Energy Efficiency Trends and Policies in Germany

An Analysis Based on the ODYSSEE and MURE Databases

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Contents

1 Introduction

This report relies on data contained in two complementary databases: the ODYSSEE database on energy efficiency indicators (Box 1) and the MURE database on energy efficiency policies (Box 2). They include data and information for the EU and all EU Member States, Switzerland, and recently also for the Energy Community Contracting Parties[1]. Both databases are regularly updated (once or twice a year) by a network of national partners from these countries. Enerdata provides the technical coordination for ODYSSEE and Fraunhofer ISI for MURE.

Box 1: The ODYSSEE database and its tools

ODYSSEE

The ODYSSEE database[2] contains more than 180 indicators that have the purpose of monitoring and evaluating the annual energy efficiency trends and energy-related CO_2 emissions in all the sectors and in priority areas in order to address the EU energy and climate policy. This database encompasses several types of indicators, calculated at a macro-economic, sectoral, sub-sectoral, specific industry and/or end-use level. Some of them are:

- *Energy and CO_2 intensities*, which relate the energy used (or CO_2 emissions) by sector to macro-economic variables (GDP, value added, etc.).
- *Specific energy consumption* (or CO_2 emissions), which measures the energy efficiency progress by comparing consumption to physical units (e.g. consumption per tonne of steel, per car or per dwelling, gCO_2/km).
- *Energy efficiency indices (ODEX)* that evaluate energy efficiency progress by main and for the whole economy.
- *Energy savings* or the amount of energy saved through energy efficiency improvements.
- *Adjusted indicators* that allow the comparison of indicators across countries (adjustments for differences in climate, general price level, fuel mix, industry and economic structure).
- *Indicators of diffusion* that monitor the market penetration of energy-efficient technologies and practices.
- *Benchmark indicators*, which compare specific energy consumption of energy intensive products across countries.
- New indicators have been added for measuring *energy poverty* and *energy sufficiency*.

The data used to calculate these indicators comes from EU data sources (especially Eurostat) as far as possible. Any remaining data gaps are filled with national data. The indicators are available using different publicly accessible **data tools** that are: the *key indicators*, *the ODYSSEE database* and the *five specific data tools* (Figure 1)that focus on relevant issues. They aim to provide an easy and simple interface for policy makers, interested parties and non-trained users.

The *five specific data tools for ODYSSEE* are:

- *Market diffusion:* monitors the progress in the market penetration of energy efficient technologies.

[1] *Bosnia-Herzegovina, Montenegro, Georgia, Ukraine, Northern Macedonia, Albania, Moldova, Kosovo and Serbia.

[2] https://www.indicators.odyssee-mure.eu/energy-efficiency-database.html (partly limited access)

- *Decomposition analysis*: displays the various factors behind changes in energy consumption in a given period (e.g. activity changes, structural changes, behaviour, efficiency improvement).
- *CO_2 Decomposition*: displays the various factors behind changes in CO_2 emission from fuel combustion.
- *Comparison*: compares the energy efficiency performance of a country with selected others by adjusted indicators.
- *Energy saving*: overview of historical and projected energy savings as compared to targets to be achieved.

Figure 1: The ODYSSEE support tools for energy efficiency indicators

Box 2: The MURE database and its tools

MURE

The MURE database[3] provides an overview of the most important energy efficiency policy measures in almost 40 European countries. The database is structured by final energy consumption sectors (households, services, industry and transport) and also includes a general cross-cutting section. At the level of sectors, the focus lies on single policy measures whereas programmes comprising several measures are mainly described in the cross-cutting section. The homogeneity of measure descriptions over sectors and countries is ensured by detailed guidelines. All measures are classified according to specific keywords such as:

- their *status* (completed, on-going or proposed);
- their *year of introduction and completion*;
- their *type* (legislative/normative, e.g. standards for new dwellings, legislative/informative, e.g. obligatory energy labels for appliances, financial, e.g. subsidies, fiscal, information/education and cooperative);
- the targeted *end-uses* and the *main actors* involved by the policy measures;
- their *semi-quantitative impact (*low, medium or high impact, based on quantitative evaluations or expert estimates);
- the involved *end-uses* and the *quantitative impact* of the policy measure related to a specific end-use.

There are several additional categories in the MURE database that allow a separate analysis of policy measures from specific sources or on specific topics:

- Energy efficiency measures which are reported in the National Energy and Climate Action Plans (NECPs) under the EU Governance Regulations and measures reported under Article

[3] http://www.measures-odyssee-mure.eu/ (fully open access)

7 of the EU Energy Efficiency Directive (EED) on energy savings obligations (Article 8-10 in the revised EED 2023).

- Measures that are common to all countries ("EU measures") are separated from purely national measures.
- Recently, new measure categories have been added covering energy efficiency policies alleviating energy poverty and policies addressing energy sufficiency.

MURE comprises three *policy tools* (Figure 2) that focus on specific topics and facilitate the analysis:

- *Successful measures:* aims at identifying successful and promising energy efficiency policies.
- *Policy mapper*: provides a visualisation of all policies targeting a given end-use and related energy efficiency indicators.
- *Policy Assessment*: allows to assess the quantitative impacts of energy efficiency policies gathered in the MURE database in the frame of a scenario analysis.

Figure 2: The MURE support tools for energy efficiency policies

A third group of support tools is based on information from both databases, ODYSSEE and MURE, and thereby combines energy efficiency indicators and policies[4]. These are

- the **European Energy Efficiency Scoreboard**, which scores European countries according to different energy efficiency criteria
- the **Multiple Benefits of Energy Efficiency** tool, which aims to show the different aspects of energy efficiency beyond energy savings and thereby gives a more holistic view on its benefit. The tool is directly linked to another EU LIFE project, SEED MICAT[5], which aims at quantifying and monetizing the multiple impacts of energy efficiency policies.
- the **Energy Efficiency First (EE1)** tool, which represents a quantitative indicator approach to assess the implementation of the Energy Efficiency First (EE1) principle in the European Union and its Member States.

[4] https://www.odyssee-mure.eu/data-tools/

[5] https://micatool.eu/seed-micat-project-en/

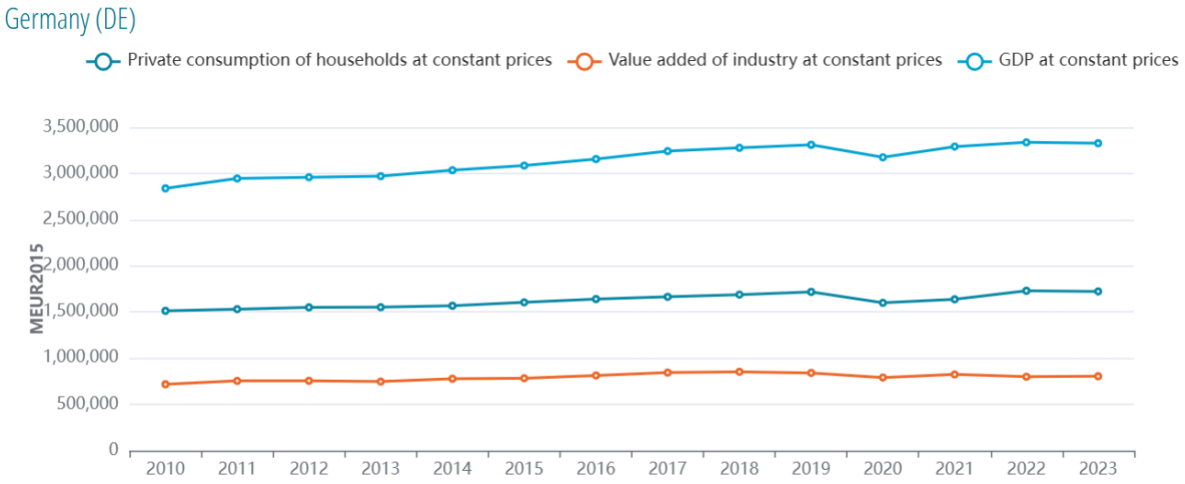
2 Economic and policy context

2.1 Economic context

Given the influence of economic growth on energy consumption, this chapter starts by evaluating the German economic context for the period between 2010 and 2023. This is done from a global perspective with the Gross Domestic Product (GDP) and from a national production and consumption standpoint, with the industry value added and the private consumption of households respectively (Figure 3).

Following the financial and economic crisis in 2008/2009, the economy started to grow again between 2010 and 2019, with an average real rate of 1.4% (private consumption), 1.8% (value added industry) and 1.7% (GDP). In 2020, the COVID-19 pandemic led to a recession again. Only in 2023 did the economy return to or slightly exceed the 2019 level.

Figure 3: Macro-economic development in Germany, 2010 - 2023



Source: ODYSSEE database (as of March 2025)

2.2 Policy background

With the "Federal Climate Change 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.

Parallel to the adoption of the new Climate Change Act in 2019, the Fuel Emissions Trading Act was adopted which established an emissions trading system in Germany for the sectors buildings and transport, starting from 2019. This system will be converted into the new European Emission Trading System for buildings and transport (ETS-2) starting from 2027.

In order to achieve the tightened reduction targets from the first revision of Climate Change Act in 2021, a new Climate Action Programme was adopted by the Federal Government on October 4, 2023[6]. The approximately 130 measures of the Climate Action Program 2023 cover a broad range of topics. The programme includes e.g. several revisions of legislation on the energy supply side

[6] https://www.bmwk.de/Redaktion/DE/Downloads/klimaschutz/20231004-klimaschutzprogramm-der-bundesregierung.html

(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.

