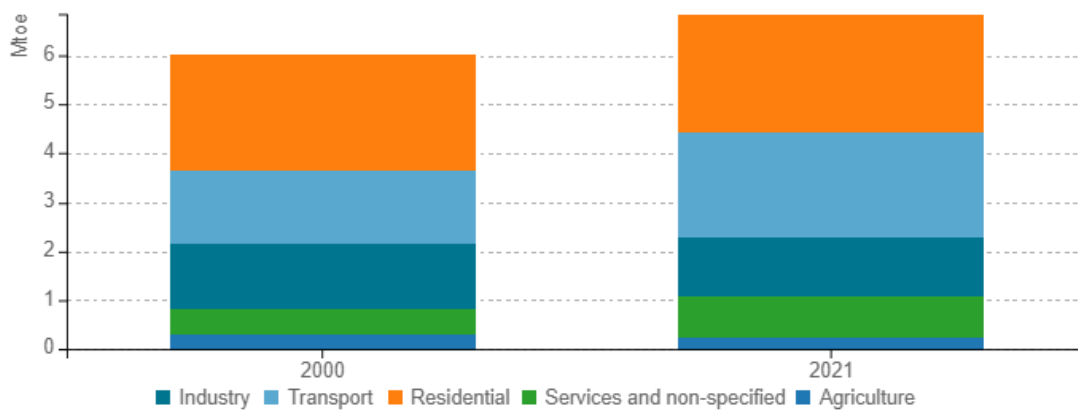


Energy efficiency trends and policies

Overview

In 2021, final energy consumption in Croatia amounted around 6.8 Mtoe, 14% above its 2000 level. Residential sector was the largest consuming sector in 2021; consumption in this sector remained stable in the period from 2000 to 2021. Final energy consumption in the transport sector increased by 1.8% per year in the period from 2000 to 2021. In services this percentage was 2.2% per year. Final energy consumption in industry sector decreased in the observed period by 0.5% per year. Final energy consumption in building sector, comprising the residential and service sector, increased by 0.5% per year in the observed period.

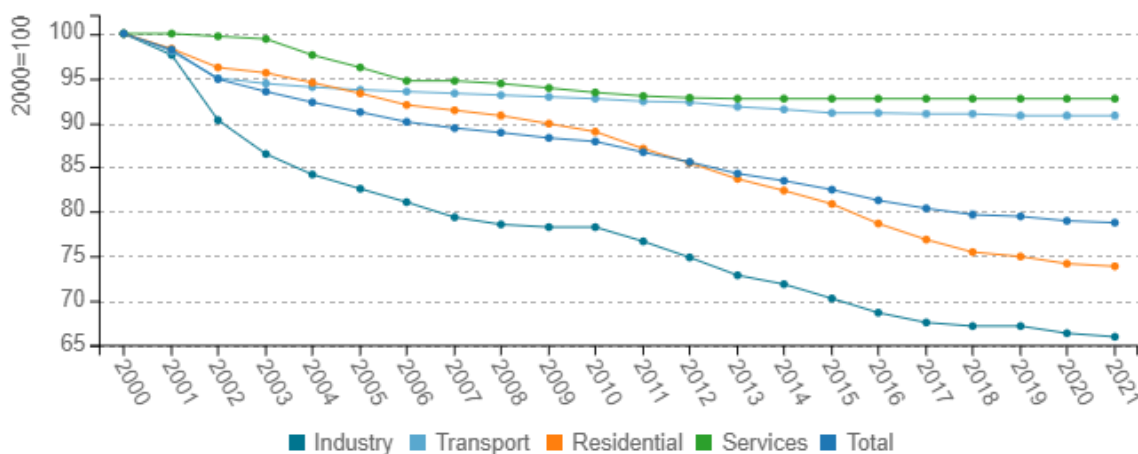
Figure 1: Final energy consumption by sector (normal climate)



Source: ODYSSEE

From 2000 till 2021, energy efficiency for final consumers, as measured by ODEX, improved by 21% (1.1% per year). The largest energy efficiency gains were achieved in the industry sector (2.0% per year), followed by the residential sector (1.4% per year) and the transport sector (0.5% per year). The trends in these sectors can be explained by the introduction of various regulations and financial incentives. In services, energy efficiency improved by 7%, or an average by 0.4% per year.

Figure 2: Technical Energy Efficiency Index



Source: ODYSSEE



The Integrated National Energy and Climate Plan for the period 2021-2030 builds on existing national strategies and plans. The Integrated National Energy and Climate Plan for the period 2021-2030, pursuant to Article 12 of the Act on the Strategic Planning and Development Management System of the Republic of Croatia (Official Gazette No. 123/17, 151/22) shall be adopted by the Government of the Republic of Croatia at the proposal of the Ministry of the Economy and Sustainable Development. The most important targets that the Plan sets for 2030 are: 1) Reduction in greenhouse gas emissions for the ETS sector, compared to 2005 by 50.2%; 2) Reduction in greenhouse gas emissions for non-ETS sectors, compared to 2005 by 16.7%; 3) Share of RES in gross final energy consumption should amount up to 42.5%; 4) Share of RES in final energy consumption in transport should amount up to 21.6%; 5) Primary energy consumption (total energy consumption without non-energy consumption) should amount up to 340.9 PJ; and 6) Final energy consumption should amount up to 274.2 PJ.

