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ENERGY MARKET GERMANY

2020

BDEW Bundesverband der Energie- und Wasserwirtschaft e. V.

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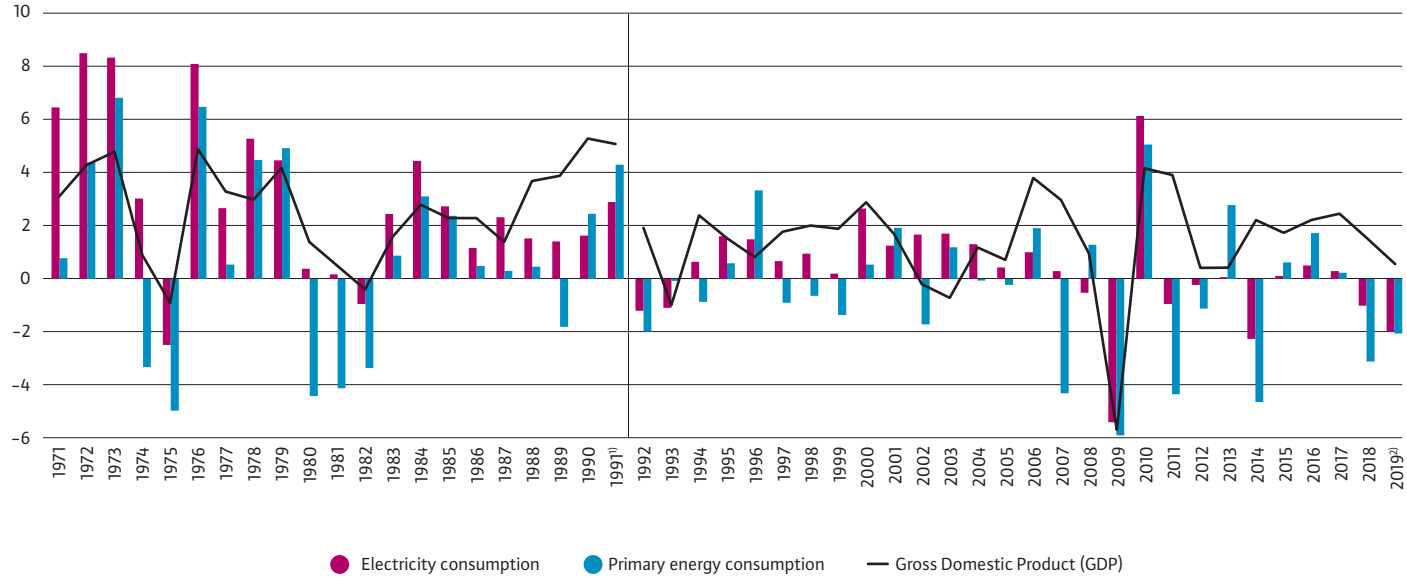
ENERGY AND THE ECONOMIC SITUATION

Energy consumption continues to fall in 2019

Annual rates of change 1971–2019[2] (per cent)



Sources: AGEB, Destatis, BDEW; Status: 05/2020

1) Up to 1991, West Germany only, 2) Preliminary figures

ENERGY AND THE ECONOMIC SITUATION

Energy consumption continues to fall in 2019

Economic growth and energy consumption were closely interrelated between 1971 and 1990, however the development of GDP and of energy consumption began to diverge at the beginning of the 1990s. From 1991 to 2010, electricity consumption increased on average by around 0.7 per cent annually whilst the economy grew on average by 1.2 per cent. From 2010 onwards, electricity consumption was on a general downward trend. In the past two years, primarily due to the mild weather and weaker economic growth, it has fallen once more.

Primary energy consumption fell in 2019 by 2.1 per cent to 12 832 PJ. That is the lowest level since the beginning of the 1970s. The main causes of the drop were economy driven falls in energy consumption by industry as well as improvements in energy efficiency. Adjusted for the effects of the weather, energy consumption even sank by 2.4 per cent.

Natural gas consumption in Germany increased in 2019 by 3.3 per cent to 982 bn kWh. The main reason for this was the increased use of natural gas for the generation of electricity and heating. Natural gas accounted for 24.9 per cent of domestic primary energy consumption.

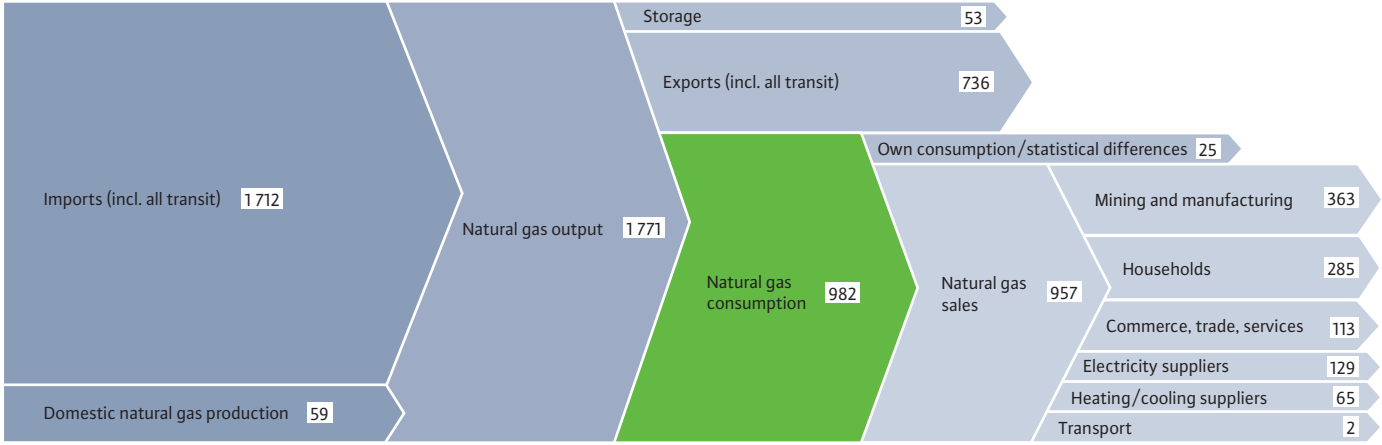
In contrast, gross electricity consumption decreased in 2019 compared to 2018. At 569 bn kWh, consumption was 2.6 per cent lower year on year. Electricity productivity for the economy as a whole, which experienced average annual growth between 1990 and 2019 of 1.8 per cent, increased in 2019 by 2.7 per cent.

Gross domestic product, after adjustment for inflation, increased by 0.6 per cent in comparison to the previous year. The growth was driven mainly by domestic consumption and investments. However, the positive contributions came primarily from the areas of commerce, trade and services as well as the construction industry, whilst the gross value added of industry shrank by 3.6 per cent.

GAS FLOW

From import and production to consumption

Gas flow in 2019[1] (bn kWh)



In 2019 a further 9.5 bn kWh of biogas upgraded to natural gas quality was injected into the German natural gas network.

Sources: Destatis, BVEG, dena, BDEW; Status: 02/2020

1) Preliminary figures

KEY DATA – GAS

The most important figures at a glance

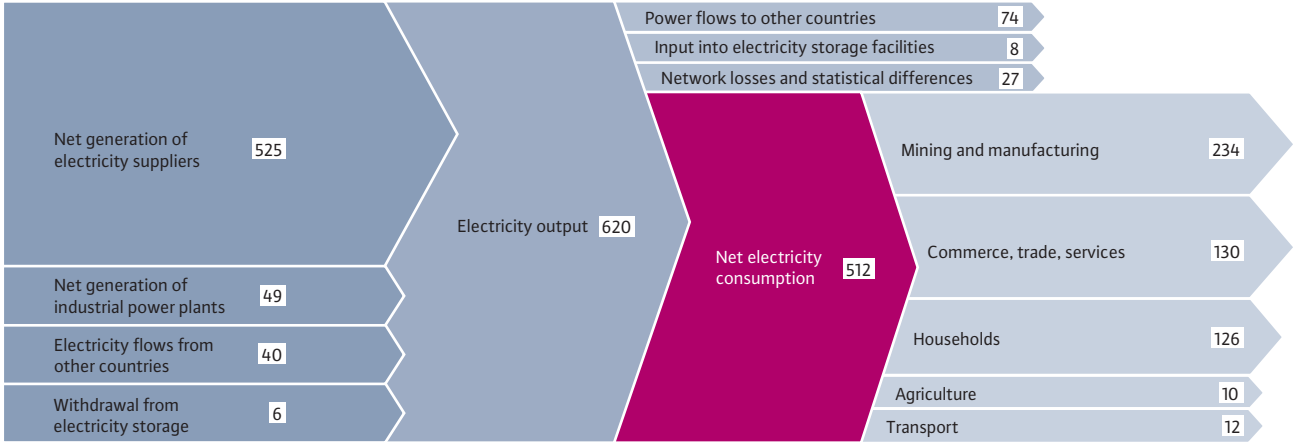
Gas suppliers	2009	2018	2019[1)]	Change year-on-year (per cent)
Employees (thousand)	35.4	39.0	**39.2**	+0.5
Revenue (€ bn) from gas sales to end users[2)]	37.0	32.3	**33.9**	+4.8
Investment (€ bn)	3.0	2.9	**2.7**	-6.7
Domestic natural gas production (bn kWh)	141.5	61.7	**59.2**	-3.9
Natural gas imports[3)] (bn kWh)	949.3	1 773.3	**1 712.1**	-3.4
Natural gas exports[3)] (bn kWh)	143.3	861.8	**736.6**	-14.5
Net-imports (bn kWh)	806.0	911.4	**975.5**	+7.0
Storage net balance (bn kWh)	-34.4	-21.9	**-52.6**	-
Natural gas consumption (bn kWh)	913.1	951.2	**982.2**	+3.3
Natural gas sales (bn kWh)	904.9	935.4	**957.3**	+2.3
Feed-in of biomethane into the grid (bn kWh)	1.0	10.4	**9.5**	-8.8
Number of homes supplied with natural gas heating (million)	19.5	20.8	**20.9**	+0.6
Network length (km)	431.7	487.7	**490.0**	+0.5
- low-pressure networks	141.0	160.3	**161.0**	+0.4
- medium-pressure networks	180.2	205.8	**207.0**	+0.6
- high-pressure networks	110.4	121.6	**122.0**	+0.3
Underground storage facilities				
- Number	47	47	**47**	-
- Capacity (million m^3)	20 804	24 298	**23 900**	-1.6

Sources: Destatis, BVEG, dena, LBEG, BDEW

1) Preliminary figures, 2) Excl. VAT, 3) From 2018, incl. all transit

ELECTRICITY FLOW
From generation to consumption

Electricity flow in 2019[1] (bn kWh)



Sources: Destatis, BDEW; Status: 02/2020

1) Preliminary figures, rounding differences

KEY DATA – ELECTRICITY

The most important figures at a glance

Electricity suppliers	2009	2018	2019[1)]	Change year-on-year (per cent)
Employees (thousand)	130.4	138.0	**138.0**	+0.0
Revenue (€ bn) from electricity sales to end users[2)]	63.5	83.5	**84.5**	+1.2
Investment (€ bn)	8.5	12.2	**13.0**	+6.6
Net capacity of power stations				
– total (GW)	150.9	213.6	**218.1**	+2.1
– general supply[3)] (GW)	139.8	202.8	**207.2**	+2.2
Net electricity generation				
– total (bn kWh)	553.1	601.3	**574.3**	–4.5
– general supply[3)] (bn kWh)	510.6	550.1	**524.8**	–4.6
Net electricity consumption				
– total (bn kWh)	509.3	522.1	**511.6**	–2.0
– general supply[3)] (bn kWh)	490.9	491.9	**483.3**	–1.8
Physical flows (bn kWh)				
– from other countries	40.6	31.5	**39.6**	+25.6
– to other countries	54.9	82.7	**74.5**	–10.0
– net balance of exchanges	–14.3	–51.2	**–34.9**	–
Number of customers				
– Customers at tariff rates and those with special agreements (million)	44.7	45.5	**45.6**	+0.1
– Customers with special rates (million)	0.32	0.34	**0.34**	±0.0
Circuit lengths (million km)	1.76	1.85	**1.85**	+0.1

