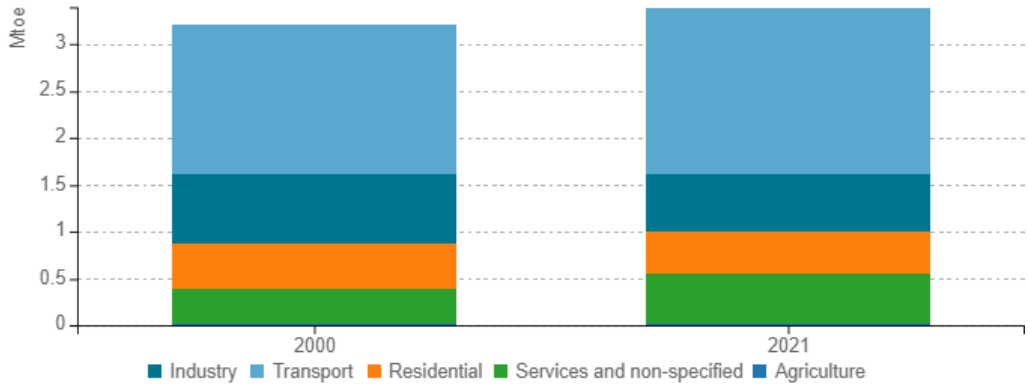
Energy efficiency trends and policies

Overview

Luxembourg's energy balance is dominated by the transport sector, due to its central location and attractive fuel prices. Although the importance of this sector has increased over the years, consumption in 2021 (1.77 Mtoe) is almost back to the 2000 level. The shares of the residential and industrial sectors in the energy balance have decreased (from 0.482 to 0.448 Mtoe and from 0.735 to 0.609 Mtoe in 2021) due to energy efficiency gains and structural changes. Only the tertiary sector faces a sharp increase, given the continuing growth in population and GDP (from 0.377 to 0.528 Mtoe in 2021).

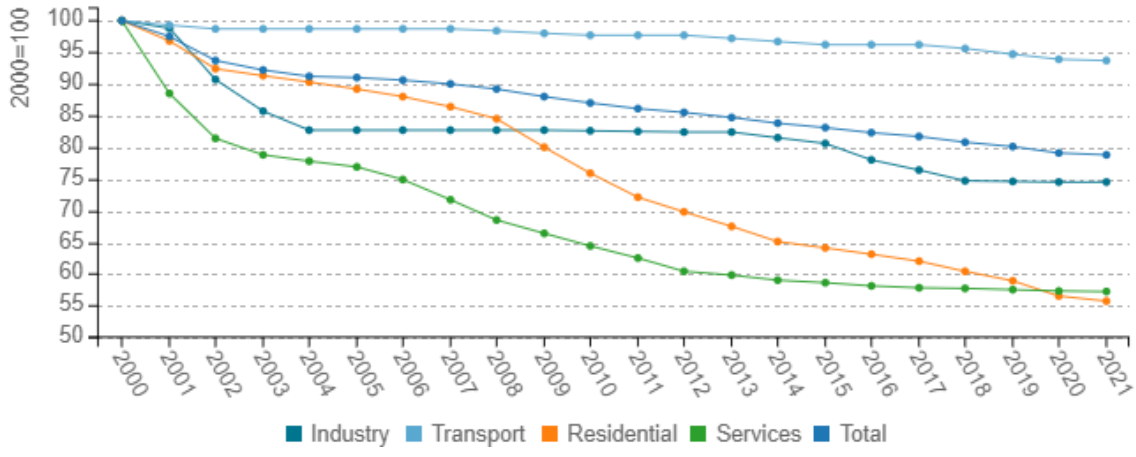
Figure 1: Final energy consumption by sector (normal climate)



Source: ODYSSEE

The gradual introduction of energy efficiency measures has led to significant improvements in ODEX since 2000. In the residential sector, only new buildings with near-zero energy consumption have been permitted since 2017. The renovation of existing buildings continues to be subsidized, with enhanced minimum requirements. In industry, the renewed voluntary agreement between the government and Fedil promotes energy efficiency among major energy consumers through quantified targets and energy management systems. In the transport sector, the implementation of fiscal measures since 2017 has led to improvements in road transport. Finally, the obligation mechanism has enabled significant energy savings since 2015 in all sectors.

Figure 2: Technical Energy Efficiency Index



Source: ODYSSEE

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The Energy Efficiency Obligation Scheme is one of the most ambitious cross-cutting measure implemented in Luxembourg in the field of energy efficiency. It was designed according to the article 7 of the Energy Efficiency Directive 2012/27/EC and was introduced in 2015 for a first period covering the years 2015 to 2020. The measure is intended to provide energy savings in every sector (buildings, industry, and some cases in transport) and with every energy vector. The mechanism was revised in 2021 for the second period covering the years 2021 to 2030. Electricity and natural gas suppliers are still the obliged parties in this mechanism. To make it easier for "small" suppliers to meet their obligations, the revision introduces a "buy-out" option enabling obligated parties to discharge part (up to a maximum of 1,500 MWh per year) of their annual energy-saving obligations by paying a sum equivalent to the investments required to meet those obligations. The 2021 revision also strengthens the obligation by introducing a penalty: obligated parties who fail to meet their annual energy savings targets will be required to pay a penalty (in full discharge of their obligations) imposed by the regulator.

