

Energy Efficiency trends and policies in Greece

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Contact persons:

Minas Iatridis, 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



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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 2000-2019. 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 2013-2019, a total increase in the final energy consumption is observed by 5%. The energy efficiency index (ODEX) for all sectors in Greece decreased regularly by 33%, between the years 2000 and 2019.

Industry

Since 2000 to 2019, 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 2019, recording a fall of 9% between 2013 and 2019, 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 39% in 2019, compared to 2000. This improvement in the energy efficiency index was the result of major decreases in chemical (67%), textile and leather (58%), paper, pulp and printing (54%) and steel (25%) industry.

Buildings

The building sector, which is consisting of the residential and tertiary sector, consumed 44% of the final energy in Greece in 2019. Since 2000 to 2019, the final energy consumption in households has decreased by 10%. 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 30%, between the years 2000 and 2019.

Transport

Since 2000 to 2009, the final energy consumption in transport increased by 29%. 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 33%, mainly because of the reduction of oil products consumption by 34%. Over 2000-2019, the energy consumption in all transport modes decreased following the trends of the total sector. In 2019, the overall energy efficiency of the transport sector has improved by 40%, 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 ENERGY EFFICIENCY CONTEXT

1.1. ECONOMIC CONTEXT

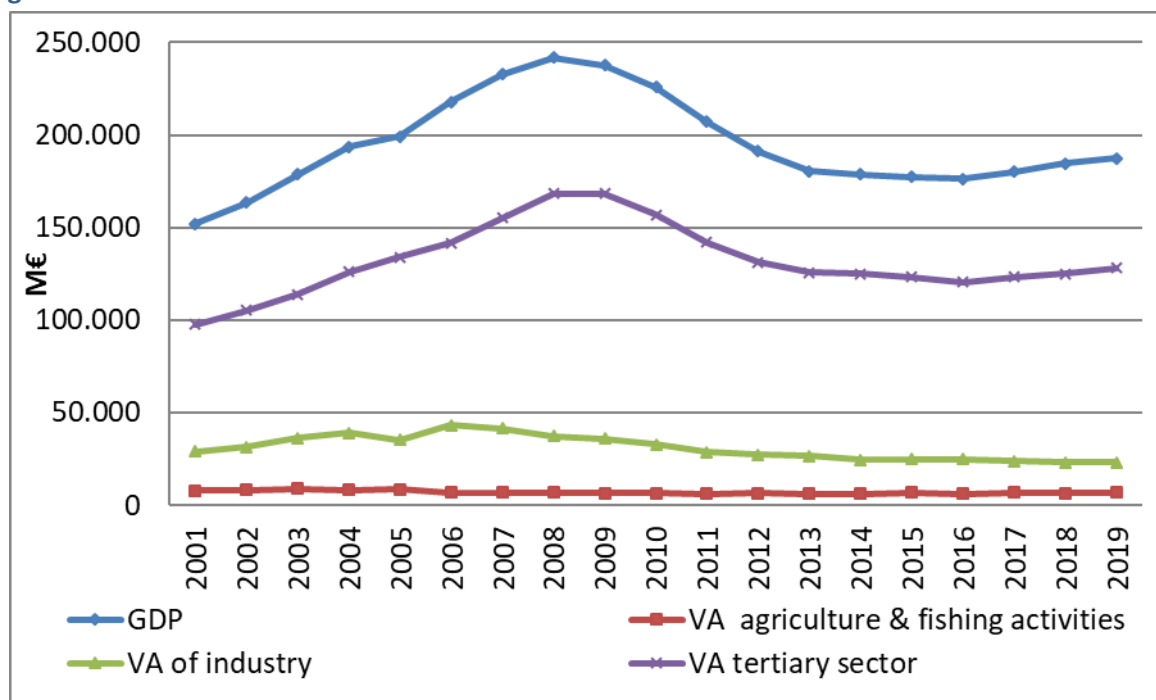
During the period 2001-2008, GDP in Greece increased by 59% at current prices. In the same period, the increase of added value almost in all sectors was also substantial (Figure 1). This increase is mainly due to the boost for major investments and infrastructure constructions for the Olympic Games and the inflow from EU structural funds which contributed to this economic performance, during the period 2001-2008.

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 2009 which was 8.3% compared to 2007, in the following period 2009-2013 there was a fall of 25%, while in the period 2013-2019 the Added Value of the service sector increased by 2%. The total decrease for the period 2008-2019 was 24% (Figure 1).

