# Wind in power 2017

Annual combined onshore
and offshore wind energy statistics

WindEurope

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This report summarises new installations and financing activity in Europe's wind farms from 1 January to 31 December 2017.

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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# EXECUTIVE SUMMARY

Europe installed 16.8 GW (15.7 GW in the EU) of gross additional wind power capacity in 2017, marking a record year on annual installations. With a total net installed capacity of 169 GW, wind energy remains the second largest form of power generation capacity in Europe, closely approaching gas installations.

**FIGURE 1**
**Total power generation capacity in the European Union 2005-2017**

Source: WindEurope

## 2017 annual figures

- Europe installed 15,680 MW of new wind power capacity during 2017, an increase of 20% compared to 2016 annual installations. 12,526 MW were onshore, and 3,154 MW were offshore.
- 2017 was a record year for both onshore and offshore installations. Onshore installations grew 9% while offshore grew 101% compared to 2016.
- Wind power installed more than any other form of power generation in Europe in 2017. Wind power accounted for 55% of total power capacity installations.
- Renewable energy accounted for 85% of all new EU power installations in 2017: 23.9 GW of a total 28.3 GW of new power capacity.
- With 336 TWh generated in 2017, wind power covered an average 11.6% of the EU's electricity demand.
- 2017 saw €22.3bn in new investments announced in wind energy. This will finance the development of 11.5 GW of new wind farms. €14.8bn of this was for onshore wind, and €7.5bn for offshore. Overall, this was 19% less than the total investment in 2016.
- Wind energy investments accounted for 52% of the new clean energy finance in 2017, compared to 86% in 2016.

## Trends and cumulative installations

- There are now 169.3 GW of installed wind power capacity in the EU: 153.5 GW onshore and 15.8 GW offshore.
- Wind energy now accounts for 18% of EU's total installed power generation capacity.
- The total net EU-installed power generation capacity increased by 15.6 GW in 2017 to 933 GW.
- Conventional power sources such as fuel oil and coal continue to decommission more capacity than they install. The amount of decommissioned gas-fired generation capacity was almost equal to the amount of newly-commissioned gas-fired generation capacity.

## Country highlights

- Germany installed the most wind power capacity in 2017, with 42% of the total EU new installations.
- Germany remains the EU country with the largest installed wind power capacity, followed by Spain, the UK and France. 16 EU countries have more than 1 GW of wind power installed. Nine of these have more than 5 GW installed.
- Seven EU countries had a record year in new wind energy installations in 2016: Germany (6.6 GW), the UK (4.3 GW), France (1.7 GW), Finland (577 MW), Belgium (476 MW), Ireland (426 MW) and Croatia (147 MW).
- Denmark is the country with the largest share of wind energy in its electricity demand with 44%. Germany registered the highest annual increase from 16% to 20% of wind energy in its electricity demand.

