



**Table 1. Key Statistics 2017, Austria**

Total (net) installed wind power capacity	2,844 MW
Total offshore capacity	0 MW
New wind power capacity installed	196 MW
Decommissioned capacity (in 2017)	0 MW
Total electrical energy output from wind	7 TWh
Wind-generated electricity as percent of national electricity demand	11%
Average national capacity factor	26%
Target	100% renewable electricity by 2030

## OVERVIEW

Austria is among the global leaders in renewable energy, with nearly 70% renewables in its electricity mix. The natural conditions in Austria—hydropower, biomass, and a high wind energy potential—have allowed for this development. However, installation rates are currently decreasing due to political uncertainties.

In 2017, Austria installed 63 turbines with a capacity of 196 MW, compared to 75 turbines (228 MW) in 2016. By the end

of 2016, more than 2,800 MW were installed in Austria. This capacity is able to produce 7.0 TWh, which accounts for 11% of the country's electricity consumption.

The government's official capacity target is 3,000 MW, per the Green Electricity Act (GEA) 2012. The feasible potential is estimated at 7,500 MW with 22.5 TWh by 2030.

## MARKET DEVELOPMENT

Wind power installations significantly proliferated following the 2012 Okostromgesetz (Green Electricity Act, GEA). This law established a 2020 target of 2,000 MW of added wind power capacity over 2010 levels (1,011 MW).

The law also upheld the existing feed-in-tariff (FIT) system. An ordinance by the Minister for Economic Affairs set the FIT, rather than the GEA itself; however, the FIT decreases automatically by 1% if not determined each year. The tariff for 2018 was 0.0820 EUR/kWh (0.098 USD/kWh). For 2017, it was fixed at 0.0895 EUR/kWh (1.107 USD/kWh).

The market price collapse significantly lowered the annual budget for green electricity. This has created a project queue, with projects waiting until as long as 2025 for new funding.

In 2017, a small amendment to the GEA 2012 lowered pressure and political uncertainty by allocating 45 million EUR in additional funding (54 million USD), this allows the installation of about 120 turbines (350 MW) that have already been approved. However, tariffs for those projects are subject to a deduction of up to 12% depending on their original ranking in the project queue.

### National Targets & Policies Supporting Development

The GEA 2012 preserved the existing targets of 15% of renewable energy supply without large hydro, and 1,700 MW total wind power capacity, by 2015. Austria reached the 2015 GEA target in the first quarter of 2014.

The GEA 2012 also established a long-term target of adding 2,000 MW of wind power capacity by 2020 (a total of 3,000 MW by 2020). This is higher than Austria's wind energy target in its National Renewable Energy Action Plan (NREAP). Austria set a target of 1,951 MW by 2015 and 2,578 MW by 2020 in the NREAP (per European Union directive 2009/28/EC).

In a 2014 study, the Austrian consultant Energiewerkstatt estimated that by 2020, Austria could achieve a total wind power capacity of 3,808 MW (annual production of 9 TWh). This study was updated in 2018. If all wind turbines which have already been approved are installed, the total wind power capacity will reach 3900 MW (annual production of 9 TWh). By 2030, a total capacity of 7,500 MW (annual production of 22.5 TWh) could be achieved [1].

