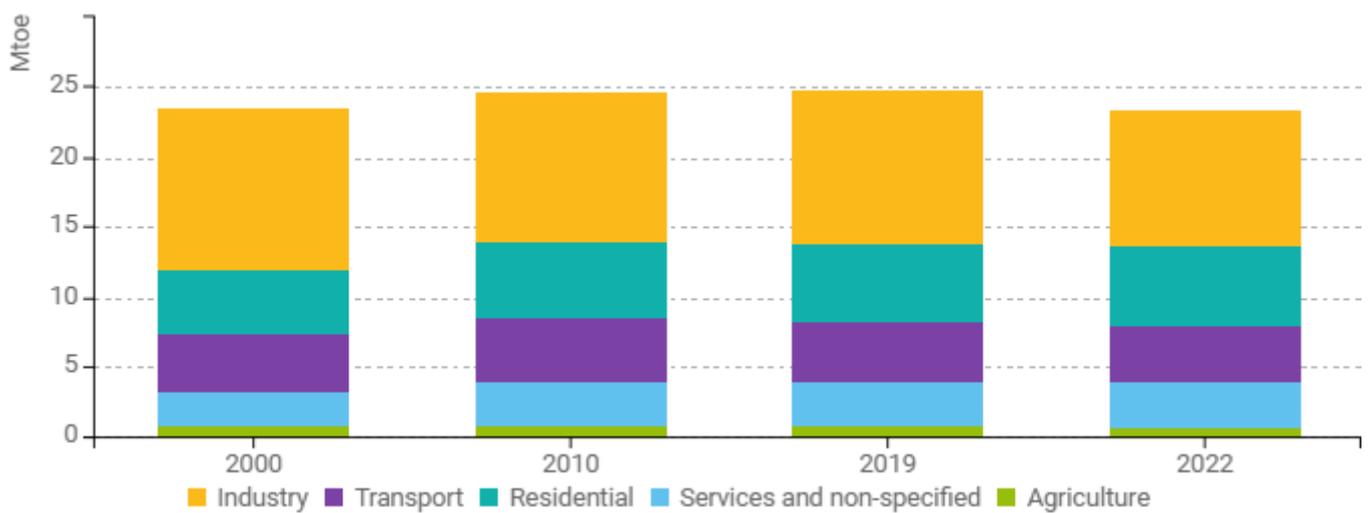


# Energy efficiency trends and policies

## Overview

Climate-corrected Total Final Energy Consumption (TFC) was 23 Mtoe in 2022, the same as in 2000. Industry is the largest energy consuming sector accounting for 42% of the TFC in 2022 which is 7.4 percent points less than in 2000. The proportion of transport in TFC was 17%, the same as in 2000. The share of the residential sector was 24% and that of the services sector 14%, with both sectors expanding their share of the total since 2020.

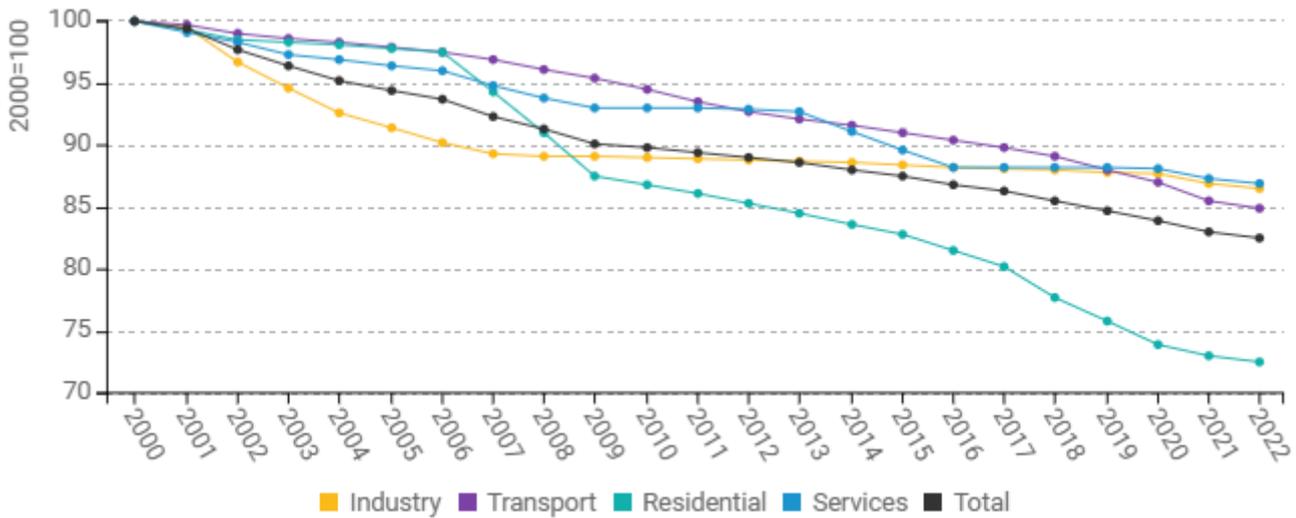
Figure 1: Final energy consumption by sector (with climatic corrections)



Source: ODYSSEE

Energy efficiency of final energy consumption sectors, as measured by ODEX, improved by 17% over the 2000-2022 period, i.e. 0.7%/year on average. ODEX improved most in the residential sector (1.1%/year) and least in the services sector and in industry.

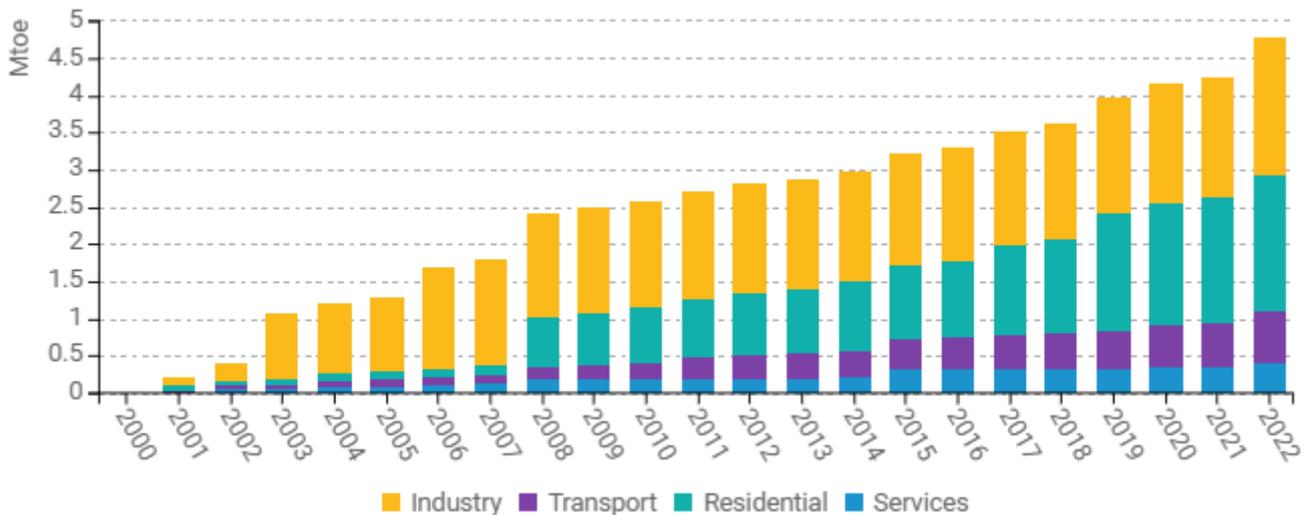
Figure 2: Technical Energy Efficiency Index



Source: ODYSSEE

Energy savings achieved in the period 2000-2022, calculated with top-down Odyssee indicators, reached 4.8 Mtoe in 2022. Savings in industry made the largest contribution (1.9 Mtoe) followed by the residential sector (1.8 Mtoe). Note: There is a break in the statistical data series for the residential sector in 2007-2008.