**15.7 GW**
OF NEW WIND POWER IN THE EU

**16.8 GW**
TOTAL EUROPE

New added capacity in 2017

**GW**

Cumulative installed capacity

Share of wind in power demand

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

WIND ENERGY COVERED
**11.6%**
OF EU ELECTRICITY DEMAND IN 2017

Source: WindEurope

**TABLE 1**
**Cumulative and new installed wind power capacity in 2016 and 2017**

| EU-28 (MW) | INSTALLED 2016 | END 2016 | INSTALLED 2017 | | END 2017 |
|---|---|---|---|---|---|
| | | | ON-SHORE | OFF-SHORE | |
| Austria | 228 | 2,632 | 196 | - | 2,828 |
| Belgium | 168 | 2,378 | 302 | 165 | 2,843 |
| Bulgaria | - | 691 | - | - | 691 |
| Croatia | 79 | 466 | 147 | - | 613 |
| Cyprus | - | 158 | - | - | 158 |
| Czech Republic | - | 281 | 26 | - | 308 |
| Denmark | 223 | 5,230 | 342 | - | 5,476 |
| Estonia | 7 | 310 | - | - | 310 |
| Finland | 570 | 1,539 | 517 | 60 | 2,113 |
| France | 1,561 | 12,065 | 1,692 | 2 | 13,759 |
| Germany | 5,443 | 50,019 | 5,334 | 1,247 | 56,132 |
| Greece | 234 | 2,369 | 282 | - | 2,651 |
| Hungary | - | 329 | - | - | 329 |
| Ireland | 255 | 2,701 | 426 | - | 3,127 |
| Italy | 283 | 9,227 | 252 | - | 9,479 |
| Latvia | 7 | 70 | - | - | 66 |
| Lithuania | 178 | 493 | - | - | 493 |
| Luxembourg | 56 | 120 | - | - | 120 |
| Malta | - | - | - | - | - |
| Netherlands | 887 | 4,328 | 81 | - | 4,341 |
| Poland | 1,255 | 6,355 | 41 | - | 6,397 |
| Portugal | 268 | 5,316 | - | - | 5,316 |
| Romania | 48 | 3,024 | 5 | - | 3,029 |
| Slovakia | - | 3 | - | - | 3 |
| Slovenia | - | 3 | - | - | 3 |
| Spain | 49 | 23,075 | 96 | - | 23,170 |
| Sweden | 468 | 6,494 | 197 | - | 6,691 |
| UK | 796 | 14,602 | 2,590 | 1,680 | 18,872 |
| **Total EU-28** | **13,062** | **154,279** | **12,526** | **3,154** | **169,319** |

| CANDIDATE COUNTRIES (MW) | INSTALLED 2016 | END 2016 | INSTALLED 2017 | | END 2017 |
|---|---|---|---|---|---|
| | | | ON-SHORE | OFF-SHORE | |
| FYROM | - | 37 | - | - | 37 |
| Serbia | - | 10 | 8 | - | 18 |
| Turkey | 1,397 | 6,091 | 766 | - | 6,857 |
| **Total** | **1,397** | **6,138** | **774** | - | **6,912** |

| EFTA (MW) | INSTALLED 2016 | END 2016 | INSTALLED 2017 | | END 2017 |
|---|---|---|---|---|---|
| | | | ON-SHORE | OFF-SHORE | |
| Iceland | - | 3 | - | - | 3 |
| Liechtenstein | - | - | - | - | - |
| Norway | 16 | 838 | 324 | - | 1,162 |
| Switzerland | 15 | 70 | - | - | 70 |
| **Total** | **31** | **911** | **324** | - | **1,235** |

| OTHER (MW) | INSTALLED 2016 | END 2016 | INSTALLED 2017 | | END 2017 |
|---|---|---|---|---|---|
| | | | ON-SHORE | OFF-SHORE | |
| Belarus | - | 3 | - | - | 3 |
| Faroe Islands | - | 18 | - | - | 18 |
| Russia | - | 15 | - | - | 15 |
| Ukraine | 12 | 526 | 68 | - | 593 |
| **Total** | **12** | **563** | **68** | - | **631** |

| | INSTALLED 2016 | END 2016 | INSTALLED 2017 | | END 2017 |
|---|---|---|---|---|---|
| | | | ON-SHORE | OFF-SHORE | |
| **Total** | **14,502** | **161,891** | **13,691** | **3,154** | **178,096** |

# 1. ANNUAL POWER GENERATION CAPACITY

## 1.1 NEW WIND POWER IN 2017

Europe insalled 16.8 GW of wind power in 2017, 15.7 GW of which were installed in the European Union.

**FIGURE 2**
**EU country shares of new wind energy capacity installed during 2017. Total: 15,680 MW**

Source: WindEurope

**7 EU COUNTRIES**
**HAD A RECORD YEAR IN WIND ENERGY INSTALLATIONS**

Of the capacity installed in the EU, 12,526 MW was onshore and 3,154 MW offshore. The annual onshore installations increased by 9%, while offshore installations doubled. Overall, the volume of new installations was 20% up on the 2016 figure.

Germany installed the most wind power capacity in 2017, with 6,581 MW of new capacity (a 15% increase on 2016 and a record year); 19% of the installed capacity in Germany was offshore. The UK came second with 4,270 MW installations, five times more than installations in 2016. France came third with 1,694 MW (9% growth on the previous year).

Finland (577 MW), Belgium (467 MW) and Ireland (426 MW) followed, with additions all above 400 MW and reaching record levels of installation.

The top six countries in 2017 all reached their highest annual installation figures.

In total, 17 countries saw some new installations last year, down from 2016 with 20 countries. There were no new installations in the Baltic countries. The Czech Republic had new installations (26 MW) after two years of inactivity.

