## **Energy efficiency trends and policies in Greece**

December 2024

Minas latridis, Centre for Renewable Energy Sources and Saving (CRES), Greece

Argyro Giakoumi, Centre for Renewable Energy Sources and Saving (CRES), Greece

Dimitris Mezartasoglou, Centre for Renewable Energy Sources and Saving (CRES), Greece



#### **Project title**

Odyssee-MURE – Monitoring the Energy Efficiency Pillar for Climate Neutrality

#### Notes

This report in its entirety is protected by copyright. The information contained was compiled to the best of the authors' knowledge and belief in accordance with the principles of good scientific practice. The authors believe that the information in this report is correct, complete and current, but accept no liability for any errors, explicit or implicit. The statements in this document do not necessarily reflect the client's opinion.

#### Funding

This project has received funding from the European Union's LIFE programme under grant agreement No. 101075902

The sole responsibility for the content of this document lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither CINEA nor the European Commission are responsible for any use that may be made of the information contained therein."



### Contents

Executi	ve Summary	5
1	Economic and policy context	7
1.1	Economic context	7
1.2	Policy background	8
2	Overall energy efficiency progress and policies	11
2.1	Development of energy consumption and energy efficiency trends	11
2.1.1	Energy consumption based on ODYSSEE	11
2.1.2	Decomposition of final energy demand	15
2.1.3	Energy Savings	16
2.1.4	Comparison with other countries	16
2.2	Cross cutting energy efficiency policies	17
3	Sectoral energy efficiency progress and policies	18
3.1	Residential sector	18
3.2	Industry sector	21
3.3	Service sector	23
3.4	Transport sector	25
4	Special focus: Energy poverty policies	29
5	Discussion and conclusion	30
6	List of figures	33
7	References	35

### List of abbreviations

EED	Energy Efficiency Directive
EEO	Energy Efficiency Obligation Scheme
GDP	Gross Domestic Product
IEA	International Energy Agency
ktoe	thousand tonnes of oil equivalent
VA	Value added

#### **Executive Summary**

This report represents the case study of Greece for the HORIZON 2020 project "ODYSSEE-MURE, a decision support tool for energy efficiency policy evaluation – ODYSSEE - MURE". It introduces an analysis of energy efficiency trends for Greece over the period 2000-2022. It gives an overview of energy efficiency trends on the basis of indicators extracted from the ODYSSEE database. Moreover, it gives an overview of energy efficiency policies and measures based on MURE database.

#### **Overall Trends**

During the period 2000-2007, the total final energy consumption was increased by 18% with a 3% average yearly increasing. However, both the implementation of measures to improve energy end-use efficiency and the economic recession, have resulted in a significant reduction of final energy consumption in 2007-2013. The total final energy consumption during this period follows an average decreasing trend of 6% per year and this subsequently led to a significant reduction of final energy consumption by 31% during this period. In the period 2013-2022, a total increase in the final energy consumption is observed by 5%, taking into account the lifting of the Covid-19 pandemic restrictions in 2021. The energy efficiency index (ODEX) for all sectors in Greece decreased regularly by 35%, between the years 2000 and 2022.

#### Industry

Since 2000 to 2022, the final energy consumption in industry has significant decreased by 42%. Although until 2007 its final energy consumption was almost stable, the industrial sector was one of the first sectors which sustained the effects of the economic recession in final energy consumption. This fact led to the decrease of final energy consumption of industry until 2013, which continued up to 2020, recording a fall of 11% between 2013 and 2020, with the exception of the period of 2014-2016, where an increase was observed. The energy consumption reduced or remained almost stable in all industrial branches. The technical energy efficiency index of the industrial sector improved by 42% in 2022, compared to 2000. This improvement in the energy efficiency index was the result of major decreases in textile and leather (78%), paper, pulp and printing (58%) and mining (57%).

#### Buildings

The building sector, which is consisting of the residential and tertiary sector, consumed 46% of the final energy in Greece in 2022. Since 2000 to 2022, the final energy consumption in households has decreased by 5%. Although until 2006 the households' final consumption was steadily increasing, the households sector was one of the sectors which sustained the effects of the economic recession in final energy consumption. This fact, in combination with the energy efficiency measures that have been implemented since 2007, led to the decrease of final energy consumption of household sector. The technical energy efficiency index (ODEX) for residential sector in Greece decreased by 28%, between the years 2000 and 2022.

#### Transport

Since 2000 to 2009, the final energy consumption in transport increased by 31%. This steadily increase of final energy consumption until 2009, with the exception of 2008, reversed after this year. The total energy consumption of the sector had been reduced in the period 2009-2013 by 31%, mainly because of the reduction of oil products consumption by 29%. Over 2000-2022, the energy consumption in all transport modes decreased following the trends of the total sector. In 2022, the overall energy efficiency of the transport sector has improved by 44%, compared to 2000. The measures that contributed to the significant energy savings that were achieved in the transport

sector were mainly related to the linking of the taxation of vehicles with CO2 emissions, information, public awareness and education measures to increase use of public transport and promotion of economical driving (Eco-Driving).

