Power generation in Germany – assessment of 2017

The first version of 02 January 2018 takes into account the monthly power generation data published by the German Statistical Office (Destatis) up to and including September 2016. The data for October, November and December were extrapolated from adjusted hourly values from the European Energy Exchange EEX in Leipzig and hourly data from the four German TSOs (50 Hertz, Amprion, Tennet, TransnetBW). The tolerance range is greater for extrapolated values.

The data at Energy Charts is updated by the hour:

www.energy-charts.de
This report presents data on German net electricity generation for public power supply. The numbers thus represent the electricity mix that actually is consumed in the households or with which even electric vehicles are charged. Only the net electricity generation is traded on the German electricity exchange EEX and only net figures are measured for cross-border electricity flows.

In contrast, the AG Energiebilanzen uses the data of the total gross electricity generation. This also includes the electrical losses of the power plants, which are consumed directly in the power plant and are not fed into the public grid at all. In addition, the AG Energiebilanzen also takes into account the self-generation of electricity in industry, the so-called "factories in the processing industry as well as in mining and in the extraction of stones and earth". This self-generation is consumed directly in the factories and also not fed into the public grid.

Data on net electricity generation and total gross electricity generation differ significantly. This also results in significantly different shares of renewable energies.
Power generation in the year 2017
Renewable energy: solar and wind

In 2017, roughly 38.4 TWh of electricity from photovoltaic arrays was fed into the grid. Production thus is 0.4 TWh or 1% higher than in 2016. Despite the increase, electricity generation is still below the 2015 level, when 38.7 TWh were generated. The installed PV power at end of October was 42.7 GW. Approximately 2 GW were added from January to October. Solar power production peaked at 28 GW and 42% of total electricity generation on 27 May 2017. In June 2017, the monthly electricity production of PV systems was higher than that of hard coal power plants.

104 TWh were generated from wind in total, 32% more compared to 2016. Wind energy is thus for the first time the second largest power source after lignite, but ahead of hard coal and nuclear. In ten months, wind power production exceeded that of hard coal and nuclear. Quarter hourly production peaked at 40 GW on 28 October 2017.

Onshore wind farms produced 85 TWh in 2017, 20 TWh more than in 2016. Offshore wind farms raised their production from 12 TWh in 2016 to 17.4 TWh in 2017. In the North Sea they produced 16 TWh compared to 10.7 TWh in 2016. The offshore wind farms in the Baltic Sea produced 1.4 TWh (1.3 TWh in 2015). At the end of October 2017, 50 GW wind onshore and 5.3 GW wind offshore were installed.

Taken together, solar and wind power generators produced approx. 142 TWh in 2017. For the first time, they are thus ahead of brown coal, hard coal and nuclear.

1 TWh = 1 terawatt-hour = 1,000 gigawatts-hours (GWh) = 1 million megawatt-hours (MWh) = 1 billion kilowatt-hours (kWh)
Power generation in the year 2017
Renewable energy: hydropower and biomass

Approximately 20.9 TWh were produced from hydropower, a level roughly unchanged year-over-year. Production was lowest in January (1 TWh) and highest in May (2 TWh).

Roughly 47 TWh of electricity was generated from biomass. Production is at the level of the previous year.

In total, renewable energy sources – solar, wind, hydropower, and biomass – produced approximately 210 TWh of electricity in 2017. This is 15% higher than the previous year's level at 182 TWh. Renewables thus made up around 38% of public net power supply. The share in gross power supply – including power plants in the processing sector, the mining sector, quarries, and excavation – is around 35%.

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Power generation in the year 2017
Non-renewable generation

The net power production from **nuclear plants** came in at around 72 TWh, 10% below the 80 TWh net in the previous year. The reasons for the decline are mainly longer repair and maintenance work. As of December 31, 2017, the Gundremmingen B nuclear power plant was finally shut down.

**Lignite power plants** generated 134 TWh net, some 1 TWh or 0.7% less than in 2016. They were forced to curtail production in particular at times of peak wind power generation during wind storms. Lignite power stations are still inflexible in their response to high feed of renewable energies.

Net production from **hard coal** plants was posted at 83 TWh, 17 TWh (16%) lower than in 2016.

**Gas power plants** for public power supply generated some 46 TWh, the same amount than in 2016. In addition to power plants for public power supply, there are also power generation facilities in the mining and manufacturing sector for self supply. These units produced additional 20 to 25 TWh.

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Power generation in the year 2017

Export surplus

In 2017, the **export surplus** reached some 50 TWh, a level equal to the previous record year 2016. The largest share of exports, 16.6 TWh, went to Switzerland, which passed along most of the electricity to Italy. In second place came Austria, which also passes some of the electricity to its neighbor countries. The Netherlands in third place, passed on most of this exports to Belgium and the UK. Poland on the fourth place passed on some of the electricity from eastern Germany to southern Germany via the Czech Republic.

