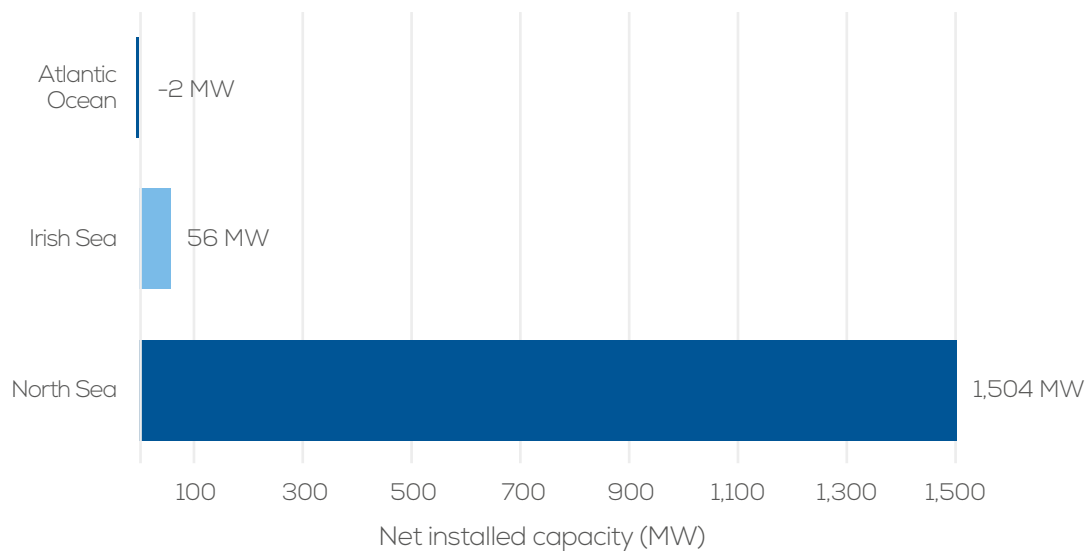
Sites with grid-connected turbines and MW fully connected to the grid during 2016 per country

COUNTRY	GERMANY	NETHERLANDS	PORTUGAL	UK
No. of Farms	4	3	-1	2
No. of turbines connected	155	177	-1	7
MW connected to the grid	813 MW	691 MW	-2 MW	56 MW

Source: WindEurope

FIGURE 3

Sea basin share of 2016 net annual installations (MW)



Source: WindEurope

96.4% of all net capacity installations occurred in the North Sea, with 3.6% in the Irish Sea from the Burbo Bank Extension site. No capacity was added in the Baltic Sea, but construction work occurred at the Wikinger offshore wind farm. The decommissioning of WindFloat resulted in removal of 2 MW from the Atlantic Ocean, where construction at Rampion offshore wind farm is also occurring.

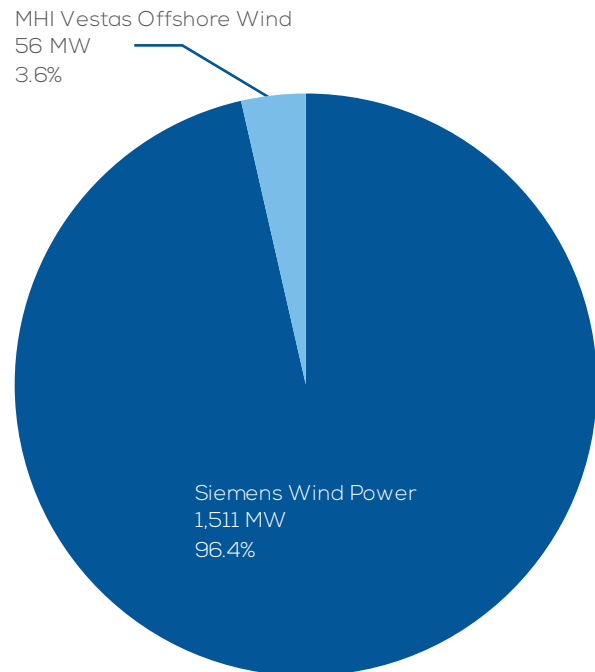
1.2 ANNUAL MARKET SHARE IN 2016 WIND TURBINE MANUFACTURERS

FIGURE 4
Wind turbine manufacturers' share of 2016 annual installations (MW)

1,567 MW of gross capacity was connected to the grid in 2016. Siemens Wind Power accounted for 96.4% of new capacity, and MHI Vestas Offshore Wind for 3.6%.

Turbines ranging from 3-8 MW were grid-connected.

A total of 9 MW was decommissioned, giving a net capacity addition of 1,558 MW in 2016.

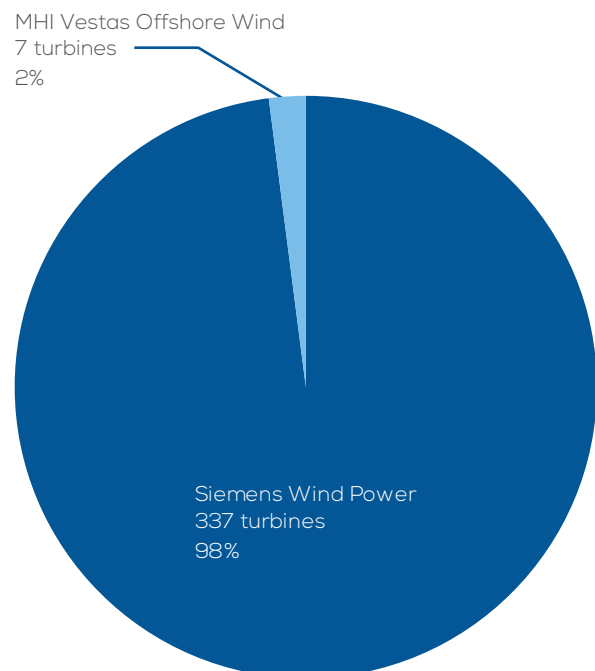


Source: WindEurope

FIGURE 5
Wind turbine manufacturers' share of 2016 net annual installations (Units connected)

344 turbines were connected to the grid, and 6 turbines were decommissioned.

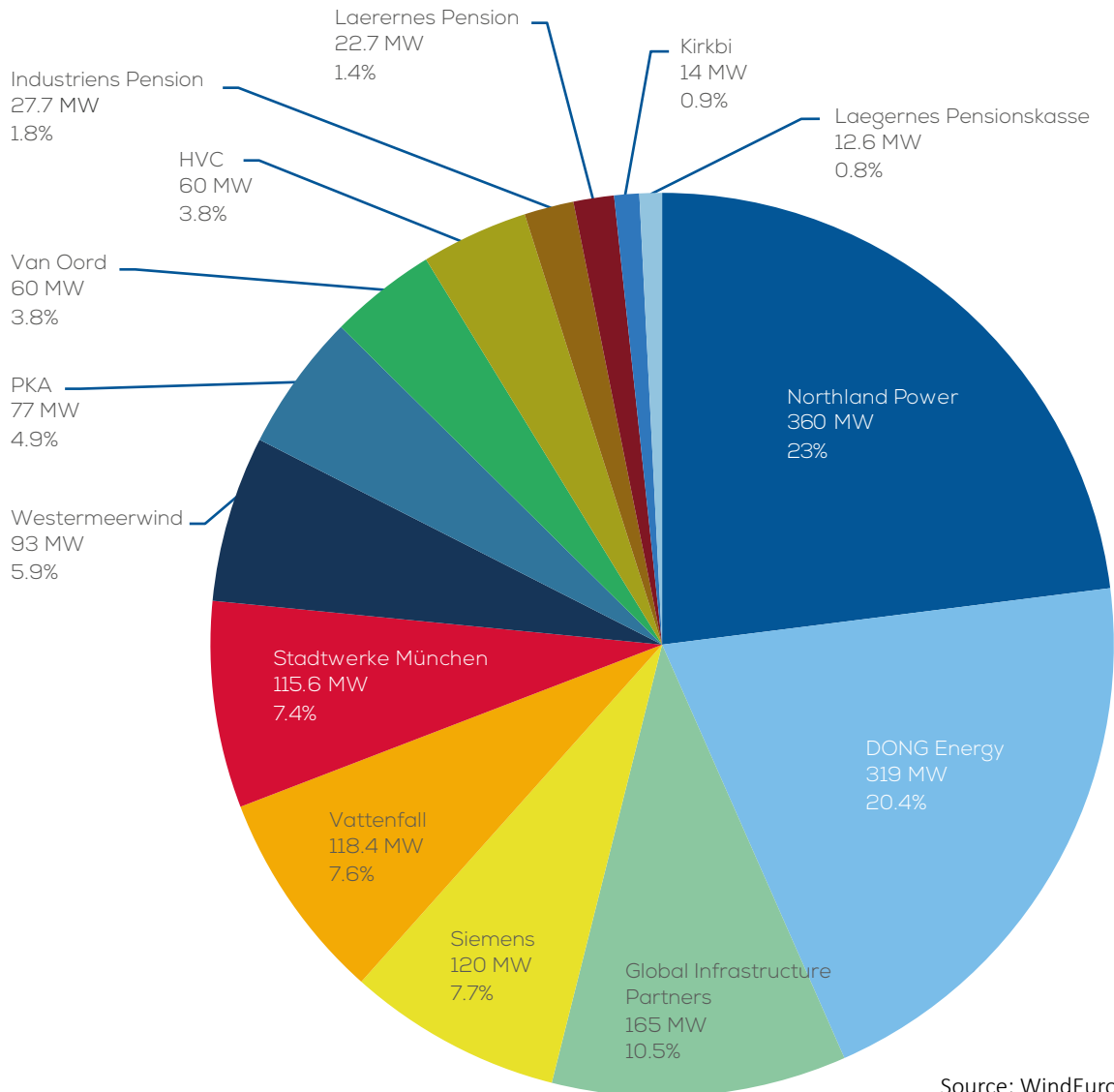
98% of turbines connected were from Siemens Wind Power, and 2% from MHI Vestas Offshore Wind.



Source: WindEurope

1.3 ANNUAL MARKET SHARE IN 2016 WIND FARM OWNERS²

FIGURE 6
Developers' share of 2016 annual installations (MW)



Source: WindEurope

In terms of ownership, Northland Power connected the most MW in 2016, representing 23% of ownership in 2016, followed by DONG Energy with 20.4%. Global Infrastructure Partners (10.5%), Siemens (7.7%) and Vattenfall (7.6%) complete the top five owners in new additional capacity.

The top five owners account for 69.2% of all new capacity in 2016.

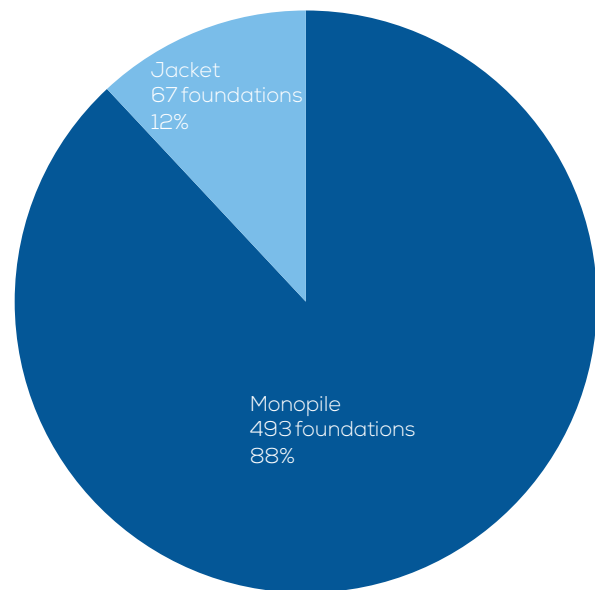
2. Grid-connected market shares are indicative only. Projects owned or developed by several companies have been split according to their respective shares. Where the shares are not known, they have been split in equal parts between the partners.

