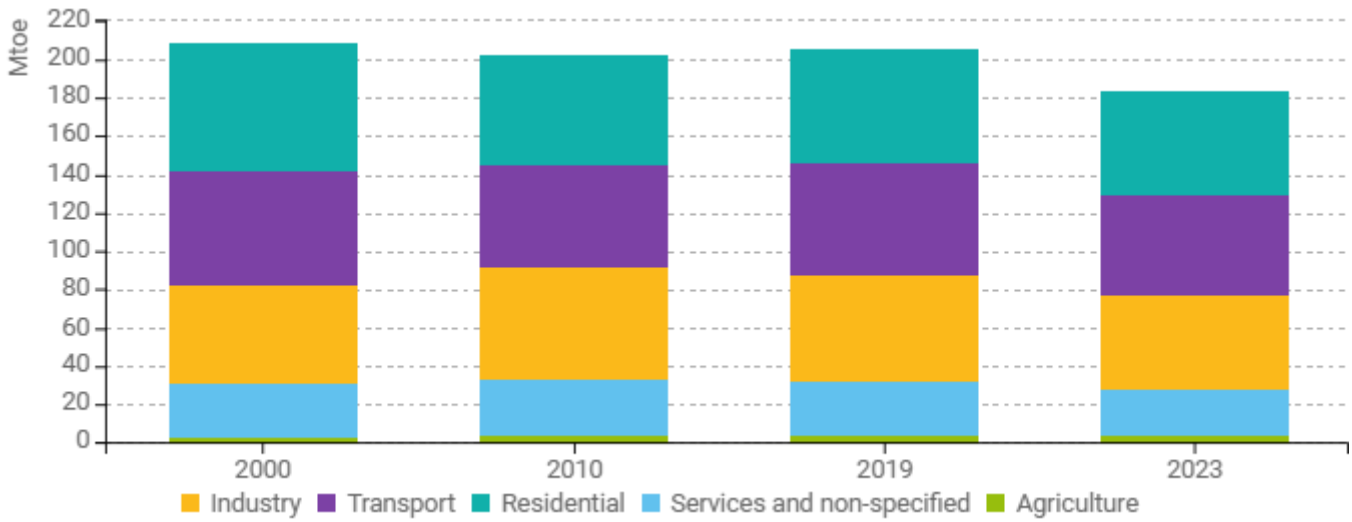
Energy efficiency trends and policies

Overview

Germany's total final energy consumption of 2023 (183 Mtoe) was noticeably below its 2000 level (208 Mtoe, -21 Mtoe or 0.7%/a per year). In 2023, the largest consuming sector is residential, representing almost 30% of total final energy consumption. With a share of 28% and 27% respectively, transport and industry are not far behind. Between 2010 and 2023, this structure remained rather stable. Services and especially agriculture contribute significantly less to final energy consumption in Germany.

Figure 1: Final energy consumption by sector (with climatic corrections)



Source: ODYSSEE

In order to measure the impact the pure energy efficiency evolution, i.e. without the impacts of external effects as weather fluctuations, structural changes and several comfort effects, ODYSSEE provides a re-aggregated energy efficiency indicator called ODEX. The technical ODEX is also cleaned from further non-technical influences (e.g. imperfect climate corrections or statistical errors). In the year 2023, the total technical ODEX in Germany reached a level of 76, which represents an energy efficiency improvement of 0.8% on the overall energy efficiency since the base year 2000. Larger efficiency gains have been registered for the residential and service sectors, whereas transport and especially industry lag behind.

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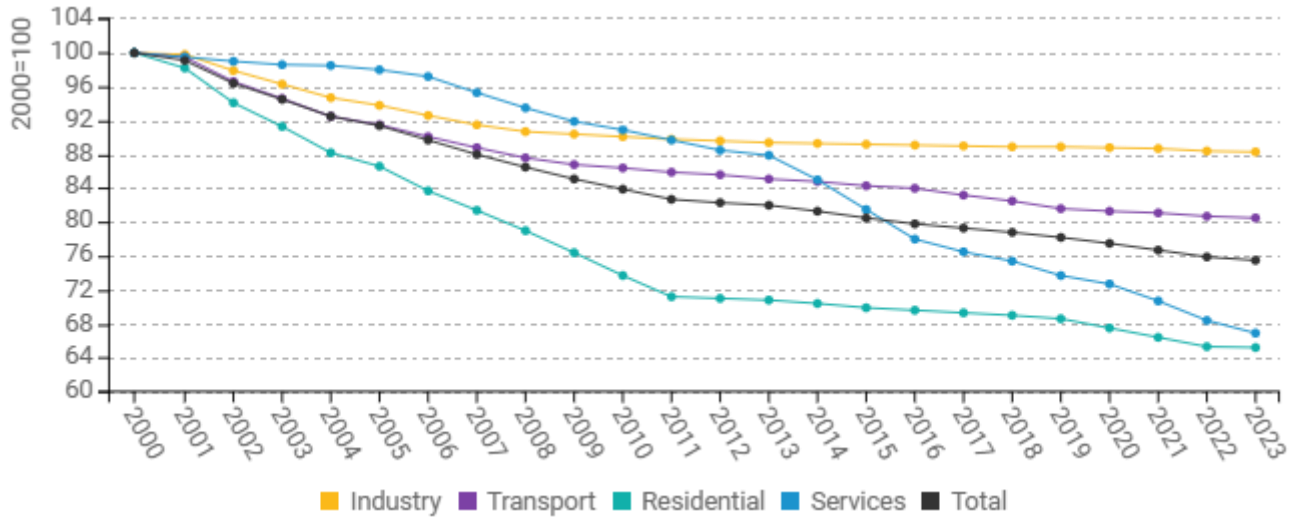
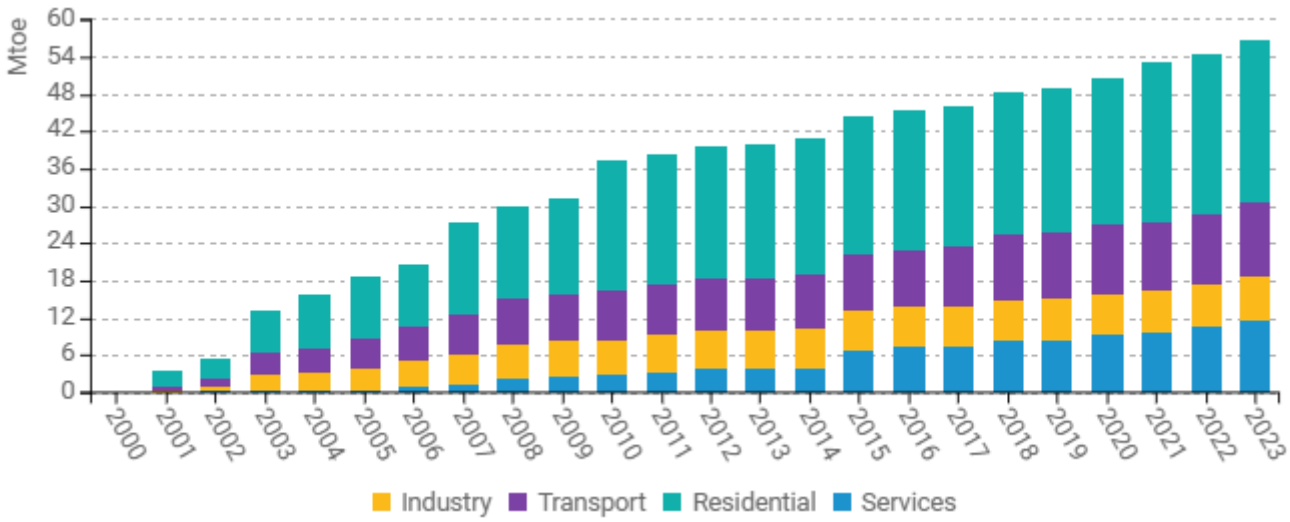
Figure 2: Technical Energy Efficiency Index



Source: ODYSSEE

Energy savings are an indicator in ODYSSEE which is derived from the ODEX and also measures energy efficiency gains by sector. In Germany, by far the highest rate of energy savings in the period 2000 - 2023 was reached in the residential sector, the lowest in industry. Transport and services lie in between.

