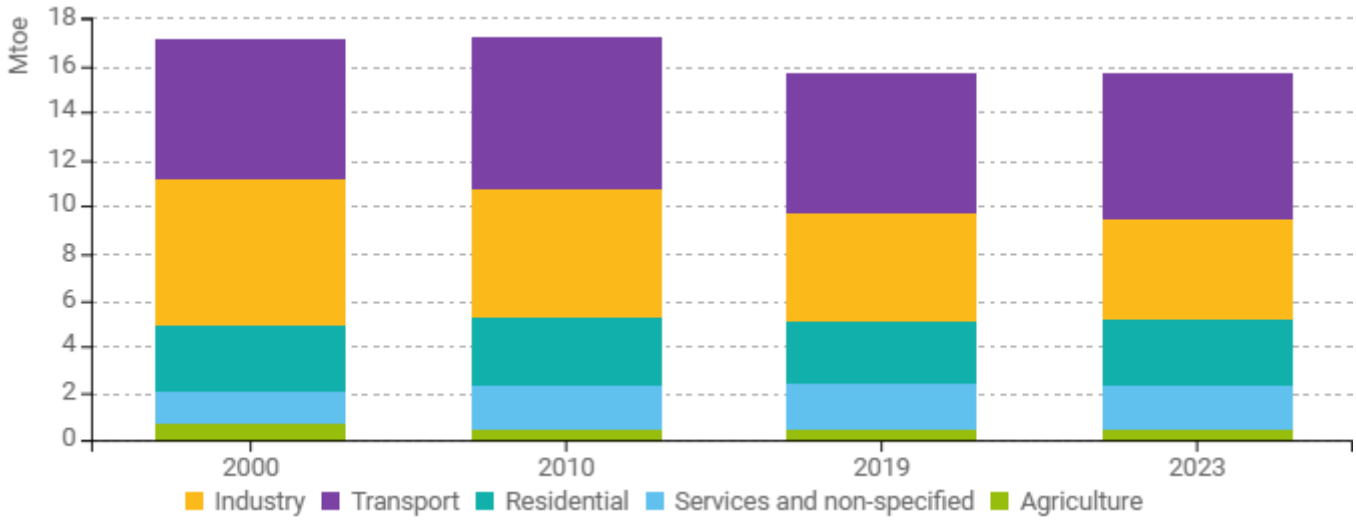
Energy efficiency trends and policies

Overview

In 2023, Portugal's final energy consumption was 15.6 Mtoe, marking a 1.5% (0.2 Mtoe) increase compared to the previous year. There was a reduction of 1.6 Mtoe at an annual rate of decrease of 0.7% in relation to 2010, and a reduction of 0.1 Mtoe at an annual rate of decrease of -0.1%, between 2019 and 2023. The transport sector remained the largest consumer in 2023, accounting for 39% of final energy consumption — up 1.7 percentage points since 2010 — followed by the industry sector with 28%, which saw a reduction of 4.1 percentage points since 2010 and was the only sector to record a reduction compared to the previous year. Next comes the residential sector, accounting for 18% of total final consumption, with a slight increase of 0.6 percentage points compared to 2010. This is followed by services, accounting for 12% of total consumption, with an increase of 1.2 percentage points compared to 2010. Finally, the agricultural sector accounts for 3% of final energy consumption, with a slight increase of 0.5 percentage points between 2010 and 2023.

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



Source: ODYSSEE

The technical energy efficiency index (ODEX) for end consumers in Portugal has improved by 11 percentage points since 2010, corresponding to an annual increase at a compound rate of 1.1%. The residential sector recorded the greatest gains in energy efficiency during the period, with an improvement of 21 percentage points, equivalent to a positive variation of 2.4%/year. This is followed by industry with an increase in energy efficiency of 13 percentage points and a positive variation of 1.3%/year. The transport sector showed a gain of six percentage points, corresponding to a positive annual variation of 0.6%. Finally, the services sector recorded an improvement of five percentage points, equivalent to an annual variation of 0.4%.

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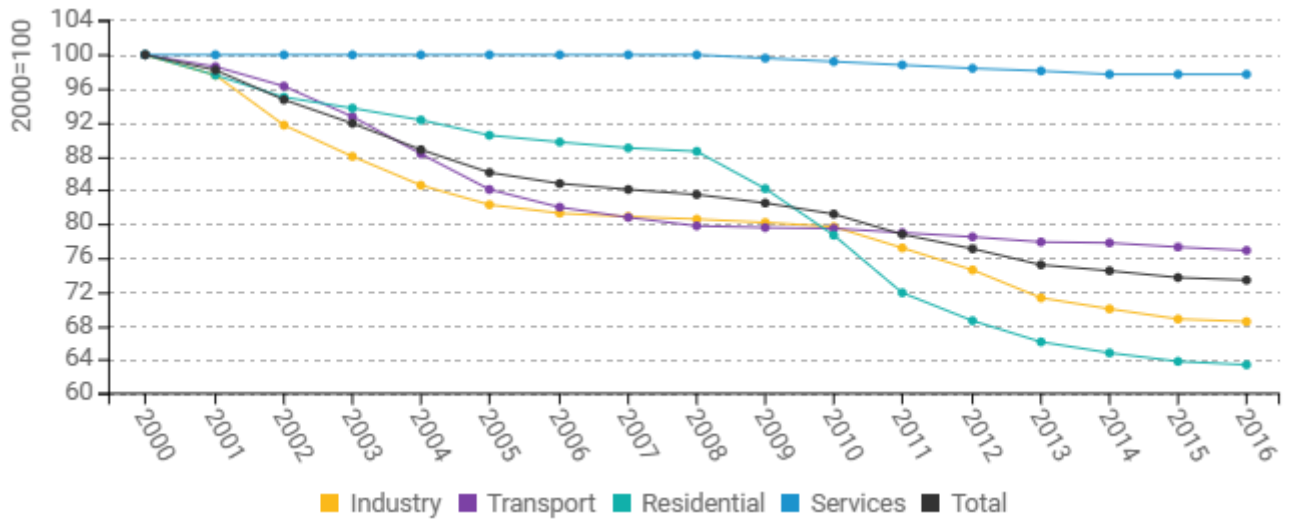
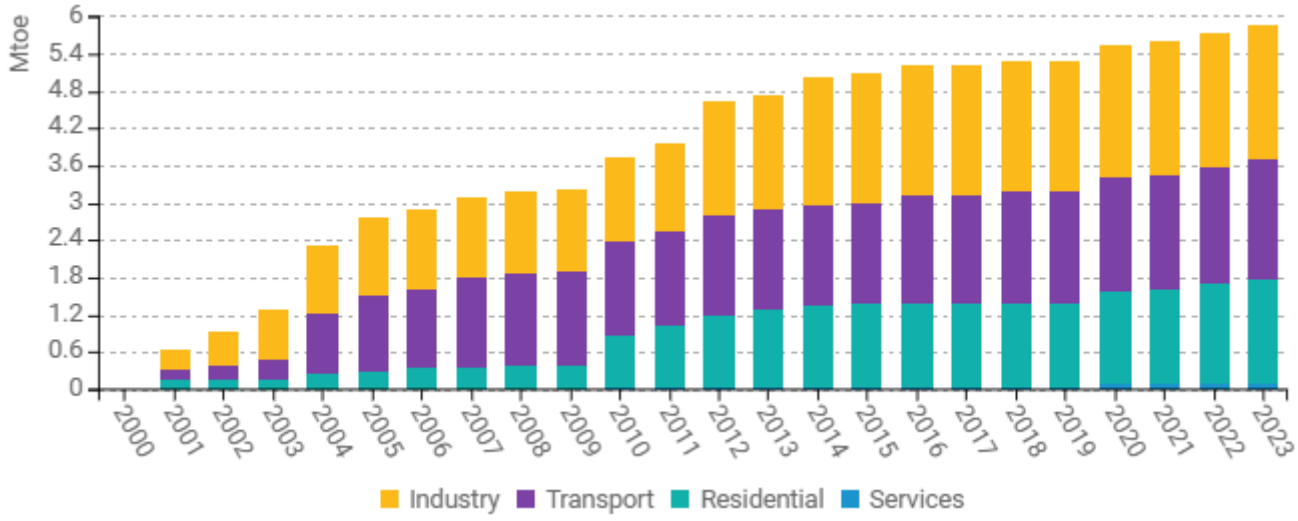
Figure 2: Technical Energy Efficiency Index



Source: ODYSSEE

In 2023, cumulative energy savings totalled 5.9 Mtoe since 2000. In 2023, industry was the sector that recorded the highest energy savings, reaching 2.2 Mtoe, which represents 37% of total savings. This figure is in line with the downward trend in final energy consumption in this sector, as shown in Figure 1. However, according to industrial production statistics for 2023, industrial production in Portugal in 2023 decreased by 2.1% in nominal terms compared to 2022, with part of the decline justified by price stabilisation. However, this contraction in production may have contributed to lower energy consumption and, consequently, to greater savings in the sector.This is followed by the transport sector with savings of 1.9 Mtoe, corresponding to 33% of total savings, followed by the residential sector, which achieved 1.7 Mtoe of energy savings, accounting for 28% of total savings. Services come last, with savings of 0.1 Mtoe, corresponding to 2% of total savings.