80% of the total new installations took place in just three countries, a considerable increase in the concentration of power capacity compared to 2016.

## 1.2 TOTAL NEW POWER GENERATION IN 2017

**FIGURE 3**
**Share of new installed capacity. Total 28,310 MW**

Source: WindEurope, Platts, SolarPower Europe, Ocean Energy Europe

In 2017 28.3 GW of new gross power generation capacity were installed in the EU, 9% more than in 2016.

Wind power was the energy technology with the highest capacity installations in 2017. With 15.7 GW, it accounted for 55.4% of all new installations. Solar PV came second with 6 GW (21.5%) and gas followed with 2.6 GW (9.2%).

Coal added 1.7 GW of new capacity (6.1% of total installations), hydro installed 1 GW (3.9%) and biomass 964 MW (3.4%).

During 2017 countries decommissioned 7.5 GW of coal capacity, 2.2 GW of gas capacity, and 2.1 GW of fuel oil capacity. 640 MW of wind power were decommissioned.

**55% OF NEW POWER CAPACITY IN THE EU CAME FROM WIND**

**FIGURE 4**

**Newly installed and decommissioned capacity in the European Union**

Source: WindEurope

## 1.3 NEW RENEWABLE POWER IN 2017

In 2017 renewables accounted for a total of 23.9 GW of new capacity, 85% of all new installed capacity in the EU-28. This was the tenth consecutive year in which renewables contributed over 55% of all additional power capacity in the EU.

**85% OF NEW POWER CAPACITY IN THE EU CAME FROM RENEWABLES**

**FIGURE 5**
**Share of new renewable power installations. Total: 23,926 MW**

Source: WindEurope

# 2. TRENDS AND CUMULATIVE INSTALLATIONS

## 2.1 RENEWABLE POWER CAPACITY

In 2000 new renewable power capacity installations were a mere 2.7 GW, accounting for less than 20% of new power installations that year. Since 2007 the share of renewables has been more than 50% of new power installations. As from 2011, this share has been 70% or higher, with annual additions of between 20 and 34 GW every year. Europe installed 495 GW of new power capacity since 2000, 33% of which has been wind power and 60% of which has been renewables.

**FIGURE 6**

**Annual installed capacity and renewable share**

Source: WindEurope

## 2.2 NET CHANGES IN EU INSTALLED POWER CAPACITY 2000-2017

Since 2000 the net growth of wind power (158.3 GW), solar PV (107.3 GW) and gas (96.7 GW) capacity has coincided with the net reduction in fuel oil (down by 40.4 GW), coal (down by 41.2 GW) and nuclear (down by 17.2 GW).

The EU's power sector continues to move away from fuel oil, coal and nuclear while increasing its total installed generation capacity with wind, solar PV and other renewables. With a net growth of 96.7 GW since 2000, gas remains the technology with the largest installed capacity in the EU.

**FIGURE 7**
**Net electricity installations in the EU from 2000 to 2017**

Source: WindEurope

## 2.3 TOTAL INSTALLED POWER CAPACITY

The share of wind power in the EU's total installed power capacity has increased from 6% in 2005 to 18% in 2017. Having overtaken coal in 2016 as the second largest form of power generation capacity in the EU, wind power is now closely catching up with gas. Wind remains the first among renewables. Over the same period renewables increased their share from 26% of total power capacity in 2005 to 47% in 2017.

**WIND REMAINS THE 2nd LARGEST POWER GENERATING CAPACITY IN THE EU**

**FIGURE 8**
**Share in installed capacity in 2005 and 2017**

Source: WindEurope

# 3. A CLOSER LOOK AT NEW WIND POWER CAPACITY

## 3.1 ONSHORE AND OFFSHORE ANNUAL INSTALLATIONS

Annual wind power installations in the EU have increased steadily over the past 12 years from 6.6 GW in 2005 to 15.7 GW in 2017, breaking all previous records.

Offshore wind represented 20% of the annual EU installations, with 3,154 MW of new capacity connected to the grid in 2017. This was double than 2016 and a slight increase compared to 2015, which was an exceptional year due to the resolving of grid connection delays in Germany.