Figure 3: Energy savings by sector



Source: Odyssee

Total energy supply measures the overall supply of energy for all activities on the territory of the country. It covers consumption by the energy sector itself, transmission and distribution losses, final energy consumption by end-users and the use of fossil fuel products for non-energy purposes. It excludes international maritime bunkers and international aviation. The main drivers are variations of final energy consumption, of net consumption of the power sector and of other transformations as well as of non-energy uses. In Germany, the observed decrease in

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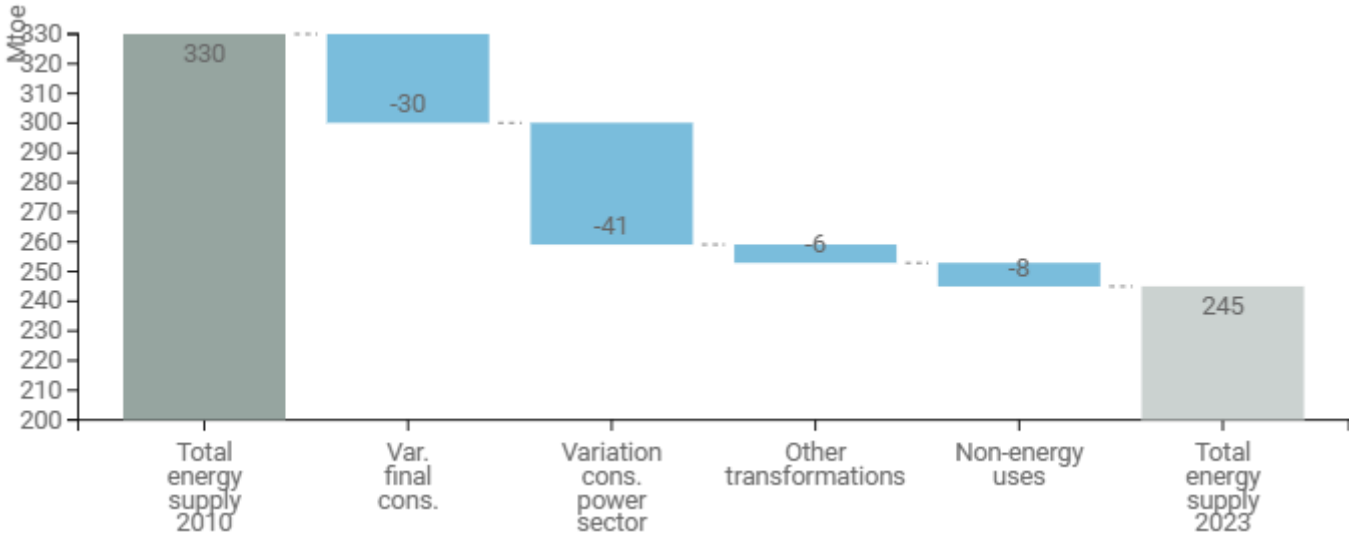
total energy supply between 2010 and 2023 was mainly caused by a drop in final consumption and consumption of the power sector.

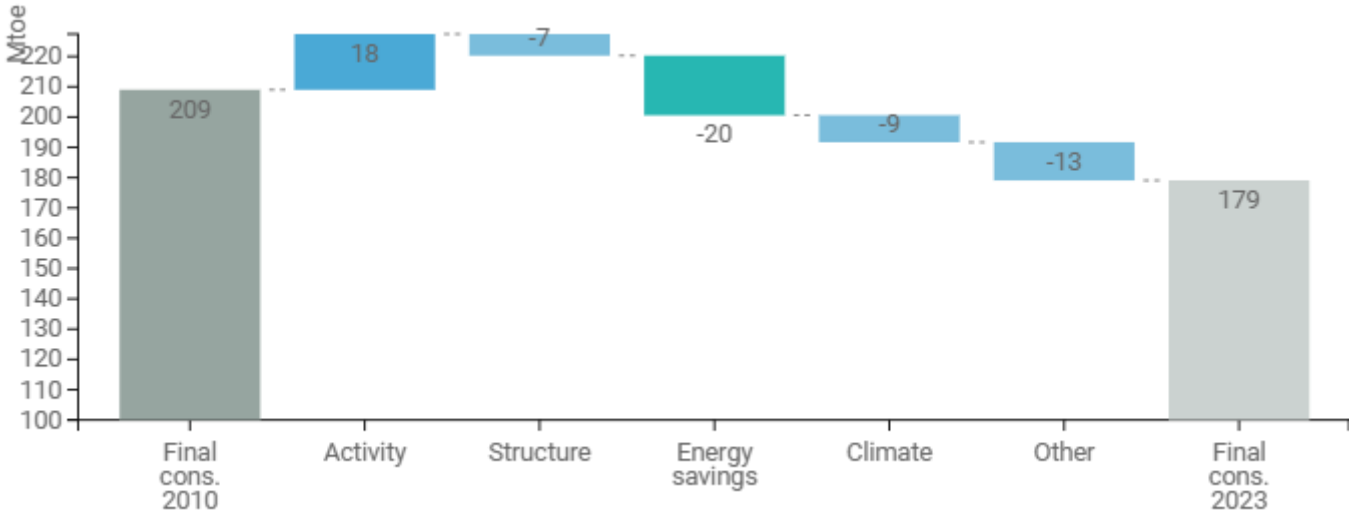
Figure 4: Main drivers of the total energy supply variation



Source: Odyssee

During the period 2000-2023, total final energy consumption in Germany decreased by 30 Mtoe (from 209 to 179 Mtoe) (Figure 5). Wheras changes in activity contributed to a total increase in final energy consumption by around 18 Mtoe, all other factors had a decreasing effect on final energy consumption. The main driver for the observed consumption decrease were the energy savings achieved through a considerable improvement in energy efficiency as measured by the ODEX. But also structural changes, the on average warmer climate and other factors (especially behavioural changes and organisational improvements in the use of energy) made significant contributions.

Figure 5: Main drivers of the final energy consumption variation



Source: Odyssee

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With the "Federal Climate Action Act" from 2019, Germany introduced legally binding sectoral GHG emission reduction targets for 2030, which were tightened in the first revision in 2021. Since the last revision in July 2024, target compliance is no longer linked to ex-post sectoral statistical emission data, but to overall projected data. In order to achieve the tightened reduction targets, a new Climate Action Program was adopted by the Federal Government on October 4, 2023. It includes further energy efficiency and climate policy measures. Among those are a new Energy Efficiency Act, which entered into force in November 2023 and serves to implement the 2023 recast of the EU Energy Efficiency Directive. The program also includes some revisions of legislation on the energy supply side (for coal and wind energy), new regulations for heating of buildings, as well as several new or enhanced funding programs supporting energy efficiency and decarbonization in buildings, industry and transport. In the Coalition Agreement of the new German Government from May 2025, some measure revisions were announced which may have an increasing impact on energy consumption (e.g. the already agreed reduction in levies on air transport and changes to the Building Energy Act expected for 2026).

Table 1: Sample of cross-cutting measures

Measures	NECP measures	Description	Expected savings, impact evaluation
Fuel Emissions Trading Act - BEHG (Brennstoffemissionshandelsgesetz, BEHG)	Yes	The German "Fuel Emissions Trading Act" (Brennstoffemissionshandelsgesetz, BEHG) establishes an Emission Trading System in the sectors heating and transport, starting in 2021.	1104 ktoe (in 2030, total final energy savings)
'Federal Energy Efficiency Act (Energieeffizienzgesetz - EnEfG)	Yes	The Energy Efficiency Act creates a cross-sectoral legal framework for increasing energy efficiency in Germany as a contribution to the national GHG emission reduction targets. It also implements the requirements from the 2023 EED revision at the national level.	
Federal Climate Action Act (Bundes-Klimaschutzgesetz - KSG)	No	The purpose of the Act is to ensure achievement of the national climate targets and compliance with the European targets. The ecological, social and economic impacts shall be taken into consideration. It includes overall GHG emission reduction target for Germany for the years 2030 (-55% comp. to 1990), 2040 (-88% comp. to 1990) and 2045 (net GHG neutrality). Sectoral annual emission budgets (for energy, industry, transport, buildings, agriculture, waste and others; excl. LULUCF) are	

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		set for the years 2020 to 2030 (with an extension planned until 2040).	

