Wind energy in Europe: Outlook to 2020

September 2017

Wind EUROPE

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This publication, the first in a series of annual reports, analyses how EU markets will develop in the next four years, starting with an in depth analysis of the first half of 2017.
The outlook is based on WindEurope's internal analysis and consultation with its members (surveys with national associations and a dedicated workshop in June 2017).

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CONTENTS

EXECUTIVE SUMMARY 5

1. THE EUROPEAN WIND ENERGY MARKET TODAY 9

1.1 Market evolution 9

1.2. First half of 2017 10

2. MID-TERM WIND ENERGY MARKET OUTLOOK 18

2.1 Introduction 18

2.2 Policy landscape 18

2.3 Market outlook 25

2.3.1 Central Scenario 27

2.3.2 Low Scenario 30

2.3.3 High Scenario 31

2.4 Investment outlook 32

2.5 Global wind energy market outlook 34

2.6 Renewable energy sources outlook 35

2.7 Wind energy generation 36

3. TECHNOLOGY TRENDS 38

EXECUTIVE SUMMARY

2020 will mark an important milestone for the European Union as Member States will be tested on their climate change and energy commitments. Wind energy will make a significant contribution to achieving these commitments in the power sector, allowing many Member States to reach their targets in a cost-effective way and to continue their energy system transformation.

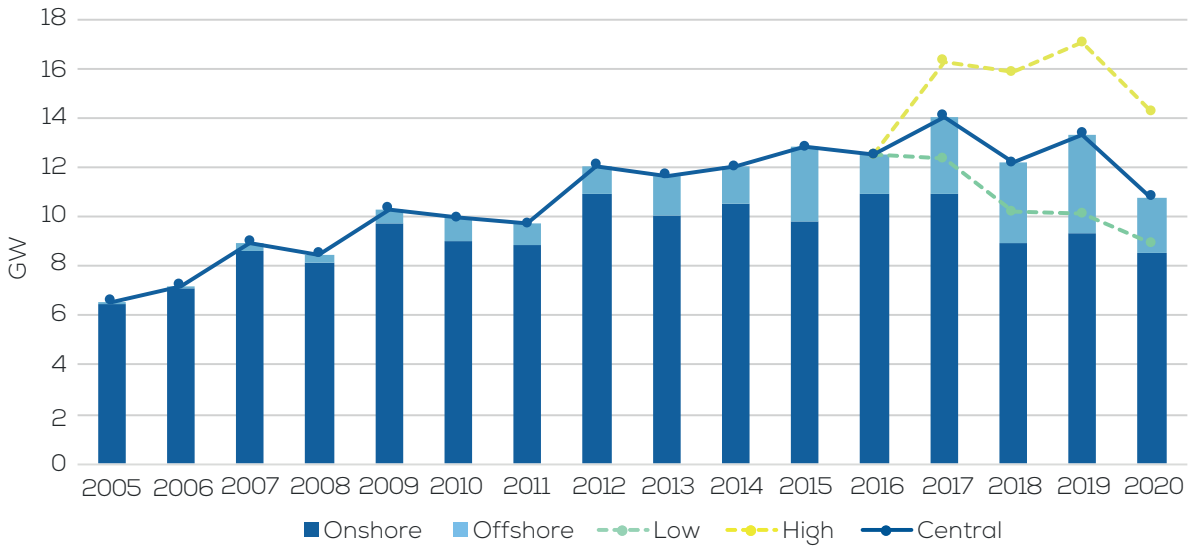
Deployment in 2017-2020

With an average of 12.6 GW per year, volumes of new deployment of wind energy capacity look set to remain fairly strong through to 2020, according to WindEurope's Central Scenario. We expect 2017 to mark a new record high in annual installations. We expect 50 GW to be installed in the 4 years of 2017-2020. We expect this would bring the EU to an accumulative installed capacity of 204 GW. We expect this 50 GW additional capacity to represent over half of all new renewable capacity in the EU over the 4-year period, well above solar PV, bioenergy and hydro power.

With over 200 GW of installed capacity, wind energy could meet 16.5% of Europe's electricity needs by 2020, surpassing hydro power and becoming the largest source of renewable electricity. We expect Denmark to meet over half of its demand with wind energy and Germany almost 30%. Ireland, Portugal, Spain and the UK will follow with respectively 29, 27, 24 and 21%.

New installations will remain relatively strong until the end of 2020, but policy uncertainty and lack of ambition for the post-2020 climate and energy framework could have a significant negative impact on the sector. Only a handful of Member States have provided visibility and regulatory certainty. With only 5 countries among the EU-28 announcing auctions plans, there is a lack of certainty on revenue stability for investors.

FIGURE A
Wind energy market outlook to 2020 in the EU



Source: WindEurope

Market concentration will remain high, with Germany, the UK, France, Spain and the Netherlands installing most of the capacity. Germany alone will represent a third of all the installed capacity, with a total of 16.5 GW. The second largest market will be the UK, with two thirds of its new installations offshore. France will be third in the list with potential installations of up to 6.5 GW.

The onshore market will remain stable with a slight decrease towards the end of the 4-year period, mainly due to lower planned activity in Germany. However, we expect Spain to experience radical growth after several years of inactivity; following the recent tenders, the industry is gearing up to install 4.1 GW of capacity.

The offshore market will grow at a higher pace than the onshore market. With average new installations of 3.1 GW/year, offshore wind will represent about one quarter of the total new installations (compared to a 15% share in the last 4-year period 2013-2016). The offshore market will concentrate mainly in the UK with 5.2 GW, representing 42% new grid-connected capacity. Another 4 countries will see offshore installations: Germany (3.5 GW), Belgium (1.5 GW), the Netherlands (1.4 GW) and Denmark (1.0 GW). In 2019, annual installations in offshore will reach to over 4 GW.

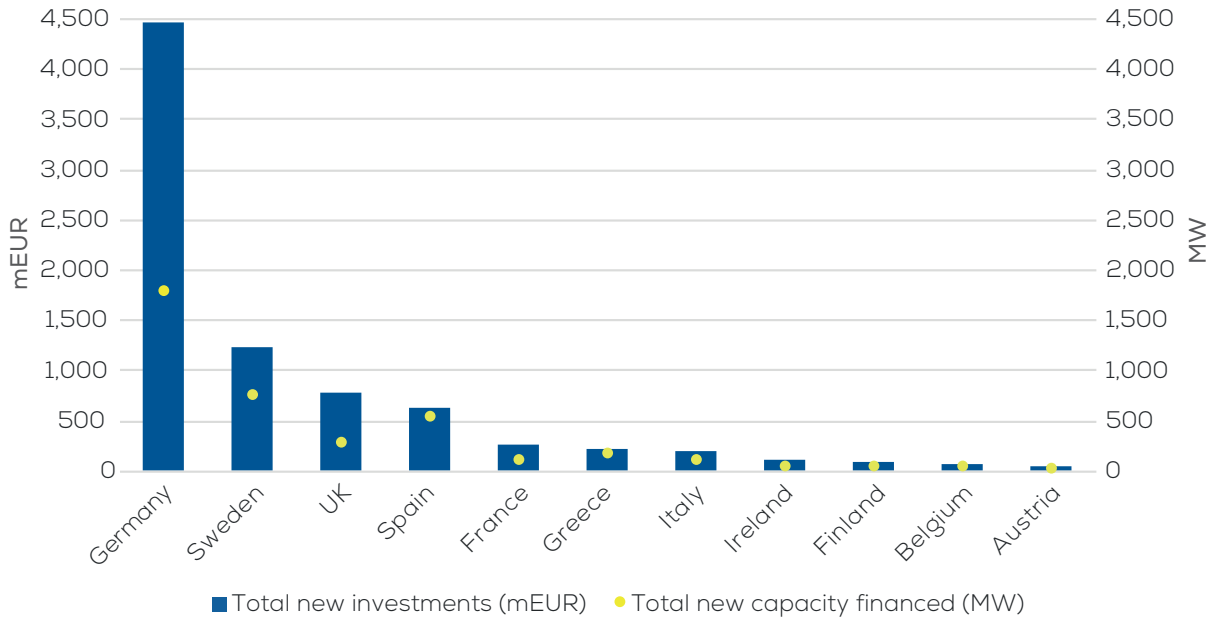
In the first half of 2017

In total, we estimate that developers have installed across the EU-28 about 6.1 GW of capacity in the first half of 2017: 4.8 GW onshore and 1.3 GW offshore. Activity has been concentrated in Germany, UK and France with a share of 82%. 15 countries out of the EU-28 saw no installations for this period while only 8 countries surpassed the 100 MW mark. The activity in the offshore market is 2.6 times higher than for the first half of 2016, with 6 wind farms bringing additional capacity in 4 countries (Germany, the UK, Belgium and Finland).

During this period, 11 EU Member States have announced new wind energy investments totalling €8.1bn for 4.1 GW of new assets. Germany was the biggest investor, with over €4.5bn and 1.8 GW of new capacity financed. Investment activity in the country accounted for 53% of the European market. With no offshore wind projects reaching Final Investment Decision in the UK during this period, investments dropped to a record low below €1bn.

FIGURE B

Investments in new wind energy assets per country during first half 2017, in the EU[1]



Source: WindEurope

1. Projects reaching First Investment Decision.

ADDITIONAL
50 GW
IN THE EU IN THE NEXT FOUR YEARS, TOTALING
204 GW in 2020

New added capacity (2017-2020)

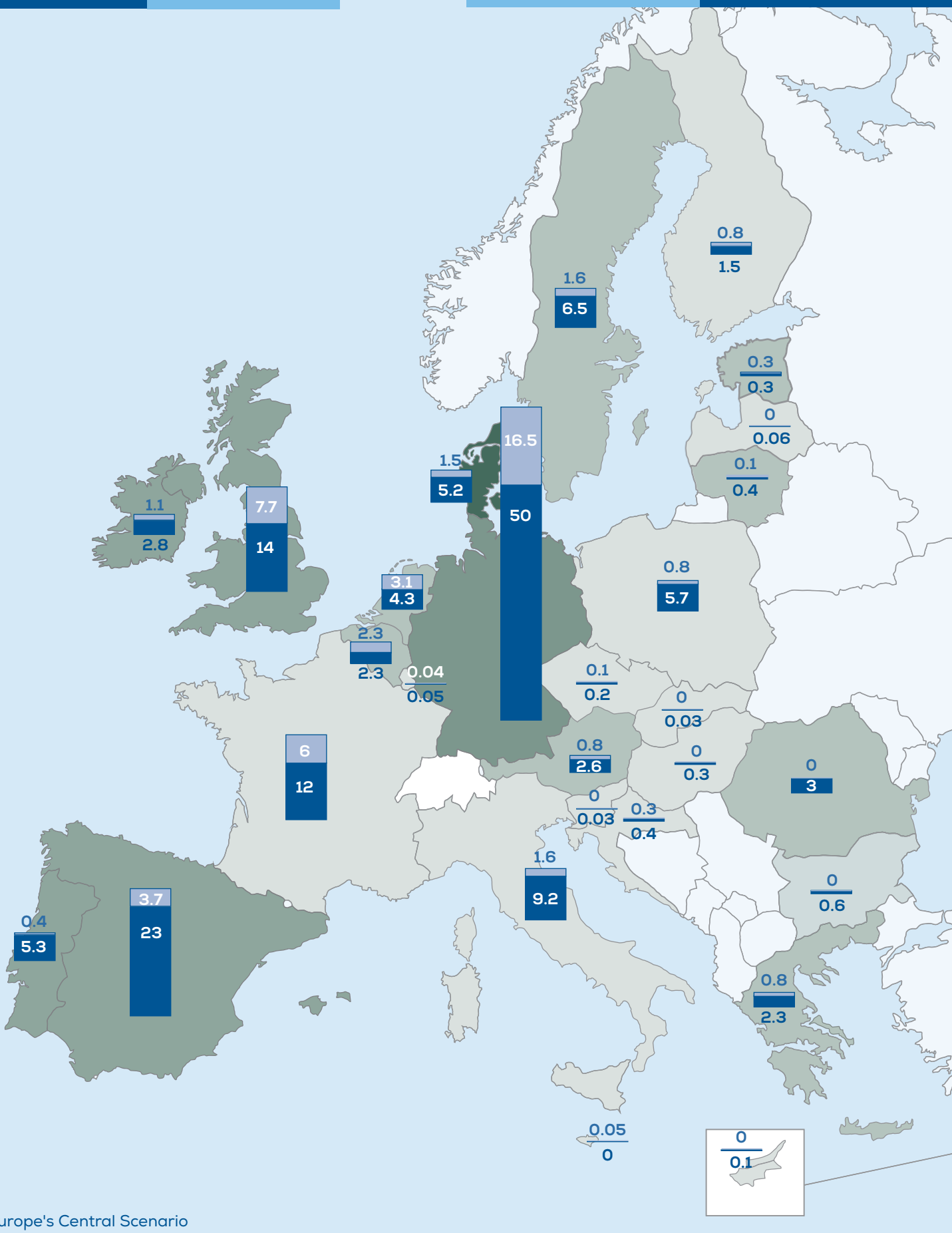
GW

Cumulative installed capacity (2016)

Share of wind in power demand

50-60%
40-50%
30-40%
20-30%
10-20%
0-10%

WIND ENERGY COULD COVER
16.5%
OF EU ELECTRICITY DEMAND IN 2020



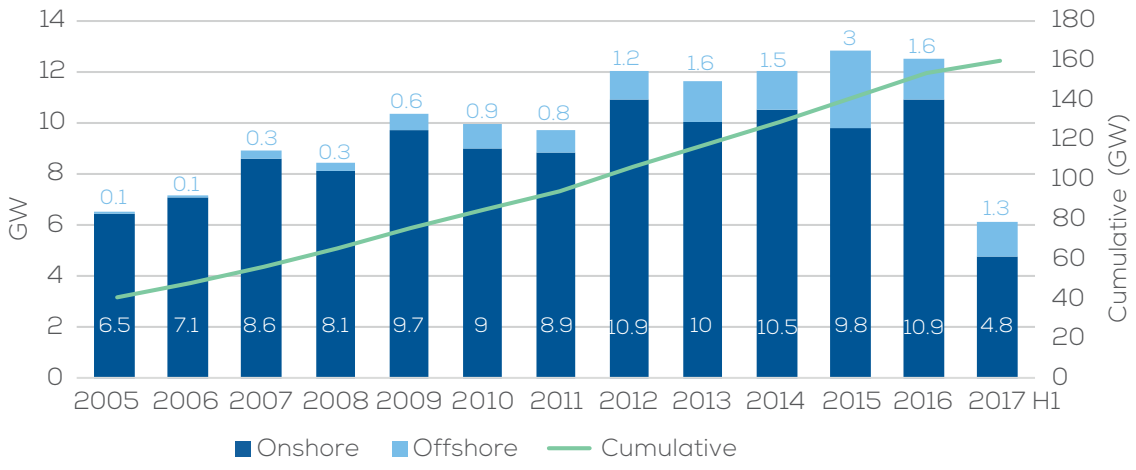
WindEurope's Central Scenario

1. THE EUROPEAN WIND ENERGY MARKET TODAY

1.1 MARKET EVOLUTION

At the end of June 2017, the European Union had a total of 159.5 GW of wind power capacity installed (145.5 GW onshore and 14.0 GW offshore). Germany remains the EU Member State with the largest installed capacity, followed by Spain, the UK, France and Italy. Four other EU countries (Sweden, Denmark, Poland and Portugal) have more than 5 GW installed. Seven additional EU countries have over 1 GW of installed capacity: Austria, Belgium, Finland, Greece, Ireland, the Netherlands and Romania.Annual wind power installations in the EU have increased more or less steadily over the past 11 years from 6.6 GW in 2005 to 12.5 GW in 2016 at an average annual rate of 11 GW per year.