The industrial sector shows an overall decline in Gross Value Added for the period 2007-2019 of 76% (Figure 1).

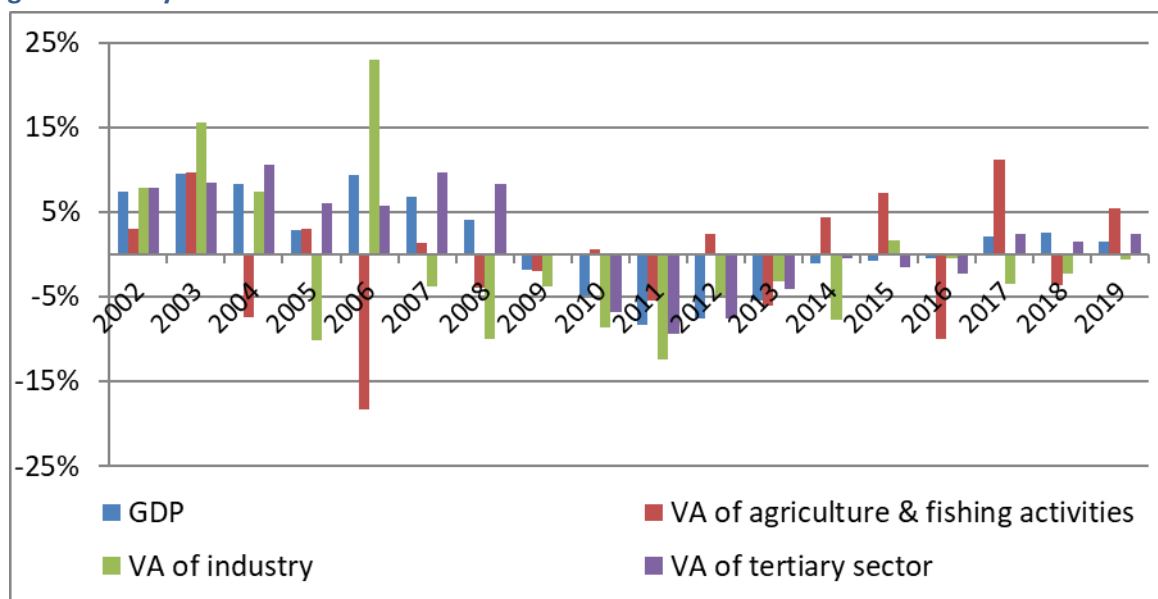
Figure 1: GDP and VA GREECE 2001-2019



* at current prices

Source: Eurostat

Figure 2: Yearly variation of GDP and VA GREECE 2002-2019



* at current prices

Source EUROSTAT

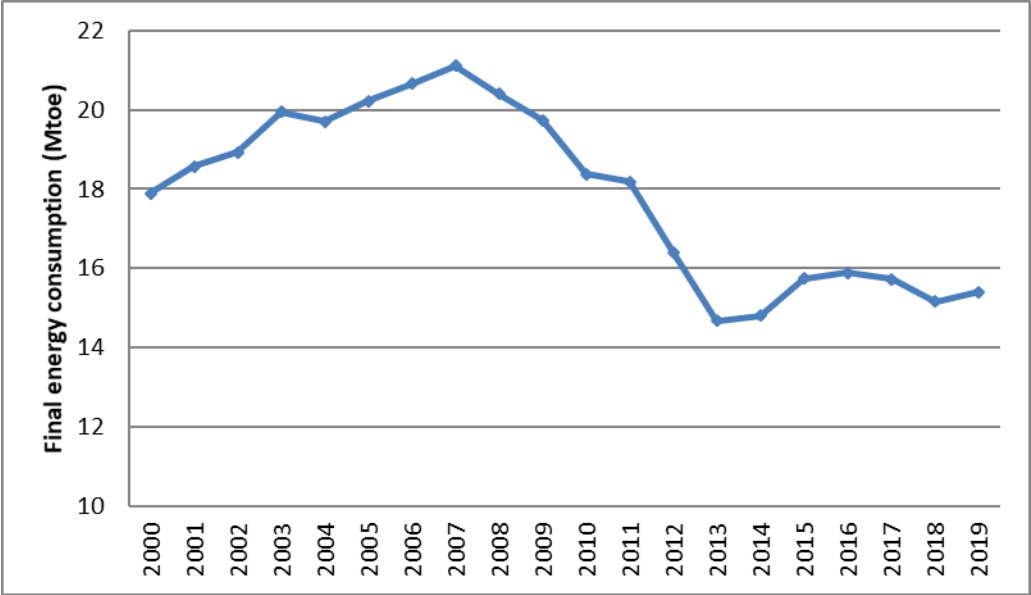
1.2. TOTAL ENERGY CONSUMPTION AND INTENSITIES

