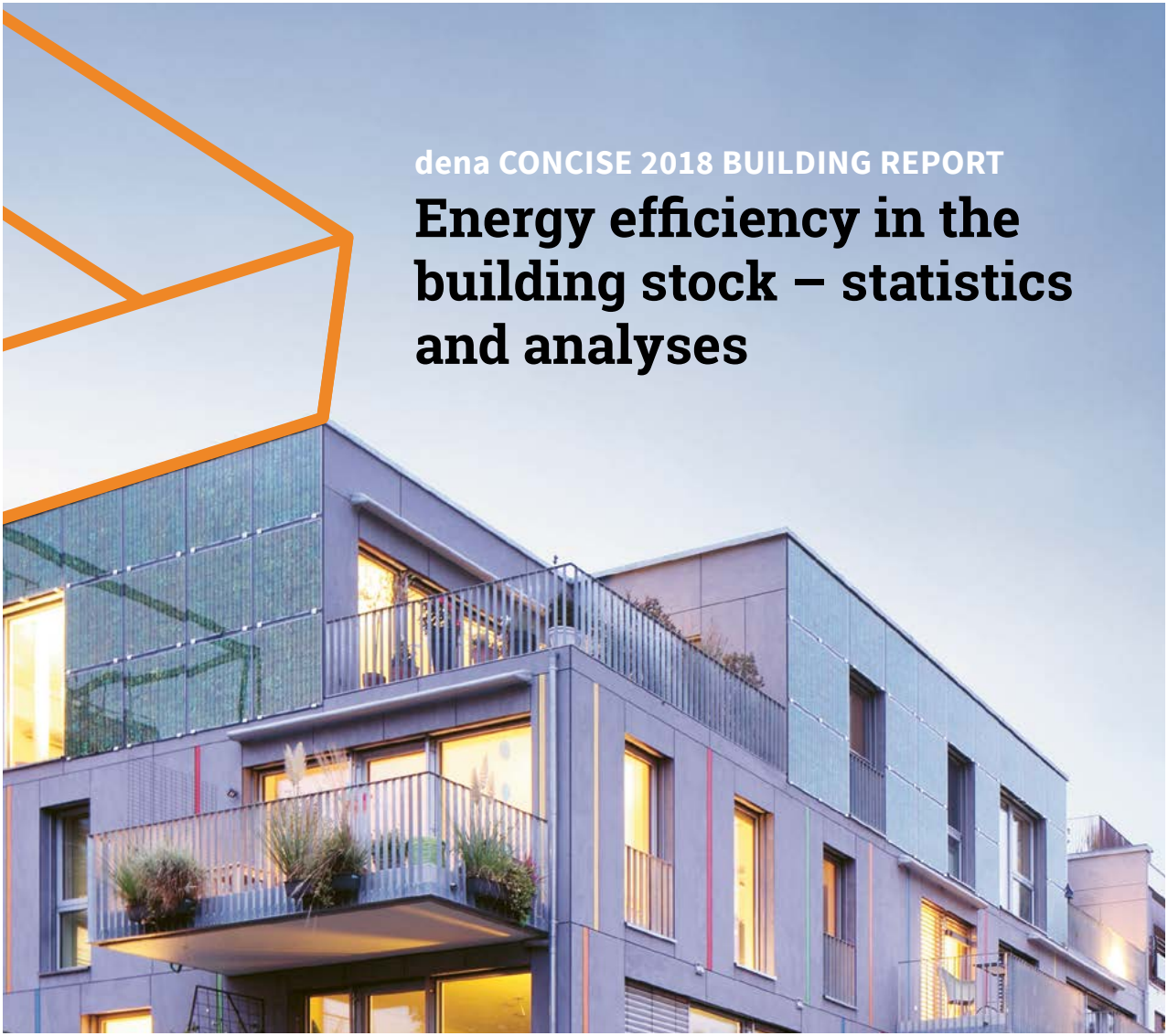
dena
German Energy Agency



dena CONCISE 2018 BUILDING REPORT

Energy efficiency in the building stock – statistics and analyses

Foreword

Dear readers,

There is a broad consensus that ambitious climate protection goals will only be achieved through a significant reduction in energy consumption and GHG emissions in the building sector. At the same time, there is intense debate over the approaches and instruments needed to reach the targets set by the Paris Climate Agreement.

In its Concise 2018 Building Report, dena presents a selection of the most important contextual factors, analyses and statistics relating to energy efficiency in buildings in Germany, with a view to furnishing upcoming discussions with a solid database on the one hand, while providing impetus for courageous and innovative decisions on the other.

We hope you will find the reading stimulating, and we look forward to a lively exchange of ideas and information.

Yours,

Andreas Kuhlmann
Chief Executive of the
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Yours,

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Andreas Kuhlmann


Christian Stolte

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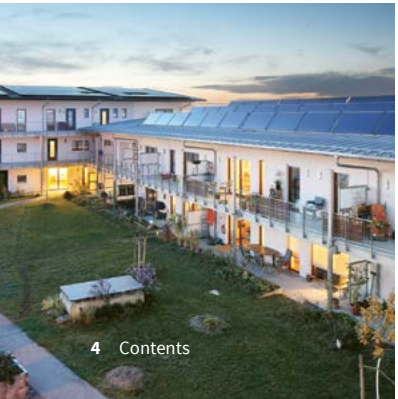


Energy transition

40 %

Targeted reduction of CO_2 in 2020 compared to 1990 levels

The federal government's energy efficiency targets will not be achieved using the strategies that have been agreed upon so far.

×2

Doubling of the refurbishment rate

The targeted doubling of the rate of refurbishment is not yet evident in the refurbishment sectors.

Savings in energy consumption in the building sector in recent years*

*Source: Federal Ministry for Economic Affairs and Energy (BMWi), 2017c; German Meteorological Service (DWD), 2017; own calculations

barometer

approx. 65 bn

Costs of energy in buildings**

Increasing economic importance is being placed on the efficient use of energy.

0 %

Although final energy consumption was reduced by 20 % between 2002 and 2010, it stopped falling during the period from 2010 to 2016.

37 %

Non-residential buildings' share of energy consumption

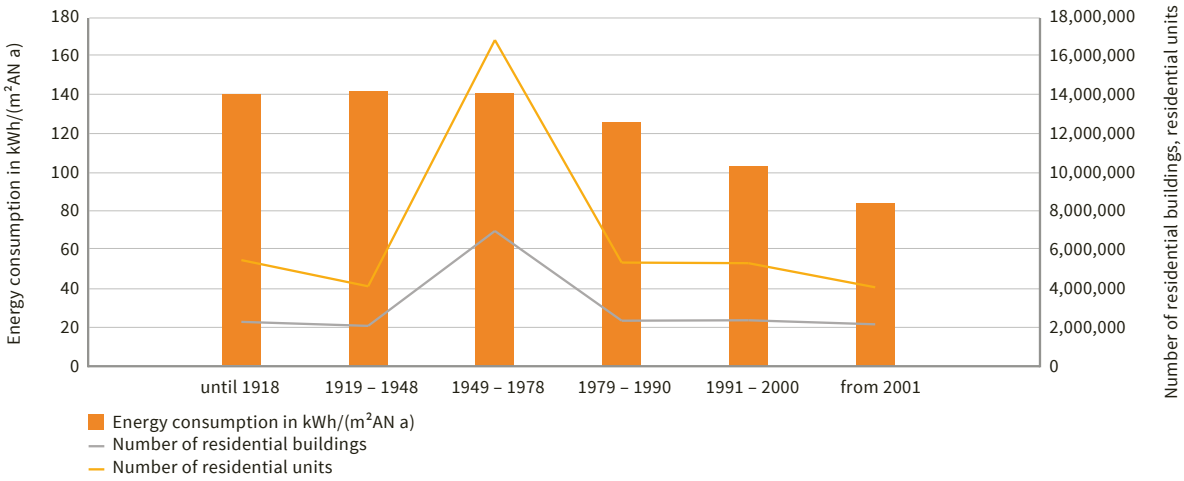
This is where there is a great deal of potential for savings through building technology, building automation and measures involving the building envelope.

**Source: Federal Ministry for Economic Affairs and Energy (BMWi), 2017c; own calculations

Building efficiency

The energy-efficient refurbishment of building envelopes and improved systems efficiency, combined with the use of renewable energy, provide the foundations for a transition in heating in the building sector.

Fig. 1: Energy consumption in the housing stock



Source: Federal Ministry for Economic Affairs and Energy (BMWi), 2017c; own calculations

The **Thermal Insulation Ordinance** came into effect on 1 November 1977 amid rising energy prices and a targeted reduction in energy consumption through construction methods. It saw the introduction of minimum standards for thermal insulation in external building components and in seals around windows and joints in new buildings.

In Germany there are approximately 19 million residential buildings, roughly 12 million of which where built before the Thermal Insulation Ordinance came into effect. Before this, energy-efficient construction was subject only to technical regulations (DIN 4108), but these were not enshrined in regulatory law.

Because of their high energy consumption per square metre compared to new buildings, these buildings have a great deal of potential for savings. In order to achieve the federal government's target of a virtually climate-friendly building stock by 2050, the focus of the refurbishment must be on the pre-1979 stock.

Key messages

Heating transition as part of an integrated energy transition

The energy-saving refurbishment of the building stock remains the primary target in the building sector. In residential buildings around two thirds of heat consumption is accounted for by pre-1979 buildings. By contrast, refurbished residential buildings achieve actual consumption figures that represent a small fraction of the building stock's figures.

The targeted doubling of the rate of refurbishment is not yet evident in the refurbishment sector. While the heating and window markets have been expanding slowly, sales of insulating materials for refurbishment have declined in the last few years.

Meanwhile, integrated, cross-sectoral approaches in the area of building efficiency are becoming more important. The aim is to completely overcome barriers between electricity generation and transmission, transport and heating. Aside from power-to-X technologies, success can be achieved, for example, through digital networking. Via computers and information technology, all equipment that generates, distributes, stores and consumes electricity is networked.

The term **integrated energy transition** represents a holistic and networked view of the three sectors: electricity, heating and transport. This has three benefits: 1. By using storage systems, it is possible to respond more flexibly to fluctuations in demand for electricity. 2. Primary energy consumption is reduced through energy-efficient technologies such as heat pumps and electric cars. 3. Renewable energy can used more effectively in all sectors and can result in decarbonisation in the transport and heating sectors.

