Electricity generation in Germany in 2023

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www.energy-charts.info
Agenda

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2. Electricity generation, share of renewable energies, full load hours
3. Imports and exports
4. Electricity prices
5. Installed capacity
6. Emissions and climate data
7. Appendix and explanations
Net electricity generation in 2023
Renewable energies: solar and wind

**Photovoltaic systems** generated approx. 59.9 TWh of electricity in 2023. Of this, approx. 53.5 TWh was fed into the public grid and 6.4 TWh was consumed. Total production increased by approx. 1 TWh or 1.4% compared to the previous year. Installed PV capacity totalled 80.7 GW at the end of November. Additions in 2023 up to November totalled approx. 13.2 GW. The maximum solar power fed into the grid was approx. 40.1 GW on 7 July 2023 at 13:15. The maximum share of solar energy in total electricity generation at this time was 68% and the maximum share of total daily energy from all electricity sources was 36.8%.

**Wind power plants** produced approx. 139.8 TWh in 2023 and were approx. 14.1% higher than production in 2022. Wind energy was once again the strongest energy source of the year, followed by lignite, solar, natural gas, biomass, hard coal, hydropower and nuclear energy. The maximum wind power generated was approx. 53 GW on 21 December 2023 at 11:00 a.m. The share of onshore wind amounted to approx. 115.3 TWh and offshore wind generated approx. 23.5 TWh. At the end of November 2023, the installed capacity of onshore wind was 60.5 GW and offshore wind 8.4 GW.

1 TWh = 1 terawatt hour = 1000 gigawatt hours (GWh) = 1 million megawatt hours (MWh) = 1 billion kilowatt hours (kWh)
## Net electricity generation in 2023

**Renewable energies: Hydropower and biomass**

**Hydropower** produced approx. 19.5 TWh compared to 16.3 TWh in 2022. The installed capacity is approx. 4.94 GW. It has hardly changed compared to previous years.

Approx. 42.3 TWh were produced from **biomass**. Production is therefore 1.3 TWh lower than in 2022, with installed capacity totalling 9 GW.

In total, the **renewable energy sources** solar, wind, water and biomass produced approx. 260 TWh in 2023. This is 7.2% above the previous year’s level of 242 TWh. The share of renewable energy fed into the public electricity grid in Germany in relation to the load, i.e. the electricity mix that actually comes out of the socket, was 56.9% compared to 50.2% in 2022.

In addition to net public electricity generation, total net electricity generation also includes solar self-consumption and self-generation by industrial and commercial enterprises. This is mainly generated using gas.

The share of renewable energies in total net electricity generation, including the power plants of "businesses in the manufacturing, mining and quarrying sectors", is around 54.9% compared to 45.5% in 2022.

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Net electricity generation in 2023
Non-renewable generation

Nuclear power plants generated 6.7 TWh of electricity in straight-line operation until their shutdown on 15 April 2023.

Lignite-fired power plants produced 77.5 TWh net for public electricity consumption and 3.7 TWh for industrial own consumption. This is 26.8 TWh less than in 2022. Gross electricity generation fell to the level of 1963.

Net production from hard coal-fired power plants for public electricity consumption totalled 36.1 TWh and 0.7 TWh for industrial own consumption. It was 21.4 TWh lower than in 2022. Gross electricity generation fell to the level of 1955.

Gas-fired power plants produced 45.8 TWh net for public electricity supply and 29.6 for industrial own consumption. This was 1.1 TWh below the previous year's level.

Lignite and hard coal-fired power plants generated more electricity than usual in 2022 due to the outage of many French nuclear power plants and high gas prices. The situation on the electricity market eased again in 2023, which led to a sharp reduction in coal-fired power generation.

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Net electricity generation in 2023
Export surplus

In 2023, Germany had a net import surplus of around 11.7 TWh in cross border electricity trading (planned or scheduled). The main reason for the imports was low electricity prices in neighbouring countries in the summer. The majority of imports came from Denmark (10.7 TWh), Norway (4.6 TWh) and Sweden (2.9 TWh). Germany exported electricity to Austria (5.8 TWh) and Luxembourg (3.6 TWh).

In 2022, a lot of electricity was still produced for export due to high exchange electricity prices, resulting in an export surplus of 27 TWh.