Figure 3: Energy savings by sector



Source: Odyssee

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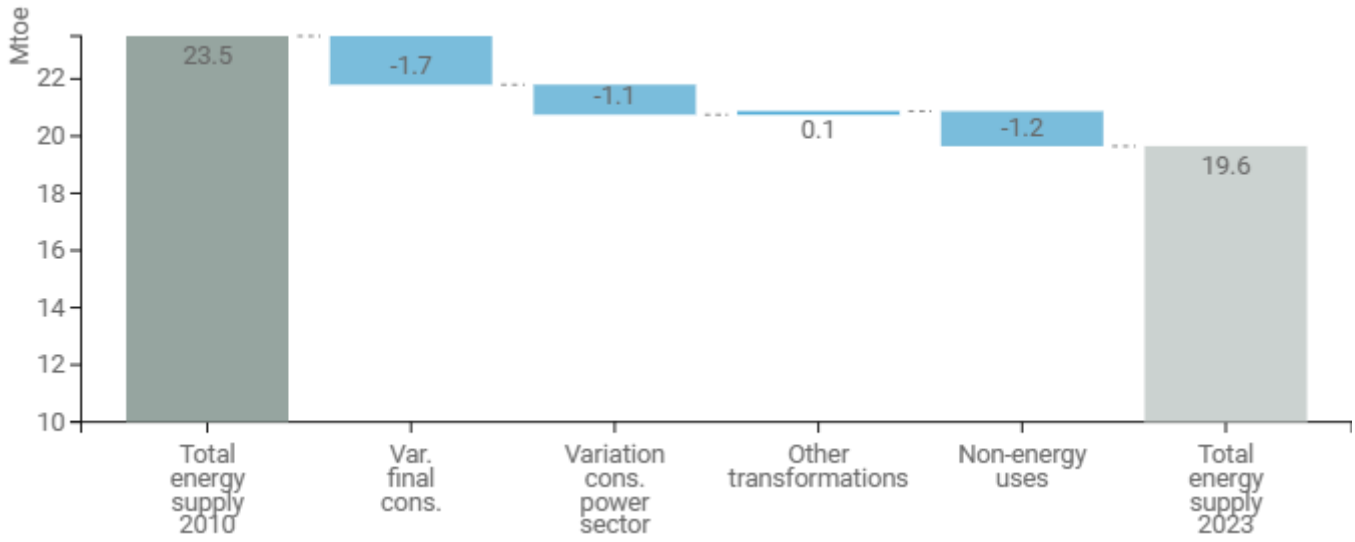
There has been a reduction of 1.7 Mtoe in total energy supply between 2010 and 2023. The main factors explaining this decrease are related to changes in consumption and transformation flows in the energy sector, as well as the reduction in non-energy uses of fossil fuels.These variations result mainly from changes in the national energy mix, namely the sharp decrease in electricity production from fossil fuels and the significant increase in renewable production, particularly hydro and photovoltaic.

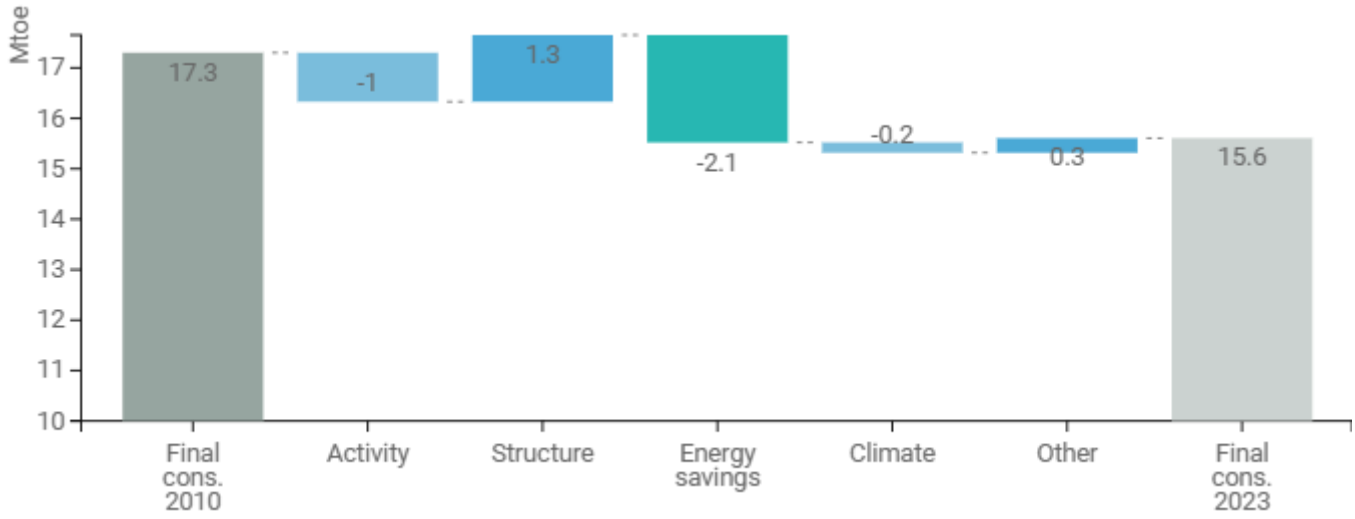
Figure 4: Main drivers of the total energy supply variation



Source: Odyssee

With regard to final energy, there was a reduction of 1.7 Mtoe between 2010 and 2023, resulting from increased energy savings in various sectors and a change in activity, which may be due mainly to the decline in industrial production. There is also a small decrease due to climatic effects, which is mainly reflected in the residential and services sector (0.2 Mtoe).

Figure 5: Main drivers of the final energy consumption variation



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Source: Odyssee

Portugal's energy transition is driven by three key cross-cutting measures: the National Electricity System, the Recovery and Resilience Plan (PRR) and ECO.AP 2030. Decree-Law No. 15/2022 establishes the organization and functioning of the National Electricity System (SEN), ensuring the paradigm shift of the SEN and its evolution towards a decentralized model that encompasses local production, self-consumption solutions, active management of smart grids and ensures the active participation of consumers in the markets. The PRR (2021-2026), established by Decree-Law No. 29-B/2021, directs European funds to promote sustainable growth through structural reforms and investments. It focuses on improving energy efficiency, promoting renewable energy and reducing GHG emissions. ECO.AP 2030 establishes that, by 2030, the Public Administration must reduce primary energy consumption by 40%, ensure that 10% of its energy consumption is supplied by renewable self-consumption and reduce water and material consumption by 20% compared to 2019; reduce total final energy consumption by at least 1.9% annually compared to 2021 and, from 2024 onwards, renovate at least 3% per year of the total area of public buildings, transforming them into nearly zero-energy or zero-emission buildings.

