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# Key Facts about the Energy Transition in Germany

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## Shaping the second phase

Germany's new government has set itself an ambitious goal: carbon neutrality until 2045. By 2030 greenhouse gas emissions shall be reduced by 65 percent compared to 1990 levels. It has also agreed on an accelerated coal phase out prior to 2038 – as had been planned by the previous administration.

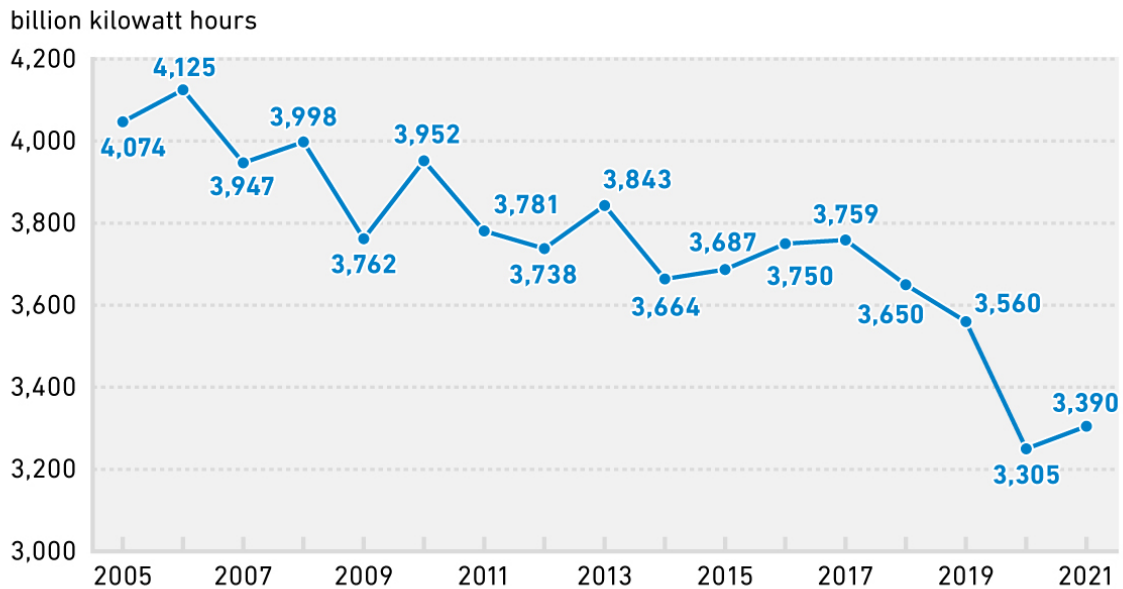
The current war against Ukraine has emphasized the importance of energy independence and of expanding locally available energy sources. Renewable energy is the only viable option for Germany to liberate itself from its dependence on foreign oil, gas and coal. The energy transition in Germany has seen some ups and downs, but in the big picture it has been a success story. In 2021, wind, solar, biomass, hydro and geothermal energy added up to a market share of 41.1 percent in power consumption. The goal is to reach 80 percent by 2030. This is a huge opportunity to modernize Germany's economy. Transforming the energy system is a driver of progress, innovation and jobs.

The first phase of the energy transition was mainly about adding renewable energy capacities, developing and refining clean energy technologies as well as reducing costs. We are now at the beginning of the second phase, where renewable energy sources are becoming the main pillars of a new energy system. They are substituting fossil fuels and nuclear energy in all sectors. The key word is "sector coupling". Technologies like electric cars, heat pumps, power-to-heat, green hydrogen and other e-fuels (e.g. synthetic methane, methanol or ammonia) allow the use of wind and solar power in the fields of transport and heating.

## Energy efficiency – Twin pillar of the energy transition

Expanding renewable energy production and reducing energy consumption have to go hand in hand. Energy efficiency reduces the overall costs and minimizes the environmental impacts of our energy consumption. In 2020 primary energy consumption dropped by 8.7 percent which resulted in Germany temporarily meeting its goal to reduce primary energy consumption by 20 percent until compared 2008. However, the COVID-19 pandemic played a significant role. In 2021 economic recovery combined with cold weather led to an increase of energy consumption by 2.6 percent. While high energy prices and the newly introduced carbon price showed an effect on the consumption of mineral oil (-5.1 percent), the use of natural gas rose by 3.9 percent. The consumption of hard coal even jumped by 17.9 percent, lignite by 18.0 percent and nuclear energy by 7.2 percent compared to 2020. The expansion of renewable energy and efficiency measures were not enough to meet the rising energy demand. The share of renewables dropped by 0.2 percent.