1.4 ANNUAL MARKET SHARE IN 2016 - SUBSTRUCTURES

FIGURE 7
Foundation types¹ installed in 2016 annual market (units)

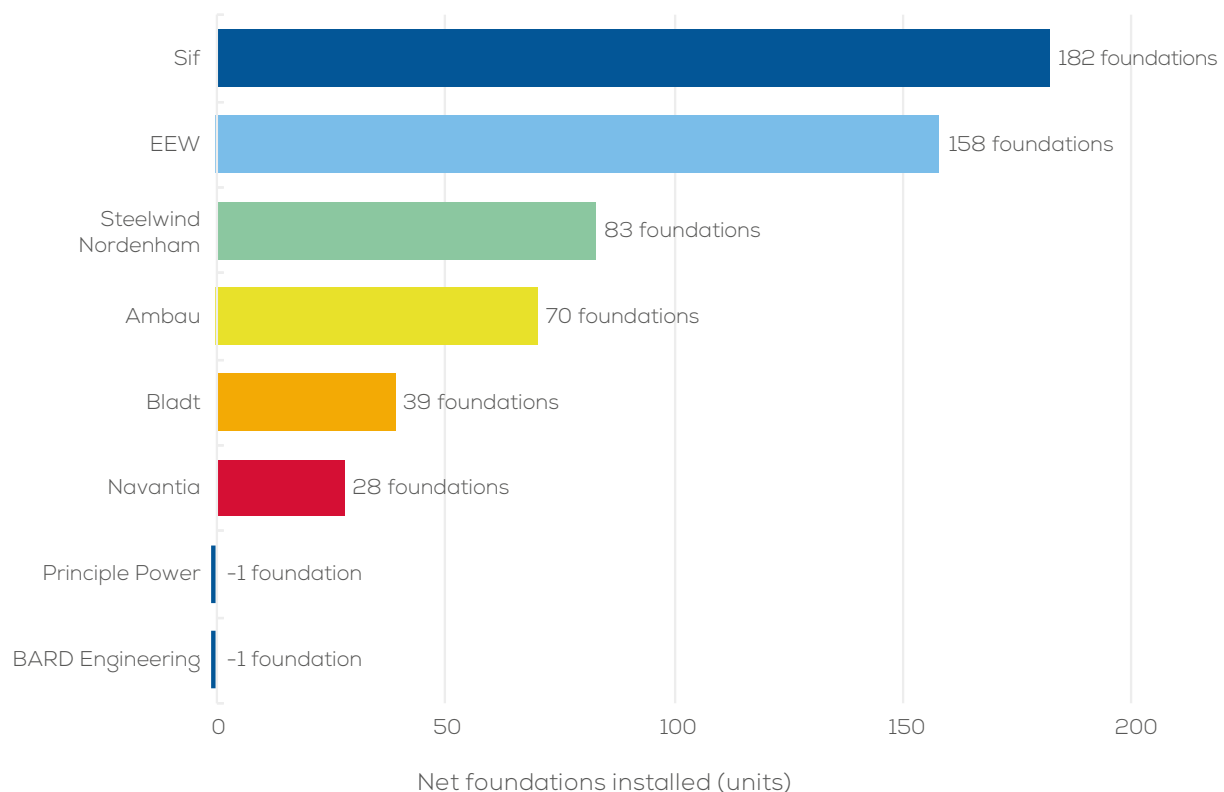
Monopile substructures remained by far the most popular substructure type in 2016, representing 88% of all installed foundations. Four monopile foundations were removed at Lely.

67 Jackets were installed at Wikinger, representing 12% of all foundations installed.



Source: WindEurope

FIGURE 8
Share of foundations installed in 2016 by manufacturing company³



Source: WindEurope

3. Shares are calculated according to the actual number of individual foundations installed in 2016. Where the project developer contracted more than one company to manufacture the foundations, and where the respective shares (in case of consortia/joint venture) were not specified, foundations installed were split in equal parts between the partners. Shares and figures also consider decommissioned infrastructure.

Sif installed 32.5% of all foundations in 2016 followed by EEW (28.2%), Steelwind Nordenham (14.8%), Ambau (12.5%), Bladt (7%) and Navantia (5%).

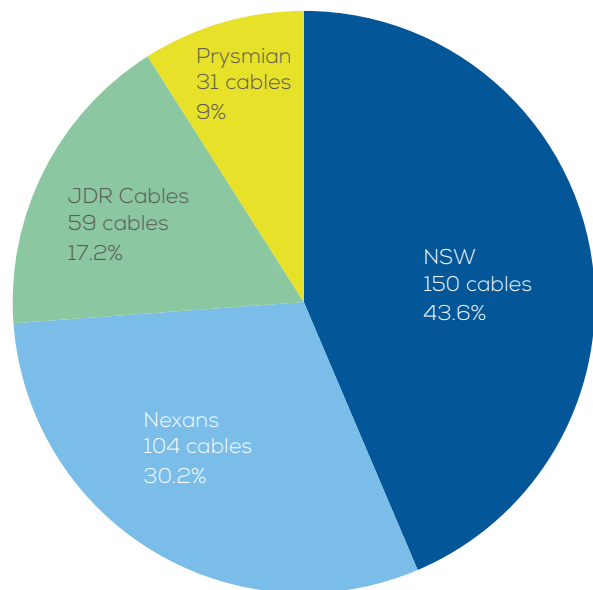
Principle Power’s floating WindFloat demonstrator was decommissioned, as was BARD Engineering’s tripile and turbine at Hooksiel. Four Sif monopiles were also removed from the decommissioned Lely site.

1.5 ANNUAL MARKET SHARE IN 2016 – CABLES⁴

FIGURE 9
Share of inter-array cable suppliers by energised cables

43.6% of inter-array cables energised in 2016 were from NSW. Nexans (30.2%), JDR Cables (17.2%) and Prysmian (9%) were the other suppliers with energised inter-array cables.

2016 also marked the introduction of 66kV cables to the market, which will be the standard cable deployed at Dutch offshore wind farms.

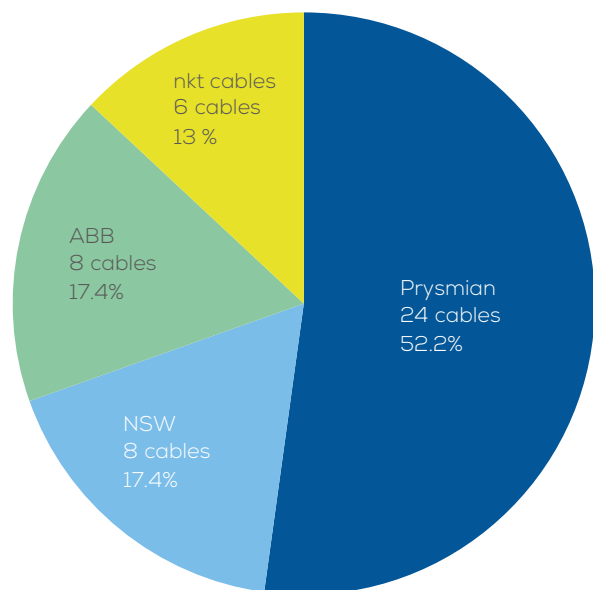


Source: WindEurope

FIGURE 10
Share of export cable suppliers in 2016 by cables energised⁵

In terms of export cables in 2016, 24 export cables manufactured by Prysmian were energised, representing 52.2% of the annual market.

NSW and ABB each had a 17.4% share, and nkt cables represented 13%.



Source: WindEurope

4. Shares are calculated taking into account the number of grid-connected turbines in each wind farm during 2016 and considers decommissioned infrastructure.

5. Shares are calculated by taking into account the number of export cables in wind farms fully completed or partially completed.

1.6 WIND TURBINE CAPACITY AND WIND FARM SIZE

The average capacity rating of the 361 offshore wind turbines under construction in 2016 was 4.8 MW, 15.4% larger than in 2015.

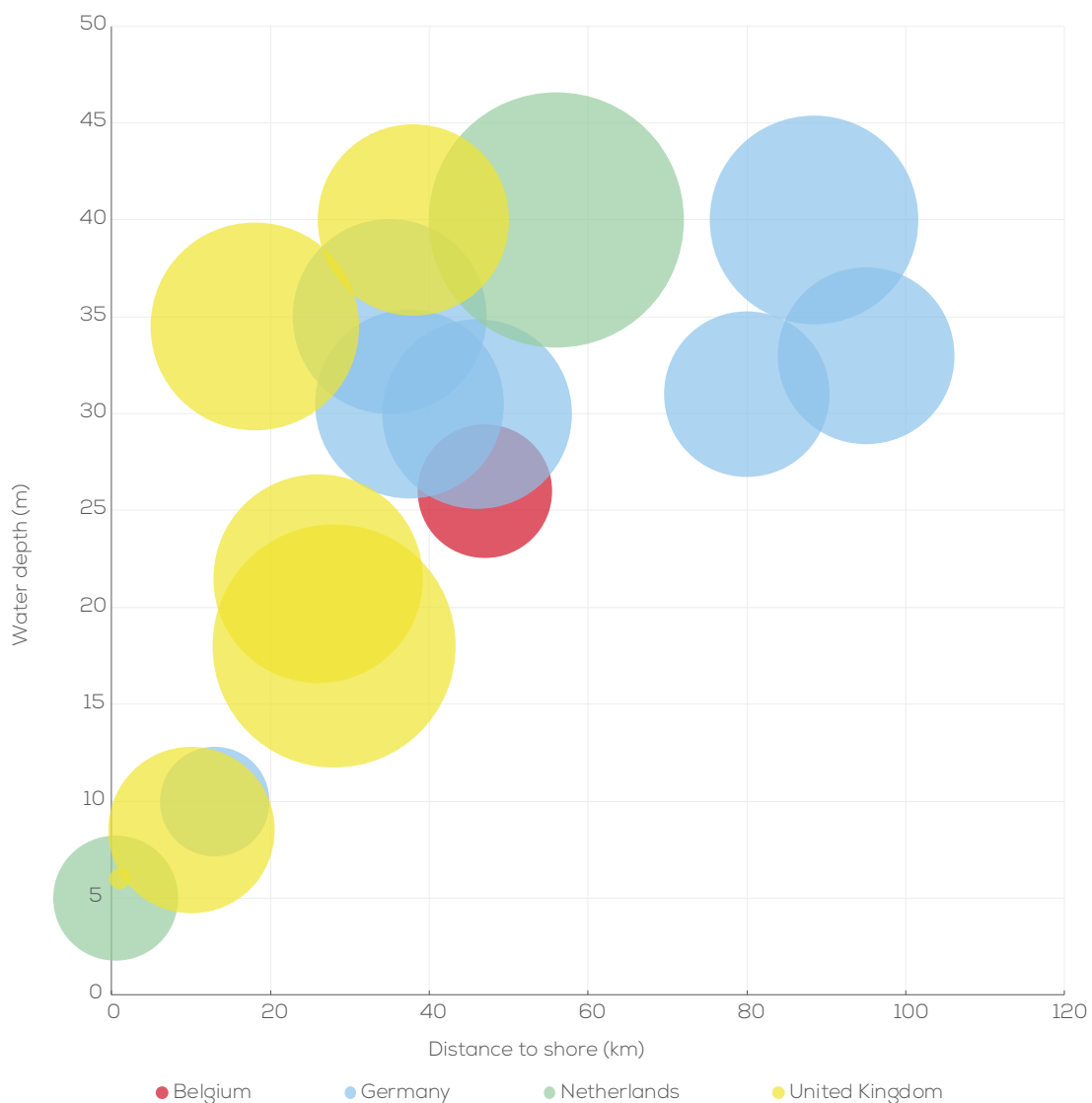
The average size of wind farms in construction in 2016 was 379.5 MW, a 12.3% increase on 2015.