Table 1: Sample of cross-cutting measures

Measures	NECP measures	Description	Expected savings, impact evaluation
The Portuguese Recovery and Resilience Plan (RRP)	Yes	he Decree Law (DL) No. 29-B/2021 of 4 May 2021 established the governance model of European funds allocated to Portugal through the Recovery and Resilience Plan (RRP), under the Recovery and Resilience Facility (RRF) of the EU for the period 2021-2026. The plan considers three dimensions (resilience, climate transition and digital transition). There are six strategic areas within the climate transition dimension: sea; decarbonization of industry; sustainable bioeconomy; energy efficiency in buildings; hydrogen and renewables; and sustainable mobility. Additionally, a REPowerEU chapter has been added by the revised RRP and impacts some of the strategic areas previously identified. Total cost of the revised RRP is 22,216 M€ and it meets the threshold regarding the principle of climate integration with 41.2% of its global investment allocated to climate transition objectives.	
Resource Efficiency and Decarbonisation Programme in Public	Yes	ECO.AP 2030 replaces the previous Energy Efficiency Program in Public Administration. With this program, the State is taking the lead as a model in adopting measures to improve energy efficiency and other resources, setting a series of objectives and targets that contribute to the decarbonization, and energy transition of the activities carried out by the Public Administration. ECO.AP 2030 is	

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Administration (ECO.AP 2030)		more ambitious and presents measures to reduce energy, water and material consumption and the respective greenhouse gas (GHG) emissions from buildings, equipment, fleets and infrastructure, including electric mobility infrastructure, and energy production capacity and energy storage solutions managed or used by public administration entities.	
Decree-Law no. 15/2022 - National Electricity System	Yes	The Decree-Law no. 15/2022 establishes the organization and functioning of the National Electricity System (SEN) adapting to the needs and challenges posed by the strategic instruments that guide the energy policy of the European Union and Portugal. It also establishes the legal framework applicable to self-consumption of renewable energy, individually, collectively or by renewable energy communities and energy storage. In 2023 the total installed power in Portugal was 24,707 MW, with 75.8% corresponding to renewable energies, an increase of 7.4% regarding to 2022. The amount of energy produced by renewable energy in 2023 was 37,102 GWh.	3.06 PJ; 90.94 kt CO2

Source: MURE

Buildings

In 2023, final energy consumption associated with buildings (adjusted for climatic conditions) stood at 4.7 Mtoe. The residential sector accounted for 2.8 Mtoe (59%) and services for 1.9 Mtoe (41%). In the period 2010-2019, there was a slight downward trend in the residential sector of around -0.9%/year, with a new increase between 2019 and 2023, at a positive rate of 0.7% per year. Services showed the opposite behavior, with a slight increase in the period 2010-2019 (+0.4%/year), followed by a downward trend between 2019 and 2023, of -0.6%/year. The reduction observed can be attributed to building renovations, with improvements in energy efficiency, while the most recent slight upward trend may be due to an increase in building occupancy and a change in behaviors and lifestyles, through the intensified use of electrical appliances and heating.

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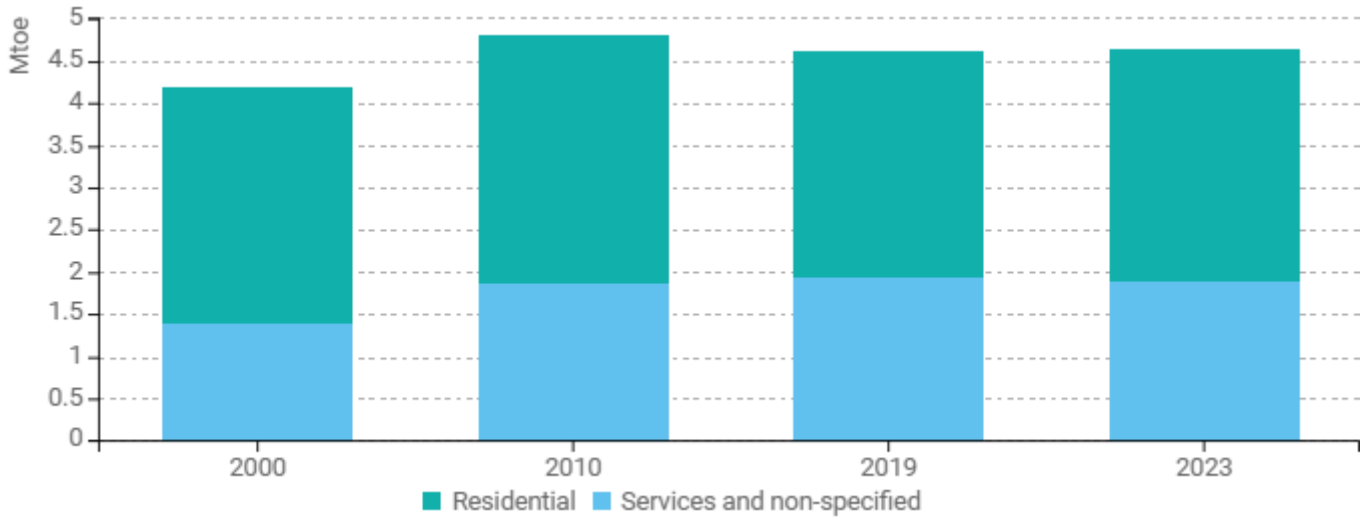
Figure 6: Final energy consumption in buildings (with climatic corrections)



Source: Odyssee

In 2023, energy consumption in the residential sector stood at 2.8 Mtoe, 0.1 Mtoe lower than in 2010. There was also a slight reduction compared to 2022 (-2.5%), but an increase of 0.1 Mtoe compared to 2019. The distribution of consumption by end use shows a similar pattern to that seen in the previous periods of 2010 and 2019, but with some variations. There were decreases in consumption related to meal preparation, accounting for 34% of total residential consumption, water heating (16% of total consumption) and lighting (2% of total consumption), and increases in consumption due to air conditioning, heating mode, which accounts for 27% of total consumption, and the use of household appliances (20% of total consumption). Compared to 2010, there was an increase of 8 percentage points in the contribution of air conditioning, heating mode, and 6.1 percentage points in the use of household appliances. Consumption due to meal preparation decreased by 5.4 percentage points, followed by consumption related to water heating, which decreased by 5.2 percentage points. Lighting consumption decreased by 4 percentage points compared to 2010. With regard to air conditioning, the variation is smaller, registering an increase of half a percentage point.

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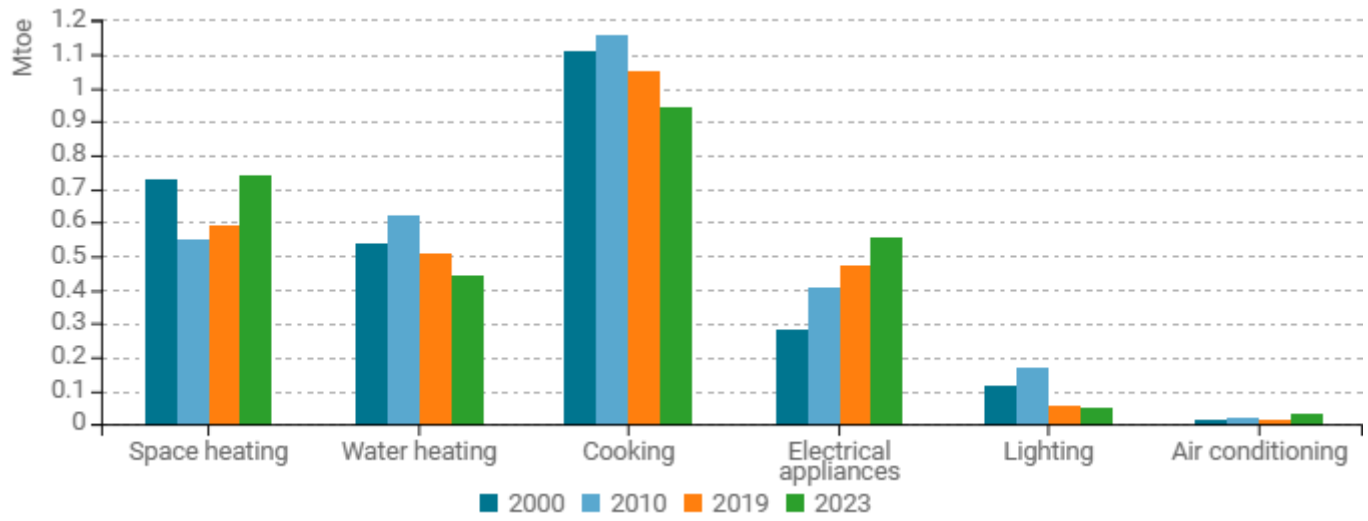
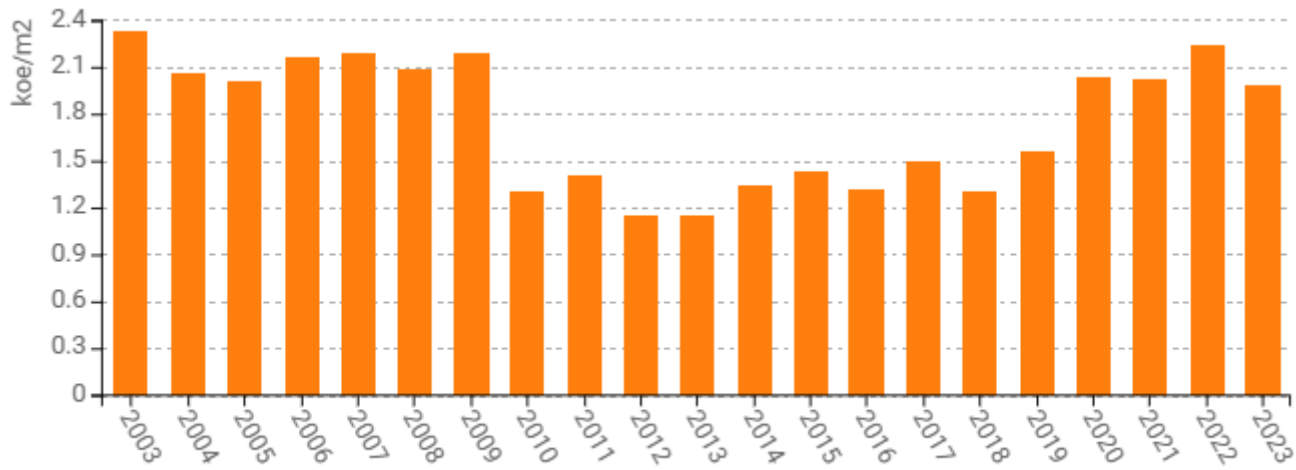
Figure 7: Energy consumption by end-use of households (with climatic corrections)