Source: MURE

Buildings

Final energy consumption in the building sector in Germany has decreased from 96 Mtoe in 2000 to 78 Mtoe in 2023, i.e. by almost 20% or 0.8%/a. The greater reduction came from residential buildings. However, since 2010, the reduction rate in residential buildings slowed down to 0.5%/a, whereas non-residential buildings achieved significantly larger reductions of around 1.6%/a.

Figure 6: Final energy consumption in buildings (with climatic corrections)



Source: Odyssee

With almost 70% in 2023, the largest share of energy consumption in households is attributable to space heating. After a signification decrease in space heating consumption until 2010, the reduction rate slowed down to 0.1%/a until 2023. Water heating consumption decreased continuously by 0.5%/a. Consumption for cooking and electrical appliances showed an upward trend until 2010, but then also declined.

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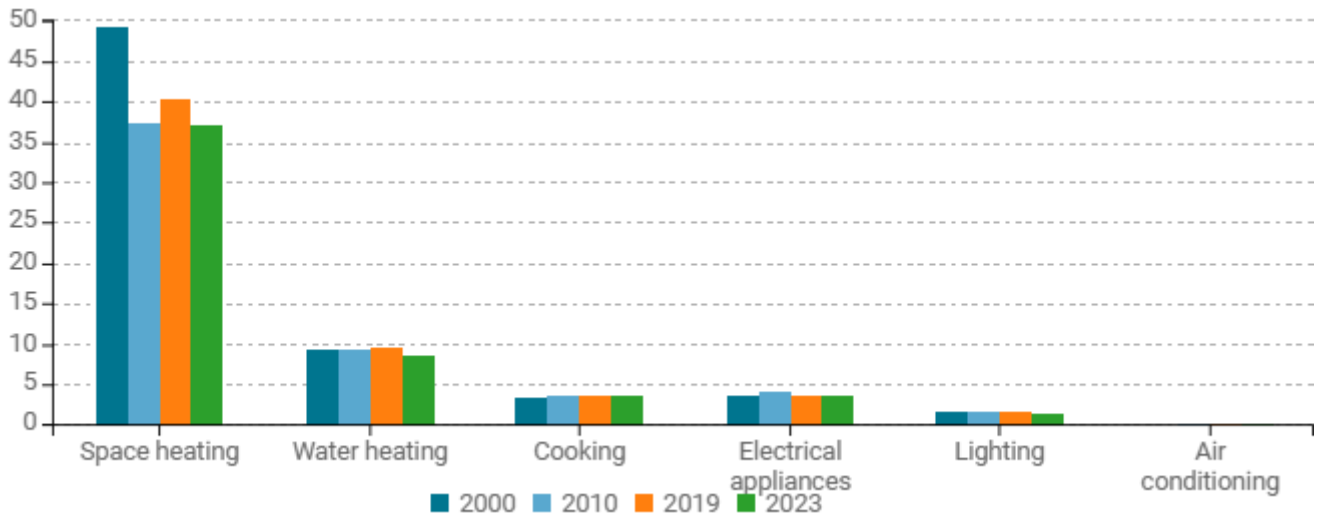
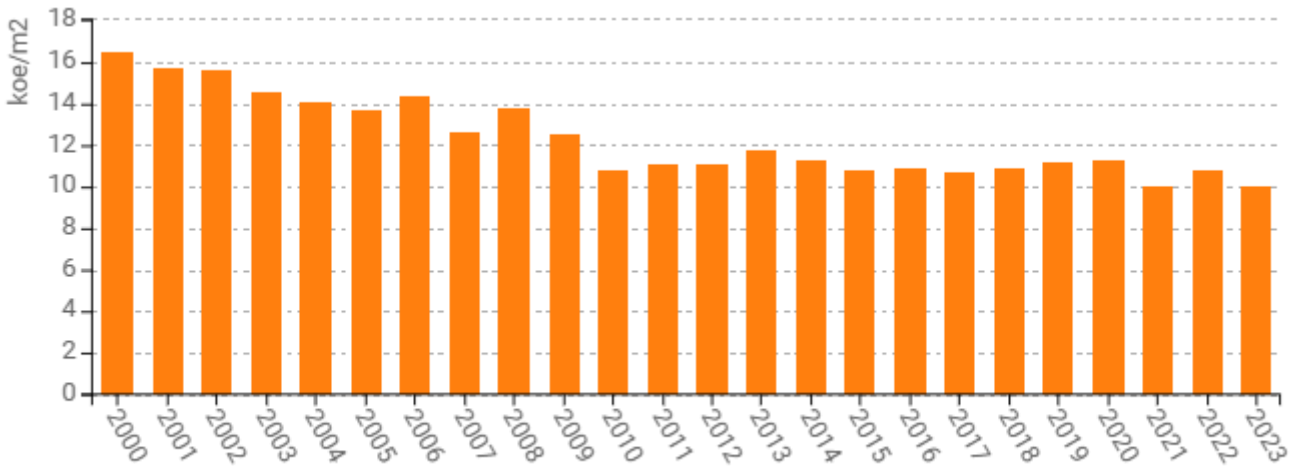
Figure 7: Energy consumption by end-use of households (with climatic corrections)



Source: Odyssee

The household energy consumption per m² for space heating has decreased by almost 35% since 2000, from 16.5 koe/m² to 10 koe/m² in 2023. Significant reductions could be observed in the first decade of the 2000s, but also in 2021 and 2023.

Figure 8: Energy consumption of household space heating per m2 (with climatic corrections)



Source: ODYSSEE

The household energy consumption per dwelling for space heating has decreased over the whole period between 2000 and 2023. In the beginning of the 2020s, this trend has intensified once again (-2.8%/a between 2019 and 2023). The consumption per dwelling for water heating, for appliances and for cooking stayed relatively constant during the last years and decreased only slightly compared to 2000. The share of air conditioning in household energy consumption is still small in Germany.

