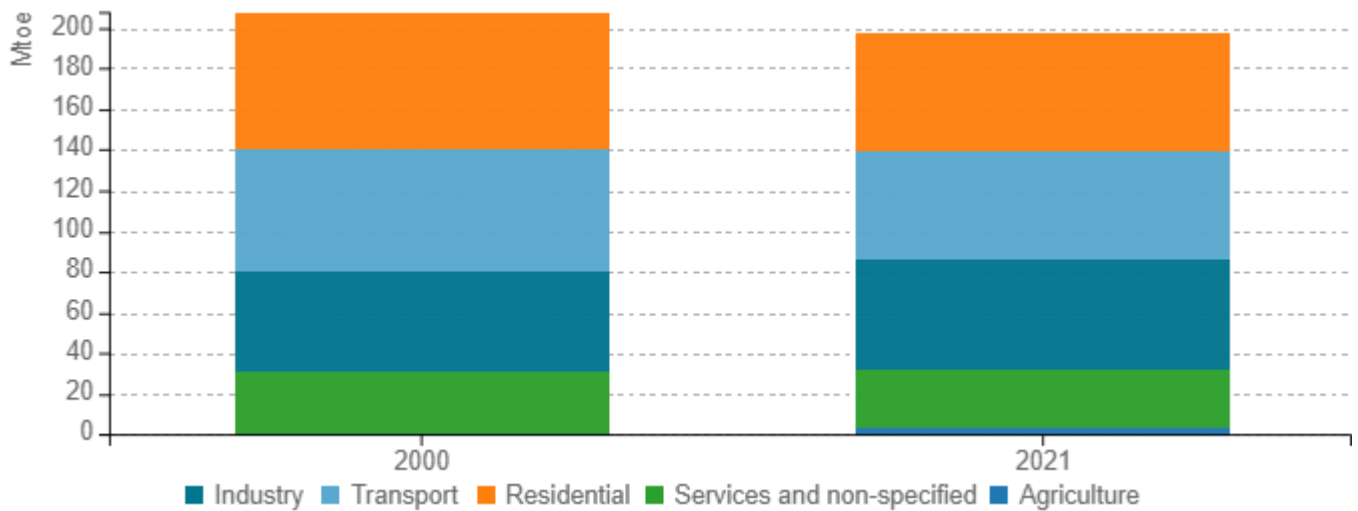


# Energy efficiency trends and policies

## Overview

Germany's total final energy consumption of 2021 (196.9 Mtoe) was slightly below its 2000 level (207.3 Mtoe, - 10.3 Mtoe, i.e. -5%). In 2021, the largest consuming sector is residential, representing 29.3% of total final energy consumption. The share of residential has slightly decreased from 32.5% in 2000 to 29.3% in 2021, while industry increased its share from 23.9% to 27.6%. The share of transport in total consumption decreased slightly from 28.8% to 26.9% (see Figure 1).

Figure 1: Final energy consumption by sector (normal climate)



Source: ODYSSEE

Energy efficiency for final consumers, as measured by the so-called technical ODEX, has improved (in average) by around 1.3% per year since 2000. Larger gains have been registered for households (2%/year), against 1%/year for transport and 1.8%/year for the services sector. A lower annual rate of improvements has been achieved in the industry sector (0.6%/year).



Figure 2: Technical Energy Efficiency Index



Source: ODYSSEE

With the "Federal Climate Change Act" from December 12, 2019, Germany introduced legally binding sectoral GHG emission reduction targets for 2030, which were tightened in the first revision of the Act in August 2021. To achieve the tightened reduction targets, further energy efficiency and climate policy measures have been implemented or proposed by the Federal Government in 2022 and 2023: a new Energy Efficiency Law (EnEfG) which serves to implement the 2023 recast of the EU Energy Efficiency Directive, a new funding programme for the decarbonisation of industry, supplemented by the new carbon contracts for difference, and the new "DeutschlandTicket", which is a subscription ticket for all means of local public transport all over Germany at a price of 49 EUR per month. These are documented in a draft new Climate Action Programme from June 2023.

Table 1: Sample of cross-cutting measures

Measures	NECP measures	Description	Expected savings, impact evaluation
<a href="#">Fuel Emissions Trading Act (BEHG) - CO2 pricing for the transport and heating sectors</a>	yes	CO2 pricing for fossil fuels in the transport and heating sectors (without parts of industry already covered by EU ETS) starting in 2021 with a yearly increasing CO2 price until 2025 and an emission trading system with a cap from 2026	2030: 145.5 PJ (without measure interaction effect) / 138.2 PJ (with measure interaction effect of 0.95)
<a href="#">Draft Climate Action Programme 2023</a>	yes	Program containing around 130 energy efficiency and climate policy measures to push the achievement of the overall 2030 climate target and of the 2030 sectoral targets.	
<a href="#">Energy Efficiency Law (Energieeffizienzgesetz)</a>	yes	The new national energy efficiency law, which also serves to implement the 2023 recast of the EU Energy Efficiency Directive.	