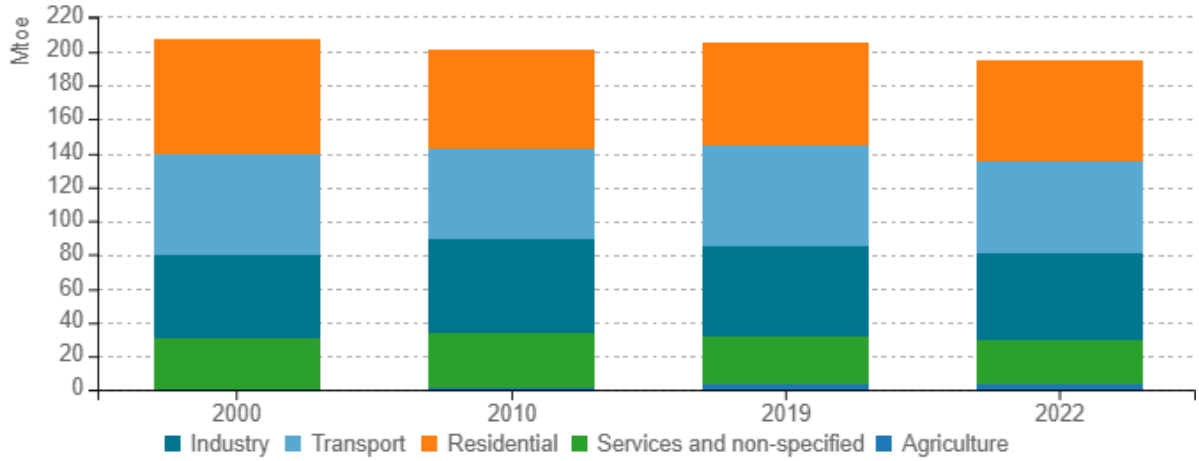
3 Overall energy efficiency progress and policies

3.1 Development of energy consumption and energy efficiency trends

3.1.1 Energy consumption based on ODYSSEE

Germany's total final energy consumption of 2022 (195 Mtoe) was slightly below its 2000 level (207 Mtoe, -12 Mtoe, i.e. -6%). In 2022, the largest consuming sector is residential, representing 30.8% of total final energy consumption. The share of residential has slightly decreased from 32.5% in 2000 to 30.8% in 2022, while industry increased its share from 23.9% to 26.5%. The share of transport in total consumption decreased slightly from 28.8% to 27.5% (Figure 4).

Figure 4: Final energy consumption in Germany by sector (with climatic corrections)



Source: ODYSSEE database (as of March 2025)

3.1.2 Decomposition of final energy demand

The variation of the **final energy consumption** between two years can be decomposed into several effects for each end-use sector, using the decomposition tool from ODYSSEE[7]:

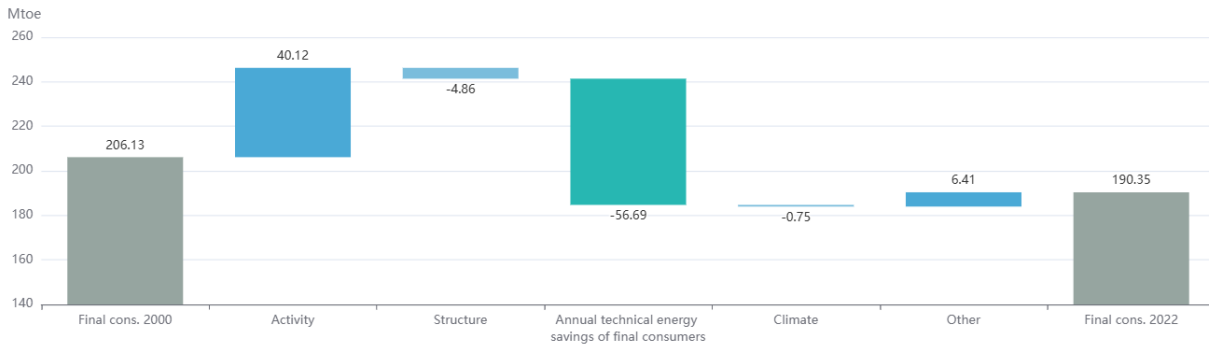
- An *activity* effect due to an increase in the economic activity, measured in economic or physical units.
- A *structural* effect due to a change in the share of the value added in sectors or sub-sectors.
- *Energy savings* linked to energy efficiency improvements and measured with the technical ODEX.
- A *climate effect* for households and services, measuring the effect of the different winter severity between two years.

[7] https://www.indicators.odyssee-mure.eu/decomposition.html

- *Residual or other effects* that are defined differently in the sectors and total; they mainly include behavioural changes and comfort effects in the household sector, changes in the value of products in the industry, changes in labour productivity in the tertiary sector and the impact of statistical differences especially in the transport sector.

During the period 2000-2022, total final energy consumption in Germany decreased by almost 16 Mtoe (from 206 to 190 Mtoe) (Figure 5). Changes in activity, structural changes, weather fluctuations and other effects contributed to a total increase in final energy consumption by around 52 Mtoe, being the activity effect the main driver with a share of more than three quarters. These were, however, compensated by the energy savings achieved through a considerable improvement in energy efficiency as measured by the ODEX. In total. the main drivers of the energy consumption variations were the growth of economic activity on the one hand and the reversal effect of the energy efficiency improvements in all final energy consumption sectors on the other.

Figure 5: Decomposition of final energy consumption in Germany – Period 2000-2022



Source: ODYSSEE decomposition tool (as of March 2025)

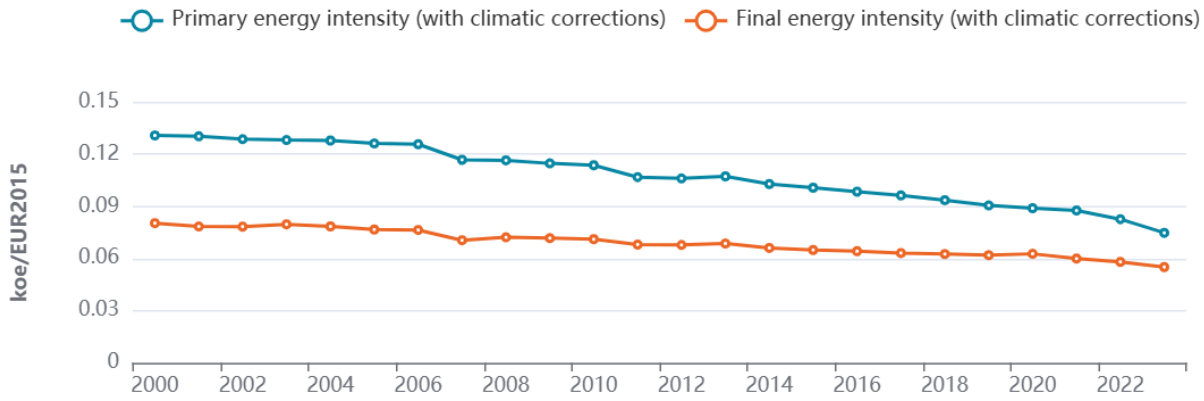
3.1.3 Energy Efficiency and Energy Savings

Energy Intensity

Germany's overall energy efficiency from an economic viewpoint is next characterized through the primary and final energy intensities, i.e. the ratio between the energy consumption and the GDP. The reverse of this ratio or the "energy productivity" is also a measure of how well the energy resources are being used. The effects of economic growth, as measured by GDP, are removed from the indicator to avoid the impact of inflation. Likewise, the weather fluctuations are taken out through the temperature-corrected intensities for the residential and tertiary sectors.

Between 2000 and 2023, the temperature-corrected primary energy intensity decreased by 2.7% per year on average, whereas the decrease in final energy intensity was less than half as high with 1.2% (Figure 6). This led to an increasing convergence of the two indicators. The main reason for the significantly greater decline in primary energy intensity in Germany is caused through the increasing importance of wind and solar power as replacements of less efficient energy conversion technologies like thermal or nuclear power.

Figure 6: Development of primary and final energy intensities in Germany between 2000 and 2023



Source: ODYSSEE database (as of March 2025)

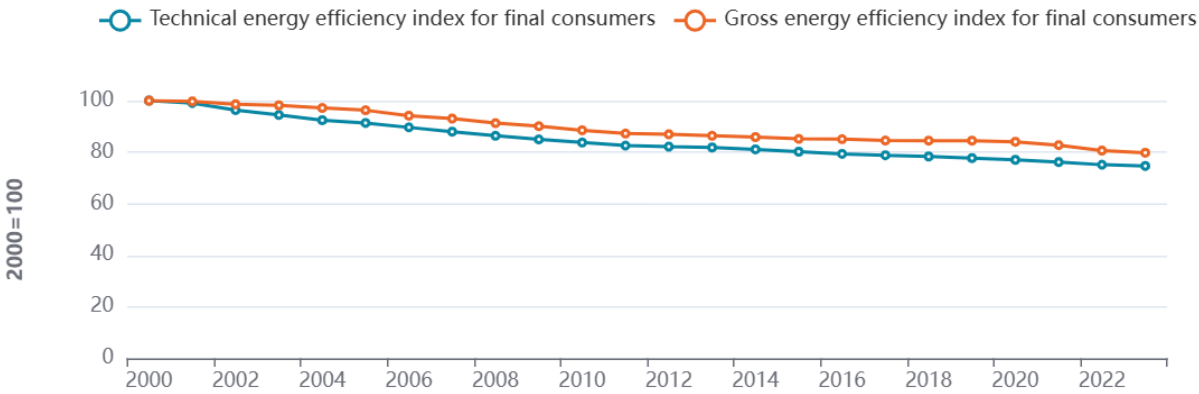
Energy Efficiency Index (ODEX)

Although the overall energy intensities described above already take into account the impact of short-term weather fluctuations and changes in activities, clearly capturing energy efficiency improvements is limited by many structural effects across the different energy consumption sectors (e.g. sector or product structure in the industrial and tertiary sectors) and several comfort effects (e.g. larger living area per household, higher room temperature, larger appliances). In addition, energy intensities which are based on monetary activities at a highly aggregated level (i.e. total GDP or added value of a sector) only give a limited understanding of the pure energy efficiency developments. ODYSSEE tackles these limitations by providing a re-aggregated energy efficiency indicator called "ODEX". This index is obtained by aggregating the unit consumption changes at detailed levels (by sub-sector or end-use), observed over a given period. The unit consumption variation is measured in terms of a ratio that use physical instead of monetary activities, which is more suitable to evaluate pure energy efficiency trends.