The cross border physical flows show an import surplus of 8.6 TWh compared to an export surplus of 27.5 TWh in 2022. The physical electricity flows do not provide any information on whether the electricity was actually consumed in the country or whether it was forwarded to neighbouring countries as transit electricity. It therefore makes little sense to analyse the individual countries here.

1 TWh = 1 terawatt hour = 1000 gigawatt hours (GWh) = 1 million megawatt hours (MWh) = 1 billion kilowatt hours (kWh)
Net electricity generation in 2023
Load, exchange electricity prices and market values

The load on the electricity grid was 457 TWh. This is around 26 TWh less than in 2022. Due to the high electricity prices and higher temperatures, electricity was probably saved significantly. Added to this is the increase in self-consumption of solar power, which also reduces the load.

The load includes electricity consumption and grid losses, but not pumped electricity consumption, self-consumption by conventional power plants and self-consumption by solar power plants.

The average volume-weighted day-ahead exchange electricity price was €92.29/MWh or 9.23 cents/kWh. This is significantly less than in 2022 (€230.57/MWh) and is almost exactly the same as in 2021 (€93.36/MWh).

The average volume-weighted intraday hourly price was €97.92/MWh or 9.79 cents/kWh. In 2022 it was € 232.55/MWh and in 2021 € 99.90/MWh.

Due to the coronavirus pandemic, 2020 should not be used for price comparisons.

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Public net electricity generation
Year 2023

The graph shows the net electricity generation from power plants for public power supply. This is the electricity mix that actually comes out of the socket. Self-consumption of solar power and generation from power plants of "companies in the manufacturing industry and in mining and quarrying", i.e. industrial generation for self-consumption, is not included in this chart.

Source: https://energy-charts.info/charts/energy/chart.htm?l=en&c=DE&year=2023&stacking=grouped&interval=year
Absolute change in public net electricity generation
Year 2023 compared to year 2022

Graphic: B. Burger, Fraunhofer ISE; Data: DESTATIS and Leipzig Electricity Exchange EEX, energy-corrected values
Public net electricity generation
Year 2023

Renewable energies

Non-renewable energies

Source: https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&interval=year&legendItems=01111111101111110&year=2023
Public net electricity generation
Year 2023

The graph shows the net electricity generation from power plants for public power supply. This is the electricity mix that actually comes out of the socket. Self-consumption of solar power and generation from power plants of "companies in the manufacturing industry and in mining and quarrying", i.e. industrial generation for self-consumption, is not included in this chart.

Source: https://www.energy-charts.info/charts/energy_pie/chart.htm?l=en&c=DE&interval=year&year=2023
Public net electricity generation
Year 2023

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Source: https://www.energy-charts.info/charts/energy_pie/chart.htm?l=en&c=DE&interval=year&year=2023
Public net electricity generation
Year 2002 - 2023

Source: https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&chartColumnSorting=default&interval=year&year=-1
Net public electricity generation from renewable energies

Year 2002 - 2023

Source: https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&chartColumnSorting=default&interval=year&year=-1&sum=1
Public net electricity generation from non-renewable sources
Year 2002 - 2023

Source: https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&chartColumnSorting=default&interval=year&year=-1&sum=1
Public net electricity generation from renewable and fossil sources

Year 2002 - 2023

Since 2019 more renewable than fossil energies

Source: https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&chartColumnSorting=default&interval=year&year=-1&sum=1&stacking=stacked_grouped
Since 2019, more solar and wind energy than nuclear energy at maximum 2006.
The chart shows total net electricity generation. This is the sum of net public electricity generation and the generation of "companies in the manufacturing industry and in mining and quarrying" for their own use.

Source: https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&interval=year&source=total&partsum=1&stacking=single&year=2023
Absolute change in total net electricity generation
Year 2023 compared to year 2022

Graphic: B. Burger, Fraunhofer ISE; Data: DESTATIS and Leipzig Electricity Exchange EEX, energy-corrected values
The chart shows total net electricity generation. This is the sum of net public electricity generation and the generation of "companies in the manufacturing industry and in mining and quarrying" for their own use.

Source: https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&interval=year&source=total&partsum=1&stacking=single&year=2023
Total net electricity generation

Year 2023

The chart shows total net electricity generation. This is the sum of net public electricity generation and the generation of "companies in the manufacturing industry and in mining and quarrying" for their own use.

Quelle: https://www.energy-charts.info/charts/energy_pie/chart.htm?l=de&c=DE&interval=year&source=total
Gross electricity generation from nuclear energy
Year 1950 to 2023
Gross electricity generation from lignite
Year 1950 to 2023

Gross electricity generation from lignite in 2023 was at the same level as in 1963.