Source: Odyssee

In 2023, energy consumption per square meter in the residential sector in Portugal for heating (adjusted for climatic conditions) was 2.0 kgep/m2, a reduction of 0.2 Kgep/m2 compared to the previous year. However, there was an increase of 26% compared to 2019 and 52% compared to 2010, representing an annual growth rate of 3.3% since 2010 and 6.0% since 2019.

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



Source: ODYSSEE

The distribution of consumption for different uses per dwelling, excluding air conditioning in heating mode, shows that the highest consumption is due to meal preparation (47%), followed by the use of electrical appliances and lighting (30%). Consumption due to water heating accounts for 22% and air conditioning, cooling mode, 2%. Since 2010, there has been a downward trend in consumption for water heating of -3%/year and also in consumption

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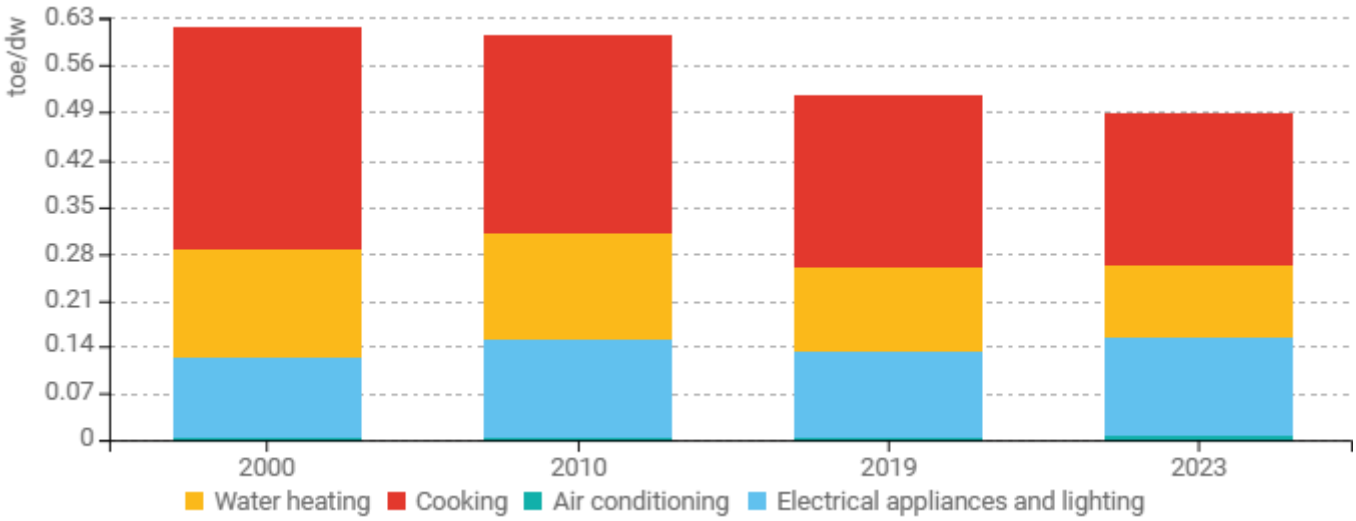
associated with meal preparation, which has fallen by 2%/year. Consumption due to air conditioning, cooling mode, fell by 1.4% per year between 2010 and 2019 and rose sharply, by around 15.9% per year, between 2019 and 2023. Consumption associated with the use of household appliances and lighting fell by 1.4% per year between 2010 and 2019, but the trend reversed in the period 2019-2023, with an increase of 3% per year. Overall, the trends reflect improvements in efficiency and changes in households' energy needs, with higher consumption associated with heating/cooling standing out.

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



Source: ODYSSEE

In 2023, electricity consumption stood at 3,575 kWh/dwelling, an increase of 5.1% over the previous year. With regard to the distribution of electricity consumption by end use and per dwelling, half of total consumption is due to thermal uses (air conditioning, heating, water heating, meal preparation), followed by the use of electrical appliances, with 44%. Lighting and air conditioning account for 4% and 3% of total household electricity consumption, respectively. Until 2019, all uses, except for electrical appliances, showed an annual decrease, but from 2019 onwards, the trend is for growth in all uses, except lighting, confirming the trend already recorded in the final energy consumption of buildings (Figure 6). Consumption associated with air conditioning will see the largest annual increase in the period 2019-2023, at a growing rate of 15.9%/year, followed by the use of household appliances with a growth of 3.7%/year. Thermal uses show a smaller increase of 1.1% per year, and lighting shows a contrary trend of reduction, in the order of 3.6% per year for the period 2019-2023. The trend towards higher electricity consumption in homes is mainly due to the electrification of consumption, confirmed by the massive uptake of the latest financing program promoted by the Environmental Fund, E-lar, for the replacement of gas appliances with more efficient electric ones. Also noteworthy are changes in lifestyles related to greater ownership of electrical appliances and increased cooling needs.

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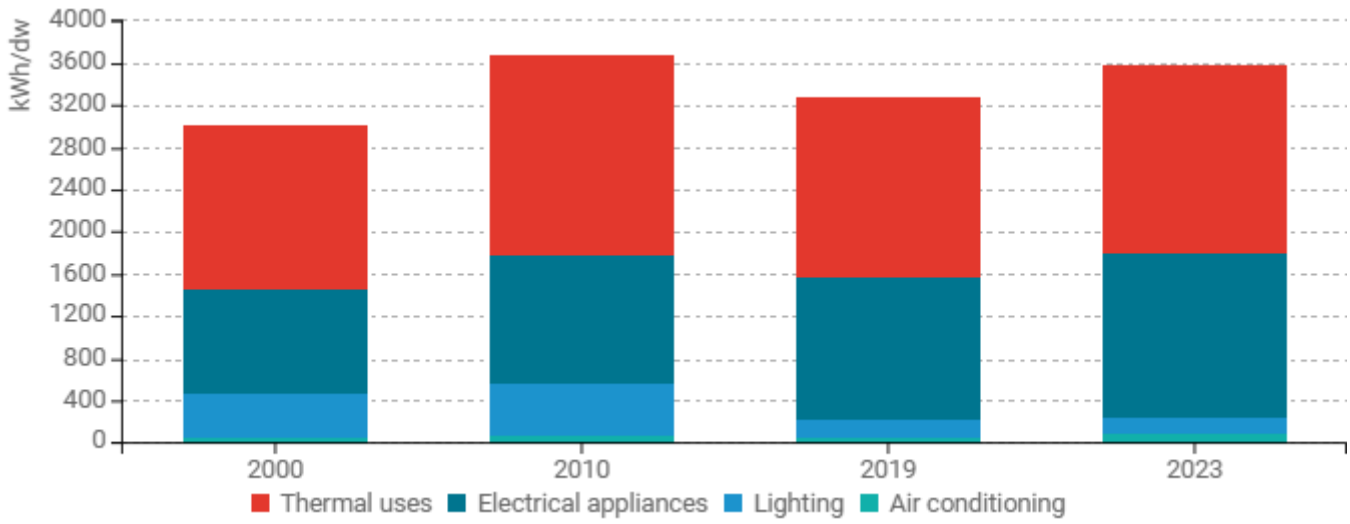
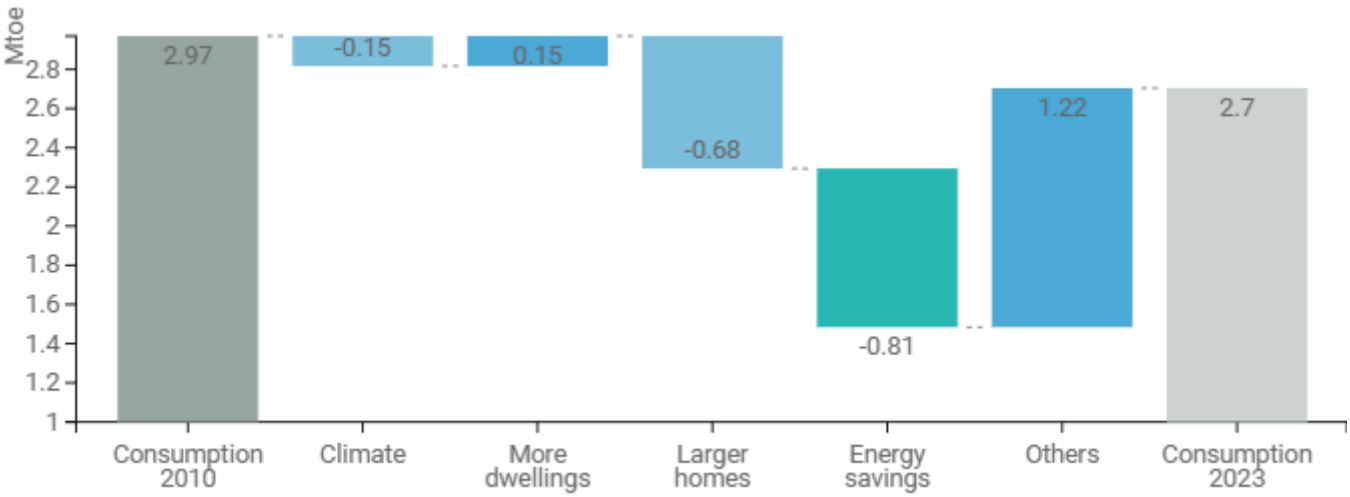
Figure 10: Electricity consumption per dwelling by end-use (with climatic corrections)