Table 1: Sample of cross-cutting measures

Measures	NECP measures	Description	Expected savings, impact evaluation
GEN-LU4455 Energy Efficiency Obligation Scheme (revision)	yes	The energy efficiency obligation mechanism, introduced in 2015 for a first period covering the years 2015 to 2020, is revised in 2021 for the second period covering the years 2021 to 2030. Electricity and natural gas suppliers are still the obliged parties in this mechanism. To make it easier for "small" suppliers to meet their obligations, the revision introduces a "buy-out" option enabling obligated parties to discharge part (up to a maximum of 1,500 MWh per year) of their annual energy-saving obligations by paying a sum equivalent to the investments required to meet those obligations. The 2021 revision also strengthens the obligation by introducing a penalty that is far more dissuasive than the orderly fine provided for in the mechanism for the first period. Obligated parties who fail to meet their annual energy savings targets will be required to pay a penalty (in full discharge of their obligations) imposed by the regulator. The level of ambition (new energy savings to be achieved each year by obligated parties) has been maintained at the (average) level for the first period.	The overall cumulative target expressed in terms of final energy consumption for the period 2021 to 2030 is 13,750 GWh, equivalent to an average new annual saving of 250 GWh.

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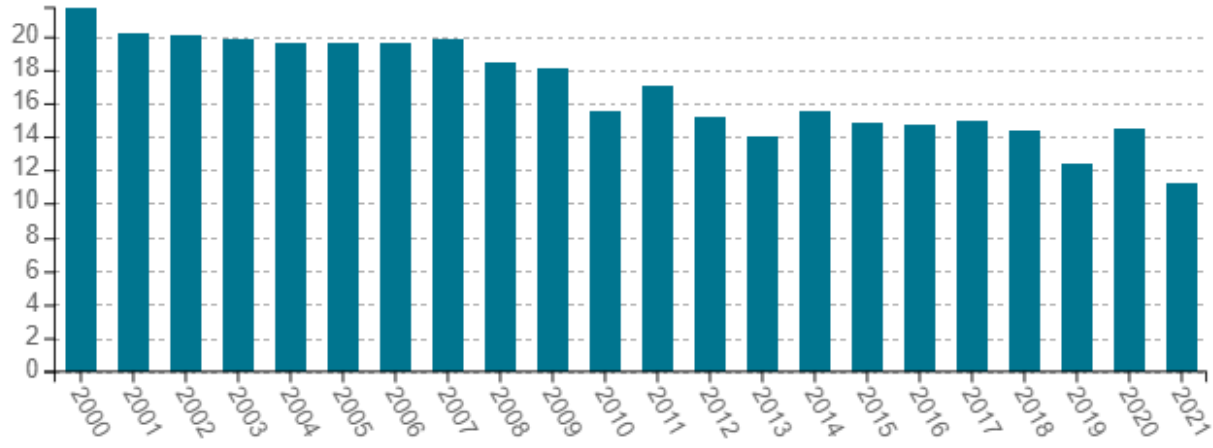
GEN-LU0247 Energy Efficiency Obligation Scheme	yes	All suppliers of electricity and natural gas serving residential, service sector and industrial customers located in Luxembourg are declared obligated parties by law. The obligation applies to all suppliers operating within Luxembourg regardless of the size of their client base. Based on the latest official lists of businesses possessing a supply authorisation in Luxembourg, as maintained by the regulatory agency ('Institut Luxembourgeois de Régulation'), 27 suppliers of electricity and 15 suppliers of natural gas are potentially affected by the obligation (as of January 2017). In fact, only 10 electricity suppliers and 8 gas suppliers received an annual energy savings target for the year 2017. Obligated parties are assigned the public service task ('mission de service public') of achieving the energy savings target imposed on Luxembourg under article 7 of the Directive. To that end, the obligation scheme is defined in Luxembourg law as a service of general economic interest ('service d'intérêt économique général'), which the obligated parties are required to provide.	The energy savings target to be achieved by 31 December 2020 in accordance with article 7 of the Directive was calculated at 5 993 GWh (final energy).

Source: MURE

Buildings

Specific energy consumption has fallen steadily, from 18.5 koe/m2 in 2008 to 11.3 koe/m2 in 2021, due to two main factors: the new building regulations implemented in 2007 and reinforced in 2017, and the evolution of the housing stock towards more energy-efficient housing thanks to a generous but ambitious subsidy program. Energy consumption per end-use per home (excluding heating) has fallen from 0.53 toe/dwelling in 2008 to 0.42 toe/dwelling in 2021. The main improvements concern electrical appliances and lighting.