#### 1 Economic and policy context

#### 1.1 Economic context

During the period 2000-2008, GDP in Greece increased by 32% at constant prices. In the same period, the increase of added value almost in all sectors was also substantial (Figure 1). This increase is mainly due to the boost for major investments and infrastructure constructions for the Olympic Games and the inflow from EU structural funds which contributed to this economic performance, during the period 2000-2008.

The official data from ELSTAT and Eurostat demonstrate the clear impact of the economic recession on the Greek economy during the period 2008-2016. All sectors of economic activity show a decrease in Gross Value Added, particularly for the period 2008-2013, where the impact of the economic recession was being felt in the real economy.

Despite the increase in the service sector for the year 2008 which was 37% compared to 2000, in the following period 2008-2013 there was a fall of 24%, while in the period 2013-2019 the Added Value of the service sector increased by 4%. The total decrease for the period 2008-2022 was 20% (Figure 1).

The industrial sector shows an overall decline in Gross Value Added for the period 2008-2022 of 30% (Figure 1).



Figure 1: GDP and Value Added in Greece, 2000-2022

\* at constant prices

Source: Eurostat



Figure 2: Annual variation of GDP and Value Added in Greece, 2001-2022

\* at constant prices

Source EUROSTAT

### 1.2 Policy background

Energy efficiency, policy development and implementation are the responsibilities of the Ministry of Environment and Energy. The Centre for Renewable Energy Sources and Saving (CRES), whose mandate from the Ministry of Environment and Energy also extends to energy efficiency, provides technical analysis and modelling services in support of policy development. This modelling keeps informed the Greek government and all involved stakeholders on its setting of energy efficiency targets and energy policy measures in general as well as their assessment.

Energy efficiency is the "first fuel of choice" for energy security enhancement and climate change mitigation. Energy efficiency offers cost-effective options for sustained savings in energy demand that, with proper policy support, can be implemented quickly. Given the recent energy crisis, Greece had the opportunity to place a strong focus on strengthening energy efficiency measures to reduce fossil fuel demand. This will provide immediate benefits for energy security and contribute to the long-term goal of carbon neutrality.

In response to the 2022 global energy crisis caused by Russia's invasion of Ukraine, the Greek government announced in September 2022 exceptional measures to reduce energy consumption by 10% in the short term and by 30% until 2030. This will be achieved by introducing new measures in the public sector and through existing programmes. For the medium term up to 2030, the NECP defines energy efficiency targets and a wide range of energy efficiency measures to be implemented across all sectors.

According to Article 8 of Directive (EU) 2023/1791, Greece has a target of achieving cumulated energy savings for 11,251 thousand tonnes of oil equivalent (ktoe) between 2021 and 2030. In its National Energy Efficiency Action Plan of 2024, the government indicated many measures in different sectors to achieve this target. The measures expected to deliver the highest amount of savings were "energy renovation of residential buildings", "energy managers and action plans for public buildings" and "obligation schemes". Data on achieved energy savings show that the energy managers delivered much fewer savings than expected, while the Energy Efficiency Obligation schemes overachieved their target during the 2017-2020 period.

Greece's Energy Efficiency Obligation Scheme (EEO) started in 2017 and is managed by the Centre for Renewable Energy Sources and Saving (CRES). Obligated parties are electricity, gas, oil products suppliers or retailers whose market share is higher than 1%. The number of obligated parties was 35 in 2022. Obliged parties certify (through CRES) the energy savings resulting from the energy efficiency improvement measures they take, satisfying the annual targets of the obligation imposed on them by the Ministry, either through their efforts or by transferring savings from other obligated parties or third parties at a negotiated price. There is no market platform for certificate trading, and the EEO excludes third parties from receiving and trading certificates. Penalties are foreseen if obligated parties do not fulfil their annual target. Actions tackling fuel poverty are eligible for a bonus factor of 40%.

From 2017 to 2020, the EEO exceeded its target demand reduction by 80%. A new cycle of energy savings is expected under the EED for EU countries from 2021 to 2030. In the government's plan, EEO schemes will account for 24% of the total cumulative objective, whereas a total of 9 alternative policy measures are to be implemented to cover the remaining part of the objective. These include energy upgrading of public and private buildings, improving energy efficiency through energy service companies, energy managers in public buildings, upgrading pumping, lighting and transport infrastructures and promoting alternative fuels in road transport.

In the building sector, the government is strengthening building codes and has launched a number of investment schemes. These programmes aim to improve the energy performance of public and private buildings, increase the number of net zero energy buildings, and expand the use of renewable water heating. In the transport sector, the country is supporting the uptake of EVs and is investing in improving charging infrastructure. Energy efficiency measures in the industry include energy audits and support for efficient equipment, mainly for heating.

In this context, a number of indicative policy measures for promoting energy efficiency in Greece are presented as follows:

The **Electra** programme, launched in 2020, aims to improve the energy efficiency of public buildings. The programme is funded from 2022 to 2026 with  $\leq$ 500 million from the Deposit and Load Fund of the European Investment Bank,  $\leq$ 170 million from the EU Recovery and Resilience Facility<sup>1</sup>, and  $\leq$ 40 million in private investments. The programme includes public buildings with an energy class between C and H that have not yet undergone radical renovation. The programme finances the renovation of the whole building, aimed to improve energy efficiency, reach class B and reduce energy demand by 30%, with the mandatory appointment of an energy manager. Financed interventions include replacing windows, modernising heating and cooling systems, and installing renewables and electricity storage. The programme encourages the participation of energy service companies to perform the renovation works.

