

Noteworthy Trends in the Europe Renewables 2018 Global Status Report

TOP 5 COUNTRIES 2017

Annual Investment / Net Capacity Additions / Production in 2017

	1	2	3	4	5
Investment in renewable power and fuels (not including hydro over 50 MW)	China	United States	Japan	India	Germany
Investment in renewable power and fuels per unit GDP ¹	Marshall Islands	Rwanda	Solomon Islands	Guinea-Bissau	Serbia
Geothermal power capacity	Indonesia	Turkey	Chile	Iceland	Honduras
Hydropower capacity	China	Brazil	India	Angola	Turkey
Solar PV capacity	China	United States	India	Japan	Turkey
Concentrating solar thermal power (CSP) capacity ²	South Africa	-	-	-	-
Wind power capacity	China	United States	Germany	United Kingdom	India
Solar water heating capacity	China	Turkey	India	Brazil	United States
Biodiesel production	United States	Brazil	Germany	Argentina	Indonesia
Ethanol production	United States	Brazil	China	Canada	Thailand

Total Capacity or Generation as of End-2017

	1	2	3	4	5
POWER					
Renewable power capacity (including hydropower)	China	United States	Brazil	Germany	India
Renewable power capacity (not including hydropower)	China	United States	Germany	India	Japan
Renewable power capacity per capita (not including hydro) ³	Iceland	Denmark	Germany/Sweden		Finland
Bio-power generation	China	United States	Brazil	Germany	Japan
Bio-power capacity	United States	Brazil	China	India	Germany
Geothermal power capacity	United States	Philippines	Indonesia	Turkey	New Zealand
Hydropower capacity ⁴	China	Brazil	Canada	United States	Russian Federation
Hydropower generation ⁴	China	Brazil	Canada	United States	Russian Federation
Solar PV capacity	China	United States	Japan	Germany	Italy
Solar PV capacity per capita	Germany	Japan	Belgium	Italy	Australia
Concentrating solar thermal power (CSP)	Spain	United States	South Africa	India	Morocco
Wind power capacity	China	United States	Germany	India	Spain
Wind power capacity per capita	Denmark	Ireland	Sweden	Germany	Portugal
HEAT					
Solar water heating collector capacity ⁵	China	United States	Turkey	Germany	Brazil
Solar water heating collector capacity per capita	Barbados	Austria	Cyprus	Israel	Greece
Geothermal heat capacity ⁶	China	Turkey	Iceland	Japan	Hungary

POLICY LANDSCAPE

- The European Union (EU) was the only regional entity to adopt a collective regional commitment to renewable energy in 2017. The EU's Clean Energy for All Europeans package covers the energy market, renewable energy and efficiency policies, and will use a common reporting framework with the intention of measuring the impact of policies on the power system as well as on emission goals. The first legislative element of the package, on energy efficiency, was passed in 2017. The debate around the next round of European energy targets extending to 2030 continued throughout the year, with the European Parliament voting in January 2018 in favour of a goal of 35% by 2030.

Heating and Cooling

- The EU funded much of an EUR 1.4 million (USD 1.7 million) solar district heating installation in Serbia.

Transport

- In Europe, 10% of transport fuels consumed in each EU member state must come from renewable sources by 2020. If the proposed European renewable energy goal is adopted, this will be increased to 14% by 2030.
- In 2017, the European Parliament voted to introduce a single certification scheme to evaluate the sustainability of palm oil entering the EU market.
- In the EU, the Renewable Energy Directive for 2030 proposed by the European Commission in 2017 included a target of 3% for advanced biofuels and a cap of 7% on first-generation biofuels.
- A proposed European directive would require aviation biofuels to count more highly in the contributions towards the region's renewable transport target.

Power

- In Europe, a multi-tiered system has developed, partly in response to European Commission State Aid guidelines through which large-scale projects or specified power supply profiles are awarded through tenders, while smaller-scale projects continue to be supported through feed-in policies.

MARKET AND INDUSTRY TRENDS

Bioenergy

- Europe is the largest consumer of modern bio-heat by region. EU member states have promoted the use of renewable heat in both buildings and industry to meet mandatory national targets under the Renewable Energy Directive.
- The EU used an estimated 3.6 EJ of bio-heat in 2016 (latest data available). The majority of this was supplied from solid biomass (91%), with additional approximately equal contributions (4% each) from biogas and from municipal solid waste (MSW).
- Since 2007, the consumption of heat from bioenergy in the EU has increased by over 30%.
- Modern use of bio-heat in buildings is concentrated in North America and the EU.
- Most of the pellets were used in Europe (11.1 million tonnes) – with the leading markets in **Italy, Germany and France**.
- In Europe, the leading region for bioelectricity generation, generation rose 11% in 2017 compared to 2016, driven by the Renewable Energy Directive and maintaining the strong growth of the previous decade.