Figure 3: Energy consumption of space heating per m2 (normal climate)



Source: ODYSSEE

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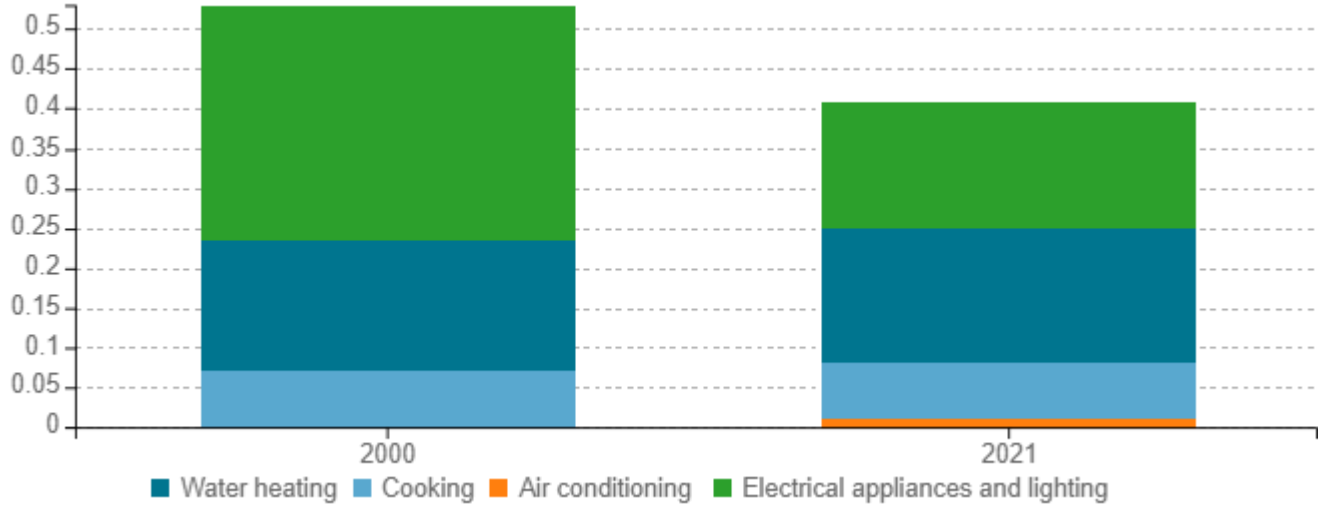
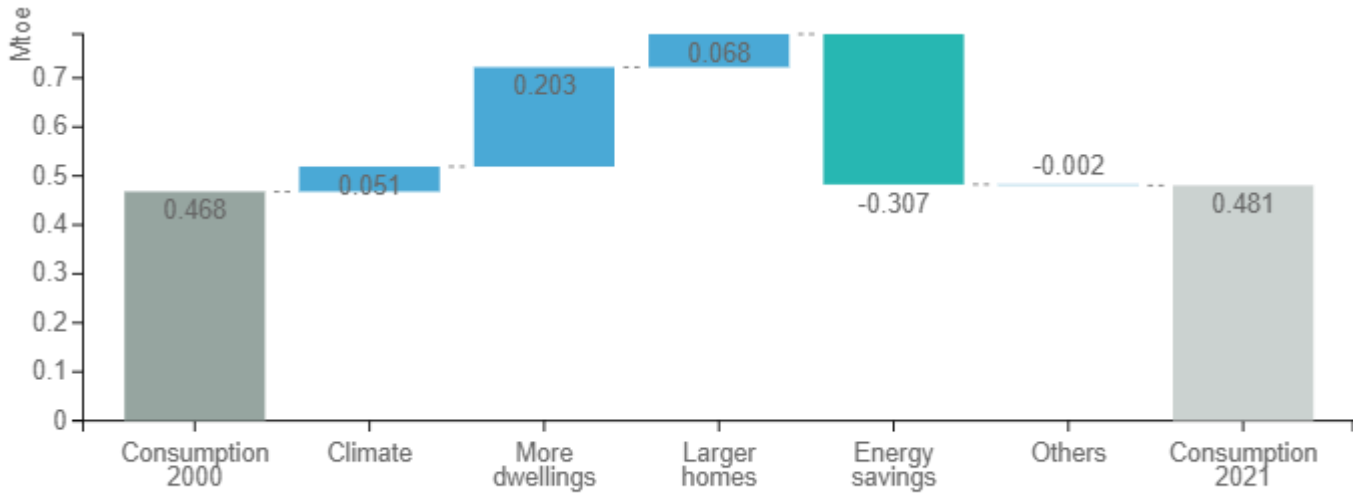
Figure 4: Energy consumption per dwelling by end-use (except space heating)



Source: ODYSSEE

Energy consumption in the residential sector has risen from 0.47 Mtoe in 2000 to 0.48 Mtoe in 2021. The main driver of this trend is the increase in the number of dwellings, which is due to a sharp rise in population (from 434,000 in 2000 to 635,000 in 2021). Added to this is the fact that new residential buildings, despite being (or precisely because they are) more energy-efficient, often have a larger living area. In combination, energy efficiency measures barely offset the increase in energy consumption.