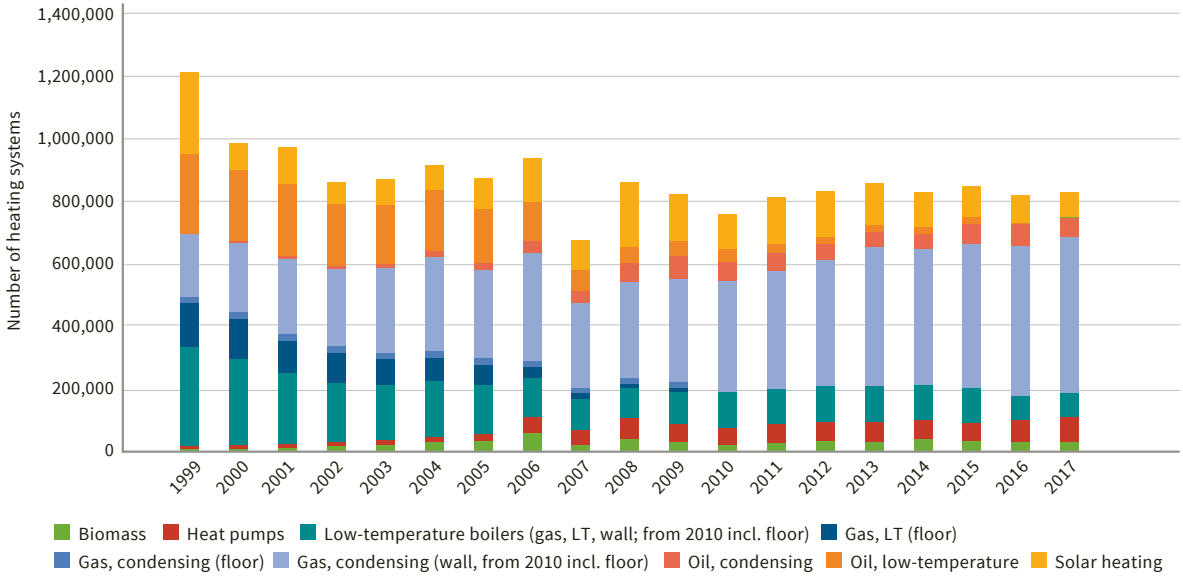
To link different sectors together, there are various approaches. Under the term, 'power to X', technologies are combined to convert surplus electricity from renewable energy sources into synthetic gases (power to gas), heat (power to heat), transport (power to mobility), fuels (power to liquids) or chemicals (power to chemicals). Power to X could be an important component in ensuring carbon neutrality in areas such as air traffic and shipping.

More than three quarters of newly sold heating systems are powered by gas. Around 10 % of new heating systems continue to use inefficient, low-temperature technology. Annual sales of electric heat pumps have now risen to a market share of 10 %. By contrast, the share of biomass heating systems is relatively small at around 4 %.

Compared to 1999, oil-fired systems' share of sales has decreased by 19 percentage points. This shows that oil-fired systems are being forced increasingly out of the market, and illustrates the declining importance of heating oil in the supply of heat.

Note: Solar heating always serves as a supplement to another heating system.

Fig. 2: Sales figures for heating systems

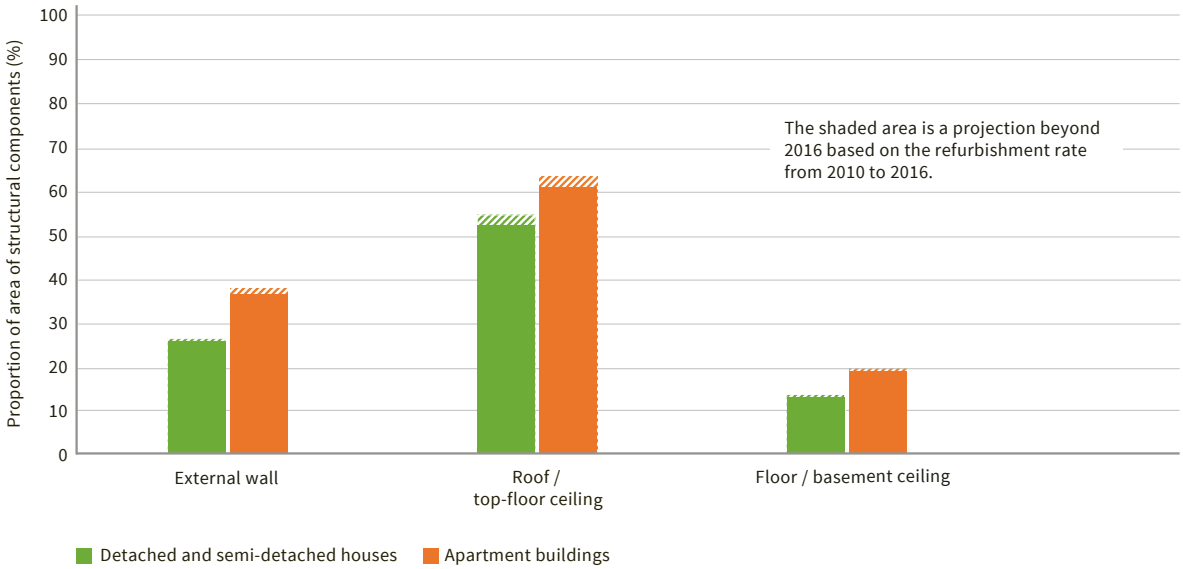


Source: Federation of the German Heating Industry (BDH), 2017; own calculations

The proportion of old buildings with external walls insulated at a later date is around 27 % for detached and semi-detached houses, and about 38 % for apartment buildings. Considerably more than half of all roof areas (detached and semi-detached 55 %; apartment buildings 64 %), but only around 14–20 % of basement ceilings in old buildings, have been subsequently insulated.

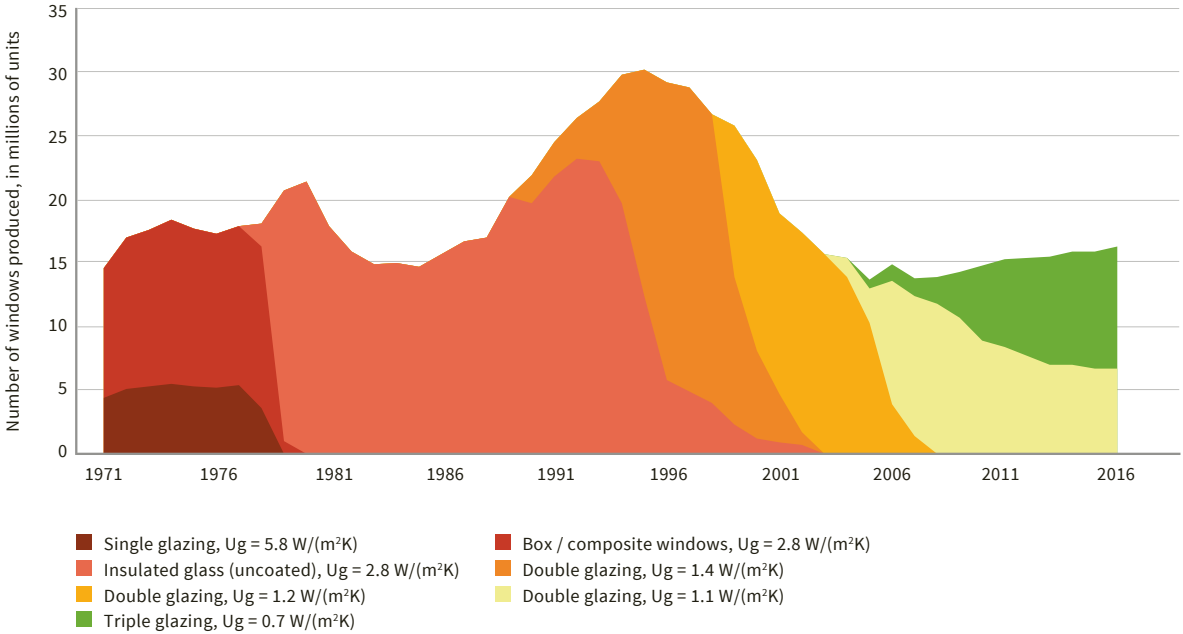
Overall progress in the modernisation of insulation in old buildings is seen as an important factor in increasing the refurbishment of all structural components to the current level of around 36 % (estimate of the Institute for Housing and Environment, IWU, 2018)

Fig. 3: Insulation installed subsequently in buildings, by structural components and type of construction