FIGURE 1
Annual wind energy installations 2005-2017

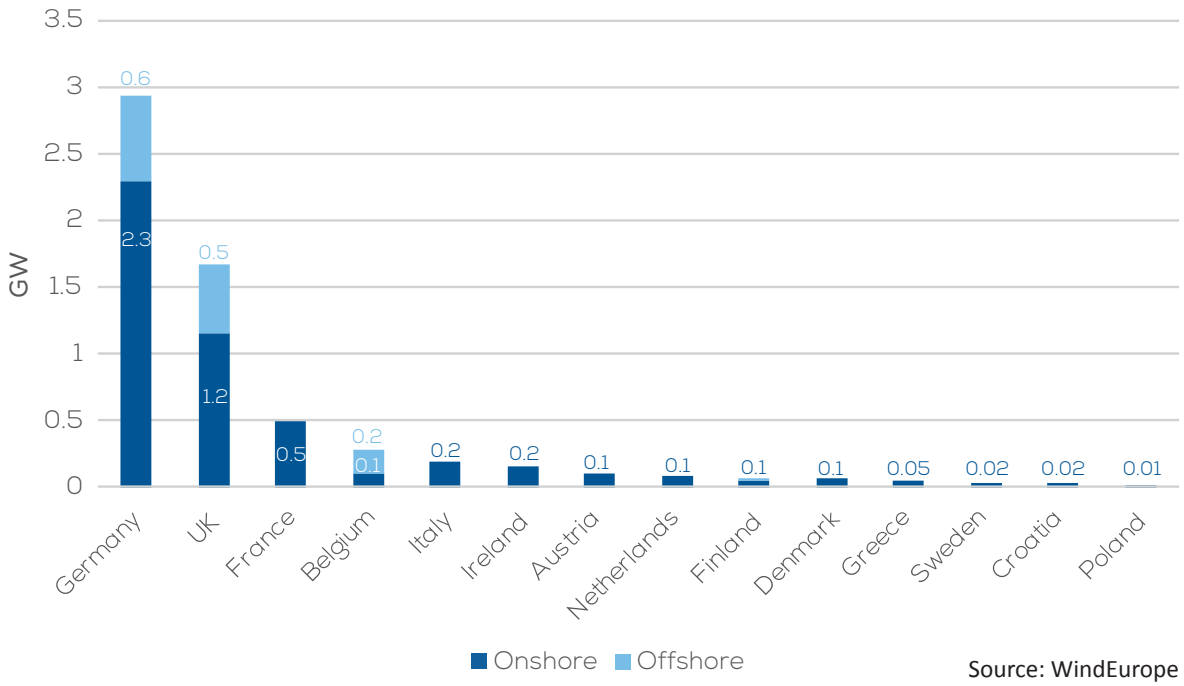


Source: WindEurope

1.2 FIRST HALF OF 2017

During the first half of 2017, project developers installed 6.1 GW of wind energy in the EU; 4.8 GW onshore and 1.3 GW offshore. 15 out of 28 countries had no wind energy installations in this period, while eight countries surpassed the 100 MW mark.

FIGURE 2
Wind energy installations in the first half of 2017



Source: WindEurope

Germany installed almost half of the EU's new onshore wind energy capacity with 2.3 GW in this period. The UK followed with close to 1.2 GW, representing almost one quarter of the total installations. This high volume of installations in the UK was due to the end of the Renewable Obligation Certificate's grace period in March 2017. Developers rushed to complete projects before this deadline. With 492 MW of new installed capacity in H1 2017, France is on track for another good year of installations. These three countries accounted for more than 80% of the EU's onshore installations, highlighting a very high market concentration.

12 more countries had new onshore installations in the first half of the year. Italy and Ireland installed 187 MW and 159 MW respectively. Both countries kept a constant installation rate, as in 2016. By contrast, the first half of 2017 represents a significant slowdown in installations in Poland (6 MW), Sweden (23 MW), Finland (50 MW), Greece (46 MW), and Portugal (0 MW).

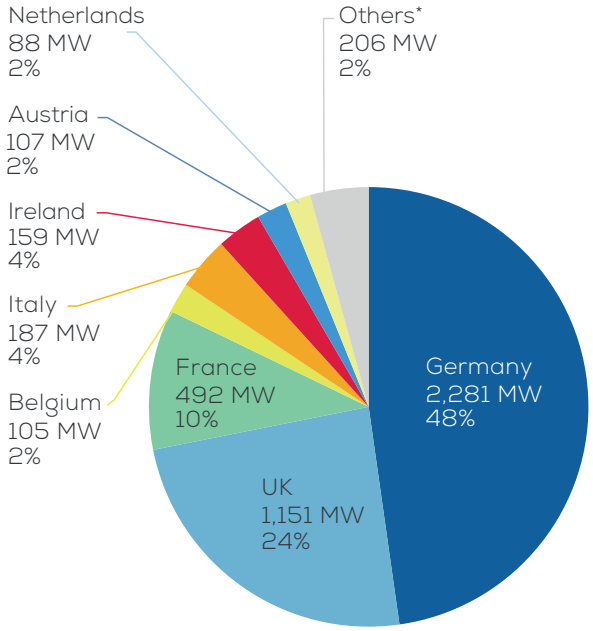
Bulgaria, the Czech Republic, Estonia, Cyprus, Hungary, Latvia and Romania have yet to install a single MW since 2016.

82%

OF THE NEW WIND CAPACITY IN THE FIRST HALF OF 2017 WAS INSTALLED IN

3 COUNTRIES

FIGURE 3
Onshore wind installations in the first half of 2017. Total 4,775 MW



*Others: include Denmark (60 MW), Finland (50 MW), Greece (46 MW), Sweden (23 MW), Croatia (21 MW) and Poland (6 MW)

Source: WindEurope

245

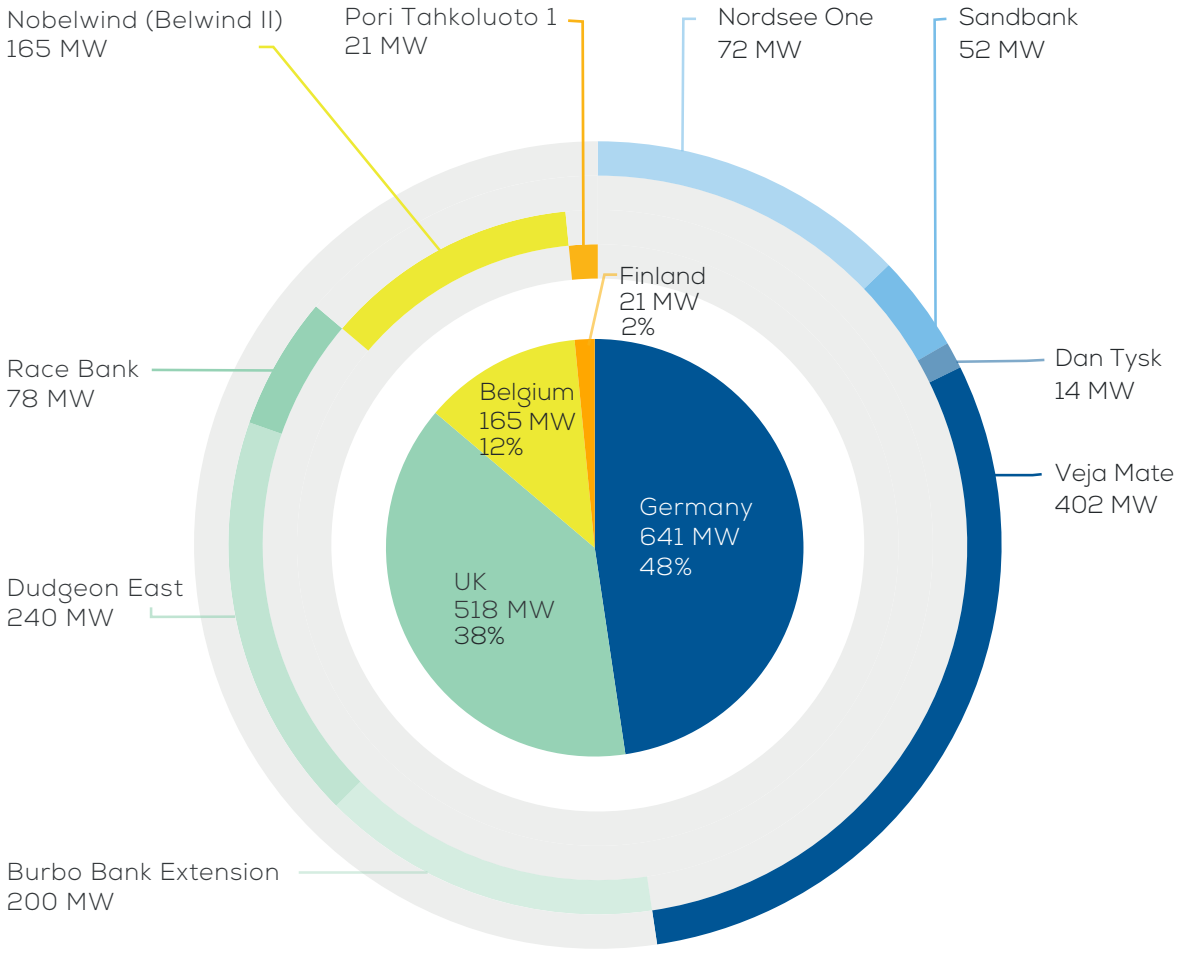
NEW GRID -CONNECTED OFFSHORE WIND TURBINES IN 6 WIND FARMS

Offshore wind in Europe saw a net 1,344 MW of additional installed grid-connected capacity from 1 January to 30 June 2017. This was 2.6 times the amount installed over the same period last year. This new capacity came from six offshore wind farms across four countries and totalling 245 grid-connected turbines. 189 new foundations were installed and 294 turbines were erected.

Germany connected 48% of the net capacity, largely with the commissioning of the Veja Mate wind farm. The United Kingdom connected 38% of the EU's capacity, mainly thanks to the completion of the Burbo Bank extension wind farm. Belgium represented 12% of the total share and Finland 2% with 1 project in each country.

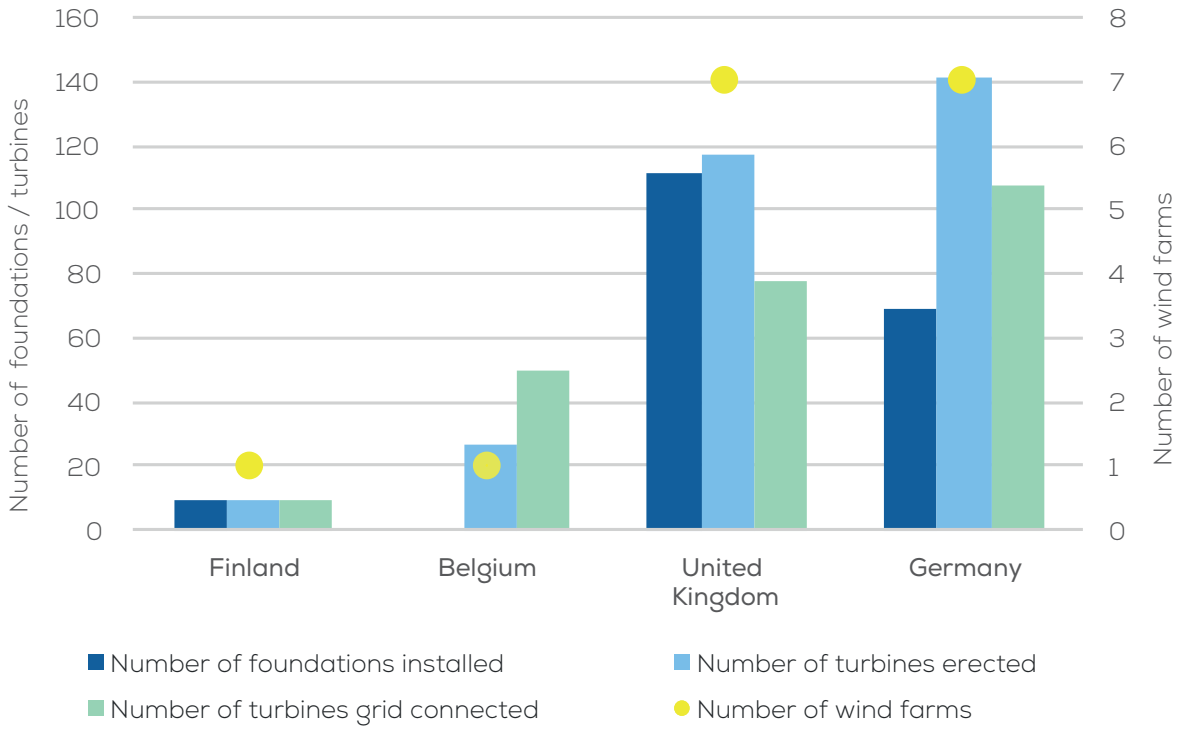
84% of the installations were in the North Sea, 15% in the Irish Sea and 1% in the Baltic Sea. Whilst the latter had very little capacity, construction works started at the 350 MW Wikinger offshore wind farm.

FIGURE 4
Offshore wind country split and grid connected farms in H1 of 2017



Source: WindEurope

FIGURE 5
Summary of work in offshore wind farms between 1st January and 30th June 2017



Source: WindEurope

Out of the 245 turbines grid-connected in the first half of 2017, 58% were provided by Siemens, 31% by Senvion and 11% by MHI Vestas. Wind turbine capacity rating ranged between 4.2 MW and 8 MW, with an average of 5.8 MW. This is a 39% increase in size over the same period last year. Only six out of the 16 sites under construction in 2017 will use turbines rated below or equal to 5 MW. Seven sites will use 6 MW turbines, one site will use 7 MW turbines and two sites will use 8 MW turbines. 25 8 MW wind turbines have been grid-connected already at the Burbo Bank extension wind farm in H1 2017.

