Development of Renewable Energy Sources in Germany in the year 2018

Charts and figures based on statistical data from the Working Group on Renewable Energy-Statistics (AGEE-Stat),
Status: December 2019
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29. Final energy consumption from renewable sources in the transport sector in Germany in the year 2018
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Notes:
In figures deviations in totals may occur due to rounding
The most important terms are explained in the glossary at the end of the document
Development of renewable energy share of gross final energy consumption in Germany

- Share calculated according to German "Energiekonzept"
- Share calculated in accordance with EU directive (2009/28/EG)

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Development of renewable energy share of primary energy consumption in Germany

Notice: declining share in primary energy consumption due to modified calculation approach from 2012 onwards, previous years not yet revised.
BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Development of renewable energy share of gross electricity consumption in Germany

Share in percent

1990: 3.4
2000: 5.3
2001: 6.6
2002: 7.7
2003: 7.7
2004: 9.4
2005: 10.3
2006: 11.6
2007: 14.3
2008: 15.2
2009: 16.4
2010: 17.0
2011: 20.4
2012: 23.5
2013: 25.1
2014: 27.4
2015: 31.5
2016: 31.6
2017: 36.0
2018: 37.8

BMWi based on Working Group on Renewable Energy - Statistics (AGEE-Stat); as of December 2019
Development of renewable energy share of final energy consumption for heating and cooling in Germany
Development of renewable energy share of final energy consumption in the transport sector in Germany

<table>
<thead>
<tr>
<th>Year</th>
<th>Share in percent</th>
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</thead>
<tbody>
<tr>
<td>1990</td>
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<tr>
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<td>2016</td>
<td>5.2</td>
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<tr>
<td>2017</td>
<td>5.3</td>
</tr>
<tr>
<td>2018</td>
<td>5.6</td>
</tr>
</tbody>
</table>

BMWi based on Working Group on Renewable Energy-Statistics (ÄGEE-Stat); as of December 2019
Development of gross electricity production from renewable energy sources in Germany

1 incl. solid, liquid and gaseous biomass, sewage sludge and the biologic fraction of waste (in waste incineration plants estimated at 50%, from 2008 only municipal waste)

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Gross electricity production from renewable energy sources in Germany in the year 2018
Total: 224.7 billion kilowatt hours

- Photovoltaics: 20.4%
- Wind energy: 48.9%
- Wind energy offshore: 8.7%
- Wind energy onshore: 40.3%
- Biomass: 22.6%
- Biogenic solid and liquid fuels: 5.0%
- Biogas: 12.9%
- biomethane: 1.2%
- Sewage and landfill gas: 0.8%
- Biogenic fraction of waste: 2.7%
- Hydropower: 8.0%

1 incl. sewage sludge; 2 biogenic fraction of waste in waste incineration plants estimated at 50%
Notice: Electricity production from geothermal power plants (0.08%) not shown because of very small share.

BMWi based on Working Group on Renewable Energy - Statistics (AGEE-Stat); as of December 2019
Gross electricity production from biomass in Germany in the year 2018
Total: 44.7 billion kilowatt hours

- Biogas: 64.8%
- Biogenic solid fuels\(^1\): 24.2%
- Biogenic liquid fuels: 1.0%
- Landfill gas: 0.7%
- Sewage gas: 3.5%
- Biomethane: 5.8%

\(^1\) incl. sewage sludge, without the biogenic fraction of waste in waste incineration plants

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Feed-in and fees under the Electricity Feed Act and the Renewable Energy Sources Act (EEG)

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Development of gross electricity production and installed capacity of hydropower plants in Germany

Notice: shown are the totals of river and storage power plants including pump storage power plants with natural inflow.

BMWi based on Working Group on Renewable Energy - Statistics (AGEE-Stat); as of December 2019
Development of gross electricity production and installed capacity of wind energy plants (onshore and offshore) in Germany

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Development of gross electricity production and installed capacity of wind energy plants (onshore) in Germany

BMWi based on Working Group on Renewable Energy-Statistics (ÄEGE-Stat); as of December 2019
Development of gross electricity production and installed capacity of wind energy plants (offshore) in Germany

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Development of gross electricity production and installed capacity of photovoltaic plants in Germany

BMWi based on Working Group on Renewable Energy - Statistics (AGEE-Stat); as of December 2019
Development of gross electricity production and installed capacity of biomass plants in Germany

1 incl. sewage sludge, without the biogenic fraction of waste in waste incineration plants;
2 since 2013 including additional capacity for increased flexibility of electricity production