Energy-Charts.info - last update: 01.01.2024, 19:52 MEZ
Gross electricity generation from hard coal

Year 1950 to 2023

Gross electricity generation from hard coal in 2023 was at the level of 1955.
Gross electricity generation from lignite and hard coal

Year 1950 to 2023

Gross electricity generation from coal in 2023 was at the same level as in 1959.
Share of renewable energies in net public electricity generation
Year 2002 to 2023

Source: https://www.energy-charts.info/charts/renewable_share/chart.htm?l=en&c=DE&interval=year&legendItems=01&share=ren_share
Share of renewable energies in the load (electricity consumption + grid losses)
Year 2015 to 2023

Source: [https://www.energy-charts.info/charts/renewable_share/chart.htm?l=en&c=DE&interval=year&sum=0&partsum=1&legendItems=01](https://www.energy-charts.info/charts/renewable_share/chart.htm?l=en&c=DE&interval=year&sum=0&partsum=1&legendItems=01)
Daily share of renewable energies in the load

Year 2023

Source: https://www.energy-charts.info/charts/renewable_share/chart.htm?l=en&c=DE&interval=day&sum=0&partsum=0&legendItems=01
Share of renewable energies in the electrical load in Europe
Year 2023

Share of renewable energies in total net electricity generation

Year 1990 to 2023

Source: https://www.energy-charts.info/charts/renewable_share/chart.htm?l=en&c=DE&interval=year&share=ren_share_total&legendItems=01
Share of renewable energies in total load
Year 1990 to 2023

Load (power consumption + grid losses)
Year 2015 to 2023

Source: [https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&interval=year&year=-1&chartColumnSorting=default&sum=1](https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&interval=year&year=-1&chartColumnSorting=default&sum=1)
Percentage change in load (power consumption + grid losses)
Year 2023 compared to 2022
Filling level of storage water and pumped storage power plants in Europe
Year 2015 to 2023

Source: https://www.energy-charts.info/charts/filling_level/chart.htm?l=en&c=ALL&stacking=stacked_absolute_area
Full load hours of offshore wind, onshore wind and solar
Year 2015 to 2023

Chart: B. Burger, Fraunhofer ISE

*Data on total electricity generation
Full load hours of nuclear energy, lignite, hard coal and natural gas
Year 2015 to 2023

*Data on total electricity generation
Percentage full load hours of offshore wind, onshore wind and solar
Year 2015 to 2023

Chart: B. Burger, Fraunhofer ISE

*Data on total electricity generation
Percentage full load hours of nuclear energy, lignite, hard coal, natural gas
Year 2015 to 2023

*Data on total electricity generation
Percentage full load hours of offshore wind
Year 2023

Source: https://www.energy-charts.info/charts/percentage_full_load_chart.htm?l=en&c=DE&chartColumnSorting=default&source=wind_offshore_unit_eex&partsum=1&year=2023
Monthly wind power generation onshore and offshore
Year 2023

Source: https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&month=-1&stacking=stacked_grouped&year=2023&partsum=1

*Data on public power generation
Monthly solar power generation

Year 2023

Source: https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&month=-1&stacking=stacked_grouped&year=2023&partsum=1

*Data on public power generation
Monthly wind and solar power generation

Year 2023

Source: https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&month=-1&stacking=stacked_grouped&year=2023&partsum=1

*Data on public power generation
Monthly renewable and fossil power generation
Year 2023

Source: https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&month=-1&stacking=stacked_grouped&year=2023

*Data on public power generation
Average power generation in one week
Year 2023

Source: https://www.energy-charts.info/charts/power/chart.htm?l=en&c=DE&week=-2&year=2023

*Data on public power generation
Average power generation in one week
Year 2023; with import/export and generation/consumption of pumped storage

Source: https://www.energy-charts.info/charts/power/chart.htm?l=en&c=DE&week=-2&year=2023&legendItems=1111111111111111110000

*Data on public power generation
Average power generation in one week
Year 2023; solar, wind, pumped storage generation and pumped storage consumption

Source: https://www.energy-charts.info/charts/power/chart.htm?l=en&c=DE&week=-2&year=2023&legendItems=1000000000010011100000

*Data on public power generation
Average power generation in one week
Year 2023; solar, pumped storage generation and pumped storage consumption

Source: https://www.energy-charts.info/charts/power/chart.htm?l=en&c=DE&week=2&year=2023&legendItems=1000000000010000100000

*Data on public power generation
Highest power generation from solar energy

Year 2023

The maximum solar output was approx. 40.1 GW on 7 July 2023 at 13:15. At this time, renewable energies supplied 85% of the load.