THE AVERAGE SIZE OF GRID-CONNECTED TURBINES IN THE 1ST HALF OF 2017 WAS

5.8 MW

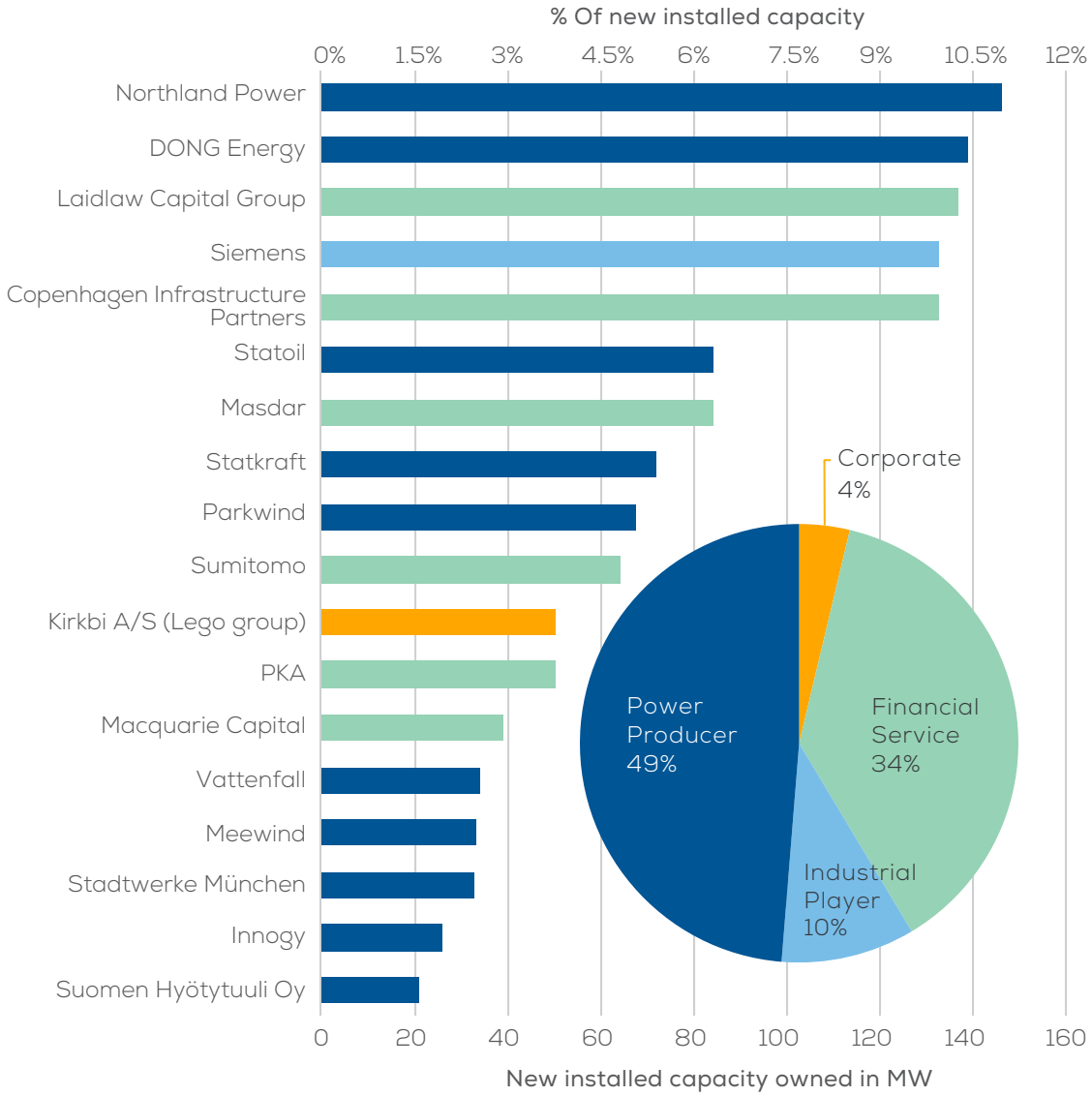
Offshore wind farms are generally owned by multiple parties, due to the large investments needed and the need to diversify risk. For the first half of the year, 18 owners have been involved in the six wind farms that connected wind turbines to the grid.

Power producers own almost half (49%) of the capacity connected to the grid in H1 2017. However, infrastructure and pension funds are steadily increasing their participation, accounting for 38% in the first half of 2017, compared to 25.2% in the first half of 2016.

Northland Power connected the most capacity in the first half of 2017, 142 MW, representing 10.9%, followed by DONG Energy with 139 MW (10.3%). Laidlaw Capital Group (10.2%), Siemens (9.9%) and Copenhagen Infrastructure Partners (7.6%) completed the top five owners in new additional capacity.

FIGURE 6

Offshore wind developers' share of new grid connected capacity between 1st January and 30th June 2017

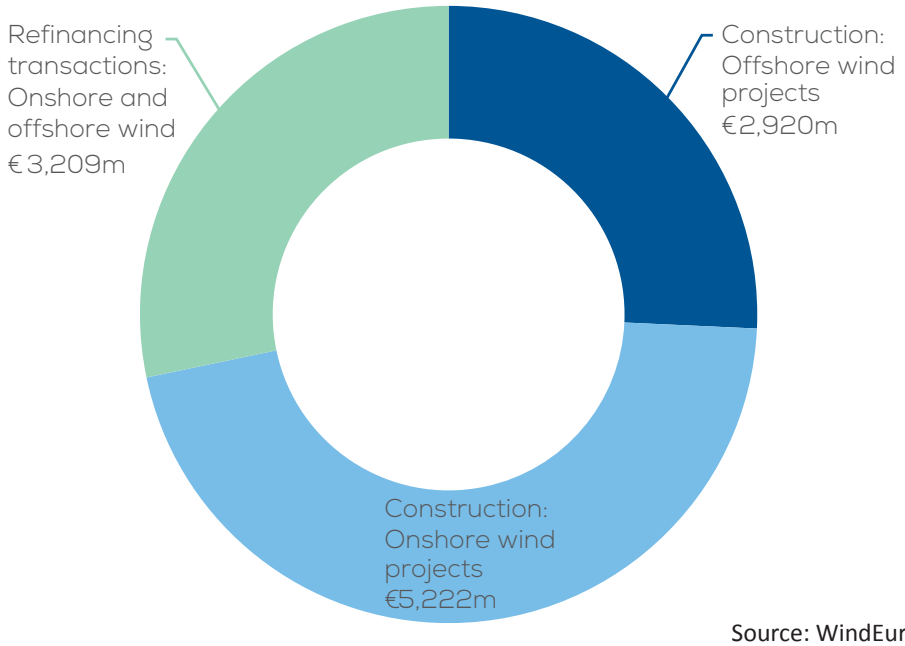


Source: WindEurope

Investment trends

The wind energy industry generated new investments of €8.1bn during the first half of 2017. A total of 4.1 GW reached Final Investment Decision (FID) in 11 Member States, with onshore wind projects driving most of the investment activity. In addition to the financing of new wind farms, the first half of 2017 also saw €3.2bn in refinancing transactions. The sector generated a total investment of €11.3bn.

FIGURE 7
Wind sector investments during H1 2017 in the EU. Total €11,351m



Source: WindEurope

During the first half of 2017, the European market has remained very uneven, with only 11 EU Member States announcing new wind energy investments during this period; a trend that follows that of previous years.

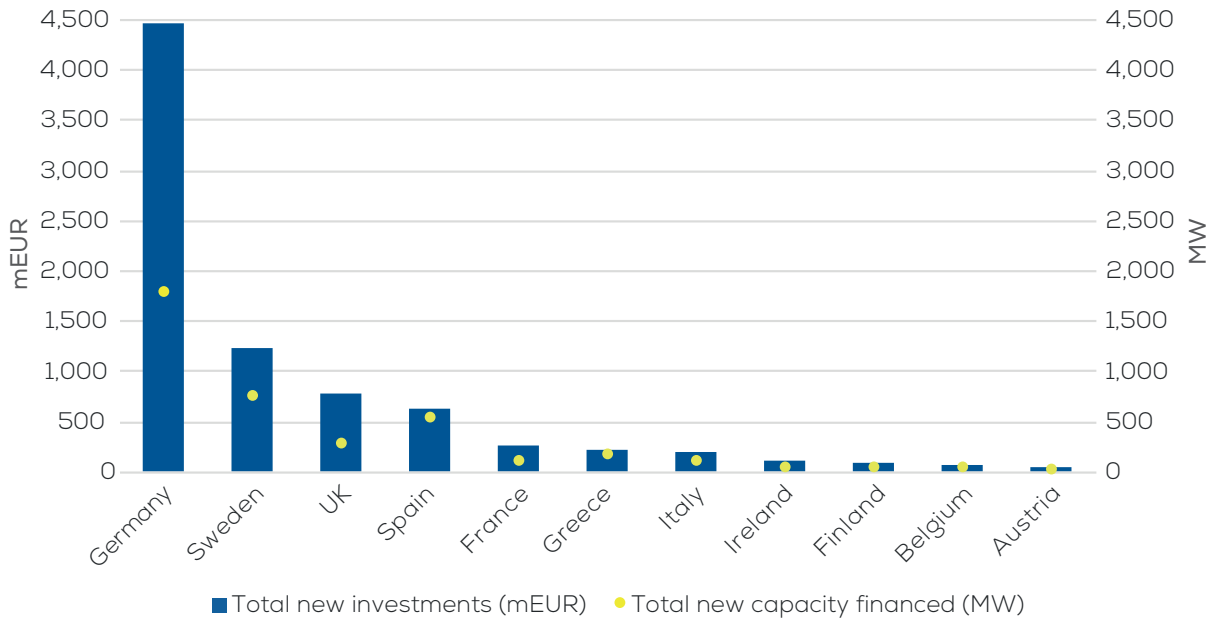
Germany was the biggest investor, with over €4.5bn and 1.8 GW of new capacity financed. Investment activity in the country accounted for 53% of the European investments market.

With no offshore wind projects reaching FID in the UK, investments in this country dropped to a record low of €784 million.

53%

OF NEW INVESTMENTS WERE IN GERMANY

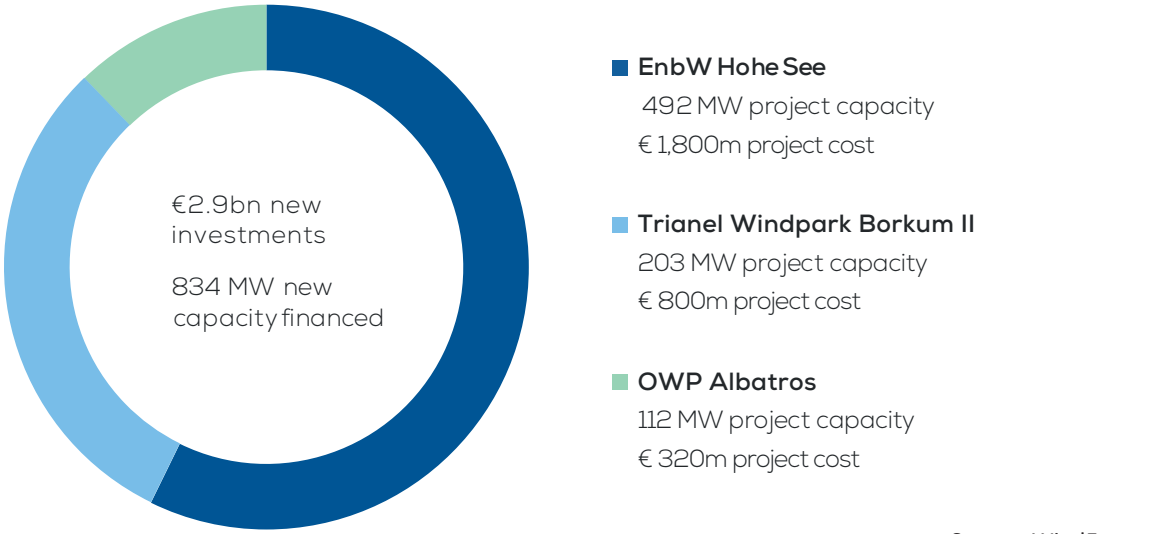
FIGURE 8
Wind investments per country during H1 2017 in the EU



Source: WindEurope

Only three offshore wind projects, totalling 834 MW in Germany, reached FID during the first half of 2017 for an estimated investment value of €2.9bn. This compares to €14bn and 3.7 GW in new assets.

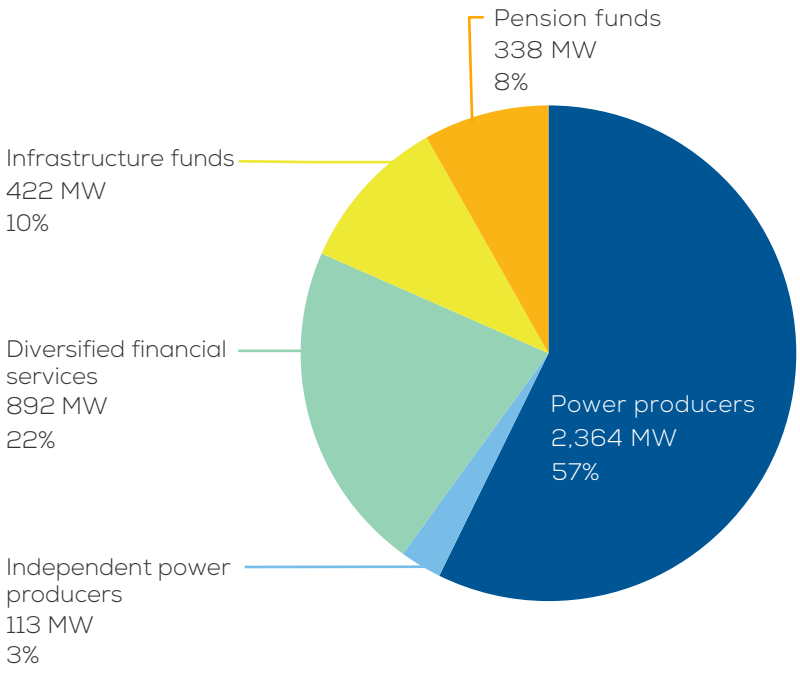
FIGURE 9
Offshore wind projects reaching Final Investment Decision during H1 2017



Source: WindEurope

The equity mix continues to bring in more corporates, financial institutions and, in particular for offshore wind, overseas investors. However, power producers still lift most of the equity requirements, especially through the development phase. Finance houses, such as pension, insurance, infrastructure and private equity funds, are gradually increasing their participation in both onshore and offshore wind markets. During the first half of 2017, they acquired 40% of the divested wind capacity.

FIGURE 10
Project acquisition activity by type of investor during H1 2017 in the EU



Source: WindEurope

2. MID-TERM WIND ENERGY MARKET OUTLOOK

2.1 INTRODUCTION

The mid-term wind energy market outlook analyses the likely development of wind power capacity in the EU Member States in the next four years. It consists of three scenarios reflecting the potential developments in EU regulatory frameworks, national policies, project development timelines (see Table 1) and the performance of the wind industry in winning capacity in upcoming technology-neutral auctions.

2.2 POLICY CONTEXT

In 2014 the European Commission introduced new rules on State-Aid for renewable energy sources. Those changes are taking effect today with a shift to competitive tender mechanisms and the use of market-based instruments. The European institutions are currently discussing the policy framework for the post-2020 period, mainly with the revision of the Renewable Energy Directive and a significant reform of Energy Market Design rules (the Clean Energy Package)[2].

Towards market-based support schemes

Following the guidance of the European Commission, a large number of Member States have already moved towards feed-in-premiums, limiting the use of feed-in-tariffs to small installations and emerging renewable energy technologies. For instance, in Germany only installations below 100 kW are eligible for feed-in-tariffs. A few countries such as Finland and Ireland still remain on feed-in-tariff systems but will need to update their support scheme before the end of 2017. Green certificates is another market-based instrument supported by the European Commission. However, having already been abandoned by Poland and the UK for new projects, green certificates use is limited to Sweden, Norway and Belgium.

