



Wind energy in Europe in 2018

Trends and statistics

Wind[•]
EUROPE

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This report summarises new installations and financing activity in Europe's wind farms from 1 January to 31 December 2018.

WindEurope regularly surveys the industry to determine the level of installations of wind farms, and the subsequent dispatch of first power to the grid. The data represents gross installations per site and country unless otherwise stated. Rounding of figures is at the discretion of the author.

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TEXT AND ANALYSIS:

WindEurope Business Intelligence

Ivan Komusanac

Daniel Fraile

Guy Brindley

EDITORS:

Colin Walsh

Ivan Pineda

DESIGN:

Lin Van de Velde, Drukvorm

FINANCE DATA:

Clean Energy Pipeline

IJ Global

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MORE INFORMATION:

policy@windeurope.org

+32 2 213 18 68

CONTENTS

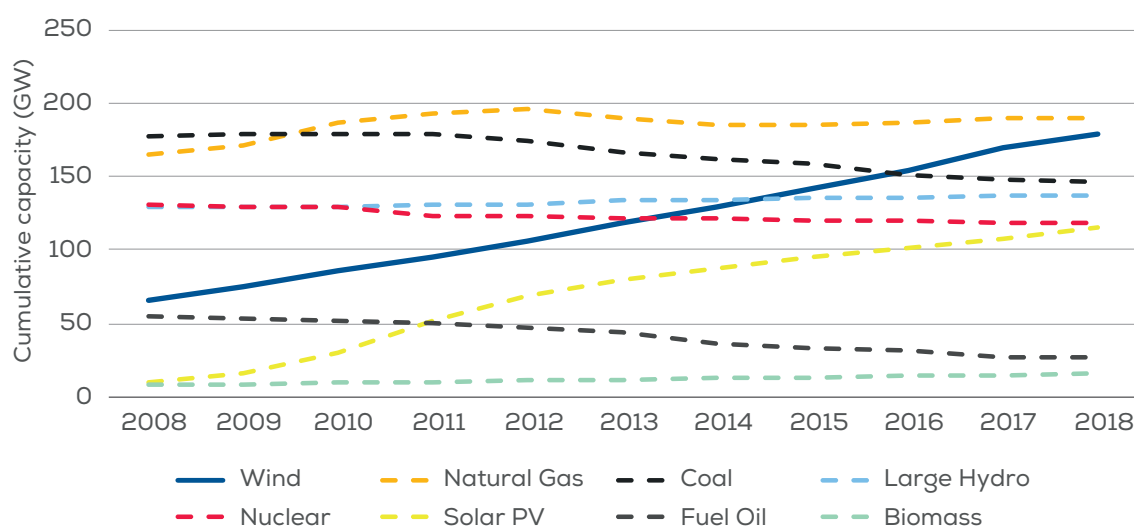
EXECUTIVE SUMMARY	7
1. WIND POWER INSTALLATIONS	11
1.1 Overview	11
1.2 National breakdown of 2018 installations	12
1.3 Cumulative wind power installations	14
1.4 Decommissioning and repowering of wind installations	16
1.5 Wind power generation	17
1.6 Wind turbine size	20
1.7 Auctions and tenders in 2018	21
2. INVESTMENT NUMBERS IN 2018	23
3. TOTAL NEW CAPACITY ADDITIONS	27
ANNEX 1	30

EXECUTIVE SUMMARY

Europe installed 11.7 GW (10.1 GW in EU-28) of new wind energy in 2018. This is a 32% decrease on 2017. Europe decommissioned 0.4 GW of wind turbines. So the net increase in Europe's wind energy capacity in 2018 was 11.3 GW.

With a total installed capacity of 178.8 GW in the EU, wind energy remains the second largest form of power generation capacity in the EU-28 and is likely to overtake natural gas installations in 2019.

FIGURE 1
Total power generation capacity in the European Union 2008-2018



Source: WindEurope

2018 annual figures

- Europe installed 11.7 GW of new wind energy in 2018. This is a decrease of 32% compared to 2017 annual installations. 9 GW were onshore, and 2.65 GW were offshore. Europe decommissioned 0.4 GW of wind capacity, almost all of which was onshore wind.
- 2018 was the lowest year for new onshore installations since 2008.
- New offshore installations were 16% down on 2017 (a record year).
- Wind power installed more capacity than any other form of power generation in the EU in 2018. It accounted for 48% of total power capacity installations.
- Renewable energy accounted for 95% of all new EU power installations in 2018: 19.8 GW of a total 20.7 GW of new power capacity.
- With 362 TWh generated in 2018, wind power covered 14% of the EU's electricity demand.
- 2018 was a record year for new Final Investment Decision (FID) in future capacity. In total, 16.7 GW worth of projects reached FID: 4.2 GW in offshore and 12.5 GW in onshore wind. This compares to 11.5 GW in FIDs in 2017. Sweden led with 3.2 GW of FIDs (all onshore). The UK had the most offshore wind FIDs with 1.9 GW.
- Investments were up on 2017 by 20% to €26.7bn, almost equalling the record year for investment in 2016. Offshore investments were €10.3bn. Onshore investments hit a record level of €16.4bn.
- Wind energy accounted for 63% of the investments in renewable energy in 2018, up from 52% in 2017.

Trends and cumulative installations

- There is now 189 GW of installed wind power capacity in Europe: 170 GW onshore and 19 GW offshore.
- Wind energy now accounts for 18.4% of the EU's total installed power generation capacity.
- The total installed power generation capacity in the EU increased by 17.5 GW in 2018 to 977 GW.
- Conventional power sources such as fuel, oil and coal continue to decommission more capacity than they install. New natural gas and coal installations in the EU reached a record-low with a mere 0.9 GW of additions.

Country highlights

- Germany installed the most wind power capacity in 2018, with 29% of Europe's gross installations, but their new installations were down 49% on 2017.
- Germany remains the European country with the largest installed wind power capacity, followed by Spain, the UK and France. 6 countries have more than 5 GW of wind installations (Italy, Sweden, Turkey, Poland, Denmark and Portugal).
- Denmark is the country with the highest share of wind energy in its electricity demand (41%). The UK registered the largest annual increase of wind energy in its electricity demand, from 13.5% to 18%. Ireland (28%), Portugal (24%), Germany (21%) and Spain (19%) are the other countries with the highest share of wind in their electricity mix.

11.7 GW

TOTAL EUROPE

10.1 GW

OF NEW WIND POWER
IN THE EU

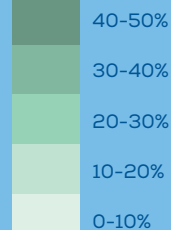
Cumulative
installed
capacity
(GW)¹

GW

GW

New
installations
in 2018 (GW)