The **Savings at Home** programme aims to improve the energy efficiency of residential buildings and is funded by EU programmes, including the Recovery and Resilience Facility. The programme provides interest-free loans and grants for the installation of renewables and energy efficiency measures. The yearly rounds from 2018 to 2020 received a total of 94,094 applications and provided grants for  $\leq 1.3$  billion and loans for  $\leq 113$  million. The 2021 round of the programme had a budget of  $\leq 1.14$  million, a maximum eligible intervention of  $\leq 28,000$  and targeted support for vulnerable

<sup>&</sup>lt;sup>1</sup> In response to the Covid-19 pandemic, the European Union established the Recovery and Resilience Facility, which provides €724 billion through 2026 to support recovery and resilience plans developed by each EU member state. Greece was among the first EU member states to submit a plan in April 2021. The plan (Greece 2.0) is one of the largest funding requests to the Recovery and Resilience Facility (€30.5 billion, equivalent to 16.7% of Greece's 2019 GDP). The plan funds energy efficiency subsidies for residential buildings (€1.1 billion), businesses (€0.45 billion) and the public sector (€0.2 billion).

households. The programme ran until the end of the first half of 2022, with a record high number of applications (87,578).

The contributions for energy efficiency improvements of the Electra and Savings at Home programmes are included in the "Renovate" component of Greece's Recovery and Resilience Plan. With a total budget of €2.7 billion, this component is the second-largest of the plan and is centred on renovation and energy upgrading of buildings, including residential, business (secondary and tertiary sector), public buildings and public lighting points. The Recovery and Resilience Plan also supports the publication of Greece's Action Plan to Combat Energy Poverty, which provides a framework for energy upgrades of residential buildings of energy-vulnerable households.

A programme called "**Recycle-Change Device**" was completed in June 2022. Through this programme, Greek households received a subsidy to replace up to three old electric appliances with new ones, including air conditioners, refrigerators or freezers. Households could apply to the programme through a digital platform and need to return the old appliances to receive the subsidy. The subsidy rate was ranged from 30% to 50% of the cost of the appliance. It is estimated that this programme will reduce electricity demand by 209 GWh per year and support annual savings of  $\notin$ 40 million.

### 2 **Overall energy efficiency progress and policies**

# 2.1 Development of energy consumption and energy efficiency trends

#### 2.1.1 Energy consumption based on ODYSSEE

The trend of final energy consumption in Greece changed during the period 2000-2022 (Figure 3). During the period 2000-2007, a total increase of final energy consumption by 18% was recorded, from 17.8 Mtoe in 2000 to 21.0 Mtoe in 2007. This increase was occurred mainly because of the economic growth of the country and the new habits that were adopted by final consumers, during this period. This growing trend mainly came from the increase of oil consumption by 15% (11.8 Mtoe in 2000 to 13.6 Mtoe in 2007) and a major increase in electricity consumption by 28% (3.7 Mtoe in 2000 to 4.8 Mtoe in 2007), as these products were the basic energy sources that participate in the final energy mix in Greece (Figure 6).

However, both the implementation of measures to improve energy end-use efficiency and the economic recession resulted in a significant reduction of final energy consumption in 2007-2013. The total final energy consumption during this period was decreased by 30%, from 21.0 Mtoe in 2007 to 14.7 Mtoe in 2013. This significant decrease was caused mainly due to the reduction of both oil products and electricity by 42% and 12%, respectively.

In the period 2013-2022, a total increase in the final energy consumption by 5% was observed, from 14.7 Mtoe in 2013 to 15.4 Mtoe in 2022. This significant increase was caused mainly due to the increase of oil products by 5%.



Figure 3: Final energy consumption in Greece, 2000-2022



Figure 4: Annual variation of final energy consumption in Greece, 2001-2022



Figure 5: Final energy consumption per fuel in Greece, 2000-2022

Source: ODYSSEE

During the period 2000-2022, the energy mix of the final consumption changed. The introduction of Natural Gas in 1998 led to the increase of its share in the country's energy mix from 1% in 2000 to 8% in 2022 (Figure 6).

■ Coal ■ Oil products ■ Gas ■ Heat ■ Renewables ■ Electricity

The final energy consumption of renewable energy sources was also increased by 49% over this period, mainly because of the implemented measures to promote the renewable energy sources in all sectors which resulted to the increasing of the participation of renewables in the final energy consumption from 6% in 2000 to 11% in 2022.

Finally, mainly because of the increasing cost of heating oil in the last years, the share of electricity consumption in the final consumption increased from 21% in 2000 to 27% in 2022, leading to the reduction of the share of oil products in the final energy mix of the country. However, oil products remain the dominant energy source of final consumers in Greece (Figure 6).



Figure 6: Share per fuel in final energy consumption mix in Greece, 2000-2022

In 2022, the transport sector consumed the biggest part of final energy consumption in Greece with 6.0 Mtoe (Figure 7). From 2008 to 2013, there was a reduction in consumption in all sectors, which was possibly due to the fact that these sectors were the first ones which were affected by the economic recession. This fact had an influence in the final energy consumption, which was further enhanced by the increase in energy prices. In the period 2014-2022, an increase in the consumption was observed, with the exception of the industrial sector. It is worth noting that the energy demand in the transport sector decreased substantially in 2020 as a result from the Covid-19 pandemic.