2. https://ec.europa.eu/energy/en/news/commission-proposes-new-rules-consumer-centred-clean-energy-transition

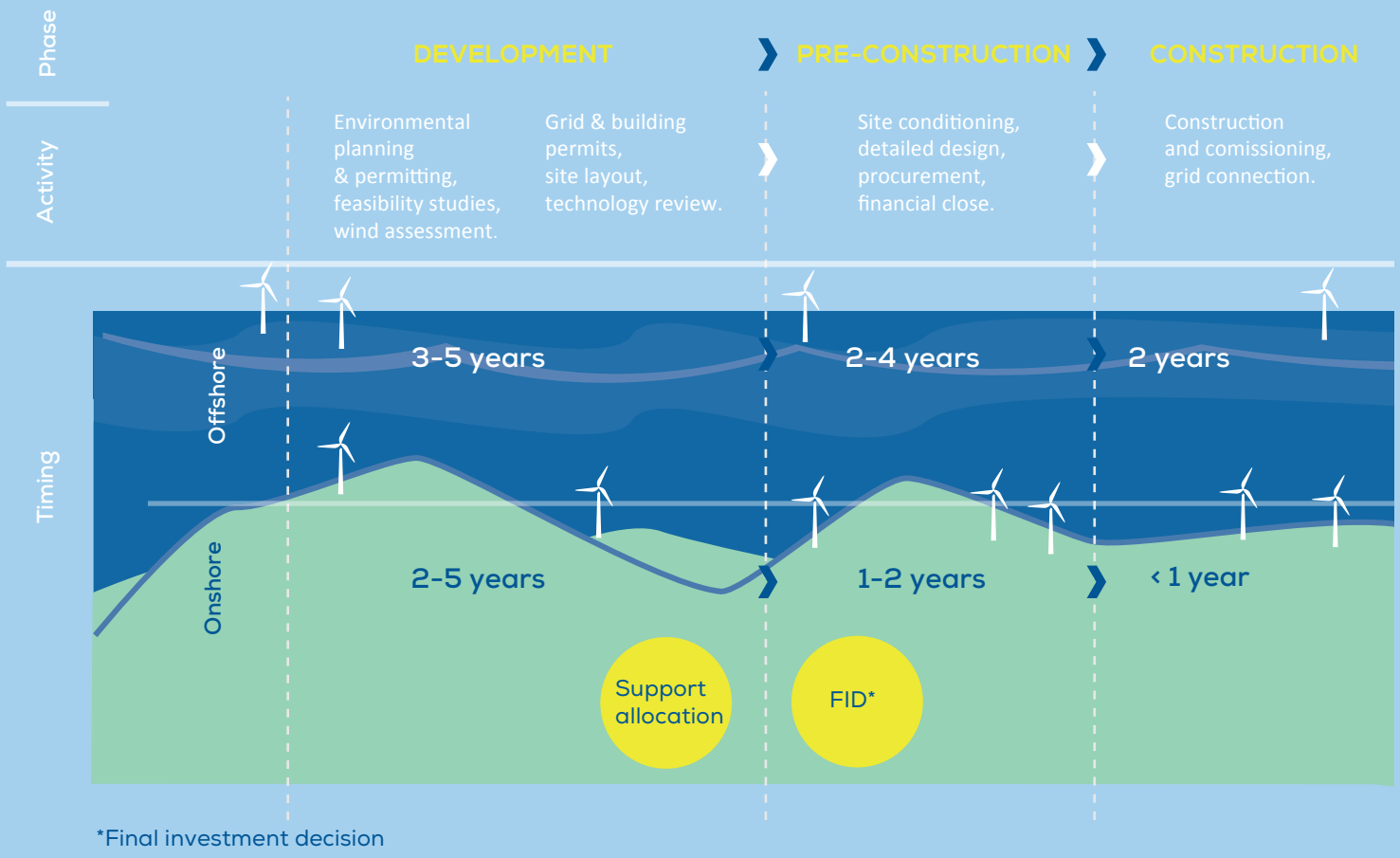
Considerations on projects' development timeline

Wind energy projects are characterised by a significant time lapse between the moment a promoter is granted a support mechanism (e.g. tender results announcement) and the moment the wind farm starts to operate (grid connection). In the case of onshore wind projects, this time is approximately two years, while for offshore wind projects it can take around five years. The overall project timeline is much longer: this includes site investigation, resource assessment, environmental impact assessments and other technical studies and consultations with local communities and other administrative procedures. This is why it is crucial to have good visibility on upcoming tenders and the regulatory framework.

Once a support mechanisms is granted or the capacity is awarded to the developer, the time allowed to realise projects is largely dependent on the regulatory framework. For instance, in Germany, large developers have a 30-month implementation deadline while community projects are allowed to connect their turbines to the grid up to 54 months after auction allocation. This might in principle extend the time gap between auction results and new grid-connection installations.

Considering these timescales, the offshore volumes presented in this outlook (new installations grid-connected between 2017 and 2020) are therefore based on support allocation that has already taken place. The accuracy is thus very high. For onshore, the installations in 2017, 2018 and 2019 are mostly based on the support and volumes allocated before the end of 2016. However, there is a degree of uncertainty for installations in 2019 and 2020 that could be affected by upcoming planned tenders (Spain and France) and by tenders not yet announced at the time of publication.

For the investment outlook, onshore projects Final Investment Decision (FID) takes place 1 year before grid connection while the FID timescale for offshore wind projects is based on individual project analysis (from 2 to 3 years).



2020 RES targets setting the pace

As part of the European objectives for 2020, the binding targets for renewable energy will have a significant influence on wind energy installations for the next four years. In Eastern Europe, most countries have already achieved their targets, which will lead to low installations in the coming years. Romania, which was once a leading country for the Eastern European market, will see no more new installations before the end of 2020.

By contrast, some countries are rushing to ensure they reach their objectives in the years leading into 2020. This is the case of Spain, which after a few years of no activity, has recently auctioned 8 GW of new renewable capacity (4.1 GW of wind energy awarded).

France, Ireland, the Netherlands and Luxembourg are likely to miss their targets, while Hungary and Poland have hindered any additional renewable energy deployment.

These countries will need to accelerate the pace of installations to fulfil their commitments. Poland is the only country among the four aforementioned without any clear plan/objective to the reach their target.

Other countries, such as Sweden and Denmark, have achieved or are well on track to reaching their 2020 target but will continue to install more wind capacity beyond 2020. These countries have set national energy plans with concrete renewable energy goals. As an example, Denmark is aiming to go for 100% renewable electricity by 2035, which forces a renewable trajectory to 2020 that goes far beyond the European target. Sweden, which plans to reach 100% of renewable electricity by 2040, will also need to overshoot its 2020 European target.

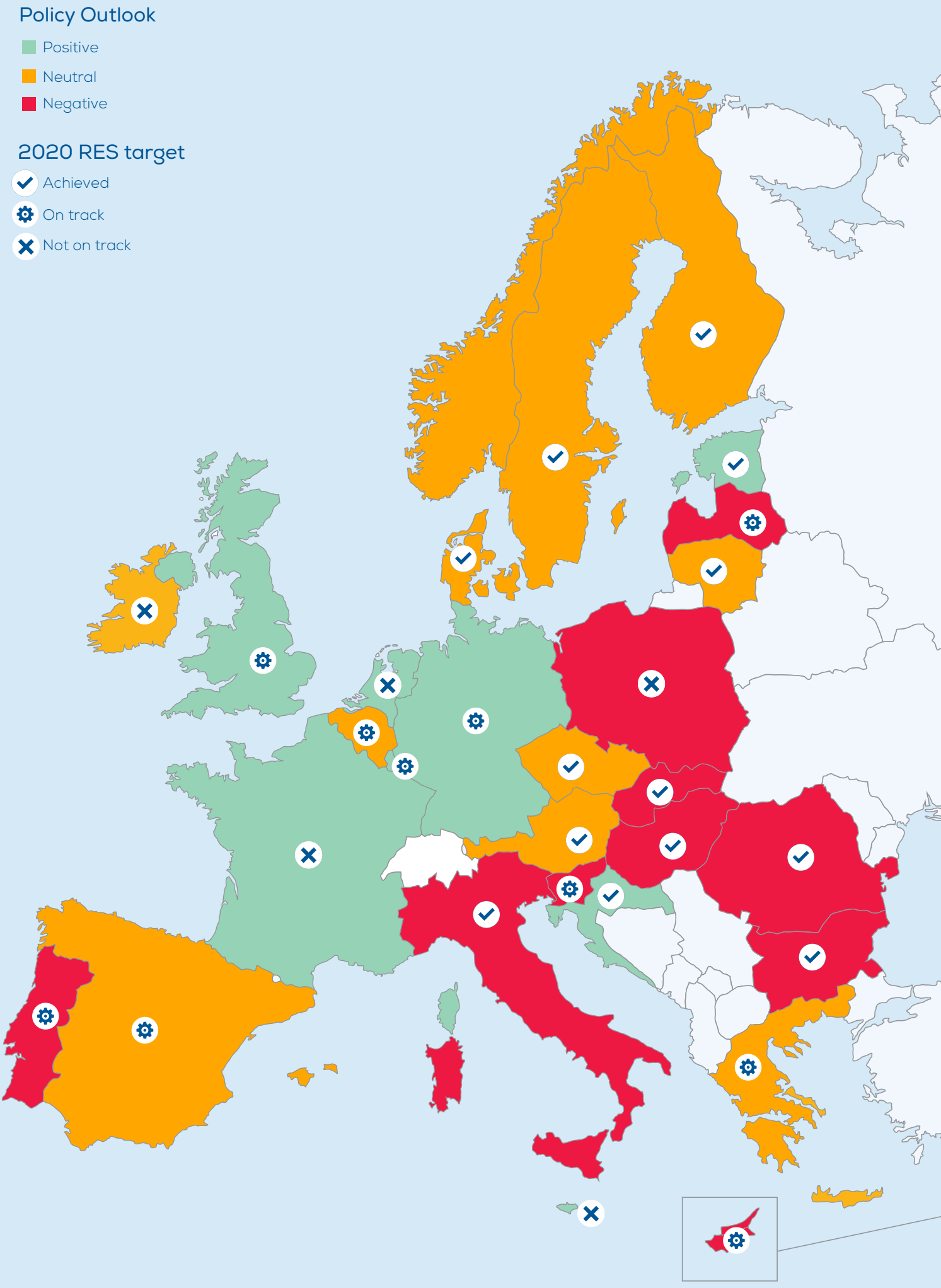

Policy Outlook
Positive
Neutral
Negative
2020 RES target
Achieved
On track
Not on track

TABLE 2
Summary of wind energy policy landscape per Member State

COUNTRY	UPCOMING DEVELOPMENTS
Austria	Changes in the Green Energy Act will unlock at least 350 MW in the current pipeline
Belgium	Large development offshore but some risks of retroactive changes on the already awarded support schemes
Bulgaria	No more incentives to build new wind assets as 2020 RES target is achieved
Czech Republic	Wind installations to remain subject to Ministry of Industry approval
Denmark	The scheme for onshore wind expires in February 2018. One year stand still is unavoidable until new scheme introduced
Estonia	Incentives to remain with a yearly production cap at 600 GWh despite reaching their RES target
Finland	FIT applications to end once the capacity limit of 2,500 MVA is exceeded
France	Government objective of 15 GW by 2018 and at least 25.8 GW by 2023
Germany	Full switch to tenders system both for onshore and offshore with good visibility and long term certainty
Greece	Switch to auction system with Feed-in-Premium as of 2018
Hungary	No incentives to build new wind assets as 2020 RES target is achieved
Ireland	Ongoing discussions regarding a new incentive scheme that will replace REFIT II
Italy	Auction system to remain but no planned auctions yet communicated
Lithuania	Government sets a new target of 30% of RES in final energy consumption by 2020 (beyond their original 2020 obligation)
Netherlands	Projects still supported by the SDE+ (budget auction) until 2020. Target of 6 GW of onshore wind by 2020 unlikely to be met. Offshore target of 4.5 GW by 2023
Poland	Current legislation highly restricts installations. Ongoing Parliament discussion to improve the situation
Portugal	No more incentive to build new wind assets as 2020 RES target is achieved
Romania	No more incentive to build new wind assets as 2020 RES target is achieved
Spain	Revival of the market after three consecutive tenders in 2016-2017. Investment conditions remain poor as retroactive changes are allowed in the regulation
Sweden	Target of addition 18 TWh RES electricity by 2030 but exponential trajectory with strong growth only at the end of the period
UK	End of the Renewable Obligation Certificate system. Offshore wind still supported through auctions

Tenders leading the pathway for market growth

The use of competitive bidding processes (e.g. tenders) as from January 2017 is another condition established by the European Commission in order for Member States to comply with state-aid regulation. Prior to 2017, some governments had already implemented competitive auctions to select wind energy projects. After the first offshore Danish auction in 2005 (which lead to the wind farm Horns Rev 2), many offshore projects have been awarded through auctions (in the UK, the Netherlands, Germany, France). Portugal was the first European country to use competitive auctions to award onshore projects, but remained an isolated case until 2013 when Italy introduced this system. Until 2017, less than 10 GW were allocated to onshore wind via competitive auctions, mainly in the UK, the Netherlands, Italy, Spain and Portugal.

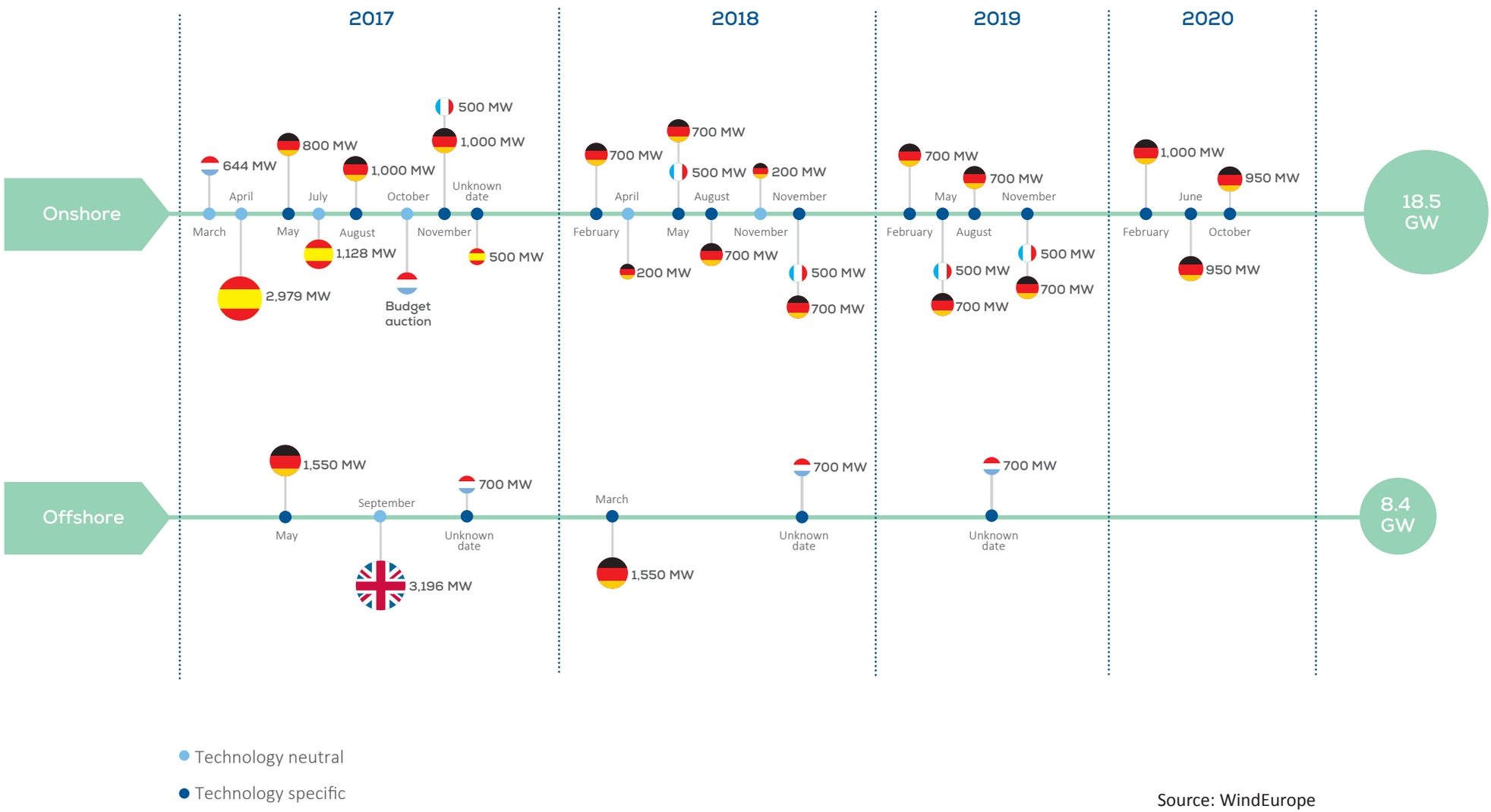
Between 2017 and 2020, more than 27 GW are already set in the plans of five countries for auctions including wind energy. Most of this capacity will be auctioned in 2017, with more than 12 GW planned. We expect other countries to make additional announcements.