Table 1: Sample of cross-cutting measures

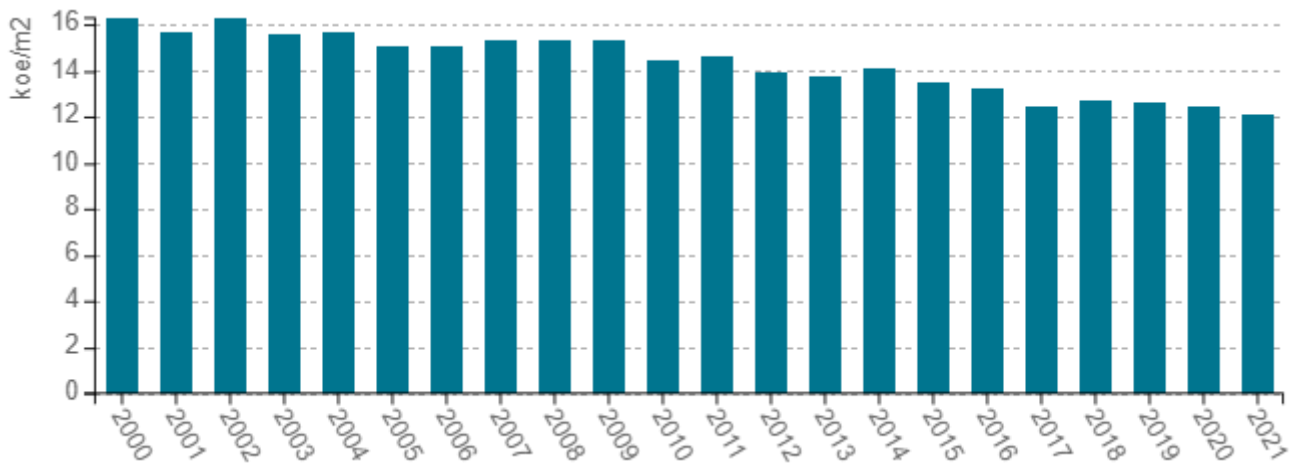
Measures	NECP measures	Description	Expected savings, impact evaluation
Energy efficiency obligation system for suppliers	yes	The Energy Efficiency Obligation System was established by the Energy Efficiency Act (OG 127/14, 116/18, 25/20), and its functioning is further defined by the Ordinance on the Energy Efficiency Obligation System (OG 41/19). From 2021 to 2030, the goal is to achieve cumulative energy savings in final consumption by achieving new annual savings every year.	Reduction of final energy consumption and consequent reduction of CO2 emissions: estimated savings in 2030 27.3 PJ (652.5 ktoe); estimated reduction in CO2 emissions in 2030, 1,532.9 ktCO2e; cumulative energy savings in the period 2021-2030 126.4 PJ (3,019.5 ktoe); cumulative reduction in CO2 emissions in 2021-2030 7,093.9ktCO2e.
Green public procurement	yes	The Government of the Republic of Croatia adopted in 2015 the first National Action Plan for Green Public Procurement for the period from 2015 to 2017 with an outlook to 2020, and green public procurement was also accepted as a measure in the 4th NEEAP, which sets the target that by 2020 green public procurement criteria are applied in 50% of implemented public procurement procedures.	Reducing energy consumption in public buildings; changes in the habits and behaviour of users of public sector buildings.
Information about energy efficiency	yes	Providing information to the general public and target groups shall be conducted through the organization of targeted information campaigns related to specific programmes of encouraging energy efficiency, particularly energy renovation of buildings.	Increasing the level of awareness of the benefits of energy efficiency with the consequent change in behaviour and reduction in energy consumption by applying concrete measures.

Source: MURE

Buildings

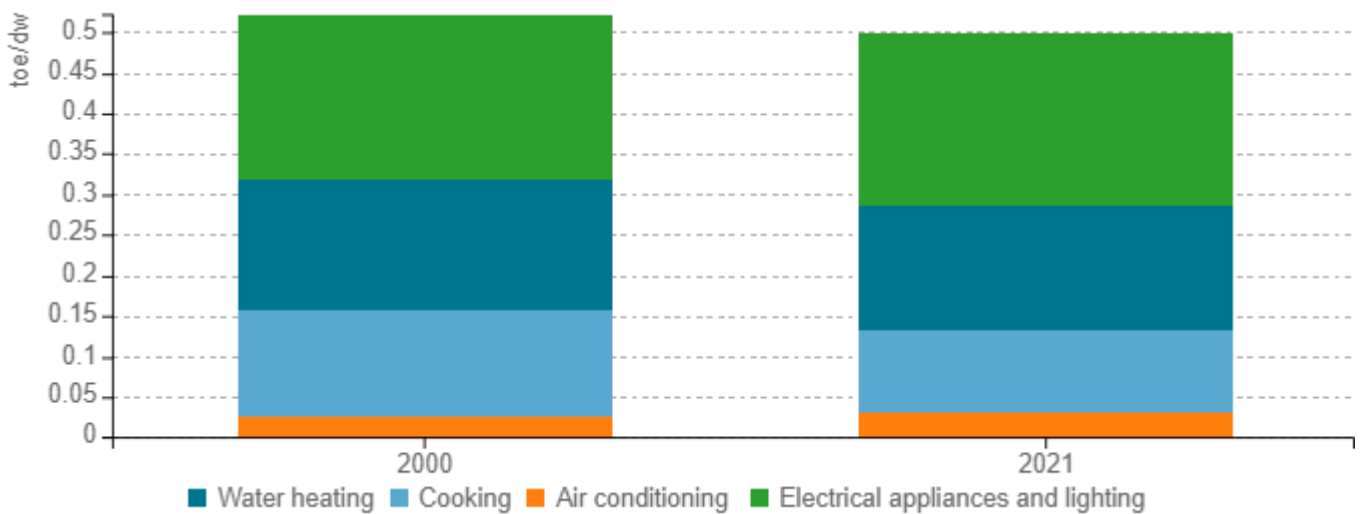
In 2021, space heating accounted for around 68% of the final energy consumption of the residential sector, electrical appliances and lighting for 13.5%, water heating for 10%, cooking for around 6.5% and air cooling for 2%. Between 2000 and 2021, final energy consumption for electrical appliances and lighting increased by 12.3% (0.6% per year) and for water heating by 4.1% (0.2% per year). In contrast, final energy consumption for space heating decreased by 1.7% (0.1% per year), due to energy efficiency and isolation of buildings, and consumption for cooking by 18.7% (1% per year).