Source: Institute for Housing and Environment (IWU), 2018; own calculations

Fig. 4: Windows produced, by type of glazing



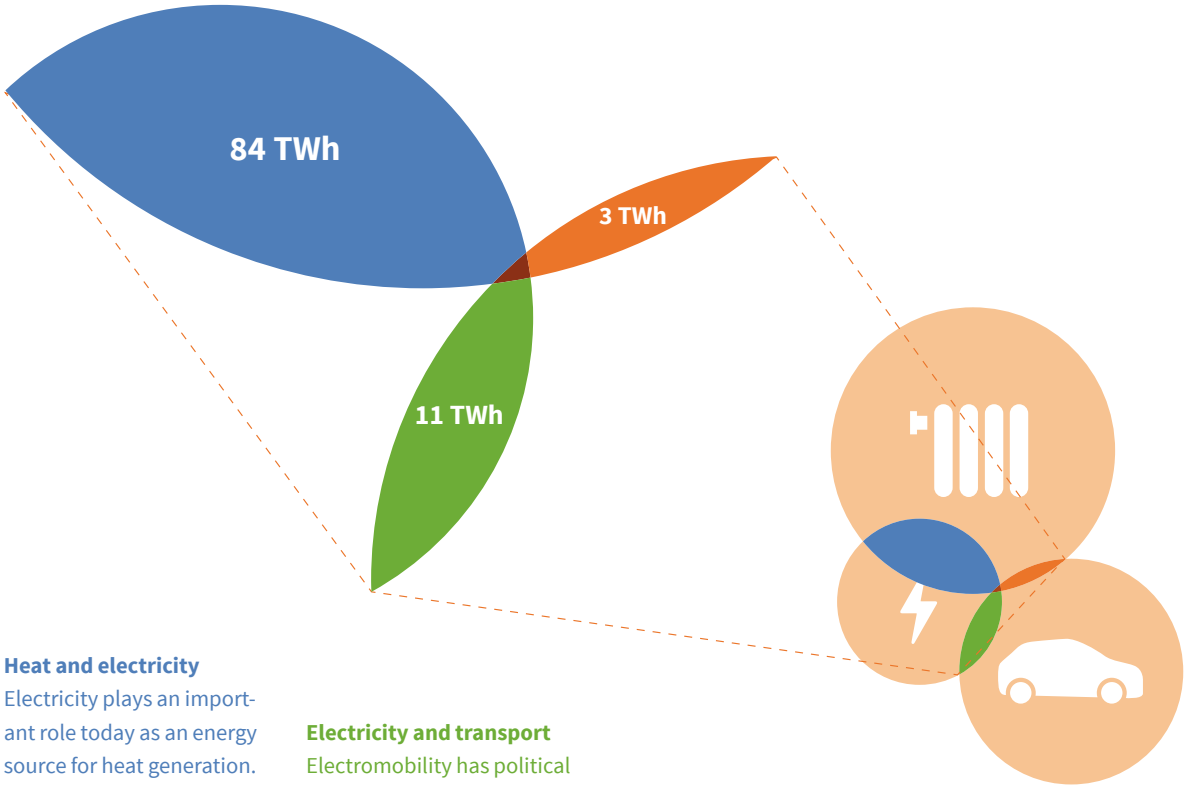
Source: Windows and Façades Association (VFF)/Federal Flat Glass Association (BF), 2017

Sales of manufactured windows in Germany have been around 15 to 16 million window units a year since about 2004. Window production reached its peak in the 1990s following reunification and the resulting investments in the new states.

The effects of the 1st Thermal Insulation Ordinance of 1977 are plain to see. The production of single, box and composite windows was discontinued within a few years and these were replaced by windows with insulated glass.

When the German Energy Saving Ordinance came into force in 2002, practically all windows were produced with improved insulated double glazing (inert gas filling, improved spacer bars). Ever since 2011 more triple-glazed windows have been produced than double-glazed.

Fig. 5: Overlaps between electricity, heat and transport



Heat and electricity
Electricity plays an important role today as an energy source for heat generation. Electric heat pumps use heat obtained from air, groundwater or soil for heating. Also, the approximately 1.4 million comparatively inefficient night storage heaters use large amounts of electricity and convert it into heat.

Electricity and transport
Electromobility has political support and its importance is growing. Nevertheless, its share compared to forms of transport powered by fossil fuels has been marginal up to now. One model for the future in this area is the charging of electric vehicles using surplus electricity.

Heat and transport
Two thirds of fuel consumed becomes waste heat and is mostly lost from the energy system. Only 1 % of it is used to heat indoor space.

Source: Federal Ministry for Economic Affairs and Energy (BMWi), 2017c; own calculations

Summary

By 2050 the building stock should be virtually carbon-neutral. This can only succeed if the key parameters of energy efficiency, renewable energy and technological innovation are used intelligently, linked with each other and receive targeted funding.

Specifically, it is a question of using energy more efficiently by using modern heating systems and reducing heat loss by means of efficient building envelopes. This includes windows, as well as walls and roofs. At the same time it is necessary to change over to carbon-neutral energy sources such as solar energy, geothermal energy or waste heat.

In order to take the smoothest possible route to transformation, pathways that are open to a range of technologies should be chosen. New processes for obtaining synthetic fuels (power to X), along with current construction technology, offer the opportunity of achieving carbon neutrality in the building sector for a part of the building stock.

Likewise, new approaches are urgently required in the area of building refurbishment. Initial pilot projects trialling refurbishment off the production line could spark a new dynamism here, which would primarily benefit the pre-1979 building stock. The potential for savings in non-residential buildings has also been given too little consideration in this context. The establishment of a sound building stock and well-directed funding measures is important here.

dena Study, 'Integrated Energy Transition'

The dena Study, 'Integrated Energy Transition', investigates the influence of the electricity, building, transport and industry sectors, and their interactions and interdependencies, in order to be able to derive an overall strategy across all sectors.

https://www.dena.de/en/integrated-energy-transition/

Overview

At least a **1.4 %** refurbishment rate would be needed, according to dena's building study, to achieve the federal government's climate protection targets (currently around 1 %).

100,000 sales per year of renewable heating systems (biomass and heat pumps) since 2012.

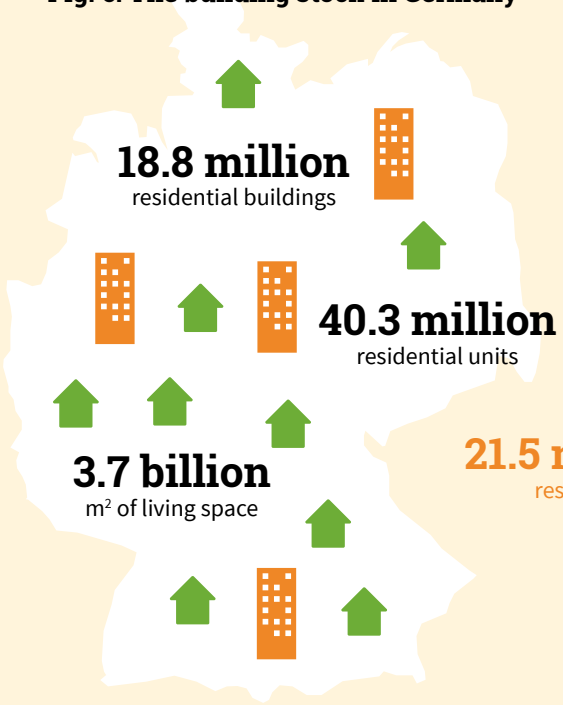
80 % is the amount by which the primary energy needs of buildings are to be reduced by the end of 2050.

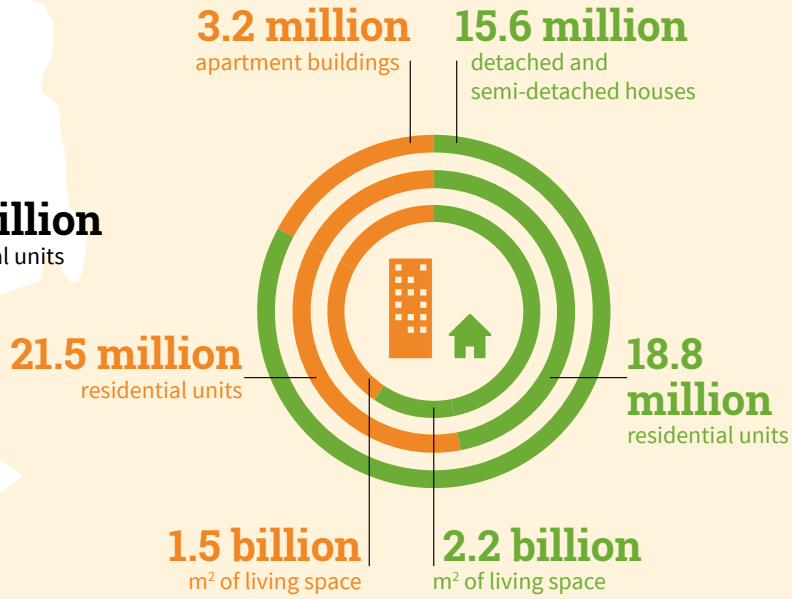
14,000 quality-assured energy consultants in dena's database of energy efficiency experts.

Building stock

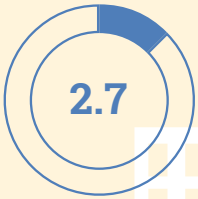
62 % of living space was built before 1979, and so before the 1st Thermal Insulation Ordinance came into effect.

Fig. 6: The building stock in Germany

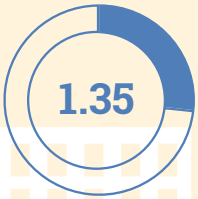




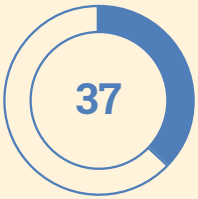
Non-residential buildings



million non-residential buildings
(non-industrial)