The evolution of tender results for wind energy in Europe has recently shown drastic cost reductions. However, comparison between results is complex, owing to the widely differing range of tender designs. For instance, the price can be guaranteed for 10 or 20 years, or for a fixed number of full-load hours (e.g. Denmark). In some cases, producers need to reimburse the government if wholesale market prices are above the guaranteed strike price (e.g. contracts for difference in the UK). In other cases, governments provide support to the investment (instead of operational support) calculated as a discount of the initial investment to ensure a fixed internal rate of return (e.g. Spain). Some of the tenders are based on pay-as-clear allocation (all producers receive the same amount, resulting from the highest awarded bidder), while others are based on pay-as-bid (e.g. offshore tender in Germany with large spread between the winners).

In addition, the timeline for project realisation is very different between onshore and offshore wind projects. Tenders for offshore wind energy projects awarded in 2017 need to be commissioned by 2025 at the latest, while onshore projects awarded the same year will need to produce electricity by 2019. For offshore projects, the location (e.g. distance to shore, depth of the sea basin) is also a determining factor for prices.

AT LEAST 27 GW OF PLANNED AUCTIONS BETWEEN 2017 AND 2020

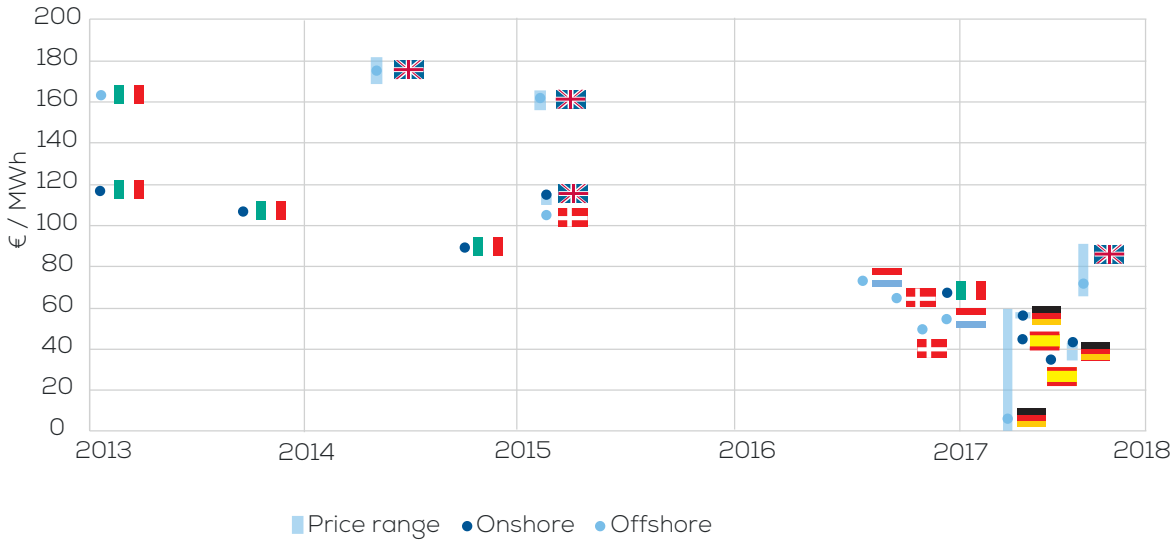
FIGURE 13
Announced tenders until 2020



Source: WindEurope

FIGURE 14

Results of wind energy tenders 2013-2017. Transmission connection costs are only included in UK offshore project. Price range refers to tenders with pay-as bid prices or several tenders happening on the same date



Source: WindEurope

2.3 MARKET OUTLOOK

By 2020, wind energy in Europe will reach between 195 GW (Low Scenario) and 217 GW (High Scenario) of cumulative installed capacity. WindEurope expects 204 GW in its Central Scenario with an average annual market of 12.6 GW.

For many countries in Europe, 2017 is a transitional year to new support schemes and tender mechanisms. Therefore, it is likely to see a peak of installations as developers rush to complete their projects in order to secure more attractive conditions under the old existing rules.

2017 IS EXPECTED TO BE A NEW RECORD YEAR IN WIND INSTALLATIONS

EU annual installations are expected to decrease in 2018 due to a slow-down in Germany and the UK. We expect a revival in 2019 with a record year for offshore wind installations and a massive amount of Spanish onshore installations connecting to the grid as a result of the 4.1 GW awarded in the two tenders in 2017.

However, the onshore market will experience a general slow-down in annual installations towards 2020, mainly due to lower planned activity in the German onshore market.

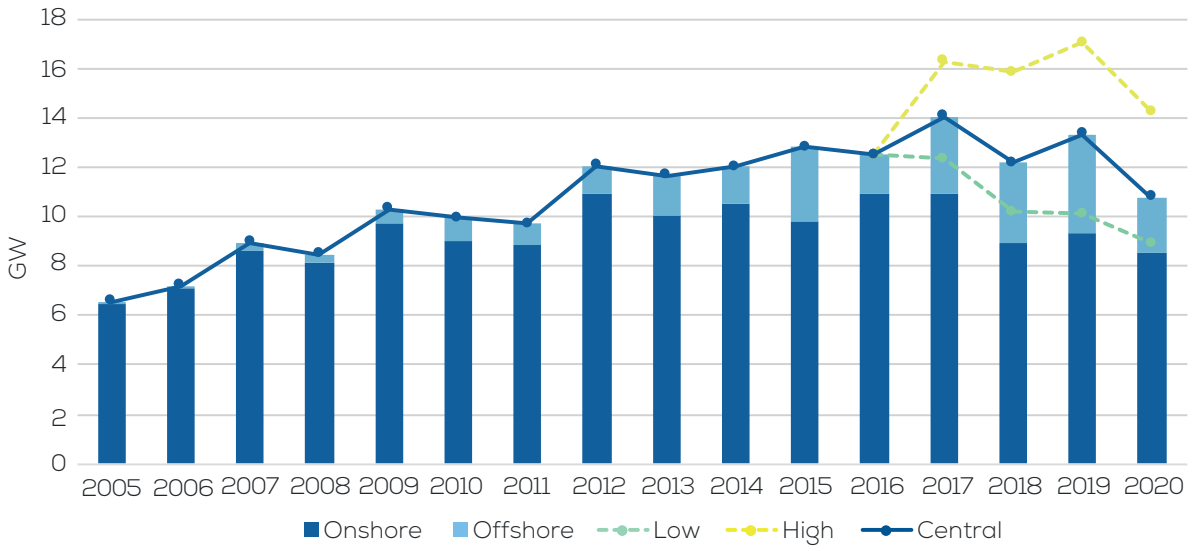
While there is a good visibility on future projects in Spain, Germany, the Netherlands and France, the uncertainty on the time to deliver them will be a crucial factor that could either accelerate (+5 GW in the High Scenario) or slow down (-3.5 GW in the Low Scenario) the market activity. In addition, the deployment of new tenders in Poland and the UK, could add new potential installations after 2019 (+2.5 GW in the High Scenario). Finally, some countries, including Ireland, Finland and Greece still need to define their new support schemes to comply with the EU State-Aid guidelines. Depending on how soon this happens the market could be up (+2.5 GW in the High Scenario) or down (-0.5 GW in the Low Scenario).

The offshore market will grow at a higher rate than today. With an average 3.1 GW/year in WindEurope's Central Scenario, offshore wind will represent about one quarter of the total market by 2020 (compared to a 15% share in the last 4-year period, between 2013 and 2016). The offshore market will concentrate mainly in the UK with 5.2 GW or 42% of the new grid-connected capacity. Another four countries will see offshore installations: Germany (3.5 GW), Belgium (1.5 GW), the Netherlands (1.4 GW) and Denmark (1.0 GW). The offshore market will peak in 2019 with annual installations over 4 GW.

Uncertainties included in the Low and High Scenarios are related to the risk of retroactive changes on the Belgian projects that were awarded without tenders and the potential installations of projects ahead of schedule in France, Germany or Estonia in the most optimistic projections.

OFFSHORE WILL REPRESENT ONE QUARTER OF THE MARKET BY 2020

FIGURE 15
Wind energy outlook to 2020 in the EU

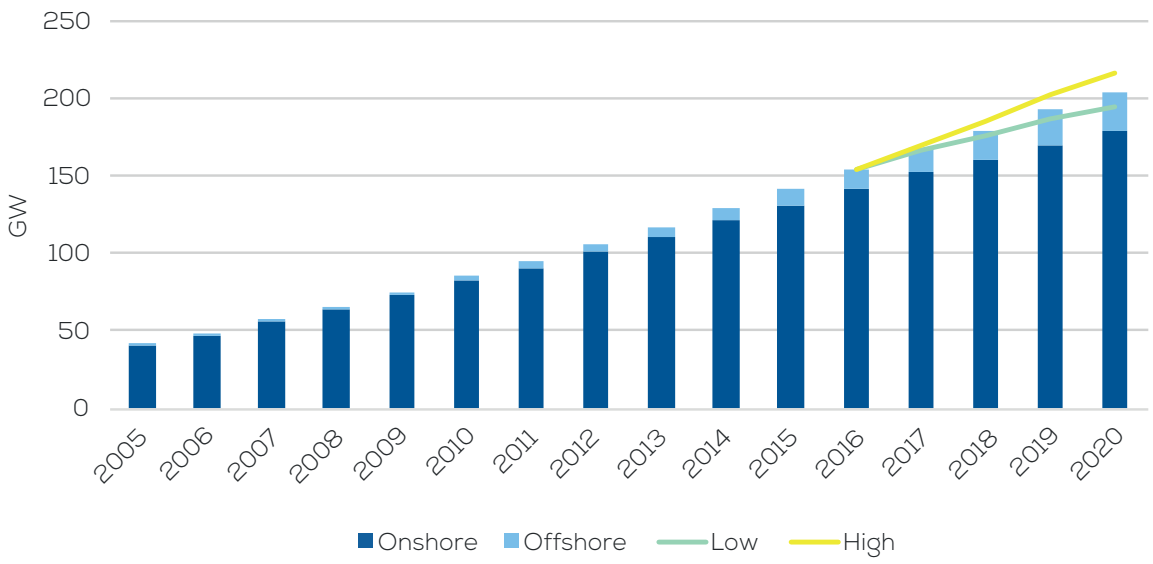


Source: WindEurope

In terms of cumulative installed capacity, Germany will remain the country with the most capacity installed with between 65.5 to 68.5 GW (66.5 GW in the Central Scenario). Spain will follow with 25 to 27.5 GW (26.5 GW in the Central Scenario) and the UK will be the third largest country with a total of 7.8 to 23.3 GW (22 GW in the Central Scenario), with almost half of that capacity (10 GW) being offshore.

CUMULATIVE INSTALLED CAPACITY COULD REACH 204 GW IN 2020

FIGURE 16
Expected cumulative installed capacity until 2020



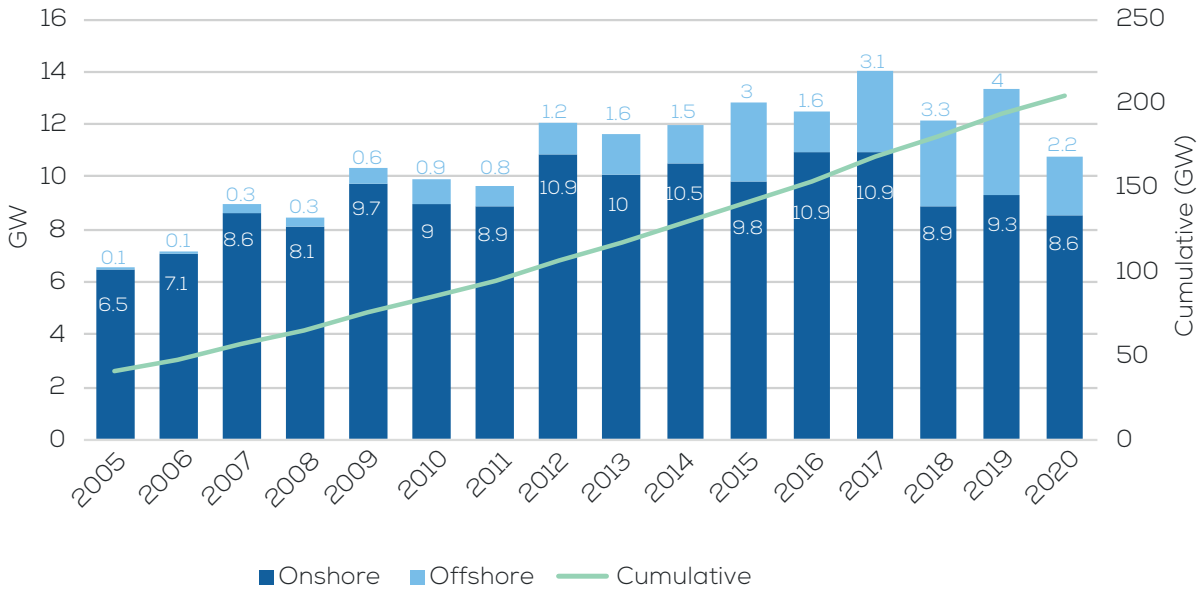
Source: WindEurope

2.3.1 CENTRAL SCENARIO

WindEurope's Central Scenario provides a best estimate of the installed capacity in Europe in the next four years. This scenario takes into account the pipeline of wind energy projects and the ongoing and future legislation in each Member State that could enable the deployment of volumes. In addition, it reflects on a case-by-case basis the impact of the 2020 targets. For offshore wind, the Central Scenario assumes that all projects are built according to a realistic timeline.

In the Central Scenario, the planned tenders in Germany, France and Spain provide good visibility on the post-2018 market development. In addition, in France and the Netherlands, the objectives set respectively for 2023 and 2020 provide clear guidance on the deployment of wind capacity. In Poland, the Wind Farm Act remains applicable, putting a pipeline of 2.2 GW of onshore projects at risk. Also, the UK will decrease its activity in onshore wind from 1.6 GW in 2016 to almost none in 2020, while shifting the government focus to offshore wind.

FIGURE 17
Wind energy market outlook in the EU28 under WindEurope's Central Scenario



Source: WindEurope

Under the central scenario, 2017 will mark a record year, with a revival in 2019 and a considerable decrease towards 2020, with the lowest level observed since 2014. Uncertainty for the onshore market after 2020 is very high as most EU Member States still do not have post-2020 energy plans in place.

ONSHORE WIND ENERGY INSTALLATIONS IN 2020 COULD BE THE LOWEST SINCE 2008

Germany will represent over one third of new installed capacity in the next 4 years, with a total of 16.5 GW. The second largest market is the UK, with two thirds of its new installations offshore. With a government objective of 15 GW of cumulative capacity by 2018, France will become the third largest European market and could install up to 6.5 GW of additional wind energy by 2020. Spain, the Netherlands and Belgium should follow with 3.7 GW, 3.2 GW and 2.3 GW respectively in the same 4-year period.

Between 2017 and 2020 onshore installations will be 37.7 GW. Germany will be the leader in onshore wind with 12.9 GW, followed by France (6 GW) and Spain (3.7 GW). The UK will only be the fourth country in onshore wind installations as it should install close to 2.6 GW.