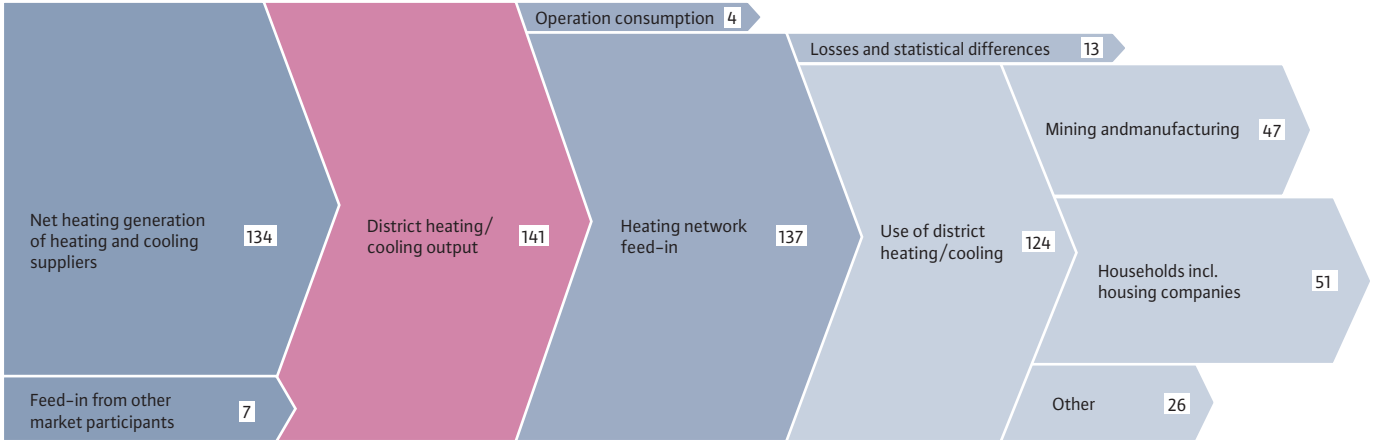
Sources: Destatis, BNetzA, BDEW

1) Preliminary figures, 2) Excl. VAT and electricity tax, 3) Excl. industrial power plants, incl. decentralised small plants

DISTRICT HEATING FLOW

From generation to consumption

District heating flow in 2019[1] (bn kWh)



Sources: Destatis, BDEW; Status: 02/2020

1) Preliminary figures

KEY DATA – DISTRICT HEATING

The most important figures at a glance

Cooling and heating suppliers	2009	2018	2019[1)]	Change year-on-year (per cent)
Employees (thousand)	15.3	15.4	**15.4**	–0.3
Revenue from heating sales to end users[2)] (€ bn)	+ 8.6	+ 8.6	**+ 9.0**	+4.7
Investment (€ bn)	1.0	1.3	**1.4**	+2.3
Net max. heating output				
– total (GW)	59.4	77.1	**74.3**	–3.6
– general supply (GW)	56.5	74.6	**71.8**	–3.8
District heating/cooling output (bn kWh)	139.3	141.2	**141.2**	+0.1
– from highly efficient combined heat and power	95.4	102.4	**101.9**	–0.5
– from separate generation in heating/CHP plants	35.1	31.7	**32.1**	+1.3
– from other market participants	8.8	7.1	**7.2**	+2.1
Use of district heating/cooling (bn kWh)	124.5	123.5	**124.1**	+0.5
– industry	51.2	48.3	**47.1**	–2.6
– private households incl. housing companies	49.1	49.7	**51.0**	+2.6
– other	24.4	25.4	**26.0**	+2.3
Number of households supplied with district heating (million)	5.1	5.8	**5.9**	+1.4
Length of pipelines (thousand km)	21.5	28.6	**29.0**	+1.4

Sources: Destatis, BNetzA, BDEW

1) Preliminary figures, 2) Excl. VAT

NETWORK LENGTHS

The development of the energy supply networks at a glance

Length of suppliers' networks (km)

	2009	2019[1)]
Gas network operators		
Low-pressure networks	141 048	161 000
Medium-pressure networks	180 215	207 000
High-pressure networks	110 416	122 000
Total length of pipes	**431 679**	**490 000**
Electricity network operators		
Low voltage	1 143 494	1 200 000
voltage	506 292	525 500
High voltage	76 954	85 700
Extra-high voltage	35 311	37 050
Stromkreislänge gesamt	**1 762 051**	**1 848 250**
Heating and cooling network operators		
Heat transfer medium: water	20 281	26 150
Heat transfer medium: steam	877	2 870
Total length of pipes	**21 158**	**29 020**

Source: BDEW

1) Preliminary figures

Pressure levels of the gas network:

Low-pressure: up to and including 100 millibars
Medium-pressure: from over 100 millibars up to and including 1 bar
High-pressure: above 1 bar

Voltage levels of the electricity network:

Low voltage: up to and including 1 kV
Medium voltage: from over 1 kV up to and including 72.5 kV
High voltage: from over 72.5 kV up to and including 125 kV
Extra-high voltage: over 125 kV

Temperatures, heating network:

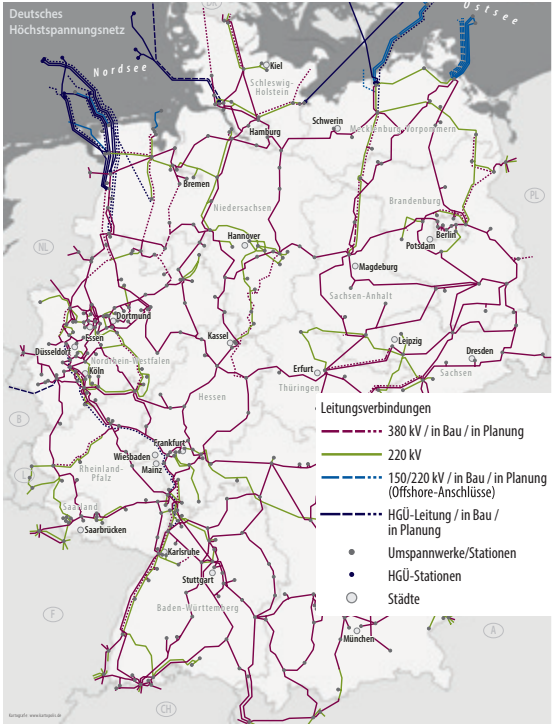
Water: < 30 °C up to over 140 °C
Steam: 110 °C up to over 300 °C

THE GERMAN EXTRA-HIGH VOLTAGE GRID

Network expansion urgently required

Germany is served by a network of around 37 000 kilometers of extra-high voltage lines. This electricity network, operated at voltages of 220 and 380 kilovolts, forms the basis of a secure electricity supply.

Further expansion is required to optimally integrate, in particular, the planned onshore and offshore wind farms and to ensure the electricity produced there can be transported to the centres of consumption. According to the German Federal Requirements Plan Act [Bundesbedarfsplangesetz, BBPIG], the intention is for the urgently required high-voltage direct current (HVDC) lines to transport electricity generated from wind power from the north to the centres of consumption in the south from 2025 onwards. In the scope of the German Grid Expansion Acceleration Act [Netzausbaubeschleunigungsgesetz, NABEG], procedures have been initiated to speed up the planning and authorisation processes. Moreover, a more intense involvement of the general public should promote acceptance for electricity line projects at a local level.

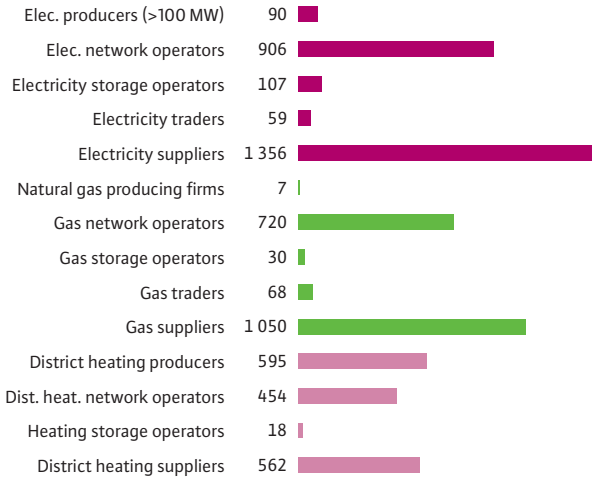


Source: VDE|FNN; Status: 01/2020

UNIQUE DIVERSITY IN THE ENERGY MARKET

Around 2 250 companies take care of the energy supply

Number of companies in the different market areas[1)]



1) Figures may not be summed as many of the companies are active in multiple sectors and at multiple levels of the value chain and have thus been recorded more than once; some figures rounded (*). In total, around 2 200 companies are active on the electricity/gas/district heating markets.

Sources: BDEW, BNetzA; Status: 05/2020

There is no other European country with as many energy supply companies as Germany. Alongside a series of major companies, there is a substantial number of small and medium-sized energy suppliers, the majority of which are in municipal ownership. Overall, they account for more than two thirds of all companies.

In total, there are around 2 250 companies active on the German energy market in 2020 – their fields of activity cover everything from the generation or production of electricity, heating and natural gas to the operation of energy storage facilities, power line and pipeline networks and the supply to end-users on a local and regional level.

Despite many mergers, particularly at a regional level, the number of companies active in the German energy market today is considerably higher than prior to liberalisation in 1998. Suppliers that mainly serve private customers are predominantly multi-utility companies who offer their customers a variety of product packages for natural gas, district heating, electricity and often also water.

SWITCHING SUPPLIERS ON THE ENERGY MARKET

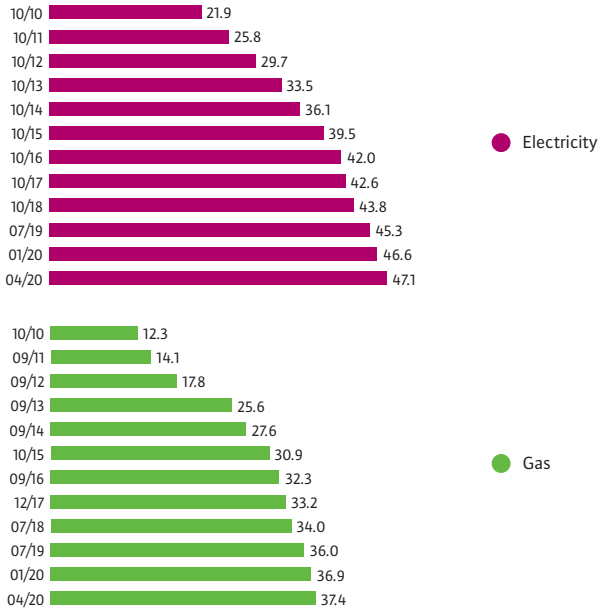
Cumulative rate of switching since liberalisation

Many new suppliers but also many established energy suppliers, now offer their products across multiple regions within Germany or even nationwide. This continues to lead to slightly increasing year-on-year rates of switching. Since liberalisation of the market, over 47 per cent of all household customers had switched electricity supplier at least once by April 2020, with many of those already having switched multiple times.