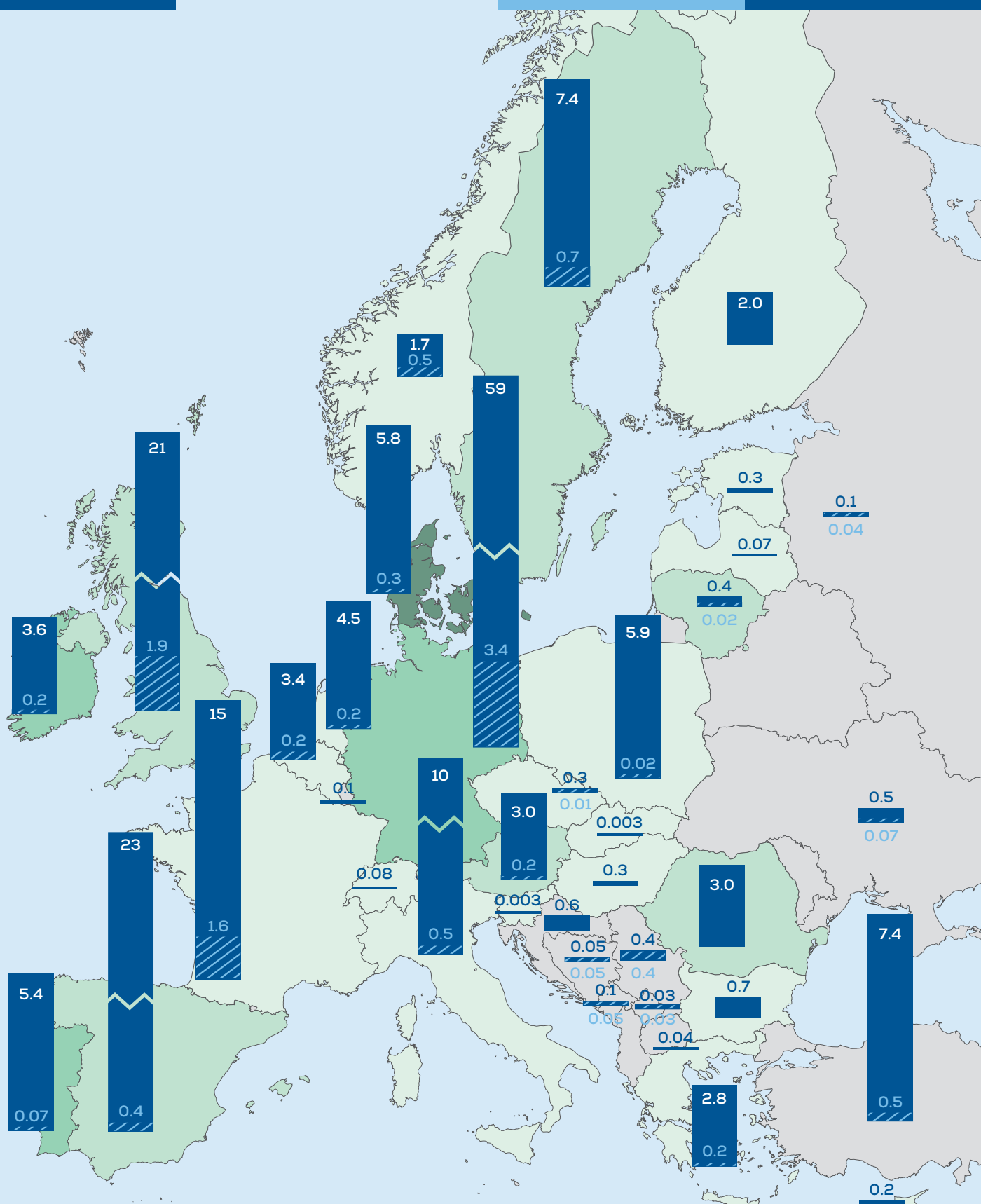
Share
of wind
in power
demand²



WIND ENERGY
COVERED

14%

OF EU ELECTRICITY
DEMAND IN 2018



1. Cumulative capacity in each country reflects decommissioning in 2018: Austria (29 MW), Denmark (12.7 MW), Finland (3 MW), France (12.6), Germany (249 MW), Greece (15.4 MW), the Netherlands (72 MW), Portugal (13.7 MW), Sweden (13.3 MW).
2. Grey colored countries did not provide data for electricity generation and consumption to ENTSO-E transparency platform.

Source: WindEurope

TABLE 1

Gross installations, decommissioning and cumulative capacity in 2018³

EU-28 (MW)	NEW INSTALLATIONS 2018		DECOMMISSIONED	CUMULATIVE CAPACITY 2018 ⁴
	ONSHORE	OFFSHORE		
Austria	230	-	29	3,045
Belgium	204	309	-	3,360
Bulgaria	-	-	-	691
Croatia	-	-	-	583
Cyprus	-	-	-	158
Czechia	14	-	-	317
Denmark	220	61	13	5,758
Estonia	-	-	-	310
Finland	0	-	3	2,041
France	1,563	2	13	15,309
Germany	2,402	969	249	59,311
Greece	207	-	15	2,844
Hungary	-	-	-	329
Ireland	193	-	-	3,564
Italy	452	-	-	9,958
Latvia	-	-	-	66
Lithuania	18	-	-	439
Luxembourg	-	-	-	120
Malta	-	-	-	-
Netherlands	166	-	72	4,471
Poland	16	-	-	5,864
Portugal	67	-	14	5,380
Romania	-	-	-	3,029
Slovakia	-	-	-	3
Slovenia	-	-	-	3
Spain	392	5	-	23,494
Sweden	717	3	13	7,407
UK	589	1,312	-	20,970
Total EU-28	7,450	2,661	421	178,826

EU-28 (MW)	NEW INSTALLATIONS 2018		DECOMMISSIONED	CUMULATIVE CAPACITY 2018 ⁴
	ONSHORE	OFFSHORE		
Bosnia and Herzegovina	51	-	-	51
Kosovo	32	-	-	32
Montenegro	46	-	-	118
North Macedonia	-	-	-	37
Norway	480	-	-	1,675
Russia	35	-	-	139
Serbia	356	-	-	374
Switzerland	-	-	-	75
Turkey	497	-	-	7,369
Ukraine	68	-	-	533
Total others	1,566	-	-	10,403
Total Europe	9,015	2,661	421	189,229

3. All numbers are rounded and therefore may not add up

4. Cumulative capacity reflects decommissioning

1. WIND POWER INSTALLATIONS

1.1 OVERVIEW

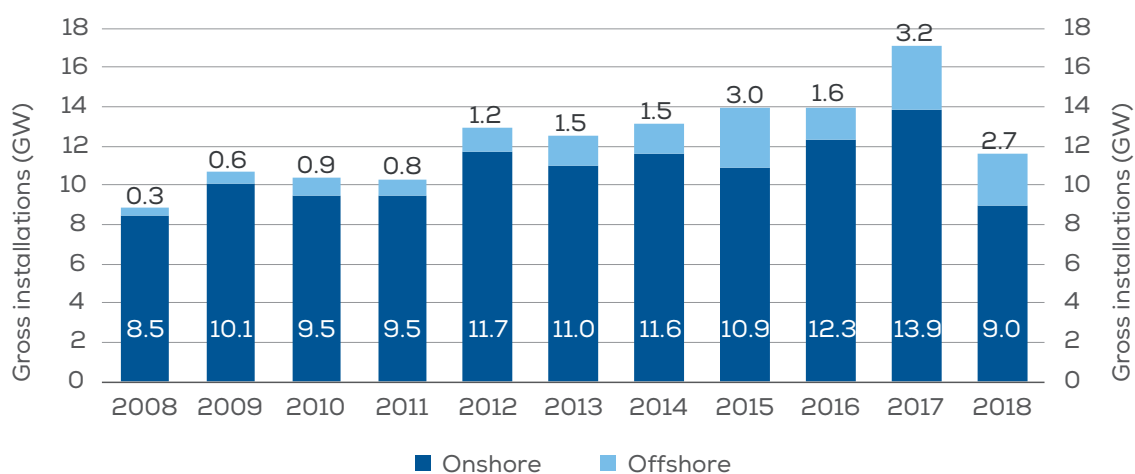
In 2018 gross annual wind installations in Europe fell to 11.7 GW, with 0.4 GW being decommissioned. This marks a significant decrease compared to 17.1 GW in 2017, a record year for Europe and a number of countries: Belgium, France, Germany, Ireland, and the UK.

Offshore wind represented 23% of the gross annual installations in Europe, with 2.65 GW of new capacity connected to the grid in 2018.

In 2018 gross annual wind installations in the EU-28 were 10.1 GW. This represents 87% of installations in Europe. This is the lowest amount since 2011, and reflects regulatory changes that European Member States have undertaken since the review of the European State-Aid Guidelines. This has led many countries to introduce auctions since 2016, creating a new environment for permitting and project development; resulting in a slowdown.

FIGURE 2

Gross annual onshore and offshore wind installations in Europe



Source: WindEurope

1.2 NATIONAL BREAKDOWN OF 2018 INSTALLATIONS

Germany installed 29% of new wind energy capacity in 2018. This is significantly lower than Germany's 2017 figure of 39%. It added 969 MW of offshore wind across 3 wind farms. One of them, Borkum Riffgrund II (465 MW) was fully connected to the grid, becoming the largest offshore wind farm in Germany to date⁵. Onshore installations recorded a significant decrease, from 5,334 MW in 2017 to 2,402 MW in 2018. This is a consequence of lengthy permitting processes and citizens' projects that were granted longer build-out periods.