The trend of final energy consumption in Greece changed during the period 2000-2019 (Figure 4). During the period 2000-2007, a yearly average increasing by 3% in the final energy consumption, led to a total increase of final energy consumption by 18%, from 17.9 Mtoe in 2000 to 21.1 Mtoe in 2007. This increase is 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% (11.9 Mtoe in 2000 to 13.7 Mtoe in 2007) and a major increase in electricity consumption by 28% (3.7 Mtoe in 2000 to 4.7 Mtoe in 2007), as this products are 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, 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, from 21.1 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.

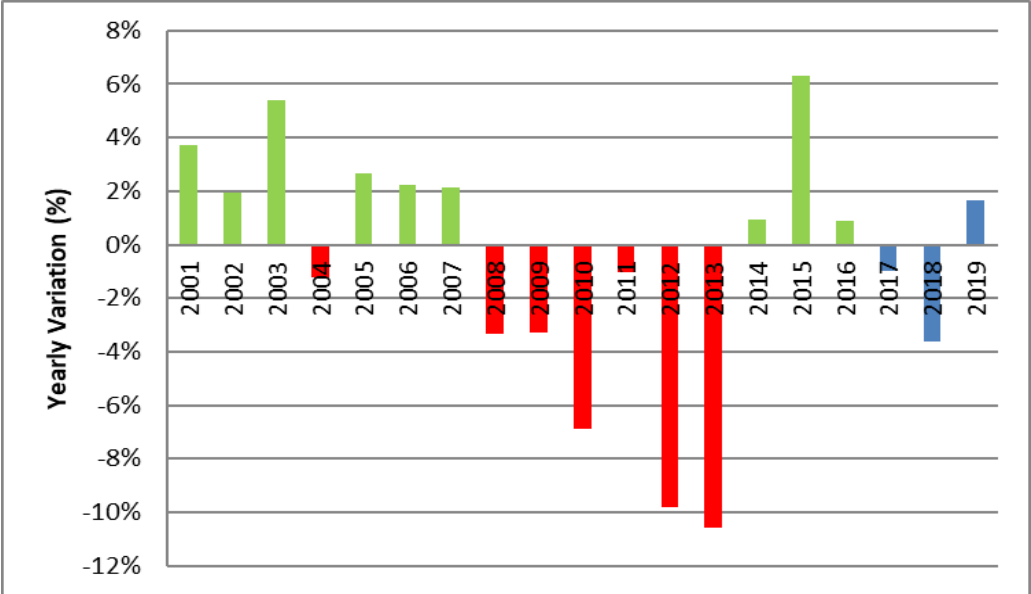
In the period 2013-2019, a total increase in the final energy consumption by 5% is observed, from 14.7 Mtoe in 2013 to 15.4 Mtoe in 2019. This significant increase was caused mainly due to the increase of oil products by 4% and electricity by 3%.