Customers can usually choose from other options offered by their energy provider in addition to the general tariff. The range of products offered by the energy providers also often includes green energy tariffs. Therefore, in addition to switching to another supplier, there are many customers who switch to a lower cost tariff or to a green power tariff from their existing supplier.

Of the around ten million households who have a direct contractual agreement with their gas supplier, over 37 per cent have already switched supplier at least once since liberalisation in 2007.

Switching of electricity and gas supply in homes (per cent)

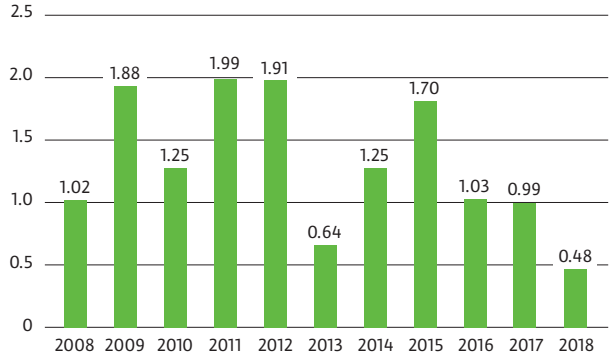


Sources: BDEW-Energietrends, BDEW-Kundenfokus; Status 04/2020

RELIABILITY OF GAS SUPPLY

Secure supply with natural gas

Average duration of interruption of natural gas supply per customer per year (minutes)[1)]



1) Unplanned interruptions without exceptional events (force majeure)

Source: BNetzA; Status: 06/2019

For thirteen years now, the BNetzA has been collecting annual data, in accordance with the German Energy Industry Act [Energiewirtschaftsgesetz, EnWG], from all gas distribution network operators regarding interruptions in supply. On the basis of this information, the SAIDI value (System Average Interruption Duration Index) – an average value across all end customers served – is determined. The SAIDI value reflects the average duration within a calendar year in which a customer is affected by an outage. All unplanned interruptions which are due to third party actions are included, reactions from other networks or other disruptions in the network operator's area.

In 2018, the SAIDI value was 0.48 minutes, i.e. the supply of natural gas to German customers was interrupted on average for around half a minute. As such, the reliability of the German gas supply remained at a very high level in 2018; it remained markedly below the multi-year median value of 1.6 minutes.

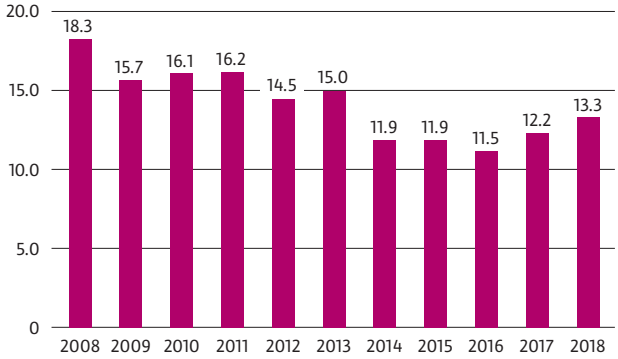
RELIABILITY OF ELECTRICITY SUPPLY

Germany's electricity networks remain particularly reliable

In 2018, the reliability of the German electricity grid was once again very high, with an average of just 13.3 minutes' interruption per customer. This is shown by the 2018 Disruption and Availability Statistical Report from the VDE|FNN. The key international standard indicator for the reliability of supply is the annual non-availability per electricity customer excluding interruptions due to force majeure. The extremely high level of reliability of supply in Germany must be viewed in light of a rapidly growing number of redispatch measures. These are short-term, unplanned interventions of network operators.

If electricity outages caused by force majeure are included – such as, in particular, adverse weather – the average annual interruption duration per electricity customer in 2018 was 17.1 minutes (2017: 20.0 minutes).

Average unavailability of electricity supply per customer per year (minutes)



Source: VDE|FNN; Status: 10/2019

SECTOR COUPLING
Linking sectors and infrastructures

Key factors for sector coupling

BDEW understands sector coupling to mean the linking of electricity, heating, mobility and industrial processes and their infrastructures in terms of energy technology and energy business. Sector coupling is a significant element within the implementation of the *Energiewende* [German energy transition]:

- Integration of renewables
- Decarbonisation of all sectors
- Supporting security of supply and
- Increasing flexibility in the energy system

Use cases of sector coupling include power-to-gas (PtG) and power-to-heat (PtH) as well as eMobility.

In Germany, there are currently over 35 PtG pilot and demonstration facilities. Further major projects for the application of PtG also exist in the form of the real life test projects within the *Energiewende* initiated by the German Federal Ministry for Economic Affairs and Energy [Bundeswirtschaftsministerium]. The hydrogen produced can be used directly or injected into the natural gas system. Through the methanation process, hydrogen can be further processed to produced synthetic natural gas (SNG) and thus fed into the gas grid without limit and used everywhere that conventional natural gas is used.

Moreover, there are already 36 larger PtH plants with a total electrical capacity of around 555 MW across Germany today. The majority of those plants are integrated into CHP/heating network systems. Through the PtH module, they are then able to generate heating, for example from excess electricity from renewable energy sources. Shutting down the CHP plant whilst simultaneously starting up the PtH plant relieves the electricity grid and can avoid wind energy plants having to be disconnected. Excess heating can be “held” in heating storage facilities and used later to supply district heating customers.

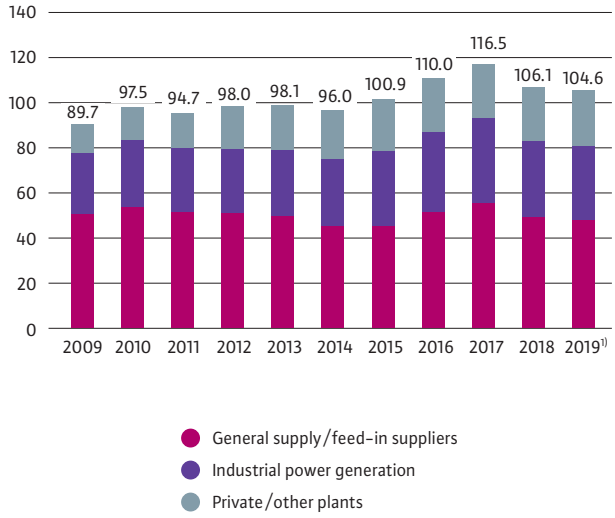
These types of sector coupling make an important contribution to the integration of electricity from renewables into the heating sector and thus to the environmentally friendly heating of buildings.

COMBINED HEAT AND POWER

A key component in the *Energiewende*

Combined heat and power (CHP) facilities generate electricity and heating simultaneously. Aside from the smaller installations, most are integrated into a system comprising heating network, heating storage facilities and increasingly also power-to-heat installations. These flexible "heating network systems" supply many customers with heating while also making an important contribution to the security of supply and system security. In 2019, electricity generation from CHP plants in Germany amounted to around 104,6 bn kWh. That meant that the volume of electricity from CHP fell slightly, by 1.4%, in comparison to 2018. CHP thus accounted for an 18.2 per cent share of net electricity generation. According to the estimates of the four transmission system operators (TSOs), CHP plant operators will claim subsidies under the German Combined Heat and Power Act [Kraft-Wärme-Kopplungsgesetz, KWKG] for around 28 bn kWh. With that, the volume of electricity subsidised under the KWKG is forecast to decrease by almost 11 bn kWh compared to 2018. This can be attributed to several factors. Firstly, many older CHP plants will, when they reach 30 000 full load hours, no longer be eligible for KWKG subsidies. Secondly, the rate of expansion of CHP collapsed in 2017 and 2018. In order to ensure the security of supply of electricity and heating in 2030, the framework conditions in the KWKG must be significantly improved via the German Act on the Phase-out of Coal [Kohleausstiegsgesetz]. Only in this way can the required 17 gigawatt gas-CHP capacities be constructed.

CHP electricity generation in Germany (bn kWh)



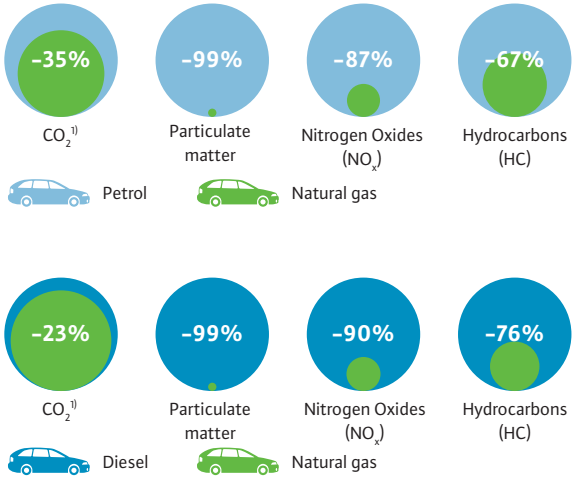
Sources: Destatis, AGEB, BDEW; Status: 02/2020

1) Preliminary figures

NATURAL GAS MOBILITY

Natural gas vehicles with almost zero particulate matter

Reduction in emissions – natural gas compared to petrol and diesel (Euro 6)



1) Taking into account the current biomethane share of 20 %
(see 3rd Interim Report of the 2015 dena Initiative for Natural Gas Mobility)

Source: Own representation from IAV data, 10/2015:
Euro 6 emissions standards, comparison using VW T5 CNG 2.0l

Road traffic causes almost 20 per cent of the greenhouse gas emissions in Germany. Alternative fuels could make a substantial contribution to reducing the emission of greenhouse gases and other pollutants (SO_2, NO_x, particulate matter). Natural gas and biomethane are also important components of the future fuel mix. A particular argument in favour of them as fuels is in the bottom-line reduction in CO_2 emissions of around 25 per cent in comparison to petrol. If pure biomethane is used, CO_2 emissions can even be reduced by up to 97 per cent. Natural gas vehicles emit as good as no particulate matter.

100 per cent biomethane is available today at 331 natural gas filling stations. In addition, biomethane is added to the mix at many of the over 830 natural gas fuel pumps in Germany. Moreover, there are now 18 LNG filling stations in the country.

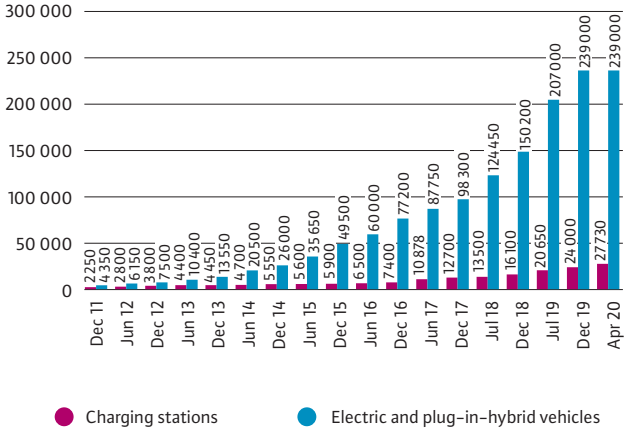
As far as the number of natural gas vehicles on the roads is concerned, there was an increase of two per cent to a total of 98 460 vehicles, of which 82 198 are natural gas-powered cars.