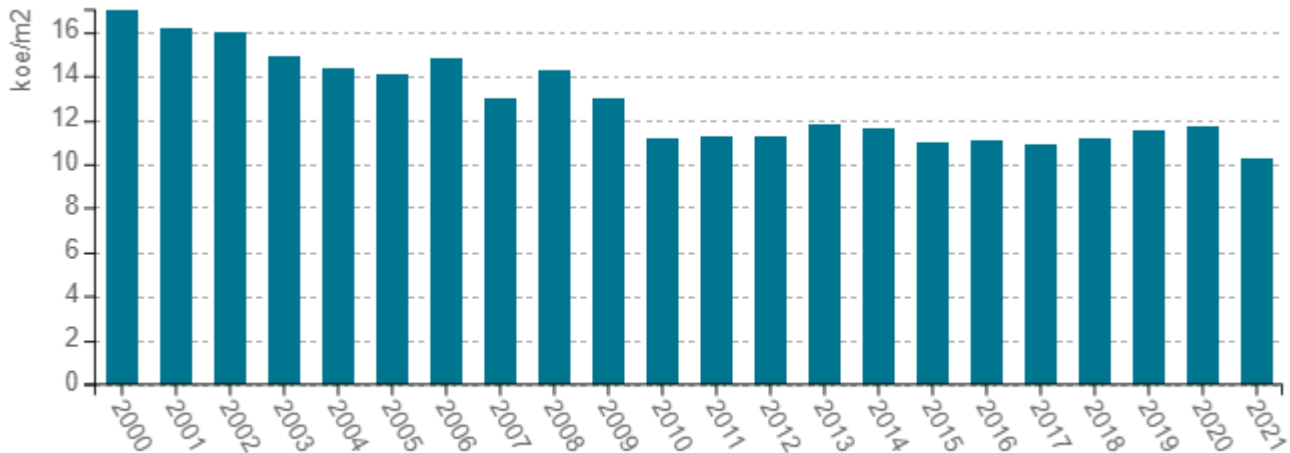
Source: MURE



### Buildings

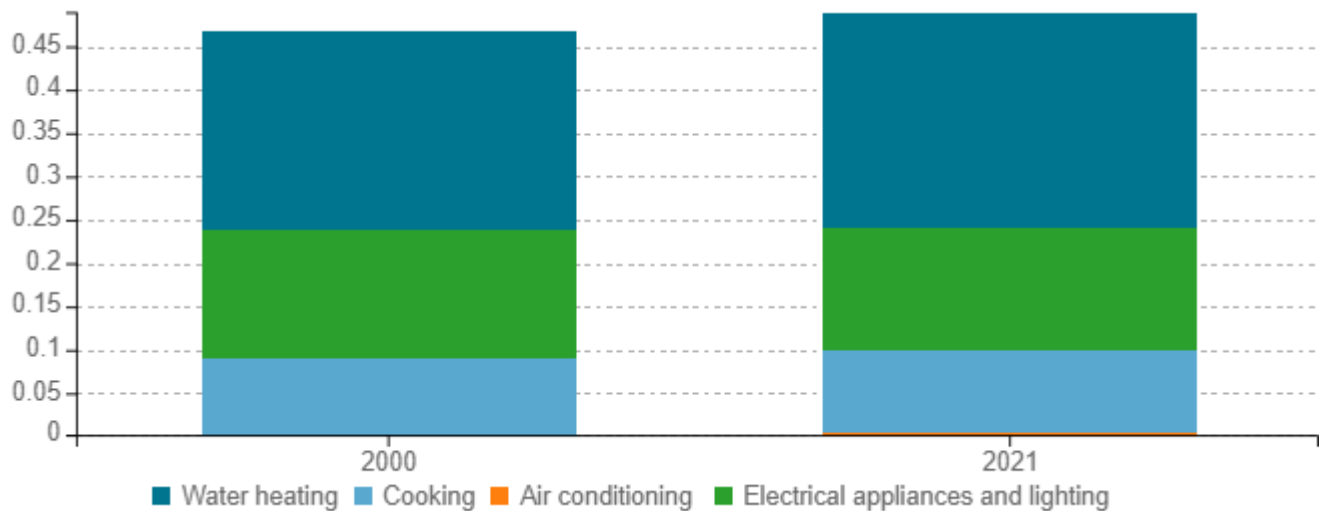
As shown in Figure 3 the household energy consumption per m<sup>2</sup> for space heating has decreased by 39.1% since 2000, from 17 koe/m<sup>2</sup> to 10.3 koe/m<sup>2</sup> in 2021. The consumption per dwelling for water heating increased slightly from 2000 to 2021 (from 0.23 toe/dw to 0.25 toe/dw), while the consumption per dwelling for appliances and cooking stayed almost constant (see Figure 4).