- Biofuels production and use are very concentrated geographically, with more than 80% of production and use taking place in the United States, Brazil and the **EU** combined.
- Although Europe was the highest-producing region in 2017, the leading countries for biodiesel production were the United States (16% of global production), Brazil (11%), **Germany** (9%), Argentina (9%) and Indonesia (7%). **Germany** was again the largest European producer at 3.5 billion litres.
- In Europe, however, the EU ended tariffs on imports of biodiesel in 2017.
- In Europe, the other globally significant market for biomethane for transport, consumption increased 12% between 2015 and 2016, to 6.1 PJ (latest data available).
- The use of MSW as a fuel for electricity or heat production is very well established, for example in Europe and Japan.
- In the EU, uncertainties continue around the future of biofuels between 2020 and 2030 under the Renewable Energy Directive, with the likelihood of a cap on conventional biofuels based on feedstocks that also can be used as food, and an increasing emphasis on advanced biofuels.
- Biogas production in Europe is focused mainly on the anaerobic digestion of agricultural wastes (including animal manures) and, increasingly, on the digestion of recovered food wastes (for example, in **Sweden** and the United Kingdom).
- More than 500 biomethane facilities now exist in Europe.

Geothermal Power and Heat

- European countries completed 10 new or renovated geothermal district heating plants in 2017.
- Continuing technology innovation, particularly in the United States and **Europe**, has raised the prospect of exploration and development of geothermal resources that previously were out of reach, even in areas with an average or low geothermal gradient, by reaching deeper into the earth and by better means of heat extraction.
- In Europe, ongoing technological advancement in deep geothermal extraction is believed to offer great potential for district heating applications as well as for power production because the region's increasingly efficient building stock can be heated at relatively low supply temperatures (40°C or less for new efficient buildings).

Hydropower

- In Europe, three (mixed) pumped storage plants entered service; each was an open-loop system that combines pumping capability with conventional hydropower generation from natural flows.
- **Portugal's** 780 MW Frades II and 263 MW Foz Tua pumped storage plants both entered service in 2017. The two variable-speed 390 MW pump turbines of Frades II are the largest of their kind in Europe.
- Many projects in Europe are incorporating variable-speed turbines for flexibility and wider operating range, particularly to accommodate rising penetration of VRE.
- The Hydropower Sustainability Assessment Protocol, introduced in 2011, has gained prominence as a global standard for evaluating hydropower projects from inception to construction and operation. In 2017, three project assessments were published under the Protocol, all for projects implemented in Europe. One of these was an ex-post evaluation of the 690 MW Kárahnúkar project in **Iceland**.

Ocean Energy

- Europe saw significant deployment activity for ocean energy devices in 2017.
- Optimism prevailed in the industry in 2017, particularly in Europe, where some technologies advanced enough to be on the brink of commercialisation.

Solar Photovoltaics (PV)

- The European Union added an estimated 6 GW of solar PV capacity in 2017, for a year-end total of nearly 108 GW.
- Europe's share of module production stayed flat, at about 6% in 2017.
- The EU extended import tariffs on solar cells and modules from China, Chinese Taipei and Malaysia and, later in 2017, set minimum import tariffs on Chinese solar products.
- A growing number of utilities, particularly in Europe and the United States, are entering the sector through acquisition of companies and solar plants, and through project development.
- Fossil fuel companies (including Europe-based BP, Shell and Total, and Thai coal-mining giant Banpu) and even manufacturers of autos and batteries (including US-based Tesla and China's BYD) also increased their reach into the sector during the year.
- Also in Europe, the trading of used modules increased during the year, particularly in Germany, where the market for repowering is starting to take off.

Concentrating Solar Thermal Power (CSP)

- Some CSP activity continued in Europe in 2017.
- In addition, the European Commission initiated funding for R&D focused on achieving a 40% reduction in CSP electricity supply prices by 2020 relative to 2013 levels.