ODYSSEE went further in isolating the pure energy efficiency evolution. Even all effects considered, apparent (or observed) energy efficiency could increase from year to year, resulting in negative energy efficiency improvement. However, the pure technical energy efficiency should not be reverse, as it is not likely that private consumers and companies are acquiring less efficient equipment from a technical point of view. They can however underutilize it, what leads to a less efficient consumption (mainly in the industry). With the intention to provide better proxy of technical energy efficiency progress, the observed ODEX is cleaned from effects of equipment's less efficient use as well as from strong fluctuations linked to statistical errors, imperfect climatic corrections and influence of business cycles. The "technical" ODEX is the result of these adaptations.

The development of the observed and the technical ODEX in Germany starting from 2000 with a level of 100, is shown in Figure 7. In the year 2023, the global observed ODEX in Germany reached a level of 80 which represents an energy efficiency improvement of 20% on the overall energy efficiency since the base year 2000. In purely technical terms, the energy efficiency improvement was stronger. The technical ODEX reached a level of 75 in 2023.

Figure 7: Development of the observed (gross) and technical energy efficiency index ODEX for all final consumers – period 2000-2023



Source: ODYSSEE database (as of March 2025)

3.1.4 Comparison with other countries: The Energy Efficiency Score-board

A major strength of the ODYSSEE-MURE project is that it provides homogeneous data and information on energy consumption, the development of energy efficiency and energy efficiency policy for all EU Member States (and Switzerland). This also enables fair comparisons of efficiency efforts and progress between the Member States.

The overall energy efficiency efforts of the countries are compared via the Energy Efficiency Score-board, which combines energy efficiency indicators and policies. The overall scoring is obtained as an average of three criteria: the energy efficiency level and the energy efficiency trend (that come from the ODYSSEE database on energy efficiency indicators) and the results and impacts of energy efficiency policies (result from the MURE database on energy efficiency policies). These three criteria are all weighted equally, i.e. by one third each, for the overall scoring and answer the following questions:

- The level score answers the question, how a country is currently performing with respect to energy efficiency.
- The trend score answers the question, how much progress a country has achieved in the area of energy efficiency in the past.
- The policy score answers the question, which future impacts can be expected from recent policies enacted in a country.

With regard to the criteria level and trend, the scoring is based on adjusted and mainly physical indicators for energy efficiency and not on simple energy intensities. These indicators are directly taken from the ODYSSEE database on energy efficiency indicators. With regard to the policy score, the scoring accounts for quantitative effects of policies and not on a simple counting of measures. Again, these figures can directly be taken from the MURE database on energy efficiency policies, since in this database these policies are not only collected and described, but also categorized with regard to their quantitative impact on energy savings.

In the combined scoreboard taking into account all three criteria, Germany is ranked 4th at the overall level across all sectors (Table 1). Germany achieves its best position for the policy score in all sectors. With respect to the energy efficiency level, Germany has a middle position, whereas for the trend score it is located at the lower end (except in the service sector).

Table 1: Germany's overall and sectoral position by all three criteria in the EU Energy Efficiency Scoreboard 2024

		Level	Trend	Policies	Combined
Overall	Germany	8 / 27	23 / 27	4 / 27	4 / 27
	Highest score (benchmark)	Lithuania	Luxembourg	Luxembourg	Luxembourg
Industry	Germany	12 / 25	25 / 25	3 / 27	7 / 25
	Highest score (benchmark)	Cyprus	Estonia	Poland	Estonia
Transport	Germany	20 / 26	21 / 26	5 / 27	15 / 26
	Highest score (benchmark)	France	Luxembourg	Cyprus	Luxembourg
Households	Germany	8 / 27	23 / 27	1 / 27	3 / 27
	Highest score (benchmark)	Netherlands	Ireland	Germany	Ireland
Services	Germany	14 / 27	3 / 27	8 / 27	3 / 27
	Highest score (benchmark)	Romania	Hungary	Ireland	Hungary

Source: ODYSSEE-MURE 2024 EU Energy Efficiency Scoreboard[8] (as of March 2025)

3.2 Cross-cutting energy efficiency policies

With regard to the reduction of greenhouse gas emissions, the Fuel Emissions Trading Act (Brennstoffemissionshandelsgesetz - BEHG) established an emissions trading system in Germany for the sectors buildings and transport, starting from 2019. Until 2025, a fixed price system is introduced, which will be replaced by a price corridor in 2026. This creates a reliable price trajectory that enables the general public and industry to adjust to the progression. From 2027, this system will be converted into the new European Emission Trading System for buildings and transport (ETS-2).

With regard to energy efficiency improvement, a new Energy Efficiency Act (EnEffG) entered into force in November 2023 and serves to implement the 2023 recast of the EU Energy Efficiency Directive (EED). The new creates for the first time a cross-sectoral framework for enhanced energy efficiency in Germany. The new legislation establishes efficiency targets for Germany for primary From and end user energy consumption for 2030, 2040, and 2045. The targets for 2030 are consistent with those set out for Germany in the revised EU Energy Efficiency Directive (EED). Targets have also been established for 2040 and 2045 to ensure planning and investment security at an early stage; these targets will be reviewed in 2027 and adjusted if necessary. Companies whose annual energy consumption exceeds 15 gigawatt hours will also be required to implement energy or environmental management systems and to document their energy efficiency measures in detailed plans and publish them. Energy efficiency standards will also be introduced for new data centres, which will be obliged to utilise waste heat and to make economical use of cooling system power. Efficiency requirements are also being introduced for existing data centres.

The introduction of the new Energy Efficiency Act was accompanied by a stakeholder process on the future development of energy efficiency policies in the next 20 years until 2045., the so-called "Roadmap Energy Efficiency 2045"[9]. This process was the German government's central dialog forum with the task of driving forward the urgently needed progress in energy efficiency. The roadmap was part of the German energy efficiency strategy and intended to discuss cross-sectoral paths to achieving the goal of climate neutrality by 2045. Further concrete instruments and measures to increase energy efficiency have been developed in consultation with representatives from science, industry and civil society. In order to cover the entire spectrum, energy efficiency will be examined both in sector-specific working groups (buildings, industry and transport) and in cross-

[8] https://www.odyssee-mure.eu/data-tools/scoring-efficiency-countries.html

[9] https://www.bmwk.de/Redaktion/DE/Dossier/Energieeffizienz/roadmap-energieeffizienz-2045.html

sector working groups (digitalization, skilled workers and qualifications and system issues). The dialog process on the Energy Efficiency Roadmap was concluded in April 2024 with the publication of a summarizing report on energy efficiency up to 2045[10].

Other cross-cutting measures in Germany described in the cross-cutting section of the MURE database[11] include several energy climate action programmes laid out to achieve energy efficiency and climate targets as well as several regulations to increase the share of renewable energies in the energy sector.

[10] https://www.bfee-online.de/SharedDocs/Kurzmeldungen/BfEE/DE/Effizienzpolitik/240628_roadmap_energieeffizienz_endbericht.html

[11] https://www.measures.odyssee-mure.eu/energy-efficiency-policies-database.html

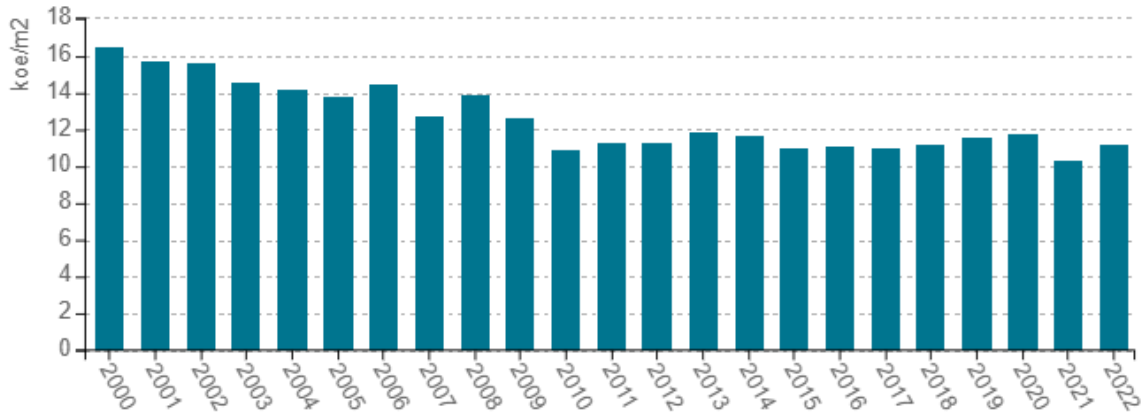
4 Sectoral energy efficiency progress and policies

4.1 Residential sector

Energy efficiency progress

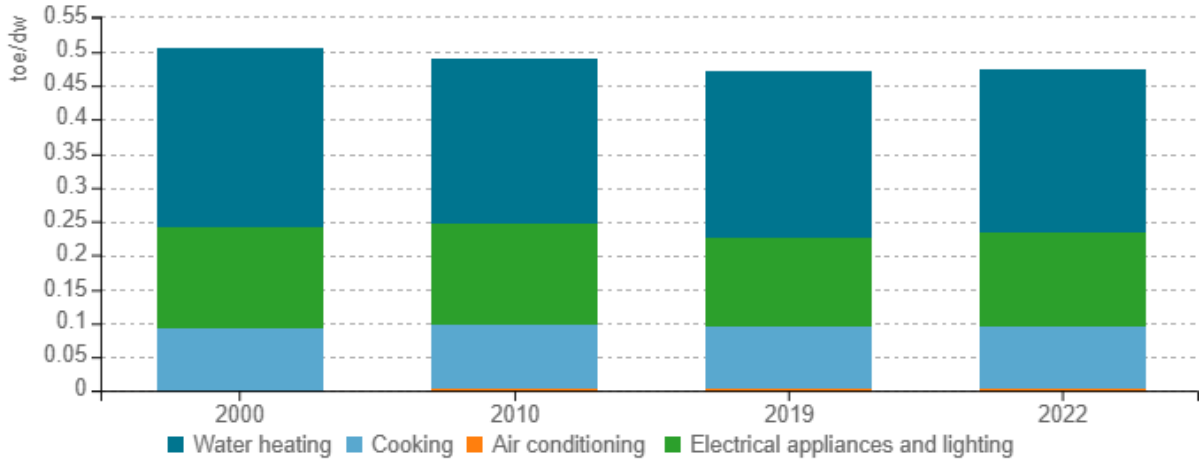
As shown in Figure 8 the household energy consumption per m² for space heating has decreased by 32% since 2000, from 16.5 koe/m² to 11.2 koe/m² in 2022. The consumption per dwelling for water heating, for appliances and for cooking stayed relatively constant during the last years and decreased only slightly compared to 2000 (see Figure 9).