Figure 3: Final energy consumption in Greece 2000-2019



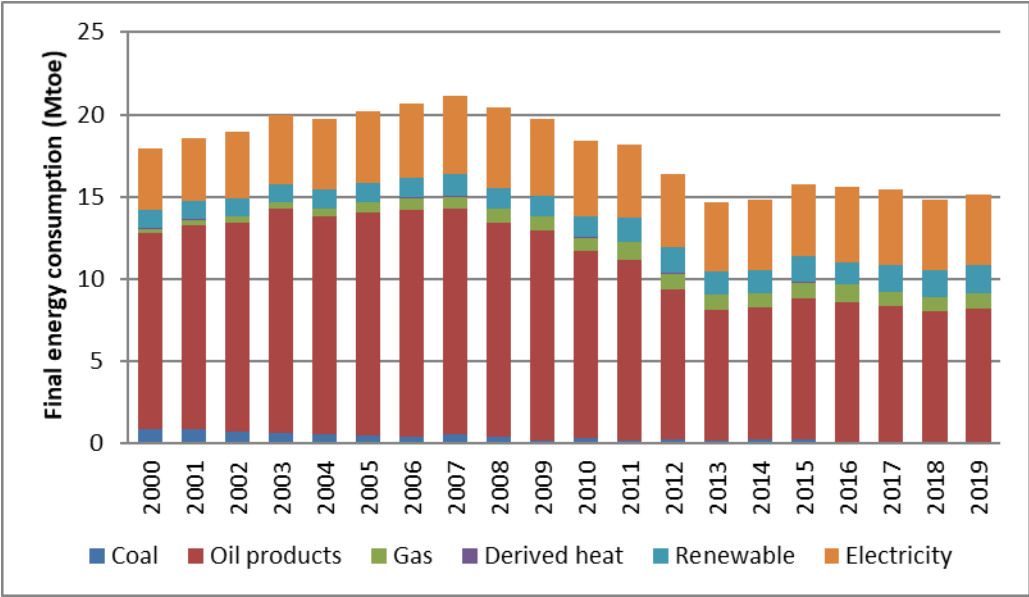
Source: ODYSSEE

Figure 4: Yearly variation of Final energy consumption in Greece 2001-2019



Source: ODYSSEE

Figure 5: Final energy consumption per fuel in Greece 2000-2019



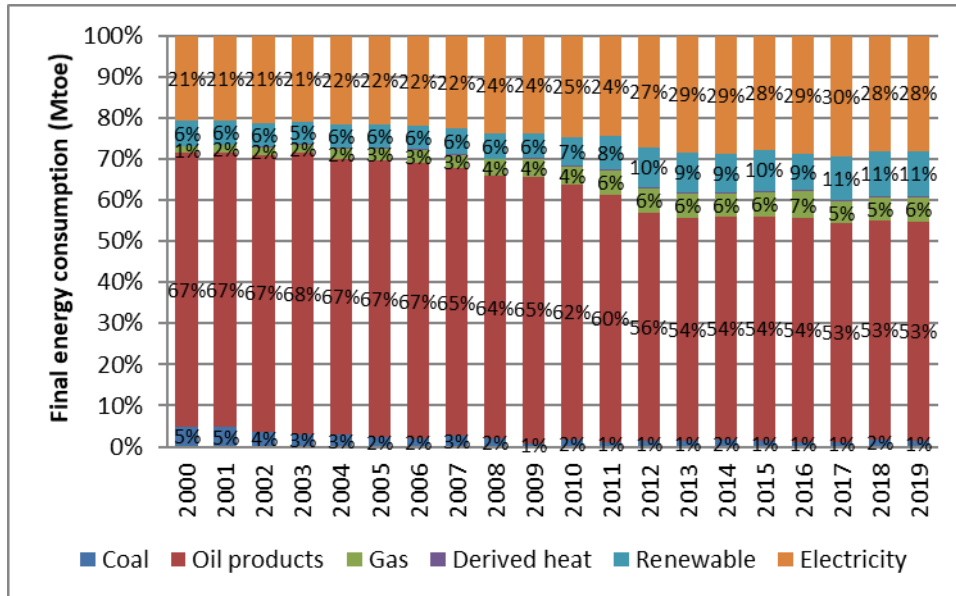
Source: ODYSSEE

During the period 2000-2019, 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 6% in 2019 (Figure 6).

Moreover, the final energy consumption of renewable energy sources has also increased by 54% 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 2019.

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 28% in 2019, 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).

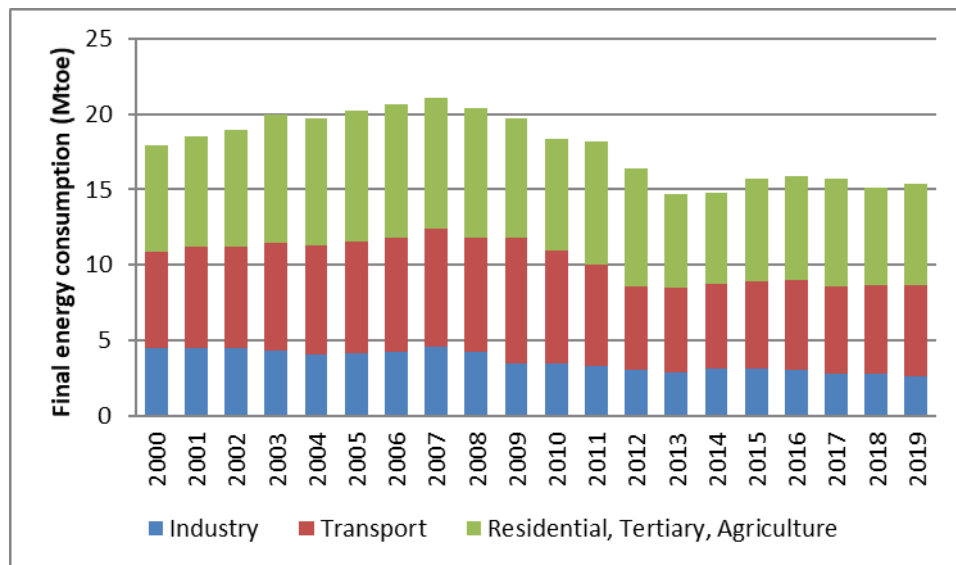
Figure 6: Share per fuel in final energy consumption mix in Greece 2000-2019