Figure 3: Energy savings by sector

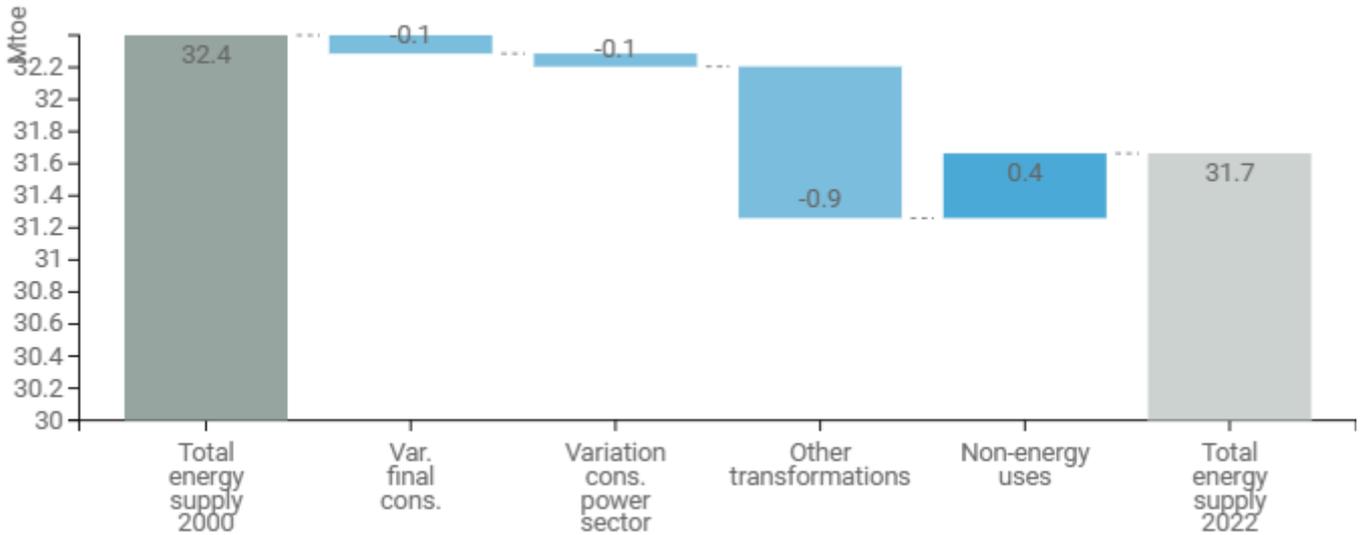


Source: Odyssee

Finland's total energy supply was 31.7 Mtoe in 2022 declining by 0.7 Mtoe (2.2%) from the 2000 level. Changes in the power mix and in final energy consumption both had a very small contribution to the observed changes while use of fuels for non-energy uses has increased. Efficiency improvements in "Other transformations" can be attributed to district heat supply, where use of waste heat and flue gas scrubbers have been increasing. Use of highly efficient CHP has had an important role in Finland already for several decades.



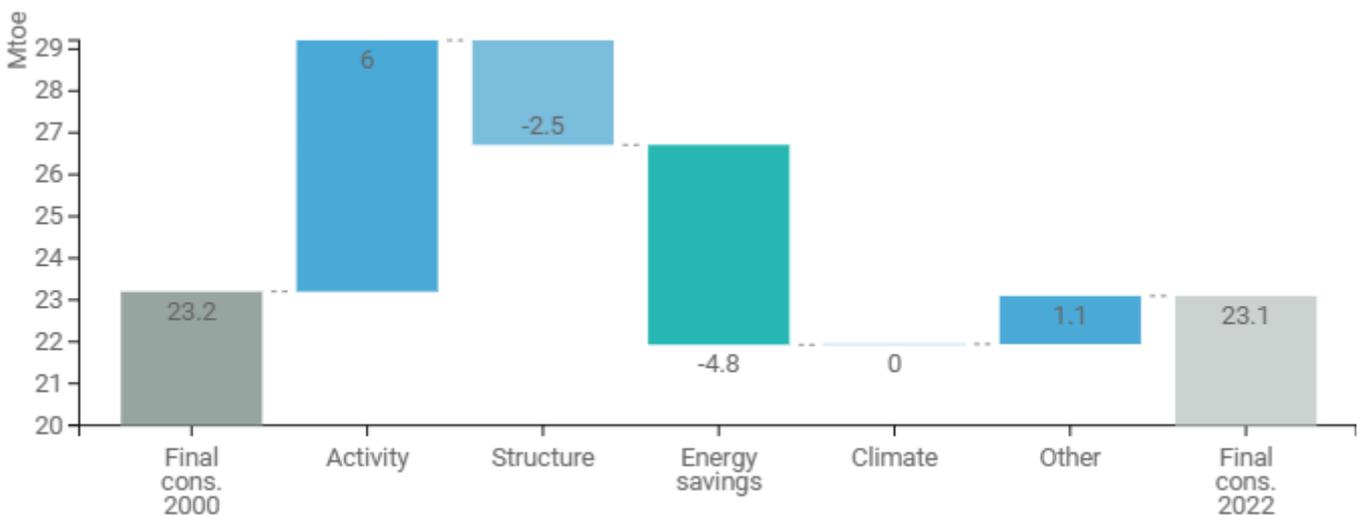
Figure 4: Main drivers of the total energy supply variation



Source: Odyssee

Although the final energy consumption in 2022 was at the same level as in 2000, several factors had opposing effects offsetting each other. Economic activity and other sectoral activity factors have increased consumption. Energy savings (as measured by ODEX) and structural effects have reduced consumption, by 4.8 Mtoe and 2.5 Mtoe, respectively.

Figure 5: Main drivers of the final energy consumption variation



Source: Odyssee

Finland's Integrated Energy and Climate Plan of June 2024 contains the national targets and the related policy measures to achieve the EU's energy and climate targets. In accordance with the EED (2012), Finland's indicative national energy efficiency target for 2020 was 310 TWh absolute level of final energy consumption. The realized



level was 271 TWh. The energy efficiency target to contribute to EU 2030 target in final energy consumption is capping Finland's final energy consumption at 239.6 TWh, calculated with EED (2023) Annex 1 formula.