Source: Odyssee

There was a reduction of 0.27 Mtoe in energy consumption in households between 2010 and 2023. The main factor behind this reduction was the savings achieved through greater energy efficiency in households.

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



Source: ODYSSEE

Between 2010 and 2023, energy consumption for heating in homes increased by 0.06 Mtoe. The main factor is the increased penetration of central heating.

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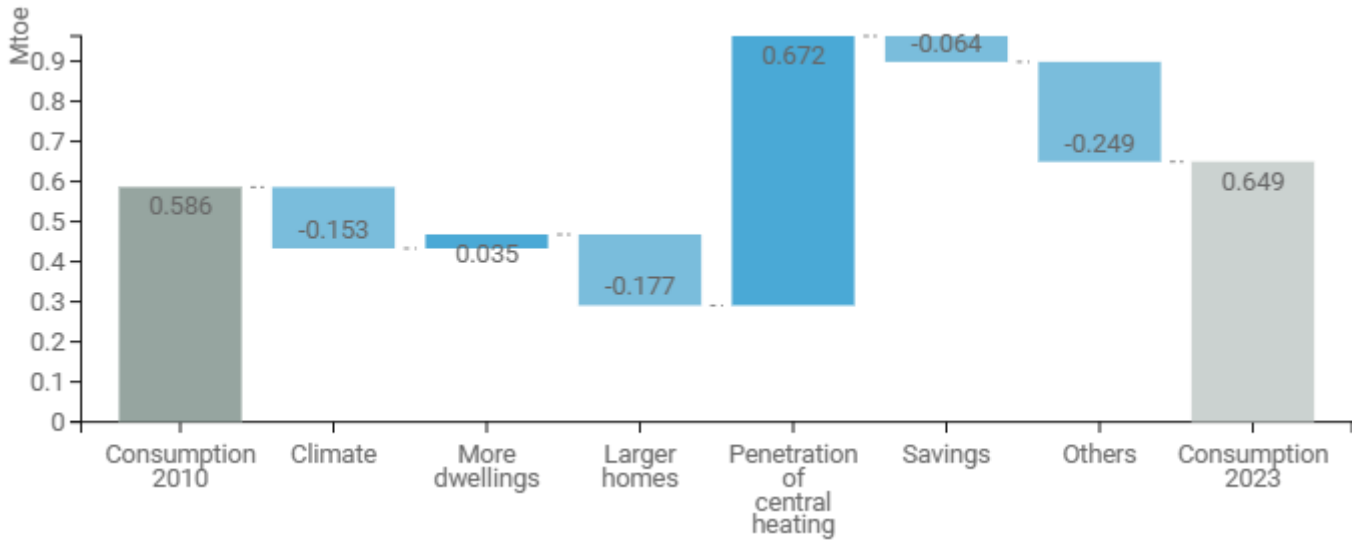
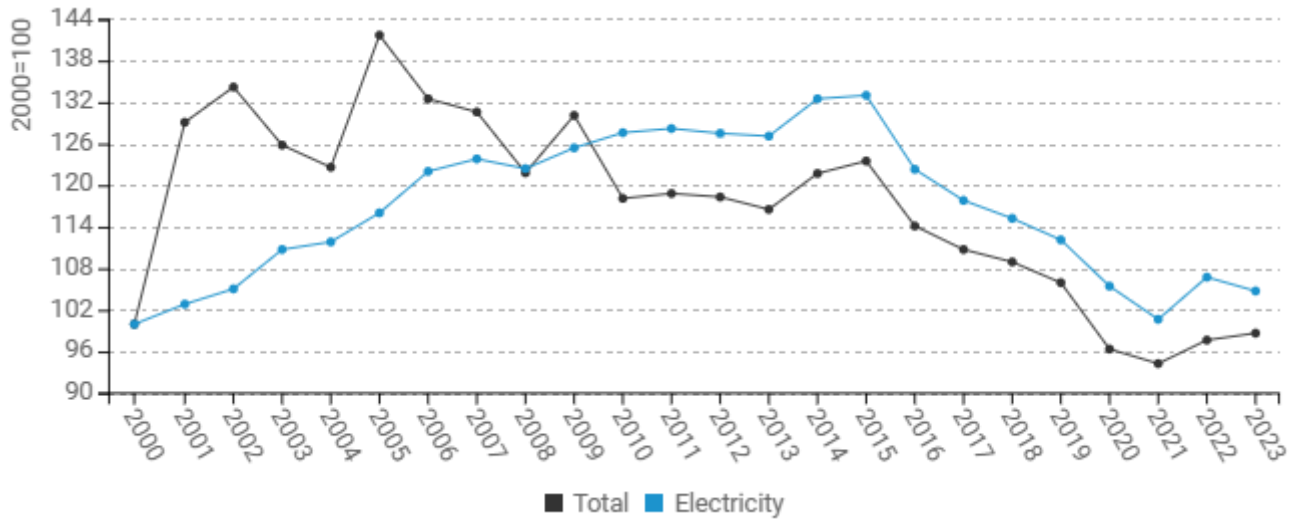
Figure 12: Main drivers of the space heating consumption variation of households



Source: Odyssee

In 2023, in the services sector, energy consumption per employee rose slightly by 1% compared to 2022, standing at 0.5 toe/employee. However, there was a reduction of around 1.4%/year compared to 2010 and 1.8%/year compared to 2019. In terms of electricity consumption per employee, the figure was 4485 kWh/employee, a decrease of 1.9% compared to 2022. Compared to previous periods, there was a reduction of 1.4%/year and 1.7%/year compared to 2010 and 2019, respectively, in line with the trend already noted in relation to energy consumption.

Figure 13: Energy and electricity consumption per employee in services (with climatic corrections)



Source: ODYSSEE

Decree-Law no. 101-D/2020 of 7 December 2020 establishes the requirements applicable to buildings to improve their performance energy and regulates the Energy Certification System for Buildings in line with the Energy

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Performance of Buildings Directive (EPBD). The Energy Certification System aims to accelerate the renovation of the national building stock, ensuring compliance with NZEB (Nearly Zero-Energy Buildings) requirements, enhancing energy efficiency, and fostering the integration of renewable energy sources. The Financial Instrument for Urban Rehabilitation and Revitalization (IFRRU 2020) was established by the Council of Ministers Resolution (RCM) no. 84-O/2016, of December 30th, with the aim of bringing together different sources of funding to support urban rehabilitation and Revitalization in a financial instrument. IFRRU 2020 therefore supports investments in urban renewal, across the entire Portuguese territory.