1.7 WATER DEPTH AND DISTANCE TO SHORE

The average water depth of offshore wind farms where work was carried out in 2016 was 29.2 m, slightly more than in 2015 (27.2 m). The average distance to shore for those projects was 43.5 km, a small increase on the previous year (43.3 km).

FIGURE 11

Average water depth, distance to shore and size of offshore wind farms under construction during 2016



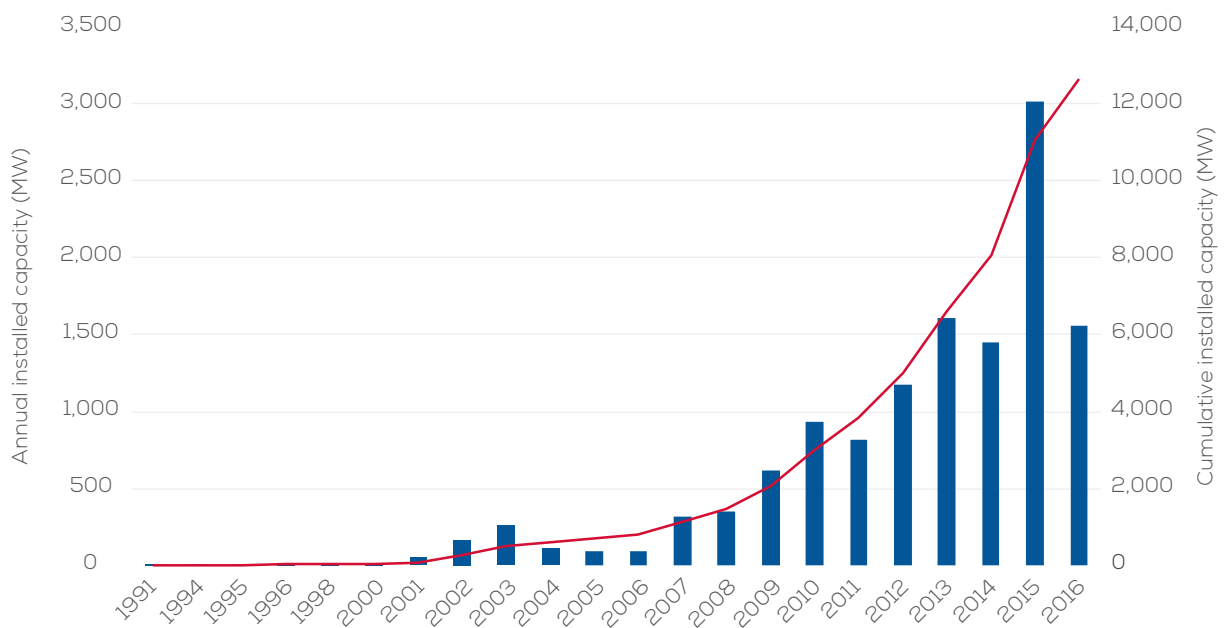
Source: WindEurope

2.

CUMULATIVE MARKET

Europe's cumulative installed offshore wind capacity at the end of 2016 reached 12,631 MW, across a total of 3,589 wind turbines. Including sites with partial grid-connection, there are now 81 offshore wind farms in 10 European countries.

FIGURE 12
Cumulative and annual offshore wind installations (MW)



Source: WindEurope

TABLE 3
Cumulative and annual offshore wind installations 2006-2016 (MW)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Annual MW	93	318	349	614	931	816	1,171	1,606	1,452	3,013	1,558
Cumulative MW	801	1,120	1,469	2,083	3,014	3,830	5,002	6,608	8,060	11,073	12,631

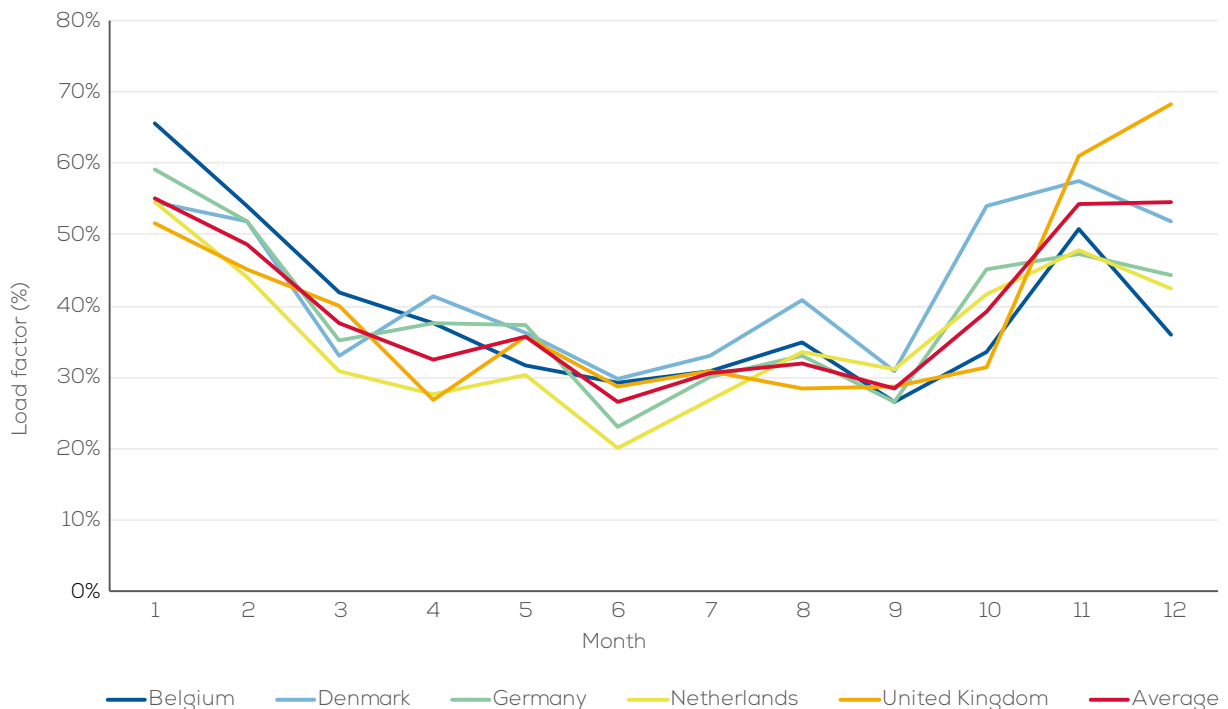
Source: WindEurope

2.1 GENERATION AND LOAD FACTORS

WindEurope analysis of offshore wind load factors in the five largest offshore wind markets in 2016 is presented below. The highest monthly load factor was in the UK in December 2016, with a load factor of 68.2%.

The annual load factors of offshore wind in these countries range from 33.1%-42.9% depending on methodology⁶.

FIGURE 13
Monthly national load factors of offshore wind in 2016 (percent)⁷



Source: WindEurope

- Annual load factors based on BEIS DUKES methodology and WindEurope's in-house methodology (below).
- Load factors are modelled by WindEurope from reported TSO generation data and installed capacity tracked in-house. Modelled generation is applied to capacity which sits on DSO networks and additional installed capacity during the year is accounted for via linear interpolation between reporting periods.

2.2 GEOGRAPHIC BREAKDOWN

TABLE 4

Number of wind farms with grid-connected turbines, no. of turbines connected and no. of MW grid-connected at the end of 2016 per country

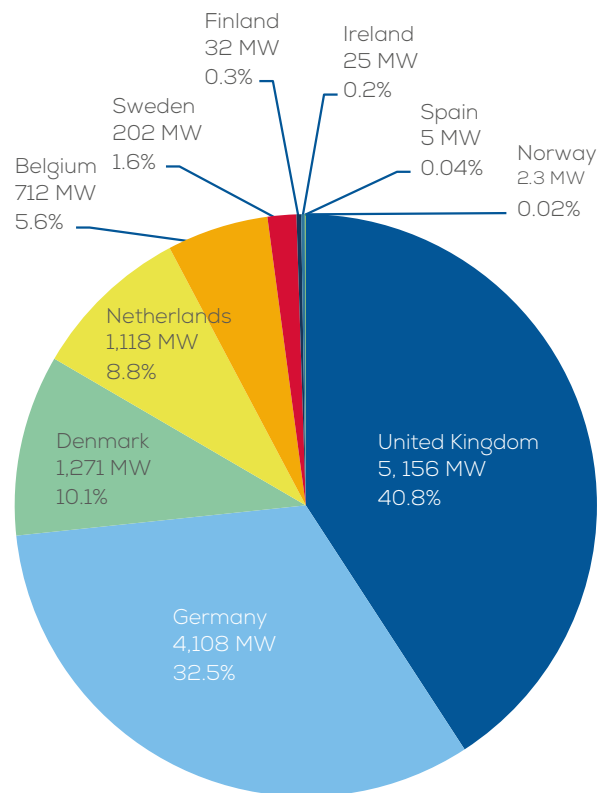
COUNTRY	BE	DK	DK	ES	FI	IE	NL	NO	SE	UK	TOTAL
Country	BE	DE	DK	ES	FI	IE	NL	NO	SE	UK	Total
No. of Farms	6	18	13	1	2	1	6	1	5	28	81
No. of turbines connected	182	947	517	1	11	7	365	1	86	1,472	3,589
Capacity Installed	712 MW	4,108 MW	1,271 MW	5 MW	32 MW	25 MW	1,118 MW	2 MW	202 MW	5,156 MW	12,631 MW

FIGURE 14

Installed capacity - Cumulative share by country (MW)

The UK has the largest amount of installed offshore wind capacity in Europe representing 40.8% of all installations.

Germany follows with 32.5%. Despite no additional capacity in 2016, Denmark remains the third largest market with 10.1% and the Netherlands (8.8%) displaces Belgium (5.6%) to have the fourth largest share in Europe.



Source: WindEurope

FIGURE 15
Installed wind turbines – Cumulative share by country (Units connected)

In terms of the number of grid-connected wind turbines in Europe, the UK leads the market with 41% of all grid-connected turbines, followed by Germany (26.4%), Denmark (14.4%), Netherlands (10.2%), and Belgium (5.1%) representing the top five markets.

Combined, the top five countries represent 97% of all grid-connected turbines in Europe.