The expansion of the charging infrastructure is continuing at a fast pace. The BDEW charging station register listed 27 730 publicly available charging points in April 2020 of which 2 480 are rapid charging points. As such, the number of publicly available charging stations had grown by 60 per cent since April 2019.

In the city rankings, Munich (1 185 charging points), Hamburg (1 096) and Berlin (1 052 charging points) occupy the top spots. As far as a ranking of the *Laender* is concerned, Bavaria (6 353 charging points), Baden-Württemberg (4 950 charging points) and North Rhine-Westphalia (4 476 charging points) are in the first three positions. Hamburg has the highest number of charging points per million residents (595), followed by Bavaria (486 charging points) and Baden-Württemberg (447 charging points). According to the German Federal Motor Transport Authority [Kraftfahrtbundesamt] (as at 1 January 2020) Bavaria had the highest number of purely battery-powered cars and plug-in hybrids (at 52 444), followed by North Rhine-Westphalia (46 697).

According to the German Federal Motor Transport Authority, as of 1 January 2019, there were 136 617 purely battery-powered electric vehicles and 102 175 plug-in-hybrid vehicles registered in Germany (total: 238 792). That represents a year-on-year increase of 64 per cent and 53 per cent respectively.

Number of electric cars[1] and publicly available charging points

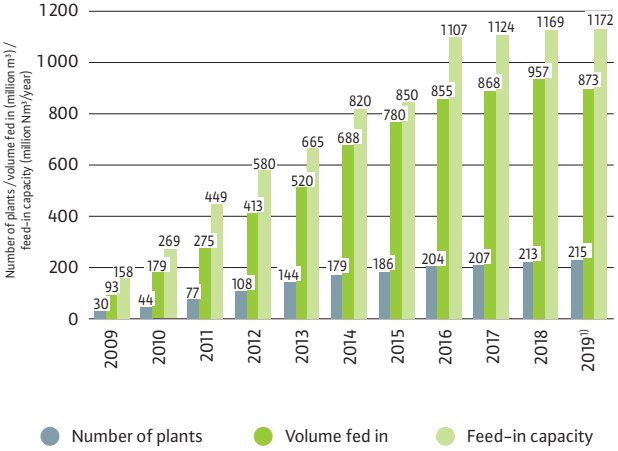


1) Purely battery-powered cars and plug-in hybrids

Sources: BDEW Survey on "Charging Infrastructure", ladesaeulenregister.de, KBA

BIOMETHANE
Renewable, storable and versatile

Feed-in capacities and volume of biomethane fed into the natural gas grid



1) Preliminary figures

Sources: dena, BDEW (own calculations); Status: 02/2020

As of December 2019, there were around 215 biomethane plants, with a capacity of around 1 172 million Nm³/a, injecting biomethane, upgraded to natural gas quality, into the natural gas grid. The injected volume of 873 million m³ (around 9.5 bn kWh) equates to just over one per cent of German natural gas consumption. More plants are currently under construction or at the planning stage.

Biomethane is the term for (raw) biogas which, after being cleaned and upgraded, has the same combustion properties as natural gas and can be injected into the natural gas network. It can be used for electricity production, in the heating market or as a fuel. Biomethane is renewable, storable and versatile.

In 2019, a total of 32 bn kWh of electricity was generated from biogas and biomethane, mostly in the around 9 300 plants with direct electricity generation. The electricity produced in this way supplied almost 5.6 per cent of gross electricity consumption. Together, biogas and biomethane provided around 16.7 bn kWh of heating and cooling in 2019. Natural gas vehicles were fuelled with 0.7 bn kWh of biomethane last year.

SOURCES OF DISTRICT HEATING

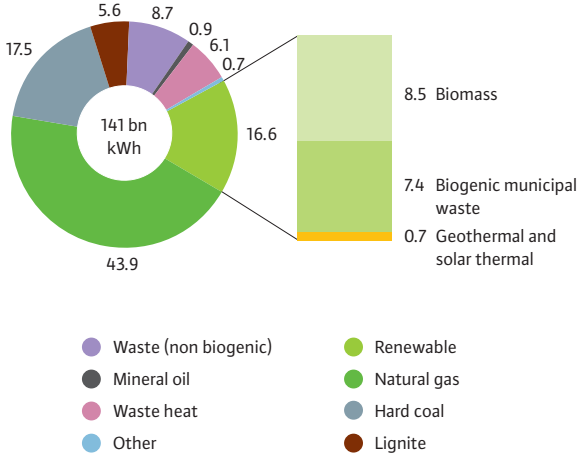
Natural gas in front

In 2019, the net heating generation for grid-bound heating supply via the heating network systems in Germany was predicted to be around 141 bn kWh. At 62 bn kWh (44 per cent), the largest proportion of this local and district heating was generated from natural gas. Hard coal and lignite together contributed around 23 per cent (33 bn kWh) of the heating generated.

Heating from renewable energies, as the third largest source, accounted for a proportion of around 17 per cent or a volume of just over 23 bn kWh. In addition, biomass contributed seven per cent (10 bn kWh) and biogenic municipal waste accounted for nine per cent (12 bn kWh). Heating from geothermal and solar thermal energy only played a minor role in grid-bound heating supply in 2019, at 0.9 bn kWh or 0.7 per cent.

Heating generation from non-biogenic waste totalled around 12 bn kWh (9 per cent) in 2019. The next largest proportion, at six per cent and accounting for around 9 bn kWh, was waste heat recovery from industrial processes, from other market participants and external live steam recovery. The provision of heating from mineral oil only accounted for 0.9 per cent (1 bn kWh).

Net heating generation[1] for grid-bound heating supply 2019[2] (per cent)



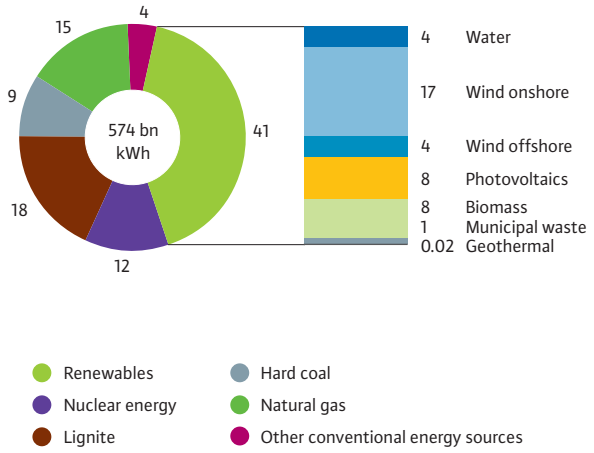
1) Heating suppliers as well as feed-in from industry and others
2) Preliminary figures

Sources: Destatis, BDEW; Status: 02/2019

ELECTRICITY GENERATION

Clear changes to energy mix

Net electricity generation 2019[1] (per cent)



Source: BDEW; Status: 03/2020

1) Preliminary figures

In 2019, (net) electricity generation in Germany amounted to 574 bn kWh. The largest proportion of that was supplied, as in previous years, from renewable energies, at 236 bn kWh (41 per cent).

The progress of the *Energiewende* is well illustrated by the hugely changed energy mix in electricity generation. The proportion of renewable energies has markedly increased over the last ten years, while electricity production from nuclear power is continuously decreasing due to the decision to phase out that energy source. The last of the seven electricity generating units will be taken offline at the end of 2022. Electricity generation from lignite and hard coal is similarly declining. In 2018, hard coal power plant units with a total capacity of 879 MW were shut-down. As of the end of the year, a further 1 973 MW of power plant capacity was in the lignite-standby pool.

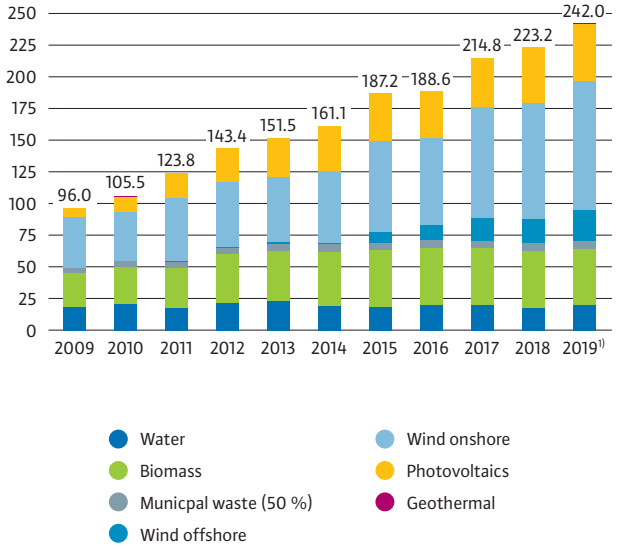
ELECTRICITY FROM RENEWABLE ENERGY SOURCES

Wind energy provides the most green power

In 2019, electricity from renewables already covered almost 43 per cent of German electricity demand. Wind and hydropower, biomass, municipal waste and photovoltaics delivered a gross figure of around 242 bn kWh of electricity. The payment guaranteed by the government for electricity generated from renewable energies was one of the reasons why green electricity generation has seen a more than 150 per cent increase over the past ten years.

Onshore and offshore wind power plants produced around 126 bn kWh in 2019; this was over three times the level as recently as 2009. Electricity generation from biogenic energy sources (including the renewable share of waste) amounted to 50 bn kWh, hydropower plants delivered 20 bn kWh. Photovoltaic plants contributed 45 bn kWh to electricity generation in Germany. The first German power station using geothermal energy came online in 2004. In 2019, 0.2 bn kWh came from this renewable source of energy.

Electricity generation by energy source (bn kWh)



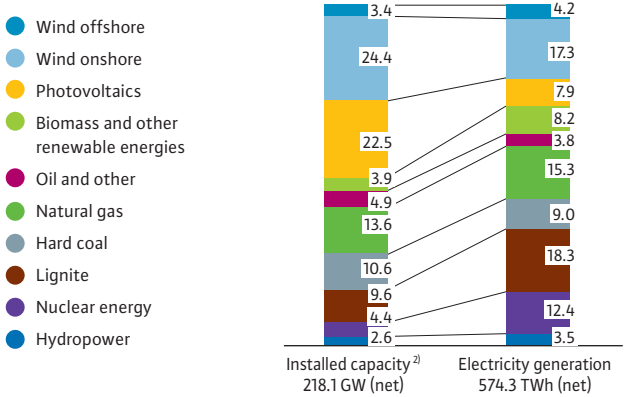
Sources: ZSW, BDEW; Status: 02/2020

1) Preliminary figures

CAPACITY AND GENERATION 2019

Not all power plants are the same

Installed capacity and generation of the overall electricity industry 2019 (per cent)[1)]



1) Preliminary figures
2) At 31 Dec. 2019, not incl. feed-in from electricity storage facilities

Source: BDEW; Status 03/2020

For reasons of cost, efficiency and availability, power plants are deployed for electricity generation in different ways. Nuclear and lignite-fired power stations currently generate, in the main in the base load – i.e. electricity demand which remains constant around the clock – almost one third of the electricity in Germany. However, as a proportion of total installed capacity, such plants only make up 14 per cent of the generation fleet as they are characterised by a long utilisation period and a high rate of availability.