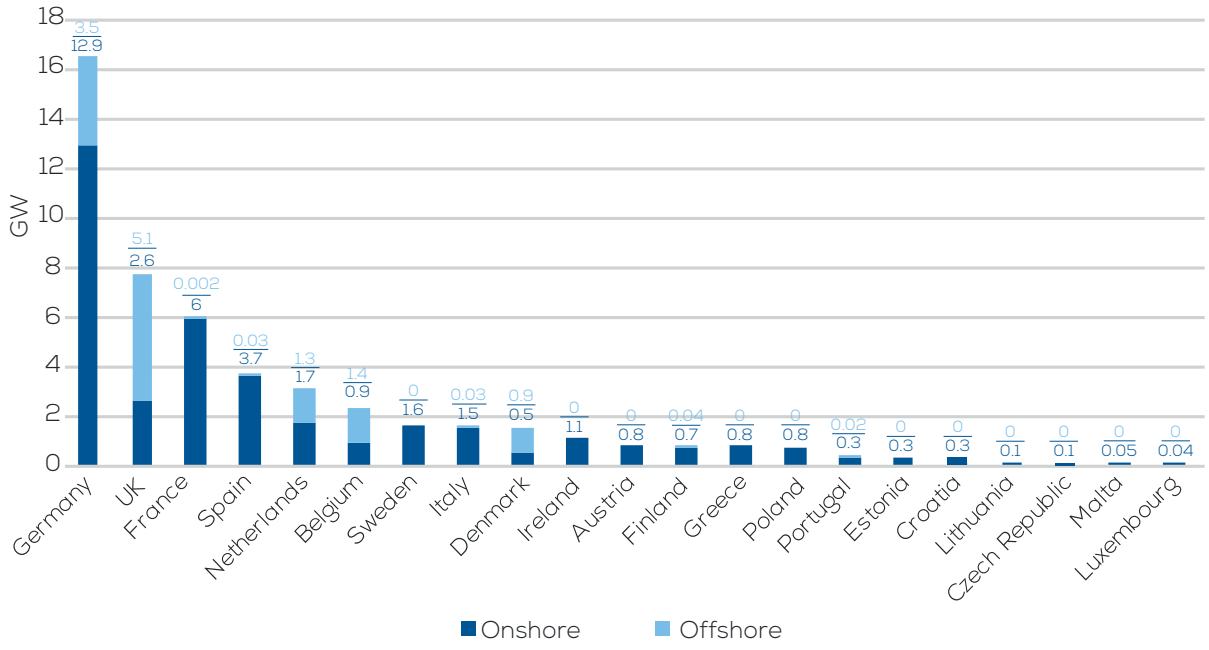
The offshore market will concentrate mainly in the UK with 5.2 GW or 42% new grid-connected capacity in the period 2017-2020. Following the UK, another 4 countries will see offshore installations: Germany (3.5 GW), Belgium (1.4 GW), the Netherlands (1.3 GW) and Denmark (1.0 GW).

In the Central Scenario, the market concentration in Germany will gradually decrease from 40% in 2016 to less than 30% in 2020, thanks to significant developments in France and Spain.

However, the wind energy market will mostly be in Western European countries. Eastern Europe will have a very small proportion of the market in the next 4 years, with less than 3% of new installations, mostly in Poland, Croatia, Estonia and Czech Republic.

GERMANY WILL BE ONE THIRD OF ALL NEW INSTALLED CAPACITY UNTIL 2020

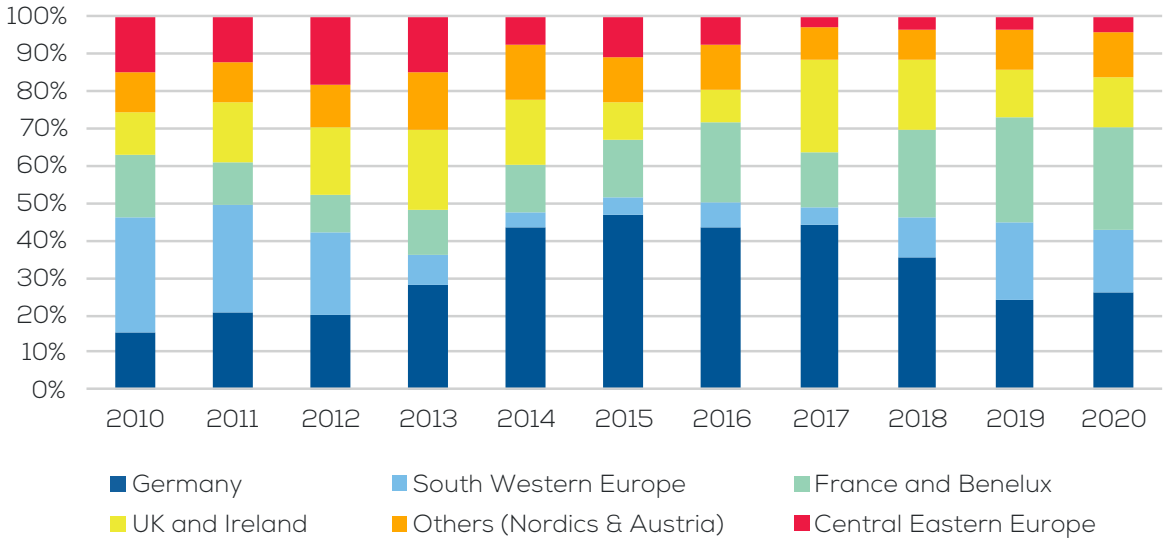
FIGURE 18
4-year installations (2017-2020) per country under WindEurope's Central Scenario*



*WindEurope expects no new installations in Bulgaria, Cyprus, Hungary, Latvia, Romania, Slovakia and Slovenia

Source: WindEurope

FIGURE 19
Market share by region under WindEurope's Central Scenario



Source: WindEurope

2.3.2 LOW SCENARIO

In the Low Scenario, European governments propose no positive improvements from current legislation. Consequently, all countries with no incentives for wind energy remain with no new installations even if they are yet to reach their renewable energy targets. The permitted and already supported pipeline is built but unfavourable national policies for permitting and planning persist; this results in a slow pace of installations for existing permitted projects and in a significant slowdown for awarding new projects. The outlook remains positive in countries that have sent strong political signals to the wind energy industry in recent years.

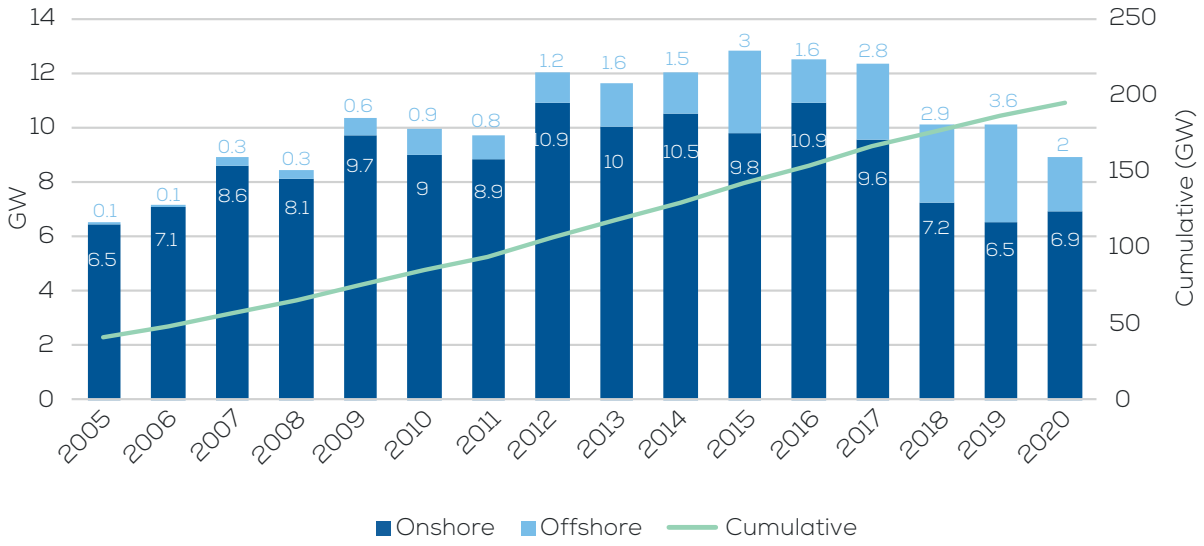
Under the low scenario, whilst 2017 is still a good year in installations, in 2019, there is no significant revamp of the market (in contrast to the Central Scenario), and it progressively decreases towards the end of the 4-year period.

Market concentration resembles that of WindEurope's Central Scenario (see Figure 19), with most of the market activity in Western Europe.

In Germany, Spain, the Netherlands and France, longer time to deliver onshore projects will lead to respectively 0.8 GW, 1.5 GW, 0.5 GW and 0.4 GW less installed capacity in the period 2017-2020 than in the Central Scenario. In Sweden, the oversupply of green certificates would persist, thereby decreasing their price. This would lead to 1.2 GW less installed capacity than in the Central Scenario. Denmark would see no new onshore wind capacity before the end of 2020 due to permitting issues and problems with public acceptance.

Offshore, WindEurope's Low Scenario considers that the Belgian projects support scheme awarded without tenders would be retroactively changed, which would lead to 600 MW less installed capacity than in the Central Scenario.

FIGURE 20
Annual and cumulative installations under WindEurope's Low Scenario



Source: WindEurope

2.3.3 HIGH SCENARIO

In the high scenario, all EU countries are able to achieve their 2020 renewable energy targets. The legislative framework is improved in those countries where current planning and permitting rules are slowing down or even jeopardizing the market. Those changes would allow developers to build the current project pipeline entirely. Governments also boost the auction volumes to accelerate the pace of installations and also ensure more cost reduction. Offshore, all projects are built according to their more optimistic schedule.

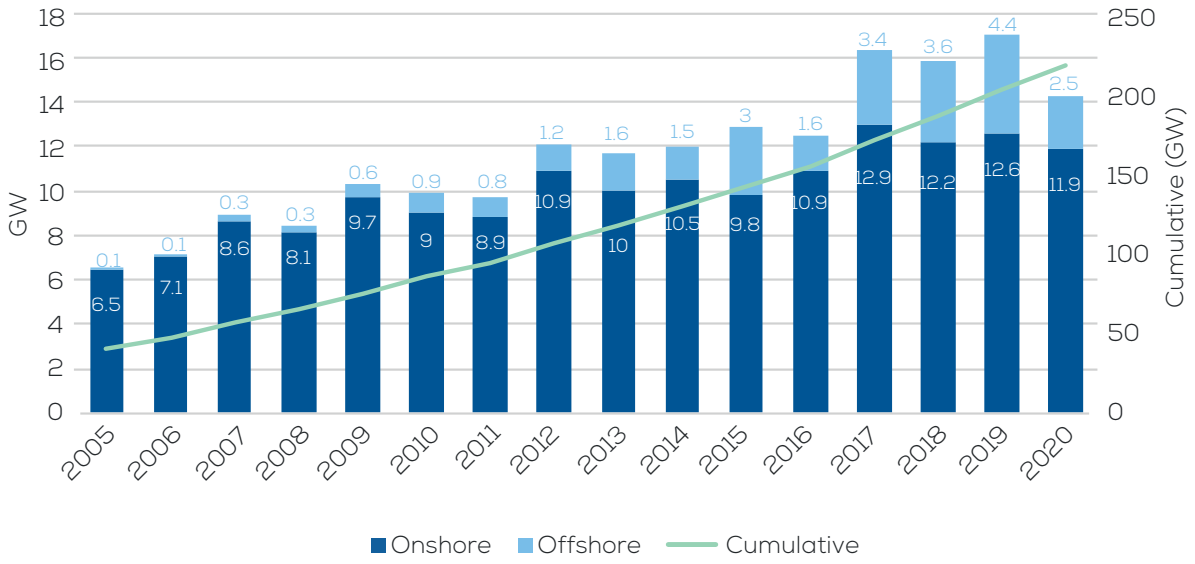
After an impressive 2017 year record with over 16 GW of installed capacity (14 GW under the Central Scenario), 2019 would mark another record with over 17 GW, 3.7 GW more than under the Central Scenario.

Germany, Spain, the Netherlands and France would accelerate their projects to reach respectively 2 GW, 1 GW, 1 GW and 0.7 GW more new installed capacity in the period 2017-2020 than in the Central Scenario. The UK would launch a new 1 GW onshore wind tender that would increase its installed capacity by 2020.

Importantly, markets that expect very few installations under the Central Scenario such as Poland, Bulgaria or Hungary would witness positive developments that would allow for respectively 1.5 GW, 0.2 GW and 0.1 GW more capacity than in the Central Scenario. With this capacity, Eastern Europe would make up 8% of the market by 2020 instead of 3% in the Central Scenario.

Offshore, the high scenario sees the early realisation of a few more projects than in the Central Scenario. Four 24 MW floating offshore wind pilot projects would be commissioned in France in 2020. In addition, Estonia would start commissioning its first offshore wind project, Loode Eesti Meretuulepark, with 250 MW installed out of the 700-1,100 MW potential capacity of the full project. A cooperation agreement would be signed between the Hiiu rural municipality and the project developer.

FIGURE 21
Market and cumulative installations under WindEurope's High Scenario



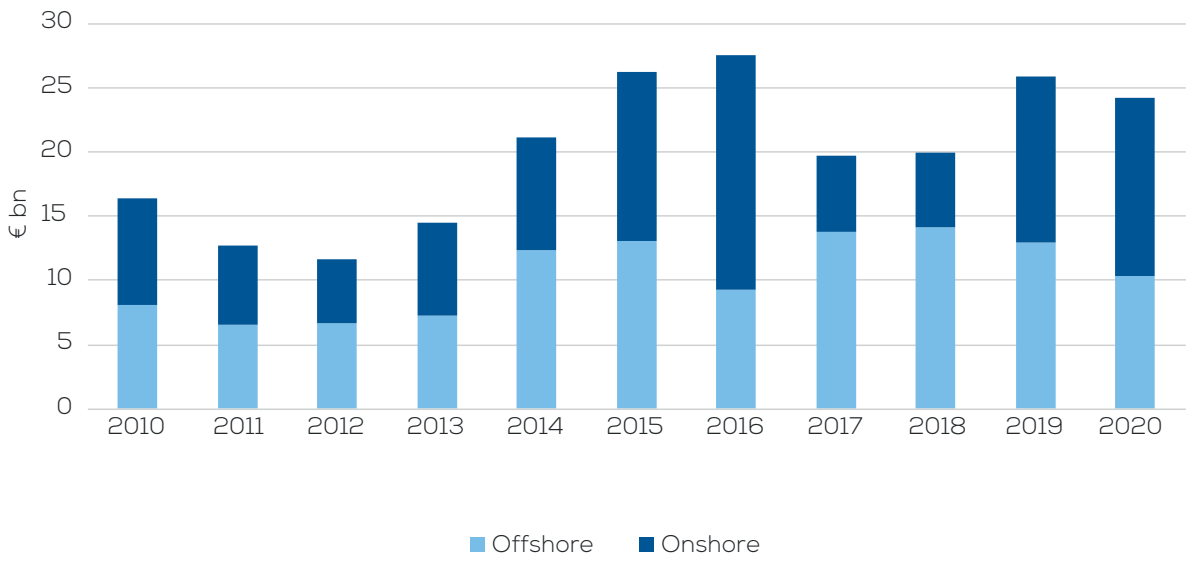
Source: WindEurope

2.4 INVESTMENT OUTLOOK

According to WindEurope, between 75 and 95 €bn in investments in new assets will be needed moving forward to 2020. Under the Central Scenario, €90bn of investments in new assets will be needed.

Whilst 2016 saw a record level of new investments, lower volumes are expected in the next 4 years, mainly due to two reasons. Firstly, cost reductions across the value chain have made it possible for investors to finance more capacity with less funds. Secondly, the transition from Feed-in Tariffs to auctions and Feed-in-Premiums, along with regulatory uncertainty for the post-2020 period, is also slowing down activity in some wind energy markets. While auctions are being rolled out in a larger number of markets, there will be a lull in investments before they lead to new project final investment decisions (FIDs).