Source: WindEurope

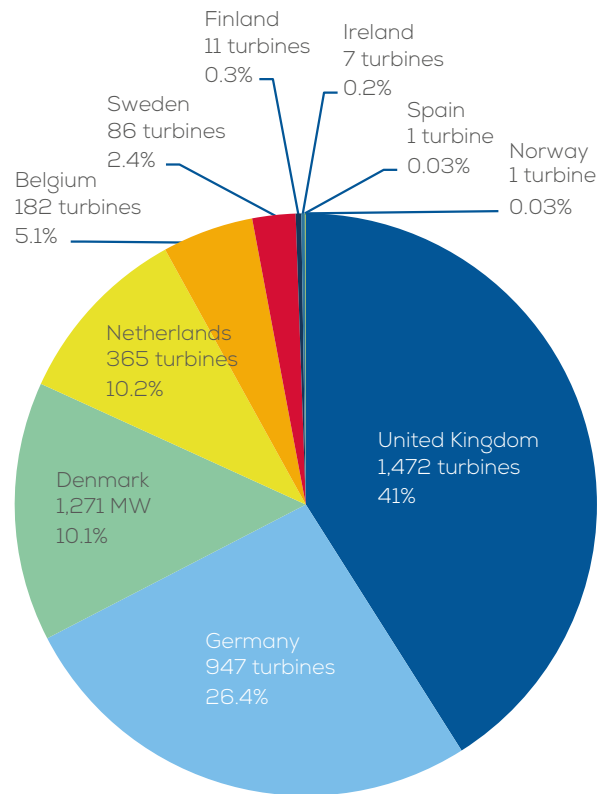
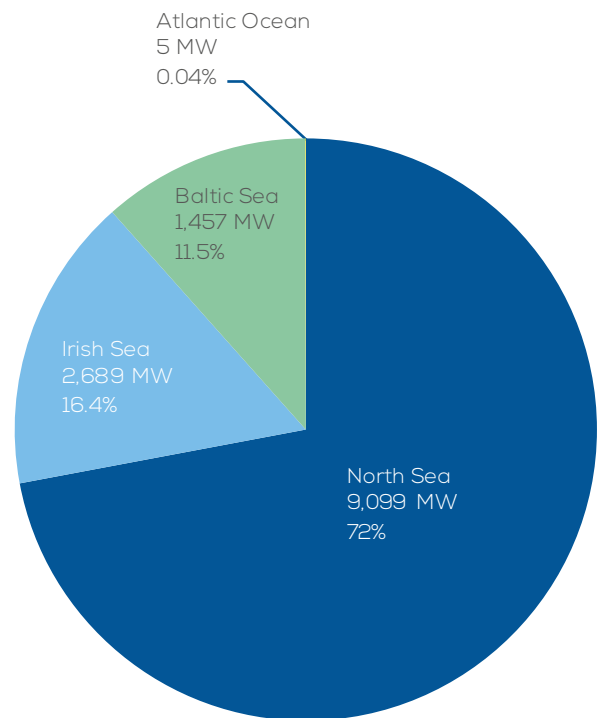


FIGURE 16
Installed capacity - Cumulative share by sea basin (MW)

Installations in the North Sea account for 72% of all offshore wind capacity in Europe, a slight increase from the previous year.

The Irish Sea has 16.4% of installed capacity, followed by the Baltic Sea with 11.5%.

Source: WindEurope

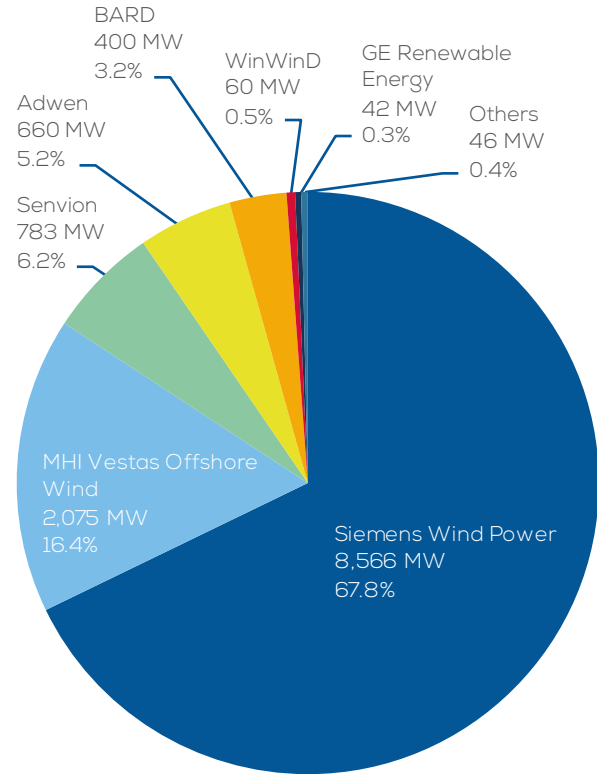


2.3 CUMULATIVE MARKET SHARE: WIND TURBINE MANUFACTURE

FIGURE 17
Wind turbine manufacturers' share at the end of 2016 (MW)

Siemens Wind Power is the leading offshore wind turbine supplier in Europe with 67.8% of total installed capacity.

MHI Vestas Offshore Wind (16.4%) is the second biggest turbine supplier, followed by Senvion (6.2%), Adwen (5.2%), and BARD (3.2%).



Source: WindEurope

FIGURE 18
Wind turbine manufacturers' share at the end of 2016 (MW)

Siemens Wind Power has a share of 67.2% of grid-connected turbines in Europe.

MHI Vestas Offshore Wind follows with a share of 21%, with Senvion (3.7%), Adwen (3.7%) and BARD (2.2%) making up the remaining top 5.

It should be noted that BARD, WinWinD are not active in supplying new turbines.

Source: WindEurope

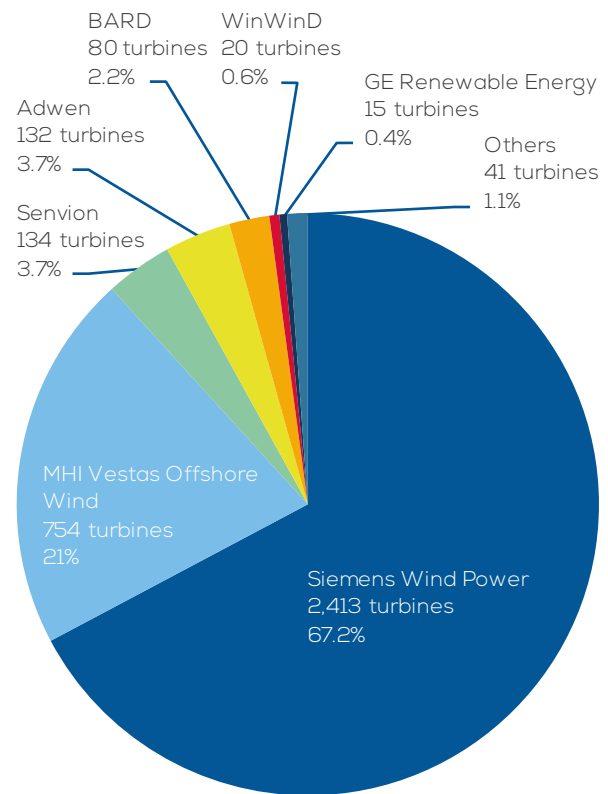
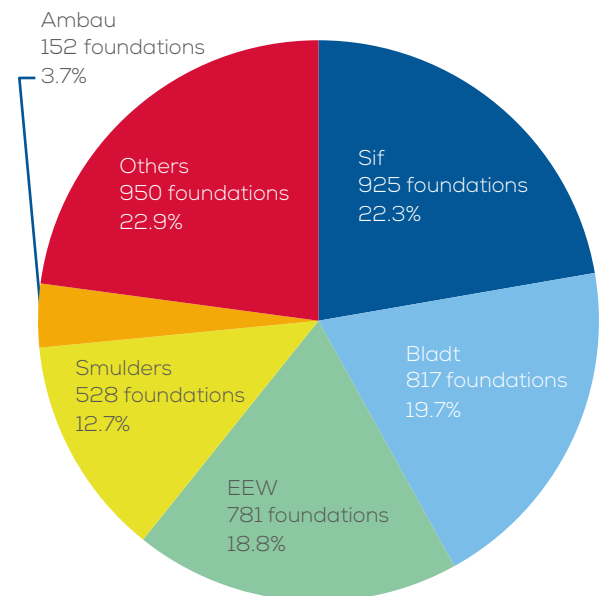


FIGURE 19
Foundation manufacturers' share at the end of 2016 (installed foundations)

Sif has the largest overall share of installed foundations, representing 22.3% of all substructures installed in Europe.

Bladt (19.7%), EEW (18.8%), Smulders (12.7%) and Ambau (3.7%) make up the remaining top 5 foundation manufacturers.

Source: WindEurope



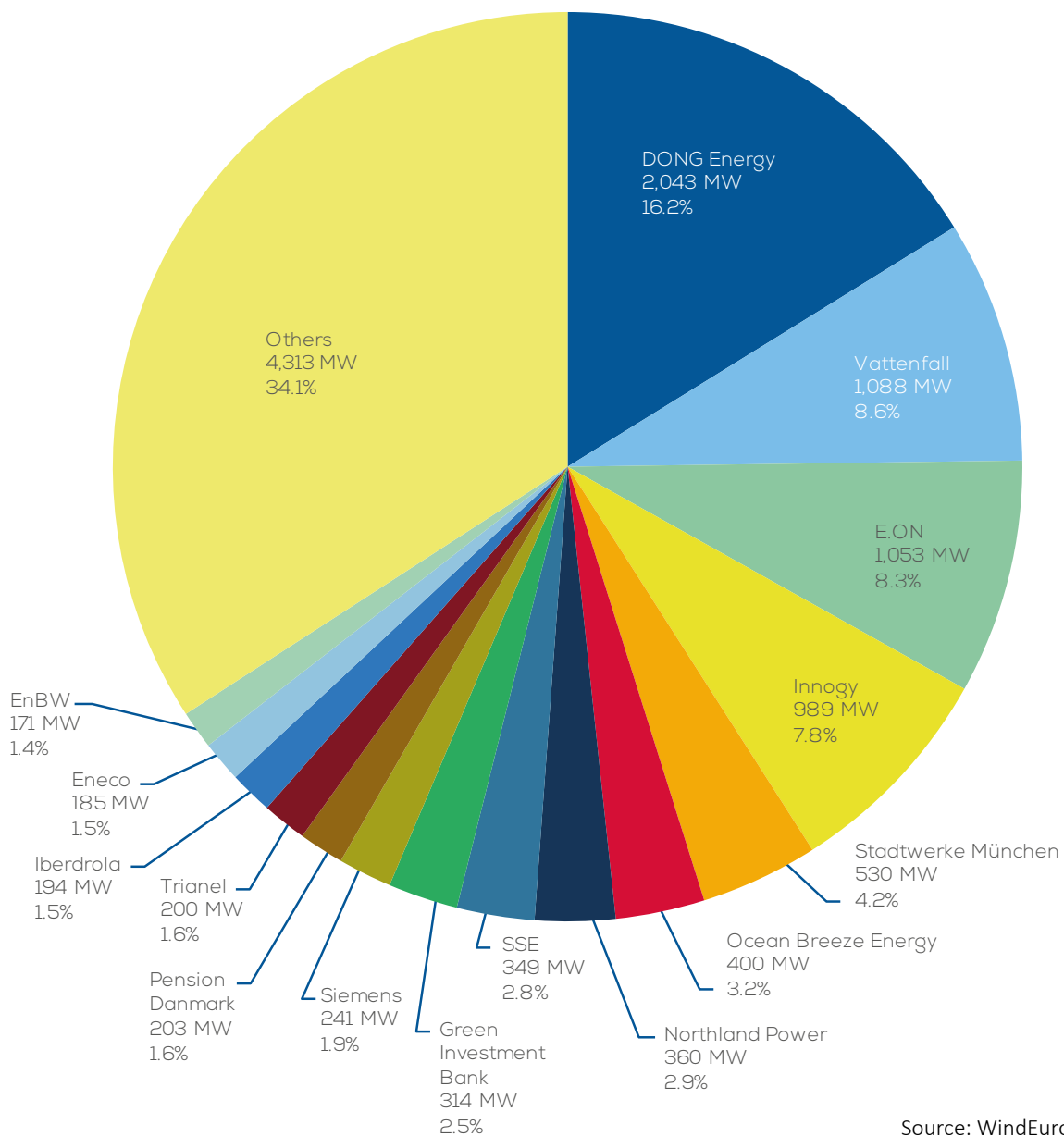
2.4 CUMULATIVE MARKET SHARE: WIND FARM OWNERS

DONG Energy maintains its position as the biggest owner of offshore wind power in Europe with 16.2% of cumulative installations at the end of 2016, a slight increase from last year.