Figure 3: Energy consumption of space heating per m<sup>2</sup> (normal climate)



Source: ODYSSEE

Figure 4: Energy consumption per dwelling by end-use (except space heating)

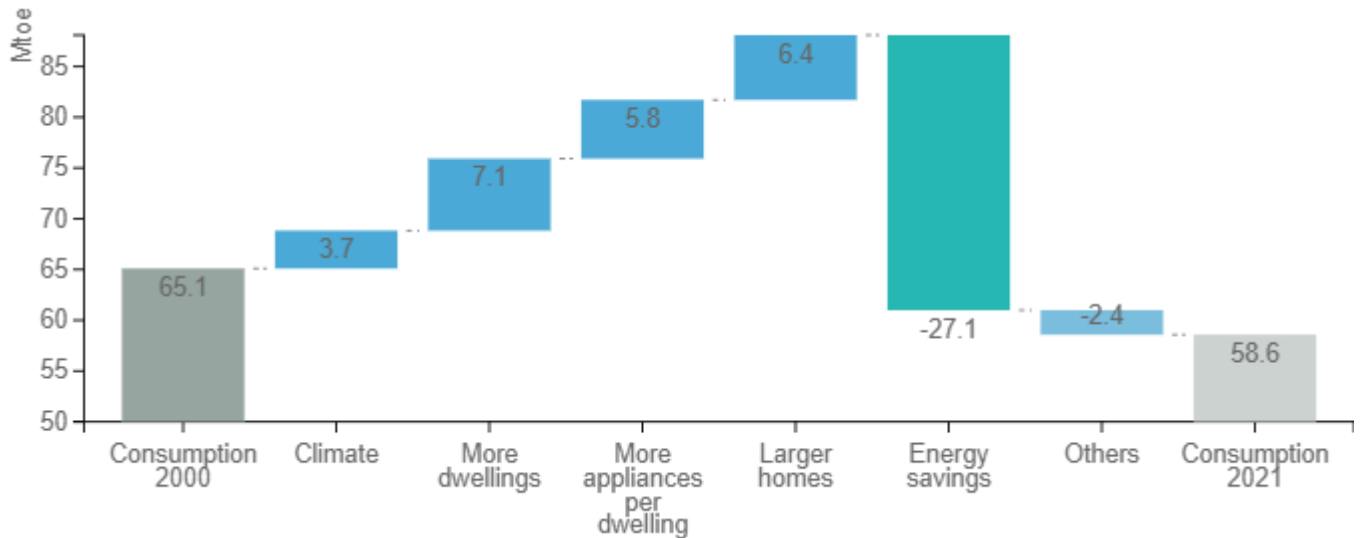


Source: ODYSSEE



Figure 5 shows a decomposition of the change in energy consumption. It shows that the total final energy consumption of households decreased by around 6.5 Mtoe between 2000 and 2021. Two main factors contributed to an increase in energy consumption – more dwellings (7.1 Mtoe) and lifestyle/comfort (12.2 Mtoe, due to larger homes and more appliances per dwelling). Climate effects also had a small increasing impact of 3.7 Mtoe. On the opposite, energy savings decreased the consumption by around 27 Mtoe, while other effects had only a small decreasing impact of 2.4 Mtoe.

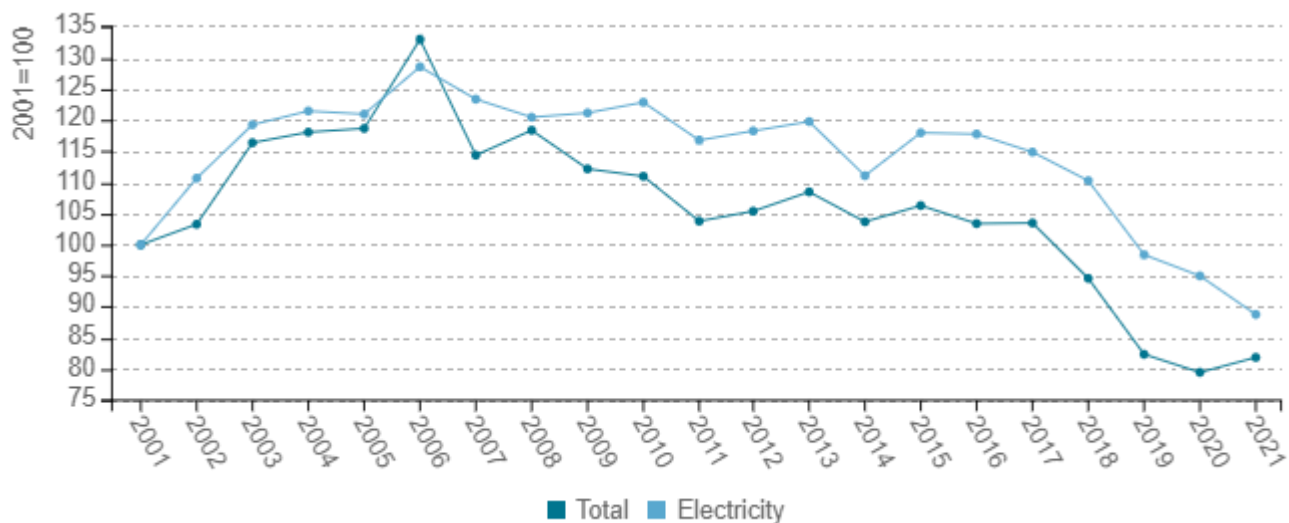
**Figure 5: Main drivers of the energy consumption variation of households**