## Primary Energy Consumption in Germany Development 2005–2021



Source: AGEb; as of: 12/2021

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Germany's energy efficiency policy relies on a broad range of instruments: financial incentives, efficiency standards as well as information and consulting. Financial incentives are given by low-interest loans or investment grants. External effects, such as environmental impacts of energy consumption, are partly internalized into energy prices through an energy use tax, through the European Emissions Trading System and, since 2021, through a new carbon price for buildings and transport. The Energy Saving Ordinance (EnEV) sets minimum requirements for efficient energy use in new buildings and for large-scale renovations of existing buildings. EU-wide provisions on energy labeling of products enhance transparency and provide incentives for consumers to choose devices with high efficiency standards. Requirements to ecodesign set binding minimum standards for the environmentally friendly design of energy-related products.

Energy efficiency is a lucrative business model. Investments in energy efficient buildings reached € 83.2 bn in 2020. 900.000 people were employed in modernizing buildings.

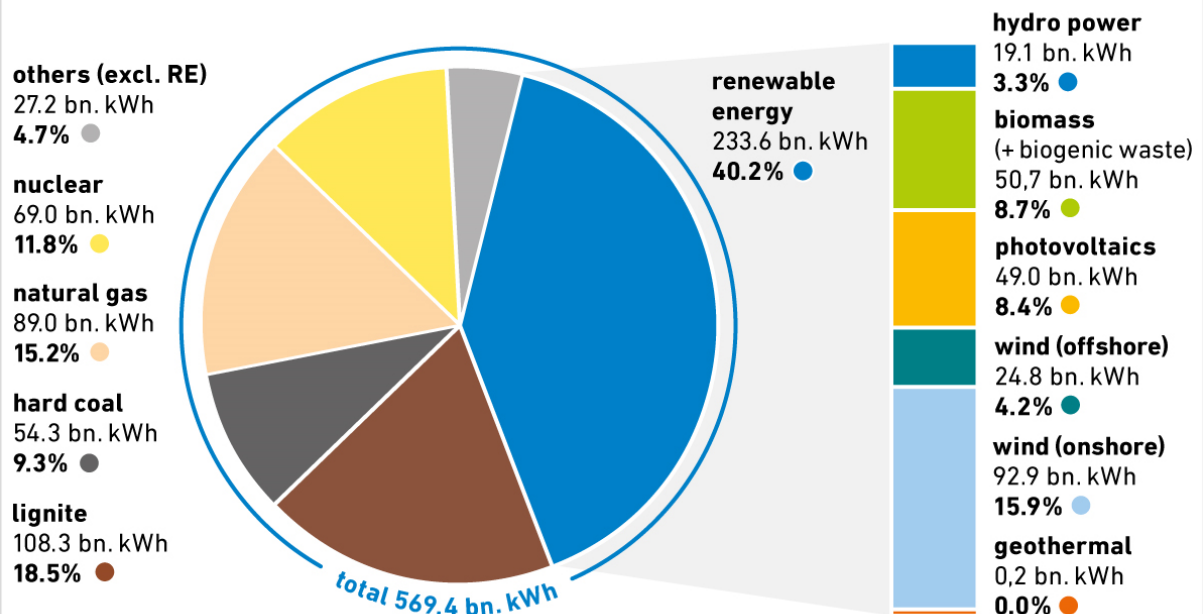
## Renewable energy – the transition continues

### The power sector: Rise in renewable power generation

In 2021, the renewable share in German power consumption dropped by four percentage points to 41.1 percent. Wind, solar, biomass and hydro power generated 233.6 bn kWh – 17 bn kWh fewer than in 2020. The decrease of renewable power production for the year 2021 was mainly due to a below average wind year. However, with 113.9 bn kWh (2020: 132.1 bn kWh) wind energy still contributed the largest share to the German power mix. Onshore wind power production fell to 89.5 bn kWh (2020: 104,8 bn kWh), offshore wind power to 24.4 bn kWh (2020: 27.3 bn kWh). Solar power production rose from 49.5 bn kWh to 50.0 bn kWh, hydro power to 19.1 bn kWh (2020: 18.3 bn kWh). Power production from biomass remained stable at 50.4 bn kWh.

### Germany's power mix 2021

At 234 billion kilowatt hours, renewables supplied 40 percent of Germany's gross electricity production. The share of renewables in power consumption reached 41 percent.