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Development of gross electricity production and installed capacity of waste incineration plants in Germany

1 biogenic fraction of waste in waste incineration plants calculated with 50%, from 2008 only municipal waste;
2 total installed capacity of thermal waste combustion plants (no breakdown into a renewable and a fossil share)

BMWi based on Working Group on Renewable Energy-Statistics (ÄGEE-Stat); as of December 2019
Development of installed capacity for renewables-based electricity generation in Germany

1 incl. solid and liquid biomass, biogas, biomethane, sewage gas and landfill gas, excl. biogenic fraction of waste

BMWi based on Working Group on Renewable Energy-Statistics (ARGE Stat); as of December 2019
Development of net capacity addition for renewables-based electricity generation in Germany

1 incl. solid and liquid biomass, biogas, biomethane, sewage gas and landfill gas, excl. biogenic fraction of waste

BMWi based on Working Group on Renewable Energy – Statistics (AGEE-Stat); as of December 2019
Installed capacity for renewables-based electricity generation in Germany in the year 2018

Total: 118.2 million kilowatt

- Biomass
  - Photovoltaics: 38.2%
  - Wind energy: 49.8%
  - Wind energy onshore: 44.4%
  - Wind energy offshore: 5.4%
- Biogenic solid and liquid fuels: 1.6%
- Biogenic gaseous fuels¹: 5.7%
- Hydropower: 4.7%

¹ Biogas, biomethane, landfill gas and sewage gas
Notice: geothermal power plants are not shown here because of their very small share (0.04%).

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Development of final energy consumption from renewable energy sources for heating and cooling in Germany

1 incl. sewage sludge and charcoal; 2 incl. biofuels used in agric., forestry, constr. and military;
3 biogas, biomethane, sewage gas and landfill gas; 4 biogenic fr. of waste in waste incineration plants est. at 50 %, from 2008 only municipal waste

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Final energy consumption from renewable energy sources for heating and cooling in Germany in 2018

Total: 169,7 billion kilowatt hours

1 TCS corresponds to trade, commercial and service sector; 2 incl. sewage sludge and charcoal; 3 incl. biofuels used in agriculture, forestry, construction and military; 4 biogenic fraction of waste in waste incineration plants estimated at 50%

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Final energy consumption from biomass for heating and cooling in Germany in the year 2018

Total: 131.9 billion kilowatt hours

- Biogenic solid fuels¹: 84.0%
- Biogas: 9.9%
- Biomethane: 2.4%
- Sewage gas: 1.9%
- Biogenic liquid fuels²: 1.7%
- Landfill gas: 0.1%

¹ incl. biofuels used in agriculture, forestry, construction and military;
² incl. sewage sludge and charcoal, without the biogenic fraction of waste in waste incineration plants

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Development of final energy consumption from biogenic waste in waste incineration plants for heating and cooling in Germany

Notice: biogenic fraction of waste in waste incineration plants estimated at 50%, since 2008 municipal waste only; decrease 2008 due to first-time inclusion of newly available data (statistical adjustment).

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Development of final energy consumption from solar thermal energy for heating and cooling and thermal plant capacity in Germany

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Additions and existing area of solar thermal plants in Germany

Notice: the figure comprises combined solar thermal systems as well as solar thermal support for heating and service water heating; in all categories the deinstallation is taken into account.

BMWi based on Working Group on Renewable Energy - Statistics (AGEE-Stat); as of December 2019
Development of final energy consumption from near-surface geothermal energy and ambient heat for heating and cooling and thermal capacity of heat pumps in Germany
Development of heat pumps in Germany

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Development of final energy consumption from renewable sources in the transport sector in Germany

1 consumption of biodiesel (including HVO) in the transport sector (excluding consumption in agriculture, forestry, construction and military)

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Final energy consumption from renewable sources in the transport sector in Germany in the year 2018

Total: 36 billion kilowatt hours

- Bioethanol: 24.2%
- Biomethane: 1.1%
- Electricity consumption (in transport): 12.7%
- Biodiesel: 62.0%

1 consumption of biodiesel (including HVO) in the transport sector (excluding consumption in agriculture, forestry, construction and military)
Notice: share of vegetable oil (0.03%) not shown because of very small contribution.