Source: ODYSSEE

The residential, tertiary and agriculture sector consumes the biggest part of final energy consumption in Greece with 6.8 Mtoe in 2019 (Figure 7). Since 2008 to 2013, there was a reduction in consumption in all sectors, which is 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 2014-2019, an increase in the consumption is observed.

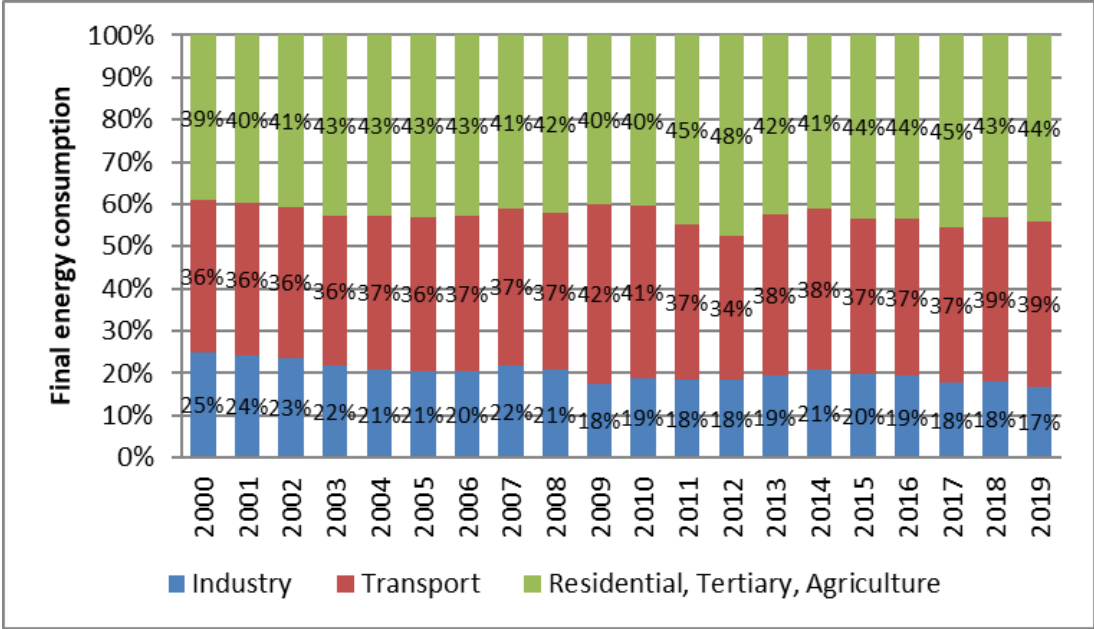
Figure 7: Final Energy Consumption by sector in Greece 2000-2019



Source: ODYSSEE

The energy share of all sectors (residential, tertiary and agriculture, transport and industry) has been decreased by 3%, 6% and 42% correspondingly (Figure 8), comparing 2000 and 2019. 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 2000-2019