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



Source: ODYSSEE

The specific energy and electricity consumption indexes per employee strongly decreased from 100 in 2000 to 69.2 (energy) and 64.2 (electricity) in 2021. This decrease is linked to the higher headcount of the whole sector (from 188.800 employees in 2000 to 387.100 in 2021) and to the technical progress in installations (HVAC, lighting, computers...).

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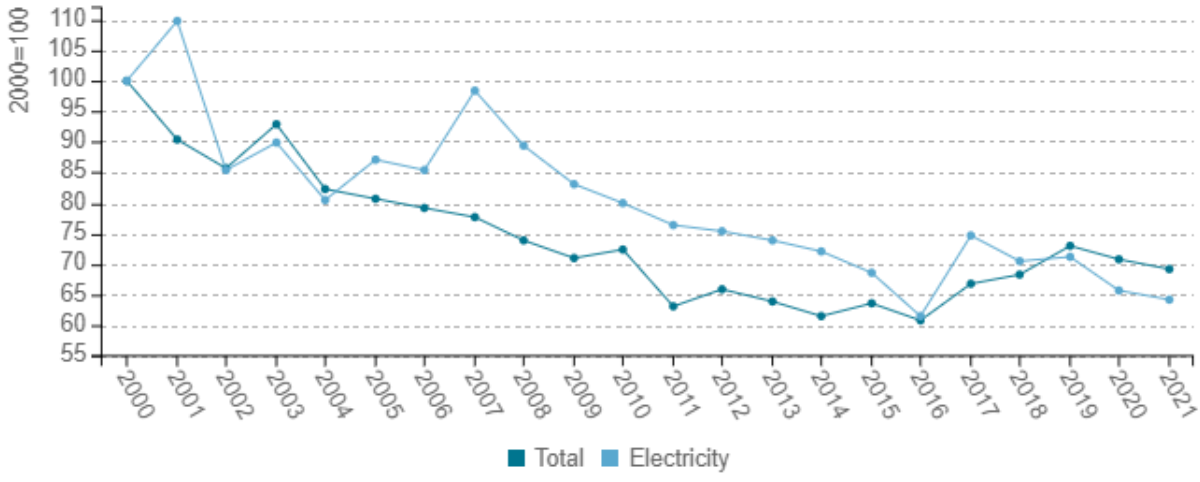
Figure 6: Energy and electricity consumption per employee (normal climate)



Source: ODYSSEE

The policies which have been implemented in the buildings sector are essential in order to trigger the uptake of significant energy efficiency improvements among households and non-residential buildings. The succeeding regulations impose an ambitious improvement trajectory involving stricter standards applying to the construction of new buildings, and the promotion of energy-efficient renovations of the existing building stock.

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

Measures	Description	Expected savings, impact evaluation
HOU-LU0766 Regulation on the energy performance of residential buildings	Implementation of the 2008 Energy Efficiency Ordinance implements European Buildings Directive 2002/91/EC for dwellings. The requirements are raised by around 30% compared with the 1996 Thermal Insulation Ordinance. Since 2017, all new buildings must be nearly zero-energy buildings (NZEB).	
HOU-LU4442 Grant scheme for renovation of residential buildings (2017-2020)	The support provides a financial incentive for the energy renovation of existing buildings in accordance with the Energy Efficiency Regulation. Subsidies are granted for improving the thermal insulation of the building envelope and for the use of a mechanical ventilation system. Prior to the renovation, the provision of energy advice is mandatory, which is also subsidised. The better the standard achieved, the higher the subsidy.	
SER-LU1698 Regulation on the energy performance of non-residential buildings	The measure targets 3 effects on the energy efficiency of non-residential buildings: Intensification of the energy efficiency requirements on new non-residential buildings; Introduction of energy efficiency requirements during the conversion or renovation of non-residential buildings; Introduction of an energy efficiency requirement on lighting in new non-residential buildings.	Energy savings will amount to 197 GWh (2020).