**Table 1: Sample of cross-cutting measures**

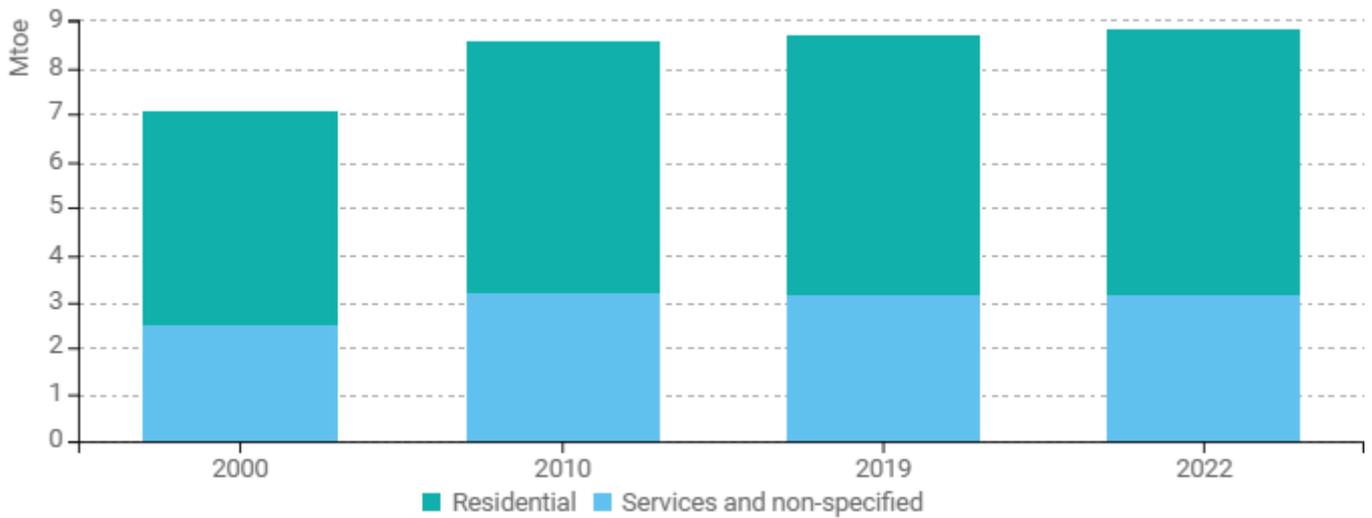
Measures	NECP measures	Description	Expected savings, impact evaluation
<a href="#">Green Deals</a>	No	In Finland, Green Deal agreement sectors/topics cover, e.g., the automotive sector, the non-road mobile machinery sector and emission-free worksites (Green Deal on sustainable procurements)	
<a href="#">Finland's Recovery and Resilience Plan</a>	No	EU Member States must present a national Recovery and Resilience Plan (RRP) in order to receive funding from the Recovery and Resilience Facility (RRF). The Plan forms part of the Sustainable Growth Programme for Finland. The Council of the EU formally approved the plan by written procedure on 29 October 2021. The four priorities of the Plan are 1) Green transition, 2) Digitalisation, 3) Employment and skills and 4) Health and social services.	
<a href="#">Act on ecodesign and energy labelling</a>	Yes	The Act transposes the EU directive into Finnish legislation setting mandatory minimum standards and establishing energy labels for energy-using products used in different sectors.	46.9 PJ in 2030

Source: MURE

## Buildings

Climate-corrected final energy consumption has grown by 26% in service sector buildings and by 24% in residential buildings from 2000 to 2022. Floor area in the services sector increased by 54% and in dwellings by 36%, and the number of households increased by 23% over the same period.

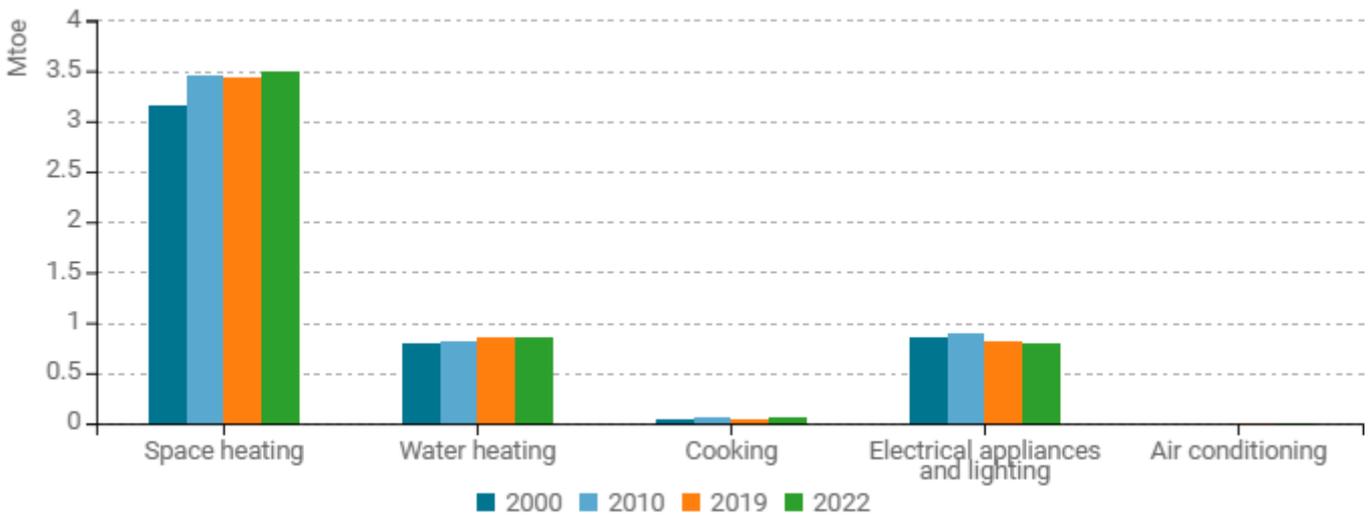
Figure 6: Final energy consumption in buildings (with climatic corrections)



Source: ODYSSEE

Figure 7 illustrates the proportion of different end-uses in households. Space heating dominates the consumption with 67% share. The share of water heating is 16% and that of appliances and lighting 15%, whereas cooking and air-conditioning have negligible contributors.

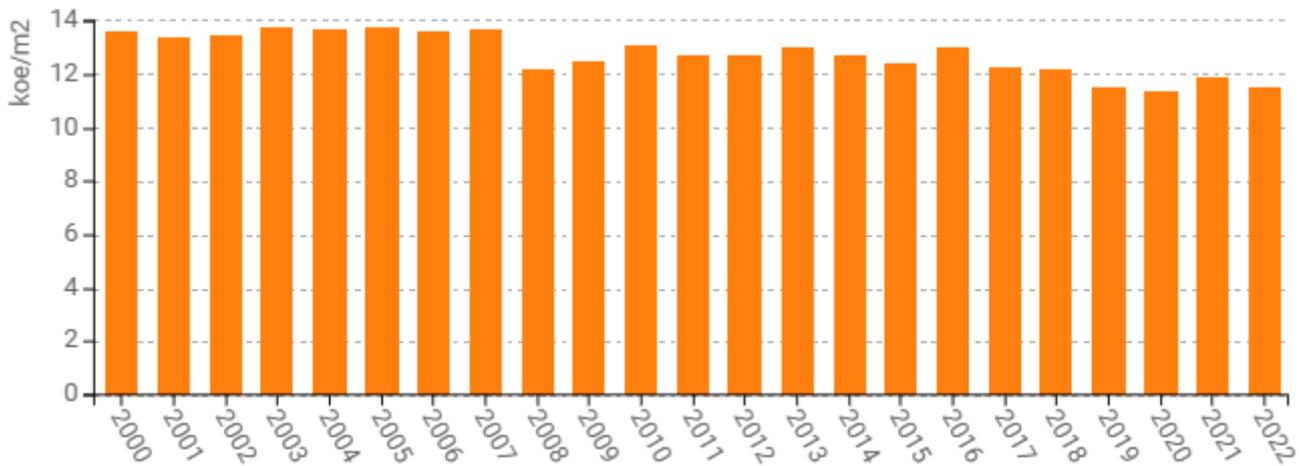
Figure 7: Energy consumption by end-use of households (with climatic corrections)



Source: ODYSSEE

Unit consumption for space heating per m2 in households has declined by about 16% (i.e. 0.8%/year) since 2000 (Figure 8). This change is considerable as unit consumption includes ambient heat used by heat pumps; without ambient heat the reduction rate was almost 40% faster (1.1%/year). Small annual variations in the long-term trend can be attributed to the fact that normalization with heating degree days does not "perfectly" correct the impact of weather.