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



Source: ODYSSEE database (ambient heat included)

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

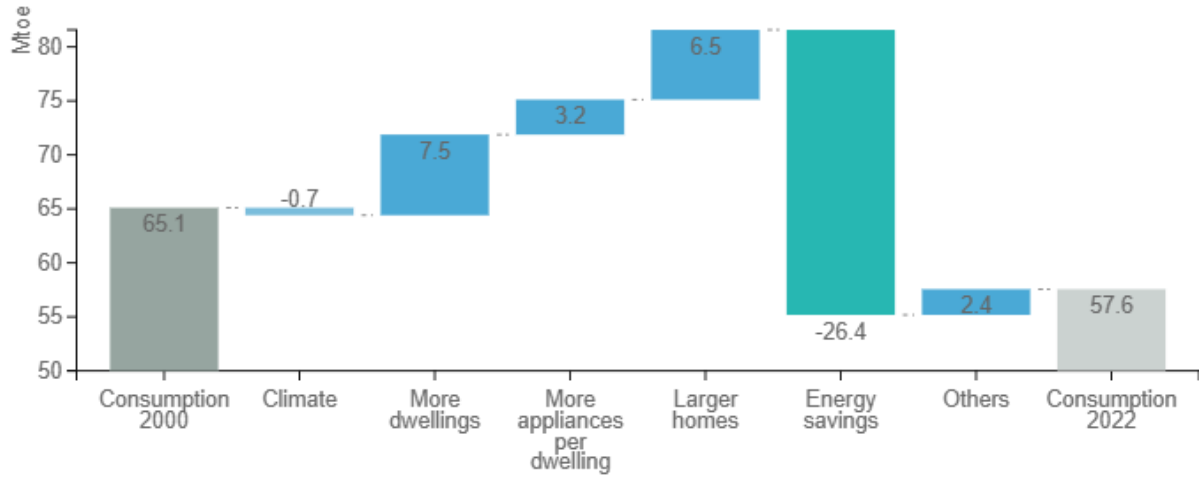


Source: ODYSSEE database

Figure 10 shows a decomposition of the change in energy consumption. It shows that the total final energy consumption of households decreased by around 7.5 Mtoe between 2000 and 2022. Two main

factors contributed to an increase in energy consumption – more dwellings (7.5 Mtoe) and life-style/comfort (9.7 Mtoe, due to larger homes and more appliances per dwelling). On the opposite, energy savings led to a consumption decrease by around 26.4 Mtoe, while other effects had only a small decreasing impact of 2.4 Mtoe. Climate effects also had a small decreasing impact of 0.7 Mtoe.

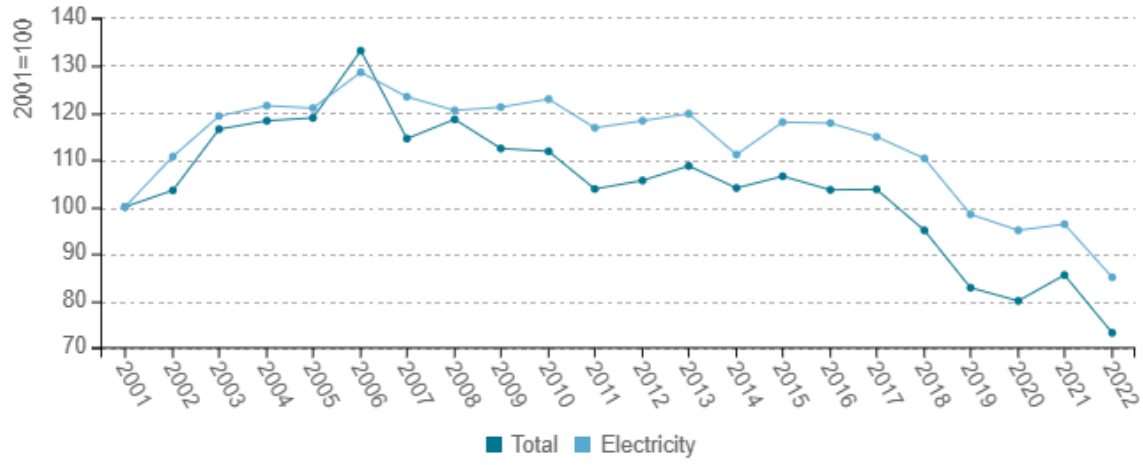
Figure 10: Main drivers of the energy consumption variation in households



Source: ODYSSEE database (ambient heat included)

Figure 11 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 (-45 % for the total final consumption, -34 % for electricity).

Figure 11: Specific energy and electricity consumption in households (with climatic corrections)

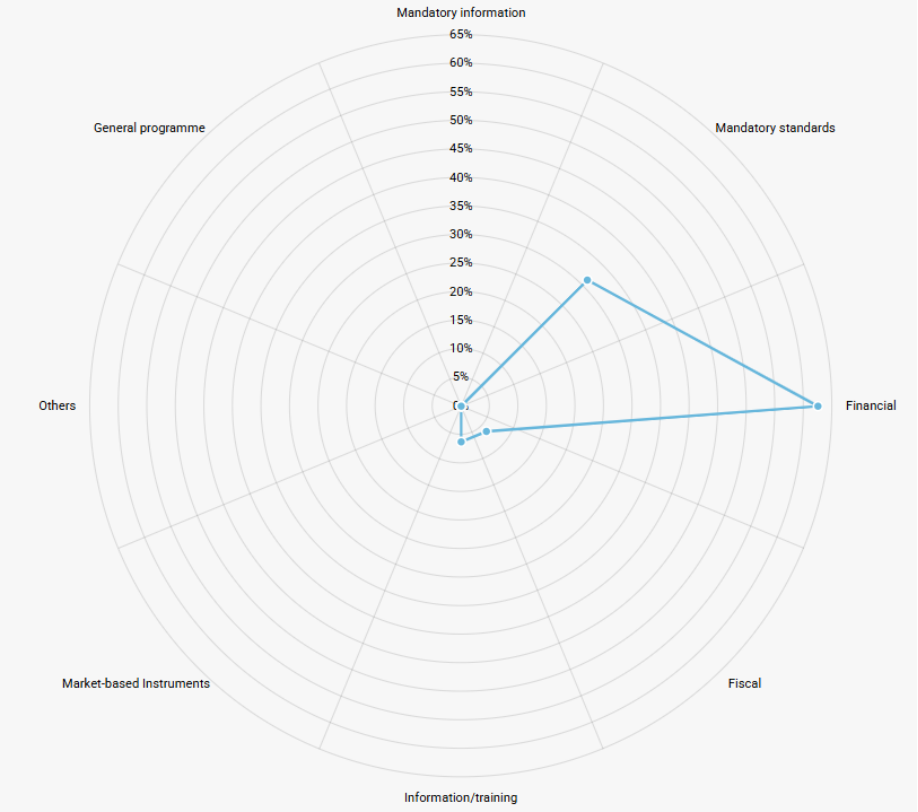


Source: ODYSSEE database

Energy efficiency policies

The overall policy mix in the residential sector in Germany is dominated by regulative and financial instruments (Figure 12).

Figure 12: Structure of policy mix in the residential sector by measure type



Source: MURE database (period 2010-2022)

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 years. The main building regulation in Germany is the “Building 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. From 1 January 2024, the switch to at least 65% renewable energies has been mandatory when installing new heating systems. The requirement to use at least 65% renewable energies is also linked to the existence of municipal heat planning in accordance with the new Heat Planning Act. 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)" since 2020. 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 percent and also includes specific conditions for low-income households. An overview of these policy measures is given in Table 2.