Source: MURE

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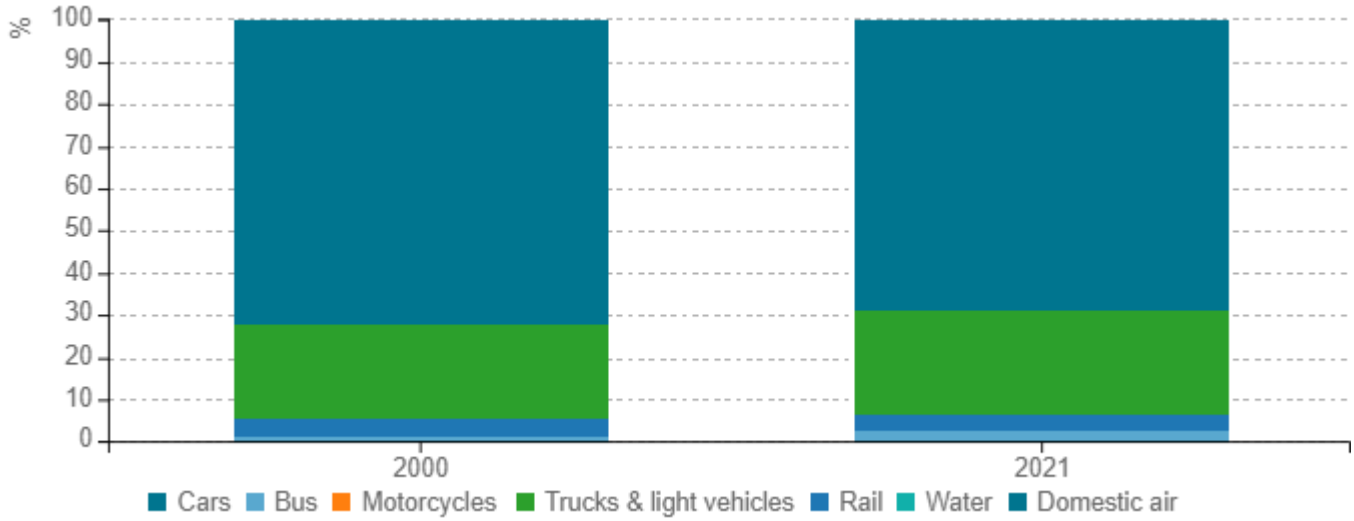
Transport

Since 2000, the majority of energy consumption in the transport sector has been attributable to road transport. Passenger cars account for by far the largest share, followed by trucks and commercial vehicles. Public transport modes remain constant, with a shift towards buses.

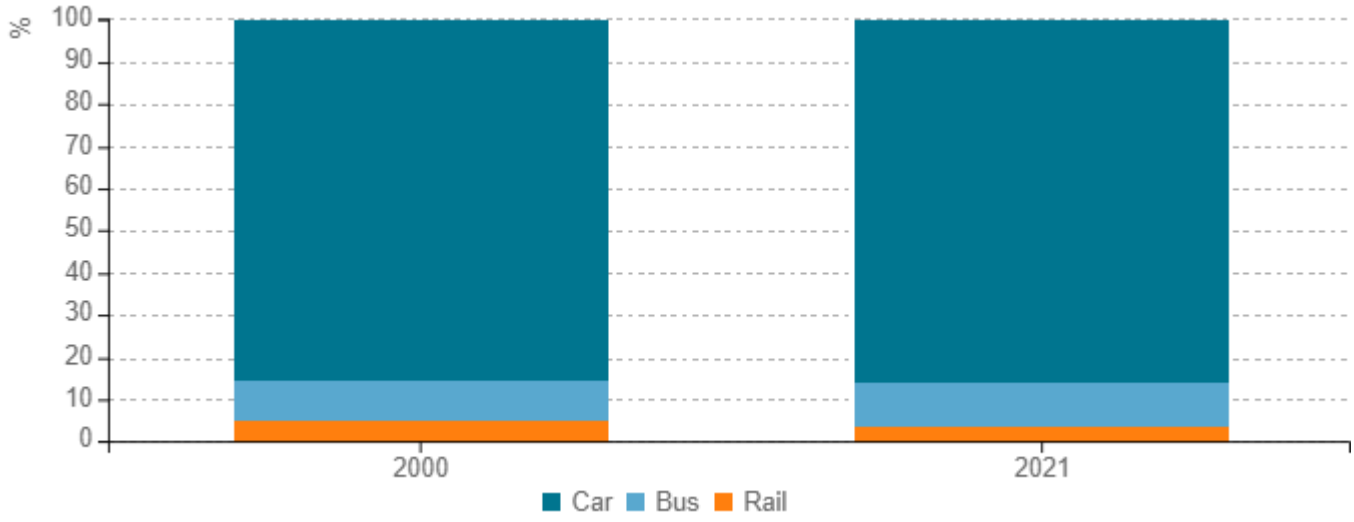
Figure 7: Transport energy consumption by mode



Source: ODYSSEE

The share of passenger transport has remained stable over the years. Cars still account for the largest share at 86%. For public transport, the share of buses in the modal split has increased slightly, while that of trains has decreased.