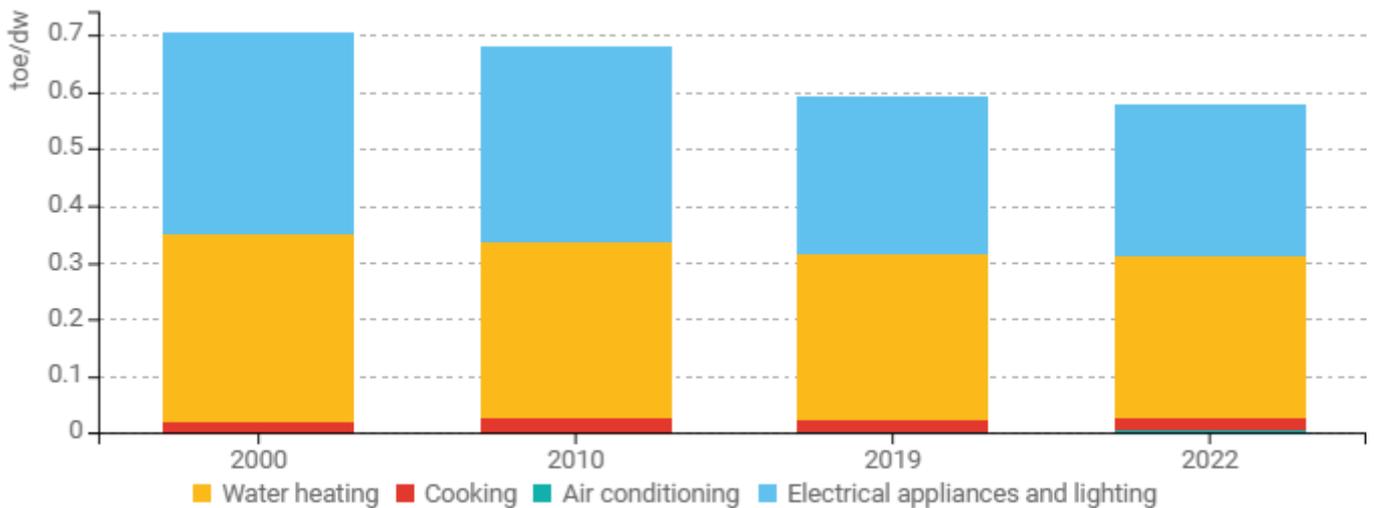
Figure 8: Energy consumption of household space heating per m2 (with climatic corrections)



Source: ODYSSEE; ambient heat included.

Energy consumption of water heating and electric appliances in dwellings has decreased, by 13% (i.e. 0.6 % per year) and 26% (1.1% per year), respectively. Eco-design policy has contributed significantly to the reduction of electricity use in households. Other uses, namely air conditioning and cooking, remain negligible.

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

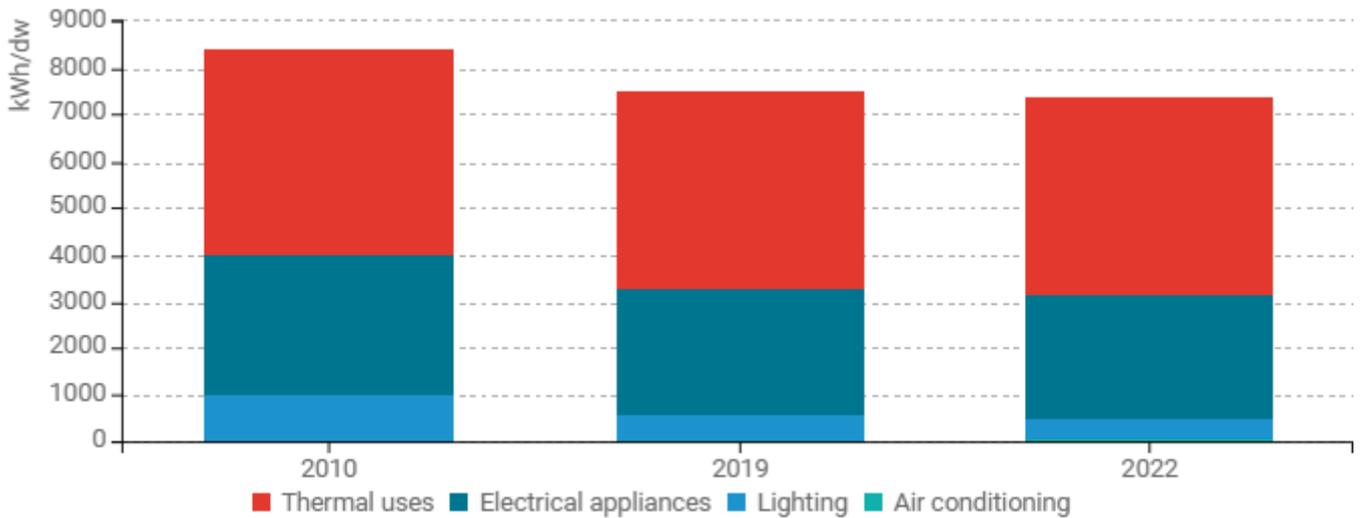


Source: ODYSSEE

Electricity consumption (with climatic correction) per dwelling has declined since 2010 by 12%. The change in lighting is the most significant (-55%) but there is a positive development also in use for electric appliances (-12%). Thermal use is rather steady; while the number of heat pumps has been increasing, they often replace direct electric heating.



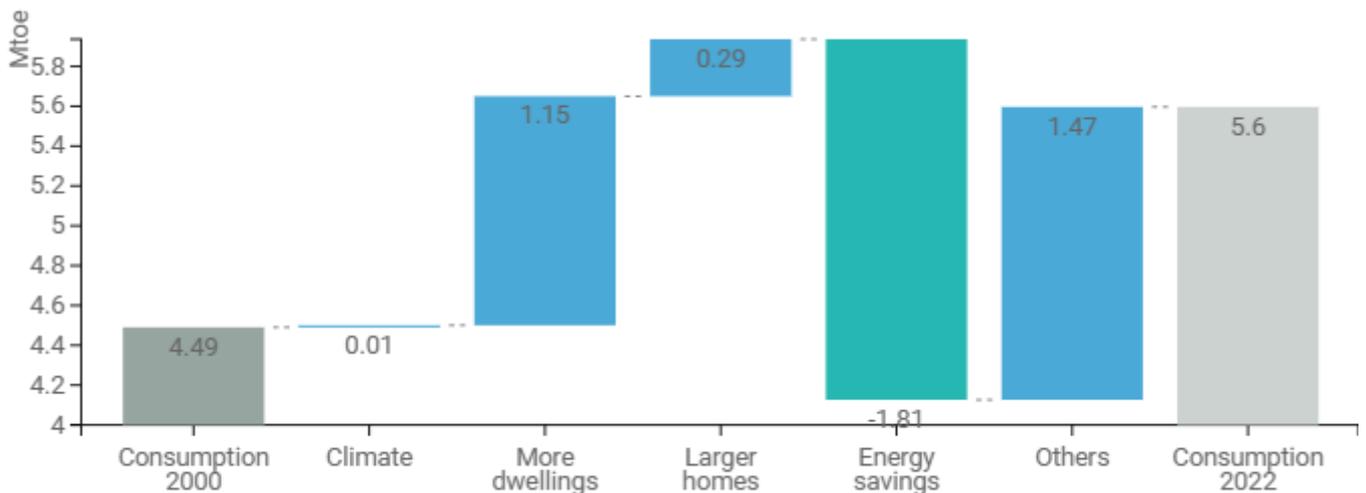
Figure 10: Electricity consumption per dwelling by end-use (with climatic corrections)



Source: ODYSSEE

Energy consumption in the residential sector has increased by 1.1 Mtoe (12.9 TWh) since 2000. It was driven upwards particularly by the continuously increasing number of dwellings, while the growth in the average size of homes has had only a marginal effect since 2010. On the other hand, energy savings fully offset the effect of these two drivers of consumption growth. Consumption growth was strongly affected by "other" factors, which include the increased use of ambient heat (+0.7 Mtoe) and behavioural changes, including increased presence at home during and after the COVID-19 pandemic (+0.8 Mtoe).