Source: ODYSSEE

Figure 6 shows the development of the specific energy consumption in households for both electricity and total final consumption. Both the electricity consumption per square meter and the total consumption have been steadily increasing until 2006 but dropped significantly since then.

**Figure 6: Energy and electricity consumption per m<sup>2</sup> (normal climate)**



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 or comprehensively revised in the last 5 years. The main building regulation in Germany is the “Buildings Energy Act (GEG)”, which came into force in November 2020. The GEG regulates the energy requirements for new and existing buildings and for the use of renewable energies in buildings. The GEG has been amended twice since then. From 1 January 2023, especially the standards for new buildings were tightened. And from 1 January 2024, the switch to renewable energies has been mandatory when installing new heating systems. In parallel, the funding conditions for energy efficiency and renewable energies in buildings were improved and combined in a "Federal funding program for efficient buildings (BEG)" starting in 2020. From 1 January 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 percent. As an alternative to the Federal funding, tax incentives for the energy-efficient renovation of residential buildings were also introduced from 2020.

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

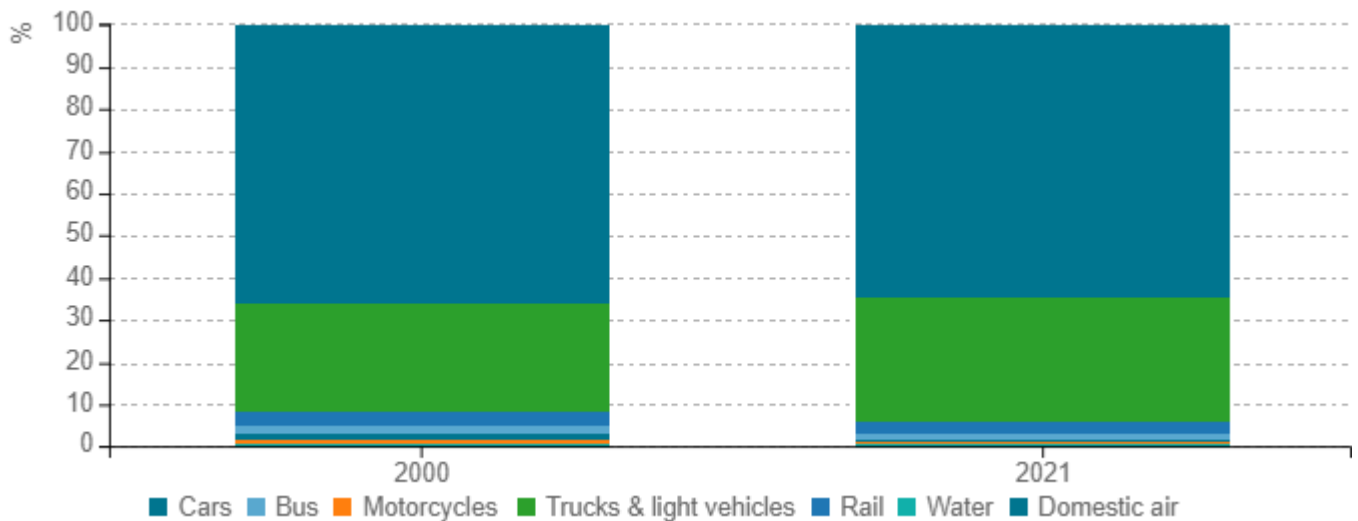
Measures	Description	Expected savings, impact evaluation
<a href="#">Federal funding programme for efficient buildings (BEG)</a>	Funding program for existing buildings merging previous programs and improved funding conditions. The revised program in place since 1 January 2024 includes an investment subsidy for the replacement of fossil heating systems by renewables up to 70% and for the first time also an income-dependent component promoting low-income households.	2030: 79.3 PJ (net impact without measure interaction effect) / 55.5 PJ (net impact and also taking into account measure interaction)
<a href="#">Tax incentives for energy-related building renovations</a>	Tax reduction for energy-related measures for buildings used for own residential purposes.	2030: 24.3 PJ (net impact without measure interaction effect) / 23.1 PJ (net impact and also taking into account measure interaction)
<a href="#">Buildings Energy Act (GEG)</a>	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).	2030: 4,100 kt CO <sub>2</sub> eq (net impact without interaction effect)