Figure 8: Modal split of inland passenger traffic



Source: ODYSSEE

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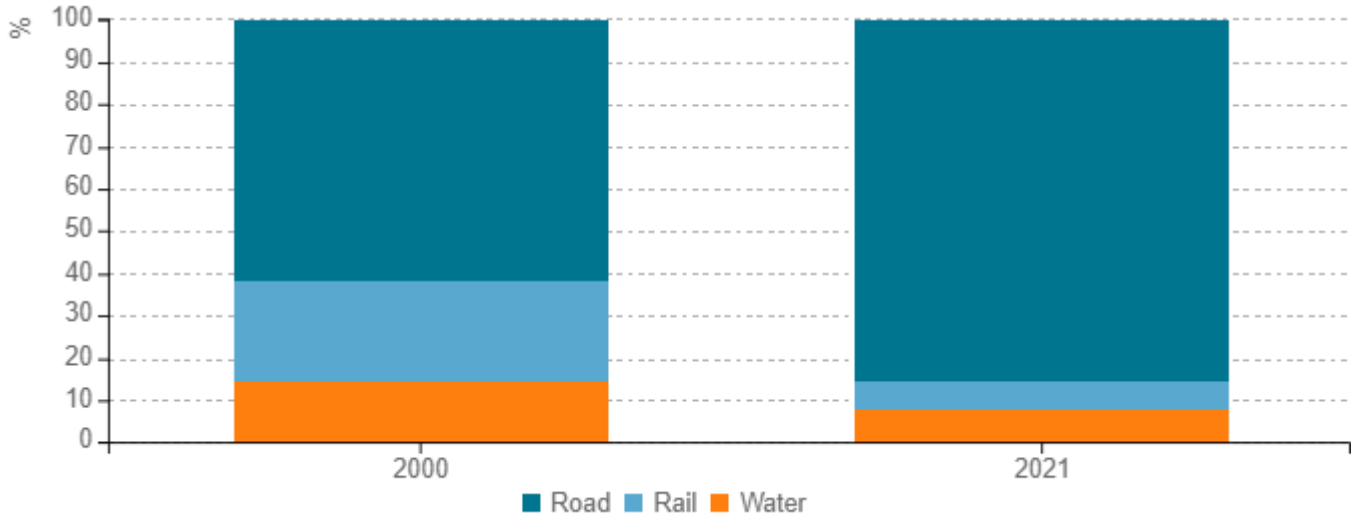
The share of road freight transport has increased over time, reaching 85.6% in 2021. However, this has been at the expense of rail freight traffic, which has fallen sharply by 72%. The absolute value of waterway traffic fell by 43% over the same period.

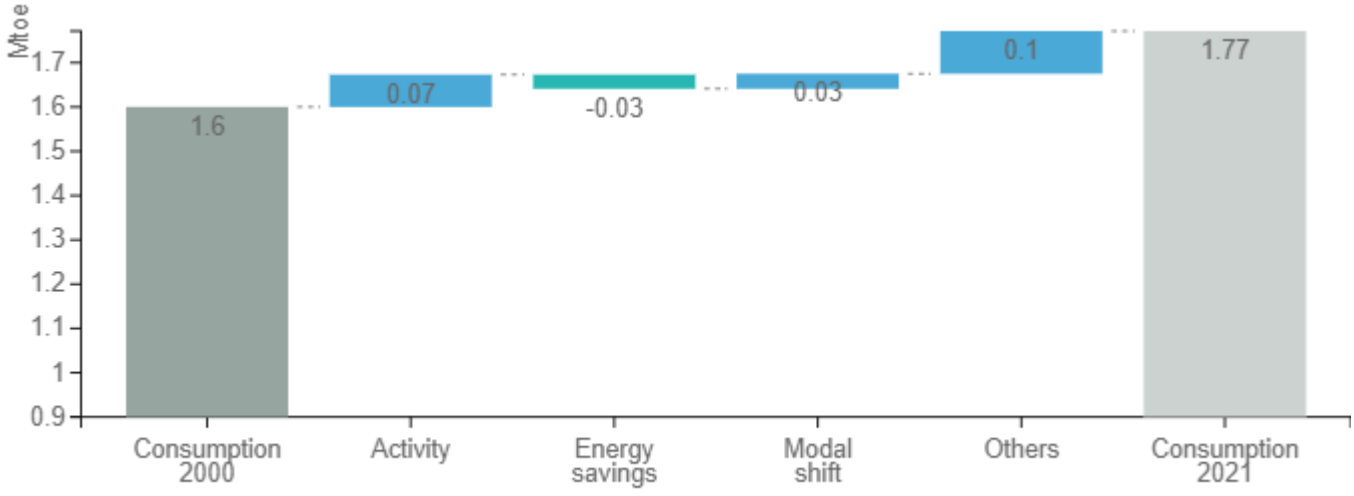
Figure 9: Modal split of inland freight traffic



Source: ODYSSEE

Analysing the drivers of energy consumption for Luxembourg is not an obvious task. The main identified cause is an increase of the transport activity, mainly in passenger road traffic. The second driver, energy savings, can be linked to the improved fuel efficiency of private cars over the years. The modal shift towards public transportation exists but does not influence the trends. The "other effects" are probably linked to the transit traffic, on which the country has little influence.