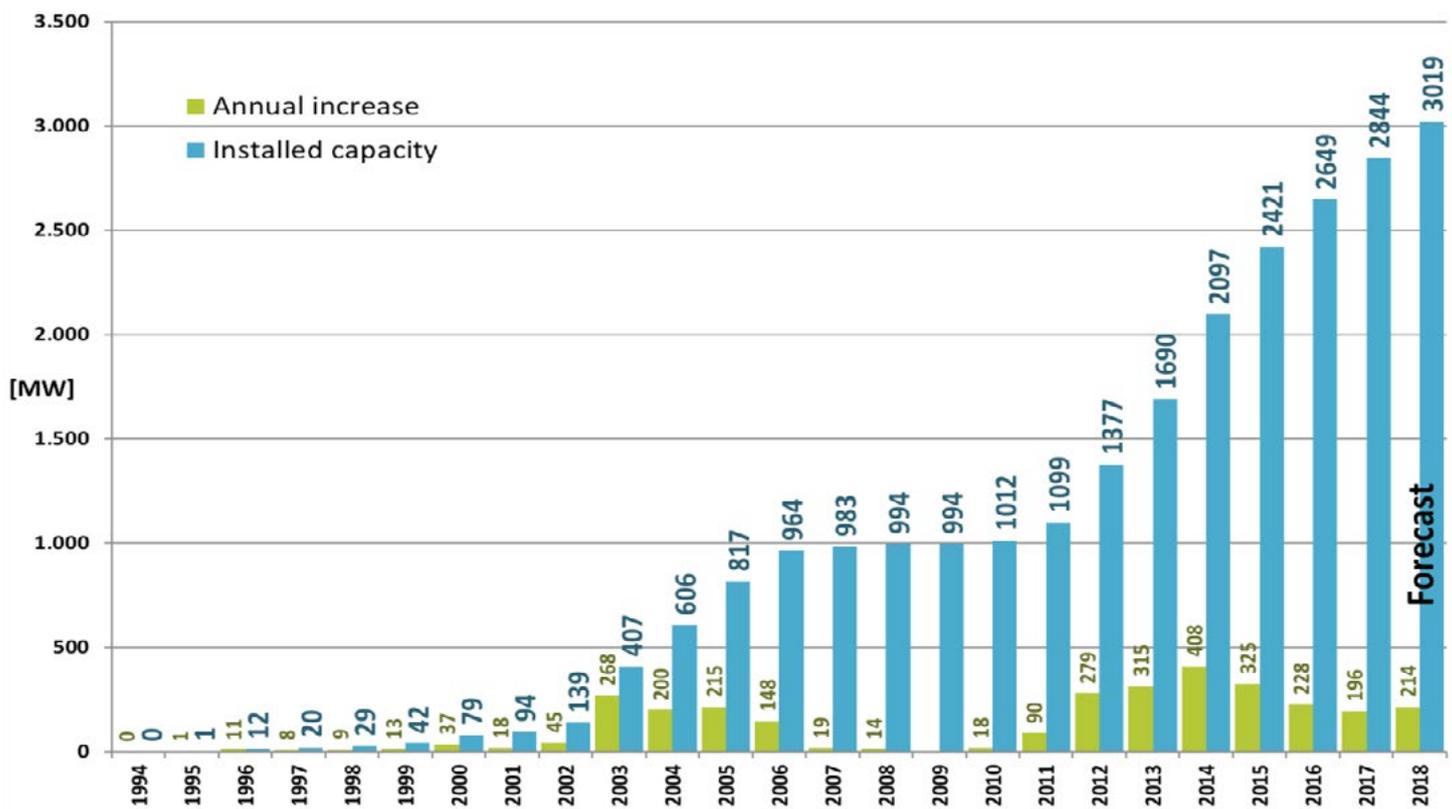


Figure 1. Wind power capacity in Austria from 1994-2017

The 2002 GEA triggered investments in wind energy from 2003-2006. An amendment in 2006 created uncertainty among green electricity producers and restricted project development. This led to nearly four years of stagnation in Austria's wind power market. A small amendment to the GEA in 2009 and a new FIT in 2010 (0.097 EUR/ kWh; 0.116 USD/ kWh) improved the situation.

In July 2011, parliament adopted new legislation for electricity from renewable energy sources: the GEA 2012. This retained the existing FIT system, but established a stable legal framework through 2020 for the first time. However, there are still restrictions; new projects only get a purchase obligation and a FIT if they contract with the Okostromabwicklungsstelle (OeMAG), the institution in charge of buying green electricity at the FIT and selling it to the electricity traders.

The OeMAG's contracts with green electricity producers are limited to the available funds for new projects — a budget that started with 50 million EUR/yr (60 million USD/yr). This is enough for approximately 120-350 MW of new wind capacity per year, depending on the market price for electricity and the applications from photovoltaics and small hydro power plants. The budget decreases by 1.0 million EUR/yr (1.2 million USD/yr) for the first ten years.

The FIT is still set by an ordinance and is not fixed in the GEA 2012. The FITs are fixed in the Okostromverordnung/Green Electricity Regulation by the Minister of Economic Affairs in accordance with the Minister of Environment and the Minister of Social Affairs. Tariffs are guaranteed for 13 years, and the purchase obligation is limited to a specific amount of capacity (based on available funds for new projects). For 2017, the tariff was fixed at 0.0812 EUR/kWh (0.0974 USD/kWh). In 2017, a small amendment to the GEA 2012 allocated 45 million EUR (54 million USD).

On average, around 480 million EUR (576 million USD) were invested annually from 2013-2017 (including investments of wind power operators for power grid expansion). Wind power was the fourth largest industry investment during this period. The current waiting queue would free investments of 1 billion EUR (1.2 billion USD), create 4,250 wind industry jobs, and raise the wind share to nearly 15% of electricity consumption.