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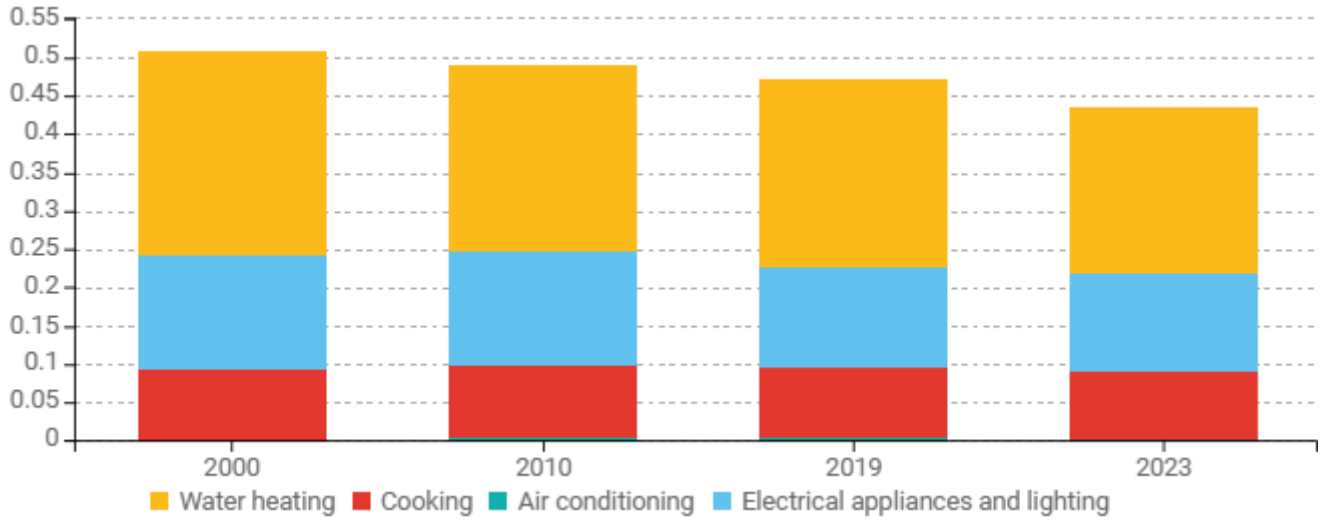
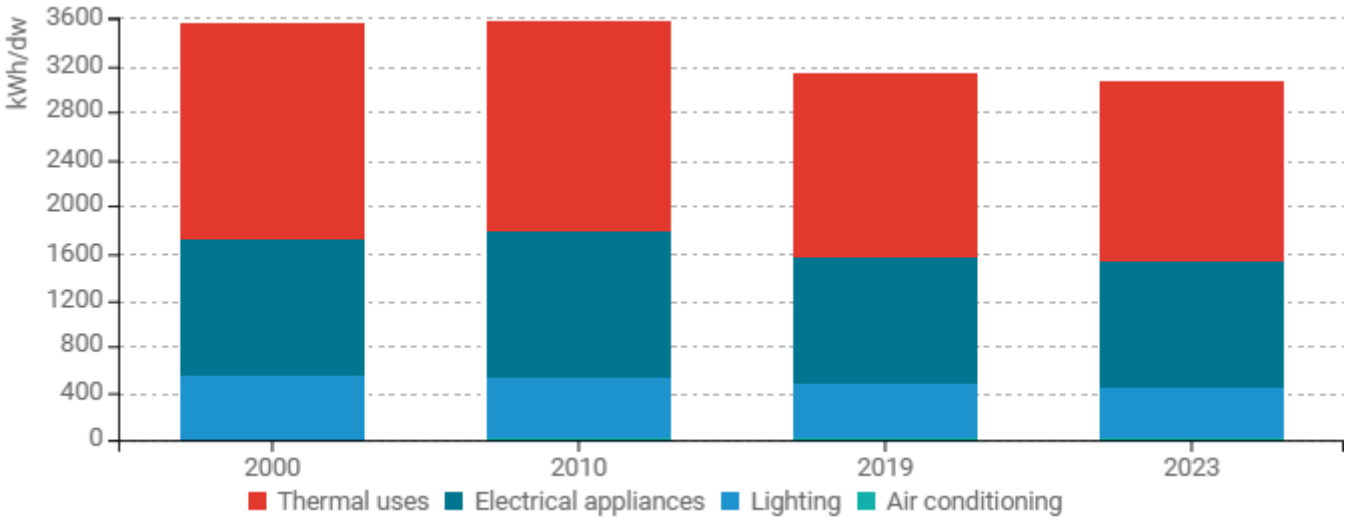
Figure 9: Energy consumption per dwelling by end-use (except space heating)



Source: ODYSSEE

Electricity consumption in households in Germany is dominated by thermal uses, followed by electrical appliances and lighting. Between 2000 and 2023, electricity consumption per dwelling decreased for all end-uses, most strongly during the period 2010-2019 (-1.5%/a). Air conditioning still has little significance in the household sector in Germany.

Figure 10: Electricity consumption per dwelling by end-use (with climatic corrections)



Source: Odyssee

The decomposition of energy consumption in the household sector shows that total final energy consumption decreased by a little more than 7 Mtoe between 2010 and 2023. Two main factors contributed to an increase in energy consumption – more dwellings (3.3 Mtoe) and lifestyle/comfort (4.9 Mtoe, due to larger homes and more appliances per dwelling). On the opposite, energy savings decreased the consumption by around 5.3 Mtoe, while

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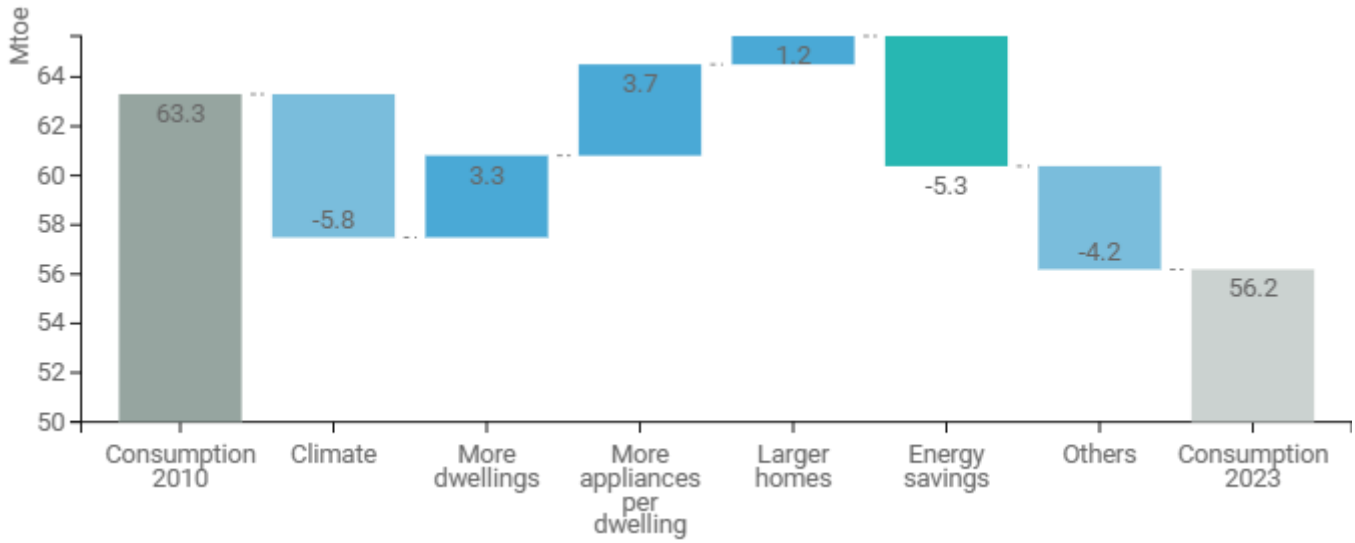
the decreasing impact of a warmer climate was even larger (5.8 Mtoe). Other effects (mainly behavior) also contributed to the decline.

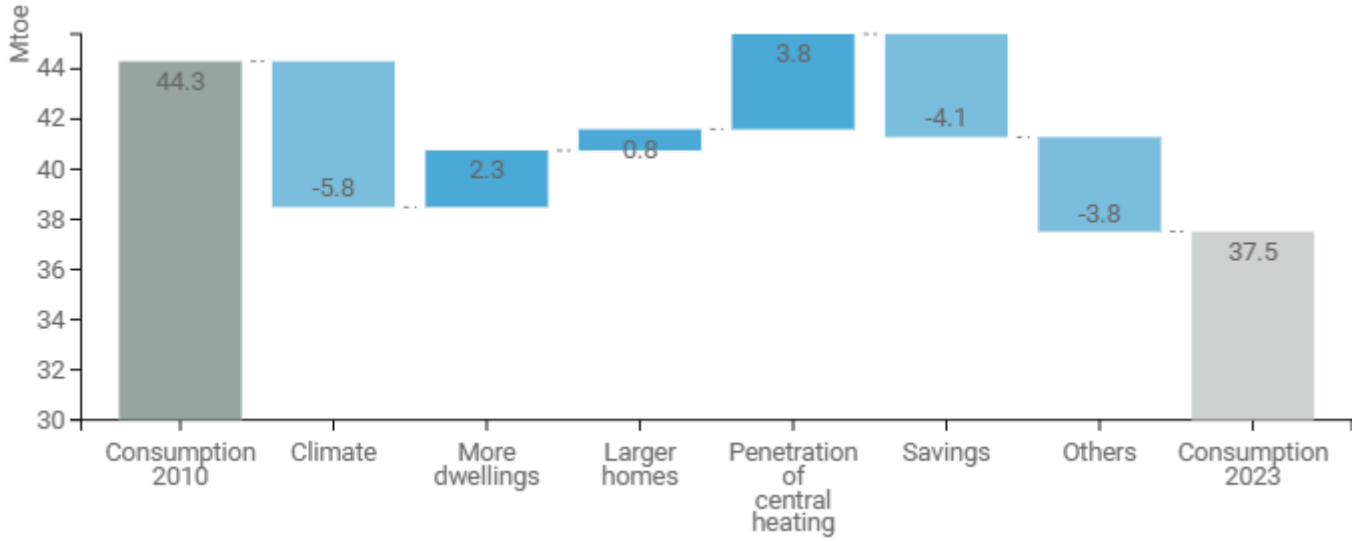
Figure 11: Main drivers of the energy consumption variation in households



Source: ODYSSEE

The decomposition of space heating consumption shows a similar picture as for total energy consumption in the households sector. Whereas the warmer climate, energy savings and other effects (mainly behavioral changes) contributed to the observed decrease in space heating consumption by almost 7 Mtoe, the effect of lifestyle, comfort and more dwellings had the opposite impact.