Source: AGEE-Stat, AG Energiebilanzen; as of: 3/2022

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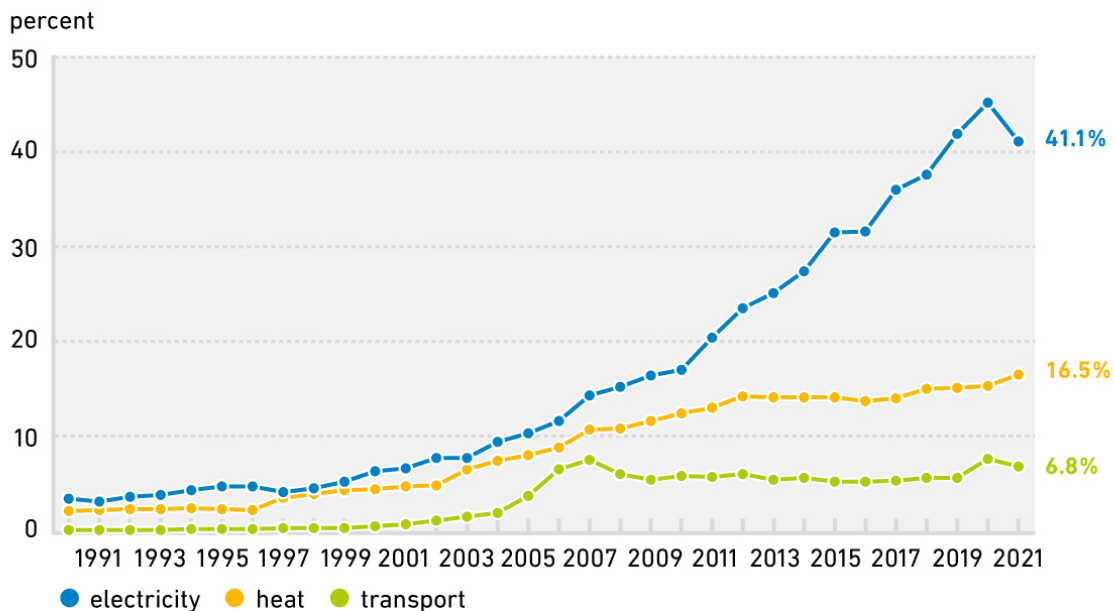


By the end of 2021, 138.5 GW of renewable energy capacity were installed. 1,677 MW of wind power capacity were added, which amounted to a total of 63.9 GW (onshore: 56.1 GW, offshore: 7.8 GW). Solar capacity rose by 5,007 MW to a total of 58.7 GW. In the biomass

sector, 127 MW in new capacity was added. In total 9.4 GW of biomass plants were installed. Hydro power adds 5.4 GW to the mix.

In the heat and transport sectors more progress is needed to reach Germany's climate goals. In 2021, renewable energy contributed 199.4 bn kWh (16.5 percent) in heating and cooling. In transport, the renewable share is still relatively small with 6.8 percent. It even dropped by 0.8 percentage points compared to 2020.

## Share of renewable energy in Germany's final energy consumption 1990–2021



Source: AGEE-Stat; as of: 3/2022

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## Multiple benefits

### Effective climate change mitigation

The use of Renewable Energies avoided 221.4 million tons (mt) of greenhouse gas (GHG) emissions (CO<sub>2</sub>-eq.) in 2021, compared to 231.9 mt of saved emissions in 2020. Renewable power generation contributed 166.7 mt of GHG savings, 44.9 mt were attributable to heating and cooling. Due to the use of biofuels and electricity in the transport sector GHG emissions of 9.8 mt were avoided.

### Investments strengthen the economy

The successful expansion of renewable power production goes hand in hand with investment in renewable capacities, storage systems, electric transport and heat as well as hydrogen. Investments in the energy transition in Germany amounted to 47 \$bn in 2021, according to the annual trend report by Bloomberg New Energy Finance. With the upcoming nuclear and coal phase outs, investments are expected to increase. The new administration announced an investment package of 200 \$bn until 2026 to accelerate the Energiewende.

### Energy independence

The lion's share of Germany's energy imports come from only a hand full of energy exporting countries with large reserves of mineral oil, hard coal and natural gas. Expanding locally available resources like wind, solar, biomass, hydro and geothermal energy enables countries to reduce their dependence on imports and their outflow of resources. While renewable energy strengthens the local economy, importing fossil fuels ties up funds that could be invested more wisely.

### Driver of innovation

The massive cost reduction in solar and wind power generation is one indicator of the innovative potential in the renewable energy sector. In good locations in Germany, wind power and PV already have lower costs than new coal or natural gas power plants. In 2021, the average price resulting from onshore wind energy auctions was below 6 €Cents/kWh, in solar energy tenders only about 5 €Cents/kWh. The lowest single price for large scale solar parks was at 3.55 €Cents/kWh. Levelized costs of small roof top systems can be up to 6-11.5 €Cents/kWh. Module costs have dropped by 90 percent since 2010 alone. Thanks to technological progress, learning curves and economies of scale new solar power plants cost 75 percent less than in 2006.