Generation from wind and solar is determined by fluctuating wind conditions and number of hours of sunshine. Photovoltaic energy contributes nearly 8 per cent to electricity generation, but accounts for 23 per cent of installed capacity. For periods when the sun is not shining or the wind is not blowing, appropriate capacity has to be available in reserve in plants which can be used in a plannable manner. In order to meet demand during short-term peaks in electricity consumption, or to compensate for rapid fluctuations in feed-in from renewable energies, gas-turbine power plants or heating oil power plants are added. They are deployed less frequently but are essential in order to provide the volume of electricity demanded at any time. Pumped storage power plants also fulfil an important function within the electricity system as electricity storage facilities which can then cover demand for electricity at short notice.

OPERATION OF POWER PLANTS

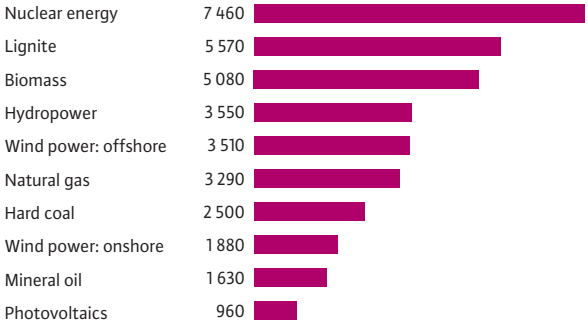
Nuclear energy has the highest capacity utilisation

The usage of the German electricity industry's power stations differs widely. Nuclear power stations, together with lignite-fired power stations, biomass plants and run-of-river power plants generate electricity for consumers almost around the clock. During the day, hard coal and natural gas-fired power stations are deployed to meet any additional demand. Oil-fired plants, storage facilities and pumped storage plants are normally only used to cover peaks in demand.

In addition, wind and photovoltaic installations today generate considerable volumes of electricity. Their capacity is, however, not available at all times. Their deployment depends on weather conditions and therefore cannot be scheduled in advance. Furthermore, their location plays a role: wind plants in coastal regions or offshore, for example, are usually utilised to a greater extent than those further inland.

In order to demonstrate the large differences within the generating fleet, the "annual full load hours" are calculated. They show how many of the 8 760 hours in a year a power plant would have to be operated at maximum capacity to generate its annual output. The actual annual period of utilisation is usually higher as power plants are not always operated at full capacity.

Annual full load hours[1)2)] 2019
General supply



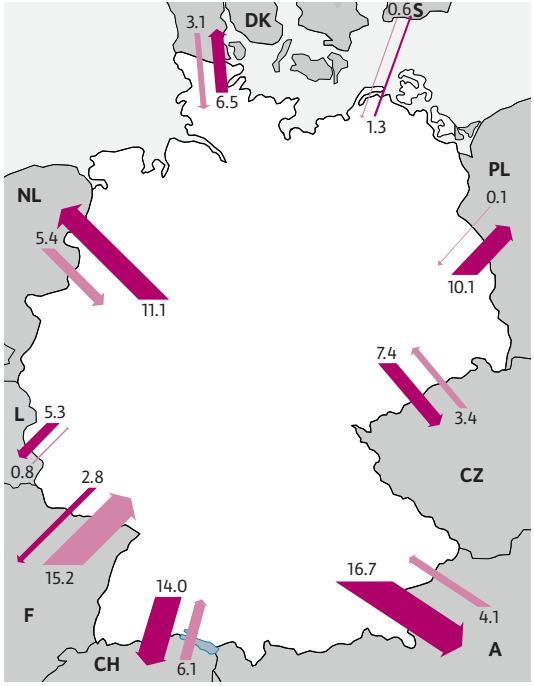
1) Preliminary figures
2) Significant changes in capacity during the period duly taken into account

Source: BDEW; Status: 05/2020

ELECTRICITY EXCHANGE WITH OTHER COUNTRIES

Germany is the European hub for electricity

Physical electricity exchanges between Germany and its neighbouring countries in 2019 (bn kWh)



With its central location in Europe, Germany is the hub for European electricity flows, directly exchanging electricity with nine neighbouring countries. A major part of these cross-border flows does not constitute contractually agreed deliveries but transit quantities and loop flows.

- Exports 74.5 bn kWh
- Imports 39.6 bn kWh

Source: BDEW; Status: 01/2020

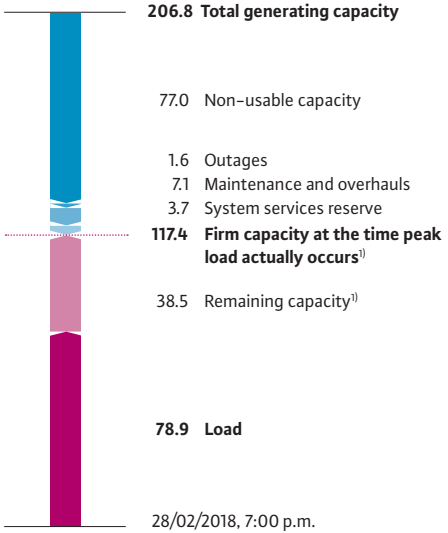
PEAK ELECTRICITY DEMAND

Consumer demand to be met by power stations

In 2018, the highest level of electricity demand from consumers and the greatest challenge for power stations occurred on 7 February at 7:00 p.m. A certain proportion of the generating capacity is not available at all times. Reasons for this can include low water flow, lack of wind, little or no sunshine, the daily limits of electricity storage facilities, district heat extraction leading to a reduction of output or regulations imposed by public authorities.

At the time of the annual peak load in 2018, the remaining capacity was sufficiently high as a medium volume of wind power was being fed-in at that time and conventional power plants were, for the most part, available. That is not always the case, however: in times of very cold weather, low wind levels and high electricity demand – as can be quite possible during the winter – the peak load would have been 81.6 GW and the firm capacity only 81.9 GW as it would almost exclusively be conventional power stations which were available to meet the electricity demand.

Power balance of general electricity supply in Germany at the time of the 2018 annual peak load (GW)



1) Incl. grid reserve power plants/stand-by backup

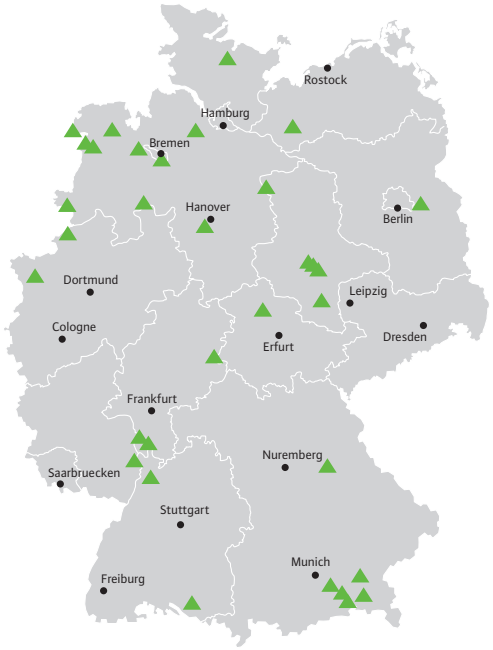
All capacity values are net values; rounding differences possible.

Source: Transmission network operators; Status: 02/2020

GAS STORAGE FACILITIES IN GERMANY

Secure natural gas supply

Locations of German underground natural gas storage



Sources: LBEG, BDEW; Status: 03/2020

The 47 German underground gas storage facilities at 33 different locations, are able to receive almost 24 billion cubic metres of working gas. This corresponds to just over a quarter of the volume of natural gas consumed in Germany in 2019.

Overall, the German gas industry has the largest storage volume in the European Union.

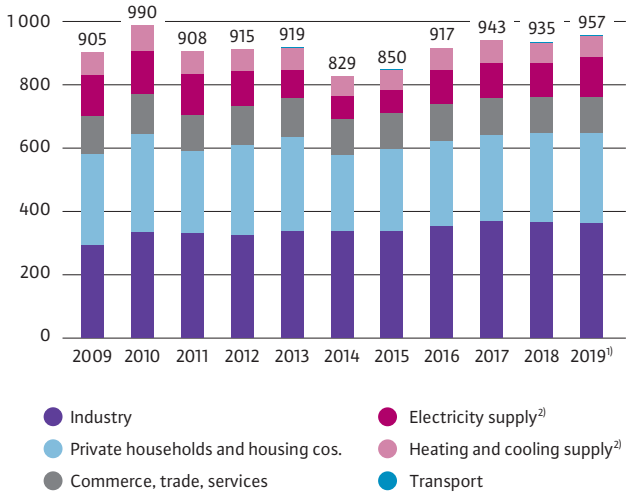
GAS SALES

Industry is the largest consumer of natural gas

Natural gas sales in Germany amounted to 957 bn kWh in 2019. Industrial companies continue to account for the largest share, at 38 per cent. The proportion accounted for by households, which can vary greatly from year to year depending on the weather conditions, was 30 per cent.

Sales of natural gas in 2019 varied across the individual customer groups. The use of natural gas in power and heating plants of the energy suppliers showed the greatest increase, with a rise of ten per cent. The demand from industry had already been falling slightly since the end of 2018 due to the slowing economy. Sales to commerce, trade, services and even to private households and housing companies increased slightly due to the at times cooler weather and a growing number of buildings heated by natural gas. At the end of 2019, just over 20.9 million homes were equipped with gas heating. That represents almost half of all homes in Germany. On the new-build market, natural gas heating systems (including biomethane) were installed in almost 37 per cent of homes. Just as relevant is the growth in households supplied with district heating, since in 2019 around 44 per cent of district heating is generated from natural gas. The trend in the sales figures over the last ten years has been characterised by the economic crisis in 2008/2009, different weather conditions in the heating periods as well as political influences such as the 2016 KWKG-Amendment.

Natural gas sales in Germany over time (bn kWh)



Natural gas sales does not include own consumption by gas industry.

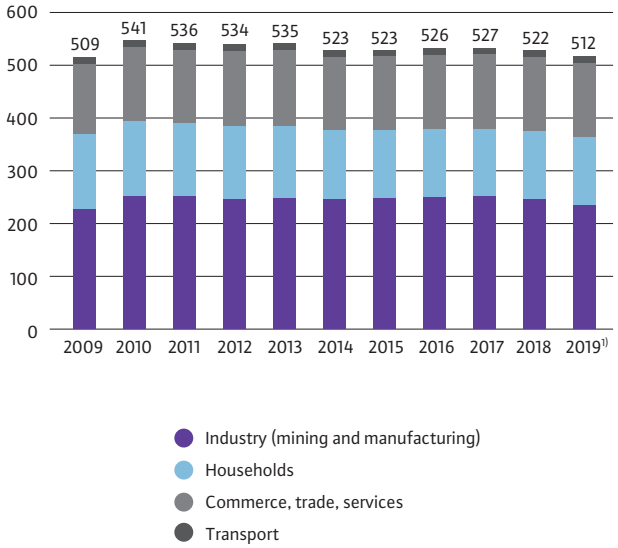
1) Preliminary figures
2) Incl. CHP units < 1 MW

Source: BDEW; Status: 02/2020

ELECTRICITY CONSUMPTION

Industry uses almost half of the electricity produced

Net electricity consumption in Germany (bn kWh)



Source: BDEW; Status: 02/2020

1) Preliminary figures

In 2019, net electricity consumption in Germany amounted to almost 512 bn kWh. It has been the case for years that industrial businesses have accounted for the highest proportion of electricity demand, at 46 per cent. The previously second largest consumption sector, private households, was overtaken some years ago by the sector, commerce, trade, services including farming, which today accounts for just over 27 per cent of electricity consumption. Almost a quarter of the electricity in 2019 was used by the just over 41 million households in Germany. As in the previous year, two per cent of consumption was accounted for by transport, which includes the operation of railways and electromobility. Electricity volumes which industry, households and commercial companies generate themselves and use immediately on site are always included in those figures, hence they are referred to as consumption and not sales.