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

Measure name (English / German)	Description	Total final energy or CO2 savings in 2030
Tax incentives for energy efficient building refurbishment (Steuerliche Förderung der energetischen Gebäudesanierung)	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.	52.4 PJ
Building Energy Act (Gebäudeenergiegesetz - GEG)	Since November 1, 2020, the Building Energy Act (GEG) has replaced the Energy Saving Act (EnEG) with the Energy Saving Ordinance (EnEV) and the Renewable Energies Heat Act (EEWärmeG). Amended versions came into force on January 1, 2023 and January 1, 2024. The changes are primarily aimed at only installing new heating systems that generate at least 65% of the heat provided using renewable energies.	4,100 kt CO2
Heat Planning Act (Wärmeplanungsgesetz - WPG)	The Heat Planning Act forms the basis for comprehensive municipal heat planning. It defines uniform nationwide standards and specifications for the proportion of heat from renewable energies and unavoidable waste heat as well as the expansion of district heating. The Heat Planning Act came into force on January 1, 2024.	
Federal subsidy for efficient buildings (Bundesförderung für effiziente Gebäude- BEG)	With the BEG, the existing funding programs for the building sector were combined in a single, modernized and optimized funding offer. The BEG 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 was first implemented on January 1st 2021. A new subsidy guideline came into effect January 1st 2024 and ends December 31st 2030. 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 and also includes specific conditions for low-income households.	14,600 kt CO2

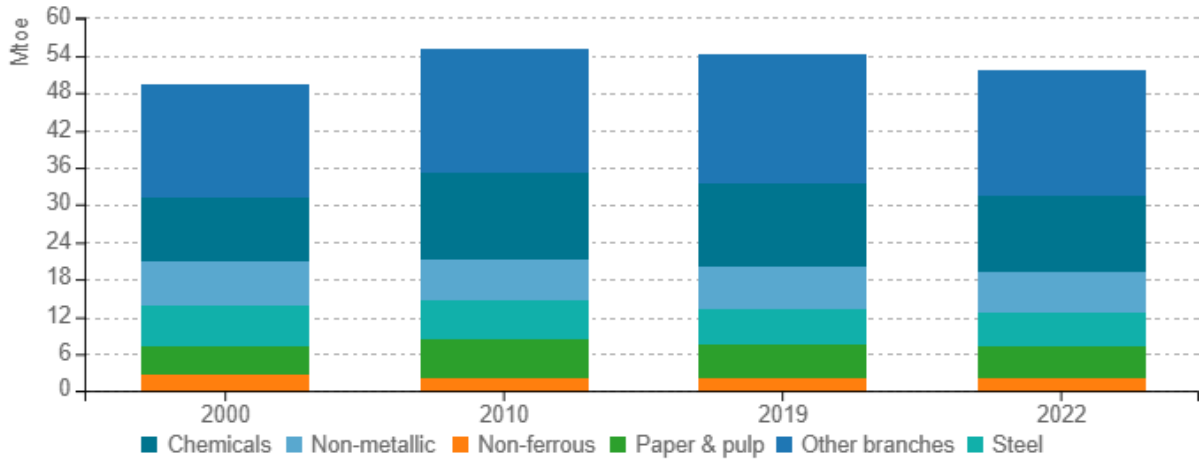
Source: MURE database

4.2 Industry sector

Energy efficiency progress

The total consumption of the industry sector increased from 49.5 Mtoe in 2000 to 51.8 Mtoe in 2022 (+4.7%). Consumption of chemical industry increased by 20% in this time period, while the energy consumption of the steel producing sector decreased by 17%. Non-ferrous metals' energy consumption decreased by 19% (Figure 13).

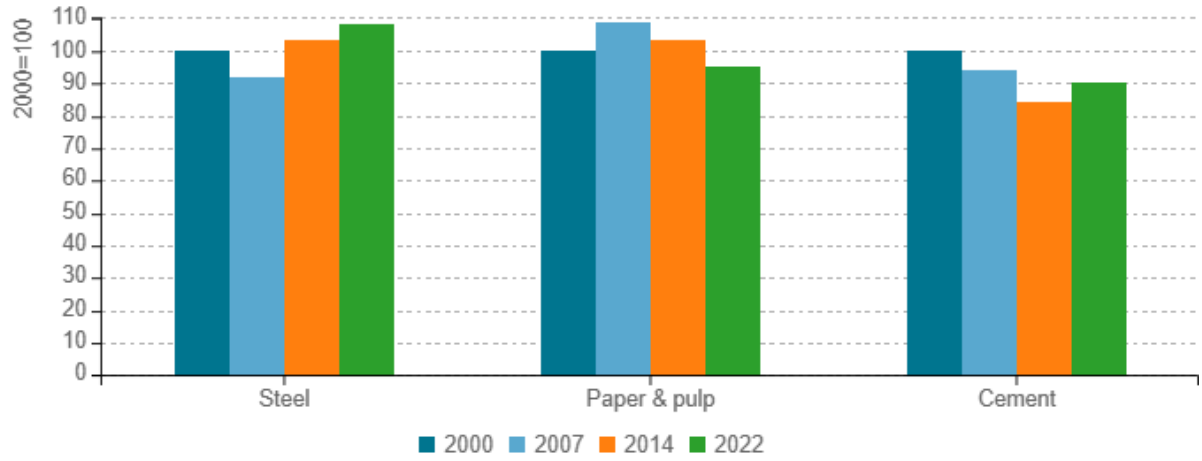
Figure 13: Final energy consumption of industry by branch



Source: ODYSSEE database (ambient heat included)

While the specific consumption of steel is higher in 2022 compared to 2000, the specific consumption for paper and cement production are lower. 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 14).

Figure 14: Unit consumption of energy-intensive products (toe/t)

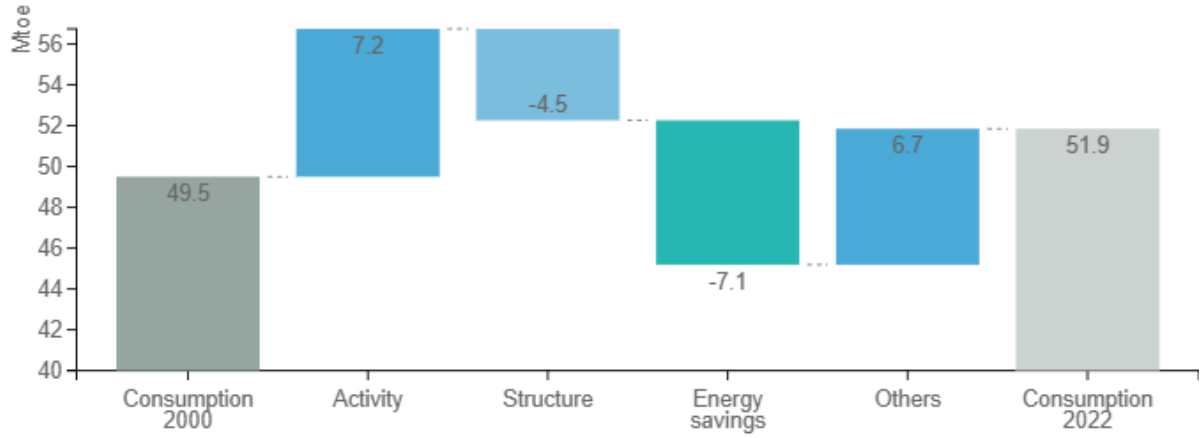


Source: ODYSSEE database

Figure 13 shows the factors influencing the changes in final energy consumption of the industrial sector. The increase of its energy consumption by about 2.4 Mtoe between 2000 and 2022 was mainly

driven by change in industrial activity (7.2 Mtoe) and other effects (6.7 Mtoe). This effect was counter-balanced by energy savings (-7.1 Mtoe) and structural changes towards less intensive branches, which increased their contribution in industrial value added (-4.5 Mtoe).

Figure 15: Main drivers of the energy consumption variation in industry

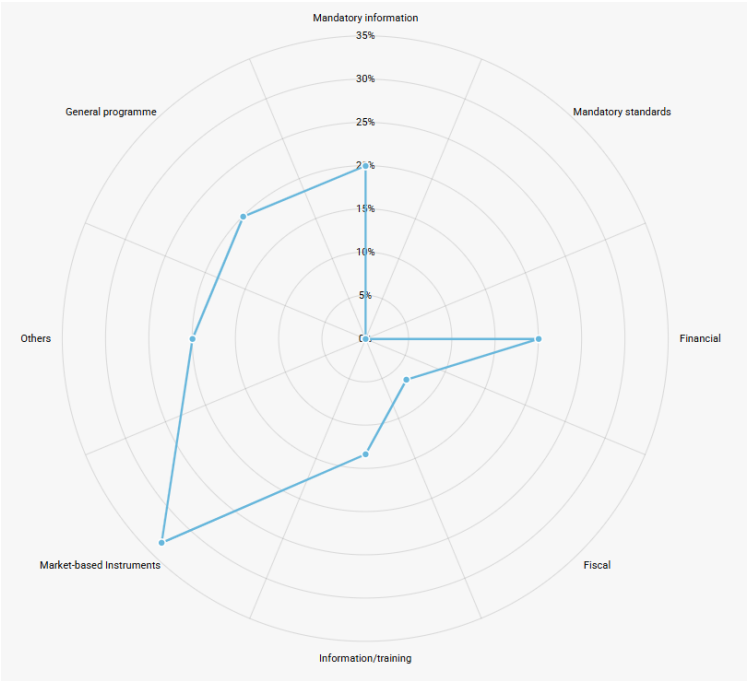


Source: ODYSSEE database

Energy efficiency policies

Compared with the residential sector, the policy mix in industry is significantly broader (Figure 12).

Figure 16: Structure of policy mix in the industrial sector by measure type



Source: MURE database

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 Industry Associations. The decarbonisation of energy-intensive industries is funded by a subsidy programme, which was re-structured in 2024 and complemented by the introduction of Carbon Contracts for Difference. An overview of these policy measures is given in Table 3.