FIGURE 22
Investment outlook in new assets for the period 2017-2020 under WindEurope's Central Scenario (in bn€)[9]



Source: WindEurope

9. Projects reaching final investment decision

2.5 GLOBAL WIND ENERGY MARKET OUTLOOK

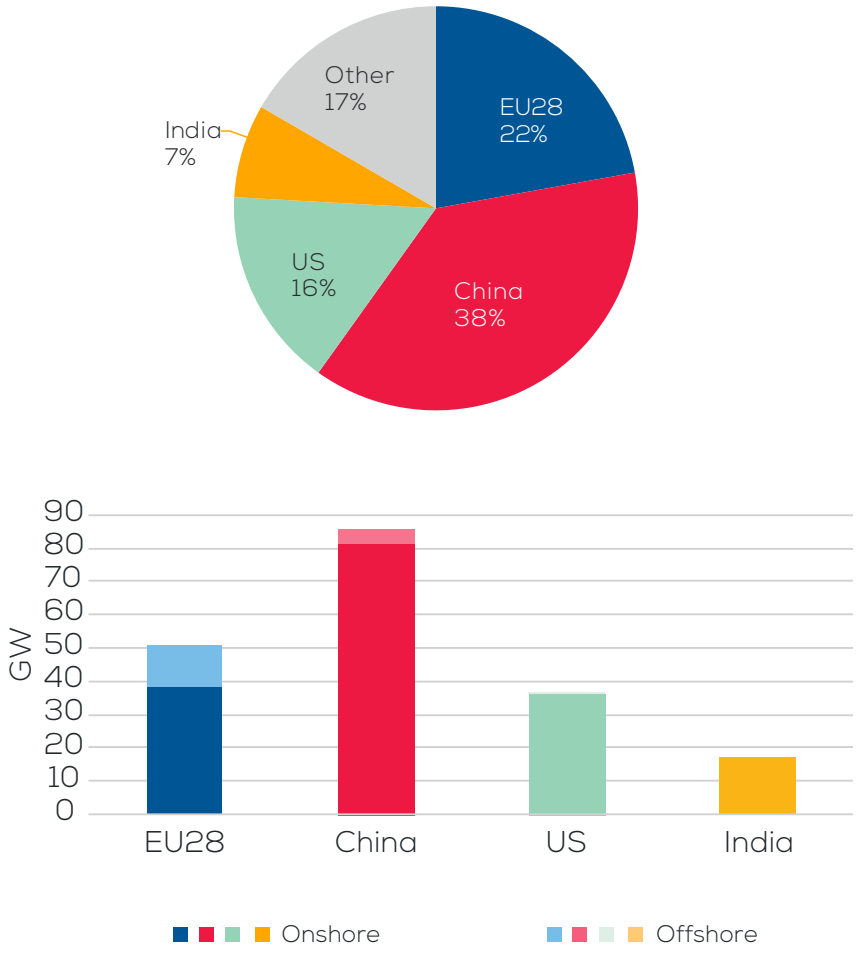
With more than 50 GW of new additions in the 2017-2020 period under the central scenario, the EU-28 will represent slightly less than a quarter of global installations, significantly lower than China, which expects to install almost the double 84 GW. Onshore wind installations in the US will be similar to those in Europe. However, no additions are expected on offshore wind technology. With 8% of world's market in the period, India is expected to bring additional 17 GW of onshore capacity.

NEW INSTALLATIONS IN THE EU WILL REPRESENT

22%

OF WORLD'S MARKET

FIGURE 23
Global wind installations in 2017-2020



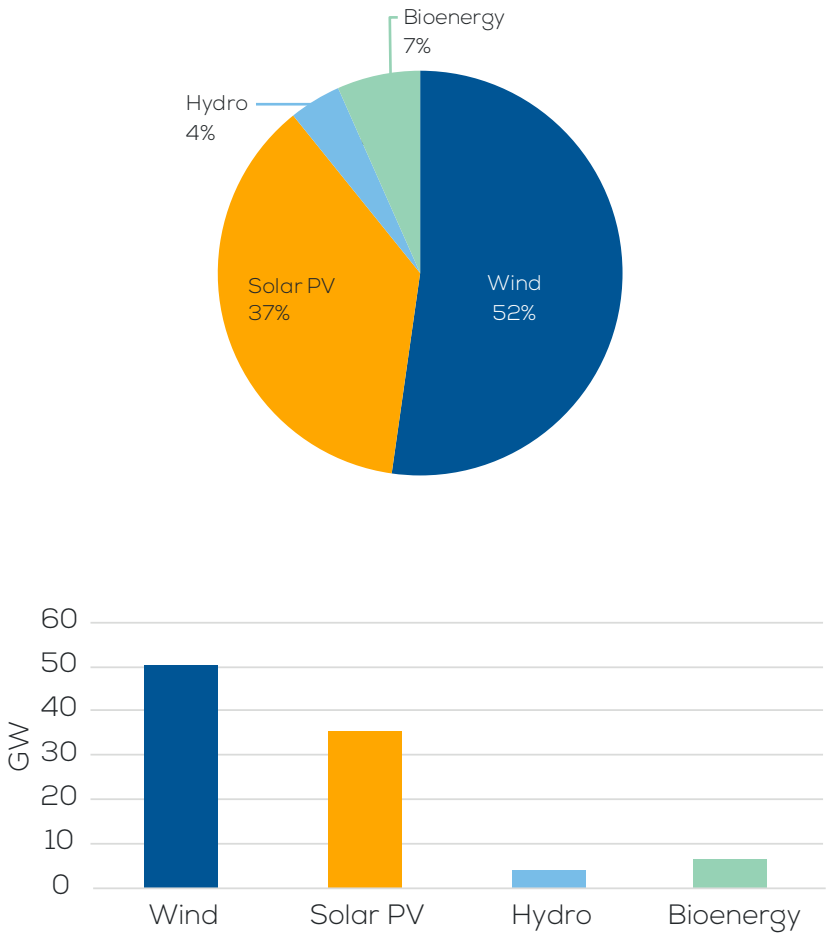
Source: WindEurope, IEA

2.6 RENEWABLE ENERGY SOURCES OUTLOOK

Under WindEurope's Central Scenario, wind power would account for more than half of new renewable installations between 2017 and 2020 in the EU. With 37% of new installations, solar PV will become the second source of growth in renewable capacity. Solar PV and wind energy will together represent almost 90% of new renewable capacity.

MORE THAN **HALF** OF NEW RENEWABLE INSTALLATIONS IN THE EU WILL BE FROM **WIND ENERGY**

FIGURE 24
Net growth in renewable capacity in 2017-2020

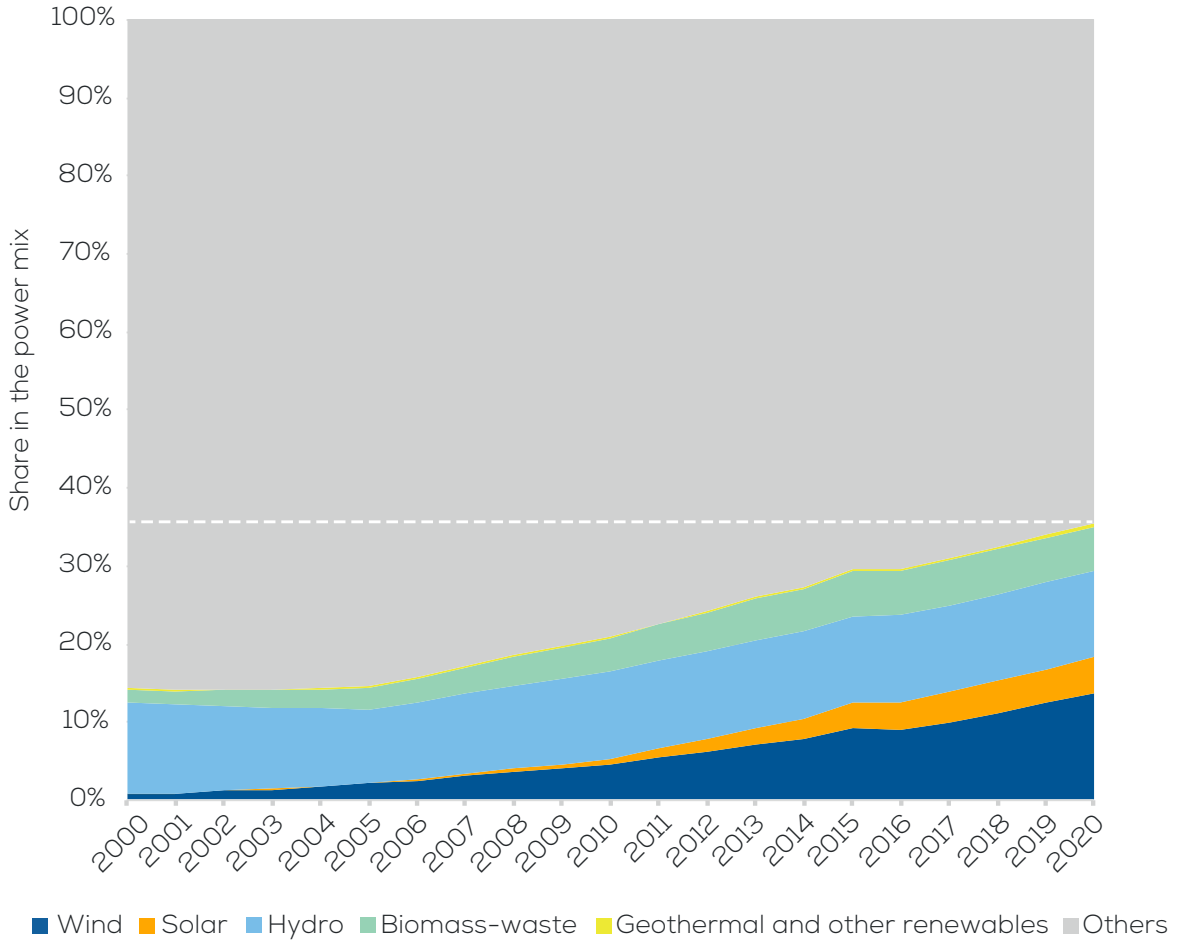


Source: WindEurope, SolarPower Europe, IEA

2.7 WIND ENERGY GENERATION

In 2020, renewables will be able to power approximately 35% of the EU's electricity mix. With 468 TWh in the Central Scenario, wind will overtake hydro (375 TWh) as the main source for renewable electricity generation. Biomass & waste (190 TWh) would become the third renewable electricity source, followed by solar PV (155 TWh).

FIGURE 25
Evolution of the EU's electricity mix



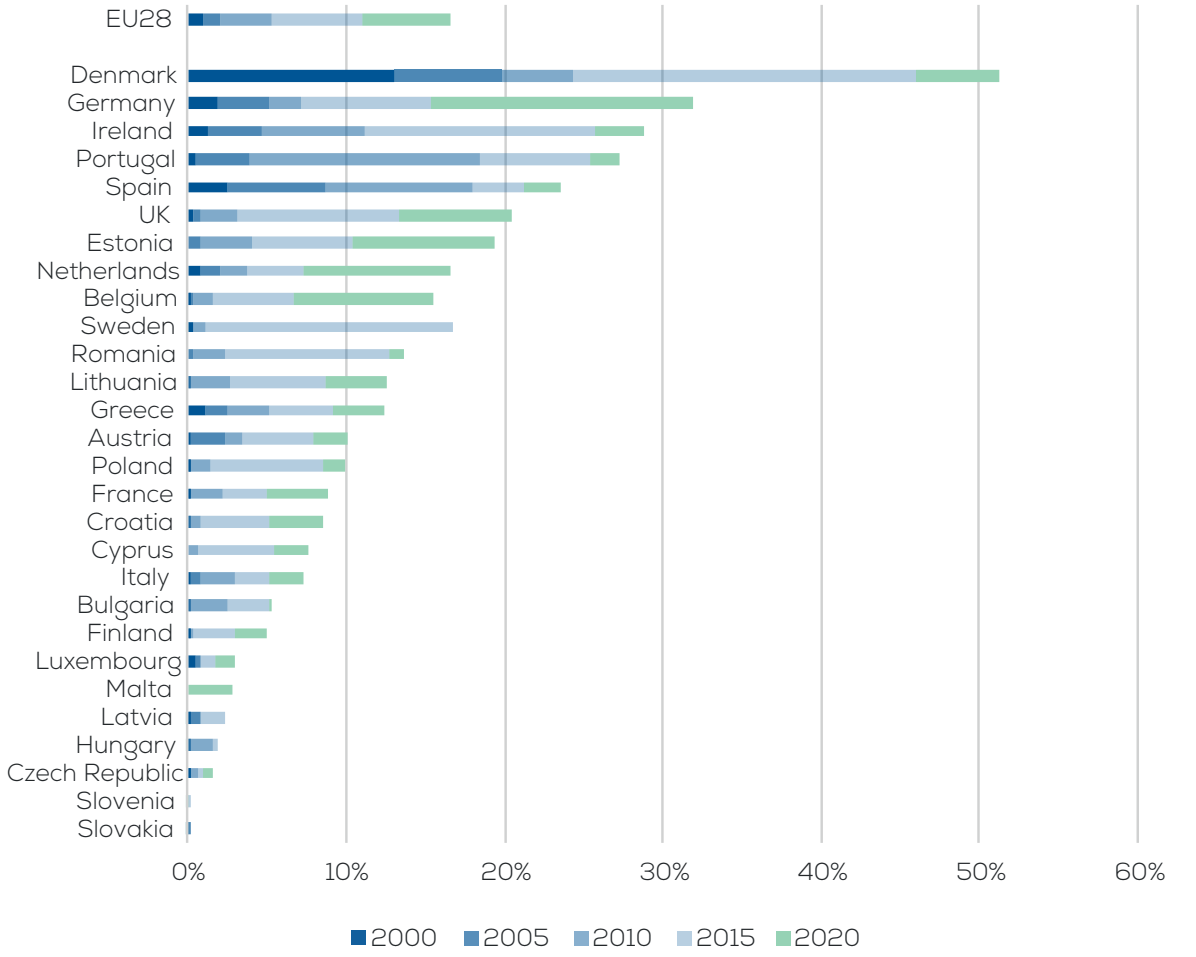
Source: WindEurope

The share of wind energy in electricity demand has increased significantly in the last 15 years, going from just 1% in 2000 up to 11% in 2015. And it is expected to continue growing, between 15.7% and 17.4% by the end of 2020. WindEurope's Central Scenario foresees a share of 16.5% of wind in the EU's electricity demand. Wind energy is thus expected to contribute significantly to the 2020 EU Renewable Energy target.

Denmark will remain the country with the highest share of wind power in its electricity demand. It will be the only country with more than half of its electricity supplied by wind energy. With an expected 30% share of wind in 2020, Germany will be the second highest country of wind energy penetration rate. Ireland, Portugal and Spain would follow with 29%, 27% and 24% of wind energy in their electricity demand respectively.

WIND ENERGY WILL COVER 16.5% OF EU'S ELECTRICITY DEMAND BY 2020

FIGURE 26
Evolution of wind energy share in EU's electricity demand



Source: WindEurope

3. TECHNOLOGY TRENDS

Wind turbine technology is facing a dramatic shift in both onshore and offshore markets, with a constant increase of turbine capacity.