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



Source: ODYSSEE

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

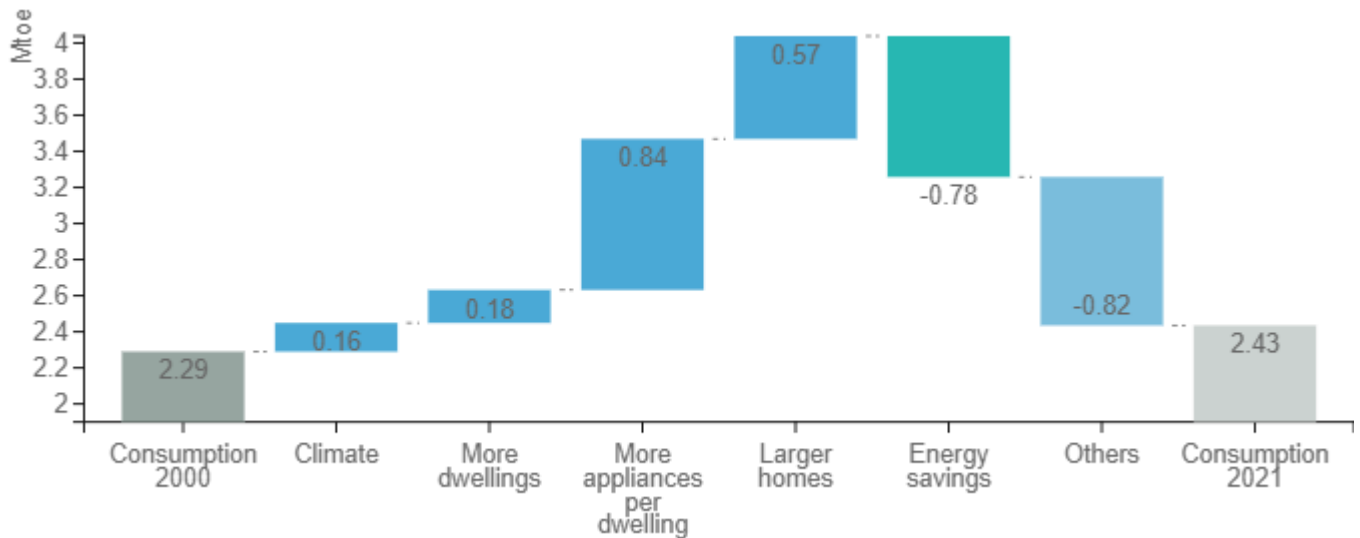


Source: ODYSSEE



Final energy consumption of residential buildings has increased from 2.29 Mtoe in 2020 to 2.43 Mtoe in 2021. Increase in final energy consumption of residential buildings was influenced by more dwellings, more appliances per dwelling and larger homes, decrease was influenced by energy savings. The factors which contributed to such development of energy consumption over this period include: more dwellings (0.18 Mtoe), more appliances per dwelling (0.84 Mtoe) and larger homes (0.57 Mtoe). Energy savings (0.78 Mtoe) and other effects (0.82 Mtoe), which are mainly interpreted as a change in heating behaviours, offset the effect of drivers on consumption growth.

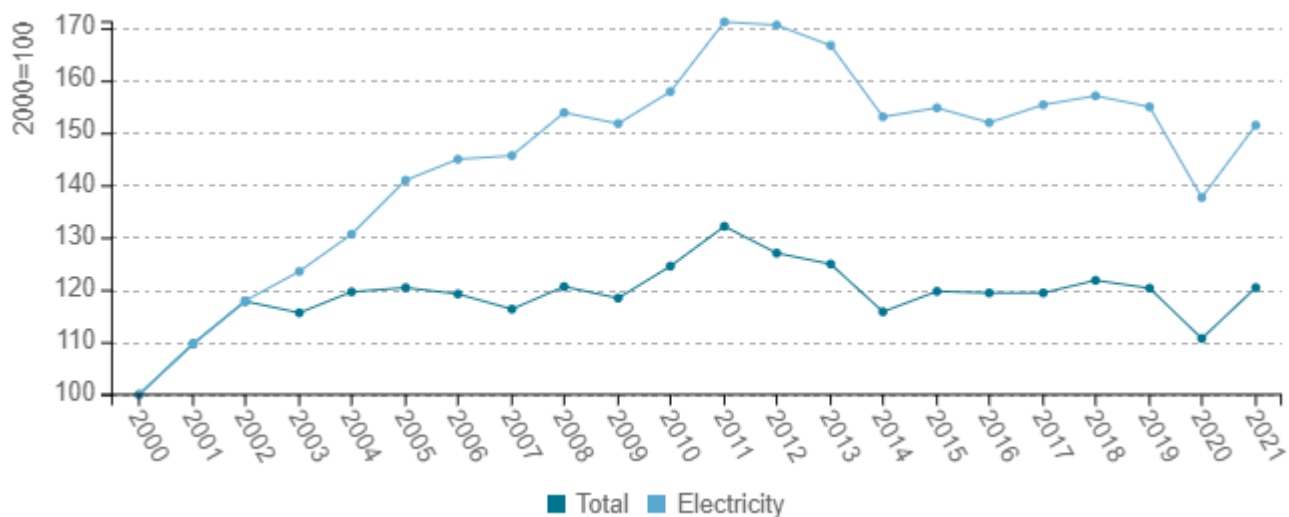
Figure 5: Main drivers of the energy consumption variation of households



Source: ODYSSEE

Between 2000 and 2021, the energy consumption per employee increased by 0.9% per year. The electricity consumption per employee increased by 2.0% per year over the same period, as a result of a widespread diffusion of IT and electrical appliances in offices.