**FIGURE 9**
**Annual onshore and offshore wind installations in the EU**

Source: WindEurope

## 3.2 NATIONAL BREAKDOWN OF NEW WIND POWER INSTALLATIONS

In 2017 42% of new wind energy capacity was installed in Germany, slightly lower than in 2016 with 44%. The UK and Ireland significantly increased their share in new capacity, from 8% in 2016 to 30% last year. France and Benelux remained the third largest region with 14% of the new installed capacity, down from 20% in 2016. Installations in the Iberian Peninsula, Italy and Greece remained very modest, with only 6% of the EU total. Wind power installations in countries that joined the EU after 2005 represented just 1%, down from 10% in 2016.

**FIGURE 10**
**Geographical concentration of the annual wind power installations[2]**

Source: WindEurope

Germany installed a record 6,581 MW of wind energy, largely due to the end of its feed-in-tariff regime and the entry of feed-in-premiums with auctions. Similarly, the UK experienced the largest growth of installations with 4,270 MW as the support framework (ROCs – Renewable Obligation Certificates) came to an end and developers rushed to ensure applicability for the outgoing regime (onshore installations). In both countries, offshore installations represented a large share of all grid-connected projects thanks to very large wind farms coming into operation[3].

The French onshore market, supported by a favourable regulatory regime, continued to grow steadily for its fourth consecutive year, reaching their best ever result with 1,692 MW. Finland (577 MW), Belgium (476 MW) and Ireland (426 MW) continued to build and connect wind farms at a strong pace, breaking their own national records. Importantly, Finland saw it first commercial offshore installation. Denmark had strong onshore installations (342 MW) while no new offshore installations have

**80% OF WIND POWER IN THE EU**
**WAS INSTALLED IN JUST 3 COUNTRIES: GERMANY, THE UK AND FRANCE**

2. Central Eastern Europe includes Poland, Czech Republic, Hungary, Romania, Lithuania, Latvia, Estonia, Croatia, Bulgaria, Slovenia, Cyprus, Malta and Slovakia.
3. Offshore Wind in 2017, WindEurope, February 2018.

been registered since 2013. In Greece, onshore installations have been growing for 4 consecutive years (272 MW). On the other hand, Italy (255 MW) is far from the rate of installations registered between 2008 and 2012 (above 1,000 MW annually). Croatia (147 MW) broke a record, doubling its installations from the previous year. Poland (41 MW) had the largest decrease compared to the last two years (above 1,200 MW). Similarly, Sweden and Austria have continued to decrease since 2014, when they experienced their highest values.

**FIGURE 11**
**2017 installed wind energy capacity onshore and offshore. Total: 15,680 MW**

Source: WindEurope

With a newly-installed wind capacity of 426 MW and an average power consumption of 3 GW (ratio of 14%), Ireland is the country with the highest level of new installed wind capacity relative to its total power consumption. Germany (12%) and the UK (12%) follow closely.

**IRELAND IS THE COUNTRY WITH MOST NEW WIND CAPACITY RELATIVE TO ITS TOTAL POWER CONSUMPTION**

**TABLE 2**
**Top 10 countries of wind power installations relative to their power consumption[4]**

| RANKING | COUNTRY | RATIO |
|---|---|---|
| 1 | Ireland | 14% |
| 2 | Germany | 12% |
| 3 | UK | 12% |
| 4 | Finland | 6% |
| 5 | Belgium | 5% |

| RANKING | COUNTRY | RATIO |
|---|---|---|
| 6 | Greece | 5% |
| 7 | Denmark | 4% |
| 8 | France | 3% |
| 9 | Austria | 3% |
| 10 | Sweden | 1% |

4. The ratio of installed capacity to average power consumption is an indicator that reflects the size of national wind energy markets relative to their electricity demand. It is a performance indicator to compare annual installations between distinct countries.

## 3.3 ONSHORE AND OFFSHORE CUMULATIVE WIND POWER INSTALLATIONS

169.3 GW are now installed in the European Union, a growth of 10% compared to 2016. Germany remains the EU country with the largest installed capacity, followed by Spain, the UK, France and Italy. Four other EU countries (Sweden, Poland, Portugal and Denmark) 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.

**169 GW**
**OF WIND POWER ARE NOW INSTALLED IN THE EU**

**FIGURE 12**
**Cumulative installations onshore and offshore in the EU. Total: 169.3 GW**

Source: WindEurope

Over half of all wind power installations in the EU are in three countries. Germany (56.1 GW), Spain (23.2 GW) and the UK (18.9 GW) together represent 58% of all the cumulative installed capacity. France, Italy and Sweden follow with 13.8 GW (8% of total EU capacity), 9.5 GW (6%) and 6.7 GW (4%) respectively.