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

Measures	NECP measures	Description	Expected savings, impact evaluation
Financial Instrument for Urban Rehabilitation and Revitalisation (IFRRU 2020)	Yes	This program combines different financial sources and creates one main instrument that provides funds for renovation measures and supports easy-to-access conditions. There are no restrictions related to the nature of the entity requesting the financing or the future use of the renovated building. The measure also aims to promote urban sustainability and improve people's quality of life in the cities.	2.6 PJ
Decree-Law No. 101-D/2020 – Energy Certification System for Buildings	Yes	The Energy Certification System sets requirements for the design and renovation of buildings. These requirements improve their energy performance and ensure that modernisation and renovation meet applicable requirements.	

Source: MURE

Transport

In 2023, the transport sector accounted for 39% of total final energy consumption (6.2 Mtoe), an increase of 6.3% compared to 2022, with road transport continuing to account for 95% of this consumption. In road transport, there was an increase in consumption in all modes compared to the previous year, with a greater increase in consumption by motorcycles. Consumption due to domestic air transport increased by 15.1% compared to 2022, representing 3% of the sector's total final energy consumption. Rail transport maintained its 1% share, with an 8.7% increase in consumption compared to the previous year. Inland waterway transport recorded a 9.8% decrease and currently accounts for 1% of the sector's total consumption.

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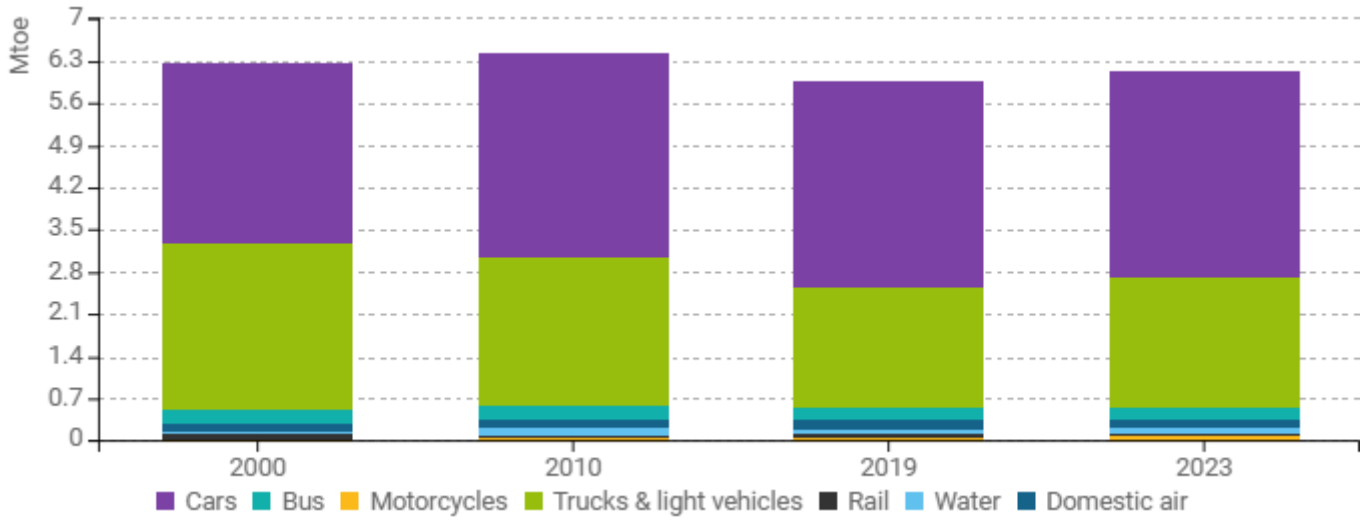
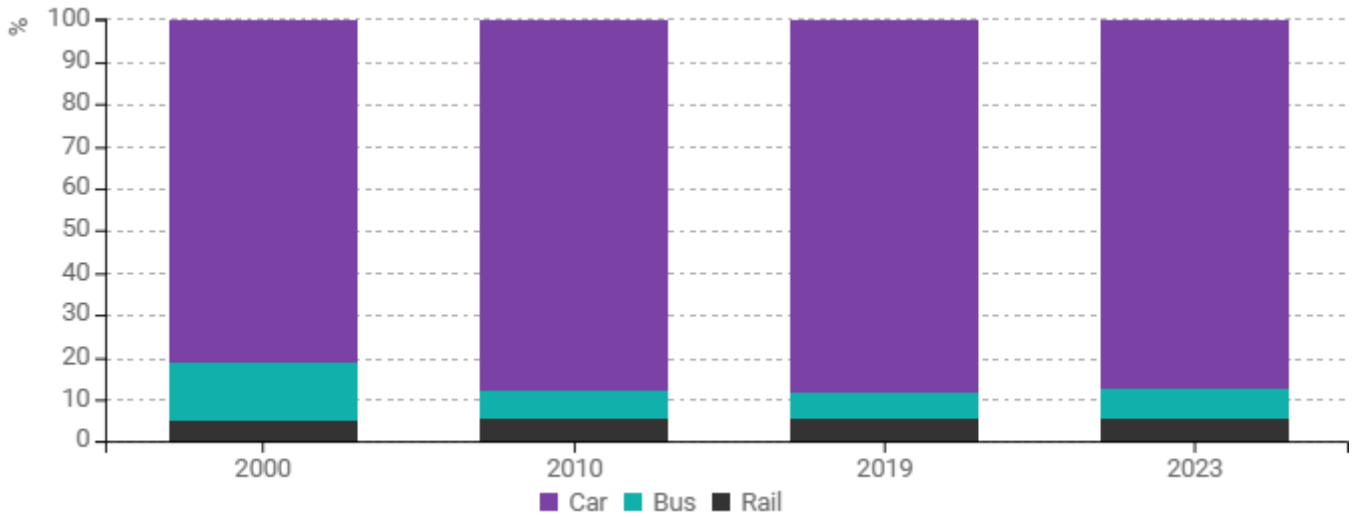
Figure 14: Transport energy consumption by mode



Source: ODYSSEE

In 2023, the car remains the main means of transport, accounting for 87% of domestic passenger traffic, an increase of 4.1% compared to 2022. Public transport will perform similarly to previous periods, with 7% of traffic attributed to road passenger transport, an increase of 3.5% compared to 2022. Rail transport accounts for 5% of traffic, an increase of 11.9% compared to the previous year. All modes of transport continue to show a growth trend, following the declines seen in 2020 caused by the pandemic.

Figure 15: Modal split of inland passenger traffic



Source: ODYSSEE

Overall freight traffic has seen a significant decline in road transport, with a decrease of 1.9 Gtkm compared to 2022 (-12%), while rail traffic has seen a slight increase of 0.1 Gtkm (+3.3%). However, road transport remains the largest mode of transport, accounting for 86% of freight traffic, with rail transport accounting for 14%.