Vattenfall returns as the second largest owner with 8.6% of installed capacity owned, followed by E.ON (8.3%), Innogy⁸ (7.8%), and Stadtwerke München (4.2%). The top five owners represent 45.1% of all installed capacity in Europe.

FIGURE 20

Owners' share of installed capacity (MW)



Source: WindEurope

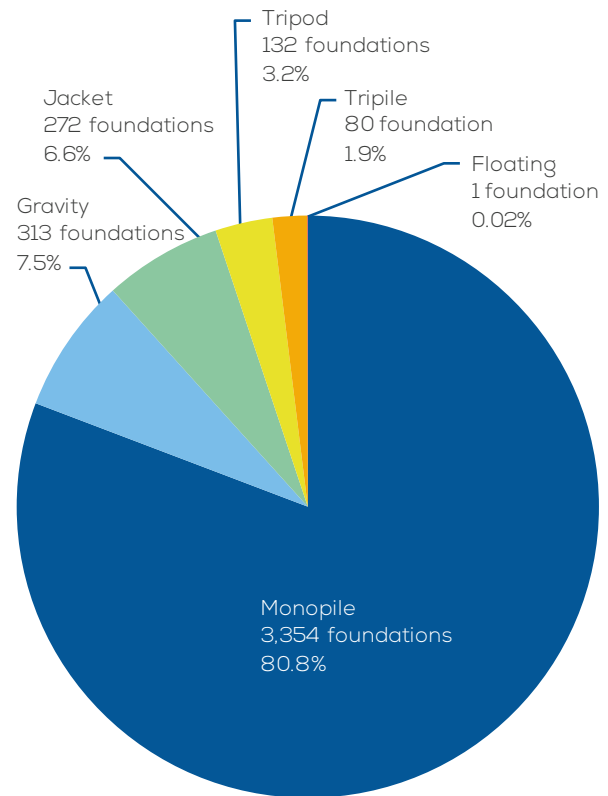
8. RWE rebranded to Innogy as of September 2016.

2.5 CUMULATIVE MARKET SHARE: SUBSTRUCTURES

FIGURE 21
Share of substructure types for grid-connected wind turbines (units)

Monopiles represent 80.8% of all installed substructures in Europe.

Gravity base foundations (7.5%) saw no additional installations although the share in jackets (6.6%) rose due to construction at Wikingen. Tripods (3.2%) and tripiles (1.9%) did not increase in share.



Source: WindEurope

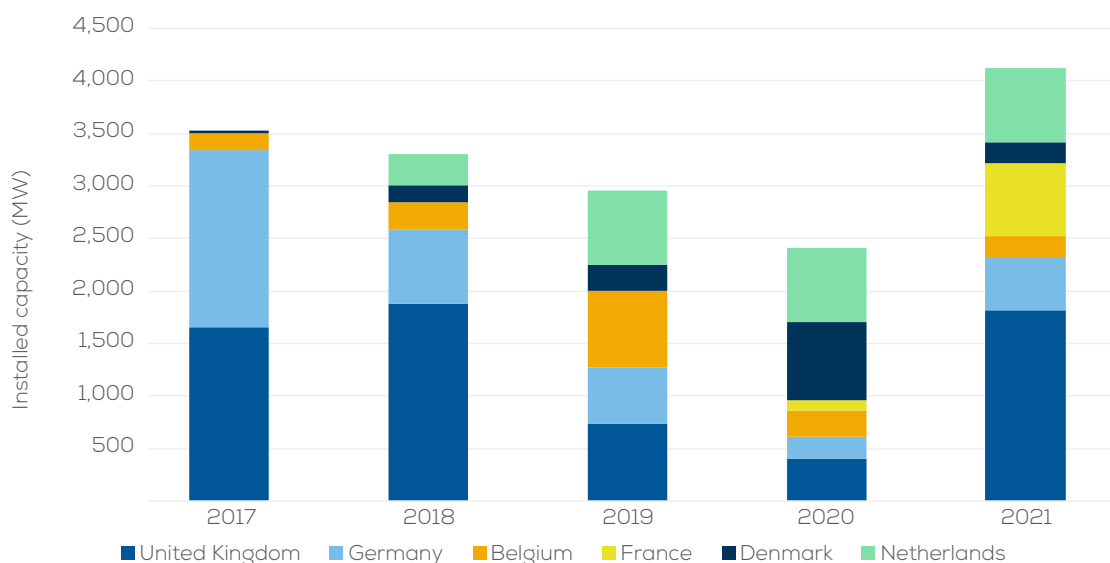
3. MARKET OUTLOOK

Whilst 2016 did not see as much grid-connected capacity as in 2015, the high number of projects that started construction means that grid-connected activity is set to increase noticeably in the next two years.

The UK will see significant capacity addition after a noticeable absence in 2016 that was down to consenting delays during Round 3. Growth in Germany will continue, and Belgium will add capacity at Nobelwind as well as from two sites that were awarded the final concession for support in August 2016. Tendered projects awarded support in 2015 and 2016 in Denmark and the Netherlands will also begin construction in the next two years.

However, the number of project starts will fall towards 2019 as European member states complete their National Renewable Energy Action Plans (NREAPs) under the current Renewable Energy Directive which covers the period up to 2020. Similar to 2016, capacity additions will stall in 2020, though a good level of construction activity will still be ongoing. By 2020, total European offshore wind capacity will be 24.6 GW.

FIGURE 22
Project pipeline five year outlook⁹



Source: WindEurope

9. Projection based on analysis of government data and in-house analysis. WindEurope C3 members and above can enquire for further outlook analysis.

FIGURE 23
Offshore market: Projects online, under construction and consented (GW)

4.8 GW of capacity will be added from sites currently construction. WindEurope has further identified 24.2 GW of projects which have been obtained consent to construct, and a further 7 GW of projects that are applying for permits.

A total of 65.6 GW of projects are in the planning phase.

For projects in Germany, 23 projects have been short-listed to compete for a total of 3.1 GW of capacity that will be awarded via transitional tenders held in 2017 and 2018. Projects awarded under this transition would deliver by 2025.

Source: WindEurope

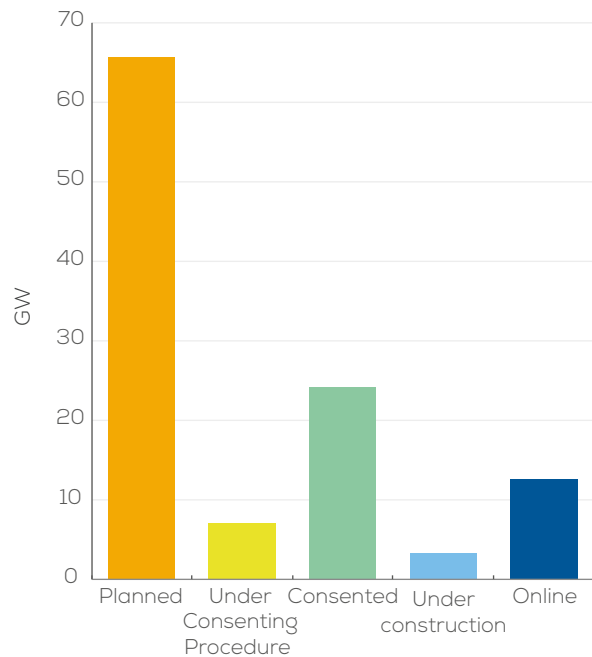


FIGURE 24
Share of consented offshore wind capacity per country (MW)

The UK has the highest share of offshore wind capacity (48.1%) that has received government consent to construct, followed by Germany (24.6%). Sweden (8%), Denmark (4.6%) and Ireland (4%) in the top five.

Projects in the Netherlands will receive consent immediately upon award of support from the tender. This will result in another 700 MW to be added following the tender at Hollandse Kust Zuid in 2017.

There is no immediate outlook for projects to be constructed in Ireland or Sweden.

Source: WindEurope

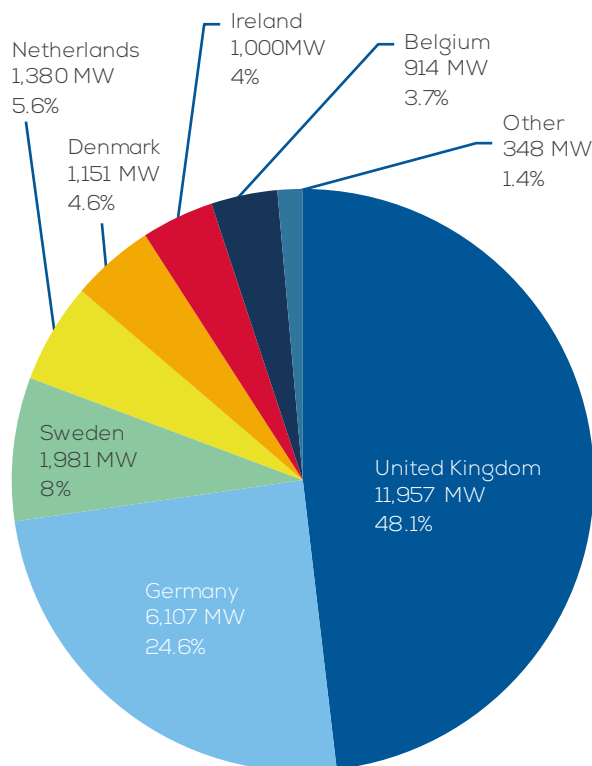
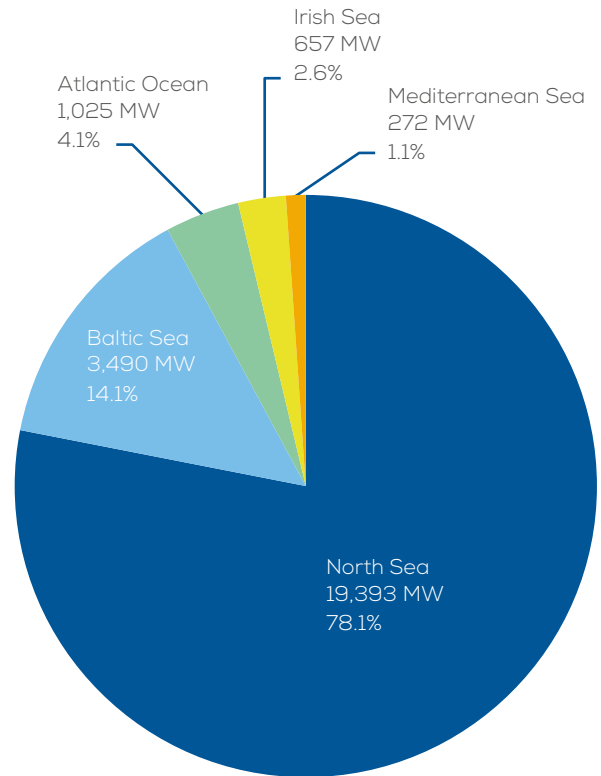


FIGURE 25
Share of consented offshore wind capacity
by sea basin (MW)

In the medium term, an analysis of consented wind farms confirms that the North Sea will remain the main region for offshore deployment (78% of total consented capacity) followed by the Baltic Sea (14.1%).