Source: [https://www.energy-charts.info/charts/power/chart.htm?l=en&c=DE&week=27&year=2023](https://www.energy-charts.info/charts/power/chart.htm?l=en&c=DE&week=27&year=2023)

*Data on public power generation*
The maximum capacity of onshore wind was approx. 48.5 GW on 21 December 2023 at 11:15 a.m. At this time, renewable energies supplied 93.1% of the load.

Source: [https://www.energy-charts.info/charts/power/chart.htm?l=en&c=DE&year=2023&interval=week&week=51](https://www.energy-charts.info/charts/power/chart.htm?l=en&c=DE&year=2023&interval=week&week=51) *Data on public power generation*
The maximum capacity of offshore wind was approx. 7.6 GW on 1 April 2023 at 07:45. At this time, renewable energies supplied 79.5% of the load.

Source: [https://www.energy-charts.info/charts/power/chart.htm?l=en&c=DE&year=2023&interval=week&week=13](https://www.energy-charts.info/charts/power/chart.htm?l=en&c=DE&year=2023&interval=week&week=13)
Highest fossil power generation
Year 2023

The maximum fossil capacity was approx. 45.0 GW on 1 December 2023 at 18:15. At this time, fossil fuels supplied 66.2% of the load.

Source: https://www.energy-charts.info/charts/power/chart.htm?l=en&c=DE&week=48&year=2023

*Data on public power generation
The minimum fossil capacity was approx. 5.3 GW on 1 July 2023 at 14:00. At this time, fossil fuels supplied 9.4% of the load.

Source: https://www.energy-charts.info/charts/power/chart.htm?l=en&c=DE&year=2023&interval=week&week=268&legendItems=00111111111111100000

*Data on public power generation
Scatter chart for solar and wind power
Quarter-hourly values from 2023

Source: https://www.energy-charts.info/charts/power_scatter/chart.htm?l=en&c=DE&interval=year&year=2023

*Data on public power generation*
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Power exchange balance
Year 2002 to 2023

Positive values mean imports. Negative values mean exports.
Source: https://www.energy-charts.info/charts/energychart.htm?l=en&c=DE&interval=year&year=-1&chartColumnSorting=default&sum=1&source=total
Monthly imports and exports
Year 2023

Positive values mean imports. Negative values mean exports.
Source: https://www.energy-charts.info/charts/energy/chart.htm?l=en&c=DE&chartColumnSorting=default&source=public&month=-1&sum=1&stacking=stacked_grouped&year=2023
Electricity import and export, scheduled commercial exchanges
Year 2023

Positive values mean imports. Negative values mean exports.

Source: https://www.energy-charts.info/charts/energy/chart.htm?en&c=DE&chartColumnSorting=default&source=tcs_saldo&interval=year&sum=0&partsum=1&year=2023
Electricity import and export, scheduled commercial exchanges

Year 2023

Germany -> Sweden: 0.37 TWh
Sweden -> Germany: 3.3 TWh

Germany -> Poland: 3.6 TWh
Poland -> Germany: 3.0 TWh

Germany -> Norway: 2.0 TWh
Norway -> Germany: 6.5 TWh

Germany -> Netherlands: 5.7 TWh
Netherlands -> Germany: 7.9 TWh

Germany -> France: 12.0 TWh
France -> Germany: 12.4 TWh

Germany -> Denmark: 4.8 TWh
Denmark -> Germany: 15.5 TWh

Germany -> Austria: 9.5 TWh
Austria -> Germany: 3.6 TWh

Germany -> Belgium: 5.0 TWh
Belgium -> Germany: 4.7 TWh

Germany -> Switzerland: 7.0 TWh
Switzerland -> Germany: 8.0 TWh

Germany -> Czech Republic: 4.0 TWh
Czech Republic -> Germany: 4.1 TWh

Germany -> Luxembourg: 3.7 TWh
Luxembourg -> Germany: 0.1 TWh

Germany: 69.3 TWh Imports; 57.6 TWh Exports; Balance: 11.7 TWh Imports

Source: https://www.energy-charts.info/charts/import_export/chart.htm?l=en&c=DE&year=2023
Scheduled commercial exchanges and cross border physical flows in Europe

Year 2023

In TWh, positive values (green) mean export surpluses, negative values (red) mean import surpluses.