Germany imported less electricity from France compared to the previous years, mainly since several French nuclear power plants were temporarily switched off for safety reasons. Germany acts as transit country for French electricity and passes it to neighboring countries.

In **power trading** so far only numbers from January to October 2017 are available. During this period, 23.0 TWh were imported to a value of 875 million euros. The export amounted to 64 TWh and a value of 2.27 billion euros. In balance, the resulting export surplus was 41 TWh and revenues worth 1.39 billion euros. Imported electricity cost an average of 38.07 Euro/MWh compared to 35.48 Euro/MWh for exports.

The average volume weighted **day-ahead price** of electricity has risen from 28.78 Euro / MWh in 2016 to 32.89 Euro / MWh and is adjusted for inflation at approximately the same level as of 2003 and 2004.

For additional information and graphics, visit: [www.energy-charts.de](http://www.energy-charts.de)

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Net power generation for the public power supply
Year 2017

Electricity production in 2017

The graph shows net power generation from power plants for the public power supply. Electricity from power plants in the processing sector, mining, quarries, and excavation is not included.

Graphic: B. Burger, Fraunhofer ISE; data: DESTATIS and the EEX power exchange in Leipzig, with adjustments
Absolute change in net power generation
Year 2017 compared to year 2016

Graphic: B. Burger, Fraunhofer ISE; data: DESTATIS and the EEX power exchange in Leipzig, with adjustments
Relative change in net power generation
Year 2017 compared to year 2016

Graphic: B. Burger, Fraunhofer ISE; data: DESTATIS and the EEX power exchange in Leipzig, with adjustments
German net power generation for public power supply
Year 2017

Graphic: B. Burger, Fraunhofer ISE; data: DESTATIS and the EEX; source: www.energy-charts.de/energy_pie.htm
German net power generation from renewable sources
Year 2002 - 2017

Graphic: B. Burger, Fraunhofer ISE; data: DESTATIS and the EEX; source: https://www.energy-charts.de/energy.htm
German net power generation from conventional sources, Year 2002 - 2017

Graphic: B. Burger, Fraunhofer ISE; data: DESTATIS and the EEX; source: https://www.energy-charts.de/energy.htm
Renewable shares of net public power production
Year 2002 - 2017

This graph shows the share of renewable energies in net public power production. That's the power mix that actually comes out of the socket. Self-generation from power plants of industry for self-consumption is not included.

Graphic: B. Burger, Fraunhofer ISE; Source: https://www.energy-charts.de/ren_share.htm
Scatter chart of solar vs. wind production
Quarter-hourly values of 2017

This graph shows 35 thousand quarter-hourly values of solar vs. wind production.

Graphic: B. Burger, Fraunhofer ISE; Source: https://www.energy-charts.de/scatter.htm
German power export surplus
Year 2010 - 2017

Physical flows. Positive values indicate import. Negative values indicate export.

Graphic: B. Burger, Fraunhofer ISE; data: TSOs and ENTSO-E; source: https://www.energy-charts.de/energy.htm
German power import / export histogram
Year 2017

Physical flows. Positive values indicate import. Negative values indicate export.

Graphic: B. Burger, Fraunhofer ISE; data: TSOs and ENTSO-E
German power import / export
Year 2017

Physical flows. Positive values indicate import. Negative values indicate export.

Graphic: B. Burger, Fraunhofer ISE; data: TSOs and ENTSO-E; source: www.energy-charts.de/trade.htm
German power trading

Year 2017

Physical flows. Positive values indicate import. Negative values indicate export.

Graphic: B. Burger, Fraunhofer ISE; data: TSOs and ENTSO-E; source: https://www.energy-charts.de/trade.htm
German power trading
Year 2017

Positive values indicate income. Negative values indicate expenditure.

Graphic: B. Burger, Fraunhofer ISE; data: TSOs and ENTSO-E; source: https://www.energy-charts.de/trade.htm
German power trading
Year 2017

Physical flows. Positive values indicate import. Negative values indicate export.

Graphic: B. Burger, Fraunhofer ISE; data: TSOs and ENTSO-E; source: [https://www.energy-charts.de/trade.htm](https://www.energy-charts.de/trade.htm)
German power trading
Net income in millions of euros

Positive values indicate income. Negative values indicate expenditure.

*Data of 2017 only from January to October; source: https://www.energy-charts.de/trade.htm
German power trading
Volume weighted average prices in Euro/MWh

Positive values indicate income. Negative values indicate expenditure.

*Data of 2017 only from January to October; source: https://www.energy-charts.de/trade.htm
EPEX day ahead spot price
Weighted by volume, inflation-adjusted, for prices from November 2017

Graphic: B. Burger, Fraunhofer ISE; data: EPEX; source: www.energy-charts.de/price_avg.htm
Thank you for your Attention!

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