Figure 12: Main drivers of the space heating consumption variation of households



Source: Odyssee

Around half of the energy consumption in the service sector accounts for private services, i.e. private offices, trade and hotels/restaurants. The public branches are of minor importance. Between 2010 and 2023, a strong decline of

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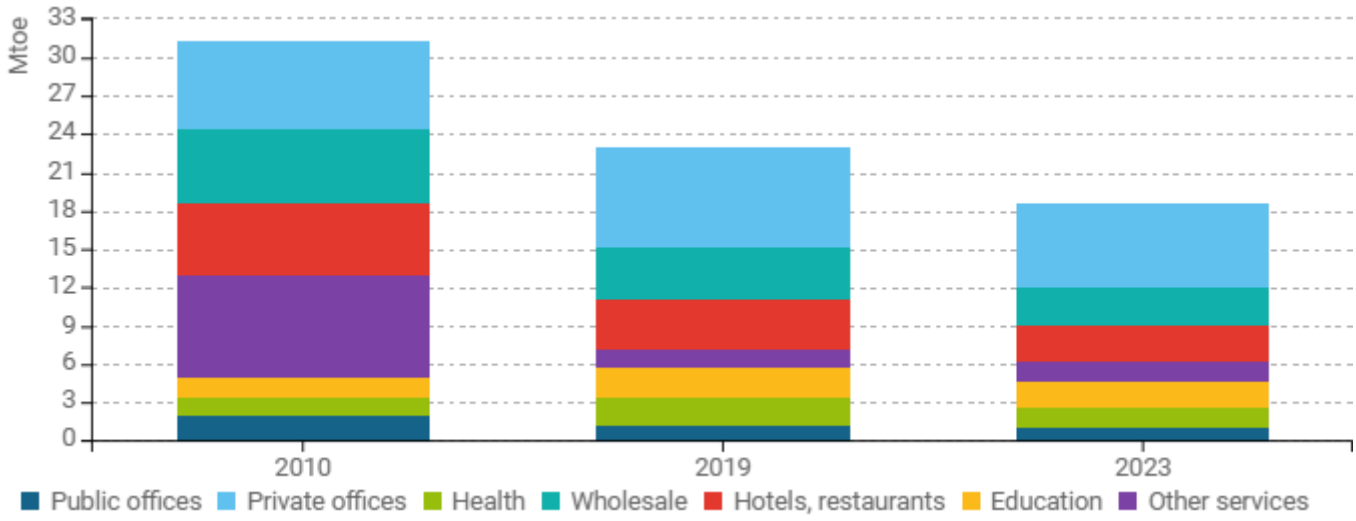
total final energy consumption in the service sector could be observed. Consumption decreased from 31 Mtoe to 18 Mtoe, i.e. by 4%/a.

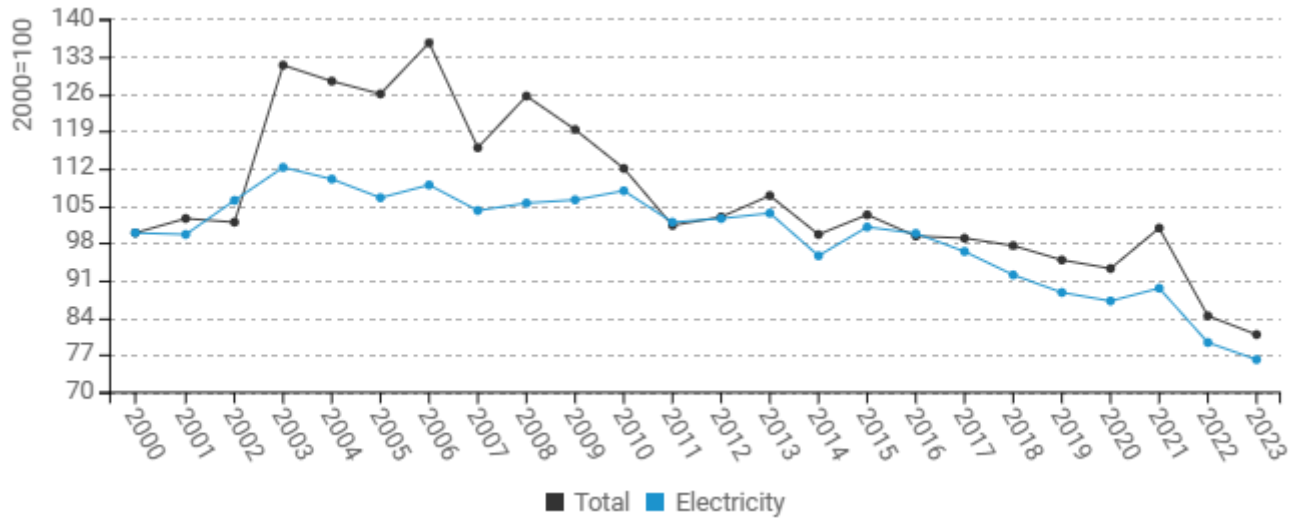
Figure 13: Final energy consumption of services by branch



Source: Odyssee

A similar decrease as for total energy consumption of services could be observed for the specific energy consumption per employee. The decreasing trend started in 2002, though it was interrupted by increases in individual years. The decline in electricity consumption per employee was weaker until 2010 in particular, but was more consistent.

Figure 14: Energy and electricity consumption per employee in services (with climatic corrections)



Source: ODYSSEE

To achieve the target of a virtually climate-neutral building stock in Germany by 2050, a set of measures was either newly established (as tax incentives for building refurbishment) or comprehensively revised (as the funding

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programs) in the beginning of the 2020s. The main building regulation in Germany is the “Building Energy Act (GEG)” from 2020, which regulates the energy requirements for new and existing buildings and for the use of renewable energies. It has been amended twice since then. From January 2024, the switch to at least 65% renewable energies has been mandatory when installing new heating systems. However, especially this part of the act should be abolished according to the Coalition Agreement of the new German government from May 2025. A decision is expected in 2026. The funding conditions for energy efficiency and renewable energies in buildings were improved and combined in a "Federal funding program for efficient buildings (BEG)". From 2024, the revised BEG supports the replacement of old, fossil-fuel heating systems with heating systems based on renewable energies with an investment cost subsidy of up to 70% and also includes specific conditions for low-income households. The BEG may also be changed in 2026 by the new government.