Figure 7: Final energy consumption by sector in Greece, 2000-2022

Source: ODYSSEE

The energy share of all sectors (industry, transport, households and agriculture) has been decreased by 42%, 6%, 5% and 74% correspondingly (Figure 8), comparing 2000 and 2022, apart from the services where an increase of 59% has been recorded. In the following chapters of this report a detailed analysis of all sectors is presented.



Figure 8: Share per sector in final energy consumption in Greece, 2000-2022

Concerning the overall energy intensities, two general indicators are generally used to characterize the overall energy efficiency trends: the primary energy intensity (i.e. the ratio primary consumption over GDP), and the final energy intensity (ratio final consumption over GDP). The primary intensity provides an assessment of the energy productivity of the whole economy. The final intensity characterizes the energy productivity of final consumers only. The final consumption, according to the ODYSSEE definitions, excludes non-energy uses.

In 2019, primary and final energy intensity decreased by 22% and 16% respectively, compared to 2000 (Figure 9).



Figure 9: Primary and final energy intensity in Greece, 2000-2022

The Global energy efficiency index (ODEX) for Greece decreased regularly by 35%, between the years 2000 and 2022, mainly because of the energy efficiency measures that started to apply since the economic crisis of 2008, leading to a total improvement in energy efficiency by 35% over these years (Figure 10).

ODYSSEE-MURE



Figure 10: Energy efficiency Index (ODEX) in Greece, 2000-2022

Source: ODYSSEE

### 2.1.2 Decomposition of final energy demand

The decomposition of the final energy consumption variation is calculated by combining the sectoral decomposition, i.e. by adding the contribution of the different drivers by end-use sector in broad categories.

As shown in Figure 11, the final energy consumption in Greece stood at 15.4 Mtoe in 2022, down by 13.5%, compared to 2000 levels. The activity, which incorporates the change in value added in industry, services and agriculture, in traffic in transport, in number of dwellings and appliances and in the size of dwellings for households, increased by 1.9 Mtoe over 2000-2022, almost the same rise compared to the other effects<sup>2</sup>, which increased by 1.8 Mtoe.

Moreover, structural effects in Greece, which cover industry (and services) impacts as well as modal shift in transport, increased 1.2 Mtoe during 2000-2022, while the technical energy savings decreased by 6.9 Mtoe and were the main parameter that moved downward the total final energy consumption in 2022.

<sup>&</sup>lt;sup>2</sup> Other effects include behaviors for households, value of product in industry, labor productivity in services and "negative" savings due to inefficient operations in industry and transport.



#### Figure 11: Variation of final energy consumption (Mtoe) in Greece, 2000-2022

Source: ODYSSEE

### 2.1.3 Energy Savings

As shown in Figure 12, the total final energy savings in Greece reached 6.9 Mtoe in 2022, recording a constant upward trend since 2000. The highest increase in terms of final energy savings was noted in 2013, compared to the previous year, from 4.4 Mtoe in 2012 to 5.3 Mtoe in 2013.



#### Figure 12: Final energy savings from ODYSSEE in Greece, 2000-2022

### 2.1.4 Comparison with other countries

According to the 2023 EU Energy Efficiency scoreboard<sup>3</sup>, Greece stands at the sixth place in EU-27 in terms of energy efficiency in general, behind Luxembourg, Germany, France, Latvia and Denmark.

<sup>&</sup>lt;sup>3</sup> https://www.odyssee-mure.eu/data-tools/scoring-efficiency-countries.html

#### Figure 13: Overall energy efficiency score in EU-27



Source: ODYSSEE

### 2.2 Cross cutting energy efficiency policies

A summary of the ongoing cross cutting energy efficiency policies in Greece is shown in Figure 14, with the majority of them having already been implemented since 2016.

#### Figure 14: Ongoing cross cutting energy efficiency policies in Greece

<ul> <li>Starting Year </li> <li>2021</li> <li>2018</li> <li>2020</li> <li>2018</li> <li>2017</li> <li>2021</li> </ul>
2021 2018 2020 2018 2017 2021
2018 2020 2018 2017 2021
2020 2018 2017 2021
2018 2017 2021
2017 2021
2021
2021
2016
2021
2021
2016
2022
2021
2021
s 2008
2018
2016
2021
2016
2016
nt

Source: MURE

#### 3 Sectoral energy efficiency progress and policies

#### 3.1 Residential sector

From 2000 to 2022, the final energy consumption in households has decreased by 5%, from 4.5 Mtoe in 2000 to 4.3 Mtoe in 2022.

Although until 2006 the households' final consumption was steadily increasing, the households sector was one of the first sectors which sustained the effects of the economic recession in final energy consumption. This fact, in combination with the energy efficiency measures that have been implemented since 2007, led to the decrease of final consumption of household sector (Figure 15).