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



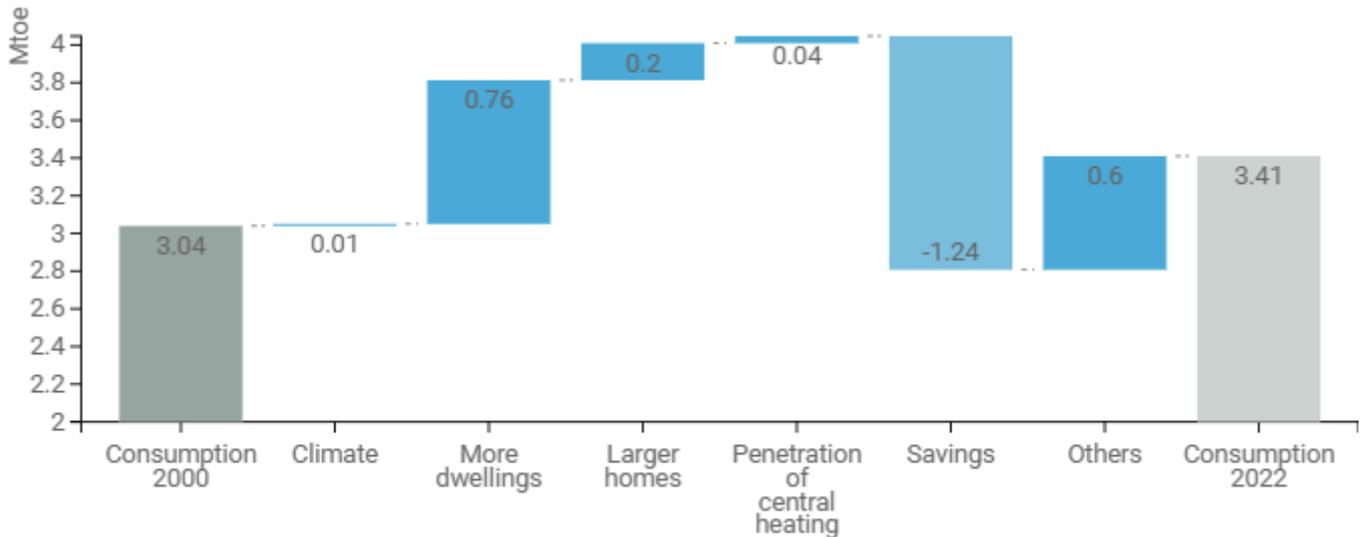
Source: ODYSSEE; ambient heat included.

Energy consumption for space heating in households has increased from the 2000 levels by 0.37 Mtoe. Energy savings more than offset the impact of increase in the number of occupied dwellings (activity) and the moderate



growth of dwelling size. "Other" factors contributed to the growth by 0.6 Mtoe mainly corresponding to the increased use of ambient heat by heat pumps.

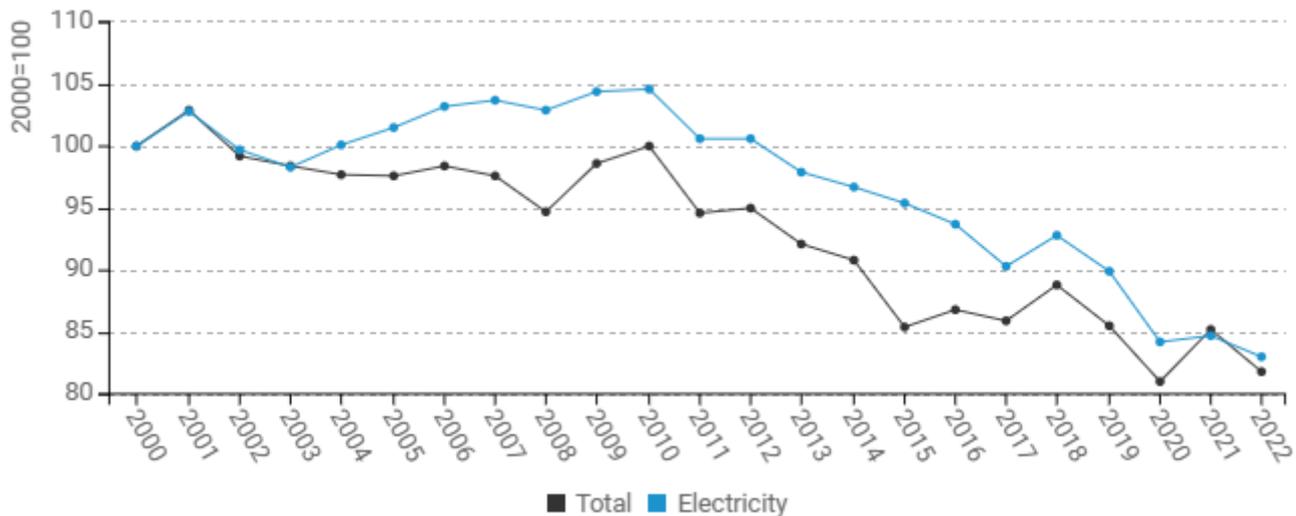
Figure 12: Main drivers of the space heating consumption variation of households



Source: ODYSSEE; ambient heat included.

Both energy consumption and electricity consumption per m2 have considerably declined in the services sector after 2000, around 0.7%/year.

Figure 13: Energy and electricity consumption per m² in services (with climatic corrections)



Source: ODYSSEE

In Finland, thermal building regulations were first introduced in 1976 and have become increasingly demanding thereafter. The building code for building renovation took force in 2013. Legislation governing nearly-zero energy buildings was issued in December 2016. The number of heat pumps has been growing rapidly as they are promoted in existing houses by income tax rebates, in oil heated households by subsidies (until mid-2025) and by



information measures. Ground-source heat pump is the most popular main heating system in new single-family houses. There are energy efficiency agreements and an energy audit scheme in place in the private services sectors and for municipalities and joint municipalities.