Table 2: Sample of policies and measures implemented in the building sector

Measures	NECP measures	Description	Expected savings, impact evaluation
Tax incentives for energy efficient building refurbishment (Steuerliche Förderung der energetischen Gebäudesanierung)	Yes	The subsidy takes the form of a deduction from the tax liability via a period of three years. The tax incentive is limited to individual measures in owner-occupied apartments and residential buildings.	223 ktoe (in 2030, total final savings)
Federal subsidy for efficient buildings (Bundesförderung für effiziente Gebäude - BEG)	Yes	The BEG is a federal subsidy program for building renovations. It offers funding for e.g. the implementation of new heating systems and the optimization of existing ones, measures on the building envelope and the use of optimized systems engineering. The BEG started in 2021 and was revised in 2024 (with better funding conditions and special conditions for low-income households).	3454 ktoe (in 2030, total final savings)
Building Energy Act (Gebäudeenergiegesetz - GEG)	Yes	The 'Building Energy Act' (GEG) from 2020 creates a new, single, coordinated body of rules for the energy requirements for new and existing buildings, and for the use of renewable energies for the provision of heating and cooling in buildings (both residential and non-residential). It also implements the requirements of the EPBD in German law.	3313 ktoe (in 2030, total final savings)

Source: MURE

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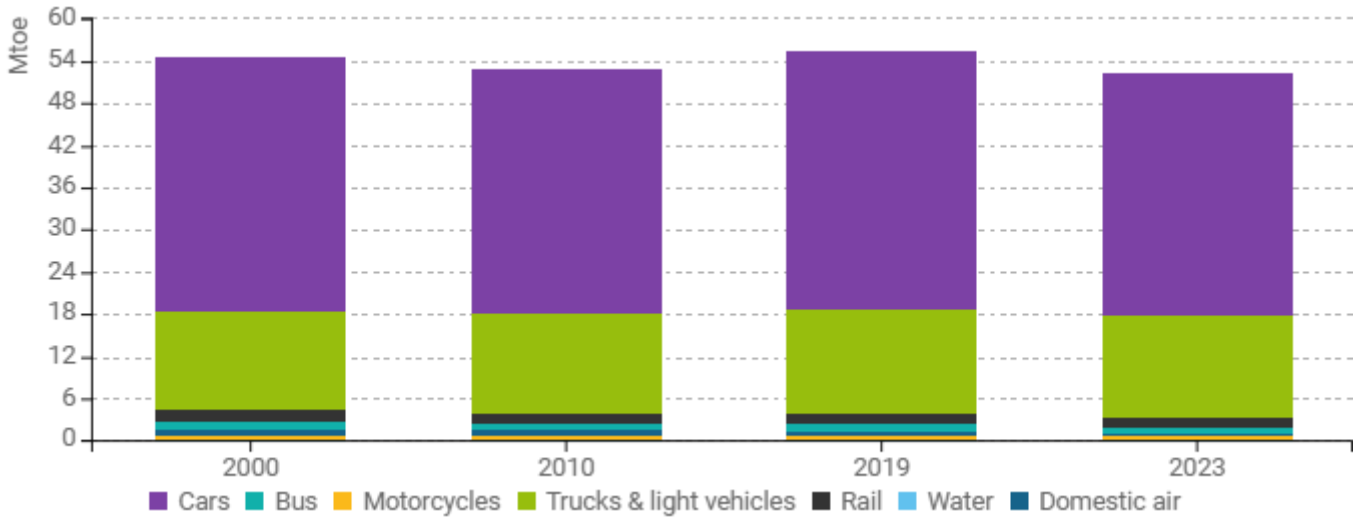
Transport

Final energy consumption in transport is dominated by cars covering 66% of total consumption in 2023. Compared to 2000, the share of road freight slightly increased from 25% to 28%, while rail and domestic air transport further dropped at a low level. Overall, the structure remained rather constant.

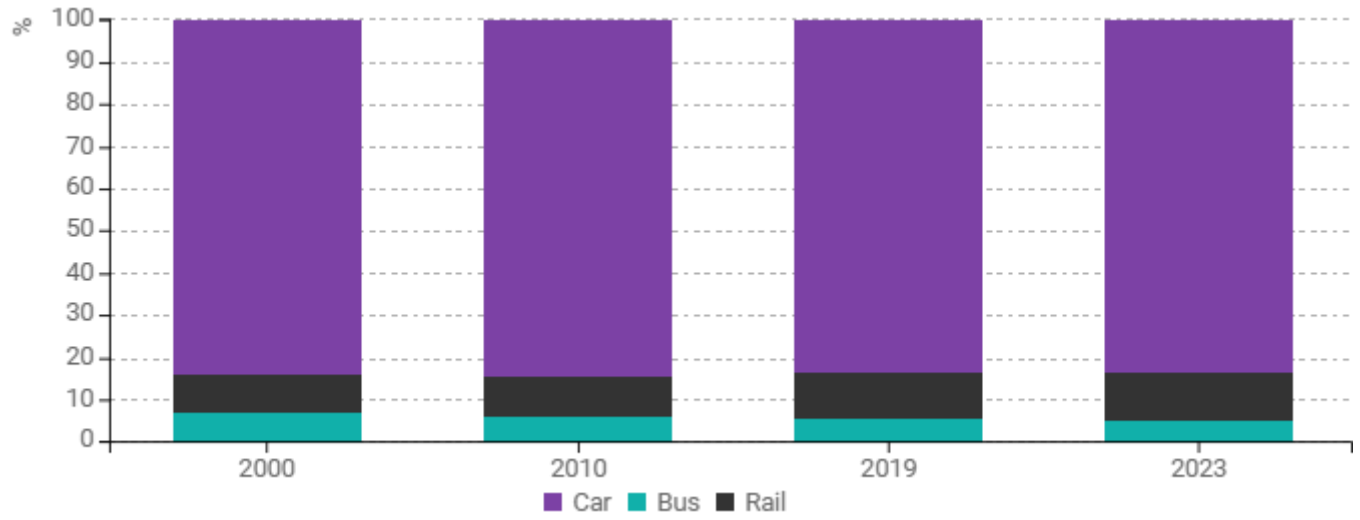
Figure 15: Transport energy consumption by mode



Source: ODYSSEE

Cars represented 84% of passenger traffic measured in passenger kilometers in 2023, followed by rail with 11% and only 5% for buses. Overall, the modal split of inland passenger traffic remained relatively constant since the year 2000.

Figure 16: Modal split of inland passenger traffic



Source: ODYSSEE

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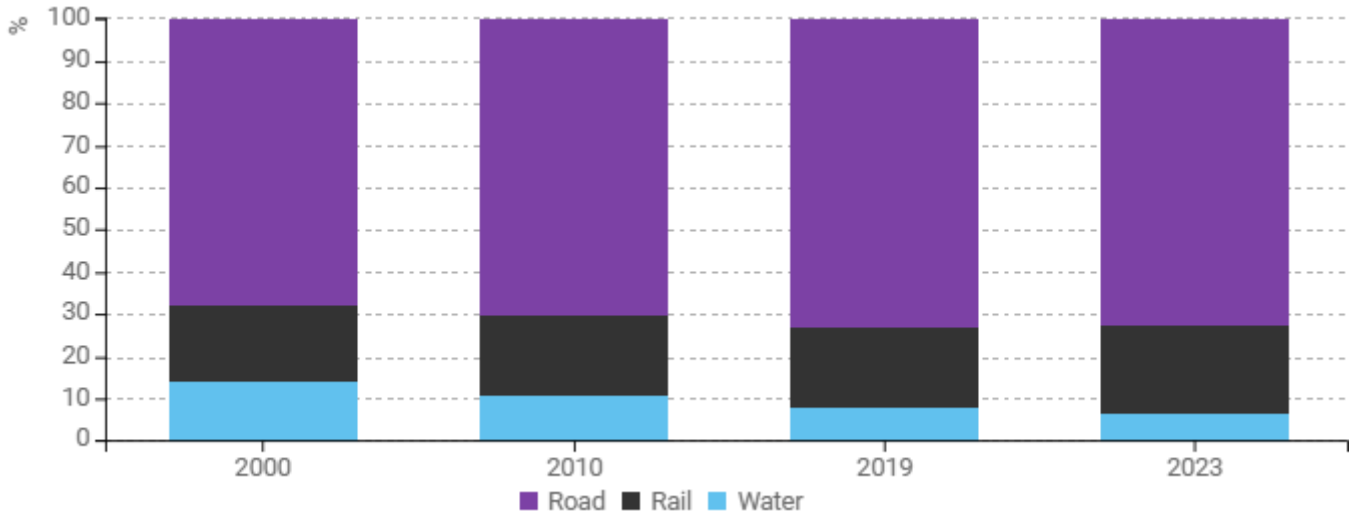
Road freight transport represents 73% of total freight traffic in 2023, 5 percent points more than in 2000. The share of rail transport in freight increased by 3 percent points to 21% in 2023, while the share of water traffic in total freight transport activity has more than halved during the last 20 years.