Source: MURE

**Transport**

Final energy consumption in transport is dominated by cars covering 65% of total consumption in 2021. The share of road freight increased from 25.5% to 29.2%, while rail transport dropped from 3.6% to 2.7% and domestic air from 1.7% to 0.5%. In the same period the share of busses and water stayed almost constant.

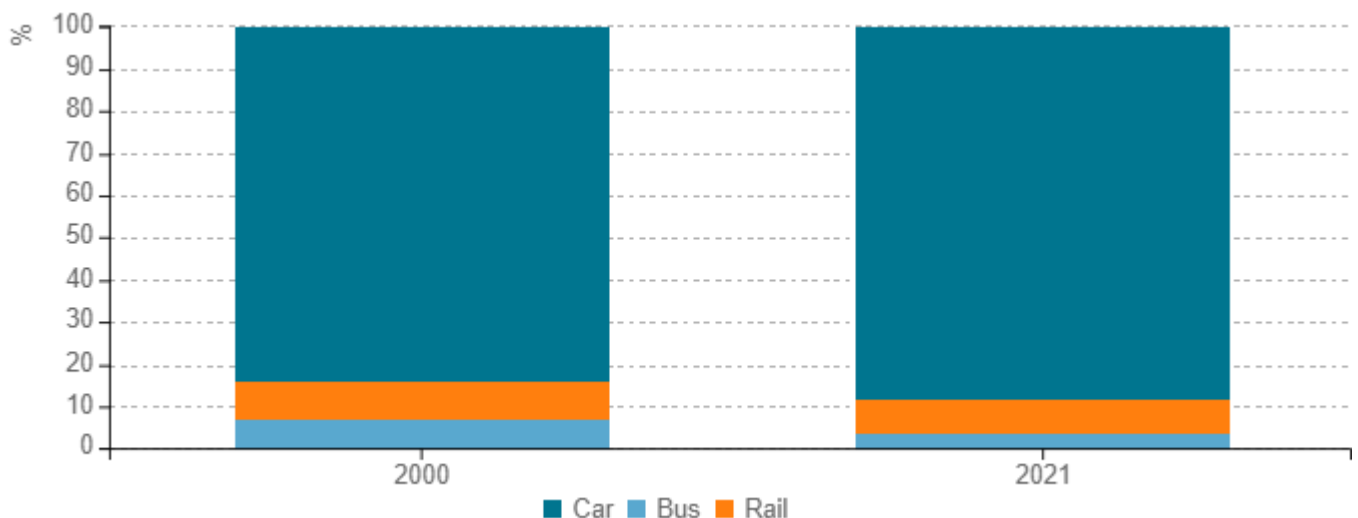
*Figure 7: Transport energy consumption by mode*



Source: ODYSSEE

Cars represented 88.5% of passenger traffic measured in passenger kilometers in 2021, followed by rail with 7.7% and only 3.8% for bus. The share of cars slightly increased in comparison to 2000 (+4.5% points), while the share of rail decreased by 1.4 % points and bus traffic dropped by 3.1% points.