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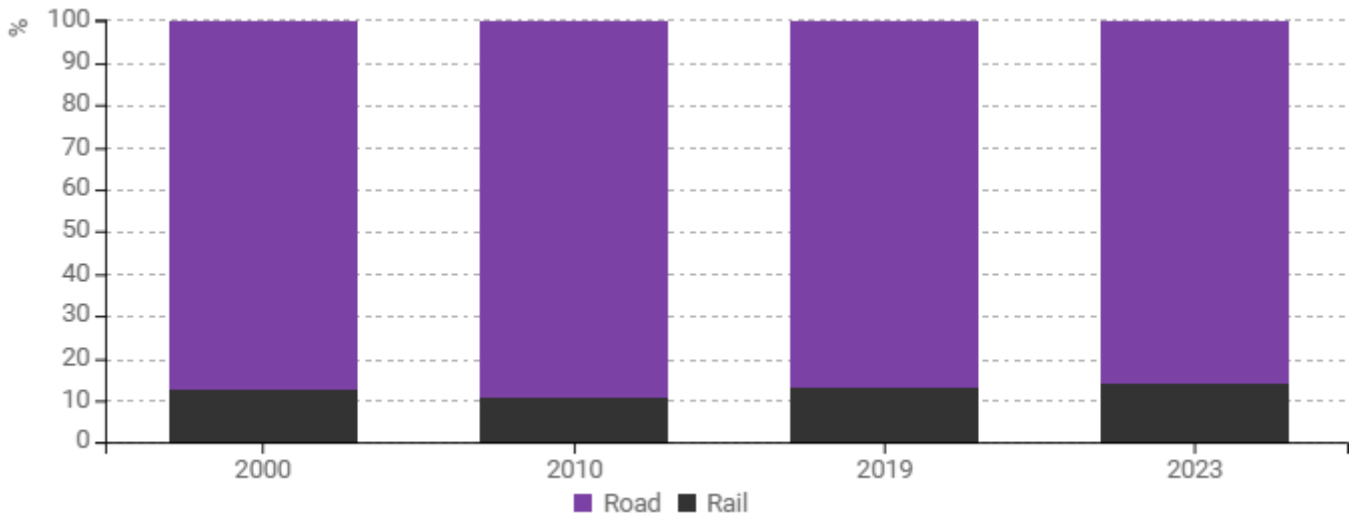
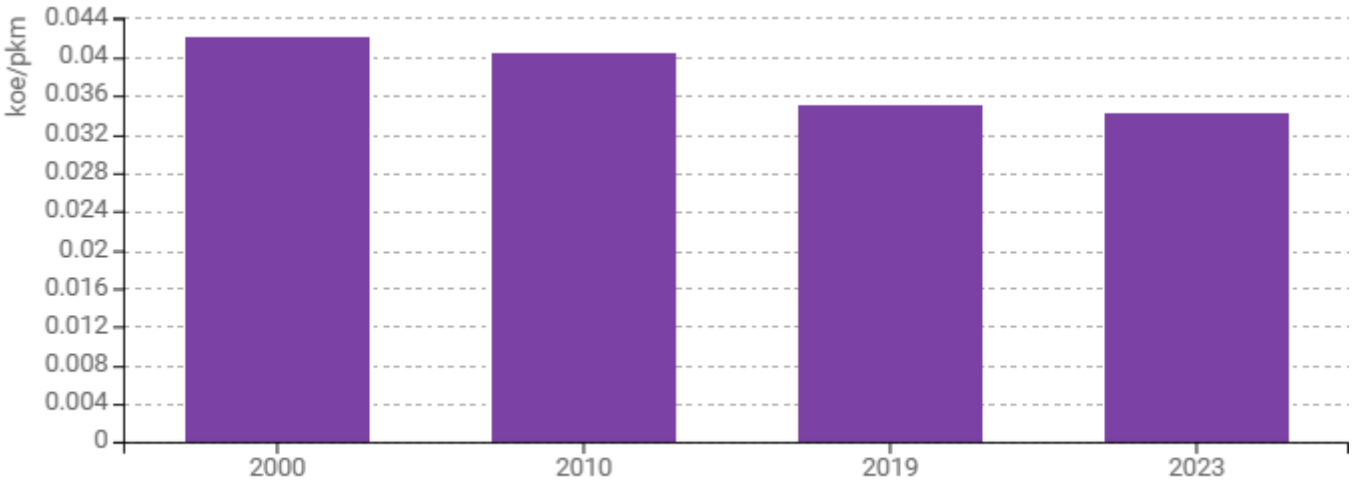
Figure 16: Modal split of inland freight traffic



Source: ODYSSEE

The energy consumption of cars, per passenger-kilometre, stands at 0.034 kep/pkm. There has been a gradual decline since 2000, with an annual decrease of 1.3% since 2010.

Figure 17: Energy consumption of cars per passenger-km



Source: ODYSSEE

Since 2010, energy consumption in the transport sector has dropped by 0.32 Mtoe, falling from 6.5 to 6.2 Mtoe. This reduction is mainly attributed to energy savings due to technological changes that have brought greater efficiency, as well as other factors such as the effect of the pandemic.

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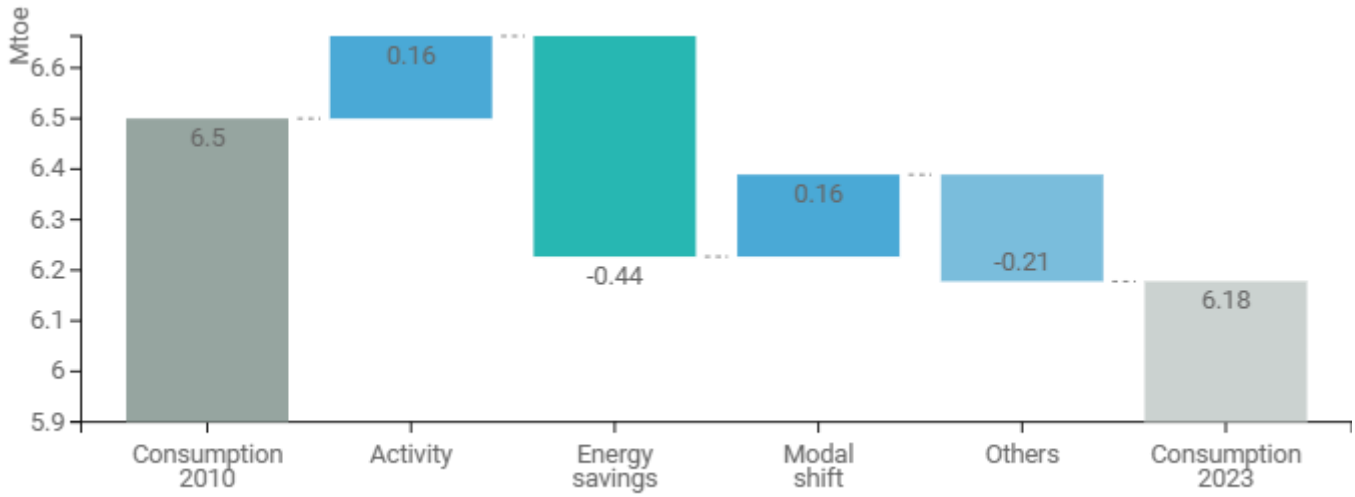
Figure 18: Main drivers of the energy consumption variation in transport



Source: ODYSSEE

Ordinance No. 228/90, of 27 March, approved the Energy Consumption Management Regulation for the Transport Sector (RGCEST), aimed at improving energy efficiency in this sector. It applies to transport companies and companies with their own energy-intensive fleets whose energy consumption during the previous year exceeded 500 toe and sets targets for the progressive reduction of specific energy consumption.

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

Measures	NECP measures	Description	Expected savings, impact evaluation
Regulation for Energy Management in the Transport Sector	Yes	The RGCEST is directed to fleet managers and vehicle fleets with an annual fuel consumption above a predetermined threshold (the current Regulation sets it at 500 toes). These fleets must conduct an audit procedure (that should be performed, at least, once every 3 years) and elaborate rationalization plans (PREn) to reduce their specific energy consumption indicators or improve the energy intensity of the fleet.	

Source: MURE

Industry

In 2023, the industrial sector accounted for 28% of total final energy consumption, totalling 4.3 Mtoe. Since 2010, there has been a gradual reduction in consumption of around 1.8% per year. The paper, pulp and printing industries consume 1.3 Mtoe of final energy, representing 30% of the industrial sector's energy consumption. This sector grew between 2010 and 2019, but consumption is expected to decline between 2019 and 2023, at a rate of -1.6% per