BMWi based on Working Group on Renewable Energy-Statistics (AGEE-Stat); as of December 2019
Development of greenhouse gas emissions avoided through the use of renewable energy sources in Germany by sectors

BMWi based on AGEE-Stat using data of the German Environment Agency (UBA); as of December 2019
Development of greenhouse gas emissions avoided through the use of renewable energy sources in the electricity sector in Germany

1 incl. solid, liquid and gaseous biomass, sewage sludge and the biologic fraction of waste (in waste incineration plants estimated at 50 %, from 2008 only municipal waste)

BMWi based on AGEE-Stat using data of the German Environment Agency (UBA); as of December 2019
Development of greenhouse gas emissions avoided through the use of renewable energy sources in the heating sector in Germany

1 incl. sewage sludge, without charcoal; ² incl. biofuels used in agric., forestry, constr. and military; ³ biogas, biomethane, sewage gas and landfill gas; ⁴ biogenic fr. of waste in waste incineration plants est. at 50 %, from 2008 only municipal waste

BMWi based on AGEE-Stat using data of the German Environment Agency (UBA); as of December 2019
Development of greenhouse gas emissions avoided through the use of renewable energy sources in the transport sector in Germany

Greenhouse gas emissions avoided in million tons CO₂-equivalents

- **Biodiesel¹**
- **Vegetable oil**
- **Bioethanol**
- **Biomethane**

¹ cons. of biodiesel (incl. HVO) in the transport sector (excl. cons. in agriculture, forestry, constr. and military)
Notice: calc. with the fossil ref. value of EU-RED 2009/28/EC: 83,8 g CO₂-eq./MJ (38. BImSchV: 94,1 g CO₂-eq./MJ); 2018 provis. BLE data.

BMWi based on AGEE-Stat using data of the German Environment Agency (UBA); as of December 2019
Greenhouse gas emissions avoided through the use of renewable energy sources in the year 2018
Total: 186.9 million tons CO₂-equivalents

1 incl. sewage sludge, without charcoal; 2 biogas, biomethane, sewage gas and landfill gas; 3 biogenic fraction of waste in waste incineration plants estimated at 50% BMWi based on AGEE-Stat using data of the German Environment Agency (UBA); as of December 2019
Development of investment in construction of renewable energy plants in Germany

Investment in billion Euro

- **2000**: 4.7
- **2001**: 6.3
- **2002**: 7.0
- **2003**: 7.4
- **2004**: 9.9
- **2005**: 12.0
- **2006**: 13.9
- **2007**: 13.6
- **2008**: 17.7
- **2009**: 23.5
- **2010**: 27.9
- **2011**: 26.1
- **2012**: 22.5
- **2013**: 16.5
- **2014**: 16.4
- **2015**: 13.9
- **2016**: 15.3
- **2017**: 15.7
- **2018**: 13.7

Legend:
- Hydropower
- Solar thermal energy
- Wind energy onshore
- Geothermal energy, ambient heat
- Wind energy offshore
- Photovoltaics
- Biomass (electricity)¹
- Biomass (heat)¹

¹ Solid, liquid and gaseous biomass

BMWi based on Centre for Solar and Hydrogen Research Baden-Württemberg (ZSW); as of December 2019
Development of investment in construction of renewable energy plants in Germany (by electricity and heat)

Investment: billion Euro

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<th>Investment electricity sector</th>
<th>Investment heat sector</th>
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<tr>
<td>2018</td>
<td>10.5</td>
<td>3.1</td>
</tr>
</tbody>
</table>

BMWi based on Centre for Solar and Hydrogen Research Baden-Württemberg (ZSW); as of December 2019
Investment in construction of renewable energy plants in Germany in the year 2018

Total investment: 13.7 billion Euro

- Wind energy offshore: 31.0%
- Wind energy onshore: 24.2%
- Photovoltaics: 19.2%
- Geothermal energy, ambient heat: 10.1%
- Solar thermal energy: 3.5%
- Biomass (electricity): 2.9%
- Biomass (heat): 8.9%
- Hydropower: 0.1%

¹ Solid, liquid and gaseous biomass

BMWi based on Centre for Solar and Hydrogen Research Baden-Württemberg (ZSW); as of December 2019
Development of economic stimuli from the operation of renewable energy plants in Germany

1 Solid, liquid and gaseous biomass

BMWi based on Centre for Solar and Hydrogen Research Baden-Württemberg (ZSW); as of December 2019
Development of economic stimuli from the operation of renewable energy plants in Germany (by electricity, heat and transport)

Economic stimuli in billion Euro


Economic stimuli (electricity) - Light blue
Economic stimuli (heat) - Dark blue
Economic stimuli (transport) - Light green