Wind power currently has the highest acceptance rate of all electricity production technologies in Austria. The acceptance rate has been approximately 80% for the past four years. Given the concentration of wind energy in the eastern part of Austria, the approval rate is especially high (92-96%) in this region.

### Progress & Operational Details

The rate of wind power installations increased significantly in 2012 (Figure 1). By the end of 2013, Austria had installed 1,685 MW of wind capacity with an estimated annual rate of 3.6 TWh of electricity production. One year later, the capacity increased to 2,086 MW, with 4.5 TWh of electricity production—7.2% of the Austrian electricity demand. New installations reached 319 MW in 2015, leading to a cumulative installed capacity of 2,404 MW (8.7% of electricity consumption). The 2015 installed capacity produced more than 5.2 TWh/yr.

With a capacity of 2,844 MW in 2017, the annual production of all Austrian wind turbines accounts for 11% of the Austrian electricity demand and avoids about 4.3 million tons of CO<sub>2</sub>. The estimated capacity by the end of 2018 is 3,019 MW.

Most wind turbines are in Lower Austria (1,535 MW), followed by Burgenland (1,026 MW), Styria (227 MW), Upper Austria (47 MW), Vienna (7 MW), and Carinthia (1 MW) (Table 2).

**Table 2. Capacity and Number of Turbines by Federal State**

Federal State	Capacity (MW)	Turbines
Lower Austria	1,535	693
Burgenland	1,026	426
Styria	227	100
Upper Austria	47	30
Vienna	7	9
Carinthia	1	2
<b>Total Austria</b>	<b>2,844</b>	<b>1,260</b>

Enercon and Vestas are the dominant wind turbine suppliers in Austria (Figure 2). Most of the nation's turbines have a capacity of 1.8-2.3 MW. Since 2013, more than 80% of new installations are 3-MW turbines or larger, leading to an average size of 3.1 MW for newly installed capacity. In 2017, the tallest turbines were the 203-m Vestas V126 in lower Austria.

### **Matters Affecting Growth & Work to Remove Barriers**

The crucial points for wind power growth are FIT amounts, the stability of the incentive program, and annual project funding. The FIT has determined wind power growth since the GEA 2012 was implemented. Because the tariffs are fixed for two years, some stability is guaranteed. However, growing demands from the grid providers and rapidly expanding installation costs have constrained growth.

## **R,D&D ACTIVITIES**

### **National R,D&D Priorities & Budget**

In Austria, several national R,D&D projects focus on the challenges of wind energy in cold climates. The "R.Ice" project, launched in April 2016, aims to elaborate on an icing map of Austria and observe icing events at wind turbines using an innovative imaging method. Project "Ice.Control" investigates the possibilities of meteorological prognosis for icing events on wind turbines.

Austria is also currently carrying out two national research projects on small wind turbines. The "Urban Small Wind Power Project" addresses the challenges of installation and operation of small wind turbines in urban, highly-turbulent areas. The project "SmallWP@ Home" investigates the flow conditions over different roof shapes.

Other issues include rising project development costs and growing burdens from ancillary services, which rose from 89 million EUR (107 million USD) in 2011 to more than 200 million EUR (240 million USD) in 2014. Rising costs are mainly the result of market failure.

Unlike most of Europe, power producers in Austria bear a major share of the ancillary cost ("G-component"), which decreases competitiveness. These factors combined with the collapsed market price to significantly lower the annual budget for green electricity. This resulted in a project queue, wherein projects may wait until 2025 for new funding.

A small amendment by June 2017 to the GEA 2012 could have reduced the pressure and political uncertainty. Nevertheless, there are still 200 wind turbines (650 MW) in the current queue waiting until 2023 for new funding. These projects, which sum up to an investment of 1 billion EUR (1.2 billion USD), would create 4,250 wind industry jobs, and would raise the wind share to nearly 15% of electricity consumption. Since those projects have already been approved by the legal authorities, significant investors might be frustrated. The amendment finally came into force in July 2017, however further funding is still required. Otherwise, the net installed capacity will decrease in the coming years.

### **Collaborative Research**

In 2009, Austria joined the IEA Wind TCP Task 19: Wind Energy in Cold Climates. The previous term continued until end of 2015, during which the Austrian participants carried out a detailed comparison of different ice detection systems. Each partner country also evaluated their country's legislative requirements for assessing the risk of falling ice fragments from wind turbines.

In the current term, Austria is leading a subtask which aims to prepare a set of guidelines and recommendations regarding ice risk assessments. Furthermore, the Vestas blade heating system will be evaluated for two winter seasons.