Source: https://www.energy-charts.info/charts/import_export_map/chart.htm?l=en&c=DE&interval=year&year=2023
Foreign trade statistics for electricity in TWh

Year 2023

Electricity import

Import surplus

Electricity export

*Data up to and including October 2023
Source: German Federal Statistical Office

Physical flows. Positive values mean import. Negative values mean export.
Source: https://energy-charts.info/charts/power_trading/chart.htm?l=en&c=DE&interval=year&DataBase=trade_sum_twh&partsum=1&year=2023
Foreign trade statistics for electricity in Euro
Year 2023

Revenues

Balance expenditures

Expenditures

*Data up to and including October 2023
Source: German Federal Statistical Office

Positive values mean income. Negative values mean expenditure.

Source: https://energy-charts.info/charts/power_trading/chart.htm?l=en&c=DE&interval=year&dataBase=trade_sum_euro&partsum=1&year=2023
Foreign trade statistics for electricity in Euro
Year 2023

*Data up to and including October 2023
Source: German Federal Statistical Office

Import price

Export price

Source: https://energy-charts.info/charts/power_trading/chart.htm?l=en&c=DE&interval=year&DataBase=trade_sum_euro_mwh&partsum=1&year=2023
Foreign trade in electricity

Balance of income 2006 to 2023

*Data up to and including October 2023
Source: German Federal Statistical Office

https://energy-charts.info/charts/power_trading/chart.htm?l=en&c=DE&interval=year&dataBase=trade_sum_euro&partsum=1&year=1
Export and import of hard coal
Year 2006 to 2023

*Data up to and including October 2023
Source: German Federal Statistical Office

Source: https://www.energy-charts.info/charts/energy_source_trade/chart.htm?l=en&c=DE&sum=1&interval=year&years=1&dataType=hard_coal_import_export_absolute
Export and import of fossil gas
Year 2006 to 2023

Source: https://www.energy-charts.info/charts/energy_source_trade/chart.htm?i=en&c=DE&sum=1&interval=year&year=-1&dataType=gas_import_export_absolute

*Data up to and including October 2023
Source: German Federal Statistical Office
Export and import of hydrogen
Year 2006 to 2023

*Data up to and including October 2023
Source: German Federal Statistical Office

Source: https://www.energy-charts.info/charts/energy_source_trade/chart.htm?l=en&c=DE&sum=1&interval=year&year=-1&dataType=hydrogen_import_export_absolute
Export and import of crude oil and oil from bituminous minerals

Year 2006 to 2023

*Data up to and including September 2023
Source: German Federal Statistical Office

Source: https://www.energy-charts.info/charts/energy_source_trade/chart.htm?l=en&c=DE&sum=1&interval=year&year=-1&dataType=oil_import_export_absolute
Export and import of enriched uranium 235
Year 2006 to 2023

*Data up to and including October 2023
Source: German Federal Statistical Office

Source: https://www.energy-charts.info/charts/energy_source_trade/chart.htm?l=en&c=DE&sum=1&interval=year&year=-1&dataType=uranium_enriched_import_export_absolute
Export and import of natural uranium and its compounds
Year 2006 to 2023

Data up to and including October 2023
Source: German Federal Statistical Office

Source: https://www.energy-charts.info/charts/energy_source_trade/chart.htm?l=en&c=DE&sum=1&interval=year&year=-1&dataType=uranium_natural_compounds_import_export_absolute
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EPEX Spotpreis Day-Ahead
Volumengewichtet, nicht inflationsbereinigt

Source: https://www.energy-charts.info/charts/price_average/chart.htm?l=en&c=DE&chartColumnSorting=default&interval=year&year=-1&partsum=1&legendItems=0001100000000000000000000000
Negative day-ahead exchange electricity prices

Hours per year

Chart: B. Burger, Fraunhofer ISE; Data: EPEX
Price of CO2 emission allowances (EUAs)
Year 2010 to 2023

Source: https://www.energy-charts.info/charts/price_average/chart.htm?l=en&c=DE&chartColumnSorting=default&interval=year&year=-1&partsum=1&legendItems=000000000000000000000000100
Price of fossil gas (NCG, THE)
Year 2015 to 2023