An increase in residential final consumption occurred in 2011, mainly because of the colder winter (Figure 16). Another reason was that this year the government announced that a new tax in heating oil would be implemented in 2012, which would lead to the increase of heating oil cost by 50%. These facts led the consumers to procure the heating oil for the next years in 2011, leading to the significant increase of final energy consumption in residential sector.



Figure 15: Final energy consumption in the residential sector in Greece, 2000-2022



Figure 16: Final energy consumption by fuel in the residential sector in Greece, 2000-2022

Source: ODYSSEE

From 2000 to 2006, the oil products were the main fuels that were used by the residential sector (more than 50%, Figure 17). After 2006, with the introduction of Natural Gas in the country's energy mix, part of the residential needs that had been covered by oil products, started to be covered by natural gas, fact that led to the reduction of the percentage of oil products at the mix of final energy consumption.

After 2013, due to the high cost of oil products, the main fuel that was consumed in the residential sector was the electricity (about 40%). Moreover, in 2022, due to the measures promoting the renewable energy sources, the percentage of these increased by 7%, compared to 2000 (Figure 17).



Figure 17: Share in final energy consumption by fuel in the residential sector in Greece, 2000-2022

The biggest part of final energy consumption in households was consuming for space heating (Figure 18). Households in 2000 consumed for space heating 3.1 Mtoe against 2.4 Mtoe in 2022; namely a 20% total reduction in space heating energy consumption. The final energy consumption of electrical appliances between the years 2000 and 2022 increased by 25% (Figure 18) because of the increase of their number and size. The final energy consumption for cooking and water heating remained almost constant during the period 2000-2022 (Figure 18).

ODYSSEE-MURE





Source: ODYSSEE

The technical energy efficiency index (ODEX) for residential sector in Greece decreased regularly by an average of 1%, in the period 2000-2022, mainly because of the energy efficiency measures that started to apply since 2008 and the economic recession, leading to a total improvement in energy efficiency by 28% over these years (Figure 19).





### 3.2 Industry sector

Over 2000-2022, the final energy consumption in industry has been significantly decreased by 42%, from 4.4 Mtoe in 2000 to 2.6 Mtoe in 2022 (Figure 20). Although its final energy consumption stood in 2007 at 2001 level, the industrial sector was one of the first sectors which sustained the effects of the economic recession in final energy consumption. This fact led to a decreasing trend of final energy consumption of industry until 2013, which continued up to 2022, recording a fall of 10% between 2013 and 2022, with the exception of the period of 2013-2016, where an increase was observed.



Figure 20: Final energy consumption in the industrial sector in Greece, 2000-2022

Source: ODYSSEE

Over 2000-2010, the oil products remained the main fuel in industry, and their reduction by 31% (1.9 Mtoe in 2000 to 1.3 Mtoe in 2010) was the main driver for the reduction of the total energy consumption of the sector. From 2011 onwards, the contribution of oil products was decreased, with electricity gaining their share. During 2000-2022, oil products declined their penetration in the total energy consumption of the industry by 60%. Moreover, a significant reduction in coal and renewable energy sources by 92% and 48% respectively was noted from 2000 to 2022. Electricity consumption also decreased by 12%, from 1.17 Mtoe in 2000 to 1.02 Mtoe in 2022. The only fuel that was increased was the Natural Gas, from 0.24 Mtoe in 2000 to 0.57 Mtoe in 2022 (Figure 21).



#### Figure 21: Final energy consumption by fuel in the industrial sector in Greece, 2000-2022

Source: ODYSSEE

As already analysed, the share of oil products in the energy mix of the sector was decreasing during the period 2000-2022. The main reason for this reduction was the introduction of Natural Gas in the energy market, which led to a rise of its consumption by 133% in 2022, compared to 2000. The penetration of renewables remains stable, and they represented around 5% of the total consumption of the industrial sector (Figure 22).

# Figure 22: Share of final energy consumption by fuel in the industrial sector in Greece, 2000-2022



#### Source: ODYSSEE

During this period, the energy consumption reduced or remained almost stable in all industrial branches (Figure 23). The branch with the greatest reduction in energy consumption was transport equipment and its consumption was decreased from 0.04 Mtoe in 2000 to 0.01 Mtoe in 2022.



Figure 23: Final energy consumption by branch in the industrial sector in Greece, 2000-2022

Source: ODYSSEE

The technical energy efficiency index of the industrial sector improved by 42% in 2022, compared to 2000 (Figure 24). This improvement in the energy efficiency index was the result of major decreases in textile and leather (78%), paper, pulp and printing (58%) and mining (57%).



Figure 24: Energy Efficiency Index (ODEX) in the industrial sector in Greece, 2000-2022

Source: ODYSSEE

#### 3.3 Service sector

Although until 2008 its final consumption was steadily increased by 6% on average per year, the services sector was one of the first sectors which sustained the effects of the economic recession in final energy consumption (Figure 25). This fact led to the decrease of final consumption of the

sector, since 2009, with exemption 2012 where a slight increase recorded, mainly because of the increase of electricity consumption (Figure 26). Also, an increase was observed in the period 2014-2017, followed by numerous variations, before increased in 2022 (Figure 26).