**FIGURE 13**
**Cumulative installations onshore and offshore by country. Total: 169.3 GW**

Source: WindEurope

## 3.4 WIND POWER GENERATION

In 2017 wind energy generated enough electricity to meet 11.6% of the EU-28's total electricity demand[5].

**TABLE 3**
**Electricity production from wind power (TWh)**

| TOTAL EU ELECTRICITY CONSUMPTION (TWh) | ONSHORE WIND ENERGY PRODUCTION (TWh) | OFFSHORE WIND ENERGY PRODUCTION (TWh) | TOTAL WIND ENERGY PRODUCTION (TWh) | SHARE OF EU CONSUMPTION MET BY WIND ENERGY |
|---|---|---|---|---|
| 2,906 | 292 | 43 | 336 | 11.6% |

Denmark was the EU country with the highest penetration rate (44%), followed by Portugal (24%) and Ireland (24%). Germany registered the highest increase from the previous year, now covering over 20% of its annual demand. 10 out of the 28 Member States had a wind penetration rate of more than 10%.

5. At time of publication, generation data for Luxemburg and Croatia was not available.

**FIGURE 14**

**Percentage of the average annual electricity demand covered by wind[6]**

Source: WindEurope

6. The figures represent the average of the penetration rates captured hourly from ENTSO-E and corrected thanks to national TSOs and BEIS data. All European countries data is not available.

## 3.5 WIND TURBINES SIZE

The size and type of wind turbines installed in the EU in 2017 varied significantly between countries. The onshore wind turbines in Denmark and Finland had an average power rating of 3.4 MW. Spain had an average rating of less than 2 MW. The average onshore turbine size was 2.7 MW.

The offshore wind turbines in the UK and Germany had an average power rating of 6.0 and 5.6 MW respectively. By contrast, all the turbines installed in Belgium belong to a project that started in 2009 and thus uses older turbine models (3.3 MW). In France, the relatively low rating (2 MW) is due to the type of project (demo floating wind turbine).

The differences observed in onshore wind turbine ratings in the different countries are due to three main factors:

- regulatory restrictions on tip height
- duration of projects and
- wind speeds.

For offshore wind turbines, the main difference observed in sizes per country is due to:

- the year of consent for specific projects, and
- whether they are floating.

**FIGURE 15**

**Number of turbines installed in 2017 and their average power rating – Onshore**

Source: WindEurope

**FIGURE 16**

**Number of turbines installed in 2017 and their average power rating – Offshore**

Source: WindEurope

# 4. INVESTMENT NUMBERS IN 2017

**FIGURE 17**
New asset finance in wind energy 2010 – 2017[7]

Source: WindEurope

2017 was a record year for new capacity financed. In total, 11.5 GW worth of projects reached Final Investment Decision (FID): 2.5 GW in offshore and 9 GW in onshore wind. This compares to 10.3 GW in FIDs in 2016.

However, in monetary terms investments were down by 19% to €22.3bn. This is due to lower offshore wind investments and cost reductions in the industry. While offshore wind energy investments dropped by 60%, down to €7.5bn, onshore investments hit a record level of €14.8bn. 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.

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

Wind energy investments in 2017 were less geographically concentrated than in 2016. The top three investor countries owned only 64% of FID announcements in 2017. This compares to 73% in 2016. Investments in non-EU countries have increased, with a total of €2.9bn, or 13% of the new announced FIDs.

Germany was the biggest investor in 2017. They generated a total financing activity of €6.7bn for the construction of new onshore and offshore wind farms. This accounts for 30% of the total wind energy investments made in 2017. The UK came second to Germany with €5bn, or 22% of the total wind energy investments in 2017.

**FIGURE 18**
**New asset financing in 2017 by country (€bn)**

Source: WindEurope

Wind energy investments accounted for 52% of the new clean energy finance in 2017, compared to 86% in 2016.

Onshore wind projects alone generated 35% of the total investment activity in the renewable energy sector.

**FIGURE 19**
**Clean energy investments in 2017 (€bn)**[8]

Source: WindEurope

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

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