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



Source: ODYSSEE



Pursuant to Article 2a of Directive 2018/844 amending Directive 2010/31/EU on the energy performance of buildings, the Republic of Croatia has adopted a new Long-term strategy for renovation of the national building stock until 2050 (29th session of the Government of the Republic of Croatia, 14th December 2020), with a plan of measures and indicators for 2030, 2040 and 2050. The building renovation rate according to the text of the Long-Term Strategy in the period from 2021 to 2030 is growing from the current 1.0% per year to 3% per year in 2030, rising to 3.5% in the period until 2040 and 4% by 2050. The increased renovation rate expressed in the Long-Term Strategy is the result of a significantly lower building demolition rate that describes the quantity of buildings that are abandoned or removed (in terms of energy consumption, buildings that are not used do not represent a burden on the energy system, but the obligation to decarbonise the total building stock by 2050 produces the need for renovation of buildings that are not used as well, i.e. the need to increase the intensity of renovation in relation to the intensity of new construction).

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

Measures	Description	Expected savings, impact evaluation
Promotion of decarbonisation and the application of the "energy efficiency first" principle in buildings	The aim is to create, through workshops and the Open Partner Dialogue, a broad network of connected professionals who are ready to engage in dialogue and contribute to the decarbonisation of the building stock by 2050.	Increasing the level of awareness of the benefits of energy efficiency with the consequent change in behaviour and reduction in energy consumption by applying concrete measures Support for a regulatory measure for the construction and renovation of buildings as well as a promotional measure that will result in measurable reduction of energy consumption, greater use of RES and avoided CO2 emissions. Increase of professional capacities for the implementation of energy efficiency measures.
Energy renovation programme for multi-apartment buildings	The programme should be conceptualized as a continuation of the implementation of the Energy renovation programme for apartment buildings for the period from 2014 to 2020.	Reduction of thermal needs and energy consumption in multi-apartment buildings and increase in the use of RES and consequent reduction of CO2 emissions; estimated savings in final consumption in 2030 amount to 1.87 PJ (44.55 ktoe; 518.16 GWh); estimated reduction in CO2 emissions in 2030 124.88kt CO2); cumulative energy savings in the period 2021-2030 8.45 PJ (201.82 ktoe; 2,348.0 GWh); cumulative reduction in CO2 emissions in 2021- 2030. 565.87 ktCO2.
Energy renovation programme for single-family houses	The programme needs to be conceptualized as a continuation of the implementation of the Energy Efficiency Programme for single-family homes from 2014 to 2020, with co-financing from the Environmental Protection and Energy Efficiency Fund.	Reduction of thermal needs and energy consumption in family houses and increase of RES use and consequent reduction of CO2 emissions; estimated savings in final consumption in 2030 amount to 4.47 PJ (106.76 ktoe; 1.241,80 GWh); estimated reduction in CO2 emissions 198 in 2030 299.27kt CO2; cumulative energy savings in the period 2021-2030 20.26 PJ (483.90 ktoe; 5,627.2 GWh); cumulative reduction in CO2 emissions in 2021-2030 1,356.16 ktCO2.