m² of heated
net floor space



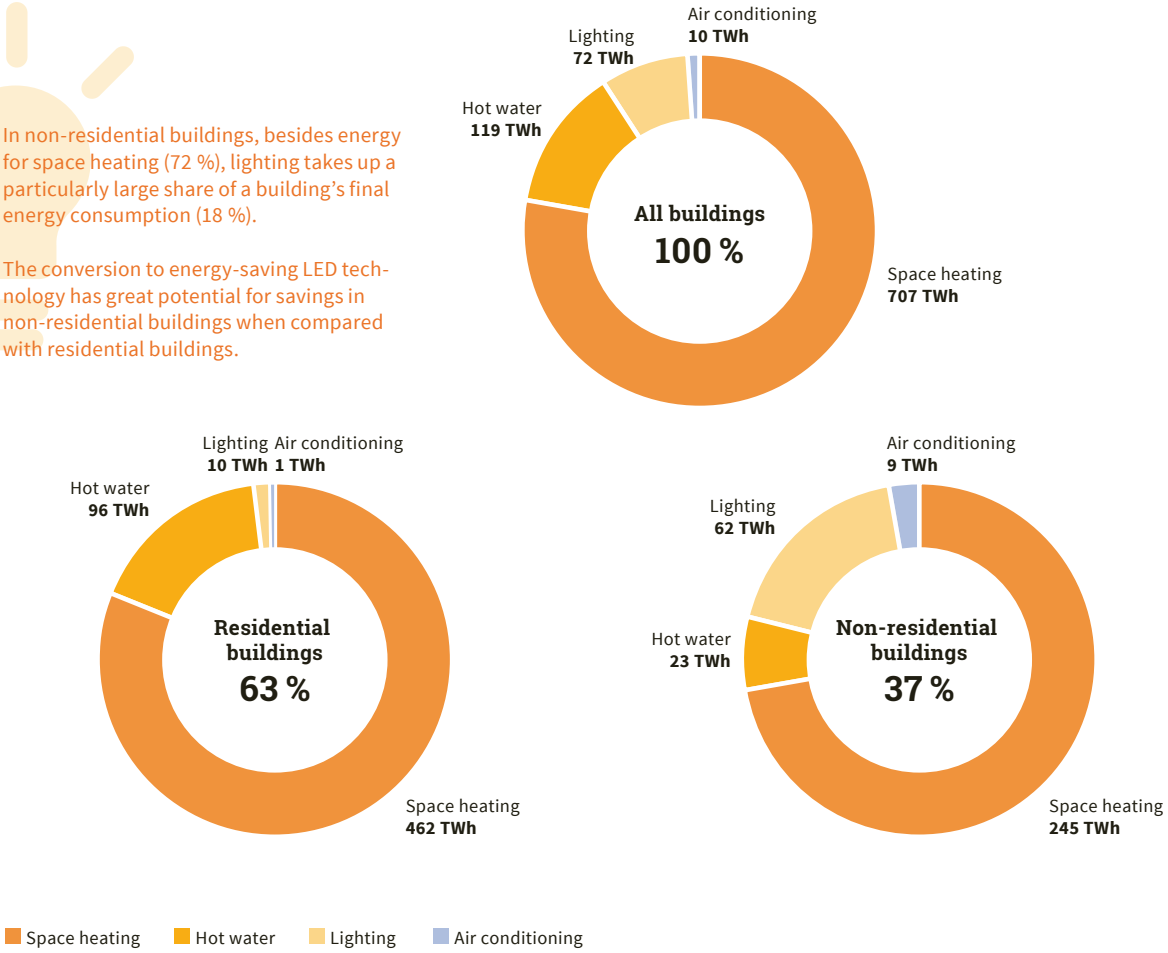
% share of building
energy consumption

Source: Destatis, 2017c; own calculations

Fig. 7: Final energy consumption in buildings

In non-residential buildings, besides energy for space heating (72 %), lighting takes up a particularly large share of a building's final energy consumption (18 %).

The conversion to energy-saving LED technology has great potential for savings in non-residential buildings when compared with residential buildings.



Source: Federal Ministry for Economic Affairs and Energy (BMWi), 2017c

Key messages

Enormous potential for savings in non-residential buildings

With around 2.7 million buildings, non-residential buildings are the smallest group in numerical terms. However, because of their large area per building and their high levels of consumption per square metre, they make a significant 37 % contribution to the total energy consumption in buildings.

Compared to apartment buildings, detached and semi-detached houses have larger living areas per residential unit, and higher levels of energy consumption per square metre. At 15.6 million, they are the largest group numerically and, at 39 %, have the biggest share of final energy consumption in buildings.

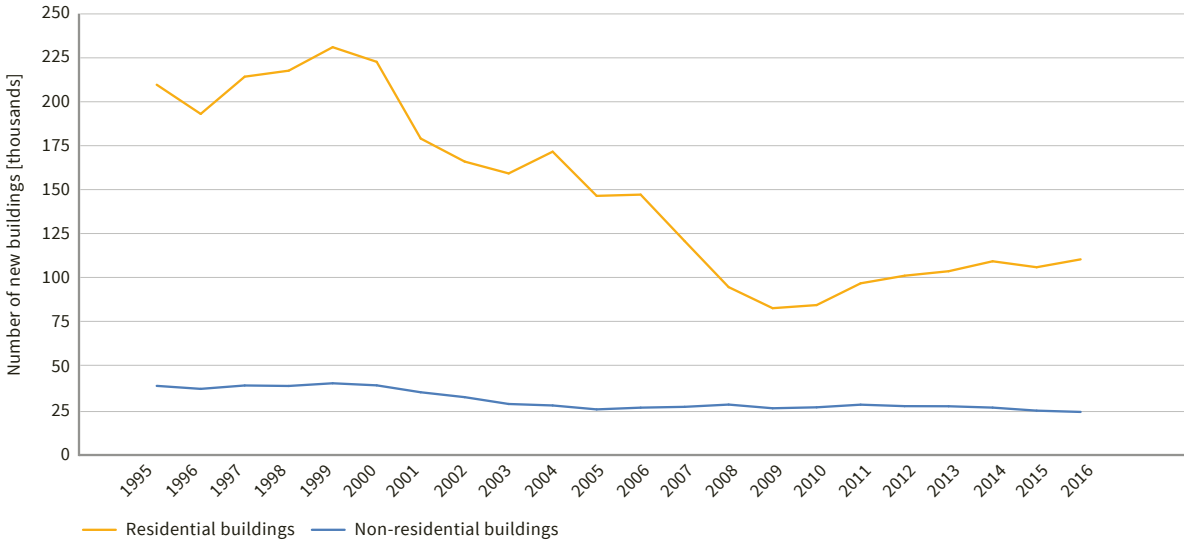
Compared with residential buildings, there are not many reliable figures at the moment relating to the stock of non-residential buildings. Moreover, the available sources differ considerably from each other in their results. Nevertheless, it can be assumed that there is enormous potential for savings in energy and costs, particularly in groups of buildings such as offices, hotels and commercial premises.

Energy efficiency in public and commercial properties

dena's project, 'Network and Pilot Project, Non-Residential Buildings', combines various initiatives to improve the data situation and increase the energy efficiency of non-residential buildings. In several studies the condition of particularly relevant groups of non-residential buildings in terms of energy efficiency, such as commercial properties and office buildings, was investigated more closely. For more information visit **www.effizienzgebaeude.dena.de**

1,002 **TWh** of primary energy is consumed by the building sector – approximately a quarter (27 %) of the total energy consumption in Germany (3,730 TWh, 2016).

Fig. 8: Number of new residential and non-residential buildings



Source: Destatis, 2017b; Destatis, 2017c

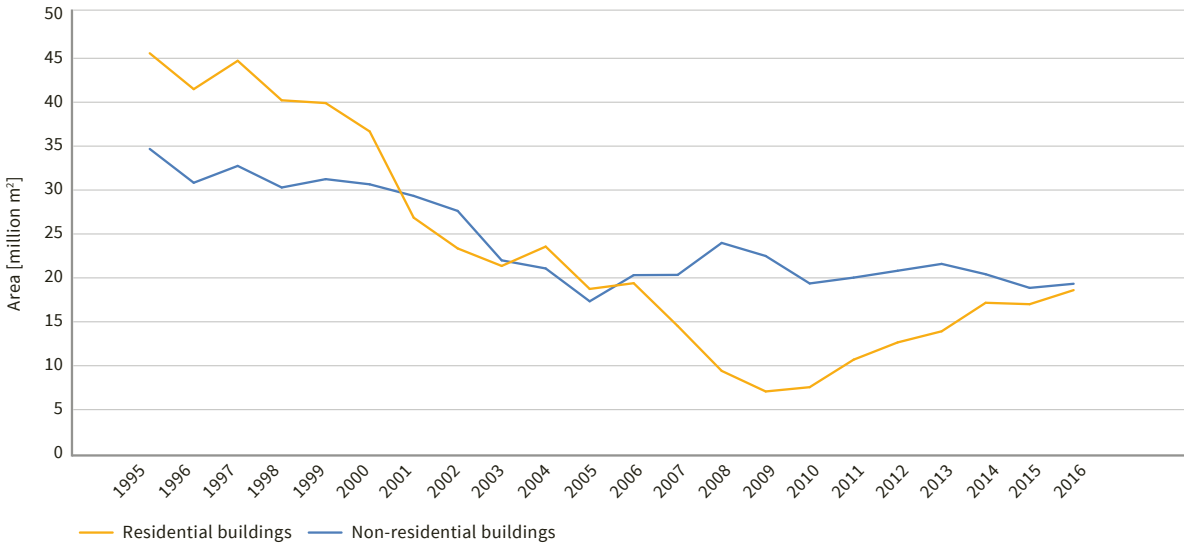
The number of newly constructed residential buildings fell sharply from approximately 220,000 at the end of the 1990s to about 80,000 in 2009. Only since 2011 has there been a slight recovery in the construction of new buildings. In 2016 the number of residential buildings completed was 110,000 (278,000 apartments). The volume of newly constructed non-residential buildings also decreased, from approximately 35,000 in 1995, until 2005, since when it has remained relatively constant at 24,500 new buildings a year.

Particularly in the new states at the beginning of the 1990s, following reunification, a large number of non-residential buildings were constructed (around 50 % growth between 1993 and 1995). From the end of the 1990s the growth in new construction in the new states stabilised at just under 5,000 new buildings a year.

In keeping with the number of new residential buildings, the completion of living space also declined steadily after the start of the millennium. Only since 2009–2010 has there been an appreciable turnaround in the trend towards more newly built living space. In 2016 approximately 25 million m² of living space in residential buildings was newly constructed.

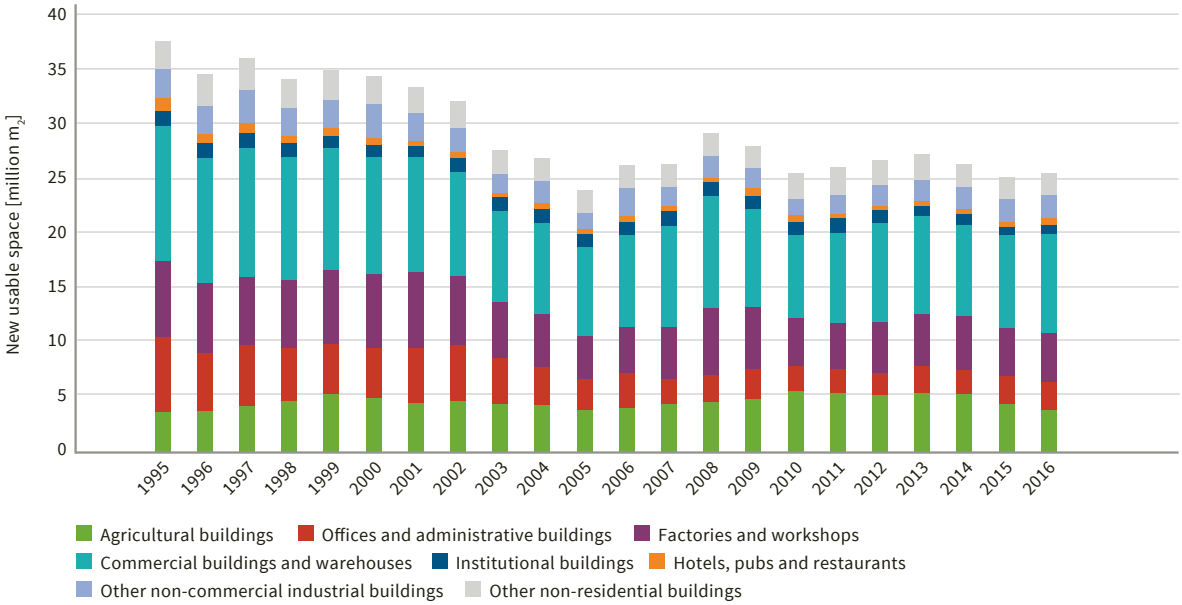
The newly constructed usable space in non-residential buildings has also declined in the last 20 years, although not so sharply as in residential buildings, so the usable space in non-residential buildings has been greater than the new living space in residential buildings since 2006. Since 1990 a total of 647 million m² of usable space has been newly built in non-residential buildings in Germany.