Figure 25: Final energy consumption in services in Greece, 2000-2022

Source: ODYSSEE

Figure 26: Final energy consumption by fuel in services in Greece, 2000-2022



Source: ODYSSEE

Over 2000-2016, the energy mix that was consuming in tertiary sector remained almost stable. Since 2006, with the introduction of Natural Gas and the increase in the contribution of renewables, especially during 2017-2022, the energy mix in Greece is constantly changing. The electricity remains the main energy carrier with a percentage of 71% in the overall energy consumption of the sector in 2022 (Figure 27).



Figure 27: Share of final energy consumption by fuel in services in Greece, 2000-2022

#### 3.4 Transport sector

From 2000 to 2009, the final energy consumption in transport increased by 31%, from 6.4 Mtoe in 2000 to 8.4 Mtoe in 2009 (Figure 28). This growing trend mainly came from the increase of oil consumption by 29% (6.4 Mtoe in 2000 to 8.2 Mtoe in 2009) (Figure 29).

Due to economic recession and the energy efficiency measures that were implemented after 2007, the steadily increase of final energy consumption until 2009, with the exception of 2008, reversed after this year (Figure 28). The total energy consumption of the sector has been reduced by 31% in the period 2009-2013, mainly because of the reduction of oil products consumption by 32% (Figure 29). In the period 2013-2022, an increase of 4% was observed.

Figure 28: Final energy consumption in transport in Greece, 2000-2022





Figure 29: Final energy consumption by fuel in transport in Greece, 2000-2022

Source: ODYSSEE

Since 2006, the introduction of Natural Gas and biofuels in the energy mix had as a result a slight decreasing trend by 2% in the share of oil products in the energy mix of transport sector. Oil products remain though the dominant fuel in transport sector (Figure 30).



Figure 30: Share of final energy consumption by fuel in transport in Greece, 2000-2022

\*Gas, electricity, renewables Source: ODYSSEE

Over 2000-2022, the energy consumption in all transport modes decreased following the trends of the total sector (Figure 31). The biggest part of final energy consumption in transport was consumed by road transport with an average share of 86% at the total final consumption of the sector during this period (Figure 32). The trend in the fuel mix remains almost stable over this 23-year period.



Figure 31: Final energy consumption by mode in transport in Greece, 2000-2022

Source: ODYSSEE



Figure 32: Share by mode in transport in Greece, 2000-2022

Source: ODYSSEE

The share by type of vehicles remained basically constant during the period 2000-2022. The cars were responsible for the biggest energy consumption of the road transport with an average share of 52% in the final consumption of the mode during this period. Trucks and light vehicles consumed the 41% of the total consumption of road mode over 2000-2022 (Figure 33).



#### Figure 33: Share by vehicle in road transport in Greece, 2000-2022

Source: ODYSSEE

In 2022, the overall energy efficiency of the transport sector has improved by 44%, compared to 2000 (Figure 34).





### 4 Special focus: Energy poverty policies

In MURE database, five energy poverty policies have been identified for Greece and all of them are in the residential sector. Four out of five energy poverty policies are the subsequent programmes of the "Saving at home" programme, started in 2011.

Code	Country	Sector	Title	Status	Туре	Starting Year	Energy Poverty	Energy Poverty Subcategories
HOU- GR0677	Greece	Household	The "Saving at home" programme	Ongoing	Financial	2012	yes	including an im- portant compo- nent addressing energy poverty
HOU- GR0679	Greece	Household	Energy Upgrading of social housing - The "Green Neigh- borhoods" Pro- gramme	Ongoing	Financial, Mandatory standards	2011	yes	aiming mainly or exclusively at en- ergy poverty
HOU- GR0684	Greece	Household	The "Saving at home II" pro- gramme	Ongoing	Financial	2012	yes	including an im- portant compo- nent addressing energy poverty
HOU- GR4542	Greece	Household	The "Save 2021" programme	Ongoing	Financial, Mandatory standards	2021	yes	including an im- portant compo- nent addressing energy poverty
HOU- GR5155	Greece	Household	The "Save 2024" programme	Ongoing	Financial, Mandatory standards	2024	yes	including an im- portant compo- nent addressing energy poverty

righte 55. Energy poverty policies in direct	Figure	35:	Energy	poverty	policies	in	Greece
--	--------	-----	--------	---------	----------	----	--------

Source: MURE

#### 5 **Discussion and conclusion**

The Greek government supports energy efficiency in buildings through strengthened minimum requirements for new buildings and investment programmes supporting renovations of existing buildings. The Climate Law includes a ban on the installation of oil boilers from 2025 onwards. As of 2030, oil for heating will have to contain renewable liquid fuels of at least 30% by volume. The government has also published a plan with intermediate milestones to increase the number of nearly zero-energy buildings and renovate almost 100% of the building stock by 2050. Investment programmes support the renovation of buildings, including an investment of over €5 billion from the Recovery and Resilience Plan.

According to the latest NECP, the government has set a target to renovate 68,000 buildings per year until 2030. Incentives for these renovations will be provided through EU funding and leveraging private financing. The **"Saving at Home"** programme (co-financed by the European Union and Greece) offers interest-free loans and subsidies to replace windows and doors and to upgrade thermal insulation and heating systems. This programme should be expanded with additional funding to meet the high consumer demand for renovation projects. In addition, the focus should be on deep renovations that combine improvement in thermal performance with the deployment of heat pumps to allow for proper sizing of the heating and cooling system to deliver the maximum benefits for energy savings and reducing energy bills. Low-income households should be prioritised, with an appropriate level of financial and technical support to ensure that they can take full advantage of the programme.