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

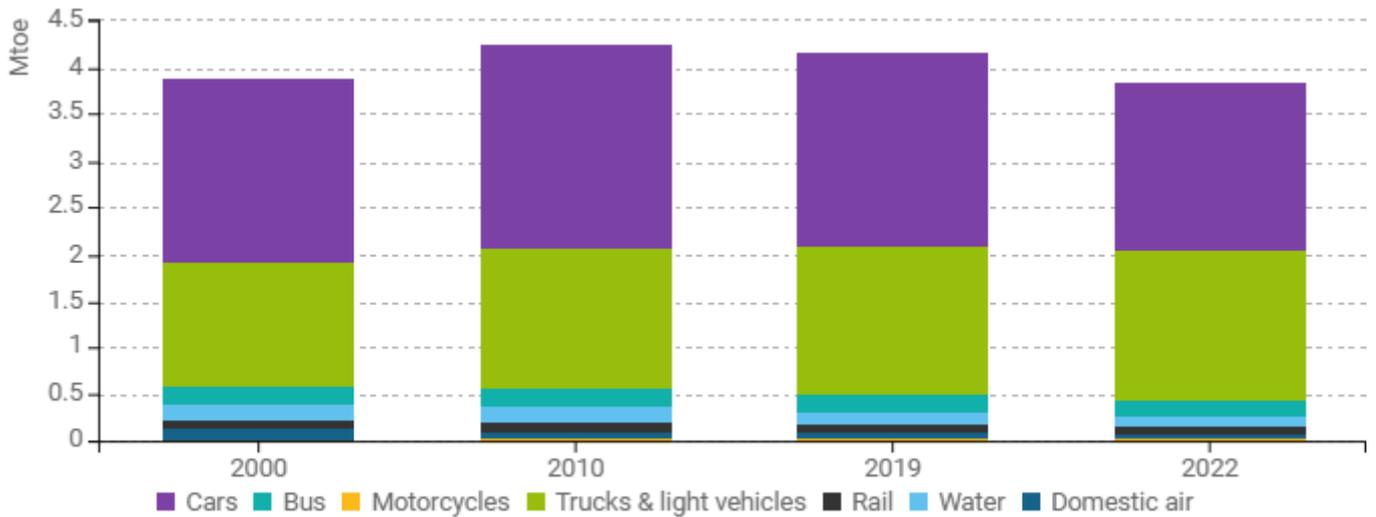
Measures	NECP measures	Description	Expected savings, impact evaluation
<a href="#">Decree on improving the energy performance of buildings undergoing renovation or alteration</a>	Yes	National implementation of the EPBD directive regarding buildings undergoing renovation or alteration.	9.80 PJ
<a href="#">Regulations for nearly-zero energy buildings</a>	Yes	Regulations for nearly-zero energy buildings took force on 1 January 2018.	
<a href="#">Energy Efficiency Agreement of the Property and Building Sector - Rental Property Action Plan</a>	Yes	Voluntary energy efficiency agreement for rental properties (dwellings) the period 2017-2025.	Cumulative total savings for EED Art 7/8 in 2030 are reported together with the energy efficiency agreement for industry (see IND-FI1108)
<a href="#">Energy Efficiency Agreement of the Property and Building Sector - Commercial Property Action Plan</a>	Yes	Voluntary energy efficiency agreement for commercial properties for the period 2017-2025.	Cumulative total savings for EED Art 7/8 in 2030 are reported together with the energy efficiency agreement for industry (see IND-FI1108)

Source: MURE

Transport

Energy consumption of passenger transport is now at the same level as in 2000. The most notable change since 2000 is the 7.6 percent point growth in the proportion of trucks and light vehicles. Cars account for 47% and trucks and light vehicles for 42% of energy consumption in transport.

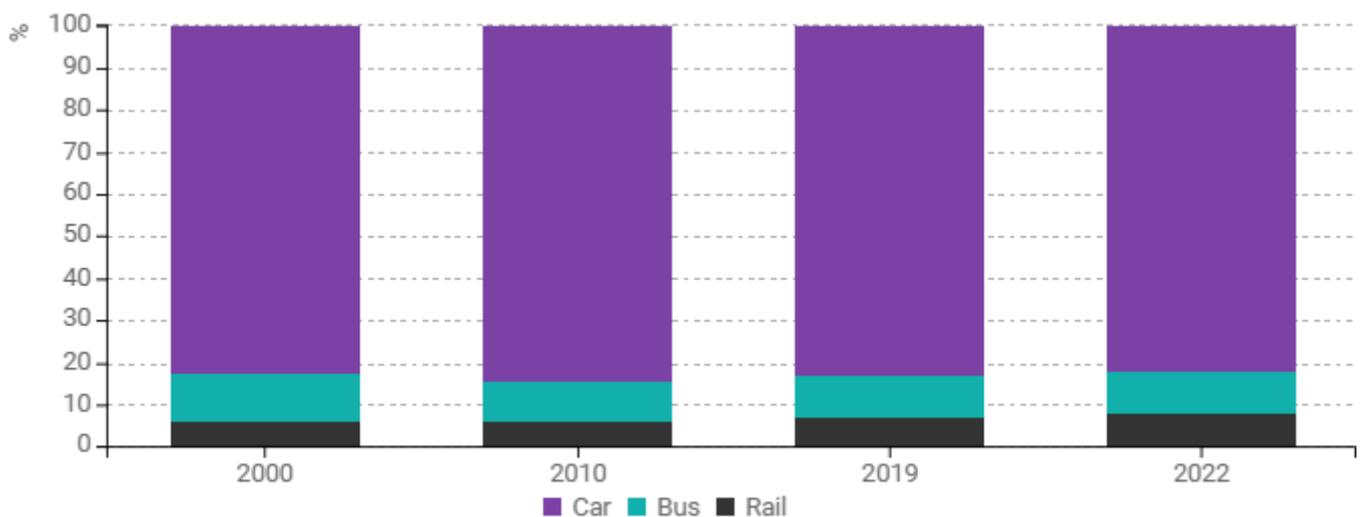
Figure 14: Transport energy consumption by mode



Source: ODYSSEE

Energy consumption of passenger transport is now at the same level as in 2000. The COVID-19 crisis temporarily reduced usage of public transport, by 39% in trains and 14% in busses between 2019 and 2020. However, in 2022 the proportion of public transport in total passenger transport was already slightly better than in 2000.

Figure 15: Modal split of inland passenger traffic

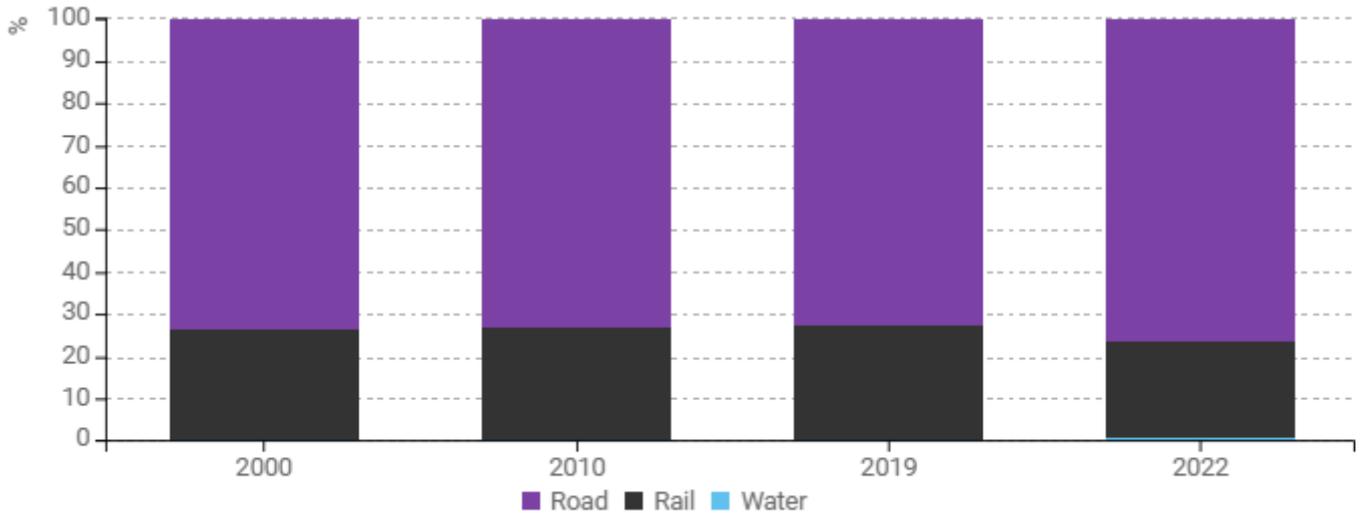


Source: ODYSSEE



The proportion of freight transport on roads has increased by 3 percentage points, while that of rail transport has declined by an equal amount between 2000 and 2022.