*Figure 8: Modal split of inland passenger traffic*

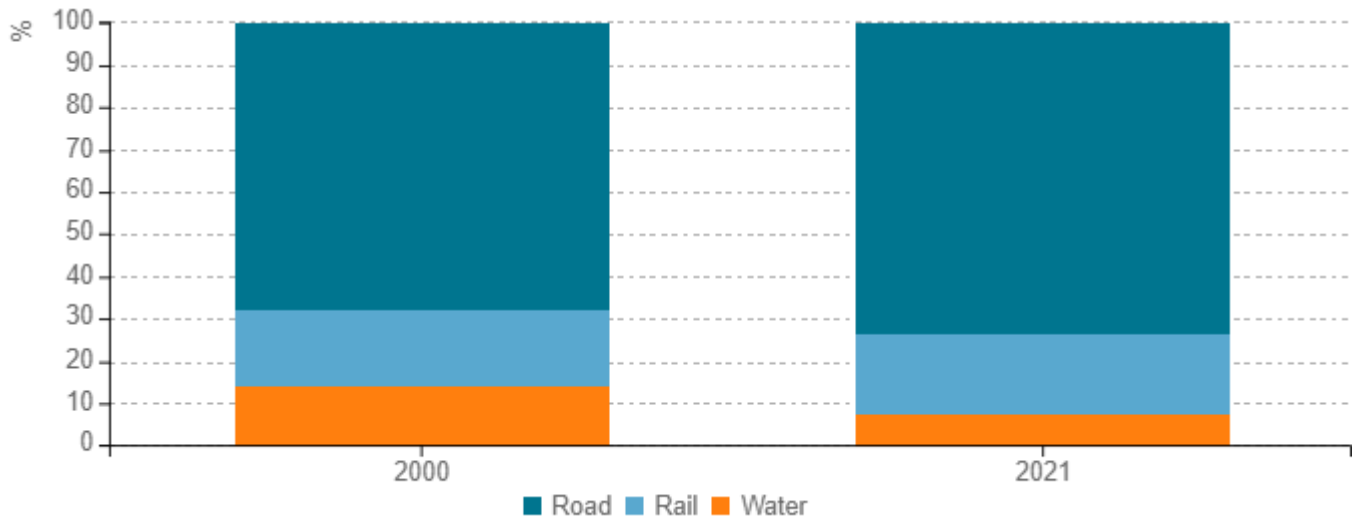


Source: ODYSSEE



Road freight transport represents 73.6% of total freight traffic in 2021, 5.5% points more than in 2000. The share of rail transport in freight increased by 1.3% points, while the share of water traffic decreased by 6.8% points to 7.4% of total freight transport activity (see Figure 9).

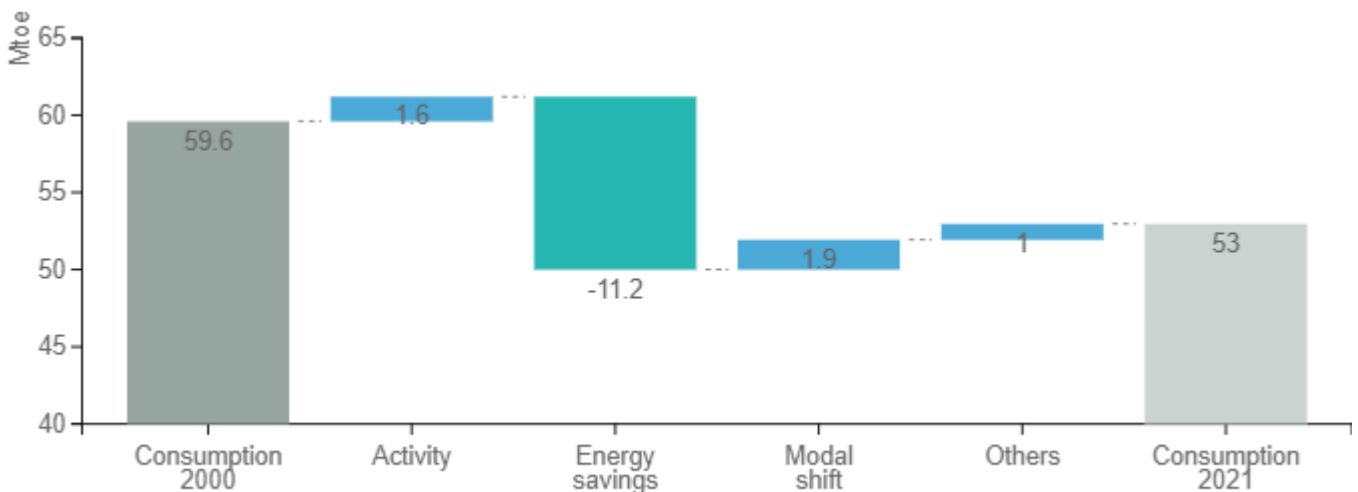
Figure 9: Modal split of inland freight traffic



Source: ODYSSEE

Figure 10 shows the different factors influencing the change in final energy consumption of transport. Germany's total final energy consumption for transport decreased by about 6.6 Mtoe in the period from 2000 to 2021. The increasing traffic of passengers and freight contributed to increase the consumption by 1.6 Mtoe (activity). This trend was counterbalanced by energy savings (11.2 Mtoe). Modal shift had a slightly increasing effect of 1.9 Mtoe, while other effects resulted in an increase of about 1 Mtoe.

Figure 10: Main drivers of the energy consumption variation in transport



Source: ODYSSEE



The draft Climate Action Programme from June 2023 includes a couple of measures addressing different fields of action in the transport sector: (1) improvement of the rail network and strengthening of urban and regional transport (among those a flat price ticket valid all over Germany, the so-called "Deutschlandticket") (2) further improvements in public transport (3) Increased use of the potential of synthetic fuels (4) Drive change for trucks and heavy commercial vehicles (5) Acceleration of climate neutrality for passenger cars (6) Increased digitalisation of local traffic systems.