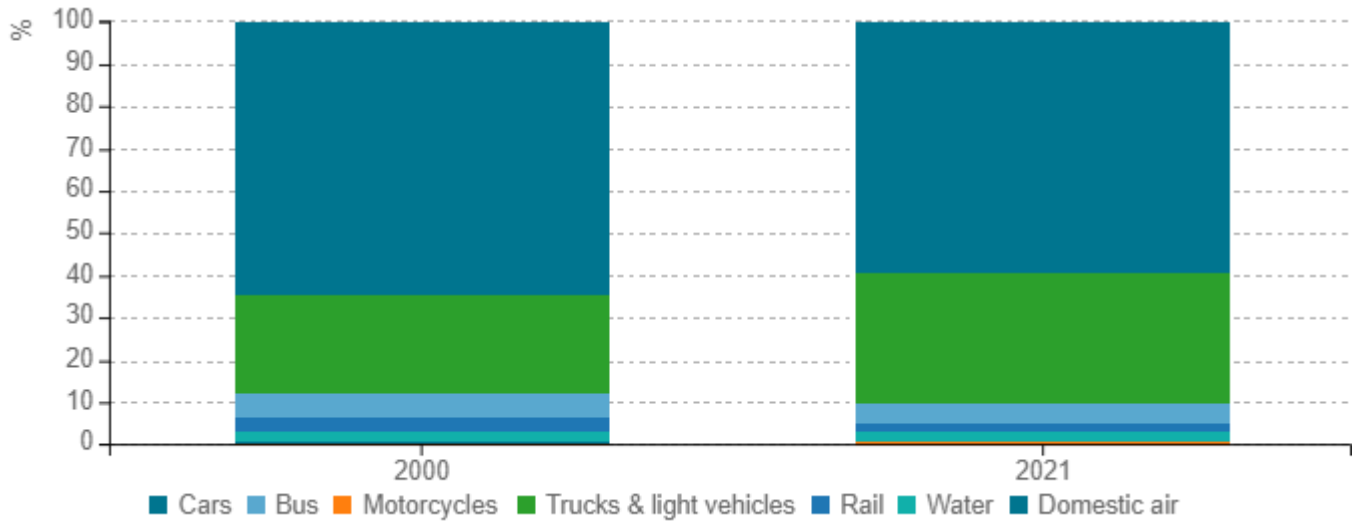
Energy renovation programme for public sector buildings	<p>The measure is a continuation of the implementation of the Public Sector Buildings Renovation Programme 2016-2020. For this purpose, funds from ESI funds should be planned for the next programming period 2021-2027 (with implementation until 2030).</p>	<p>Reducing heat demand and energy consumption in public sector buildings and increasing RES usage and consequently reducing CO2 emissions; estimated savings in 2030 1.69 PJ (40.40 ktoe); estimated CO2 emission reductions in 2030 46.52 ktCO2e; cumulative energy savings in 2021-2030 9.30 PJ (222.20 ktoe); cumulative CO2 emission reductions in the period 2021-2030 264.93 ktCO2e.</p>
Energy renovation program for heritage buildings	<p>Protected buildings within the meaning of this Programme are those which can be classified into two categories: Individually protected cultural property (individual buildings and building complexes) and Buildings within a protected cultural and historical unit.</p>	<p>Reduction of thermal needs and energy consumption in buildings with the status of cultural property and increase in the use of RES and consequently reduction of CO2 emissions; estimated cumulative savings in the period up to 2030. 6.32 PJ (150.95 ktoe); estimated reduction in CO2 emissions in 2030 245.48ktCO2e.</p>
Energy management system in the public sector	<p>The measure is based on the information system for energy management (ISEM). The goal is to cover and regularly monitor all public sector buildings and public lighting systems by the end of 2030 using the ISEM.</p>	<p>Reducing energy consumption in public buildings; changes in the habits and behaviour of users of public sector buildings, estimated savings in 2030 0.20 PJ (4.78 ktoe); estimated CO2 emission reductions in 2030 5.50 ktCO2e; cumulative energy savings in 2021-2030 1.90 PJ (45.41 ktoe); cumulative CO2 emission reductions in the period 2021-2030 54.13 ktCO2e.</p>

Source: MURE

Transport

Road transport in 2021 represents about 95.5% of total final energy consumption in transport. Water transport has a share of around 2.4%, rail transport of about 1.7% and domestic air transport of about 0.4%.

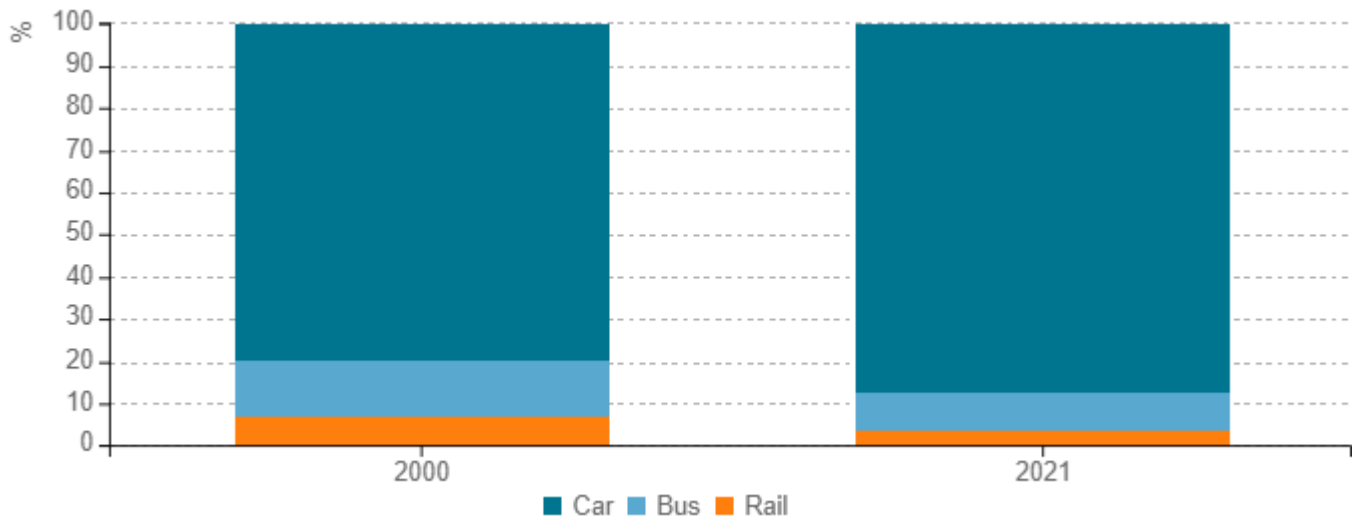
Figure 7: Transport energy consumption by mode



Source: ODYSSEE

The transport of passengers (measured in passenger-kilometre) increased by 5% between 2000 and 2021. This increase was mainly observed in road transport while rail transport decreased.