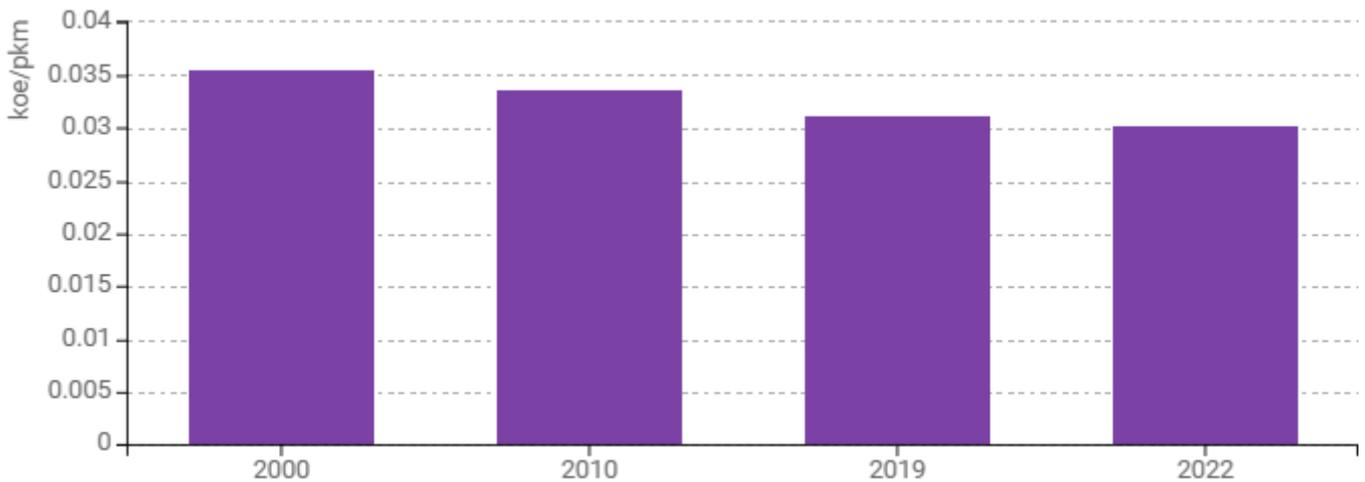
Figure 16: Modal split of inland freight traffic



Source: ODYSSEE

Energy consumption of cars per passenger-km has declined by 15% since 2000. While new cars are more energy efficient, the sluggish fleet renewal rate slows down the process.

Figure 17: Energy consumption of cars per passenger-km

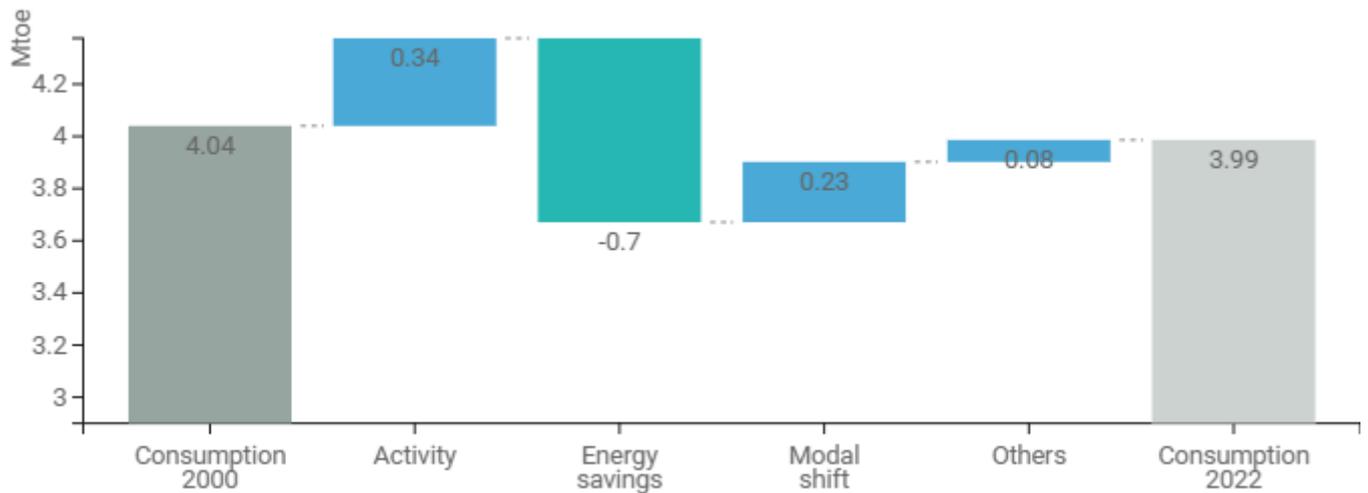


Source: ODYSSEE

In 2022, energy consumption of transport was slightly lower than in 2000. Energy savings more than compensated for the changes in the activity levels (i.e. traffic volumes) and a higher share of road transport (modal change). Other factors increasing consumption were a shift from mass goods (e.g. paper) to parcelled goods, and increased empty runs due to logistical challenges related to customer needs.



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



Source: ODYSSEE

Energy improvements in new vehicles are taking place because of the CO2 emission norms, taxation favouring less emitting cars and information measures. However, the pace of fleet renewal in Finland is among the slowest in Europe causing some delay in seeing the full benefit of these measures. Measures are in place to support public transport and to promote non-motorized modes. In road transport of goods, allowing larger and heavier trucks to enter the roads is making some contribution.

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

Measures	NECP measures	Description	Expected savings, impact evaluation
<a href="#">Energy efficiency of new heavy duty vehicles</a>	Yes	The first-ever EU-wide CO2 emission standards for heavy-duty vehicles, adopted in 2019, set targets for reducing the average emissions from new lorries for 2025 and 2030.	2.20 PJ
<a href="#">Improving the energy efficiency of new vans</a>	Yes	Part of 2019 NECP measures "Improving the energy-efficiency of vehicles" up to 2020 and "Improving the energy-efficiency of cars and vans (additional measures)" in 2021-2030.	1.03 PJ
<a href="#">Procurement of clean and energy-efficient road transport vehicles</a>	No	Directive 33/2009 aimed to improve the environmental impact and energy economy of vehicles procured in the public sector. The Directive was transposed into national legislation by Law 1509/2011. The revised Clean Vehicles Directive (EU/2019/1161) was implemented by Law (740/2021) which took force in August	

The ODYSSEE-MURE project is co-funded by the European Union.

Views and opinions expressed are those of the authors only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for the information contained therein or for any use that may be made thereof.



Co-funded by  
the European Union

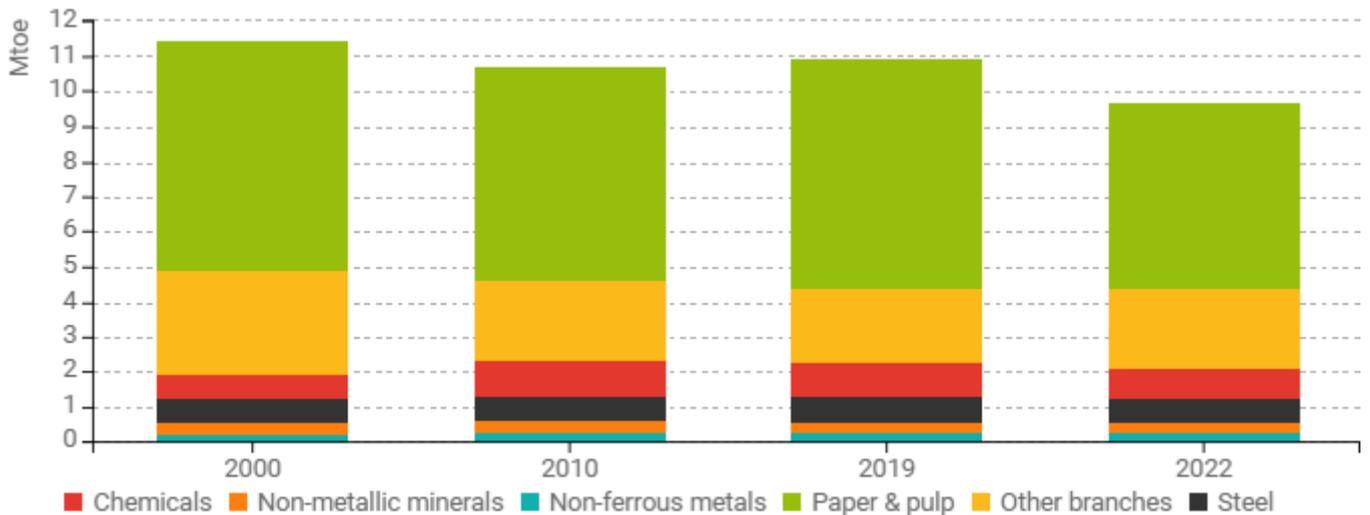
		2021.	
<a href="#">Taxation of transport fuels</a>	Yes	High taxes are used to manage consumption of transport fuels	5.1 PJ