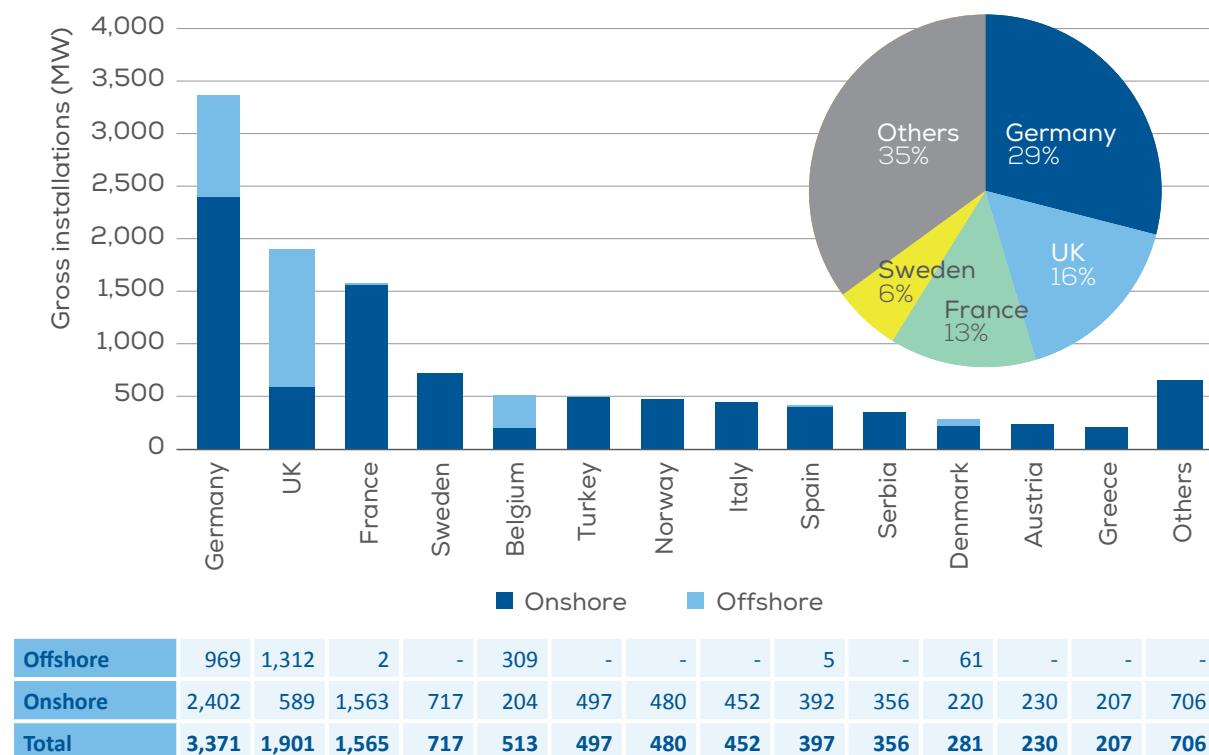
65% OF WIND POWER

IN EUROPE WAS INSTALLED IN JUST 4 COUNTRIES: GERMANY, THE UK, FRANCE AND SWEDEN.

The UK was the second largest market, with 16% of gross installations. Offshore installations represent 2/3 of the additions. The Walney 3 Extension offshore wind farm was completed in October. With 87 turbines and a capacity of 657 MW, this is now the largest operational offshore wind farm in the world.

The UK experienced a significant decrease in onshore wind installations. The end of the Renewable Obligation Certificate (ROC) caused a peak in 2017 and onshore wind installations will now have to rely on Power Purchase Agreements (PPAs) and other merchant options, as the UK government has given clear signals that there will be no auctions for onshore wind. After a stunning European installation share of 26% in 2017, wind installations in the UK fell to 16% in 2018.

FIGURE 3
2018 gross annual onshore and offshore wind installations in Europe



Source: WindEurope

5. For a detailed analysis of the offshore market, visit <https://windeurope.org/about-wind/statistics/offshore/european-offshore-wind-industry-key-trends-statistics-2018/>

France was the third largest market, with 13% of installations. But the authorisation process for onshore wind projects in France is severely delayed or even suspended in some parts of the country. Developing an onshore wind farm in France currently takes up to 8 years.

And so far no commercial offshore wind farm has been developed (although the government already held auctions in 2011). In France, installations fell from 1,692 MW in 2017 to 1,565 MW in 2018. However, due to overall lower installations in Europe in 2018, France's share of installations in Europe increased from 10% in 2017 to 13%.

Sweden had 6% of installations in Europe and the joint Swedish-Norwegian electricity certificate system is fully subscribed nine years in advance of its expiration date.

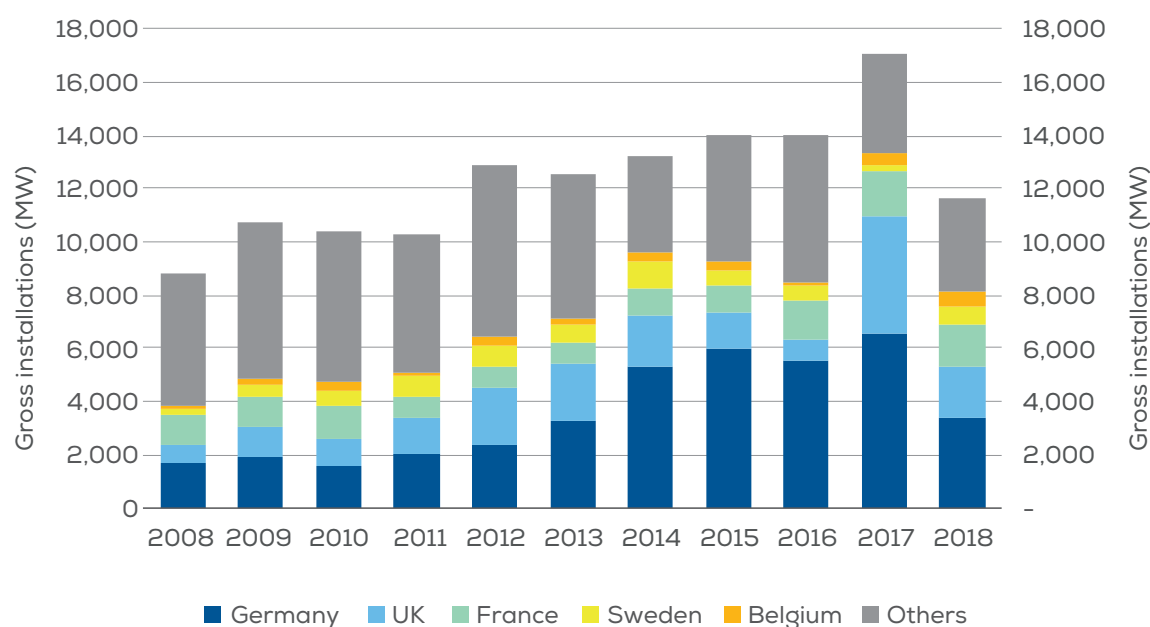
Belgium, Turkey, Norway and Italy each had installations between 450 and 500 MW.

14 countries did not have any wind installations in 2018. 12 of these are EU-28 Member States.

44% OF WIND INSTALLATIONS

IN 2018 CAME FROM GERMANY AND THE UK, COMPARED TO 65% IN 2017

FIGURE 4
Distribution of the gross annual wind installations in Europe



Source: WindEurope

1.3 CUMULATIVE WIND POWER INSTALLATIONS

189 GW of wind power capacity are now installed in Europe. 10% of these are offshore. Cumulative capacity grew 6% compared to 2017. Germany remains the country with the largest installed capacity in Europe, followed

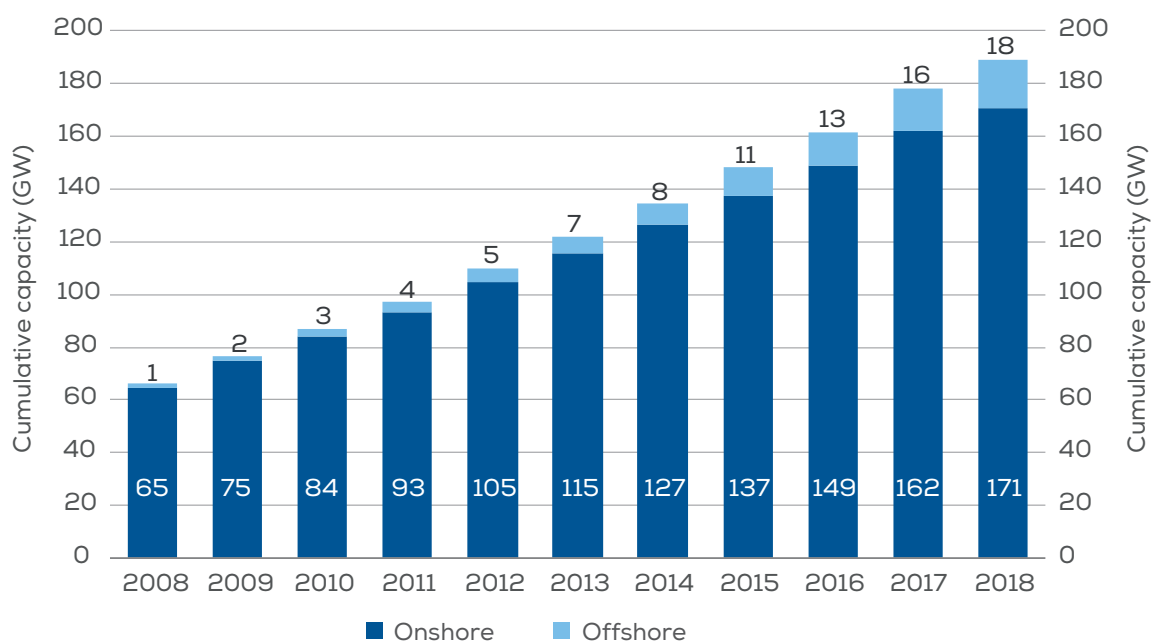
by Spain, the UK, France and Italy. Five other countries (Sweden, Poland, Portugal and Denmark) have more than 5 GW installed. Five additional countries have over 3 GW of installed capacity: the Netherlands, Ireland, Belgium, Austria and Romania.