Source: https://www.energy-charts.info/charts/price_average/chart.htm?l=en&c=DE&chartColumnSorting=default&interval=year&year=-1&partsum=1&legendItems=000000000000000000000000001
Day-ahead electricity price and CO2 certificate price

Year 2010 to 2023

Source: https://www.energy-charts.info/charts/price_average/chart.htm?l=en&c=DE&chartColumnSorting=default&interval=year&year=-1&partsum=1&legendItems=000110000000000000000000100
Day-ahead electricity price, CO2 certificate price and gas price
Months in 2023

Source: https://www.energy-charts.info/charts/price_average/chart.htm?l=en&c=DE&chartColumnSorting=default&interval=month&year=2023&partsum=1&month=1&legendItems=0010000000000101
Solar market value and EEG remuneration for new systems

Months in 2023

Source: https://www.energy-charts.info/charts/market_values/chart.htm?l=en&c=DE&year=2023
Day-ahead exchange electricity price above wind power
Hourly values in 2023

Wind feed-in lowers the day-ahead exchange electricity price. Each additional GW of wind feed-in lowers the price by €1.84/MWh.

Day-ahead exchange electricity price above the solar output
Hourly values in 2023

Solar feed-in lowers the day-ahead exchange electricity price. Each additional GW of solar feed-in lowers the price by EUR 1.59/MWh.
Day-ahead exchange electricity price above the sum of wind and solar
Hourly values in 2023

The sum of wind and solar lowers the day-ahead exchange electricity price. Each additional GW of feed-in lowers the price by €2.36/MWh.

Source: https://www.energy-charts.info/charts/price_scatter/chart.htm?l=en&c=DE&wind_onshore=1&solar=1&wind_offshore=1&year=2023
Day-ahead exchange electricity price above the residual load

Hourly values in 2023

The residual load increases the day-ahead exchange electricity price by EUR 3.14/MWh per GW of additional load.

Source: https://www.energy-charts.info/charts/price_scatter/chart.htm?l=en&c=DE&w=0&s=0&o=0&n=0&t=0&r=1&y=2023
European day-ahead electricity prices
Year 2023, arithmetic mean values

Source: https://www.energy-charts.info/charts/price_average_map/chart.htm?l=en&c=DE&interval=year&year=2023
Day-ahead electricity prices in Germany and its neighbouring countries
Year 2023

Source: https://energy-charts.info/charts/price_average/chart.htm?i=en&c=ALL&chartColumnSorting=ascending&interval=year&partsum=1&year=2023
EEG account balance
Monthly values, year 2010 to 2023

Source: https://energy-charts.info/charts/eeg_account/chart.htm?l=en&c=DE
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Installed capacity for power generation
Year 2023

Source: https://energy-charts.info/charts/installed_power/chart.htm?en&c=DE&year=2023

*Daten bis einschließlich November 2023*
Installed capacity for power generation
Year 2002 to 2023

Fossil/nuclear (left bar) and renewable (right bar). Since 2016, the installed capacity of renewable energies has been greater than the installed capacity of fossil/nuclear.

source: https://energy-charts.info/charts/installed_power/chart.htm?l=en&c=DE&year=-1&stacking=stacked_grouped

*Data up to and including November 2023
Annual expansion of installed solar capacity
Actual values from 2002 to 2023 and planning until 2025

Source: https://energy-charts.info/charts/installed_power/chart.htm?l=en&c=DE&year=-1&expansion=installation_decommission

* 2023: Januar bis November
Annual expansion of installed wind onshore capacity
Actual values from 2002 to 2023 and planning until 2025

Source: https://energy-charts.info/charts/installed_power/chart.htm?l=en&c=DE&year=-1&expansion=installation_decommission
Annual expansion of installed wind offshore capacity
Actual values from 2002 to 2023 and planning until 2025

Source: https://energy-charts.info/charts/installed_power/chart.htm?l=en&c=DE&year=-1&expansion=installation_decommission

* 2023: Januar bis November
Installed power and capacity of battery storage systems
Year 2014 to 2023

*Data up to and including November 2023

Source: https://energy-charts.info/charts/installed_power/chart.htm?l=en&c=DE&year=-1&expansion=installed_power&partsum=1&sum=0&legendItems=00000000110000&timeslider=0&min=12&max=21
Agenda