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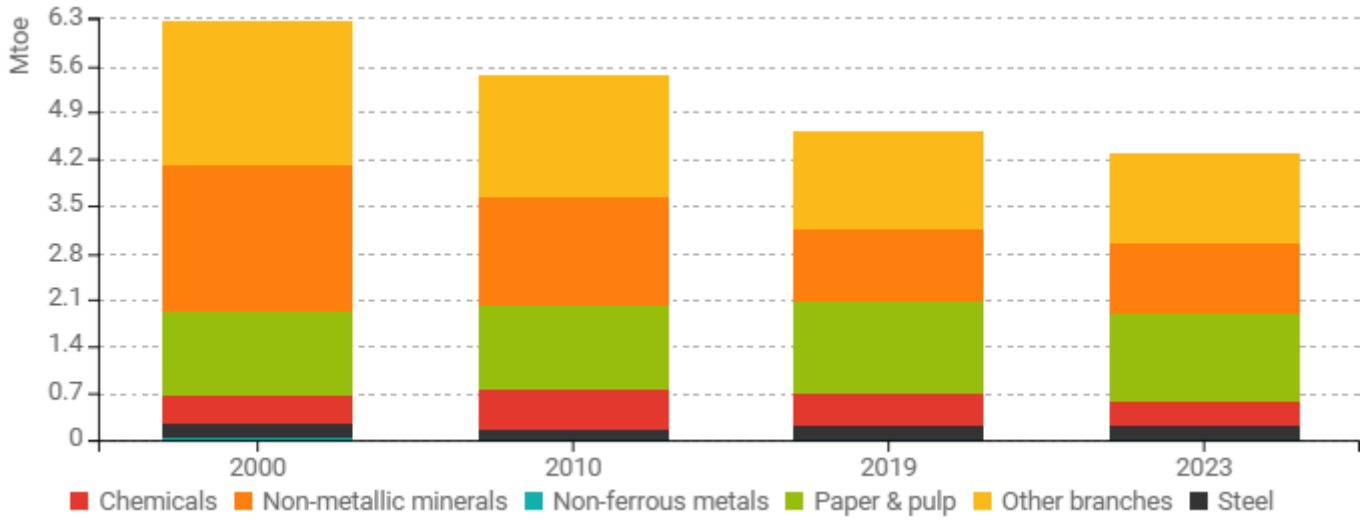
year. The non-metallic minerals industry accounted for 24% of industrial energy consumption in 2023, maintaining the downward trend at a rate of -3.2%/year since 2010. The chemical industry accounted for 9% of the total, marking a decrease compared to the previous year and confirming the decline since 2010, with an annual variation of -3.3%/year. The steel and non-ferrous metals industries contributed 4% and 1%, respectively. The steel industry, after showing growth in the period 2010-2019, recorded a decrease in the period 2019-2023, at a rate of -1.8%/year. There is also a decrease in the non-ferrous metals industry compared to 2022, of -4.8%. However, this industry maintains a positive annual variation in the period 2010-2023 of +0.9%/year. It should also be noted that other unspecified industries account for 32% of total final energy consumption. Consumption in other industries shows a downward trend, with a negative annual variation of 2.1%/year in the period 2010-2023.

Figure 19: Final energy consumption of industry by branch



Source: ODYSSEE

With regard to energy-intensive industries, since 2000 there has been a trend towards reducing energy consumption per unit produced. However, while crude steel production continues this trend, with a 7.5% reduction in energy consumption per unit of crude steel in 2023 compared to 2022, the paper industry recorded a 10.7% increase over the same period.

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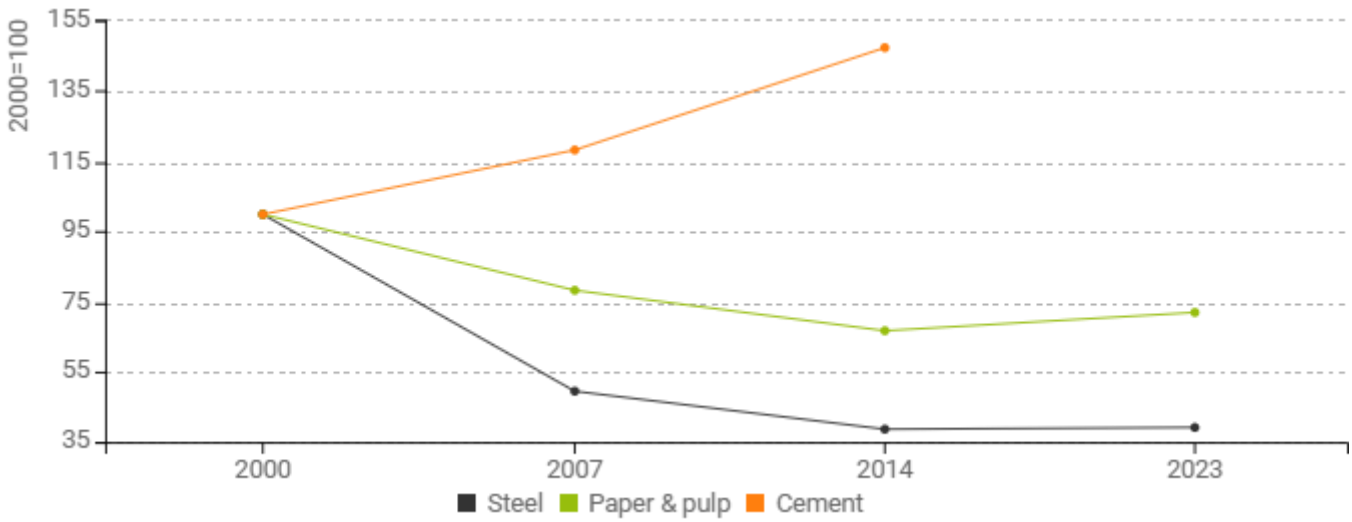
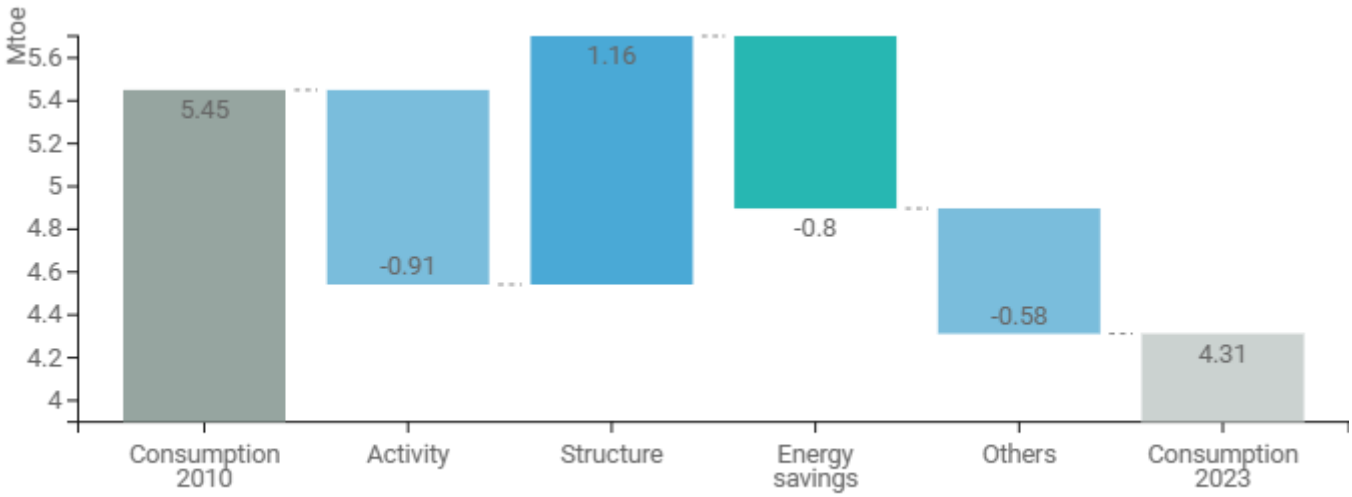
Figure 20: Unit consumption of energy-intensive products (toe/t)



Source: ODYSSEE

The reduction in energy consumption in the industrial sector in the period 2010-2023 was 1.14 Mtoe, mainly attributed to the decline in industrial activity (-0.91 Mtoe), energy savings achieved through the adoption of more efficient technologies (-0.8 Mtoe) and also to the contribution of other factors such as structural changes within branches, towards energy intensive products, which contributed to a reduction of 0.58 Mtoe.

Figure 21: Main drivers of the energy consumption variation in industry



Source: ODYSSEE

The intensive energy consumption management system (SGCIE), established by Decree-Law No. 71/2008 of 15 April 2008, applies to all companies and facilities with an annual consumption of over 500 toe/year, imposing binding energy audits, with an 8-year periodicity. Intensive energy users are obliged to elaborate and execute energy

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consumption rationalisation plans (PREn), establishing targets for energy and carbon intensity and specific energy consumption, which also outlines energy rationalisation measures.

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

Measures	NECP measures	Description	Expected savings, impact evaluation
Intensive Energy Consumption Management System (SGCIE)	Yes	The objective of SGCIE is to promote the increase of energy efficiency through the modification of production processes, the introduction of new technologies and behaviour changes. The SGCIE applies to all companies and facilities (also named "Operators") that have an annual consumption of over 500 toe/year, imposing binding energy audits, with an 8-year periodicity. Intensive energy users are obliged to elaborate and execute energy consumption rationalisation plans (PREn), establishing targets for energy and carbon intensity and specific energy consumption, which also outlines energy rationalisation measures. By the end of each PREn period, operators must reduce their target indicators – energy intensity and specific energy consumption – by 4% or 6% depending on if they have reference energy consumptions over 500 toe/year or under 1000 toe/year respectively. They also must, at least, maintain carbon intensity.	5.85 PJ

Source: MURE

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