Solar Thermal Heating and Cooling

- The vast majority (90%) of solar thermal capacity for district heating was in Europe, with **Denmark** alone accounting for 76% (932 MW_{th}) of the global total by the end of 2017.
- **Austria** brought online one new district heating plant (0.9 MW_{th}), **Germany** added two (totalling 1.3 MW_{th}), and **Sweden** added one (0.4 MW_{th}) as did **Serbia** (0.63 MW_{th}). **France's** subsidy scheme for large-scale solar thermal projects, launched in 2015, saw its first results with the inauguration of the country's first large solar district heating field (1.6 MW_{th}) in December.
- Demand for solar thermal cooling systems was stimulated by three factors: the potential to reduce electricity consumption, including peak loads; the potential to use natural refrigerants, such as water, which is appealing to European customers in particular; and the ability to provide both heating and cooling, depending on the needs over the year.
- In southern European countries that have cooling needs during summer months, solar thermal solutions that combine solar cooling with solar hot water have been shown to improve the economics of the solar investment.
- Europe also was home to several of the largest flat plate collector manufacturers, with four based in **Germany**, two each in Greece and Spain, and one each in **Italy and Poland**. Germany's Bosch Thermotechnik remained the largest entirely European-owned manufacturer of flat plate collectors in 2017.
- European producers focus on chiller units between 5 and 50 kW. The number of solar thermal cooling system suppliers in Europe declined during 2017, largely because some chiller manufacturers shifted to combined solar PV-split air conditioning systems, which they consider to be more economical, especially in central Europe where the cooling season is short.

Wind Power

- The EU installed roughly 15.6 GW of gross capacity (15 GW net, accounting for decommissioning), up 25% over 2016 additions to a record high, bringing its total capacity to 168.7 GW (153 GW onshore and 15.8 GW offshore).
- In a rush to beat a change in the EU regulatory framework (which required member states to introduce competitive auctions for the allocation of support as of 2017), the region saw record additions both onshore (12.5 GW) and offshore (3.2 GW).

- Wind power represented an estimated 55% of new generating capacity added during 2017, and its share in the EU's total power capacity reached 18% (up from 12% in 2012).
- By year's end, 16 EU member states had more than 1 GW each, and 9 had more than 5 GW. For the EU as a whole, wind power generation in 2017 was up 12% over 2016, due in part to better wind resources, and it met about 11.6% of total electricity demand.
- Europe connected a record 3.1 GW, for a total approaching 15.8 GW, with an additional 1.9 GW awaiting connection at year's end.
- Europe was home to about 84% of global offshore capacity (down from 88% in 2016), with Asia accounting for nearly all the rest.
- In 2017, wind energy covered an estimated 11.6% of EU annual electricity consumption and equal or higher shares in at least 8 EU member states, including **Denmark**, which met 43.4% of its annual electricity consumption with wind power.
- The big story of 2017 was tumbling bid prices for wind power – both onshore and offshore – in several auctions around the world. This was due to a number of factors, including technology innovation and scale, expectations of continued technology advances, lower financing costs (especially for European offshore wind power) due to lower perceived risk, as well as fierce competition in the industry.
- By region, average turbine sizes (including onshore and offshore) were highest in Europe (3.1 MW), due in part to the large offshore market, and lowest in Asia-Pacific (2.1 MW).
- Across Europe, the average capacity of newly installed turbines offshore was 5.9 MW in 2017, up 23% relative to 2016 and double compared to 10 years earlier.
- Floating turbines are moving beyond the demonstration phase and attracting significant investment, with a pipeline of projects in place in Europe and plans for projects elsewhere.
- New offshore markets still face challenges that **Europe** and China have addressed, including building supply chains and associated infrastructure such as ports, rail links and installation vessels, as well as technology for electrical connections.
- Across Europe, a demonstration project was initiated to develop new design and manufacturing processes that make it easier to recycle and extend the life cycle of composite products, which are used for numerous applications including wind turbine blades.