Fig. 9: Development of new living space and usable space



Source: Destatis, 2017b; Destatis, 2017c

Fig. 10: Area of new non-residential buildings by use



Source: Destatis, 2017b

The largest share of the space in new non-residential buildings (heated and unheated) is comprised of commercial buildings and warehouses, followed by agricultural buildings, factories and workshops.

With the exception of institutional and agricultural buildings, newly constructed space in all kinds of non-residential buildings has declined nationally by around 30 % a year since 1995. Slight falls in the growth of space were recorded in 2005 and 2010. The reasons for these might have been the easing of the post-reunification boom (up to 2005) and the consequences of the 2008–2009 financial crisis.

Summary

The residential and non-residential building stocks offer enormous energy-saving potential that must be exploited much more quickly in the short term.

Current measures in the area of energy efficiency are not sufficient to achieve the climate protection targets, nor the intended reduction in greenhouse gases in the building sector. In order to better exploit the savings potential offered by the building stock in Germany and be able to develop specific measures, the data situation needs to be improved in many areas (particularly in relation to non-residential buildings).

Non-residential buildings are considerably more heterogeneous and technically more complex than residential buildings. So the construction technology installed varies greatly according to usage and space. There are significant differences between office premises, pubs and restaurants, administrative buildings, schools and shopping centres that require specific approaches to energy efficiency measures, in terms of heat as well as electricity.

Innovation through refurbishment off the production line

Particularly in the energy-efficient refurbishment of buildings, new ideas and technologies are required. One innovative approach involves refurbishment of the production line. By using the industrial production method, buildings can be refurbished in only 3 to 10 days and at relatively low cost. As part of the 'Energiesprong Deutschland' project, dena is working on opening up a new refurbishment market.

For more information visit **www.energiesprong.de**

EnergieSprong

Overview

36 % of final energy consumption in Germany is accounted for by the building sector (heat and electricity).

In 2050 the building sector in Germany should be almost carbon neutral.

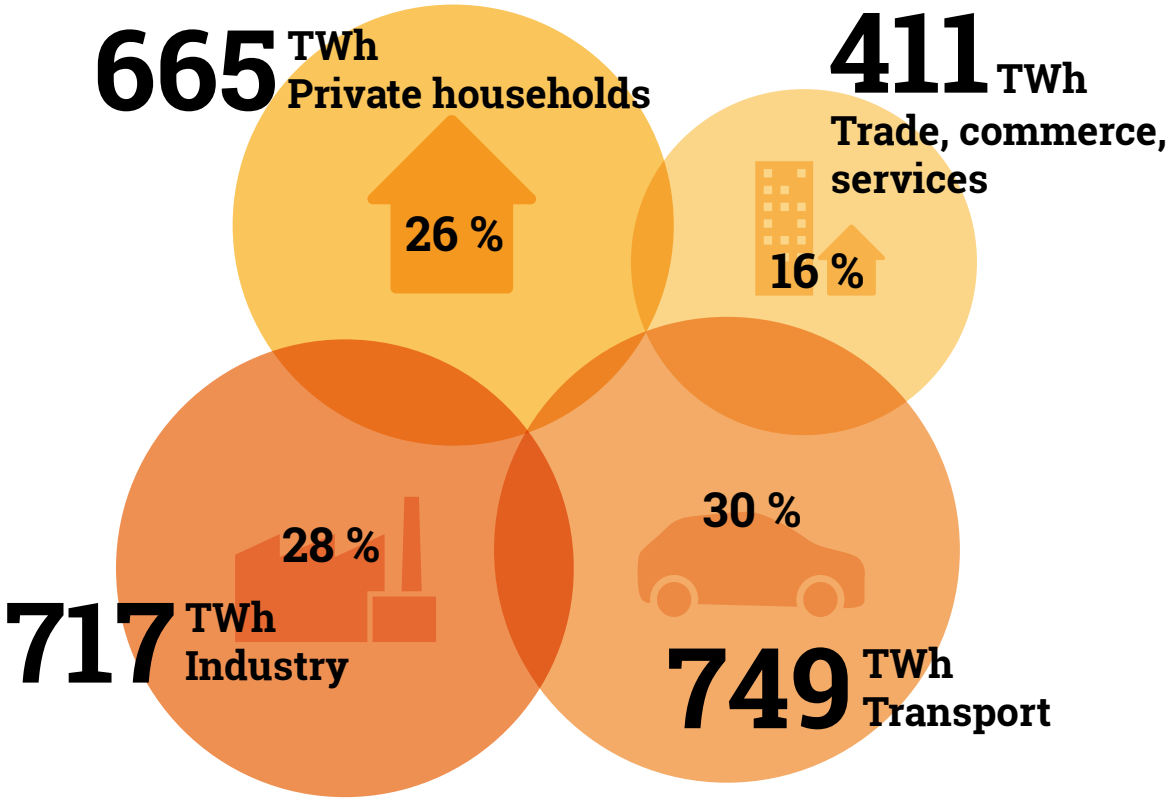
By 2020 heat consumption should be 20 % lower than in 2008.

12 million residential buildings were built before the first Thermal Insulation Ordinance came into effect.

Energy consumption

The annual amount of CO_2 produced per capita in Germany is 11.0 t. According to the Federal Environment Agency, an eco-friendly figure would be 2.5 t.

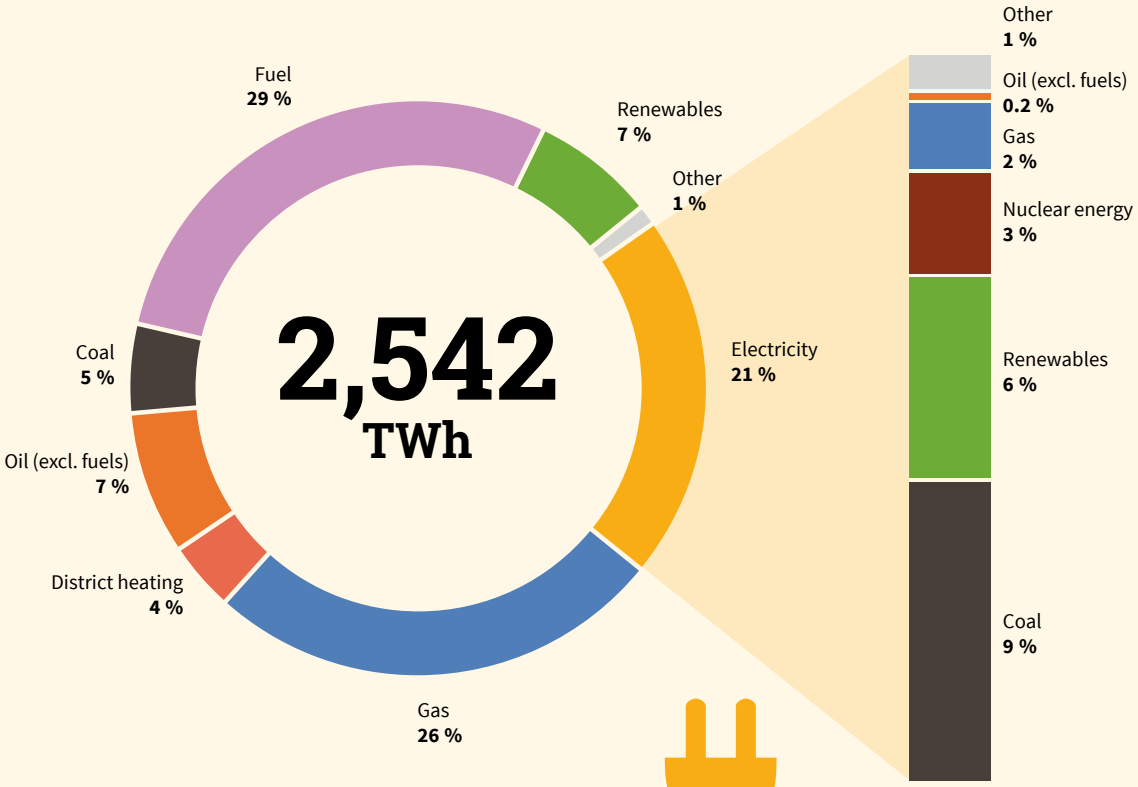
Fig. 11: Final energy consumption by sector



Source: Federal Ministry for Economic Affairs and Energy (BMWi), 2017c

Final energy consumption in Germany is accounted for by sector: industry; trade, commerce and services; transport; and private households. This allows for a differentiated overview of the sectors that are the major consumers. In 2016, final energy consumption in Germany totalled around 2,542 TWh.

Fig. 12: Final energy consumption by energy source



Source: Federal Ministry for Economic Affairs and Energy (BMWi), 2017c; own calculations

Key messages

Dealing more efficiently with energy

Having fallen by around 20 % between 2002 and 2010, final energy consumption for space heating and hot water in residential buildings has since been falling much more slowly. In industry, and in trade, commerce and services, even final energy consumption for space heating and hot water is stagnating.

The main sources of energy in Germany, measured in terms of final energy consumption, are fuel and gas. Coal and renewable energy sources are in third place with 13 % each.