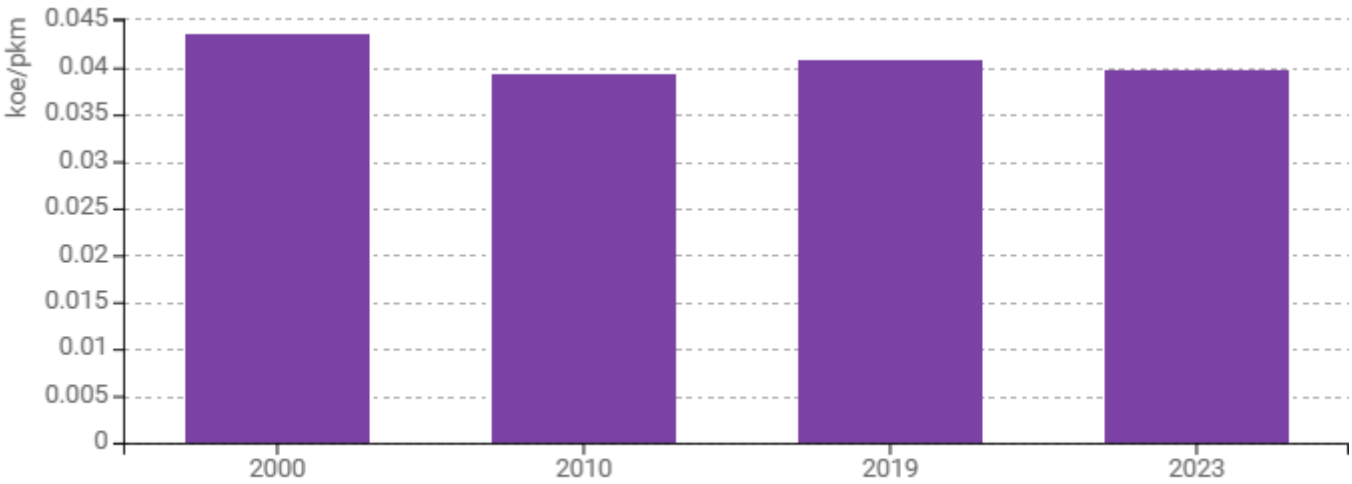
Figure 17: Modal split of inland freight traffic



Source: ODYSSEE

Energy consumption of cars per passenger-km decreased between 2000 and 2010 by around 10%. Afterwards, it remained rather stable, with a slight increase between 2017 and 2020. This was probably due to a trend to heavier cars in Germany, which compensated efficiency gains. The slight decline since 2021 may be influenced by a rising share of the more efficient electric vehicles. Though the stock of vehicles is still largely dominated by combustion engines in Germany.

Figure 18: Energy consumption of cars per passenger-km



Source: ODYSSEE

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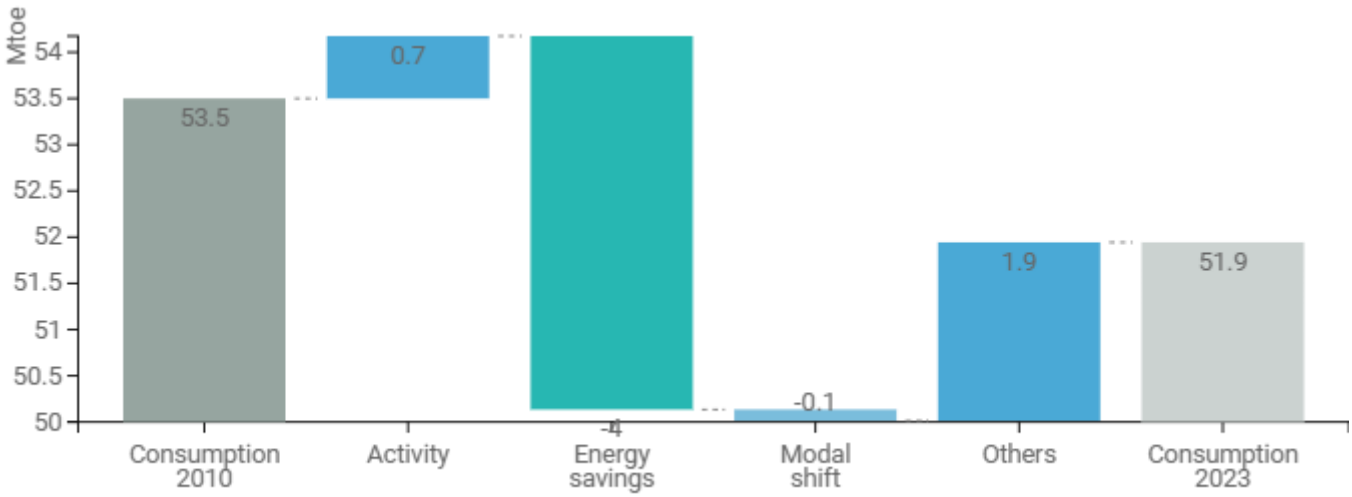
Figure 19 shows the different factors influencing the change in final energy consumption of transport. Germany's total final energy consumption for transport only decreased slightly by 1.6 Mtoe in the period from 2010 to 2023. A consumption increase can be attributed to the rising passenger and freight-km (activity) and especially behavioral changes and capacity-induced efficiency losses (other effects).This increasing trend was, however, more than counterbalanced by energy savings (-4 Mtoe) and a little by changes in the modal shift.

Figure 19: Main drivers of the energy consumption variation in transport



Source: ODYSSEE

The «Climate Action Program 2023" included some measures addressing energy consumption in the transport sector, e.g. a flat price ticket valid all over Germany, the so-called "Deutschlandticket" and further improvements in public transport. From 2016 to 2023, a subsidy program for the promotion of electric mobility was in place, the so-called "Umweltbonus". However, the transport target missed its national emission reduction target in almost all years since 2020. In the Coalition Agreement of the new German Government from May 2025, some measure revisions were announced which may even have an increasing impact on energy consumption (e.g. the already agreed reduction in levies on air transport). The new Climate Action Program announced for March 2026 may include further measures for transport.

Table 3: Sample of policies and measures implemented in the transport sector

Measures	NECP measures	Description	Expected savings, impact evaluation
Levy on air traffic (Luftverkehrssteuer)	Yes	This measure aims at decreasing the share of air travel passengers through an increase of the air traffic levy.	330 ktoe (in 2030; total final energy savings)

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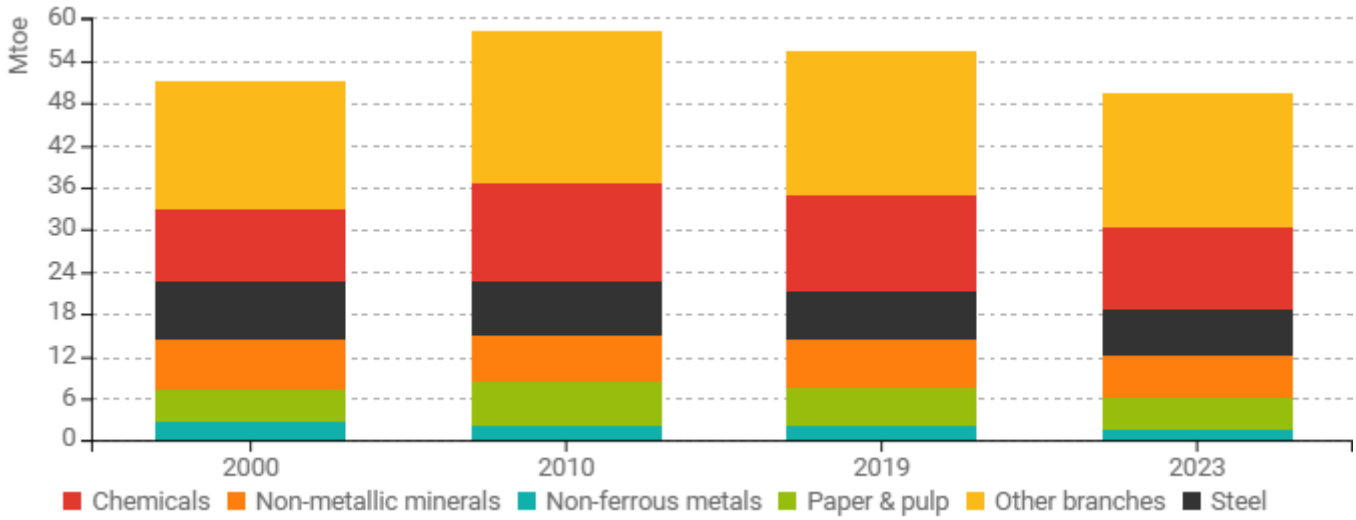
Tax incentives for electric mobility (Umweltbonus)	Yes	Large incentive program to increase the market share of electric vehicles in Germany (from 2016 to 2023)	1732 ktoe (in 2030; total final energy savings)
Germany-Ticket for local public transport (Deutschlandticket)	Yes	The "Deutschland-Ticket" is a low-cost and climate-friendly ticket offer that enables the use of German public transport at a flat price for journeys regardless of national borders or tariff zones. It aims to relieve energy consumers in Germany in dealing with high energy costs.	60 ktoe (in 2030; total final energy savings)

Source: MURE

Industry

Between 2000 and 2010, energy consumption of industry increased by 14%. Until 2018, consumption stagnated at around 58 Mtoe and has been declining since then, due to the weak industrial growth. Industrial energy consumption is dominated by the energy-intensive branches, especially steel and chemicals.