An increase of 3 GW in the share of consented projects in the Atlantic (4.1%) is expected once French projects receive full consent.

The Irish Sea (2.6%) is largely from the Walney Extension project, and whilst there are consented projects in the Mediterranean Sea (1.1%), no significant momentum is expected there before 2020.



Source: WindEurope

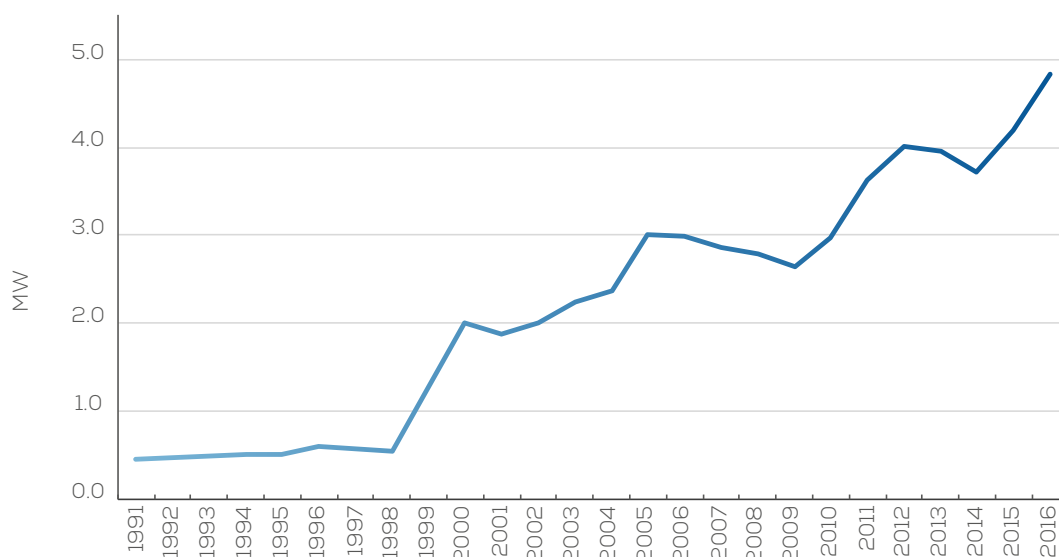
4.

TRENDS: TURBINES, DEPTH, DISTANCE

4.1 WIND TURBINE RATED CAPACITY

The rated capacity of offshore wind turbines has grown 62% over the past decade. The average rated capacity of turbines installed in 2016 was 4.8 MW, 15.4% larger than 2015. 8 MW turbines were installed and sending power at sea for the first time this year, reflecting the rapid pace of technological development.

FIGURE 26
Average offshore wind turbine rated capacity (MW)

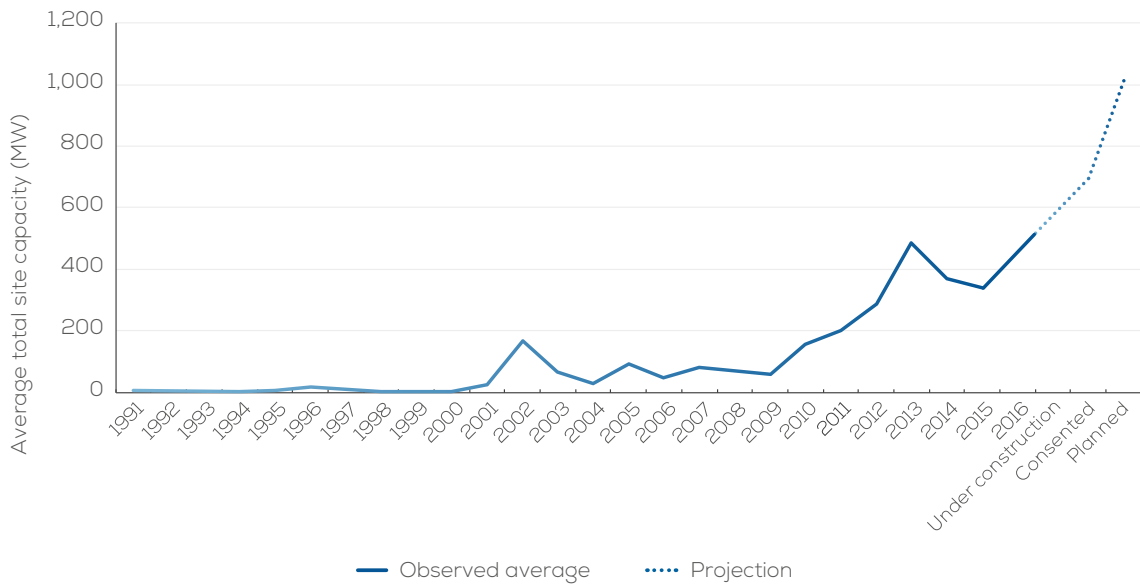


Source: WindEurope

4.2 WIND FARM SIZE

In the last ten years, the average wind farm has increased dramatically in size from 46.3 MW in 2006 to 379.5 MW for offshore wind farms under construction in 2016. The 1.2 GW Hornsea One project is the largest offshore wind farm to reach FID to date.

FIGURE 27
Average size of offshore wind farm projects (MW)



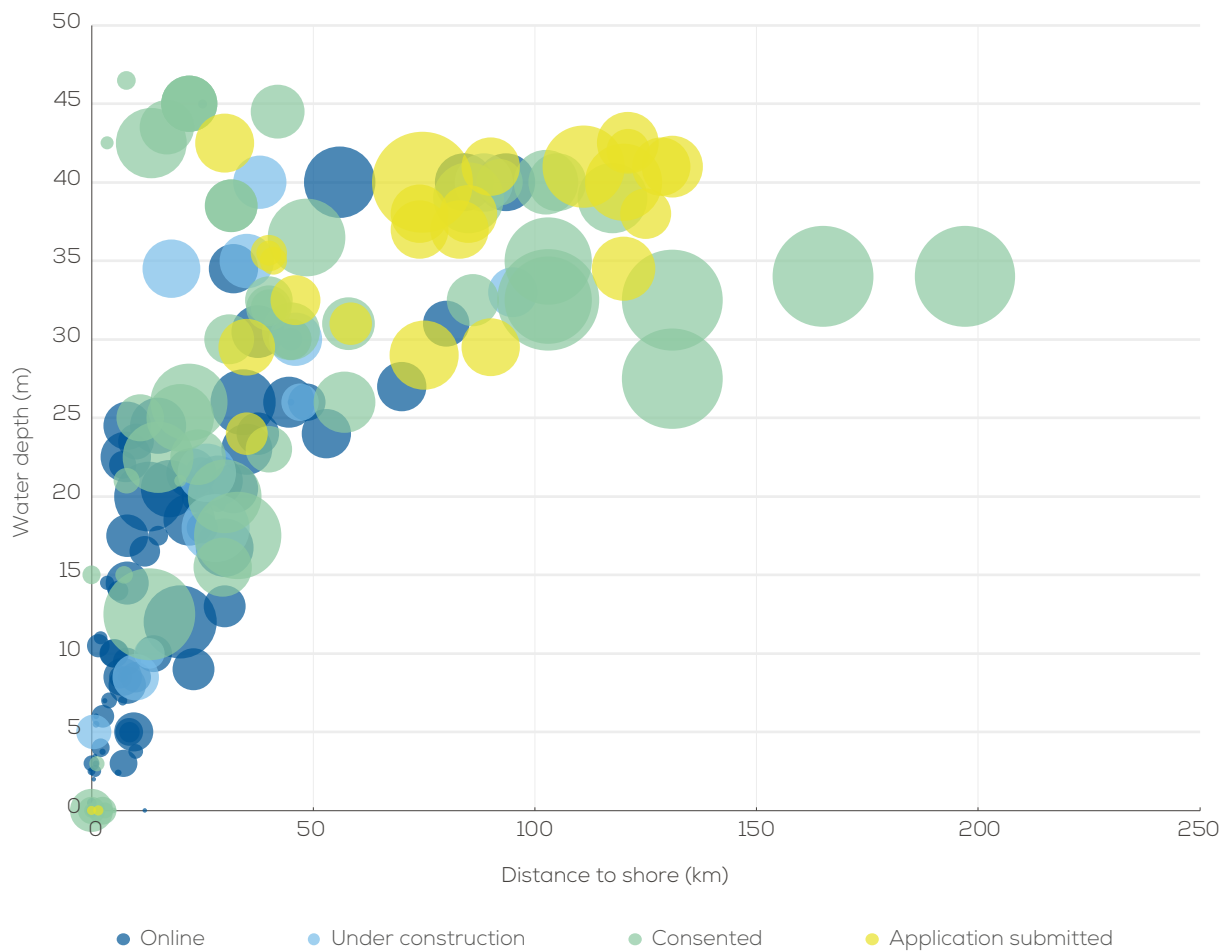
Source: WindEurope

4.3 WATER DEPTH AND DISTANCE TO SHORE

The average water depth of offshore wind farms with grid-connections in 2016 was 29.2 m and the average distance to shore was 43.5 km.

FIGURE 28

Average water depth, distance to shore of bottom-fixed, offshore wind farms by development status.
The size of the bubble indicates the overall capacity of the site.



Source: WindEurope

5. INVESTMENTS

5.1 FINANCING ACTIVITY IN 2016

New investments in offshore wind in Europe continued to grow strongly during 2016. Eleven projects reached Final Investment Decision (FID) in 2016, with a combined investment value of €18.2bn. This represents an increase of 39% over 2015. In total, 4.9 GW of new capacity was financed across five countries. Over half of this activity was in the United Kingdom.