The current energy mix is still based mainly on fossil fuels. Every kilowatt-hour consumed releases greenhouse gases that affect the climate. Remarkably, not even a quarter of the energy is used as electricity. Even so, more than a third of Germany's energy is used to provide space heating and hot water in the building sector.

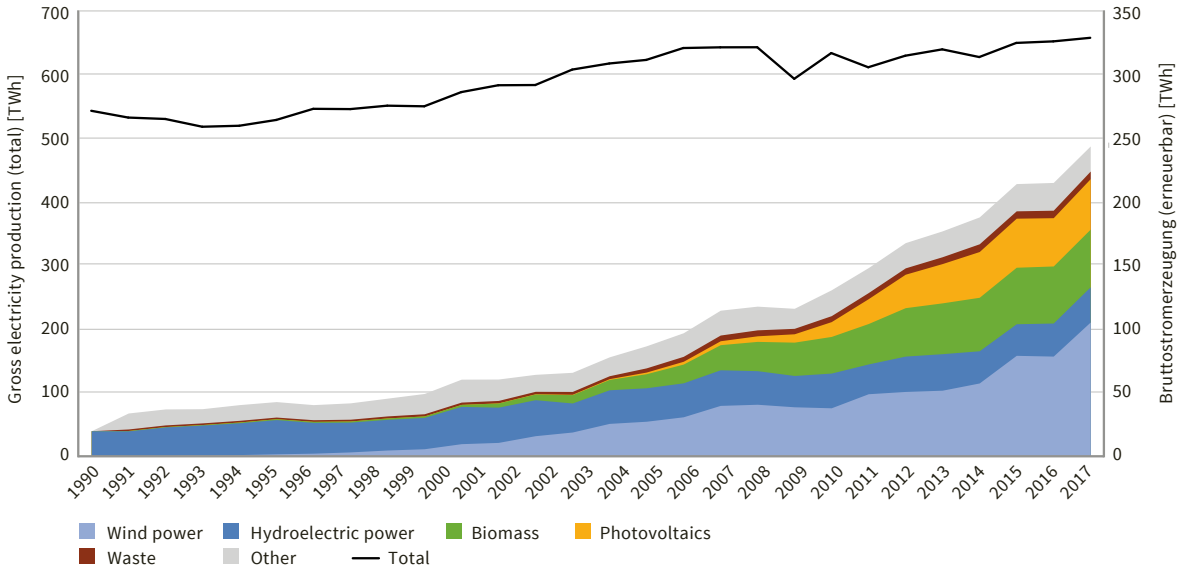
– 20 %

Savings in the heating needs of buildings are still too low. Following the current trend, the climate policy target of 20 % below the 2008 level will not be met by 2020.

80 %

Saving electricity is active climate protection. Nevertheless, areas of activity such as transport, space heating, hot water and industrial processes must not be excluded from consideration where the energy transition is concerned, because approximately 80 % of final energy consumption is not used in the form of electricity.

Fig. 13: Renewable energy sources in electricity production



Source: Federal Ministry for Economic Affairs and Energy (BMWi), 2017c

While the proportion of renewable energy in final energy consumption is still comparatively small, it has already become one of the most important sources of electricity generation. It is making a significant contribution to an increasingly climate-friendly energy supply in Germany, while reducing dependence on the importation of fossil fuels.

Gross electricity production from renewable energy sources totalled around 244 TWh (secondary axis) in 2017. This has increased the proportion of renewable energy sources to around 37 % of gross electricity production (see the black line, primary axis). Wind power, biomass and photovoltaics account for the largest share of renewable energy sources.

Summary

The energy transition needs rethinking and innovation. The more efficiently electricity, heat and fuels are used, the more successful a sustainable transformation of the energy system will be.

In order to be able to largely dispense with fossil fuels in the future and avoid increasing environmental costs, investment is necessary today – e.g. in renewable energy sources, energy efficient products and systems, and in energy-efficient construction and refurbishment.

Current trends show that the share of renewable energy in electricity consumption is steadily increasing, yet it remains relatively small in the areas of heat and transport. Nevertheless, according to the Federal Environment Agency, 160 million tonnes of greenhouse gas emissions were avoided in 2016 through the use of renewable energy in Germany. Of this, 119 million tonnes of CO_2 equivalent were attributed to the electricity sector. In the heating sector it was around 35 million tonnes, and 6 million tonnes of CO_2 equivalent were saved through the use of biofuels (Federal Environment Agency, UBA, 2017).

At the same time, renewable energy is gaining in importance as an economic factor, as shown in the **study, 'Economic Indicators of the Energy System'** (GWS, 2018), commissioned by the Federal Ministry for Economic Affairs and Energy (BMWi). More and more jobs are being created in the wind energy sector. Since 2011, job numbers have risen to almost 100,000.

Database of Energy Efficiency Experts for Government Subsidy Programmes

Energieeffizienz Experten für Förderprogramme des Bundes

The Database of Energy Efficiency Experts for Government Subsidy Programmes has enabled professional support for energy-efficient construction and refurbishment to be found quickly and easily. More information can be found at **www.energie-effizienz-experten.de**

Overview

338,600 people were employed in renewable energy in 2016.

3× as many as in 2000, and 10,000 more than in the previous year, 2015.

160,200 employees work in the wind energy sector – 27,000 of those in offshore wind.

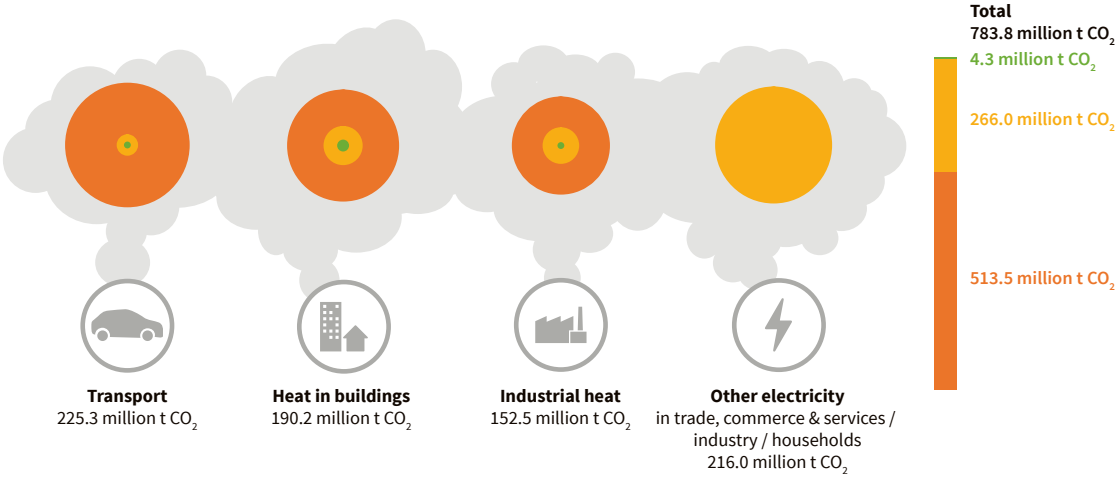
10,000 people work in coal mining – 90,000 fewer than in 2000.

Source: GWS, 2018

Climate policy

According to the federal government's Climate Action Plan 2050, greenhouse gas emissions in the building sector are to be cut by 67–66 % of their 1990 levels by 2030.

Fig. 14: Energy-related greenhouse gas emissions by area of activity and type of energy source



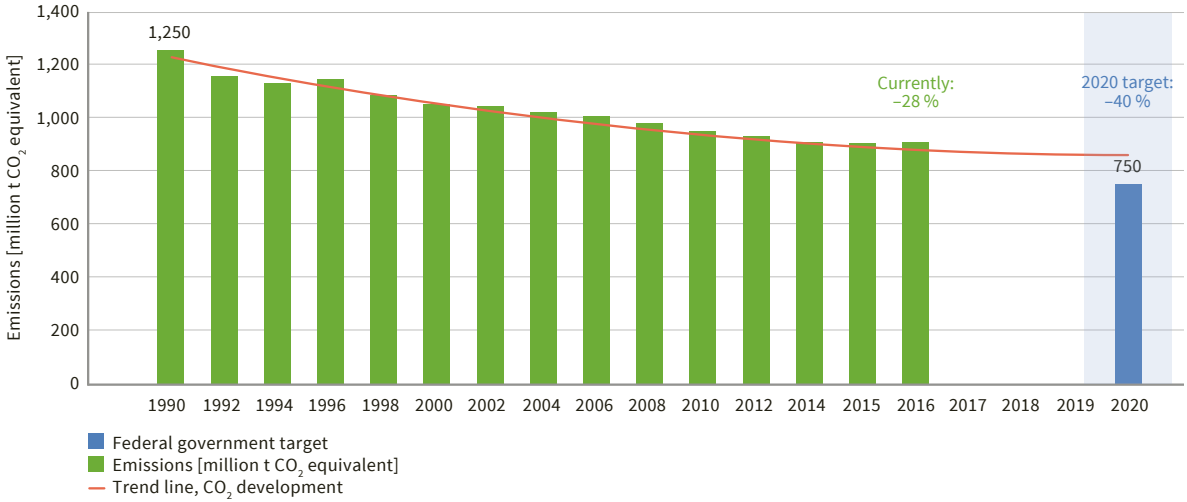
Transport	Heat in buildings	Industrial heat	Other electricity	
218.6 million t CO_2	168.1 million t CO_2	126.8 million t CO_2		Fossil fuels
6.0 million t CO_2	19.3 million t CO_2	25.1 million t CO_2	215.6 million t CO_2	Electricity (energy mix)
0.7 million t CO_2	2.9 million t CO_2	0.7 million t CO_2		Renewable energy sources

Source: Federal Ministry for Economic Affairs and Energy (BMWi), 2017c; own calculations

Shown here are all of the energy-related greenhouse gas emissions in Germany (polluter pays principle) by area of activity, amounting to 783.8 million tonnes of CO_2 equivalent (compared with 768 million tonnes of CO_2 in 2015). The biggest source of greenhouse gas emissions is transport, producing around 226 million tonnes of CO_2. Almost on a par is the use of other electricity for trade, commerce and services, industry and households, with around 216 million tonnes of CO_2.