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

Measures	Description	Expected savings, impact evaluation
<a href="#">Deutschlandticket (Germany-ticket for local public transport)</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 also aims to relieve energy consumers in Germany in dealing with recently high energy costs.	550 kt CO2 in 2030
<a href="#">Purchase Premium for Electric Cars (Umweltbonus)</a>	Joint contribution by the federal government and car industry to boost sales of electrically powered vehicles - both new and young used ones. The programme was stopped prematurely in December 2023 due to funding limitations in the federal budget.	2030: 12.53 PJ (net impact without measure interaction effect) / 11.9 PJ (net impact incl. measure interaction effect)

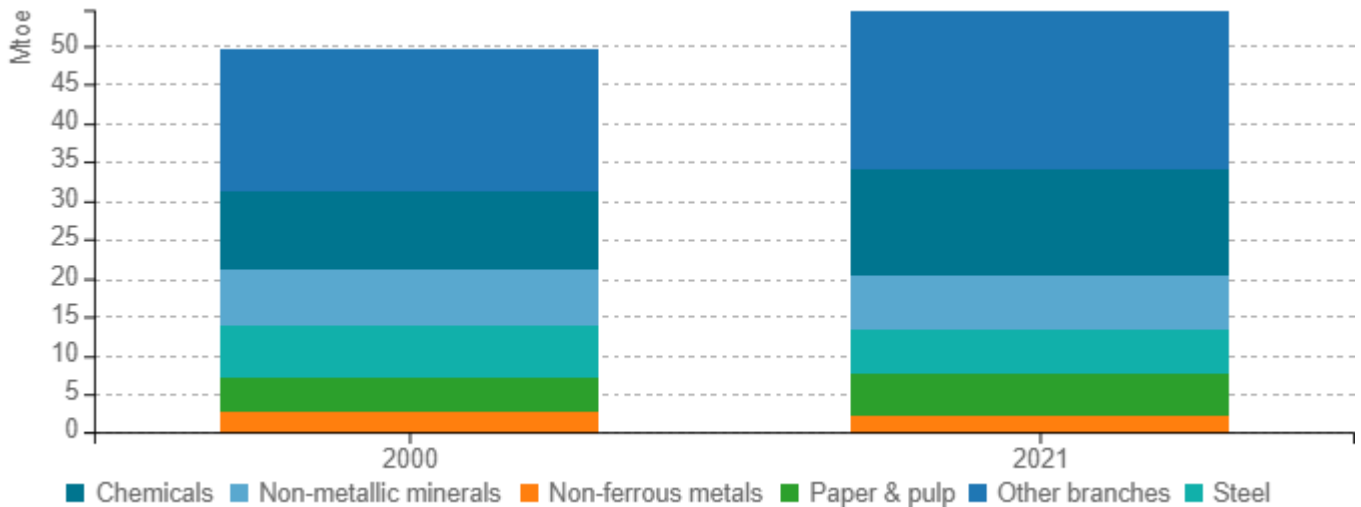
Source: MURE



### Industry

The total consumption of the industry sector increased from 49.5 Mtoe in 2000 to 54.4 Mtoe in 2021 (+10%). Consumption of chemical industry increased by 33 % in this time period, while the energy consumption of the steel producing sector decreased by 13%. Non-ferrous metals' energy consumption decreased by 16%.

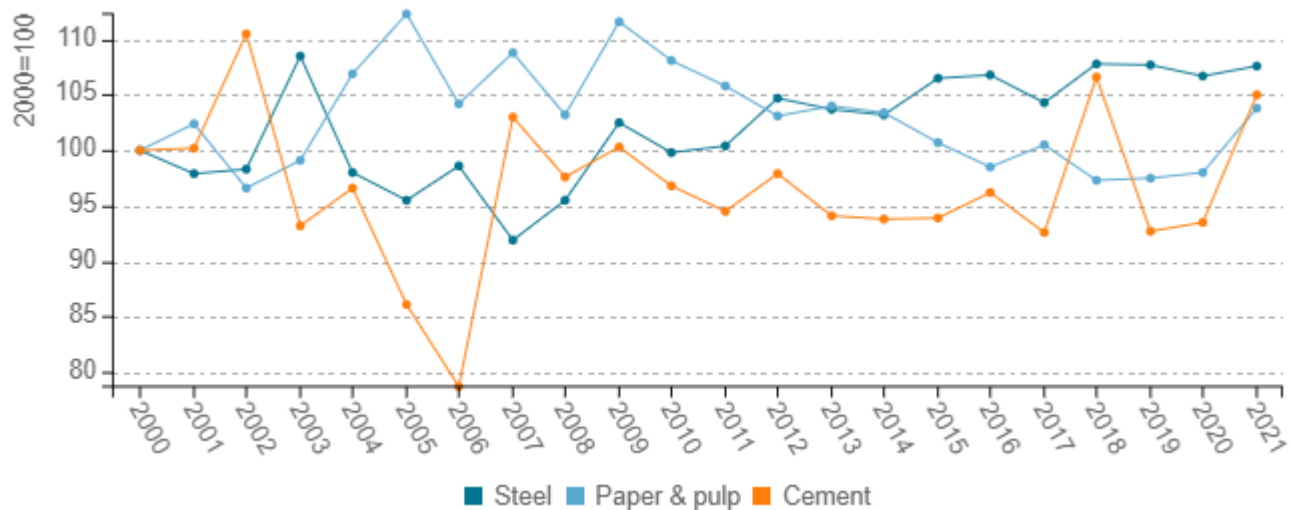
Figure 11: Final energy consumption of industry by branch