In 2013, Austria joined the IEA Wind TCP Task 27: Small Wind Turbines in High Turbulence Sites. Since 2016, Austria has been participating in Task 32 LIDAR: Lidar Systems for Wind Energy Deployment. This cooperation will continue until the end of February 2019.

## IMPACT OF WIND ENERGY

### Economic Benefits & Industry Development

The Austrian wind power market is made up of wind turbine operators, planning offices, and component suppliers for international wind turbine manufacturers. In 2017 (the latest available statistics), the annual turnover of existing wind parks operators was over 550 million EUR (660 million USD).

Austria's wind energy industry includes more than 180 supplier and service companies. These companies are industry leaders in the fields of conducting, wind power generators, wind turbine generator design, and high-tech materials. Local companies are successful in both the land-based and the offshore sectors, and Austrian crane companies, planning offices, and software designers, work intensively abroad. Many wind energy operators have expanded abroad to implement their know-how on a global level.

According to a study conducted by the Austrian Wind Energy Association, one-third of the Austrian industry in the wind energy supply chain obtains an export volume of more than 454 million EUR (545 million USD).

Cooperatives and private companies own 60% of Austria's existing wind turbines, while the other 40% are owned by utilities. When the first wind turbines in Austria were built in 1994, cooperatives or single wind turbines built by farmers were most common. Utilities and other companies entered the market in 2000 and 2003, after a stable framework in the support system was established.

Austrian operators are very active with neighboring countries in Central and Eastern Europe, and some independent companies have also started businesses outside Europe. There are no major wind turbine manufacturers in Austria, though there are manufacturers of small- (and micro-) wind turbines.

Austrian component suppliers also serve the international wind turbine market. Bachmann Electronic GmbH is a leading manufacturer of turbine control systems. Hexcel Composites GmbH develops and produces materials for blades. Elin EBG

## NEXT TERM

Currently, the GEA 2012 does not provide the necessary incentives to develop wind energy in Austria to its full potential. It also harms investment security, as it will expire before the queued wind energy projects are fully installed. Overall, the political risk has risen massively in 2017, and the situation for wind isn't likely to improve in 2018.

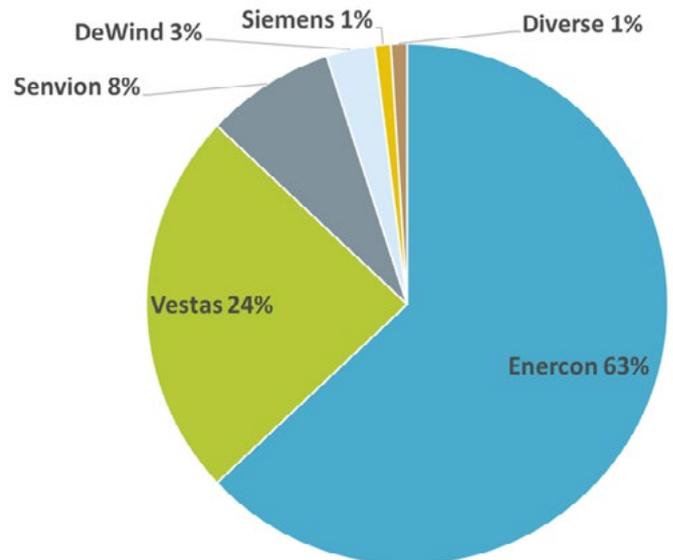


Figure 2. Turbine supplier market share by installed capacity

Motoren GmbH supplies generators for the global market. There are also several global players with wind competence centers in Austria, such as SKF. There has been an increase of small and medium enterprises entering the market in recent years, largely due to the growth of the domestic market.

Start-ups have also emerged in the wind energy industry. For example, start-up company Eologix implemented an innovative ice detection system on rotor blades after working in the radio frequency identification sector. Due to the economic structure of the Austrian industry, there is a significant potential for high quality products from the software, service, and component sector, which is partially transferred from the automotive and aerospace industry.

The recently-published scientific paper *Stromzukunft Österreich 2030* quantifies the total investment costs as 1,350 to 1,570 EUR/kW (1,620 to 1,884 USD/kW) and the O&M costs as 36 to 40 EUR/kW (43 to 48 USD/kW) per year.

### References

- Opening photo: Oberzeiring wind park, Austria
- [1] Energiewerkstatt. [www.energiwerkstatt.org](http://www.energiwerkstatt.org)
  - [2] Innovative Energietechnologien in Österreich; BMVIT; 2018
  - [3] Neubewertung des Potentials zur Nutzung der Windkraft
  - [4] Stromzukunft Österreich 2030, TU Wien, Energy Economics Group 2017 in Österreich bis zum Jahr 2030, 2018
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