Heat in buildings causes CO_2 emissions amounting to 190 million tonnes of CO_2. A small part of that comes from the use of electricity for heat. Process heat in industry and trade, commerce and services accounts for the smallest share, at around 153 million tonnes of CO_2. This is mainly a result of using fossil fuels.

Fig. 15: Development of greenhouse gas emissions in all sectors



Source: Federal Ministry for Economic Affairs and Energy (BMWi), 2017a; BMWi, 2017c

Climate Action Plan 2050

The **Climate Action Plan 2050** (adopted in November 2016) is the signpost showing the way to a carbon-neutral Germany. In line with the Paris Agreement of 2015, Germany is set to be largely carbon neutral by 2050. The medium-term plan is to reduce greenhouse gas emissions by at least 55 % of their 1990 levels by 2030. More information can be found at **www.bmu.de/themen/klima-energie/klimaschutz/nationale-klimapolitik/klimaschutzplan-2050**

The short-term goal of reducing greenhouse gas emissions by 40 % of their 1990 level by 2020 is hardly achievable. This is demonstrated primarily in data from last year, which show that emissions have risen slightly again – and that the figures have stagnated in the last three years at around a 28 % reduction compared to 1990.

Viewed over a longer period, greenhouse gas emissions decreased between 2000 and 2016 by an average of approximately 10 million tonnes of CO_2 equivalent per year. The rate would have to triple by 2020, though, to reach the 2020 target.

Carbon-neutral building stock

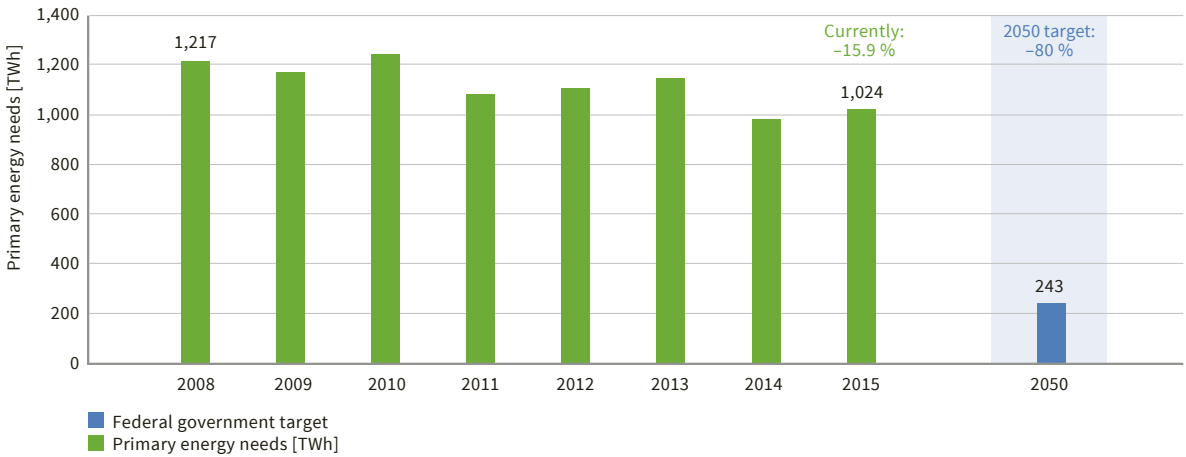
The federal government's climate action plan envisages achieving the target of an almost carbon-neutral building stock by 2050 through a combination of energy efficiency and renewable energy. Because of the long lifespan of buildings, the 2030 interim goal of cutting greenhouse gas emissions in the building sector to 70 to 72 million tonnes of CO_2 equivalent (primary energy sources without industry) is particularly important.

By 2050, primary energy needs in buildings are to be reduced by 80 % of their 2008 levels. From 2008 to 2015 primary energy needs fell by around 16 % according to figures from the Federal Ministry for Economic Affairs and Energy (BMWi).

However, the figures quoted are not adjusted for variations in climate, which is why there are obvious fluctuations from one year to the next. This also explains, for example, the savings in 2014, which were partly the result of a mild winter.

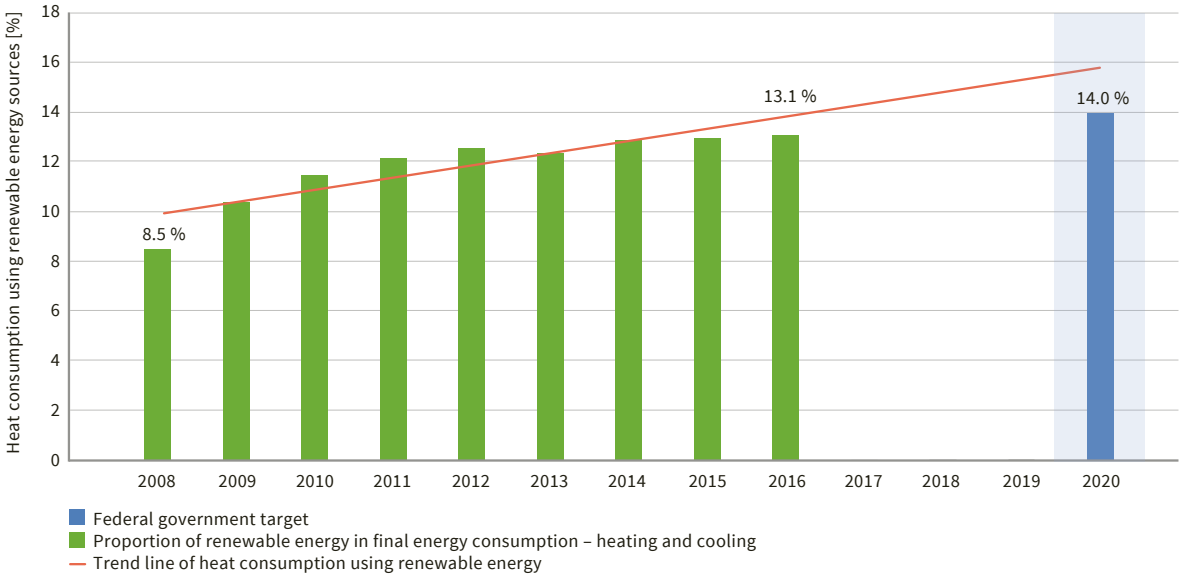
Whether the 2050 energy policy target can be achieved, mainly depends on what additional measures are taken in the area of building efficiency and in the use of carbon neutral energy sources in the next few years.

Fig. 16: Development in primary energy needs



Source: Federal Ministry for Economic Affairs and Energy (BMWi), 2017a

Fig. 17: Proportion of renewable energy in heat consumption



The heat consumption represented here includes industrial heat, as well as heat in buildings.
Source: Federal Ministry for Economic Affairs and Energy (BMWi), 2017b

The proportion of renewable energy in heat consumption is set to increase to 14 % by 2020. In 2016 its share was 13.1 %, having fallen slightly compared to the previous year. Despite this slight decline, it can be expected that, if the trend in recent years continues, the 2020 target figure will be achieved or even surpassed.

Key messages

Transformation of the building sector

The biggest source of greenhouse gas emissions is transport, producing around 225 million tonnes of CO_2. Heat in buildings produces CO_2 emissions totalling approximately 190 million tonnes of CO_2 (private households, trade, commerce and services, and industry), a small part of which comes from the use of electricity for heat (approx. 19 million tonnes of CO_2).

The aims of German energy and climate policy are ambitious. The plan is to reduce greenhouse gas emissions by 80 to 95 per cent by 2050 compared to their 1990 levels. The transformation of the building sector is vitally important for the energy transition as a whole; after all, in 2016, out of a total of 2,542 TWh of final energy in Germany, 826 TWh were used for heat in the building sector alone (BMWi 2017) – more than for transport (790 TWh) and industrial heat (504 TWh).

So there is great potential in the building sector for reducing greenhouse gas emissions. In the integrated energy system, buildings will play an even more important role in the future, in terms of their storage potential, and in their interaction with energy production and distribution, transport and industry.

Three conditions need to be met in order to reach the 95 % target in 2050:

- **major improvements in the efficiency of building envelopes**
- **a significant increase in the energy efficiency of construction technology and the use of renewable energy sources**
- **the development of an international market for carbon-neutral gas and oil**

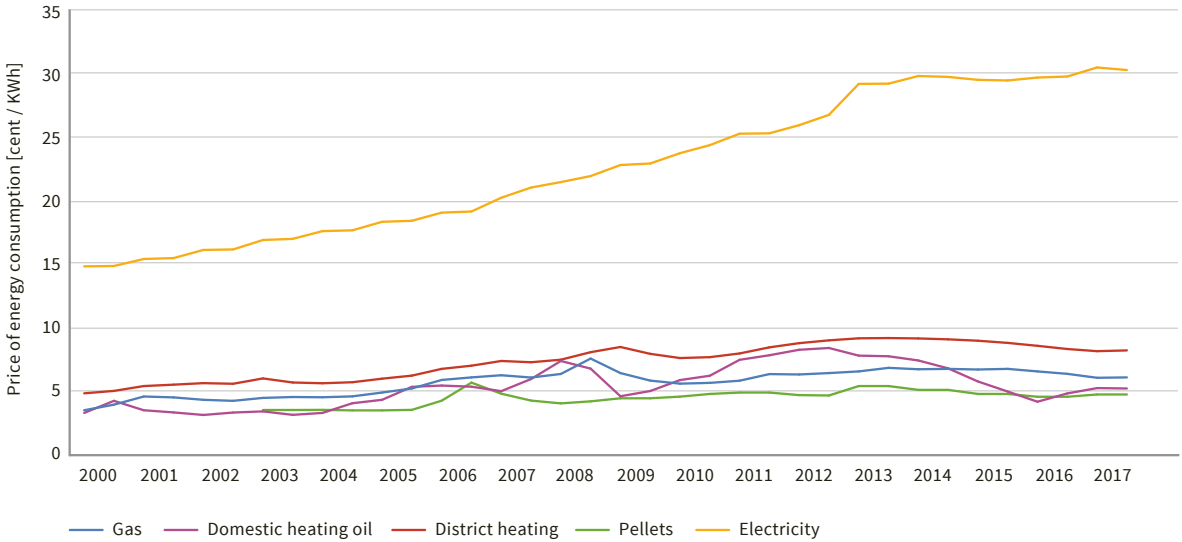
dena-geea Building Study,

'Scenarios for a market-based climate and resource conservation policy 2050 in the building sector'

dena's Building Study investigates how the transformation of the building sector can achieve the target of an 80 to 95 % reduction in greenhouse gases through synergy between building envelopes, construction technology and changes in energy efficiency.

www.dena.de/gebaeudestudie

Fig. 18: Consumer prices for heating energy by energy source



Source: Destatis, 2017b; Federal Ministry for Economic Affairs and Energy (BMWi), 2017c; own calculations

After a temporary increase in 2006–2007, wood pellets have been the only energy source whose price, at around 5 cents per kilowatt-hour, has been relatively constant. The price of heating oil has been subject to considerably greater fluctuations, reaching a new low of just over 5 cents/kWh in 2016.