In comparison to the previous year, electricity consumption of the individual customer groups in 2019 was very varied. Whilst the electricity consumption of industrial businesses fell sharply, households only used slightly less than in 2018. The commerce, trade and services sector consumed around the same amount as in the previous year. Consumption in the area of road transport increased by just over two per cent. The falling trend in electricity consumption in recent years is primarily due to efficiency gains.

DISTRICT HEATING/COOLING SALES

More and more households supplied with district heating

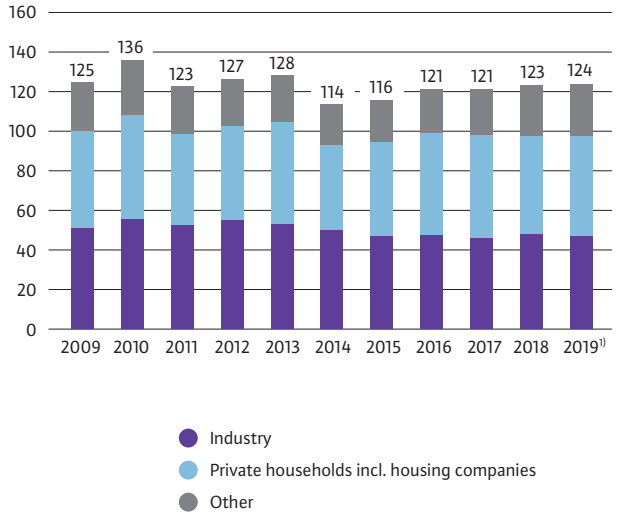
In 2019, grid-bound heating/cooling sales amounted to 124 bn kWh. 51 bn kWh of that was sold to private households directly or to housing companies for supplying residential buildings. Industrial consumers used 47 bn kWh of heating energy. The heating consumption of other consumers amounted to around 26 bn kWh.

Whilst the proportion of district heating used by private households is strongly dependent on the weather and a steady construction of new homes heated by district heating, the proportion of consumption accounted for by industry commerce, trade, services and other consumers has remained more or less stable over time.

In private households, district heating is used for the most part for space heating. Heating consumption in industry tends to be more dependent on economic developments; manufacturing businesses tend to use district heating and district cooling in industrial processes. In the commerce/trade/services sector, in addition to the use for space heating, use for heating water and for other heating and cooling processes also plays a role.

In 2019, the number of households supplied by (district) heating networks was 5.9 million and as such 17 per cent higher than the number in 2009 (5.1 million).

District heating sales[1)] in Germany (bn kWh)



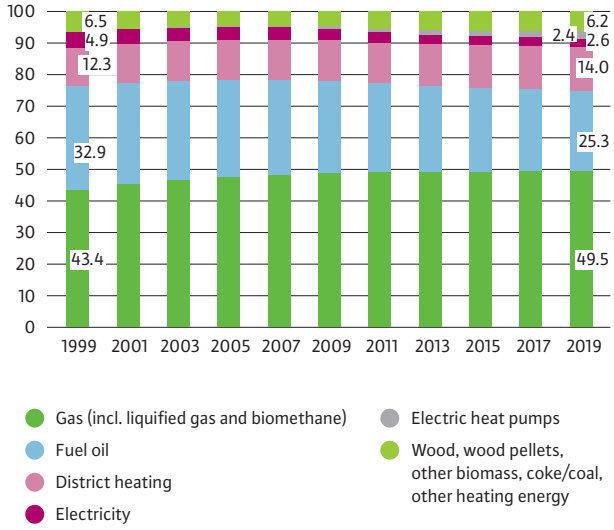
1) Incl. district cooling
2) Preliminary figures

Sources: Destatis, BDEW; Status: 02/2020

SPACE HEATING MARKET

Every second home heated by natural gas

Heating systems in existing homes[1] in Germany by energy source (per cent)



1) Number of homes in buildings with residential space; heating installed

Source: BDEW; Status: 01/2020

The number of housing units heated by natural gas reached just over 20.9 million in 2019. That corresponds to a market share of 49.5 per cent of the just over 42 million homes. 11.7 million housing units (25.3 per cent) were heated by fuel oil. The share of housing units supplied with district heating rose to 14.0 per cent. Electricity was the source of power for heating in 2.6 per cent of dwellings.

The share of dwellings heated with electric heat pumps is climbing steadily (2.4 per cent). The share accounted for by other solid fuels (primarily wood and wood pellets) was unchanged at 6.2 per cent.

HEATING IN NEW-BUILDS 2019

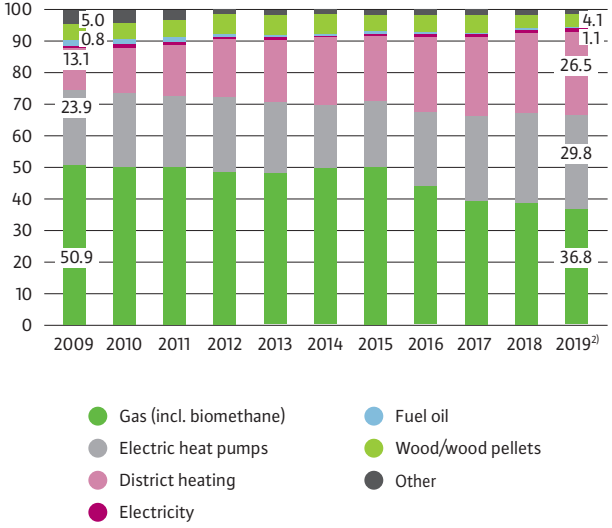
Natural gas remains most popular heating energy

In the new-build sector, natural gas (including biomethane) remains the most popular choice of heating energy. Natural gas heating systems were planned for nearly 37 per cent of new homes approved for construction in 2019. The proportion of planned new-builds to be heated with electric heat pumps is almost 30 per cent. At almost 27 per cent, over a quarter of planned homes are to be heated by way of district heating.

Electric heating is planned for one per cent of new homes for which permission has been granted. Wood and wood pellet heating systems have a market share of four per cent. Homes which are primarily heated with solar heating and passive houses account for just over one per cent. Heating oil accounted for a 0.5 per cent share of new builds in 2019.

In 2019, planning permission was granted for a total of around 348 000 new homes in new buildings to be constructed. Compared to 2018, that represents a rise of 3.6 per cent.

Heating systems in new builds[1] in Germany, proportions of energy sources (per cent)



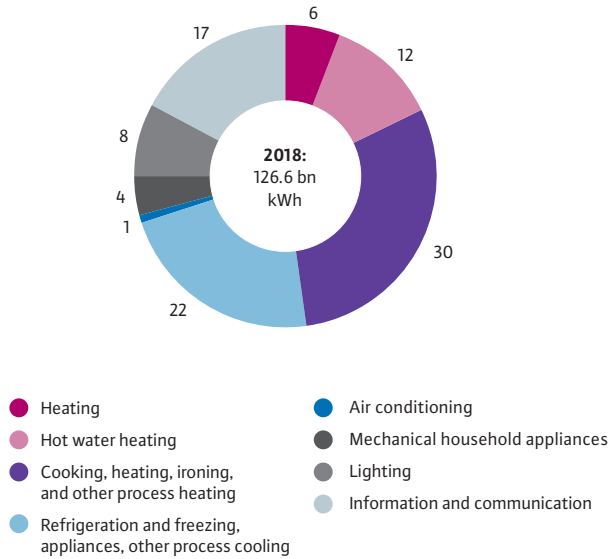
1) New-builds with planning consent; primary heating energy
2) Preliminary figures

Sources: Statistical Offices of the German *Laender*, BDEW; Status: 04/2020

ELECTRICITY CONSUMPTION OF HOUSEHOLDS

Almost ten per cent lower than 10 years ago

Electricity consumption by area of use (per cent)



Source: AGEB; Status: 02/2020

Electronic entertainment devices and communications devices today account for a large share of electricity consumption in private households, namely 17 per cent.

Cooling and freezing appliances have become considerably more efficient in recent years. Currently, the proportion of energy used for cooling and freezing, as well as other process cooling applications, is 22 per cent.

The greatest share, however, is still accounted for by process heating, at 30 per cent. Included within this are all applications which require heat, such as electric hobs, tumble dryers and toasters but also hairdryers. The heating of water in washing machines and dishwashers is also covered.

At eight per cent, the proportion of electricity consumption accounted for by lighting is low. Today, LED lights in particular have established themselves as especially efficient and long-lasting alternatives.

Overall, despite the rising numbers of households, electricity consumption has fallen by nearly ten per cent over the last ten years.

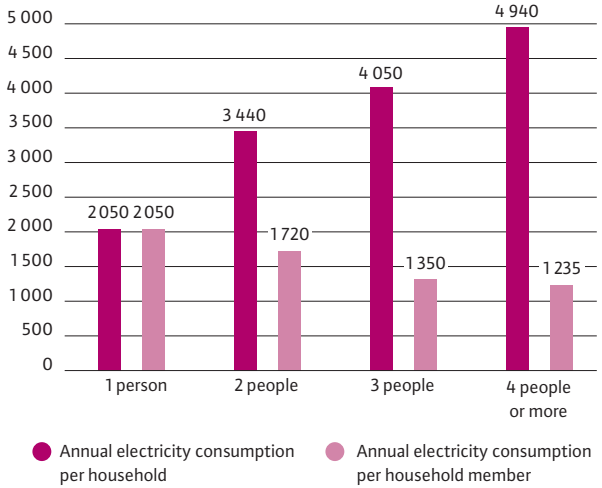
ELECTRICITY DEMAND OF HOUSEHOLDS

Growing number of one-person households increases demand for electricity

Of the around 41.5 million German households, there are 17,4 million one-person households today, which amounts to 42 per cent. By way of comparison: in 1991 this figure was 34 per cent. The average household size has shrunk: in 1991, there was an average of 2.27 people per household compared to only 2.00 people in 2019. The rising number of people living alone increases the electricity consumption of German households. Someone living alone in Germany uses, on average, 2 050 kWh of electricity in a year. A two-person household uses around 3 440 kWh of electricity. The consumption per head is thus 1 720 kWh, a value which decreases consistently as the size of the household increases. A family consisting of three people consumes an average of 4 050 kWh of electricity per year and a four-person household consumes 4 940 kWh.

These reference values can help households to identify potential savings in their own electricity use. It is important, however, also to consider regional differences. For example, households in the east of Germany use on average around 20 per cent less electricity than those in the west. The key reasons for this are a smaller average size of dwelling and lower numbers of electrical appliances and devices.

Average electricity use[1)] per household, by size of household



Sources: BDEW, HEA

1) Excl. heating in kWh

NATURAL GAS IMPORT PRICES

Border prices in 2019 lower than ten years previously

**BAFA border prices for natural gas –
figure for first month in each quarter (cents/kWh)**

Source: BAFA; Status: 03/2020

The statistical average price of all imports by gas suppliers into Germany reached a peak level at the end of 2008. From 2012 to 2016 it fell continuously and has remained at a lower level since then. In mid-2019, import prices even reached the lowest value of the ten years previously.

The main influences on the trend in prices are factors such as the worldwide demand for energy, especially in fast-growing economies like China or India, and the availability of unconventional natural gas, in particular in the USA.