Energy performance certificates must be issued when a building is built, purchased or rented, and before and after a major renovation. However, in 2021, only 38% of residential buildings had an EPC, greatly limiting information for consumers. More effort is needed to increase the share of buildings with an EPC. The relatively low number of EPCs issued can be attributed to a shortage of assessors, a lack of enforcement mechanisms, and low awareness among owners and builders.

The **Electra** programme aims to improve the energy efficiency of public buildings and has a budget of  $\notin$ 670 million (from the European Union) for 2022 to 2026, topped up with  $\notin$ 250 million of private investments. It supports deep renovations of public buildings to reach class B and achieve a 30% reduction in energy demand. The government should take steps to accelerate this programme (e.g. by front-loading the funding) so it can deliver savings in the near term as part of the effort to use energy efficiency to limit the impacts of the energy crisis.

Moreover, the Greek government aims to improve the efficiency of the transport sector and reduce its impact on climate by increasing electrification and the use of alternative fuels and promoting a modal shift to public transport. A sound energy policy in the transport sector involves a comprehensive approach following the "avoid, shift, improve and finance" model. In this approach, measures are adopted to avoid the need for transport, shift to more efficient transport modes such as public transport, improve the efficiency of transport devices and infrastructure, and finance the overall reform in a just way.

Greece aims to significantly increase the electrification of its transport sector in the coming years as a key tool to achieve its climate goals. The NECP sets clear annual targets for the adoption of passenger EVs in the country's vehicle fleet until 2030.

In July 2020, the Greek government passed a law for promoting electromobility in Greece. The law introduces grants for the purchase of electric cars, motorcycles, bicycles and scooters, allocates free-of-charge parking spaces to EVs (with emissions lower than 50 g CO2/km), lowers taxes for EV-related industry, and promotes spatial and urban planning favourable to EVs, such as the

installation of public charging stations. The law also increases taxes for imported old vehicles with high emissions. The Climate Law 2022 requires that as of 2024, at least a quarter of new company cars must be EVs (battery only or plug-in hybrid), emitting less than 50 g CO2/km. Moreover, from 1 January 2026, all new taxis circulating in the prefecture of Athens and Thessaloniki, as well as one-third of new cars registered for rental purposes, must be battery electric. In addition, the law introduces the obligation to sell only zero-emission vehicles starting in 2030.

The programme **"I Move Electric"** supports the purchase of EVs in Greece. In its first wave, it offered subsidies of up to  $\in 6,000$  for the purchase of electric cars and motorcycles. The first cycle of the programme was largely successful. It significantly contributed to increasing the number of EVs, overshooting the initial target. In July 2022, a second version of the programme had been in place (I Move Electric II), with a budget of  $\in 50$  million for 2022-2023. It included an increase in the subsidy for individuals and companies for the acquisition of electric cars and motorcycles. These subsidies covered up to 30% of the price, up to a maximum of  $\in 8,000$ . The purchase of a smart home charger could be subsidised up to  $\in 500$ . An extra bonus of  $\in 1,000$  was given for scrapping an old car. Moreover, an extra bonus of  $\in 1,000$  was given to individuals under 29 when buying an electric car and  $\in 500$  when buying an electric two- or three-wheeler.

Subsidies are also provided for business cars and taxis. Taxis could receive up to  $\notin$ 17,500 plus another  $\notin$ 5,000 for scrapping an old taxi and replacing it with a battery electric one, financed by a dedicated budget of  $\notin$ 40 million from the Recovery and Resilience Plan. The target is to replace 2,000 taxis. This programme also included tax benefits for private individuals and businesses owning EVs, such as an exemption from the registration tax, ownership tax, luxury commodity tax and a reduced VAT rate for EV purchases (13% instead of 24%).

In addition, the e-mobility law bans or places high fees on the import of older passenger vehicles. Greece's Recovery and Resilience Plan also includes €80 million to support the installation of about 8,000 publicly accessible EV charging points. Greece has targets to have 12,000 charging points in 2025 and 25,000 in 2030. The government is working on an online platform that will show all publicly accessible charging points.

In addition, the Greek government is expanding the electrification of the rail network along multiple lines. The ministry has signed a public service obligation contract with the national rail company, which is expected to invest in the acquisition of electric and hydrogen-fuelled trains. While in the short term hydrogen trains are aimed to cover non-electrified portions of the rail network, in the long term they will be the first choice for any type of line, provided that hydrogen is generated using renewable energy sources. The government is also planning to extend the railway network and increase rail connections with Greece's main ports.

Since 2021, all regional authorities and certain municipalities have been obliged to prepare sustainable urban mobility plans. These plans include guidance for implementing policies that promote the use of public transport, walking and cycling, and mobility management. The government can financially support the measures proposed in the sustainable urban mobility plans as part of the Public Investment Program or other financial instruments.