189 GW

OF WIND POWER ARE NOW INSTALLED
IN EUROPE

In the EU-28, cumulative capacity reached 178.8 GW. The EU-28 provides almost all of the installed offshore wind capacity in Europe.

FIGURE 5
Cumulative onshore and offshore installations in Europe



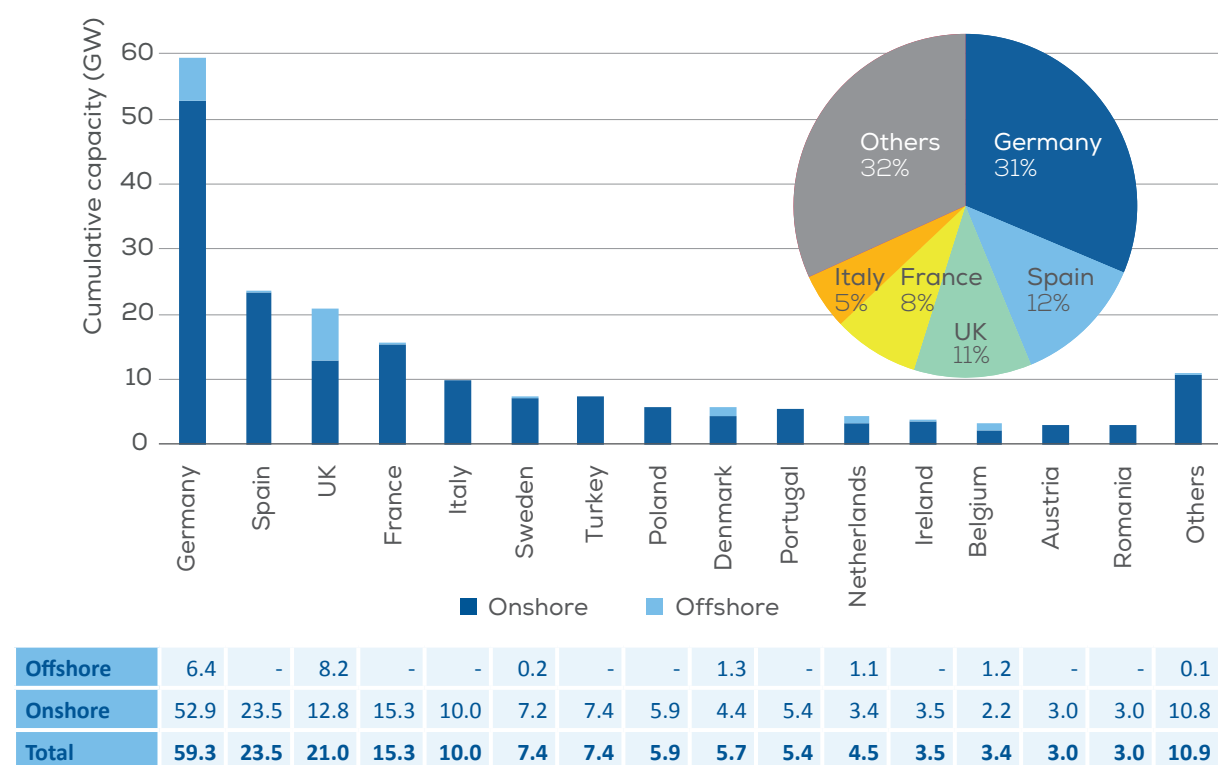
Source: WindEurope

68% of all wind power installations in Europe is in 5 countries: Germany (59.3 GW), Spain (23.5 GW), the UK (21 GW), France (15.3 GW) and Italy (10 GW). Sweden, Turkey and Poland follow with 7.4 GW, 7.4 GW and 5.9 GW respectively.

68% OF WIND POWER
IN EUROPE IS INSTALLED IN
5 COUNTRIES

FIGURE 6

Cumulative onshore and offshore installations by country



Source: WindEurope

1.4 DECOMMISSIONING AND REPOWERING OF WIND INSTALLATIONS

In 2018, 421 MW of wind power were decommissioned, down from 683 MW in 2017. This took place in Germany (249 MW), the Netherlands (72 MW), Austria (29 MW),

Greece (15.4 MW), Portugal (13.7 MW), Sweden (13.3 MW), Denmark (12.7 MW), France (12.6 MW) and Finland (3 MW). Most of this (407 MW) was in onshore wind.

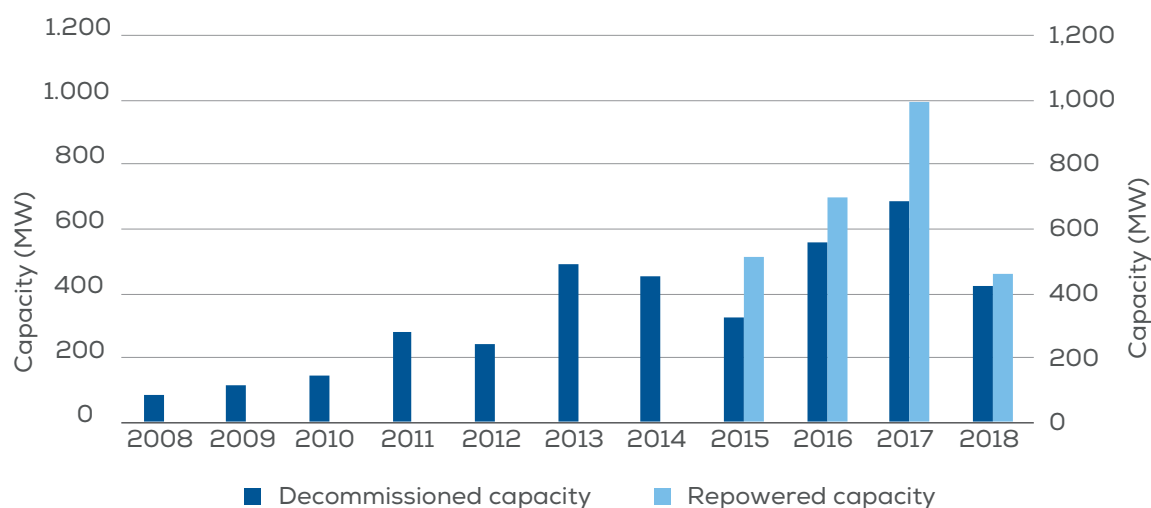
421 MW

OF WIND POWER WERE
DECOMMISSIONED IN 2018

Out of the decommissioned 421 MW, a number of projects were repowered. That and a part of decommissioned capacity in 2017 resulted in 461 MW of repowered capacity.

The majority came from Germany, but there was also repowering activity in Austria, France, Portugal and Spain.