Figure 8: Modal split of inland passenger traffic

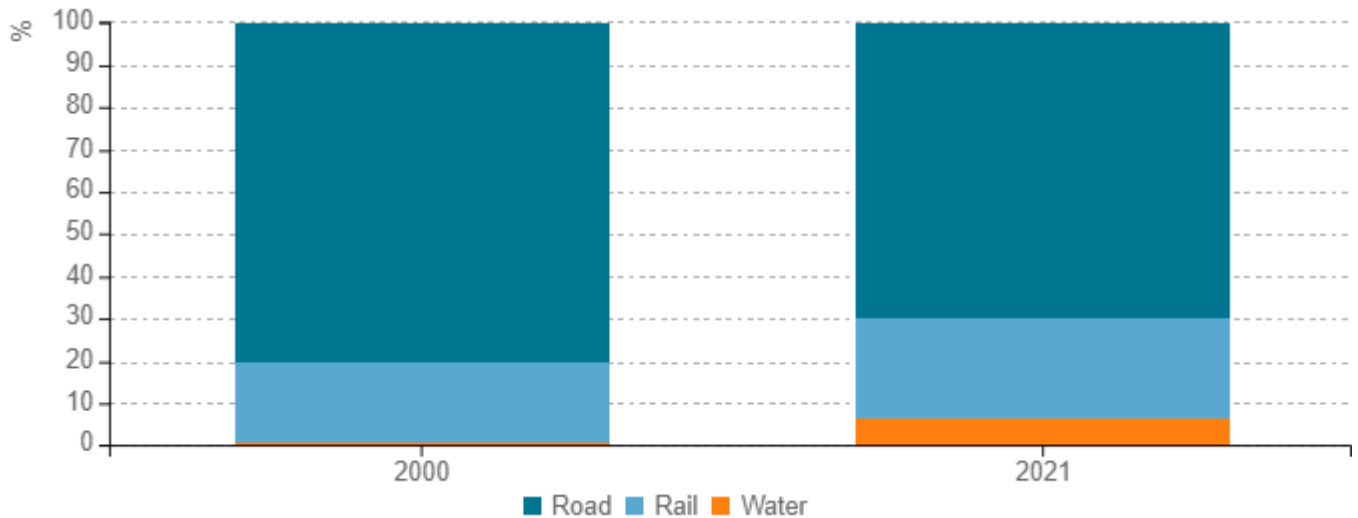


Source: ODYSSEE



The total transport of goods (measured in tonne-kilometre) increased significantly, around 41% (1.7% per year) between 2000 and 2021. Concerning the total transport of goods, road and rail transport increased by 23% and 77%, respectively.

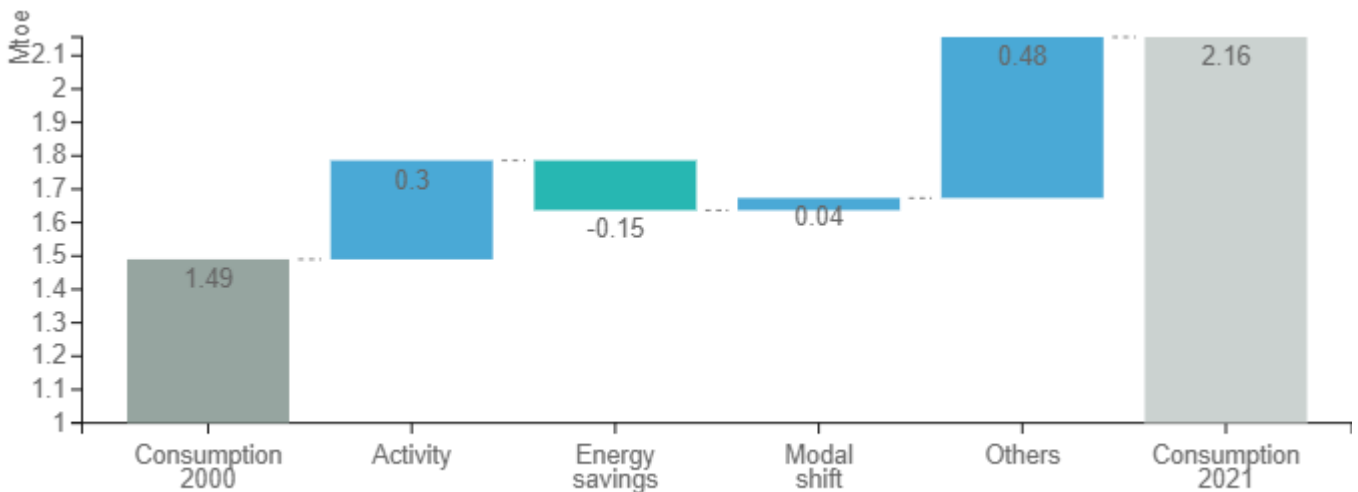
Figure 9: Modal split of inland freight traffic



Source: ODYSSEE

Energy consumption of transport increased by around 45% from 2000 to 2021. Energy consumption is mainly driven by the increase of the activity, slightly compensated by the energy savings. Modal shift and other drivers also participate to a higher energy consumption.

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



Source: ODYSSEE

In the transport sector, the Croatian energy efficiency policy focuses on the use of alternative fuels and more efficient vehicles. This is mainly done through the fiscal policy (special tax on motor vehicles) as well as financial incentives for more efficient vehicles and for the development of an infrastructure in favour of alternative fuels usage, especially in the field of e-mobility.

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

Measures	Description	Expected savings, impact evaluation
Regulatory instruments to promote a cleaner transport system	The aim of the measure is to encourage changes in the transport system that will reduce environmental pollution and achieve a more sustainable transport system. This measure includes the application of regulatory instruments such as regulations, standards and taxes that will encourage the use of low-emission vehicles and increase the use of public transport, pedestrian and bicycle paths.	Energy savings, reduction of CO2 emissions, reduction of pollutant emissions, acceleration of the development of the market for alternative energy products, increase of the share of RES in final energy consumption in transport and increase of the share of vehicles powered by alternative energy sources in road transport.
Programme for co-financing the purchase of new alternative fuel vehicles and the development of alternative fuel infrastructure in road transport	In the context of co-financing of cleaner transport projects, special lines of co-financing for specific purposes will be defined for the purchase of vehicles of all categories with alternative energy sources.	Increasing the number of places for supplying light vehicles with electricity in residential areas, increasing the installed power for supplying light-duty vehicles with electricity along the core and comprehensive TEN-T network, increasing the installed power for the supply of heavy-duty vehicles with electricity along the basic and comprehensive TEN-T network, increasing the installed power for electricity supply in safe and secure parking lots, increase in installed power for the supply of heavy-duty vehicles with electricity in urban hubs.
Encouraging the development of energy-efficient rail transport	This measure establishes the objective of constructing an appropriate number of stations for the supply of electricity or hydrogen from electric trains with a battery storage system and from hydrogen-powered trains on sections of the basic and comprehensive TEN-T network whose electrification is not possible for technical or cost reasons.	The indicative target for 2030 is 6 operational sites with a high-power battery charging port.