1. Summary
2. Electricity generation, share of renewable energies, full load hours
3. Imports and exports
4. Electricity prices
5. Installed capacity
6. Emissions and climate data
7. Appendix and explanations
Carbon dioxide emissions (CO₂) from electricity generation
Year 1990 to 2023

Source: Umweltbundesamt, Data for 2023 provisional.
Carbon dioxide emissions (CO$_2$) from power plants
Brown coal/lignite

Releases into the air. Pollutant threshold value: 0.1 million tonnes of CO$_2$ per year. Data source: Federal Environment Agency (UBA), E-PRTR Register

Source: https://energy-charts.info/charts/emissions/chart.htm?l=en&c=DE&chartColumnSorting=default&year=-1&sum=1&source=lignite
Carbon dioxide emissions \((\text{CO}_2)\) from power plants

Hard coal

Releases into the air. Pollutant threshold value: 0.1 million tonnes of \(\text{CO}_2\) per year. Data source: Federal Environment Agency (UBA), E-PRTR Register

In 2023, the average sunshine duration in Germany was 1753 hours. This is 13.4% less than in 2022.

Source: https://energy-charts.info/charts/climate_annual_average/chart.htm?l=en&c=DE&legendItems=00000000000000001000000000000000010&source=sun_dur
Average air temperature in Germany
Year 1881 to 2023

In 2023, the average air temperature in Germany was 10.63 °C. This is 2.43 °C higher than the long-term average (1961-1990) of 8.2 °C.

Source: https://energy-charts.info/charts/climate_annual_average/chart.htm?l=en&c=DE&legendItems=00000000000000001000000000000000010&source=air_color_flat
Average air temperature in Germany
Warming stripes from 1881 to 2023

Datenquelle: Deutscher Wetterdienst (DWD)
Source: https://energy-charts.info/charts/climate_annual_average/chart.htm?l=en&c=DE&source=air_color_flat
1. Summary

2. Electricity generation, share of renewable energies, full load hours

3. Imports and exports

4. Electricity prices

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7. Appendix and explanations
Electricity generation in Germany in 2023

Version 1

The first version of the 2023 annual evaluation from 1 January 2024 takes into account all electricity generation data from the Leipzig electricity exchange EEX up to and including 31 December 2023. The quarter-hourly values from EEX and Entsoe were energetically corrected using the available monthly data from the Federal Statistical Office (Destatis) on electricity generation up to and including September 2023 and the monthly data on electricity imports and exports up to and including October 2023. For the remaining months, the correction factors were estimated on the basis of past annual data. The extrapolated values are subject to larger tolerances.

You can find hourly updated data on the energy charts:

https://www.energy-charts.info
Difference between net and gross electricity generation

Net electricity generation

This report presents data on German net electricity generation for public electricity supply. When using net figures, a power plant’s own consumption is supplied directly from the power plant’s gross electricity generation. The difference between gross electricity generation and own consumption is the net electricity generation that is fed into the grid. According to this convention, a coal mill in a lignite-fired power plant, for example, is supplied directly from the electricity generated by the power plant and is therefore operated exclusively with lignite-based electricity.

The entire electricity industry calculates with net figures, e.g. for electricity trading, grid calculation, grid utilisation, power plant deployment planning, etc.

Only net electricity generation is traded on the German electricity exchange EEX, the transmission system operators calculate with net flows, Entsoe only provides net figures and only net figures are measured for cross-border electricity flows.

Public net electricity generation represents the electricity mix that actually comes out of the socket at home and is consumed in the household or used to charge electric vehicles in public. The electricity meter in the home measures the net electricity that is consumed or fed into the grid.
Difference between net and gross electricity generation

Gross electricity generation

**Gross electricity generation** also includes the power plants' own consumption, which is used directly in the power plant and is not physically fed into the public electricity grid. On the consumption side, the power plants' own consumption is added to the gross electricity consumption so that the balance is correct again. According to this convention, a coal mill in a lignite-fired power plant, for example, is operated with the gross electricity mix and thus with approx. 45% renewable energies.

In addition, the gross electricity generation also includes the electricity generated by industry itself, the so-called "companies in the manufacturing industry and in mining and quarrying". This in-house generation is consumed directly by the companies and is not fed into the public grid. Gross figures are only collected for statistical purposes, but are not used in the daily electricity industry.

The data on net public electricity generation and total gross electricity generation differ significantly. This also results in significantly different shares of renewable energies in electricity generation and electricity consumption.
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