FIGURE 7
Decommissioned and repowered capacity



Repowering terminology Example - Tauerwindpark (Austria)			
Old project		New project	
Number of turbines	13	Number of turbines	9
Turbine power rating	1.8	Turbine power rating	3.5
Repowered capacity	23	Repowered capacity	31

Decommissioned capacity = repowered capacity + fully decommissioning

Source: WindEurope

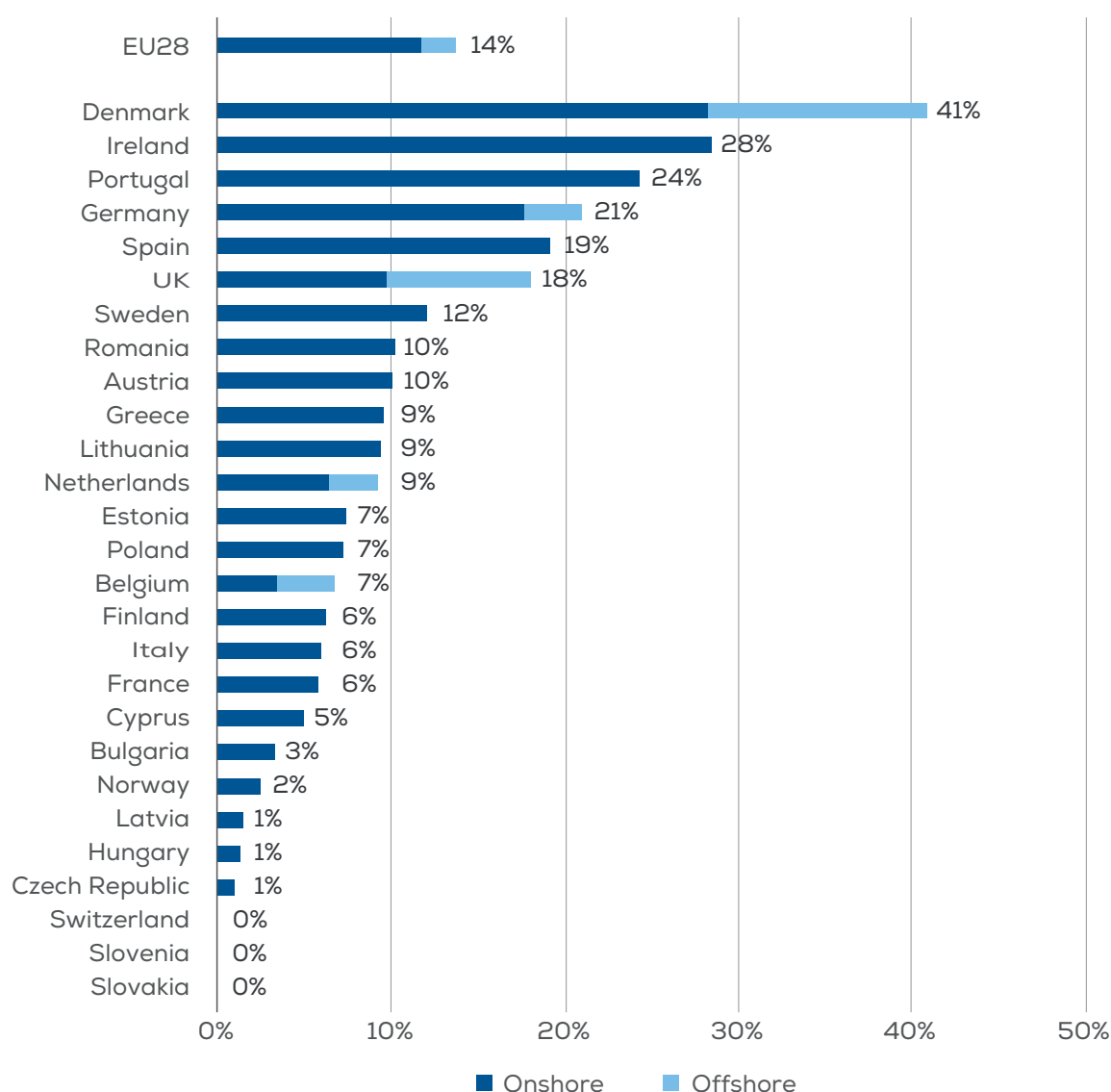
1.5 WIND POWER GENERATION

In 2018 wind energy generated enough electricity to meet 14% of the EU's electricity demand⁶. This is a 2% share higher than in 2017 levels, in part due to the lower electricity demand registered⁷.

Denmark had the highest share of wind (41%) in Europe, followed by Ireland (28%) and Portugal (24%). Germany, Spain and the UK follow with 21%, 19% and 18% respectively. 9 Member States had a wind share of 10% or more.

FIGURE 8

Percentage of the average annual electricity demand covered by wind⁸



Source: WindEurope

6. At time of publication, generation data for Luxembourg, Croatia and Malta was not available (their combined demand represent less than 1% of EU demand).
7. Data from ENTSO-E transparency platform. It excludes data for Luxembourg, Croatia and Malta. Data for the UK comes from BEIS quarterly reports. Data for Ireland has been corrected for January to March (using 2017 values) due to lack of information.
8. The figures represent the average of the share of wind in final electricity demand, captured hourly from ENTSO-E and corrected thanks to national TSOs and BEIS data. Data is not available from all European countries.

TABLE 3

Electricity production from wind power (TWh)

EU ELECTRICITY CONSUMPTION (TWH) ⁹	ONSHORE WIND ENERGY PRODUCTION (TWH)	OFFSHORE WIND ENERGY PRODUCTION (TWH)	TOTAL WIND ENERGY PRODUCTION (TWH)	SHARE OF EU CONSUMPTION MET BY WIND ENERGY
2,645	309	53	362	14%

Throughout 2018, wind power plants produced a stable output, with peak production (98 GW of average output during the day) on 8 December. On that day, wind energy supplied one third of Europe's electricity needs.

2018 was a less windy year than 2017. This is reflected in a decrease of the capacity factors both for onshore (22%) and offshore (36%).