TABLE 5
Investment in European offshore wind farms in 2016

COUNTRY	TOTAL NEW INVESTMENTS (mEUR)	FINANCED NEW CAPACITY (MW)
Belgium	2,300	679
Denmark	1,000	400
Finland	120	40
Germany	4,289	1,235
UK	10,493	2,594
Total	18,202	4,948

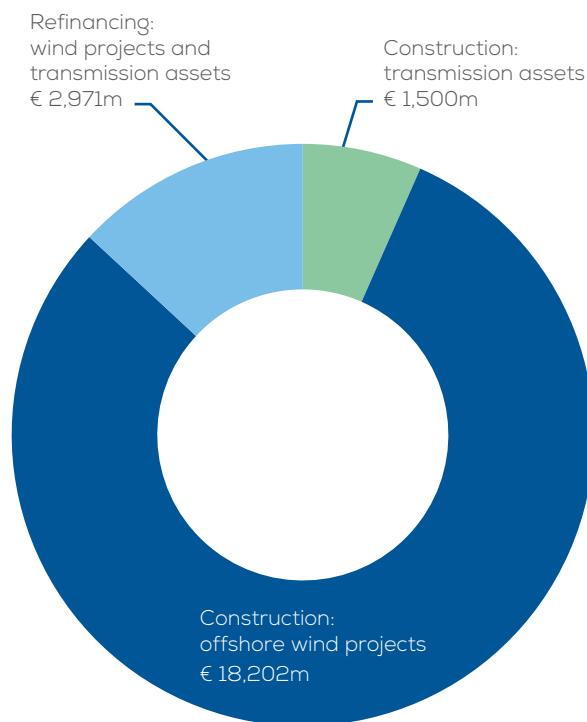
Source: WindEurope

FIGURE 29
Investments in the offshore wind sector in 2016 (mEUR)

In addition to the investments in new wind farms, 2016 also saw €2.9bn in refinancing transactions and €1.5bn committed for the construction of new transmission lines. The sector generated a total investment of €22.6bn.

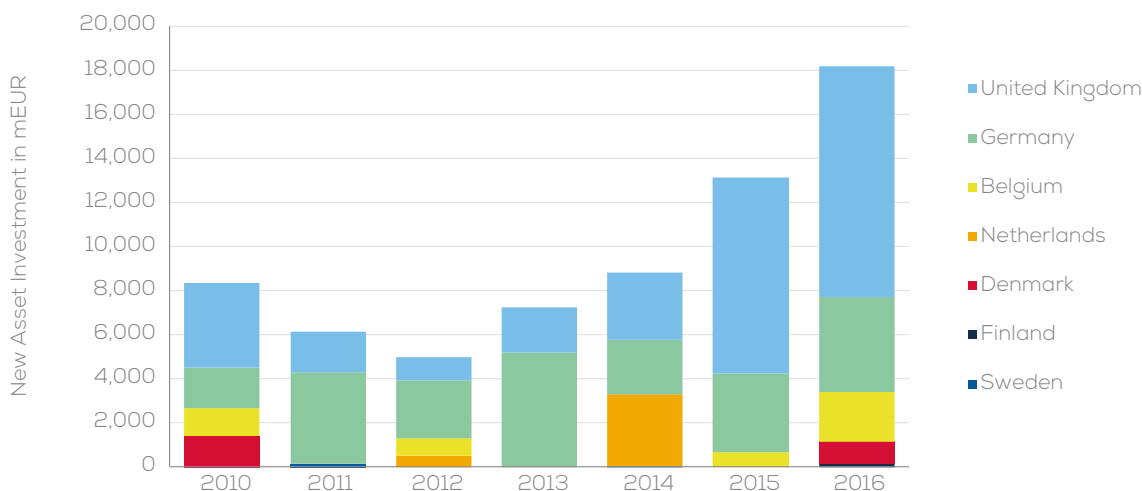
Overall, the investment in the offshore wind industry in Europe has grown at an annual average of 30% in the last five years. This is due to the sustained level of investments in its biggest markets, Germany and the United Kingdom.

With €10.5bn, the United Kingdom had the largest level of investment in 2016. Cumulatively, the country has attracted €31.3bn since 2010 for new asset financing, making it the biggest offshore wind market for capital spending commitments for the given period.



Source: WindEurope

FIGURE 30
Investments in new offshore wind farms 2010-2016



Source: WindEurope

5.2 NON-RECOURSE DEBT

Financial markets have supported the offshore wind sector through a variety of investors and financial structures. Non-recourse debt hit a record of €7.6bn in 2016 for the financing of both new and operational wind farms.

€5.3bn of non-recourse finance were raised for the construction of four new projects. These include Norther (370 MW) and Rentel (309 MW) in Belgian waters, Merkur (400 MW) in Germany, and Beatrice (588 MW) in the United Kingdom.

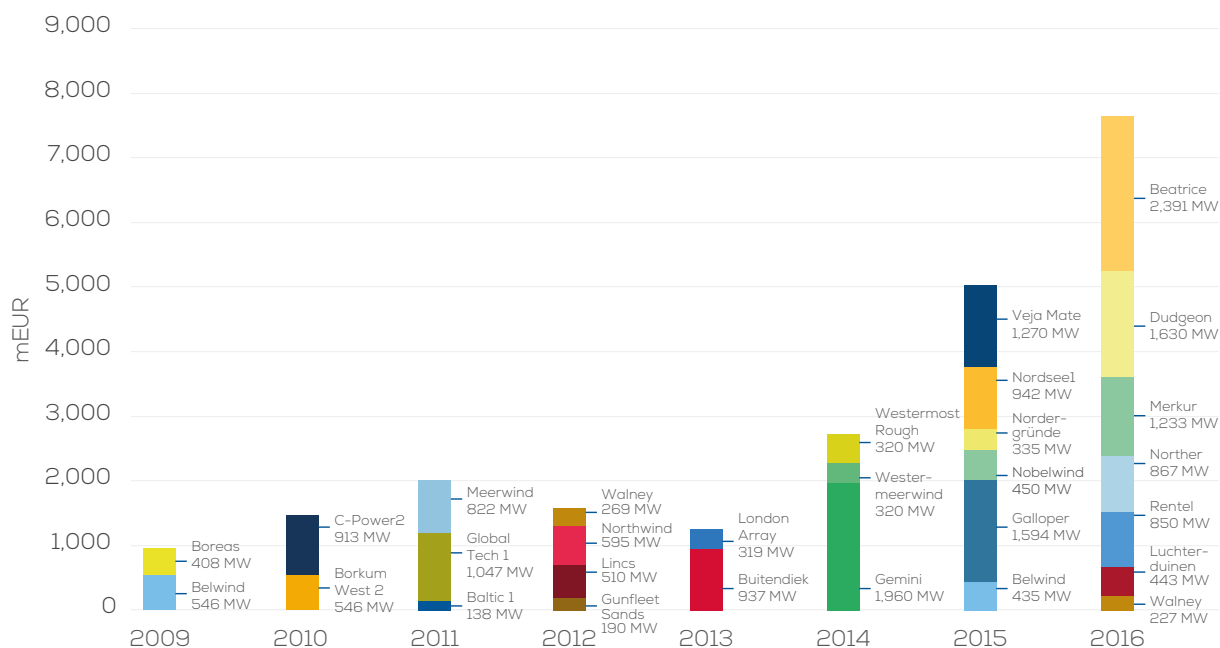
The remaining €2.3bn was used to refinance the operations of Walney (367 MW) and Luchterduinen (129 MW), as well as the construction activity in Dudgeon (402 MW).

Transactions this year continued to reflect the general trend of easing loan terms, supported from commercial banks, export credit agencies, and policy driven lenders. The European Investment Bank (EIB) alone, backed also by the European Fund for Strategic Investments (EFSI), has provided a combined value of €1.1bn in 2016 for the construction of new offshore wind farms¹⁰.

Attractive sector yields have diversified the profile of lenders. Japanese banks have strengthened their presence in European offshore wind projects driven also by a low interest rate environment in their home market.

FIGURE 31

Project finance transactions 2010-2016

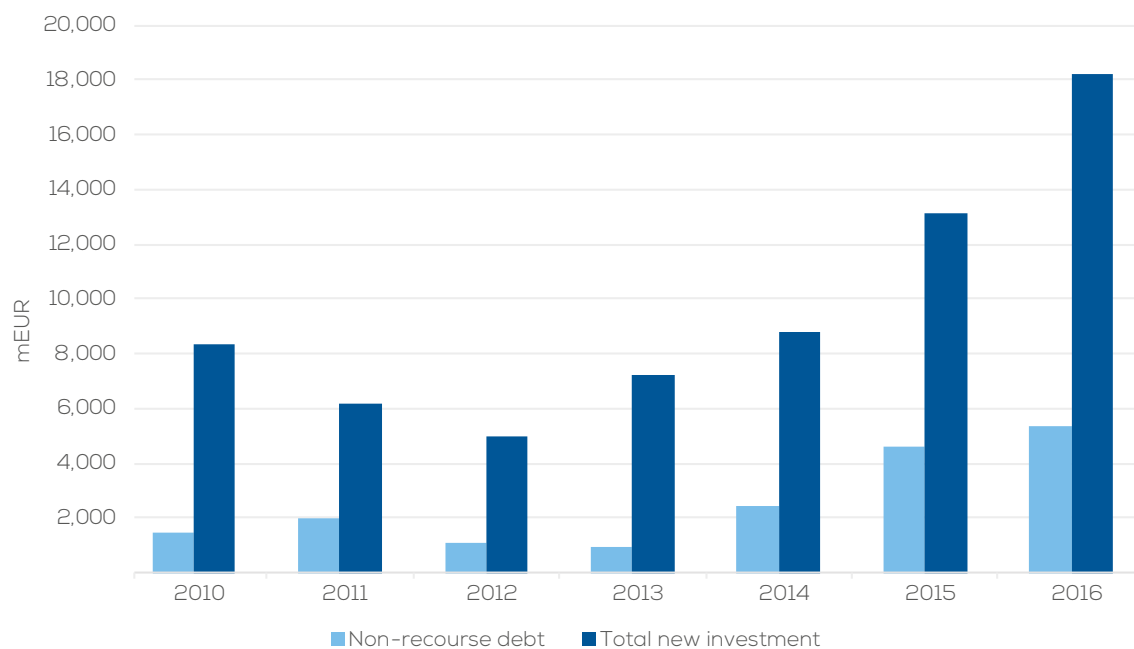


Source: WindEurope

10. As per European Investment Bank online EFSI project list

FIGURE 32

Non-recourse debt levels as a share of total new investments 2010-2016 (mEUR)



Source: WindEurope

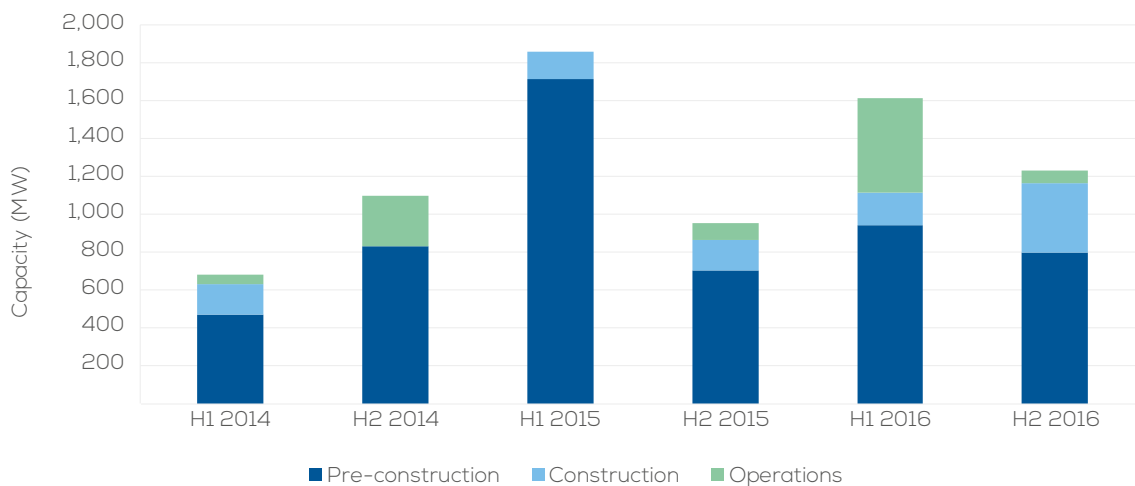
While project finance remains an important tool in offshore wind deployment, corporate finance dominated the market this year. Banks extended a lower share of non-recourse debt, down to 33% of new asset financing compared to 44% in 2015.