In the industrial sector, Greece requires large industries to either conduct an energy audit every four years or implement an energy or environmental management system, such as ISO 50001, according to the EED. The integrated management system in Greece was expanded in 2016, according to the ISO 50001 standard. Companies are not obliged to implement the measures identified in the audit, and the government does not provide support for conducting the audits or implementing the identified measures.

The **"Green Businesses"** programme encourages the deployment and marketing of environmentally friendly products, while the **"Support to Improve Energy Efficiency in Industrial** 

**Processes**" specifically targets the reduction of energy demand and the cost and climate impact of industrial processes.

In 2023, the government introduced the **"Energy Efficiency Improvement in SMEs"** programme. The programme is co-financed by the European Regional Development Fund and the Operational Programme Competitiveness, Entrepreneurship and Innovation 2014-2020. The programme has a budget of €700 million and aims to support energy efficiency improvements in 25,000 companies, of which 3,400 are new companies and more than 6,500 have research and innovation action plans. The programme provides a subsidy of 40% for each investment, from a minimum of €30,000 to a maximum of €1 million.

# 6 List of figures

Figure 1: GDP and Value Added in Greece, 2000-2022	7
Figure 2: Annual variation of GDP and Value Added in Greece, 2001-2022	
Figure 3: Final energy consumption in Greece, 2000-2022	11
Figure 4: Annual variation of final energy consumption in Greece, 2001-2022	12
Figure 5: Final energy consumption per fuel in Greece, 2000-2022	12
Figure 6: Share per fuel in final energy consumption mix in Greece, 2000-2022	13
Figure 7: Final energy consumption by sector in Greece, 2000-2022	13
Figure 8: Share per sector in final energy consumption in Greece, 2000-2022	
Figure 9: Primary and final energy intensity in Greece, 2000-2022	14
Figure 10: Energy efficiency Index (ODEX) in Greece, 2000-2022	15
Figure 11: Variation of final energy consumption (Mtoe) in Greece, 2000-2022	
Figure 12: Final energy savings from ODYSSEE in Greece, 2000-2022	
Figure 13: Overall energy efficiency score in EU-27	17
Figure 14: Ongoing cross cutting energy efficiency policies in Greece	17
Figure 15: Final energy consumption in the residential sector in Greece, 2000-2022	
Figure 16: Final energy consumption by fuel in the residential sector in Greece, 2000- 2022	
Figure 17: Share in final energy consumption by fuel in the residential sector in Greece, 2000-2022	
Figure 18: Share of final energy consumption by energy use in the residential sector in Greece, 2000-2022	20
Figure 19: Residential Energy Efficiency Index (ODEX) in Greece, 2000-2022	20
Figure 20: Final energy consumption in the industrial sector in Greece, 2000-2022	21
Figure 21: Final energy consumption by fuel in the industrial sector in Greece, 2000-2022	22
Figure 22: Share of final energy consumption by fuel in the industrial sector in Greece, 2000-2022	22
Figure 23: Final energy consumption by branch in the industrial sector in Greece, 2000- 2022	23
Figure 24: Energy Efficiency Index (ODEX) in the industrial sector in Greece, 2000-2022	23
Figure 25: Final energy consumption in services in Greece, 2000-2022	24
Figure 26: Final energy consumption by fuel in services in Greece, 2000-2022	24
Figure 27: Share of final energy consumption by fuel in services in Greece, 2000-2022	25
Figure 28: Final energy consumption in transport in Greece, 2000-2022	25

Figure 29: Final energy consumption by fuel in transport in Greece, 2000-2022	26
Figure 30: Share of final energy consumption by fuel in transport in Greece, 2000-2022	26
Figure 31: Final energy consumption by mode in transport in Greece, 2000-2022	27
Figure 32: Share by mode in transport in Greece, 2000-2022	27
Figure 33: Share by vehicle in road transport in Greece, 2000-2022	28
Figure 34: Energy Efficiency Index (ODEX) in transport in Greece, 2000-2022	28
Figure 35: Energy poverty policies in Greece	29

#### 7 References

European Commission (2024), "Recast Energy Performance of Buildings Directive", https://eurlex.europa.eu/legal-

content/EN/TXT/?uri=OJ:L\_202401275&pk\_keyword=Energy&pk\_content=Directive

- Greece's Ministry of the Environment and Energy (2024), "National Energy and Climate Plan", http://www.opengov.gr/minenv/?p=13352 (in Greek)
- European Commission (2023), "Recast Energy Efficiency Directive", https://eur-lex.europa.eu/legalcontent/EN/TXT/?uri=CELEX%3A32023L1791
- IEA (2023), "Energy Policies of IEA Countries: Greece 2023 Review", https://iea.blob.core.windows.net/assets/5dc74a29-c4cb-4cde-97e0-9e218c58c6fd/Greece2023.pdf
- European Commission (2022), "Energy Efficiency Directive", https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficiency-targets-directiveandrules/energy-efficiency-directive\_en
- The Greek government (2022a), "National Climate Law 4936/2022"
- The Greek government (2022b), "Greece 2.0, National Recovery and Resilience Plan", https://greece20.gov.gr/wpcontent/uploads/2021/07/NRRP\_Greece\_2\_0\_English.pdf#page= 25
- The Greek government (2017), "Ministerial Decision No 174063/11.04.2017 on Energy Efficiency Obligation Scheme"