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



Source: ODYSSEE

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The situation regarding energy consumption in the transport sector is rather difficult to address. The two successful measures have effects that apply to different types of consumers : an increase in fuel taxes, which applies to all fuel consumers and is therefore likely to result in greater energy savings, a CO2-linked vehicle tax, which applies only to resident vehicle owners, and is therefore less significant. Nevertheless, its effect has the potential to last in the medium term, because it has triggered changes in the vehicle fleet.

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

Measures	Description	Expected savings, impact evaluation
TRA-LU2268 Increase of fuel taxes	Taxes on fuel (petrol and diesel) are raised on a regular basis. The effects of this measure are: In the short-term: this will encourage driving behaviour that aims to achieve lower fuel consumption; In the longer-term: this will influence the motorists to purchase more economical vehicles.	The energy savings are expected to reach 86 GWh by year 2020.
TRA-LU2269 CO2-related vehicle tax	Since 1 January 2017, vehicle tax has been dependent on the vehicle's CO2 emissions. On average, this change in approach led to an increase in tax. In the longer term, this will influence purchasing decisions in favour of more economical vehicles.	The energy savings are expected to reach 31 GWh by year 2020.
TRA-LU4445 Subsidies for low CO2 emission and electric cars	To speed up the transition to zero-emission mobility, a bonus of up to €8,000 is available for zero-emission CO2 vehicles, including 100% electric cars (BEVs), hydrogen fuel cell cars (FCEVs), 100% electric vans and hydrogen fuel cell vans.	

Source: MURE

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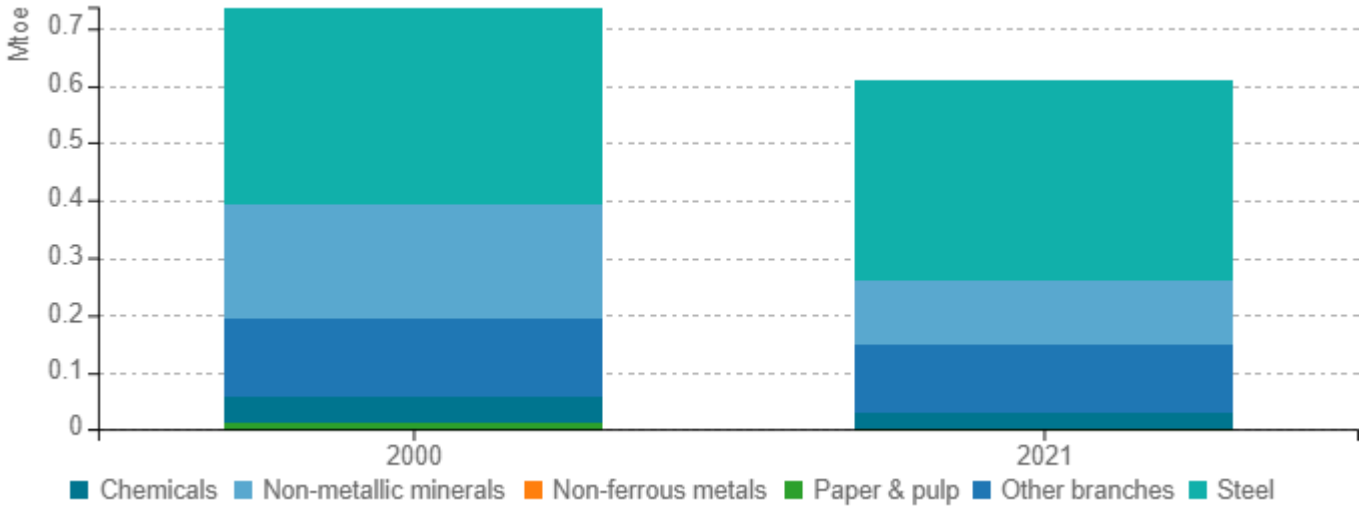
Industry

Between 2000 and 2021, the structure, activity levels and energy efficiency of industry have evolved, with the steel industry remaining at a constant level, while all other branches have declined over the years. The result is a 17% reduction in energy consumption for the industrial sector.