9. See footnote 4.

EUROPEAN WIND ENERGY GENERATION | 2018

14%

of EU's electricity demand

24%

Average capacity factor

41% 28% 24% 21% 19%



Highest wind energy penetration rates

ONSHORE

160 GW

onshore wind capacity

12%

onshore wind of EU's electricity demand

22%

average onshore wind capacity factor

OFFSHORE

18.5 GW

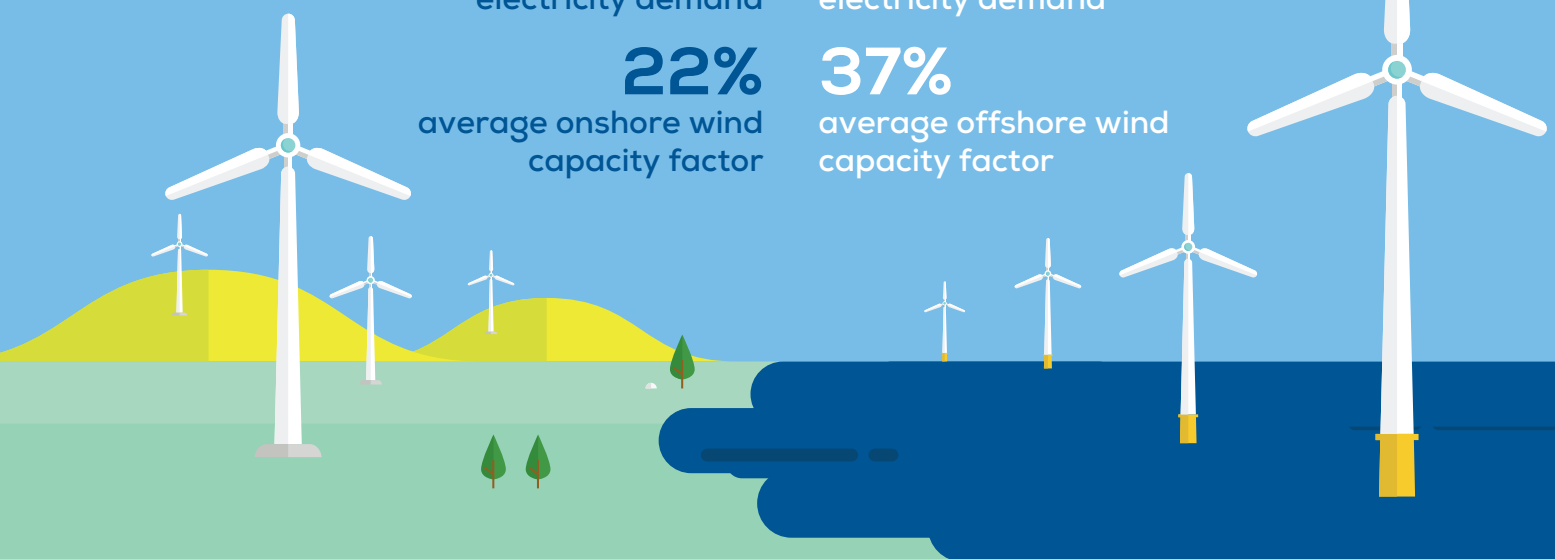
offshore wind capacity

2%

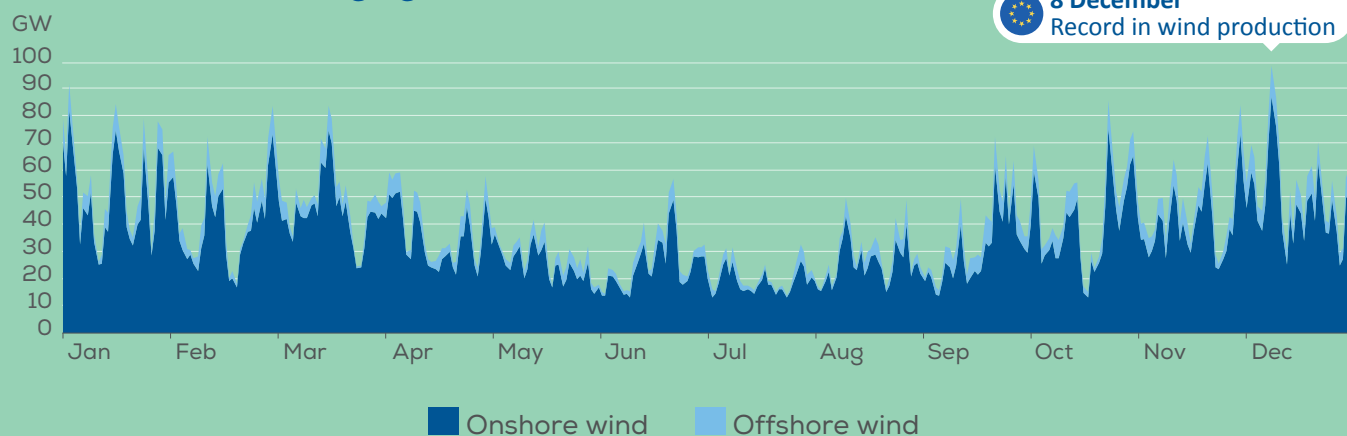
offshore wind of EU's electricity demand

37%

average offshore wind capacity factor



European wind energy generation in 2018



Data refers to EU Member States only

1.6 WIND TURBINE SIZE

The size and type of wind turbines installed in Europe varied significantly between countries. On average, the most powerful onshore wind turbines were installed in Norway, with an average rating of 3.6 MW. Lithuania and Greece

had the lowest average power rating: 2 MW. The weighted average onshore turbine size was 2.7 MW.

In 2018 the average rated capacity of newly installed offshore turbines was 6.8 MW, 15% larger than in 2017. The largest turbine in the world was installed in the United Kingdom. Two V164-8.8 MW from MHI Vestas Offshore Wind, with a rotor diameter of 164m, were connected at the European Offshore Wind Development Centre (EOWDC) wind farm. However, the average power rating of offshore turbines in the UK was 5.9 MW. The largest average power rating was in Denmark, with 7.7 MW.

8.8 MW
WAS THE POWER RATING OF THE LARGEST TURBINE INSTALLED IN 2018

FIGURE 9
Number of turbines installed in 2018 and their average power rating



Source: WindEurope

1.7 AUCTIONS AND TENDERS IN 2018

In 2018 8 countries had renewable energy auctions where wind energy secured volumes for 9.3 GW. It is hard to compare auction results between different countries due to the different support mechanisms, their length, the maturity of markets, and conditions surrounding the auctions such as cost of capital (WACC), permitting and other sources of revenue or risks for developers. Nevertheless, several auction results were notable. The German and Dutch offshore auctions saw zero-subsidy bids. The latest onshore wind auctions in Germany and France were undersubscribed, while the Polish, Danish and Greek auctions recorded extremely low prices in their countries due to a healthy pipeline of permitted projects.

Auctions in Finland and the SDE+ onshore renewable auction in the Netherlands had not released their results by the time of this publication.

9.3 GW

WAS AWARDED TO WIND THROUGH
AUCTIONS AND TENDERS IN 2018

TABLE 4

Successful auctions and tenders for wind energy in 2018

	Country	MW AWARDED	TYPE OF AUCTION	SUPPORT MECHANISM ¹⁰	PRICE IN €/MWH
	Denmark	165	Technology-neutral	Feed-in-premium (fixed)	2.5 – 3.4 ¹¹
	France	118	Technology-specific	Feed-in-premium (floating)	Not Available
	Germany	709	Technology-specific	Feed-in-premium (floating)	38.0 – 52.8
		604	Technology-specific	Feed-in-premium (floating)	46.5 – 62.8
		666	Technology-specific	Feed-in-premium (floating)	40.0 – 63.0
		363	Technology-specific	Feed-in-premium (floating)	50.0 – 63.0
	Greece	171	Technology-specific	Feed-in-premium (floating)	68.2 – 71.9
		159	Technology-specific	Feed-in-premium (floating)	55.0 – 65.4
	Netherlands	68	Technology-neutral	Feed-in-premium (floating)	Not Available
	Poland	1,000	Technology-neutral	Contract for difference	36.4 – 50.1
	Russia	823	Technology-specific	Quotas for capacity	Not Available
	Turkey	2,110	Technology-specific	Feed-in-Tariff	-2.4 – 6.1 ¹²

	Country	MW AWARDED	TYPE OF AUCTION	SUPPORT MECHANISM	PRICE IN €/MWH
	Germany	1,610	Technology-specific	Feed-in-premium (floating)	0 – 98.3
	Netherlands	700	Technology-specific	Zero-subsidy bid	0

10. For an explanation between the different types of auctions see Annex 1

11. The price reflects the premium on top of the wholesale electricity price in Denmark, while other countries with a feed-in-premium (floating) already include wholesale electricity price.

12. Because of the Local Content Rule in Turkey, low revenue can be compensated with local content price premiums from the government and that's why developers were able to bid lower than anywhere else in Europe.



Photo: Keith Arkins

2.

INVESTMENT NUMBERS IN 2018

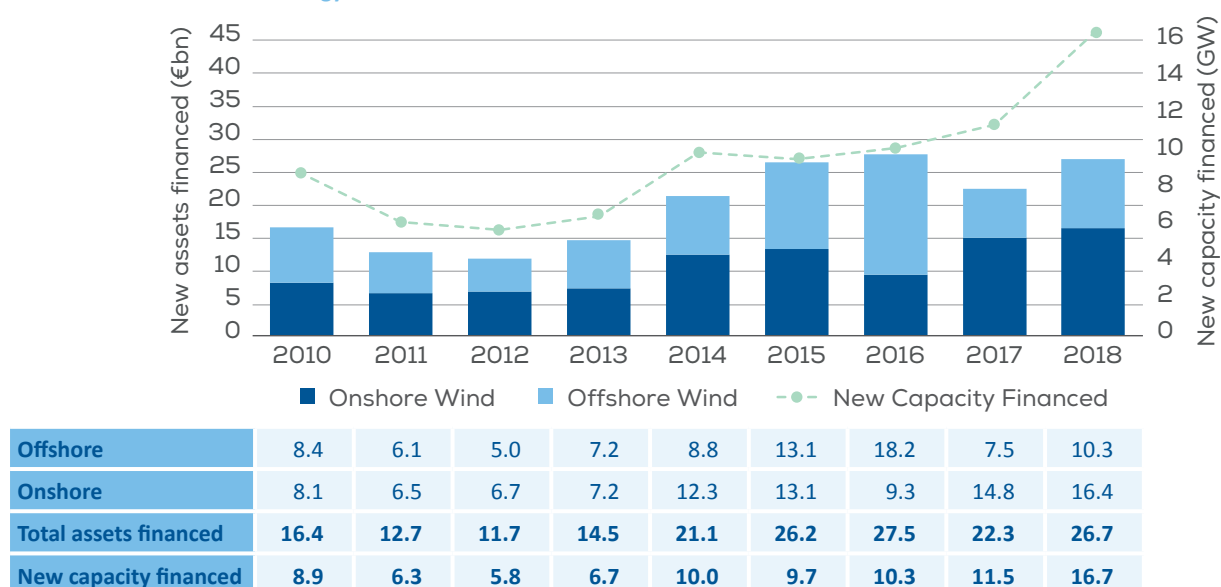
2018 was another record year for new capacity financed. In total, 16.7 GW worth of projects reached Final Investment Decision (FID): 4.2 GW in offshore and 12.5 GW in onshore wind. This compares to 11.5 GW in FIDs in 2017.

In monetary terms investments were up from 2017 by 20% to €26.7bn, almost equalling the record year for

investment in 2016. New capacity financed was 45% up on 2017 and 62% from 2016. There were €10.3bn in offshore wind energy investments, a recovery from the drop seen in 2017. Onshore investments hit a record level of €16.4bn. Cost reductions across the industry's value chain and increased industry competition have made it possible for investors to finance more capacity for less cash.