The price of gas has been relatively constant since 2011 at around 6 to 7 cents/kWh, while the price of district heating has been around 9 cents/kWh since 2011. The price of electricity has risen by 15 cents per kilowatt-hour since 2000. Since 2013 electricity prices have stayed around 30 cents/kWh. There is no significant reduction in prices on the horizon.

It must be assumed that the prices of fossil fuels like gas and oil will remain at very low levels in the long term due to new means of extraction, such as fracking, or that they will drop even further due to falling demand.

Key messages

Prospects for carbon pricing

Existing measures in the area of energy efficiency and renewable energy are not sufficient to achieve the federal government's climate protection policy targets. One reason for this is the low price of fossil fuels. Controlling the price of CO_2 could be the remedy.

The basic idea of carbon pricing is to create economic incentives in order to make investment in energy efficiency and renewables more attractive, and thereby get the 'second phase' of the energy transition under way in Germany. Another advantage of carbon pricing is that the hidden costs of fossil fuels, such as environmental costs that have to be borne by the state (i.e. the taxpayer), are made more transparent.

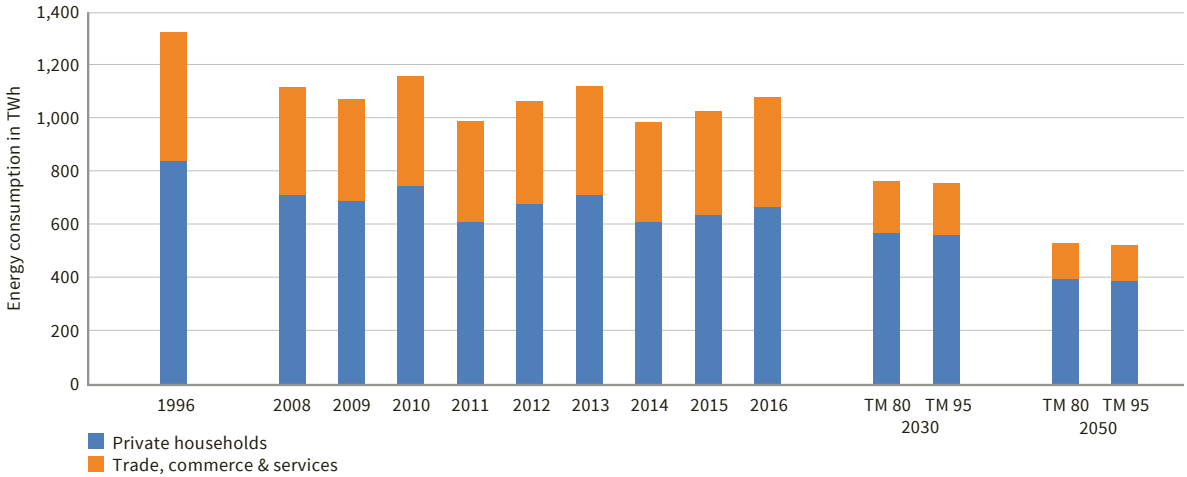
Carbon pricing is an instrument that can be used alongside incentives for energy efficiency measures and the reconstruction of the energy system. At the same time, a sociopolitical framework needs to be created to prevent new taxes placing a disproportionately heavy burden on the less well-off sections of the population.

Firmer carbon pricing New impetus for climate policy

In a joint declaration, 15 leading energy and climate protection experts have called for a realignment of the economic framework for the energy transition with a view to focusing more on avoiding CO_2. To this end, the group of experts have identified, alongside the existing proposals for carbon pricing, common guiding principles and have combined these into one specific proposal.

www.dena.de/co2-bepreisung

Fig. 19: Energy needs in buildings, 2030/2050



Source: Destatis, 2017a; Federal Ministry for Economic Affairs and Energy (BMWi), 2017c

Between 2008 and 2016, with only a 3 % reduction in 8 years, very little was achieved in terms of reducing final energy consumption. According to the calculations carried out in the dena pilot study, 'Integrated Energy Transition 2050', the forecast final energy consumption in technology mix scenarios is almost identical for both an 80 per cent (TM 80) reduction and a 95 per cent (TM 95) reduction in greenhouse gases.

The difference is in the composition of the two scenarios. Whereas in the TM 80 scenario small quantities of fossil fuels are still used in the building sector, the TM 95 scenario leans heavily towards synthetic fuels.

The results of the dena pilot study show that, with a broadly similar final energy consumption of around 500 TWh in 2050, the TM 80 scenario produces 41 million tonnes of CO_2 equivalent, whereas the TM 95 scenario produces only around 1 million tonnes of CO_2 equivalent. The relationship between private households and trade, commerce and services is constant in both scenarios.

Summary

Up to now Germany has assumed a leading role in climate protection. In the past, the subjects of energy saving and energy production were not simply considered from an ecological perspective, but primarily from an economic perspective.

Ever since the first Thermal Insulation Ordinance in 1977, Germany has been challenging energy efficiency standards in buildings. Since then, the regulatory standards have been continually raised. Although a great deal of progress has been made, around 36 % of Germany's final energy consumption is accounted for by the building sector.

For the **transformation of the building sector**, approaches must be found that will significantly increase the rate of refurbishment, while also optimising construction technology and the supply of energy. Furthermore, strategic decisions need to be made that will best enable energy sources to achieve their respective transformation targets.

What shares do fossil, biogenic or synthetic gas and oil have in the energy mix? What are the effects of this on the importation and exportation of energy? What investments must be made with regard to plants and electricity grids. How will security of supply be guaranteed? Answers to these questions form the basis of the second phase of the energy transition in Germany.

There is still an extraordinarily high amount of energy-saving potential here, which is why buildings have a special role to play in achieving the energy and climate policy targets.

Overview

40–45 % is the share of renewable energy in electricity consumption to be achieved by 2025.

80 % less need for primary energy than in 2008 is the goal to be reached in all sectors by 2050.

67–66 % fewer greenhouse gas emissions in the building sector than in 1990 is the target to be achieved by 2030.

In 2022 the last of the nuclear power stations are to be decommissioned.

Source: Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), 2016

Outlook

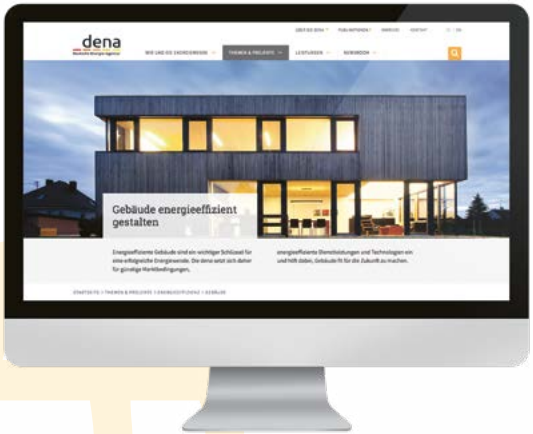
Impetus for the energy transition in buildings

Comprehensible, well-prepared data and facts provide a solid foundation from which to restore the energy transition in Germany to a project for the future. One thing is certain – the federal government's climate protection targets will not be achieved without new impetus in the building sector.

In order to give fresh momentum to the transition in energy and heating within the building sector, people must again be motivated to 'get involved'. This is where politicians in particular are needed. A realignment of the public funding system is needed to come up with approaches that are open to a range of technologies, while at the same time ensuring planning security. In addition, with continually low prices for fossil fuels, new incentives must be provided. Carbon pricing has the potential to revive the market for renewable energy and create a new investment climate.

Ultimately, the energy transition can only make progress as a sociopolitical project with the necessary acceptance among the population. It is a matter of the right communication and reliable forecasts.

The dena building report will contribute to this in the future as well. Data, facts & analyses on the transition in energy and heating in the building sector will continue to be available at dena.de in the Buildings section.



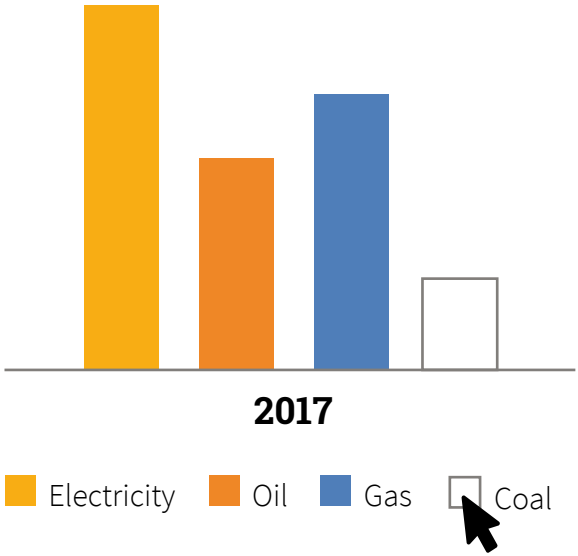
Visit the dena Buildings section online

There you will find all of the important information on the subject of energy efficiency in the building sector. To successfully promote the energy transition, dena is advocating favourable market conditions and energy-efficient services and technologies, and is helping to make buildings fit for the future.

www.dena.de/gebaeude

Besides dena's Concise 2018 Building Report, you will also be able to access analyses and interactive charts in the future.

The topic are wide-ranging, from energy consumption in buildings and information on the housing stock in Germany to regulatory frameworks for energy efficiency in the building sector.



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