BMWi based on Centre for Solar and Hydrogen Research Baden-Württemberg (ZSW); as of December 2019
Economic stimuli from the operation of renewable energy plants in Germany in the year 2018
Total: 16.8 billion Euro

- Biomass (electricity)\(^1\): 26.8%
- Biomass (heat)\(^1\): 20.5%
- Wind energy onshore: 13.2%
- Wind energy offshore: 3.0%
- Photovoltaics: 8.9%
- Hydropower: 1.3%
- Biofuels: 16.4%
- Solar thermal energy: 1.8%
- Geothermal energy, ambient heat: 8.1%

\(^1\) Solid, liquid and gaseous biomass

BMWi based on Centre for Solar and Hydrogen Research Baden-Württemberg (ZSW); as of December 2019
## Glossary (I)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>Final energy</td>
<td>Final energy is the portion of primary energy that reaches the consumer after deducting transmission and conversion losses and is then available for other purposes. Final energy forms include district heating, electricity, hydrocarbons such as petrol, kerosene, fuel oil or wood, and various gases such as natural gas, biogas and hydrogen.</td>
</tr>
<tr>
<td>Final energy consumption (FEC)</td>
<td>Final energy consumption is the direct use of energy sources in individual consumption sectors for (FEC) energy services or the generation of useful energy.</td>
</tr>
<tr>
<td>Gross electricity consumption</td>
<td>Gross electricity consumption corresponds to the sum of total electricity generated in Germany (wind, water, sun, coal, oil, gas etc.), plus electricity imports and minus electricity exports. Net electricity consumption is gross electricity consumption minus grid and transmission losses.</td>
</tr>
<tr>
<td>Gross final energy consumption (GFEC)</td>
<td>Gross final energy consumption refers to the final energy consumption of the final consumer, plus the losses incurred in the generating units and during transport. The gross final energy consumption for renewable energy is the final energy consumption for households, transport, industry, skilled trades, commerce and services, plus on-site consumption in the conversion sector as well as line and flare losses.</td>
</tr>
</tbody>
</table>
Glossary (II)

Primary energy consumption (PEC)

Primary energy consumption (PEC) is the net total of domestic production and fuel exports minus marine bunkers and changes in stock.

Renewable energy sources

Energy sources which, on a human time scale, are available for an infinite period of time. Nearly all renewable energy sources are ultimately fueled by the sun. The sun will eventually burn out and so is not, strictly speaking, a renewable energy source. However, present knowledge indicates that the sun is likely to continue in existence for more than 1 billion years, which is virtually unlimited from our human perspective. The three original sources are solar radiation, geothermal energy and tidal energy. These can be harnessed either directly or indirectly in the form of biomass, wind, hydropower, ambient heat and wave energy.

Renewable Energy Sources Act (EEG)

The 2000 Act on Granting Priority to Renewable Energy Sources (shortened to: Renewable Energy Sources Act – EEG) regulates the grid operators’ obligation to purchase electricity generated from renewable sources before all other sources, the (declining) feed-in tariffs for the individual generation methods, and the procedure for allocating the resulting additional costs among all electricity customers. It has been amended several times. The last amendment took place in 2016.

Note: For detailed information please refer to the brochure „Renewable Energy Sources in Figures“.
Sources

- Working Group on Renewable Energy-Statistics (AGEE-Stat)
- Working Group on Energy Balances e.V. (AGEB)
- Federal Office for Economic Affairs and Export Control (BAFA)
- German Association of Energy and Water Industries e.V. (BDEW)
- Federal Office of Agriculture and Food (BLE)
- Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU)
- Federal Ministry of Food and Agriculture (BMEL)
- Federal Ministry for Economic Affairs and Energy (BMWi)
- Federal Network Agency (BNetzA)
- German Solar Association (BSW)
- German Wind Energy Association e.V. (BWE)
- German Heat Pump Association e.V. (BWP)
- German Biomass Research Centre (DBFZ)
- German Energy Agency (DENA)
- German Energy Pellet Association e.V. (DEPV)
- German Institute for Economic Research (DIW)
- Specialist agency renewable raw materials e.V. (FNR)
- International Geothermal Center (GZB)
- Leibniz Institute for Applied Geophysics: Geothermal Information System for Germany (LIAG)
- Leibniz Institute for Economic Research (RWI)
- Federal Statistical Office (StBA)
- Institute of International Forestry and Forest Economics (TI)
- Federal Environment Agency (UBA)
- UL International GmbH, DEWI (UL)
- Information platform of the German Transmission System Operators (ÜNB)
- Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW)

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