FIGURE 10

New asset finance in wind energy 2010 – 2018¹³



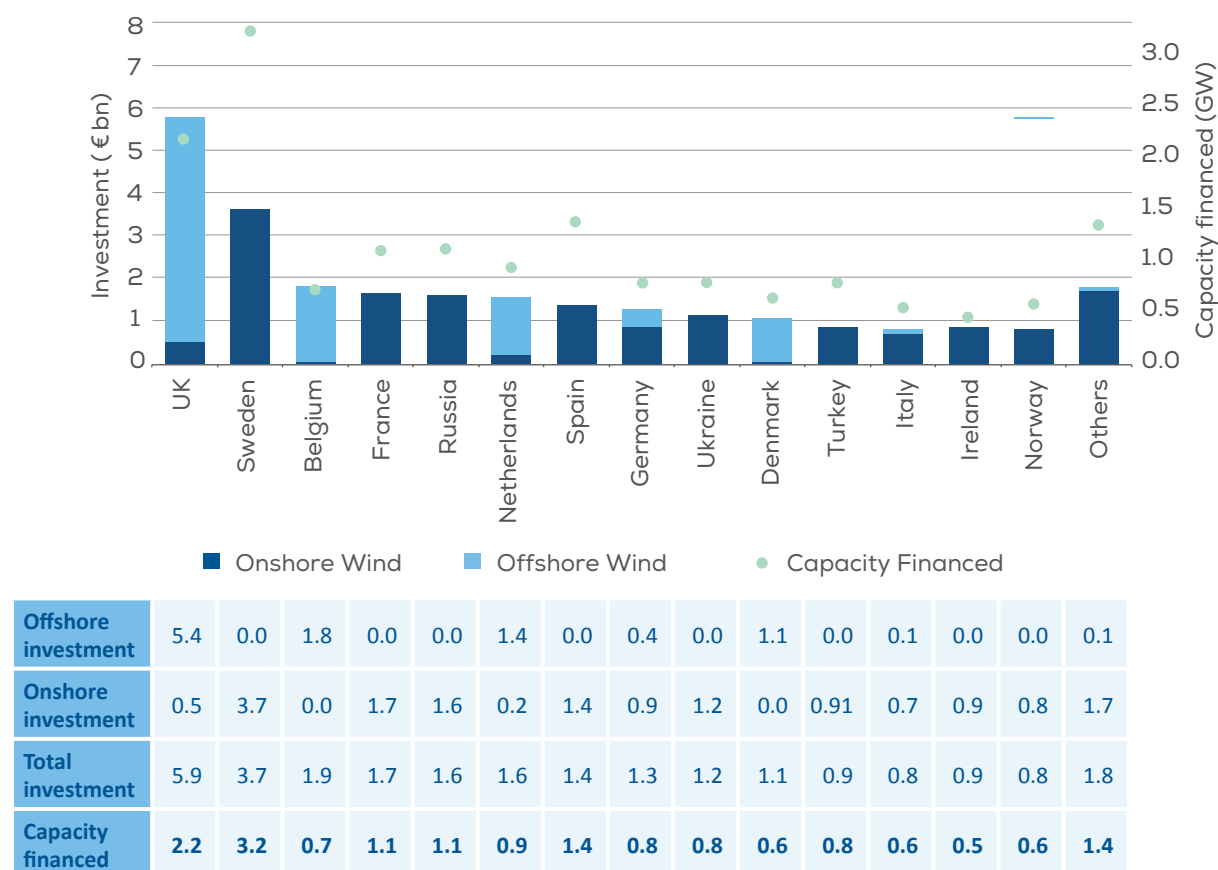
Source: WindEurope

13. Figures include only new asset financing. Project refinancing and public markets are not included in the investment activity.

Wind energy investments in 2018 continued the trend of geographical diversification. The top 3 investor countries owned only 43% of FID announcements in 2018. This compares to 64% in 2017 and 73% in 2016. Investments in non-EU countries have also increased to a total of €5.1bn. This was a 75% increase on 2017 and represented 19% of the new announced FIDs.

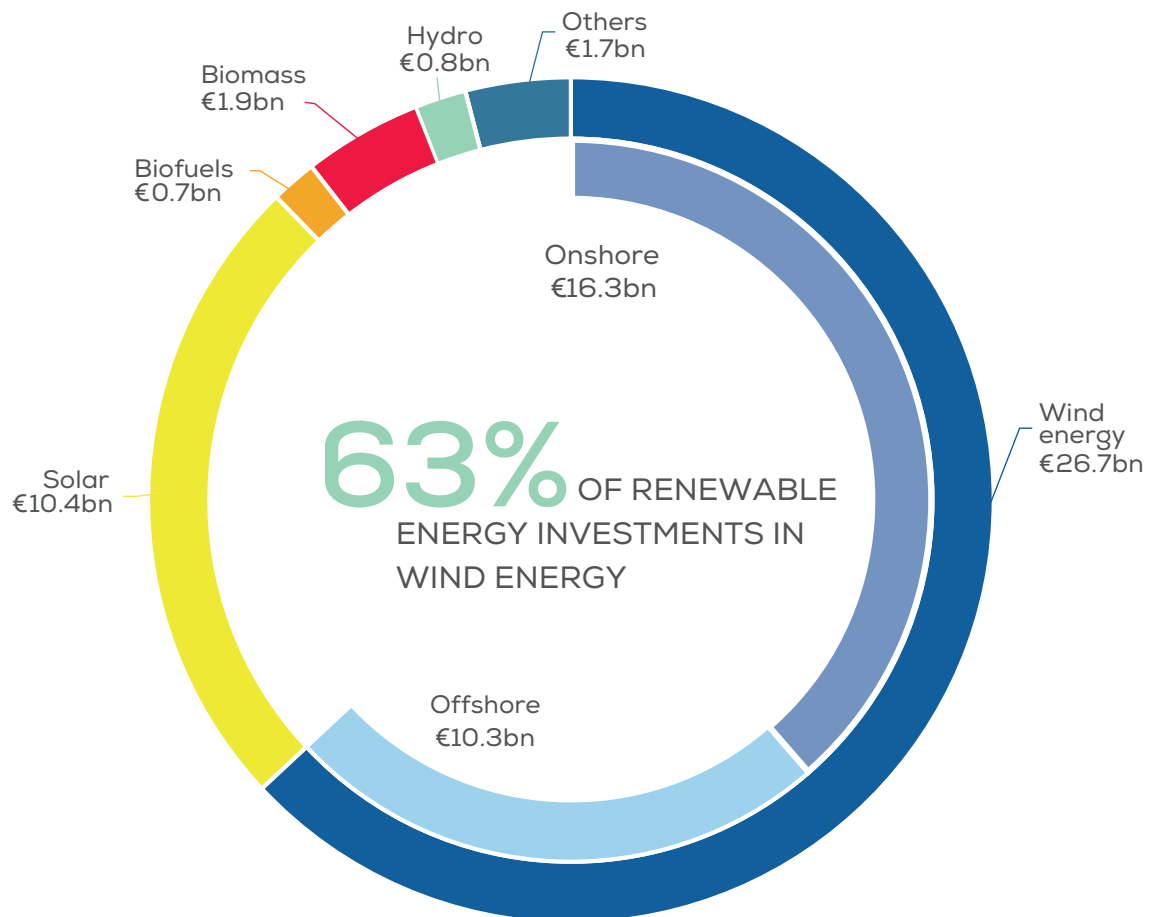
The United Kingdom was the biggest investor in 2018. They generated a total financing activity of €5.9bn for the construction of new onshore and offshore wind farms. This accounts for 22% of the total wind energy investments made in 2018. Over 90% of UK investment was in offshore wind. Sweden was the second largest investor in 2018 with €3.7bn (all in onshore wind). This represented 14% of the total wind energy investments in 2018. Sweden also led in onshore investments, with a 26% share.

FIGURE 11
New asset financing in 2018 by country (€bn and GW)



Source: WindEurope

Wind energy accounted for 63% of Europe's investments in renewable energy in 2018, compared to 52% in 2017. Onshore wind projects alone attracted 39% of the total investment activity in the renewable energy sector.

FIGURE 12Renewable energy investments in 2018 (€bn)¹⁴

Source: WindEurope

14. Figures include only new asset financing. Residential ownership is not included in new investment numbers



Photo: Dave Harris

3.

TOTAL NEW POWER CAPACITY ADDITIONS

In 2018, 20.7 GW of new gross power generation capacity were installed in the EU-28. This marks a 27% drop from 2017.

Wind power was the energy technology with the highest capacity installations in 2018. With 10.1 GW, it accounted for 49% of all new installations. Solar PV came second with about 8 GW (39%)¹⁵ and biomass followed with 1.1 GW (5%).