Improving the public transport system and promoting sustainable integrated transport	<p>The aim of the measure is to promote the sustainable development of urban transport systems through the optimization of freight transport logistics and intelligent management of public parking areas, the introduction of platforms for integrated passenger transport, the introduction of car-sharing systems in cities, the introduction of low-emission zones in cities, the introduction of public urban bicycle systems and the construction of associated cycling infrastructure, intelligent traffic management (upgrading, adaptation and replacement of obsolete signalling devices and equipment, the installation of advanced traffic equipment and intelligent traffic lights equipped with an autonomous system of power from renewable sources, the construction and equipping of central operational centres for supervision and management of intersections with set traffic lights).</p>	<p>Fully functional commercial service of the autonomous driving system, a minimum of 70 buses powered by alternative fuels, at least 30 modern trams. Save energy, reduce CO₂e emissions and reducing pollutant emissions.</p>
Encouraging the development of energy-efficient maritime transport and inland navigation	<p>The measure involves encouraging the construction of an onshore electricity supply system for seagoing ships and inland waterway vessels</p>	<p>The indicative target for the period to 2030 is 80 MVA of installed OPS power, and the installed infrastructure in 7 seaports and 4 inland waterway ports.</p>
Encouraging the development of energy-efficient air transport	<p>In order to reduce greenhouse gas and pollutant emissions, the electricity supply should replace the consumption of liquid fuel in airports. In this respect, it is necessary to build infrastructure for the electricity supply of stationary aircraft and infrastructure for the supply of preconditioned air (fixed or mobile systems that enable the external supply of conditioned air for cooling, ventilation or heating of stationary aircraft cabins).</p>	<p>Indicative target for 2030 - infrastructure available at 7 airports (total of 40 GPU systems and total of 50 PCA systems).</p>
Developing a low-carbon fuel market	<p>Increasing the share of RES in transport by 2030 through the development of the market for low-carbon fuels and achieving the planned share of fuels produced from renewable energy sources in final energy consumption in transport. The implementation of the measure is based on amendments to the relevant laws and bylaws based on the Renewable Energy Directive.</p>	<p>Meeting the preconditions for supplying the market with low-carbon fuels, meeting the set targets for the share of renewable energy sources in the transport sector.</p>

Source: MURE

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

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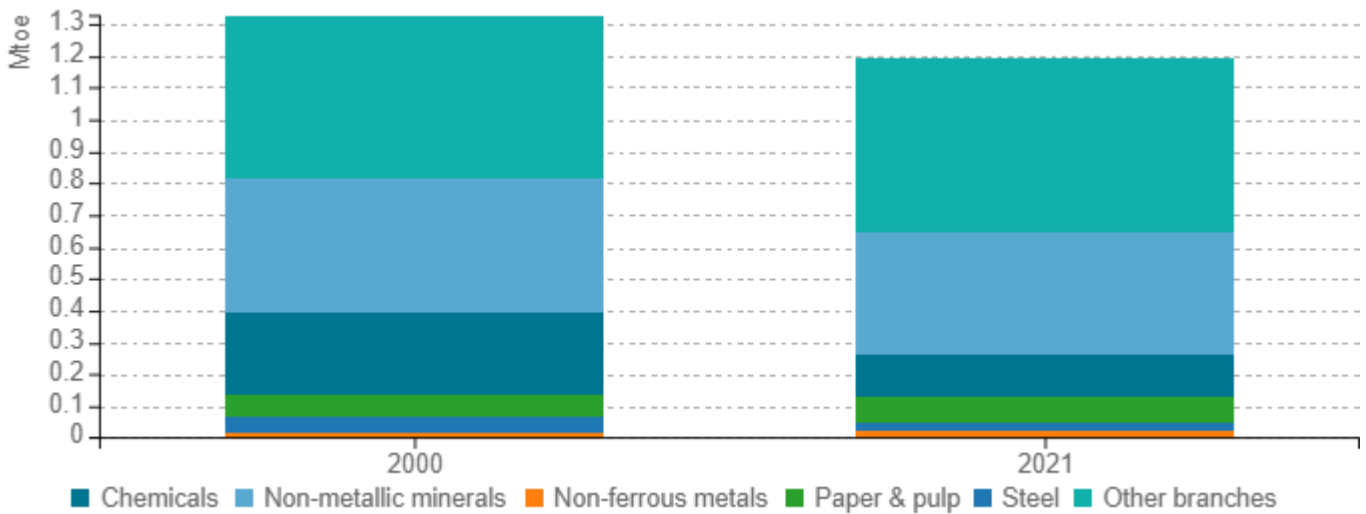


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Industry

Final energy consumption in industry decreased by 10% (0.5% per year) between 2000 and 2021. In 2021, two thirds of the energy consumption was concentrated in four branches: non-metallic minerals (32% of total final energy consumption in industry), food, beverage and tobacco (15%), chemicals (11%) and construction (10%).