The average values given here do not enable a direct conclusion to be drawn on the underlying contracts concluded between the natural gas importers and foreign natural gas producers. Different durations and conditions are stipulated in these contracts so that the import prices actually paid may, in some cases, deviate considerably from the average price.

NATURAL GAS PRICES FOR HOUSEHOLDS

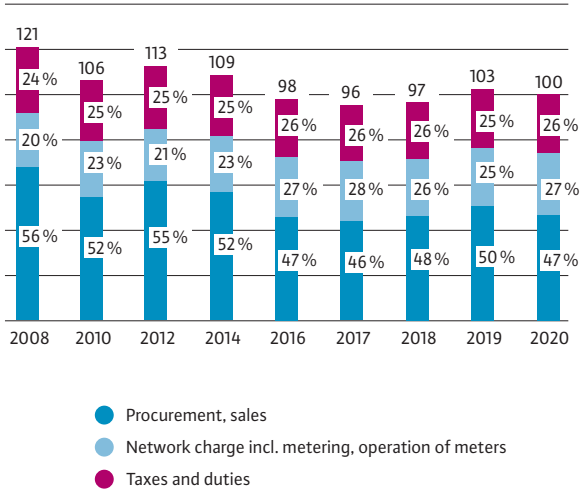
Still at a low level

The natural gas price for households has fallen in the past year by almost three per cent, primarily due to the lower costs of gas for suppliers. With that, it is around 17 per cent lower than 2008 levels. A household that was paying over 120 euros per month for a single-family home with natural gas heating back then, pays only around 100 euros today.

Within that bill, natural gas procurement and sales account for almost half of the sum. Network charges, taxes and levies each account for just over a quarter of the natural gas price.

The largest part of the taxes and levies is value added tax, at 16 euros per month. In addition, there is natural gas tax (0.55 cents per kWh) at just over nine euros per month as well as the concession fee at 50 cents per month. Heating gas customers are generally special-rate customers. Therefore, they only have to pay the reduced concession fee in the amount of 0.03 cents per kWh.

Average monthly bill for a single family household (euros)
Single family house, natural gas central heating with hot water heating, annual consumption 20 000 kWh

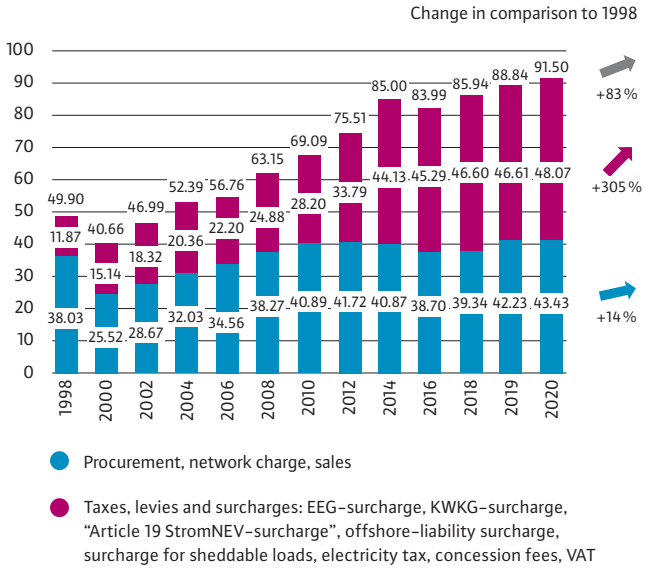


Source: BDEW; Status: 01/2020

ELECTRICITY PRICES FOR HOUSEHOLDS

53 per cent is taxes, levies and surcharges

Average electricity bill for a household with an annual consumption of 3 500 kWh (euros)



Source: BDEW; Status: 01/2020

In 2020, an average household pays more than 91 euros per month for electricity. This represents an increase of three per cent year on year. The pure electricity price – before taxes, levies and surcharges – is just over 43 euros per month which is just 14 per cent higher than 1998 levels. Almost 21 euros of that amount is for electricity procurement and sales, just over 22 euros is for network charges.

State levies rose again in 2020. The EEG-surcharge continues to represent the largest proportion of such charges, at 6.76 cents per kWh. Since 1998, the monthly amount paid by the average household for taxes, levies and surcharges has increased from 12 to 48 euros, meaning it has quadrupled. These governmental levies currently account for 53 per cent of the electricity bill of an average household (1998: 24 per cent).

ELECTRICITY PRICES FOR INDUSTRY

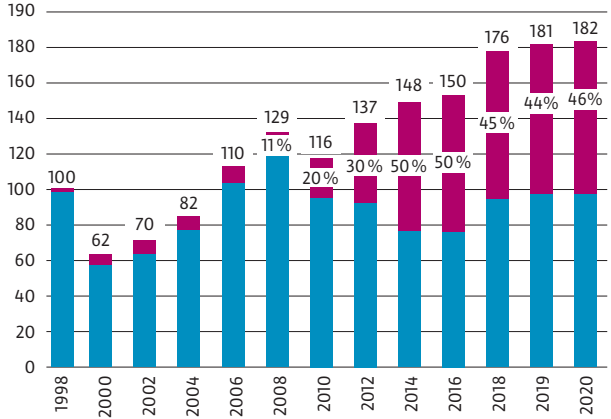
Taxes, levies and surcharges remain high

The liberalisation of the German electricity market in 1998 triggered a drive towards optimisation and efficiency in the electricity industry and initially led to a Germany-wide price reduction.

However, the growth in worldwide energy demand led to a considerable price increase up to autumn 2008. As a result of the economic crisis in 2009, electricity prices for industrial customers initially fell. However, the downward trend in prices was counteracted by the rise in levies imposed by the state: the levies imposed on one kilowatt hour of electricity for an industrial business under the EEG, the KWKG, the surcharge under Article 19 of the Network Charges Ordinance ("Article 19 StromNEV-surcharge"), the offshore network surcharge, the concession fee and the surcharge for sheddable loads remained high in 2020 at around 7.8 cents per kWh. Their share of the industrial electricity price is 46 per cent and is thus considerably higher than in the first ten years after liberalisation.

In addition, there is an electricity tax, although this is partly reimbursed to industrial enterprises.

Trend in industry electricity prices[1)]



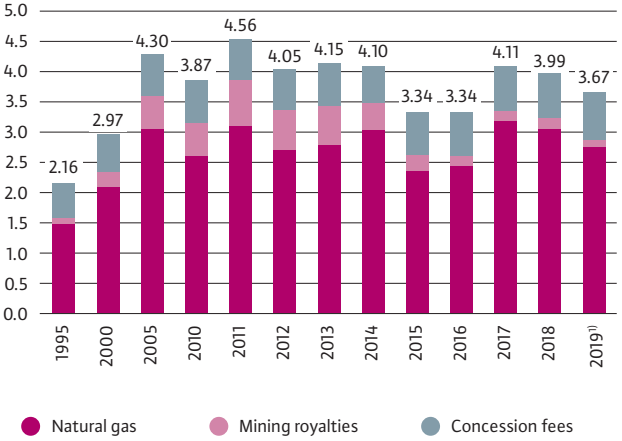
1) Supply from the medium-voltage level, not incl. electricity tax and turnover tax

Sources: VEA, BDEW; Status: 01/2020

TAXES AND LEVIES ON NATURAL GAS

State levies amount to 3.7 bn euros

Fiscal burden on natural gas in Germany (bn euros)



Sources: BDEW, BMF, BVEG; Status: 05/2020

1) Preliminary figures

State revenues from taxes and levies on natural gas increased considerably after 2000, amounting to over four billion euros in recent years. In 2015 and 2016, federal tax revenues from the energy tax on natural gas, as well as from mining royalties experienced a temporary decline before reaching the four billion euro mark again in 2017 and 2018. Last year, the total was € 3.7 bn. The gradual increasing of the natural gas tax since 1999 in the course of the introduction of the eco-tax has led to a steady rise in the state burden imposed on the fuel, natural gas, for consumers.

Since early 1999, the natural gas tax rate has trebled from 0.18 cents per kWh to its current level of 0.55. As a result, revenues from the natural gas tax have considerably increased. Whilst revenues from concession fees have remained largely stable for many years now, receipts from the mining royalty for the production of natural gas have been falling considerably since 2012 as a result of decreasing domestic gas production.

TAXES, LEVIES AND SURCHARGES ON ELECTRICITY

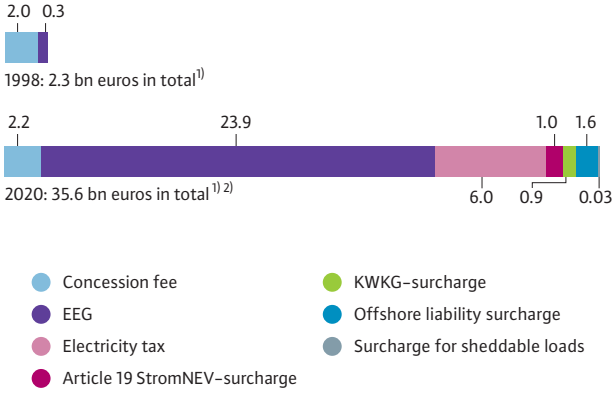
15-fold increase in state levies on electricity prices

The government also takes its share from electricity sales: in the past few years, taxes, levies and surcharges on the price of electricity have considerably increased. Since 1998 – the beginning of competition with massive price reductions – the burden of levies, surcharges and taxes for all electricity customers (including commerce, trade, services, industry and households) has increased fifteen fold. It is predicted that consumers will pay almost 36 bn euros for electricity taxes, levies and surcharges in 2020.

The largest single factor is the subsidisation of renewable energies, which will cost electricity customers almost 24 bn euros in 2020 (see p. 44). In addition to that, there is the electricity tax, totalling six bn euros. The concession fee brings in just over two bn euros. The simultaneous, environmentally friendly generation of electricity and heating is subsidised by the government through the KWKG. Costs to the consumer were around one bn euros.

The Article 19 StromNEV-surcharge, with which network fee exemptions are financed, amounts to 0.9 bn euros. The offshore network surcharge will be around 1.6 bn euros in 2020, the surcharge for sheddable loads 33 million euros. The value added tax revenues from electricity sales in the amount of around eight bn euros are not shown.

State imposed additional levies on electricity prices in 1998 and 2020 (bn euros)



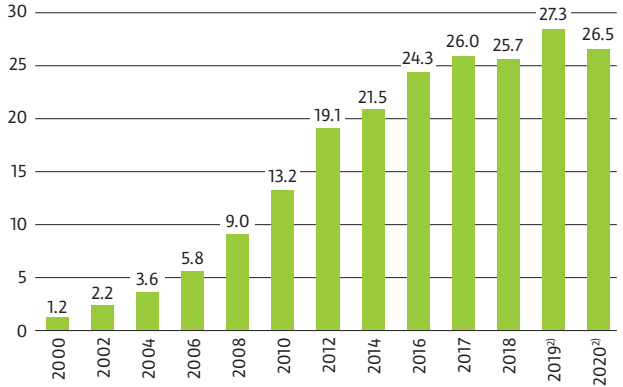
1) Excl. VAT
2) Rounding differences

Source: BDEW; Status: 05/2020

PROMOTION OF RENEWABLE ENERGIES

EEG: 2018 forecast 26.5 bn euros

Payments to plant operators[1] under the EEG (bn euros)



1) Payment under the EEG, remunerated PV own consumption, market premium and flexibility premium
2) As per EEG forecast

Sources: BDEW and publications of transmission system operators
Status: 04/2020

The total annual payments to power plant operators under the EEG increased more than twenty fold, from 1.2 bn euros to 27.3 bn euros between 2000 and 2019. In 2020, it is estimated that total payments will amount to around 26.5 bn euros*. 39 per cent of that sum goes to operators of photovoltaic installations, with payments totalling 10.3 bn euros. The next largest proportion goes to biomass, for which almost a quarter of payments are allocated (2020: 6.5 bn euros). Background: the legislator promotes the generation of electricity from renewable energies under the EEG. The producers are guaranteed a purchase price which is usually above the market price. The difference between the purchase price and the market price is paid, in the form of the EEG-surcharge, by the consumer through their electricity bill. The rest is covered by the marketing of EEG electricity on the electricity exchange. The additional costs for consumers will, according to the EEG forecasts of the transmission network operators, amount to almost 24 billion euros in 2020.