Source: ODYSSEE

Specific consumption of steel, paper and cement production are slightly higher in 2021 compared to 2000. In the meantime, some (strong) fluctuations e.g. due to capacity effects during low utilization of production capacities (especially in an economic crisis such for cement in 2006) can be observed.

Figure 12: Unit consumption of energy-intensive products (toe/t)

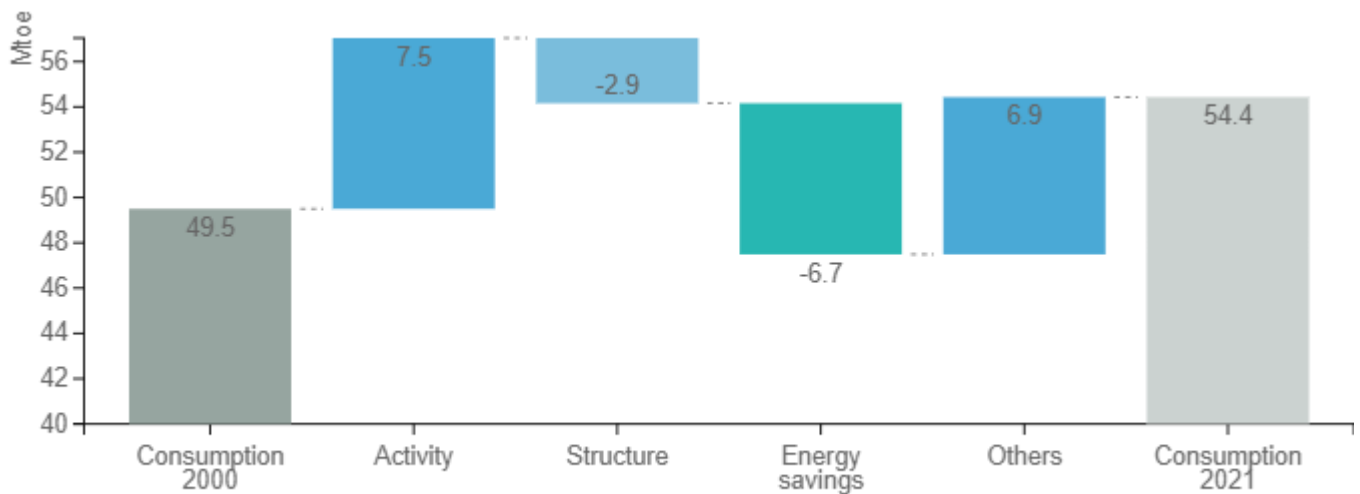


Source: ODYSSEE



Figure 13 shows the factors influencing the changes in final energy consumption of the industrial sector. The increase of its energy consumption by about 5 Mtoe between 2000 and 2021 was mainly driven by change in industrial activity (7.5 Mtoe) and other effects (6.9 Mtoe). This effect was counterbalanced by energy savings (-6.7 Mtoe) and structural changes towards less intensive branches, which increased their contribution in industrial value added (-2.9 Mtoe).

**Figure 13: 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 the In September 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 Industry Associations. The decarbonisation of energy-intensive industries is funded by a "National Decarbonisation Programme", which is complemented by Carbon Contracts for Difference since 2024.

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

Measures	Description	Expected savings, impact evaluation
<a href="#">Federal Funding for Energy and Resource Efficiency in Companies</a>	Funding of cross-cutting technologies, process heat from renewable energies, control technologies, EMS etc.	2030: 92 PJ (net impact without measure interaction effect) / 87.4 PJ (net impact incl. measure interaction effect)
<a href="#">Energy Efficiency Networks Initiative</a>	Introduction of 500 energy efficiency networks in industry, trade and commerce	2020: 15.8 PJ 2030: 54.3 PJ
<a href="#">National Decarbonisation Program and CcfdS</a>	Funding program in the area of development, demonstration and market introduction of innovative climate protection technologies in industry and Carbon Contracts for Difference	2030: 21,100 kt CO <sub>2</sub> eq 2040: 56,300 kt CO <sub>2</sub> eq (net impact of both the National Decarbonisation Program and the CcfdS combined)

Source: MURE

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