INVESTMENT FLOWS

- Investment in Europe totalled USD 40.9 billion in 2017, a significant drop (36%) from 2016. Asset finance accounted for 74% of the region's investment, at USD 30.4 billion, of which USD 26.7 billion was invested in wind power and USD 2.8 billion was invested in solar power. Small-scale distributed capacity in Europe fell sharply in 2017, to USD 6.6 billion, due in part to a significant reduction (by more than half) in the United Kingdom.
- Although Europe's two biggest markets (**UK** and **Germany**) saw reductions in 2017, investment increased in several other countries in the region.
- Europe was again the biggest regional investor in R&D and witnessed an 8% increase in 2017, to USD 2.7 billion.
- Among those that had published data in early 2018, the European Investment Bank provided finance for renewables totalling EUR 4.7 billion (USD 5.6 billion) in 2017, up from EUR 3.9 billion in 2016.
- Direct investment by institutional investors in renewable energy hit a record in 2017 in Europe, totaling USD 9.9 billion, up 42% from 2016

ENERGY SYSTEMS INTEGRATION AND ENABLING TECHNOLOGIES

- On 28 October 2017, wind power generated a record 24.6% of the European Union's (EU) electricity demand, meeting 109% of demand in **Denmark**, followed by 61% in **Germany** and 44% in **Portugal**.
- Market reforms under way in Europe and elsewhere are enabling VRE to play a wider role in supporting the grid.
- Europe's first harmonised grid code, which entered into force during 2017, opens the door for such requirements.
- The EU is providing funding to help build four major transmission lines across Europe that will support the integration of VRE, particularly wind power.
- In **Europe** and the western United States, grid operators are expanding their balancing areas.
- In 2017, power exchanges and transmission system operators from 12 European countries were building a single intra-day market solution based on a common communication and control system, with the first of three phases expected to begin operation in early 2018.
- Experience in Europe has shown that expanding the balancing area enables system operators to hold less balancing power in reserve, such that balancing costs are declining even as the shares of VRE increase.
- Despite the potential benefits of expanding balancing areas, regulatory and other barriers to implementation remain in **Europe**, the United States and elsewhere.
- Several utilities in Europe and the United States have partnered with storage, solar and other technology companies to pilot similar concepts.
- In 2017, European utility TenneT (**Netherlands/Germany**), renewable project developer Vandebrom (**Netherlands**), and the companies sonnen (**Germany**) and IBM (United States) launched two utility-scale pilot projects that aim to more cost-effectively and efficiently integrate VRE into the grid.
- The largest markets for heat pumps are China, the United States and Europe as a whole, where (in order of size) **France, Italy, Spain, Sweden and Germany** were the most significant national markets in 2017.
- Europe's combined heat pump market (air- and ground-source) grew by an estimated 10% in 2017, a slightly slower growth than was seen in 2016. An estimated 1.1 million units were added, accounting for nearly 20% of the overall boiler market, for a total of 10.6 million units in use by the end of 2017. The European market is rather concentrated, with the top seven countries accounting for more than 75% of the region's sales in 2017.
- In recent years, the global industry has grown in scale and scope as major manufacturers from **Europe**, China and the United States have extended their areas of activity both geographically and sectorally (integrating heating, cooling and ventilation as well as, increasingly, dehumidification).
- China, **Europe** and the United States together accounted for 94% of the total global EV market.

ENERGY EFFICIENCY

- An agreement was reached in late 2017 on updates to the European Union's (EU's) Energy Performance of Buildings Directive, designed to quicken the rate at which cost-effective renovations of existing buildings occur and to unlock public and private sector capital for energy efficiency and renewable energy in buildings.
- An important factor in this net reduction [7% net reduction in final energy use in the residential sector] was improved space heating, notably in Europe.

CORPORATE SOURCING OF RENEWABLE ENERGY

- Around 20% of the cumulative corporate PPA capacity has been signed in Europe, with the **Netherlands, Norway, Sweden** and the United Kingdom dominating this market.
- The RE-Source Platform focuses on the European market (at both the EU and national levels) and was launched in 2017 by SolarPower Europe, WindEurope, RE100 and the World Business Council for Sustainable Development.
- As of early 2018, most large utilities in Europe offered some sort of green premium product supported by the European Guarantee of Origin scheme, which certifies that the electricity was produced from renewable energy sources.
- In Europe, green tariffs have been used in various ways.
- Currently, unbundled certificates can be purchased in the **European Union (EU)** as well as in China, India, Singapore and the United States, among other countries.
- As of end-2017, certificate markets were in place mainly in North America and **Europe**.

JOBS

- In 2016 (latest available data), the number of renewable energy jobs in the EU reached 1.27 million, up from 1.19 million in 2015. The solid biomass and wind power sectors were the largest employers, followed by biofuels. Solar PV employment continued to shrink, dipping to just below 100,000 jobs. **Germany** remained in the lead in Europe. After four years of retrenchment, it posted a gain in 2016, to 332,000 jobs.