49%

OF NEW POWER CAPACITY IN THE
EU-28 CAME FROM WIND ENERGY

| 15. Forecasted value (source: SolarPowerEurope)

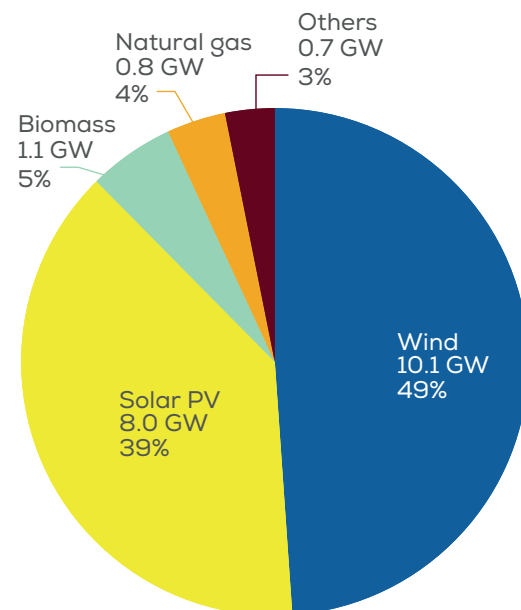
Fossil fuel additions were very low in 2018, with a mere 4% share. The majority of fossil fuel additions came from natural gas (0.8 GW), while coal made 0.2 GW of additions.

In 2018, decommissioning in the EU-28 fell by 75% compared to 2017. Fossil fuels remain the most decommissioned source of energy. Coal decommissioned 1.7 GW, followed by fuel oil with 0.7 GW.

95%

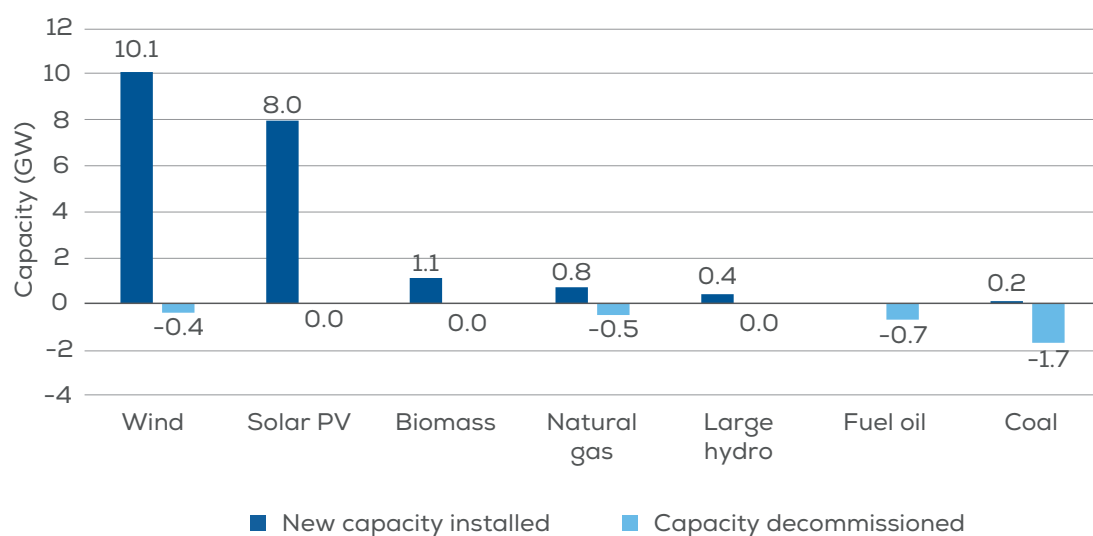
OF NEW POWER CAPACITY IN
THE EU-28 CAME FROM
RENEWABLE ENERGY

FIGURE 13
Share of new installed capacity in the EU-28



Source: Platts, SolarPowerEurope, WindEurope

FIGURE 14
Newly installed and decommissioned capacity in the EU-28



Source: Platts, SolarPowerEurope, WindEurope

In 2018, new power capacity installations were a mere 20.7 GW. This is the lowest level of new power capacity installations since 2003. Natural gas and coal power additions reached a record low of new installed capacity in 2018 with 0.9 GW. This is the lowest level of natural gas and coal power additions since 2000.

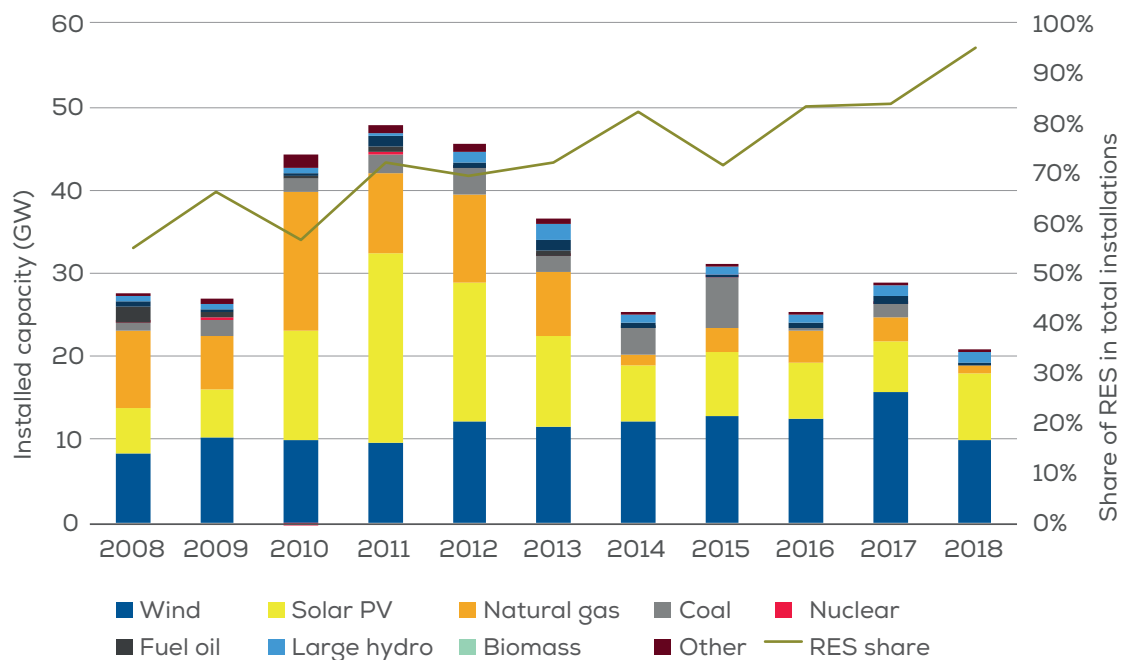
20.7 GW

OF POWER CAPACITY WAS INSTALLED
IN THE EU, THE LOWEST SINCE 2003

Consequently, the share of renewables in new power capacity installations reached a record high level of 95%.

FIGURE 15

Annual installed capacity and renewable share in EU-28



Source: Platts, SolarPowerEurope, WindEurope

ANNEX 1

TABLE 5

SUPPORT MECHANISM	DESCRIPTION
Feed-in-Tariffs	A type of price-based policy instrument whereby eligible renewable energy generators are paid a fixed price at a guaranteed level (irrespective of the wholesale price) for the RES electricity produced and fed into the grid.
Feed-in-premium (fixed)	A type of price-based policy instrument whereby eligible renewable energy generators are paid a premium price which is a payment (x€/MWh) in addition to the wholesale price.
Feed-in-premium (floating)	A type of price-based policy instrument whereby eligible renewable energy generators are paid a premium price which is a payment in addition to the wholesale price. The floating premium would be calculated as the difference between an average wholesale price and a previously defined guaranteed price. Effectively it works as a floor price, guarantees always a minimum revenue.
Contracts for differences	Similar to the floating premium. However, under contracts for difference, if the wholesale price rises above the guaranteed price, generators are required to pay back the difference between the guaranteed price and the wholesale price.
Quotas for capacity	Support scheme based on capacity, resulting from a tender. There is an obligation to provide the capacity during 15 years. The tender criterion is the price of CAPEX. Applies only to Russia
Zero-subsidy bids (Dutch model)	Developers compete for the right to build a wind farm in a tender in which the selection criteria is not based on the price. The selection is made according to the experience of the bidders, the quality of the project design, the capacity of the project and the social costs, with added weight given to the quality of the survey, risk analysis and mitigation measures. While the winner doesn't receive any price premium, the transmission costs for the project are covered by the government.
Green Certificates	A tradable commodity proving that certain electricity is generated using renewable energy sources. May have guaranteed minimum prices. The certificates can be traded separately from the energy produced.

WindEurope is the voice of the wind industry, actively promoting wind power in Europe and worldwide. It has over 400 members with headquarters in more than 35 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 Europe's largest and most powerful wind energy network.



Rue d'Arlon 80, 1040 Brussels, Belgium
T +32 2 213 1811 · F +32 2 213 1890
windeurope.org