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

Measure name (English / German)	Description	Total final energy or CO2 savings in 2030
Federal support for energy and resource efficiency in the economy (Bundesförderung für Energie- und Ressourceneffizienz in der Wirtschaft - EEW)	Since 2019 the entire federal funding package for energy efficiency in the economy consists of two funding guidelines: the guideline on grants and loans with four funding modules and the guideline on funding competitions (Federal Ministry for Economic Affairs and Energy (BMWi)). The subprogramme "grant and loan" comprises several modules. Some are related to cross-cutting technologies, other are open to all to all technologies or systemic improvements in order to facilitate and simplify investments in more complex energy efficiency measures.In order to meet the wide range of needs and projects with varying degrees of complexity, a funding competition is offered in a separate funding guideline. The competitive basis for the distribution of funding makes it particularly interesting for those projects that require a higher level of funding for their implementation and are therefore prepared to develop particularly innovative project ideas.	105 PJ
Peak balancing under the Energy Tax Act (EnergieStG) and the Electricity Tax Act (StromStG) (Spitzenausgleich im Rahmen des Energiesteuergesetzes und des Stromsteuergesetzes)	Under the so-called peak balancing tax, relief is provided for companies of the manufacturing industry.	41 PJ
Energy Efficiency and Climate Protection Networks Initiative (Initiative Energieeffizienz- und Klimaschutz-Netzwerke)	On 14 September 2020, the Federal Ministry for Economic Affairs and Climate Action (BMWK) and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, together with 21 business associations and organisations, agreed on the continuation and further development of the Energy Efficiency Networks initiative.	31 PJ

Measure name (English / German)	Description	Total final energy or CO2 savings in 2030
	The initiative, which has been further developed into an energy efficiency and climate protection network, started in January 2021. The basic principles of the initiative and the networks will not change in this second phase. By the end of 2025, up to 350 new networks are to be established, thus saving up to six million tonnes of greenhouse gas emissions per year. Climate protection aspects will play a stronger role in the networks than before. An energy efficiency and climate protection network consists of 8 to 15 companies. Each company develops a savings target and individual measures with the help of an experienced energy consultant. In a professionally supervised exchange of experience, the companies set a common goal for their network work on this basis. Annual monitoring of the measure is done by an independent institute by means of a survey of the implemented measures at the network companies at regular intervals (which ensures the fulfilment of the EED reporting obligations).	

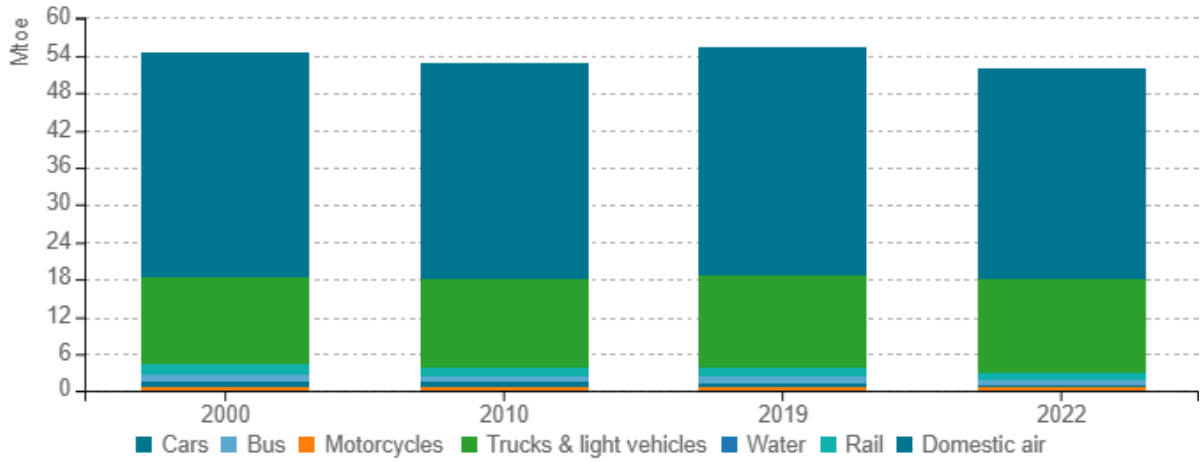
Source: MURE database

4.3 Transport sector

Energy efficiency progress

Final energy consumption in transport is dominated by cars covering 65% of total consumption in 2022. Compared to 2000, the share of road freight increased from 25.5% to 28.8%, while rail transport dropped from 3.6% to 2.4% and domestic air from 1.7% to 0.7%. In the same period the share of busses and water stayed almost constant (Figure 17).

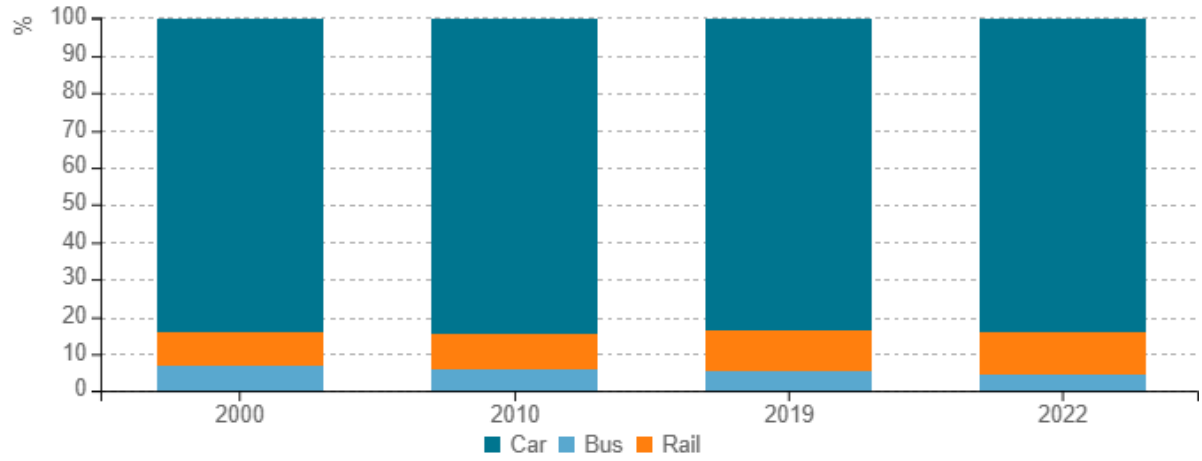
Figure 17: Transport energy consumption by mode



Source: ODYSSEE database

Cars represented 84% of passenger traffic measured in passenger kilometers in 2022, followed by rail with 11.4% and only 4.7% for bus. The share of cars slightly increased in comparison to 2000 (+0.1% points), while the share of rail increased by 2.3 % points and bus traffic dropped by 2.3% points (Figure 18).

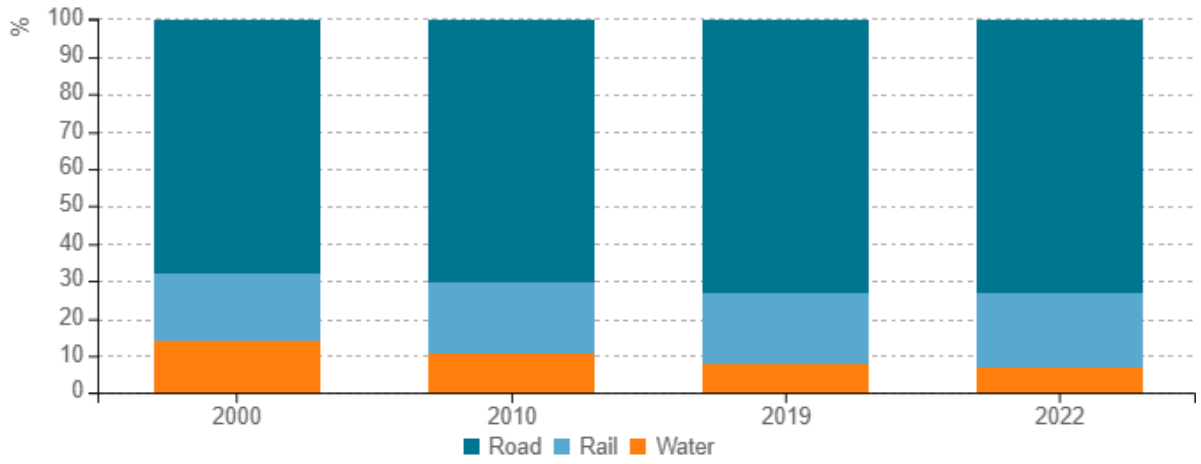
Figure 18: Modal split of inland passenger consumption



Source: ODYSSEE database

Road freight transport represents 73.3% of total freight traffic in 2022, 5.2% points more than in 2000. The share of rail transport in freight increased by 2.2% points, while the share of water traffic decreased by 7.4% points to 6.8% of total freight transport activity (Figure 19).

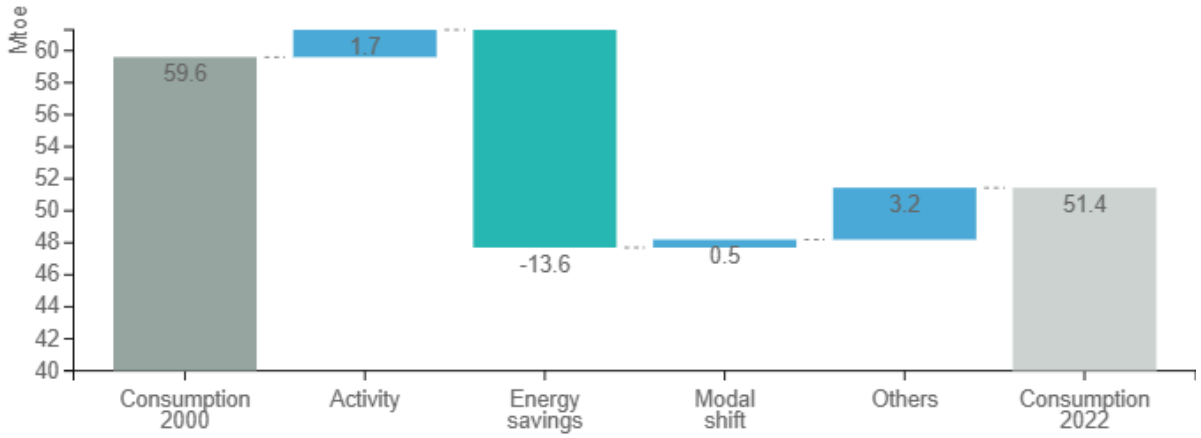
Figure 19: Modal split of inland freight traffic



Source: ODYSSEE database

Figure 20 shows the different factors influencing the change in final energy consumption of transport. Germany's total final energy consumption for transport decreased by about 5.8 Mtoe in the period from 2000 to 2022. The increasing traffic of passengers and freight contributed to increase the consumption by 4.5 Mtoe (activity). This trend was counterbalanced by energy savings (11.2 Mtoe). Modal shift had a slightly increasing effect of 0.6 Mtoe, while other effects resulted in an increase of about 0.2 Mtoe.