This trend is largely due to two factors. These are the changing regulations in the banking sector and the increasing competition in the offshore wind sector. Power producers have chosen to finance projects on their balance sheets through the development phase, spinning them off at a later stage as construction begins. This structure is exemplified in the refinancing of Dudgeon (402 MW) and the minority stake of Walney (367 MW).

5.3 EQUITY FINANCE

FIGURE 33

Divestments in the offshore wind sector



Source: WindEurope

With 2.8 GW of capacity divested in 2016, wind project mergers and acquisitions sustained the same level of activity as the year before. The majority of transactions happened at pre-construction stage, which is one of the most critical phases in the fundraising for a project.

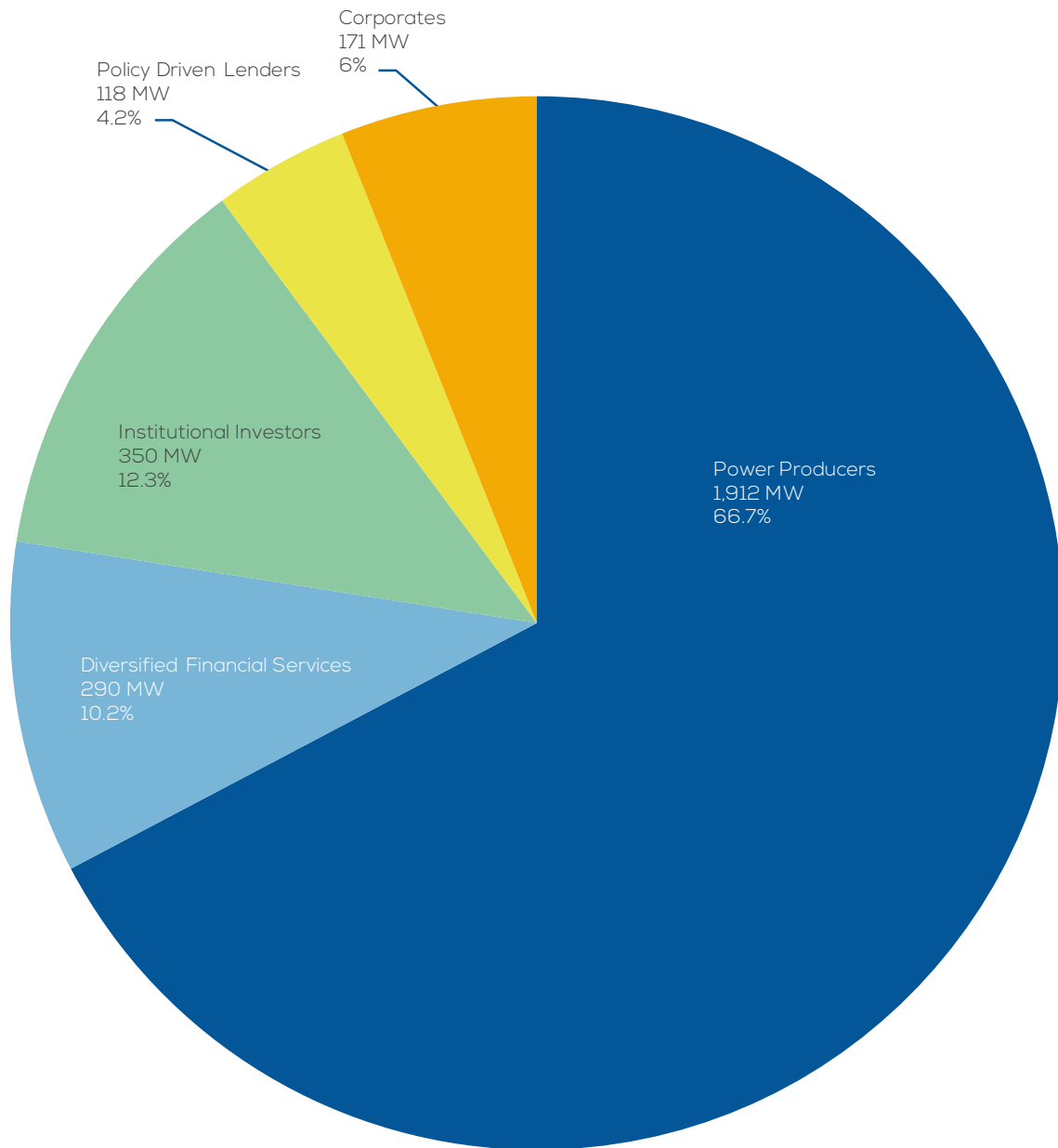
Transactions at construction and operation phase almost doubled in value compared to 2015. This indicates the changing trend in financial structures, where power producers are choosing to bring additional partners in the later stages of a project.

The equity mix continues to diversify with more corporate, financial and in particular overseas investors coming in the sector. Four out of the top five biggest acquirers in 2016 were international investors. The financial services industry, including institutional investors and policy-driven lenders, such as the Green Investment Bank, own 27% of the capacity traded throughout 2016. Their involvement has been mainly limited to assets under construction or in the operational phase.

A series of big transactions were announced in 2016, some of which included:

- Enbridge's acquisition of a 49.9% stake in EnBW Hohe See (492 MW), together with a 50% interest in Éolien Maritime France SAS and consequently its portfolio of offshore wind farms;
- China Three Gorges' acquisition of an 80% stake in Meerwind (288 MW) offshore wind farm;
- SDIC Power of China's acquisition of Repsol's offshore wind business and consequently a 100% stake in Inch Cape (784 MW) offshore wind farm and a 25% stake in Beatrice (588 MW) offshore wind farm;
- PKA and KIRKBI A/S jointly acquisition of a 50% stake in Burbo Bank Extension (258 MW) wind farm.

FIGURE 34
Market segmentation of major equity investors in 2016

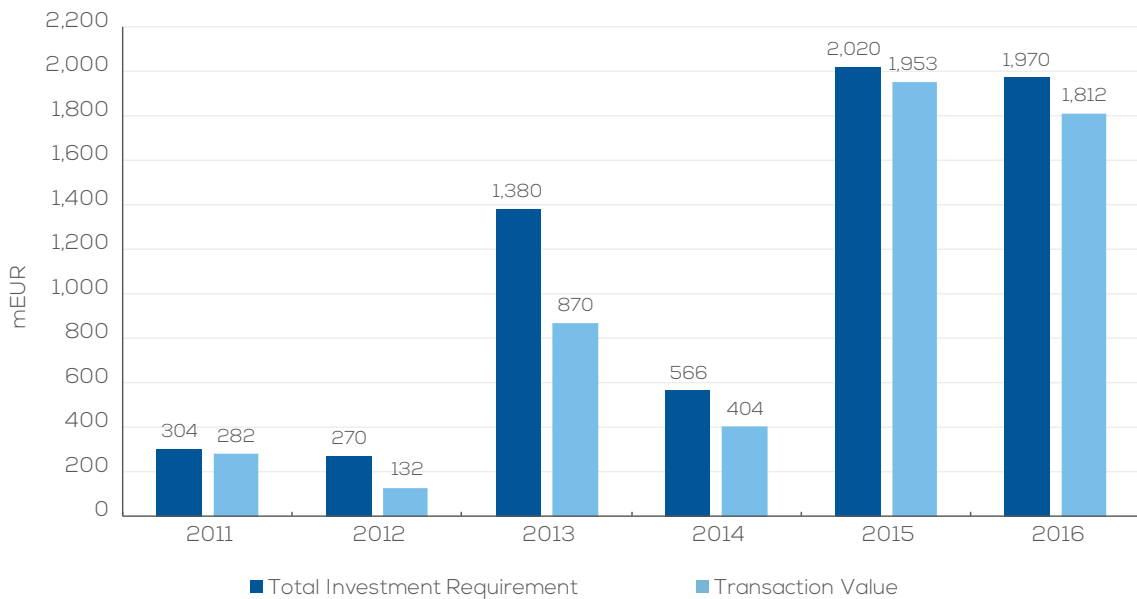


Source: WindEurope

5.4 TRANSMISSION ASSETS

Investments in transmission assets stood at €2bn, including refinancing. €1.8bn was raised through commercial debt, out of which €1.5bn was through green bond issuances from TenneT. The proceeds will be used to finance a portfolio of transmission lines in the German North Sea. This year also saw the financial close for the transmission assets of Westermost Rough and Humber Gateway in the United Kingdom.

FIGURE 35
Investments in transmission assets 2011-2016



Source: WindEurope

5.5 OUTLOOK FOR 2017

Projects expected to go through FID in 2017 are estimated at a combined capacity of 2.8 GW. These include Borssele I & 2 (700 MW) and Borssele 3 & 4 (700 MW), Global Tech II (553 MW), Kriegers Flak (600 MW), and the financial close of Deutsche Bucht (252 MW). The refinancing of Butendiek (288 MW) and the minority stake in London Array (630 MW) are also scheduled for financial close in 2017. Financing needs could top €7bn based on disclosed transaction costs.

The logo features a stylized sun icon with rays on the left, followed by the word "ffshore" in a bold, lowercase sans-serif font. Below this, "WIND ENERGY 2017" is written in a smaller, uppercase sans-serif font. At the bottom, a dark blue horizontal bar contains the text "LONDON 6-8 JUNE" in white, uppercase sans-serif font.

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WIND ENERGY 2017
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A blue silhouette of the London skyline is centered, featuring the Shard, Big Ben, the London Eye, and the Gherkin. On either side of the skyline are two stylized wind turbines. Below the skyline is a dark blue horizontal bar containing the event title.

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A light blue rectangular button with rounded corners containing the word "EXHIBITION" in white, uppercase sans-serif font.

EXHIBITION

A light blue rectangular button with rounded corners containing the word "CONFERENCE" in white, uppercase sans-serif font.

CONFERENCE

A light blue rectangular button with rounded corners containing the word "NETWORKING" in white, uppercase sans-serif font.

NETWORKING

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The logo for Wind Europe, featuring the word "Wind" in a large, bold, blue sans-serif font with a small circle above the 'i', and the word "EUROPE" in a smaller, blue, uppercase sans-serif font below it.

Wind
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The logo for renewableUK, featuring a stylized green sun icon with rays on the left, followed by the text "renewableUK" in a black, lowercase sans-serif font.

renewableUK

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