* The difference between the sum which consumers contribute through the EEG-surcharge in 2020 (see p. 43), and the sum of the payments to EEG plant operators comes from market revenues, the offsetting of liquidity reserves and reimbursements from 2019 etc.

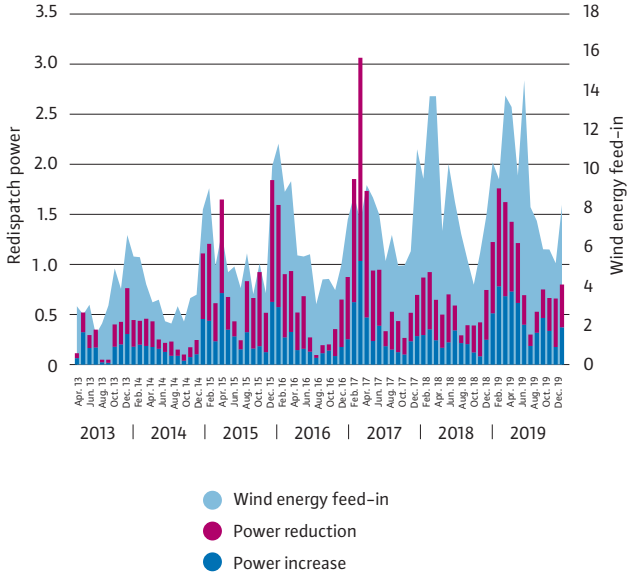
REDISPATCH IN GERMANY

Feed-in of wind energy not the only driving factor

Redispatch refers to intervention, requested by a transmission system operator, in the market based schedules of the power plants in order to shift feed-in and prevent power overloads in the electricity grid (preventive redispatch) or remedy them (corrective redispatch). In this process, the feed-in of electricity is reduced “in front of” a bottleneck (negative redispatch) and increased “after” a bottleneck (positive redispatch). In order to counteract bottlenecks in the electricity network, it is not the volume of electricity fed in which is altered but merely its regional distribution.

The trend in redispatch volumes is underscored by the increase over recent years. In this context, the redispatch volume increased from approx. 3 bn kWh in 2013 to approx. 9.3 bn kWh in 2018. Especially in the winter months, there is a high usage of redispatch measures. Extreme peaks occurred, for example, in December 2016 and January 2017. From 1 October 2021, bottleneck management, comprising i.a. redispatch for conventional plants and feed-in management for renewable energies as well as CHP plants, will be consolidated for the first time.

Redispatch and wind energy feed-in (bn kWh)

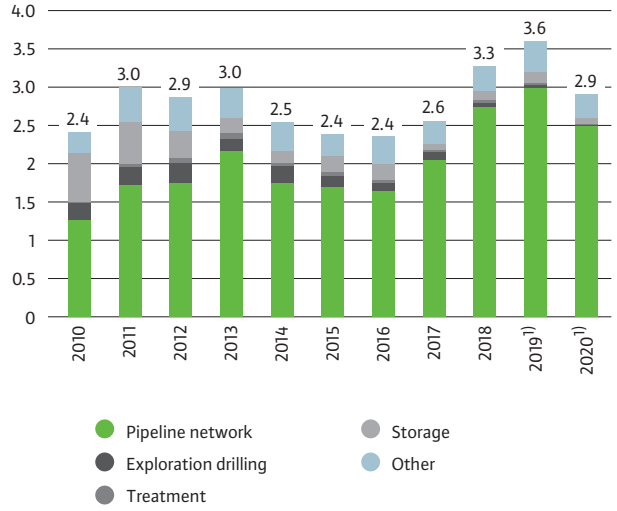


Source: BDEW; Status: 05/2020

INVESTMENTS OF THE GAS INDUSTRY

Billions invested in security of supply

Investment by the German gas industry (bn euros)



Source: BDEW; Status: 05/2020

1) Planned

Around two thirds of the total investment in the German gas industry is spent each year on the expansion and maintenance of the pipeline network. The remaining proportion is used for exploration drilling, gas treatment, gas storage and other applications.

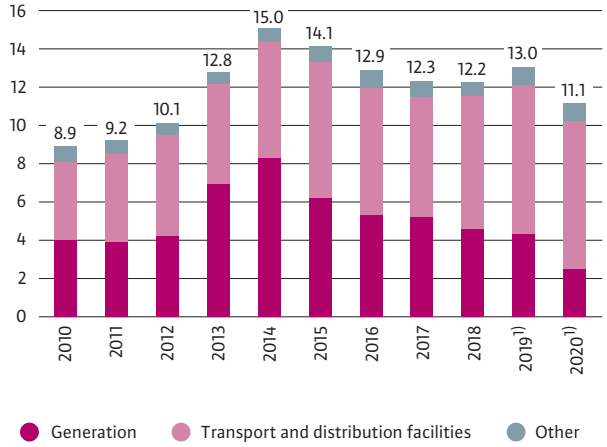
Since 2018, large sums are once more being invested for connecting pipelines to international long-distance gas links. Over the last three years, the average level of investment of German gas suppliers has been over three billion euros. In 2019, a peak value for the last two decades of 3.6 billion euros was reached. Around three billion euros of this went on investments in the transport and distribution network.

INVESTMENTS OF THE ELECTRICITY INDUSTRY

On average, twelve billion euros per year since 2013

The investment in plants by the companies within the electricity industry in Germany is currently at a high level. Considerably more money is being invested now than was the case ten years ago. In the years from 2014 to 2019, German electricity suppliers made on average almost 13 billion euros of investment every year. Whilst investments in the networks increased to a high level, the overall investment and in particular investment in generating plants have been falling since the peak in 2014.

Investment by German electricity suppliers (bn euros)



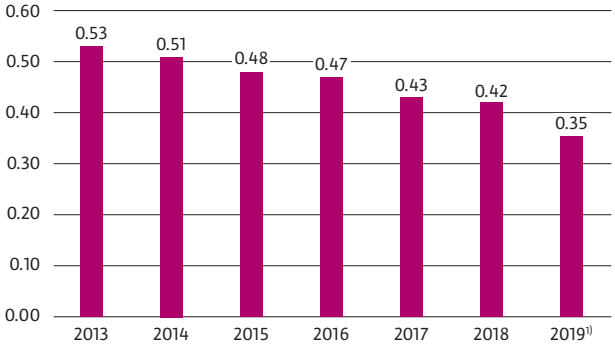
Source: BDEW; Status: 05/2020

1) Planned

CLIMATE RELEVANT CO_2-EMISSIONS OF ELECTRICITY GENERATING PLANTS

CO_2 emissions continue to fall

Specific CO_2 emissions of the general electricity supply (kg CO_2 per kWh net)



Source: BDEW; Status: 03/2020

1) Preliminary figures

The specific net CO_2 emissions from electricity generation from general supply power plants fell, according to BDEW's calculations, in 2019 compared to the previous year by 17 per cent to 0.35 kg CO_2 per kWh. The reduction has been driven primarily by the expansion of renewable energies and the reduction in consumption together with a simultaneous reduction of electricity generated from hard coal and lignite.

For the energy industry as a whole, 2019 figures revealed, in the sectoral breakdown of the German Federal Government's climate protection plan according to information from the Federal Environment Ministry, a reduction in greenhouse gas emissions by 45 per cent compared to 1990. The energy industry has thus achieved its 2022 sector target from the German Federal Climate Protection Act early.

Power

1 kW	=	1 kilowatt	=	1 000 Watt
1 MW	=	1 megawatt	=	1 000 kW
1 GW	=	1 gigawatt	=	1 000 MW

Energy (legal unit)

1 J	=	1 joule
1 MJ	=	1 megajoule
1 PJ	=	1 petajoule = 1 quadrillion J

Energy (normally used in the energy sector)

1 kWh	=	1 kilowatt hour	= 1 000 Wh	= 3.6 MJ
1 MWh	=	1 megawatt hour	= 1 000 kWh	
1 GWh	=	1 gigawatt hour	= 1 000 MWh	= 1 million kWh
1 TWh	=	1 terawatt hour	= 1 000 GWh	= 1 billion kWh

Weight

1 kg	=	1 kilogram		
1 t	=	1 ton	=	1 000 kg

1 m^3	= 1 cubic metre
1 Nm^3	= 1 normal cubic metre
k	thousand
m	million
bn	billion

CO_2	carbon dioxide
NO_x	nitrogen oxides
SO_2	sulphur dioxide

Laws

EEG	Gesetz für den Ausbau erneuerbarer Energien [Erneuerbare-Energien-Gesetz = German Renewable Energy Sources Act]
KWKG	Gesetz für die Erhaltung, die Modernisierung und den Ausbau der Kraft-Wärme-Kopplung [Kraft-Wärme-Kopplungsgesetz = German Combined Heat and Power Act]

EXPLANATORY NOTES
Units of measurement and abbreviations

AGEB	Arbeitsgemeinschaft Energiebilanzen e. V. [Working Group on Energy Balances]
BAFA	Bundesamt für Wirtschaft und Ausfuhrkontrolle [Federal Office for Economic Affairs and Export Control]
BMF	Bundesministerium der Finanzen [Federal Ministry of Finance]
BNetzA	Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen [Federal Network Agency]
BVEG	Bundesverband Erdgas, Erdöl und Geoenergie e. V. [Federal Association for Natural Gas, Petroleum and Geoenergy]
dena	Deutsche Energie-Agentur GmbH (dena) [German Energy Agency]
Destatis	Statistisches Bundesamt [German Federal Statistical Office]
HEA	HEA – Fachgemeinschaft für effiziente Energieanwendung e. V. [Professional Community for the Efficient Use of Energy]
IAV	IAV GmbH Ingenieurgesellschaft Auto und Verkehr [Automotive Engineering]
KBA	Kraftfahrt-Bundesamt [Federal Motor Transport Authority]
LBEG	Niedersächsisches Landesamt für Bergbau, Energie und Geologie [Lower Saxony State Authority for Mining, Energy and Geology]
VDE|FNN	Forum Netztechnik / Netzbetrieb im VDE (FNN) [Network Technology/Network Operation Forum within the German Association for Electrical, Electronic and Information Technologies]
VEA	Bundesverband der Energie-Abnehmer e. V. [German Federal Association of Energy Users]
ZSW	Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg [Centre for Solar Energy and Hydrogen Research Baden-Württemberg]

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Editorial deadline: May 2020

Image credits: stock.adobe.com/julvil; stock.adobe.com/VIGE

Publishing and distribution:
wvgw Wirtschafts- und Verlagsgesellschaft Gas und Wasser mbH
Josef-Wirmer-Straße 3 · 53123 Bonn
info@wvgw.de · www.wvgw.de

August 2020

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