Figure 20: Main drivers of the energy consumption variation in transport

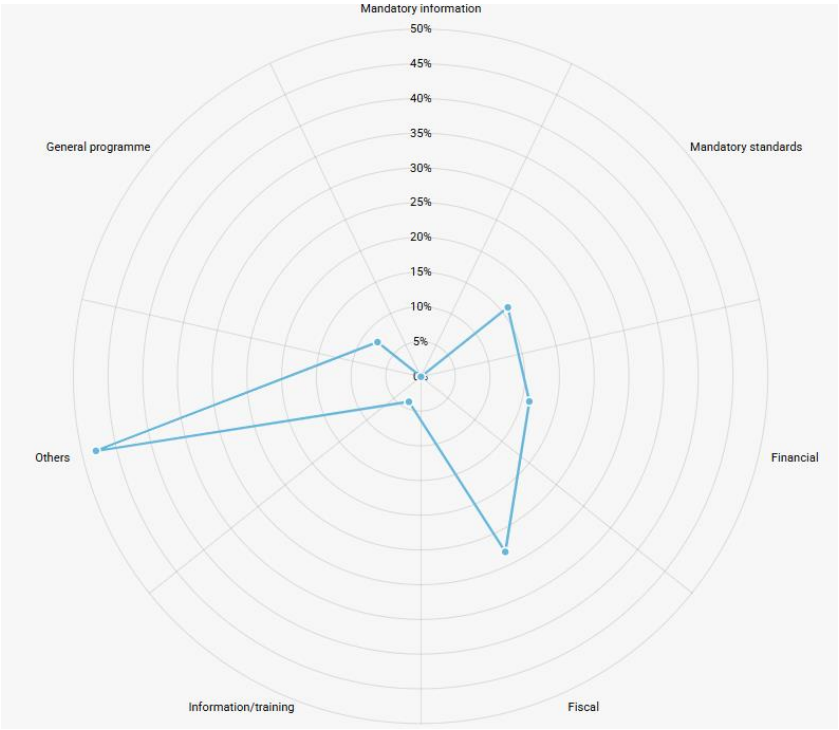


Source: ODYSSEE database

Energy efficiency policies

The overall policy mix in the transport sector in Germany is dominated by regulative instruments on the one hand and a mix of financial and fiscal instruments on the other hand (Figure 21).

Figure 21: Structure of policy mix in the transport sector by measure type



Source: MURE database (period 2011-2023)

The Climate Action Programme 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. From 2016 to 2023, a subsidy programme for the promotion of electric mobility was in place, the so-called "Umweltbonus". An overview of these policy measures is given in Table 4.

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

Measure name (English / German)	Description	Total final energy or CO2 savings in 2030
Levy on air traffic (Luftverkehrsabgabe)	This measure aims at decreasing the share of air travel passengers through an increase of the air traffic levy. It is the counterpart measure to the decrease of value added tax on long-distance railway tickets, which aims at increasing the share of railway passengers.	67.40 PJ / 270 ktCO2
Germany-Ticket for local public transport (Deutschlandticket))	The so-called "Deutschlandticket" is the result of the nine-euro ticket, which was offered at the initiative of the German government in the summer months of 2022 and sold 52 million times. The Deutschlandticket as a follow-up was introduced on 1 May 2023 and was intended to build on the success of this temporary campaign as a permanent offer. It offers a significant simplification of the country's many regional fare systems and also reduced the cost of mobility in general. For 49 euros a month, citizens can use public transport throughout Germany. Since 1 January 2025, the price was raised to 58 euro. The ticket is intended to significantly increase the attractiveness of local public transport and provide an incentive to switch from car to bus and rail - and thus help achieve the climate targets. The federal states can offer additional discounts for the tickets, mainly regarding trainees, students and people with a lower income. The federal states can choose themselves which of these discounts, if any at all, they implement.	550 ktCO2
Electric vehicle purchase subsidy (Umweltbonus)	The programme provided rebates on purchase of battery electric vehicles (BEVs) and plug-in hybrid vehicles (PHEV) sold in Germany between 2016-2023.	2,910 ktCO2 (total gross annual savings in 2023, starting in 2016)

Source: MURE database

5 Special focus in MURE: Energy poverty and energy sufficiency policies

The focus of the MURE database is on energy efficiency policies. In the last years, more emphasis was placed on those energy efficiency policies targeting energy poverty and the policies on energy sufficiency.

5.1 Energy efficiency policies alleviating energy poverty

The focus on energy efficiency policies aiming at alleviating energy poverty in MURE was done against the background, that the alleviation of energy poverty plays a key role in the European Green Deal and several parts of the Fit-for-55 package for its implementation[12]. Targeted support for vulnerable consumers has not only been made mandatory by Article 24 of the revised EED, but it is also an important element for the application of the energy efficiency first principle according to Article 3 and the implementation of energy efficiency obligation schemes and alternative policy measures according to Articles 8 - 10 in the Member States. It is also supported by the newly established Social Climate Fund[13], which complements the new emission trading system for buildings, road transport and small emitting industry (ETS 2)[14], and also requires the implementation of policy measures in favour of vulnerable groups in the Member States.

It is important to know that the MURE database only includes measures which are explicitly targeting the alleviation of energy poverty by increasing energy efficiency, and not pure social policies. The database also distinguishes between measures aiming mainly or only at energy poverty and those only having some components addressing energy poverty[15]. In this delimitation, almost 150 energy poverty measures can be found in the MURE database for all countries included, most of them in the household sector (Figure 22) [16]. A more detailed overview of these measures is given in a Policy Brief on the main energy poverty measures in Europe, which was prepared within the ODYSSEE-MURE project[17].

In Germany, energy poverty was predominantly addressed in the past through social policy measures. It was therefore not considered an integral part of energy efficiency and climate policy[18]. Therefore, up to now the MURE database only reports three policies addressing the alleviation of energy poverty by energy efficiency. Two of them include components addressing low-income households (an advice program by the German Consumer Organisation and the newly structured subsidy program for building renovation – BEG). The third measure, an advice programme for saving electricity (Stromsparcheck), which has been established for many years, only addresses low-income households.

[12] A more detailed overview of the role and state of energy poverty in the EU and of the handling of this issue in the ODYSSEE and MURE databases is given in a Working Paper which was prepared by Fraunhofer ISI within the ODYSSEE-MURE project: Heller, A. L., Brunzema, I., Schlomann, B.: Energy efficiency policies across the EU and their impact on alleviating energy poverty. Insights from the MURE database. August 2024. doi: 10.24406/publica-3160. https://publica.fraunhofer.de/entities/publication/66469b38-cf1a-41bb-a091-dd9085d046b6

[13] https://eur-lex.europa.eu/legal-content/DE/TXT/?uri=CELEX%3A32023R0955

[14] https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/ets2-buildings-road-transport-and-additional-sectors_en

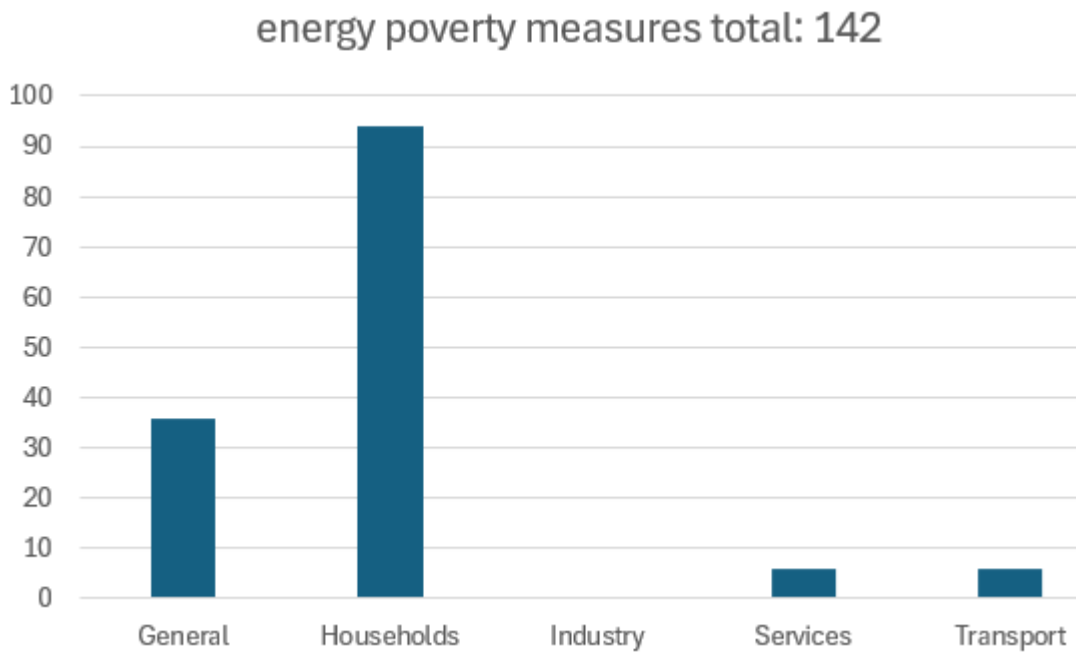
[15] Energy poverty measures can be accessed in the MURE Database Query under "More Options – Measure Characterisation – Energy poverty & sufficiency".

[16] As of mid February 2025, 26 countries reported 142 energy efficiency measures related to energy poverty.

[17] https://www.odyssee-mure.eu/publications/policy-brief/energy-poverty-measures-eu-epov-eed.html

[18] Noka, V., Cludius, J. (2021): Working Paper. Energy Vulnerability and Energy Poverty: Experience and Approaches in the EU. Öko-Institut Working Paper 9/2021. Hg. v. Öko-Institut e. V. Online verfügbar unter: https://www.oeko.de/fileadmin/oekodoc/WP-EnergyVulnerability_Energy-Poverty.pdf.