Source: MURE

### Industry

In 2022, energy consumption in industry was 9.68 Mtoe, i.e. 15% under the 2000 level. The energy-intensive pulp and paper industry is by far the largest industrial sub-sector with 55% share of the total, followed by chemical and steel industries (9% and 8% shares, respectively).

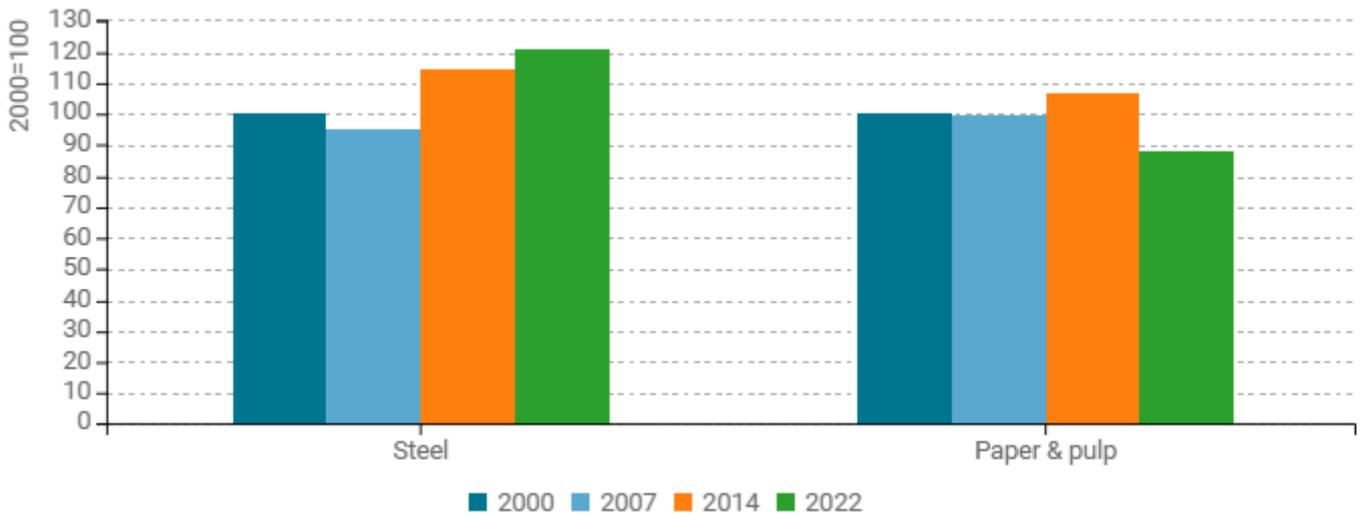
Figure 19: Final energy consumption of industry by branch



Source: ODYSSEE

The specific energy consumption pulp and paper declined by 12% from 2000 to 2022. Factors like capacity utilization rates, product mix, growing production of kraft pulp for exports and even climate have an impact on both the national level of specific consumption and country comparisons. The specific consumption of steel production was 21% higher in 2022 than in 2000.

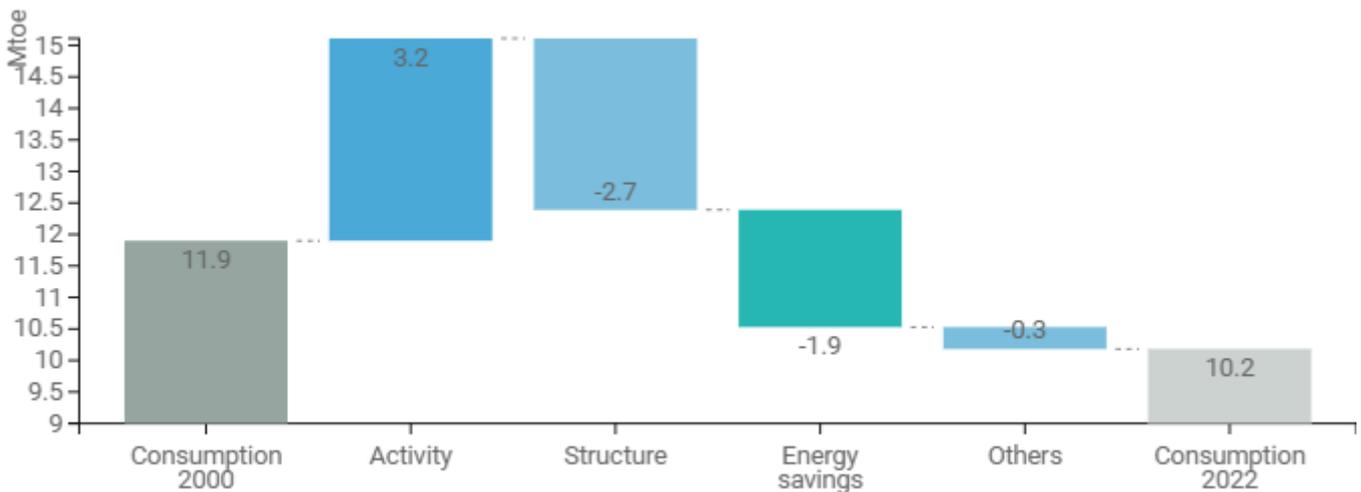
Figure 20: Unit consumption of energy-intensive products (toe/t)



Source: ODYSSEE

The observed decline in industrial energy consumption from 2000 to 2022 was driven by structural changes towards less energy consuming branches (-2.7 Mtoe) and energy savings (-1.9 Mtoe). In turn, growth in industrial activity has increased consumption by 3.2 Mtoe.

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



Source: ODYSSEE

The first voluntary agreements to save energy in industry were launched in 1997. The current third generation runs during the period 2017-2025 and the next period is under negotiations. This is the main measure in industry. Monitoring results show that energy savings from the agreements are very high. Energy audits have made a major contribution, but subsidized energy audits are available now only for those falling outside the scope of mandatory energy audits.



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

Measures	NECP measures	Description	Expected savings, impact evaluation
<a href="#">Energy Efficiency Agreement of Industry</a>	Yes	Third generation of voluntary energy efficiency agreement for different industries for 2017-2025. The former agreement periods were 1997-2007 and 2008-2016.	54.99 PJ (includes the impact service, municipal and real estate sector agreements)
<a href="#">In-depth energy audits</a>	Yes	A new in-depth energy audit model for heavy industries.	
<a href="#">Subsidies for energy audits and energy investments</a>	Yes	Subsidies are available for energy audits and energy efficiency investments. However, audit subsidies apply only to those not subject to mandatory energy audits stipulated by the EED Directive.	Savings partly overlap with those of the voluntary agreements. Therefore, not reported separately.

Source: MURE