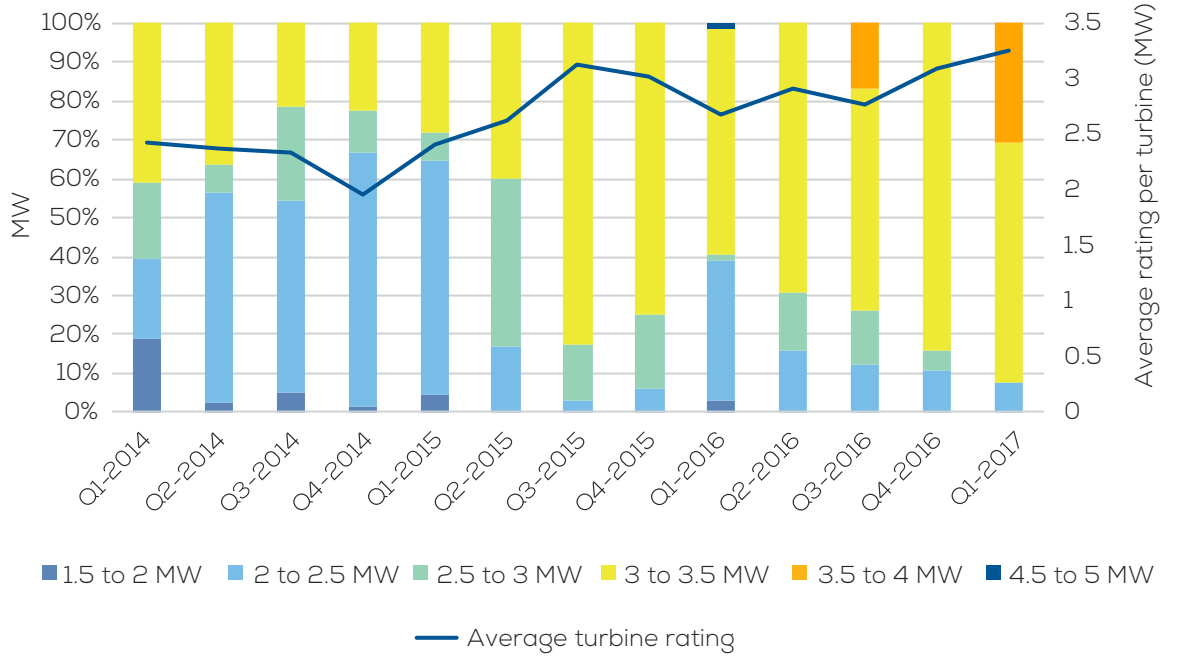
Towards 4 MW onshore wind platforms

In the first quarter of 2017, above 90% of onshore wind turbines ordered for delivery in 2018 to 2020 were above 3 MW[10] , a trend that is set to continue toward larger and

MOST ONSHORE TURBINES ORDERED IN H1 2017 ARE

ABOVE 3 MW

FIGURE 27
Capacity rating of ordered onshore wind turbines in Europe

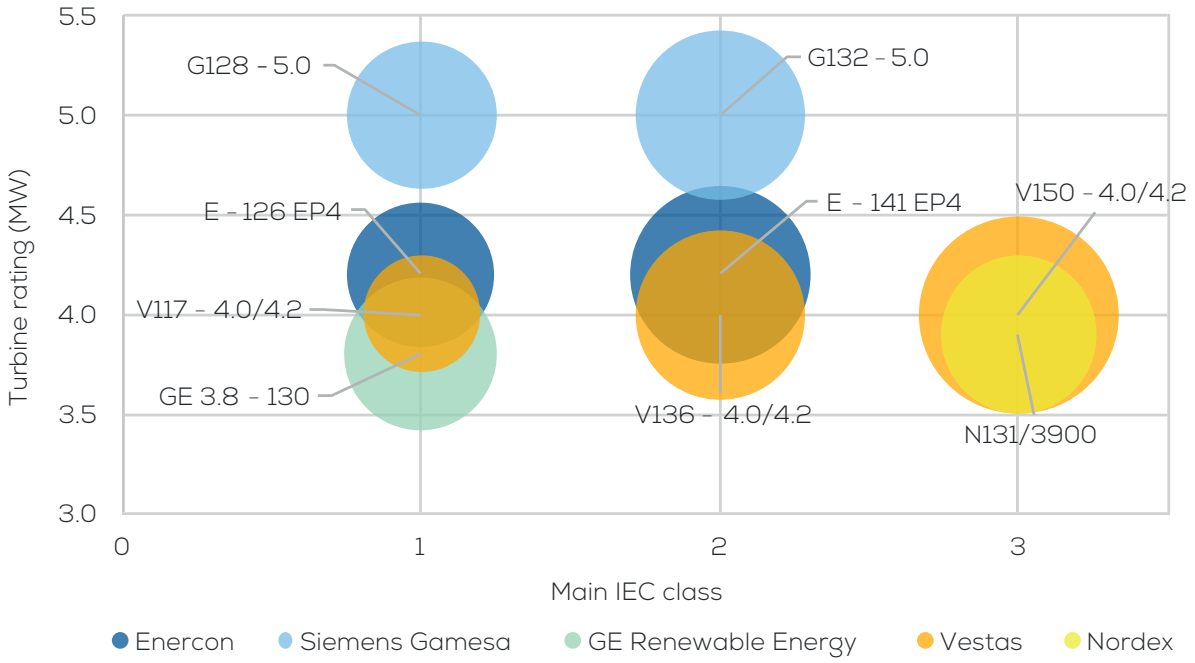


Source: WindEurope

10. See WindEurope's quarterly turbines order monitoring (members only)

In 2017, 4 MW platforms have appeared in almost every European turbine manufacturers' book and will be ready for installation as of 2018. The product diversity will allow operations from all wind sites between IEC I (high winds) to IEC III (light winds). Within these platforms, there is a very wide range of rotor diameters from 117 metres (for high winds) to 150 metres (light winds).

FIGURE 28
3.8 MW+ onshore turbines currently available in Europe (size of the bubble represents the rotor diameter)

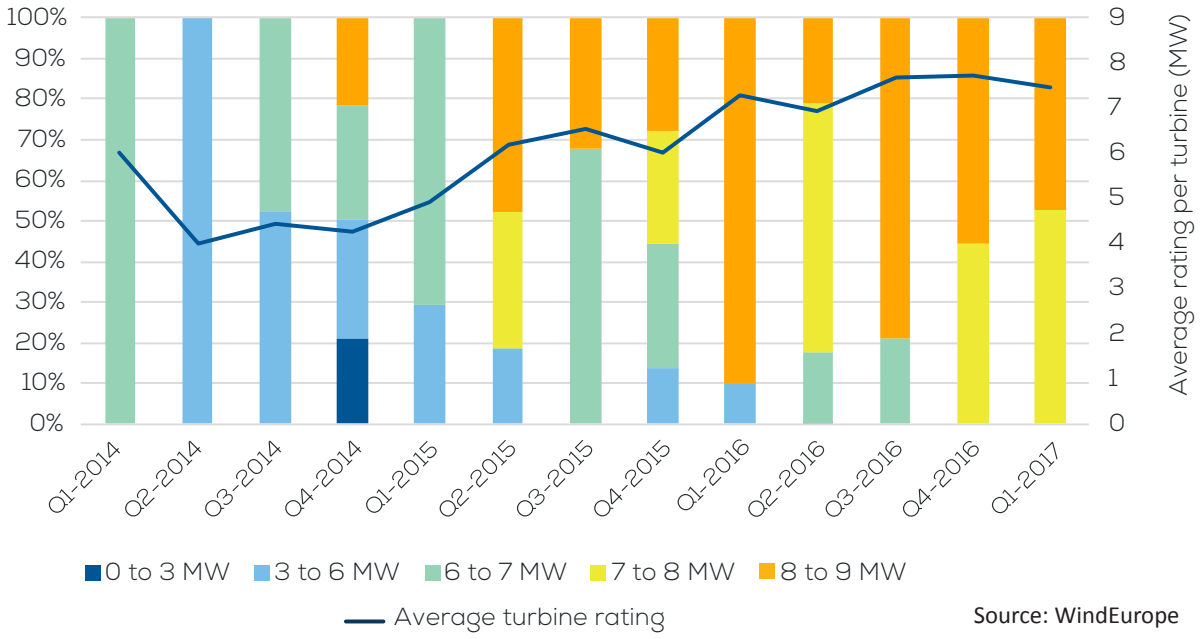


Source: WindEurope

Beyond 7 MW offshore wind platforms

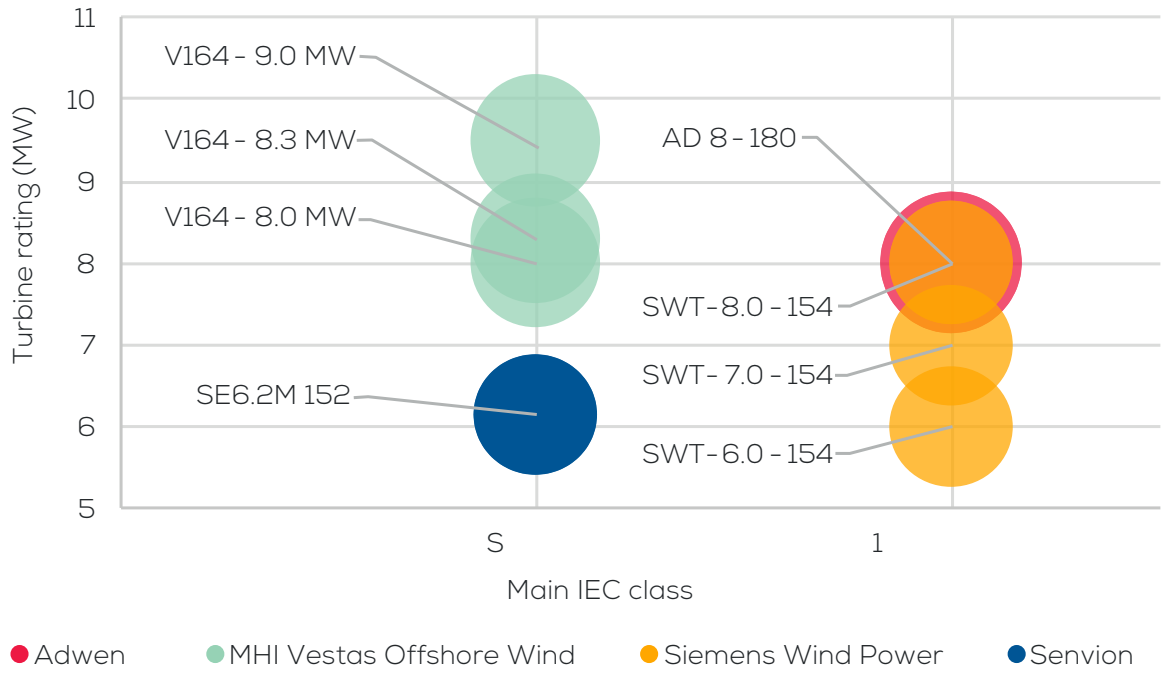
In the first quarter of 2017, all offshore wind turbines ordered were in the 7 to 9 range, following a trend that already started in 2016 and is expected to continue leading towards larger machines.

FIGURE 29
Capacity rating of ordered offshore wind turbines in Europe



Source: WindEurope

FIGURE 30
Recent 7 MW+ offshore turbines currently available in Europe (size of the bubble represents the rotor diameter)



Source: WindEurope

An increasing number of platforms above 7 MW have been introduced in turbine manufacturers' book since 2016. The rated capacity of offshore wind turbines has grown significantly over the past decade, facilitating the harnessing of sites with higher wind speeds (IEC 1) and capable of operating under extreme weather conditions (IEC S). Within these platforms, there is a very wide range of rotor diameters from 128 metres (for high winds) to 180 metres (light winds).

OFFSHORE TURBINES ORDERED SINCE 2016 ARE ABOVE 7 MW

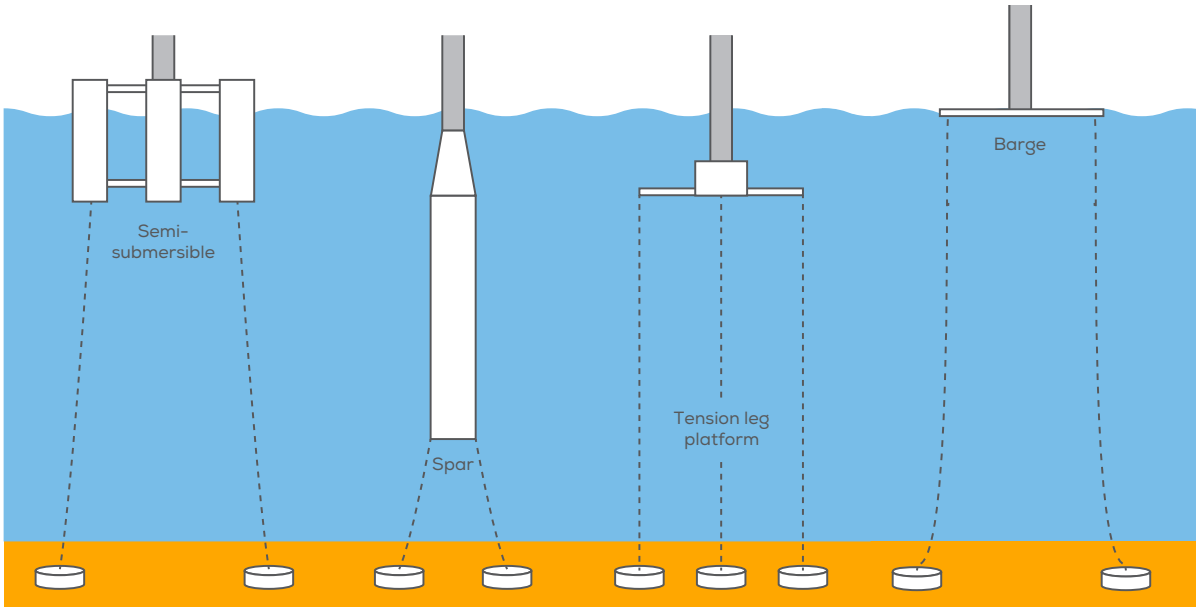
Floating offshore is coming of age

Floating offshore wind (FOW) is on the rise. While FOW technology was previously confined to R&D, the technology has developed significantly in recent years, and FOW is now ready to be deployed into the market. Semisubmersible and spar buoy floating substructures are now deemed appropriate for launch and operations, while the barge and the tension leg platform (TLP) floating substructure concepts are still under development and will be operational in the coming years. The floating offshore wind sector will benefit from the latest technologies available in the offshore wind supply chain, enabling costs to fall significantly in the years to come. 9 projects, with a total of 338 MW of capacity are planned to be commissioned by 2021 in France, the UK, Ireland and Portugal. [11]

The Hywind Scotland floating wind farm, the first commercial project, is expected to go live before the end of 2017, with the first turbines already towed to site in July 2017.

11. A detailed list of projects with capacity and commissioning date is available in WindEurope's Floating vision statement, June 2017

FIGURE 31
The four main technologies for floating offshore wind



Source: WindEurope

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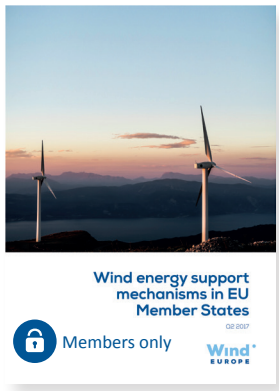

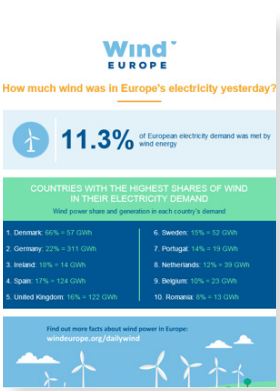

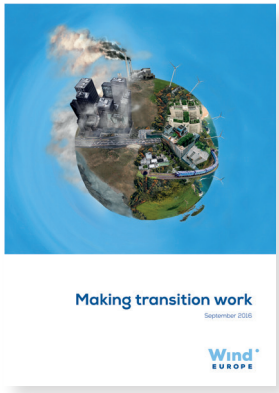

WindEurope is the voice of the wind industry, actively promoting wind power in Europe and worldwide. It has over 450 members with headquarters in more than 40 countries, including the leading wind turbine manufacturers, component suppliers, research institutes, national wind energy associations, developers, contractors, electricity providers, financial institutions, insurance companies and consultants. This combined strength makes WindEurope the world's largest and most powerful wind energy network.

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