Figure 22: Energy poverty measures in the MURE database by sector



Source: MURE database (as of mid February 2025)

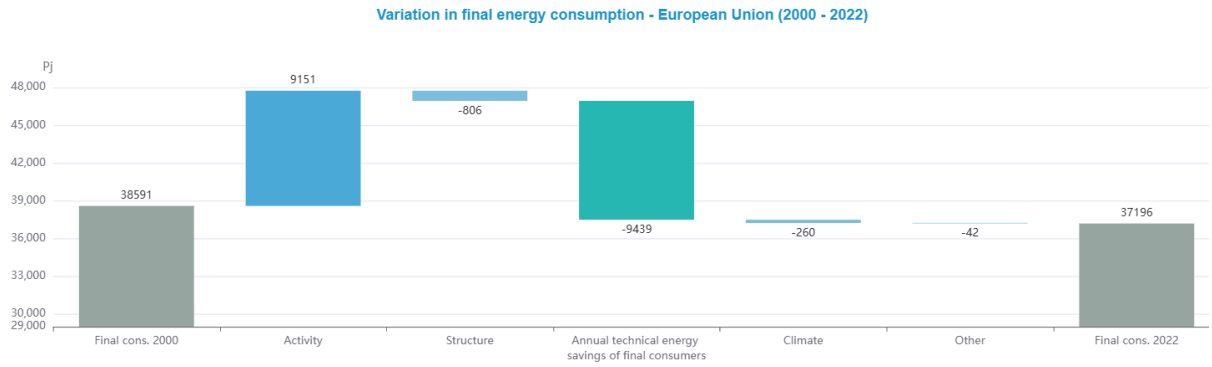
5.2 Policies addressing energy sufficiency

The new focus on energy sufficiency policies in MURE was established against the background that while improving energy efficiency is a key cornerstone in achieving the European Union's climate targets, it does not necessarily lead to a reduction in energy demand. However, reducing the demand for energy and materials in the buildings, industry and transport sectors - also referred to as energy sufficiency - is an important lever for a fair and just transition, as e.g. the ESABCC stated in its Assessment Report 2024[19]. This means that achieving the EU's energy and climate goals will require not only energy efficiency but also energy sufficiency measures in the Member States. This assessment also becomes clear when considering the major significance of changes in activity for the development of final energy consumption over the last two decades. This analysis can be made with the decomposition tool in ODYSSEE[20]. The decomposition of final energy consumption shows that activity changes (i.e. changes in the economic activity, in the number of dwellings and appliances, as well as in the size of dwellings for households and in the traffic for passengers and goods in transport) almost compensated energy savings during this period. This can both be observed in in the European Union as a whole (Figure 23) and in Germany (Figure 24).

[19] https://climate-advisory-board.europa.eu/reports-and-publications/towards-eu-climate-neutrality-progress-policy-gaps-and-opportunities

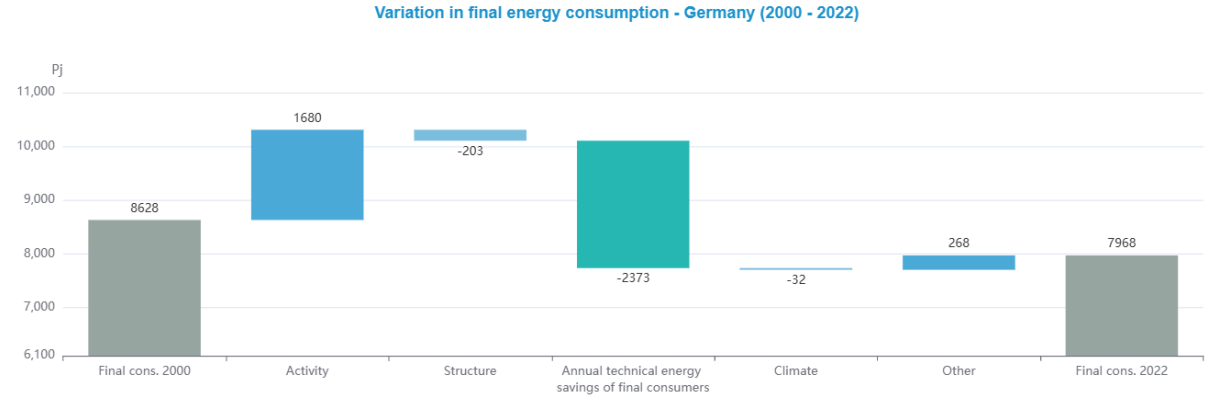
[20] https://www.indicators.odyssee-mure.eu/decomposition.html

Figure 23: Decomposition of final energy consumption in EU-27, 2000-2022



Source: ODYSSEE database

Figure 24: Decomposition of final energy consumption in Germany, 2000-2022



Source: ODYSSEE database

As technical coordinator of the MURE database, Fraunhofer ISI formulated the following definitions, based on the available literature on energy sufficiency, as a basis for identification and classification of energy sufficiency measures in the MURE database[21]:

- Energy sufficiency: A state in which people's basic needs for energy services are met equitably and ecological limits are respected.
- Energy Sufficiency Actions: Actions which reduce energy demand, to take us towards the energy sufficiency state, whilst at the same time changing the quantity or quality of the energy services demanded in a sustainable way and not below people's basic needs.
- Energy Services: The benefits provided by energy, such as cooking, lighting, cooling, IT-based communication, automotive transport and industrial processes.
- Sufficiency vs. Efficiency: Their nature of changing the quantity or quality of the energy services demanded is exactly what distinguishes energy sufficiency actions from energy efficiency actions.

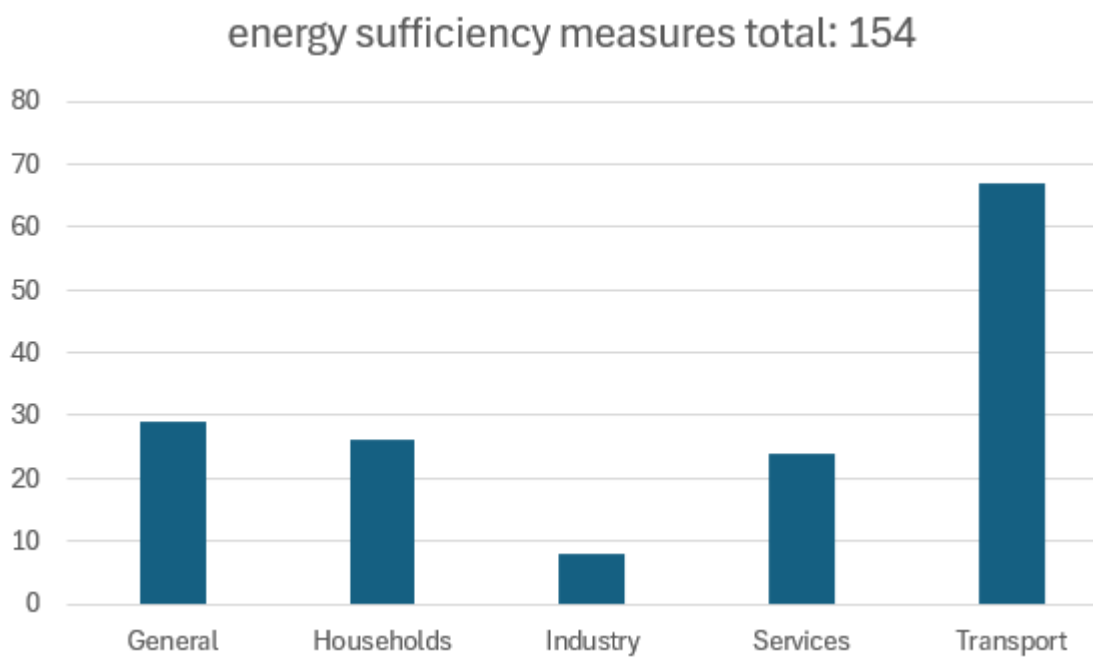
Based on these definitions, around 150 energy sufficiency measures were reported in the MURE database for all countries included (Figure 25) [22]. In the database, these measures are categorized both by their type of action (avoiding/ceasing of energy services, substitution of energy services,

[21] Energy sufficiency measures can be accessed in the MURE Database Query under "More Options – Measure Characterisation – Energy poverty & sufficiency".

[22] As of mid February 2025, 23 countries reported 154 measures related to energy sufficiency.

adjustment of energy services) and by their sufficiency impact mechanism (direct energy sufficiency measures, indirect energy sufficiency measures - monetary, and indirect energy sufficiency measures - non-monetary). Most of the energy sufficiency measures are reported for the transport sector (e.g. measures aiming at a modal shift or reduction of mileage), followed by cross-cutting policies (e.g. general sufficiency plans) and households (e.g. temperature limits for buildings)[23].

Figure 25: Energy sufficiency measures in the MURE database by sector



Source: MURE database (as of mid February 2025)

For Germany, five measures are reported addressing energy sufficiency:

- The Fuel Emissions Trading Act (BEHG) starting in 2021 as a general cross-cutting policy aiming, among others, at a reduction of activities in all sectors.
- Four measures in the transport sector aiming at modal shift from air and road transport to rail and public transport. The reported sufficiency measures are a levy on air traffic, the modernization of the railway network and the strengthening of rail freight transport as well as the new Germany-Ticket for local public transport (Deutschlandticket).

[23] For concrete policy examples in these sectors also see the overview in the Policy Brief "A Leap Beyond Efficiency – Energy Sufficiency Policies in Europe", prepared within the ODYSSEE-MURE project (December 2024). Link: https://www.odyssee-mure.eu/publications/policy-brief/achieving-climate-goals-sufficency-efficiency-europe.html.

6 List of figures

7 List of tables