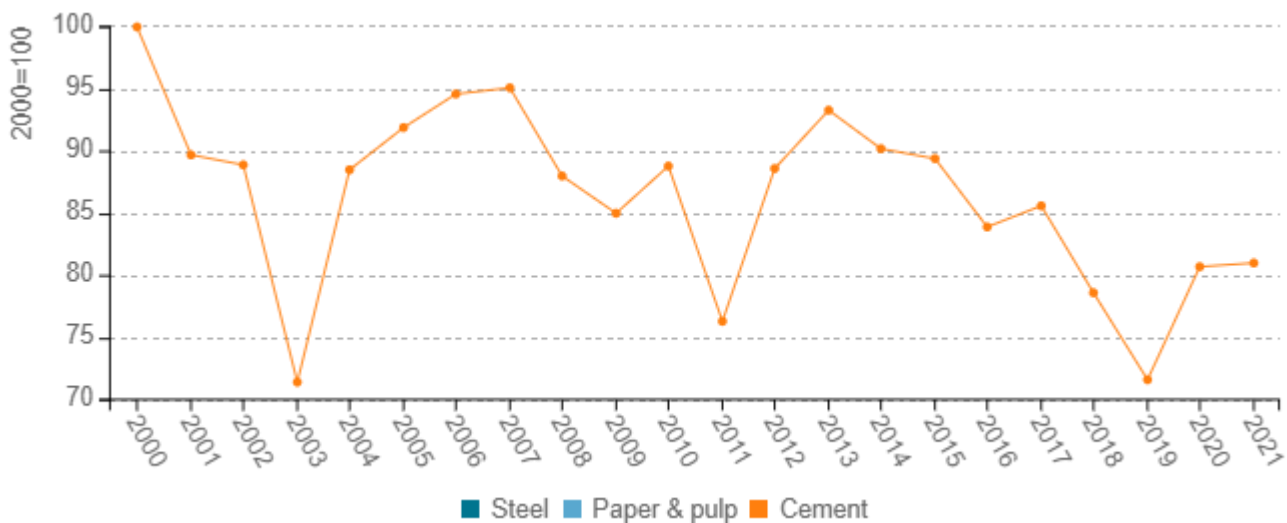
Figure 11: Final energy consumption of industry by branch



Source: ODYSSEE

In the specific energy consumption for cement production, variations occur in certain years. During the period from 2000 to 2021, a trend of decreasing specific consumption can be observed, so that in 2021 it was lower by about 19% compared to the initial year.

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

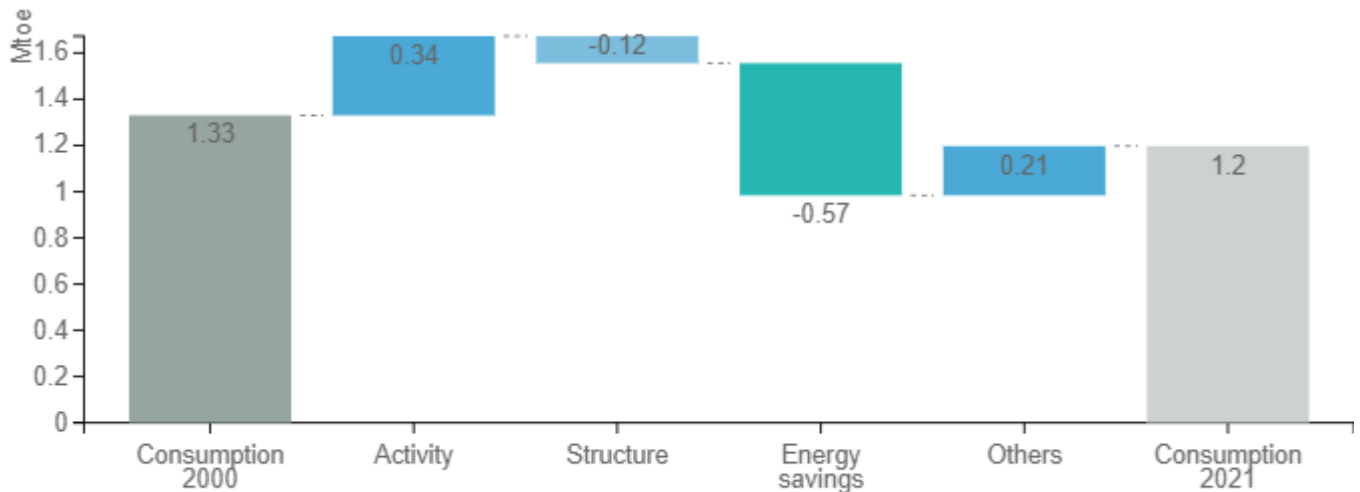


Source: ODYSSEE



Factors that have contributed to a decrease in industrial energy consumption (0.13 Mtoe) since 2000 are energy savings and structure; energy savings had the greatest contribution to this decrease. Structural changes and energy savings have been partly offset by other effects and activity.

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



Source: ODYSSEE

The Croatian energy efficiency policy for the industrial sector is focused on regulatory, informational and financial measures. According to the Energy Efficiency Act, all large enterprises are obliged to perform energy audits every five years or, alternatively, to introduce a standardised energy management system based on international norms. A total of €60 million of funding from the EU Structural Funds has been used since 2017 for stimulating energy efficiency and RES in manufacturing industry.

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

Measures	Description	Expected savings, impact evaluation
Increasing energy efficiency and use of RES in manufacturing industries	The aim of this measure is to ensure the continuation of co-financing of the implementation of such measures in manufacturing industries through grants and financial instruments.	Reducing the energy consumption of businesses in the industrial sector.

Source: MURE