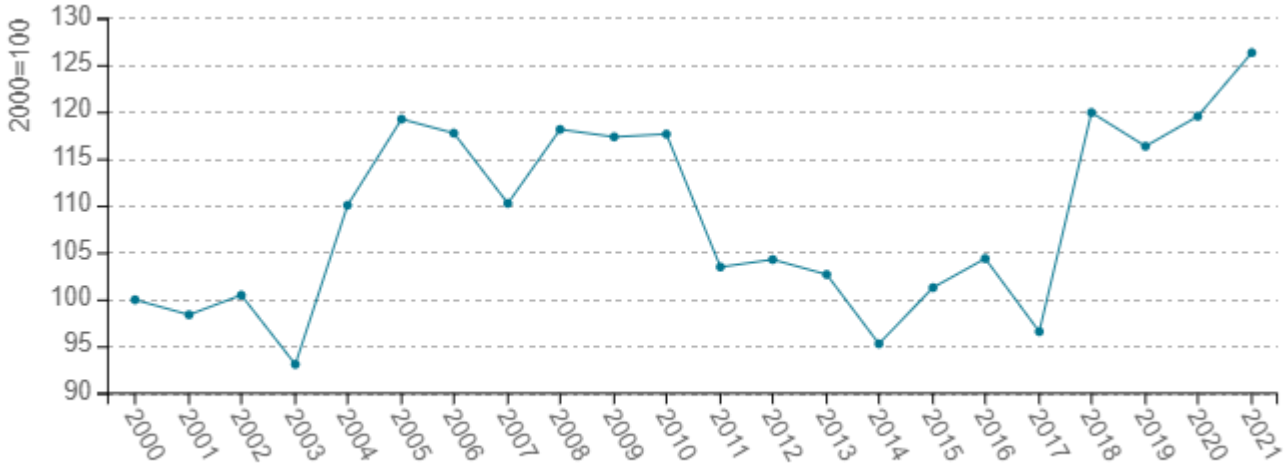
Figure 11: Final energy consumption of industry by branch



Source: ODYSSEE

The steel industry has undergone a number of distinct events that explain the evolution of its energy performance: the refurbishment of its large steel mills; the post-crisis years requiring partial charging; and voluntary agreements enabling greater energy efficiency. Recent years, however, have been marked by insecurity, notably linked to CO2 taxes and high production costs.

Figure 12: Unit consumption of steel (toe/t)



Source: ODYSSEE

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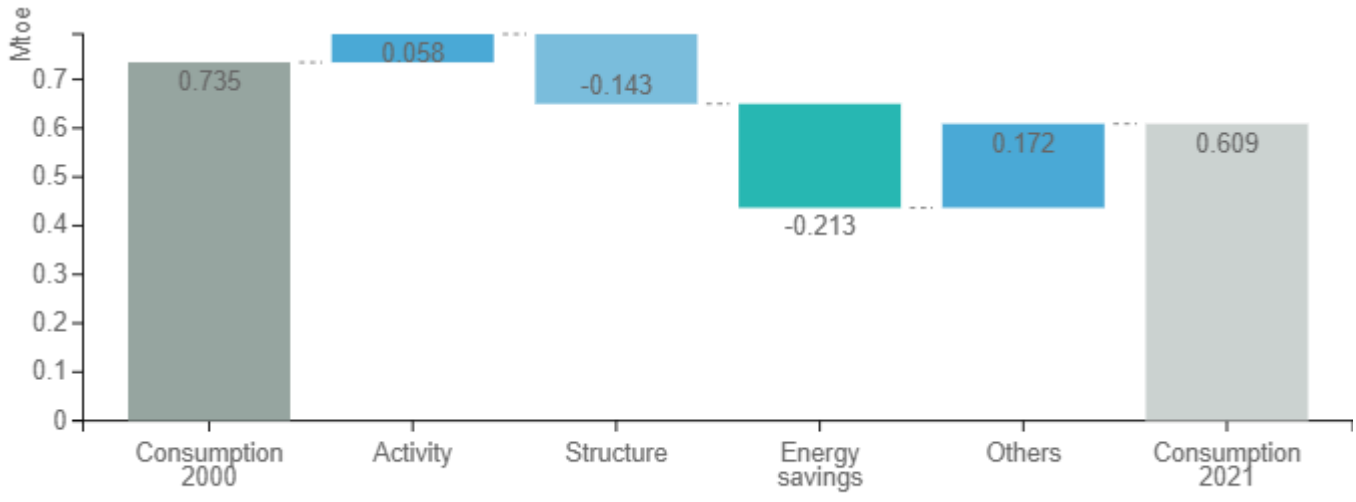
The 17% reduction in industrial sector energy consumption between 2000 and 2021 can be explained partly by structural change in many sectors (cement, chemicals) and partly by energy savings generated mainly by successive voluntary agreements with industry and by competitive forces that have more than offset the increase in energy consumption due to activity levels.

Figure 13: Main drivers of the energy consumption variation in industry



Source: ODYSSEE

The most effective measure for industry is the voluntary agreement, which began in 1996 and covers most of the energy consumption of industrial consumers. The most recent agreement ended in 2017 and achieved significant energy efficiency gains. Since 2015, the Energy Efficiency Obligation system has complemented the voluntary agreement by involving obliged parties to play an active role in industrial energy efficiency improvement plans.

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

Measures	Description	Expected savings, impact evaluation
IND-LUX10 Voluntary Agreements (2017-2020)	The majority of the country's large industrial energy consumers participate in this voluntary agreement (about 50 companies) The aim of the voluntary agreement is to improve energy efficiency by a general objective of 7 % between 2017 and 2020.	The energy savings are expected to reach 152 GWh by year 2020.

Source: MURE

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