### Job engine

Suppliers of chemicals, glass, steel, copper and electronics highly benefit from the expansion of renewable technologies. The energy transition creates jobs in various fields, such as manufacturing, planning, administration, installation, operation and maintenance. These job opportunities even extend into remote parts of the country which have been in need of a bright economic outlook for decades. In 2019, 299,700 people worked in the renewable energy sector in Germany.

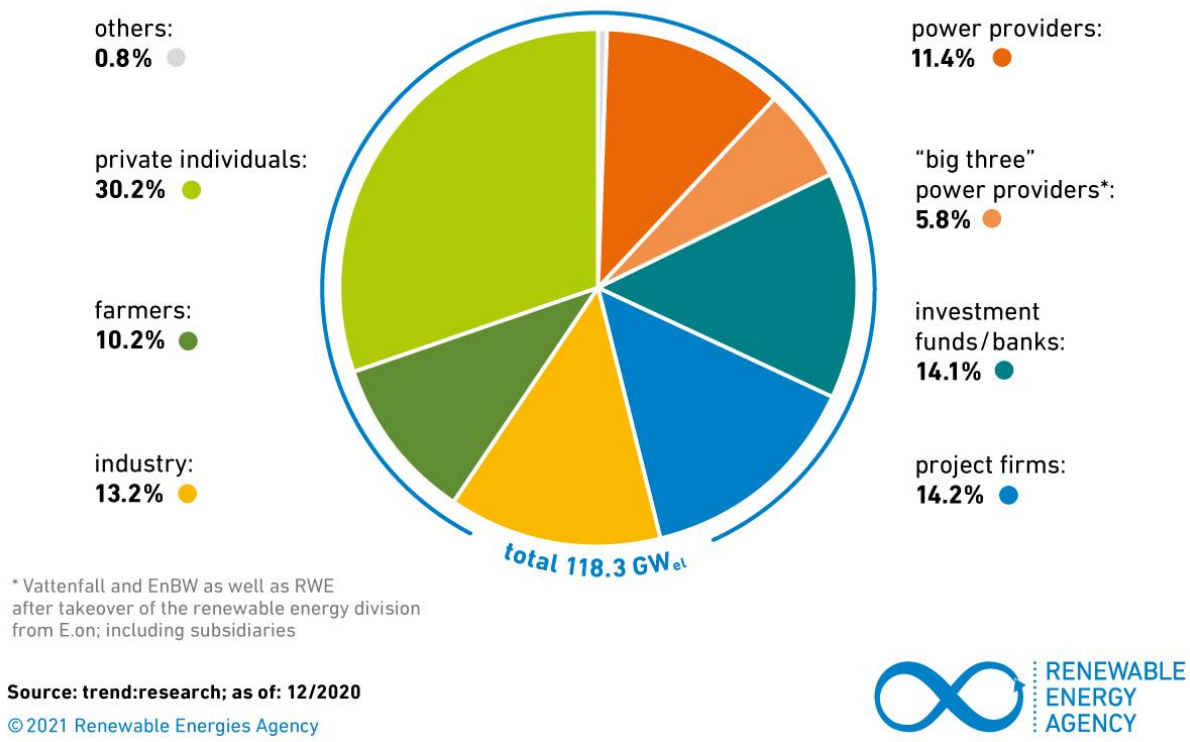
### Public participation

With renewable energy, every citizen can be a plant operator. Energy cooperatives give people the opportunity to invest in citizen-owned wind energy systems or citizen-owned solar energy plants – even with minor payments, starting with €500. According to a survey by the market research institute trend:research, more than 40 percent of all renewable power capacity installed in Germany lies in the hands of private individuals and farmers.



## Renewable energy in the hands of the people

Ownership distribution of installed RE capacity for power production in Germany in 2019



## The way ahead

Renewable energy is the key to energy independence. Even in a relatively small and densely populated country like Germany there are sufficient resources to produce most of its energy within its own borders. The energy transition gives a boost to the local economy and reduces the need for energy imports.

Fluctuating energy sources like wind and solar will dominate the energy system of the future. To fulfill their potential a new policy framework with incentives for flexible supply and demand is necessary. Biomass, hydro power, storage systems and load management can fill the gaps in times of low wind and solar power production. Heat pumps, district heating networks, electric vehicles and hydrogen help to adjust power demand to supply.

This factsheet was prepared by:

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