Figure 20: Final energy consumption of industry by branch



Source: ODYSSEE

While the specific consumption of steel is higher in 2023 compared to 2000, the specific consumption for paper and cement production is lower. Strong fluctuations can be observed, mainly due to capacity effects during low utilization of production capacities in economic crises. Overall, the unit consumption levels of the three energy-intensive branches converged significantly until 2023.

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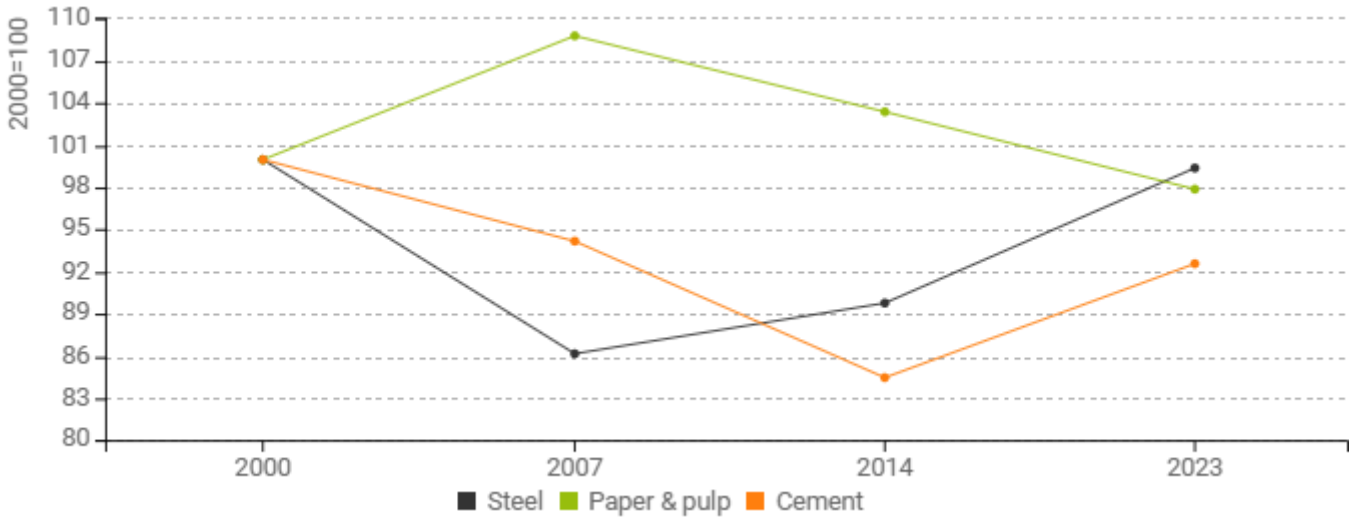
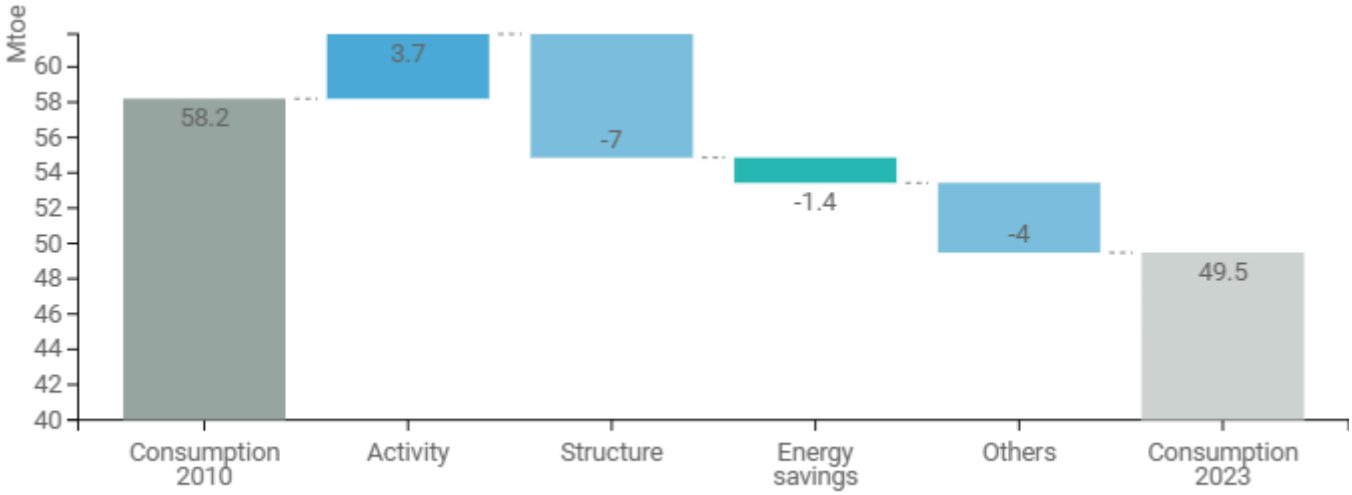
Figure 21: Unit consumption of energy-intensive products (toe/t)



Source: ODYSSEE

The decomposition below shows the factors influencing the changes in industrial energy consumption. The consumption decreases by almost 9 Mtoe between 2010 and 2023 was mainly driven by structural changes at the expense of energy-intensive branches (7 Mtoe) and other effects (4 Mtoe; mainly structural effects within branches and inefficient operations during recessions). Due to the weak industrial growth in the last years, the activity effect did not fully counter-balance the consumption decrease, as observed in earlier periods.

Figure 22: Main drivers of the energy consumption variation in industry



Source: ODYSSEE

The main funding program for energy efficiency in industry is the "Federal Funding for Energy and Resource Efficiency in Companies", starting in 2019. In 2020, the continuation of the Energy Efficiency Networks Initiative and its further development to Efficiency and Climate Networks was agreed between the Federal Government and

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Industry Associations. The decarbonization of energy-intensive industries is funded by a subsidy program, which was re-structured in 2024 and complemented by the introduction of Carbon Contracts for Difference.

Table 4: Sample of policies and measures implemented in the industry sector

Measures	NECP measures	Description	Expected savings, impact evaluation
Federal support for energy and resource efficiency in the economy (Bundesförderung für Energie- und Ressourceneffizienz in der Wirtschaft - EEW)	Yes	The program "Federal support for energy and resource efficiency in the economy" aims to provide incentives for companies to invest in highly efficient energy-saving technologies, particularly in plant and process modernization, and to speed up market penetration. Its goal is to reduce energy consumption and CO2 emissions and thus simultaneously strengthen the competitiveness of the companies receiving support. The special concerns of small and medium-sized enterprises are taken into account, too.	4000 ktoe (in 2030, total final energy savings)
Energy Efficiency and Climate Protection Networks Initiative (Initiative Energieeffizienz- und Klimaschutz-Netzwerke)	Yes	The measures carried out within the framework of the "Initiative for Energy Efficiency and Climate Protection Networks" can be used by the participating companies to identify and implement goals and projects to increase energy efficiency. This process can be supported by energy consultants.	600 ktoe (in 2030, total final energy savings)

Source: MURE

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