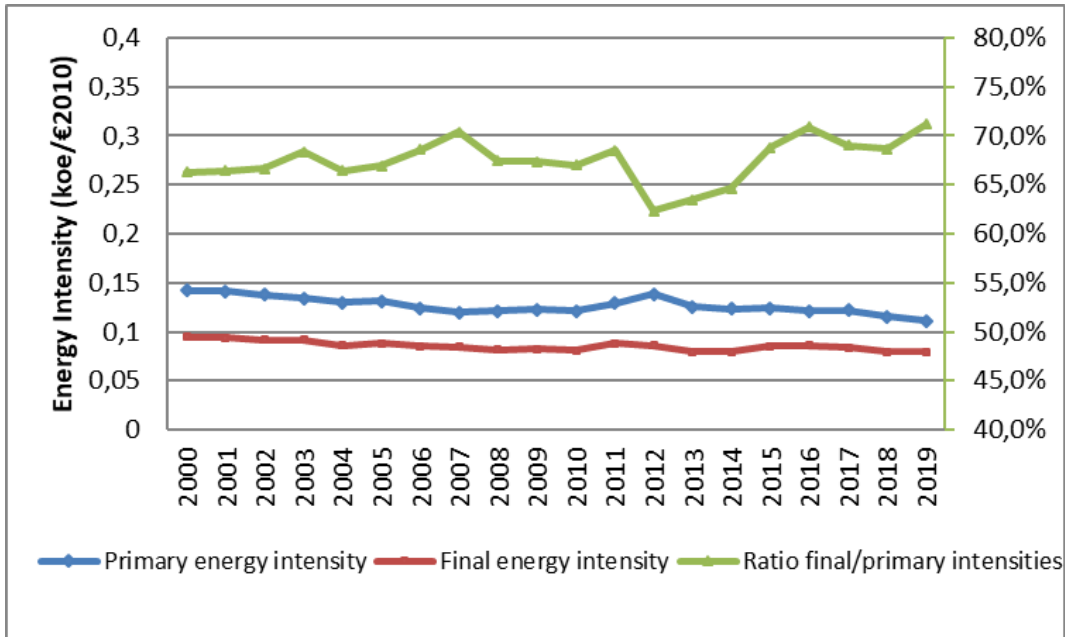


Source: ODYSSEE

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).

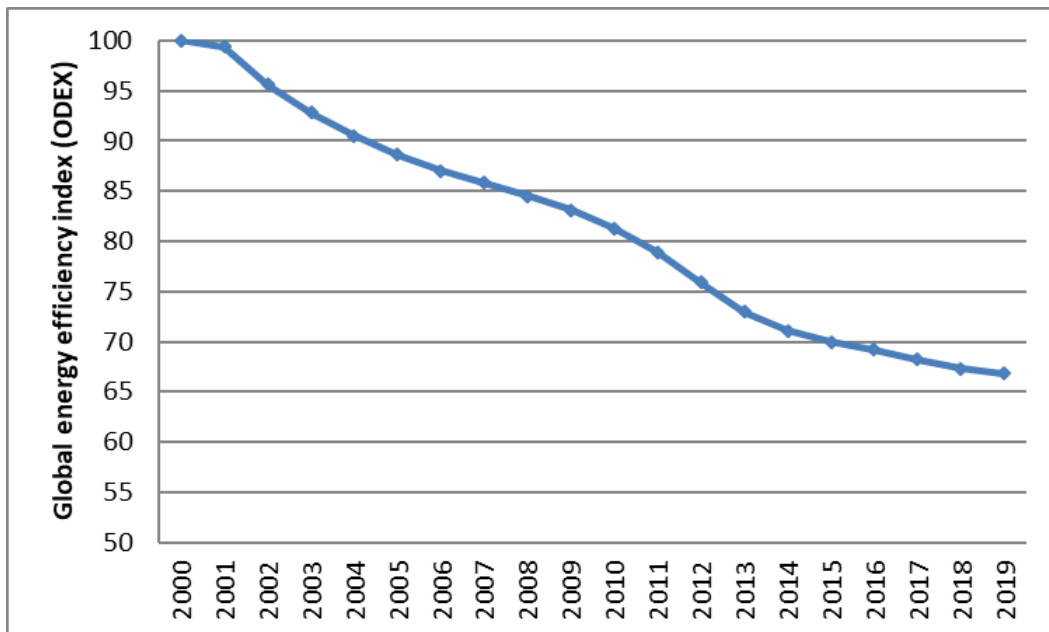
Figure 9: Primary and Final Energy Intensity Greece 2000-2019



Source: ODYSSEE

The Global energy efficiency index (ODEX) for Greece decreased regularly by 33%, between the years 2000 and 2019, mainly because of the energy efficiency measures that started to apply since 2008 and the economic crisis, leading to a total improvement in energy efficiency by 33% over these years (Figure 10).

Figure 10: Global Energy efficiency index-ODEX, in Greece 2000-2019



Source: ODYSSEE

1.3. ENERGY EFFICIENCY 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 (CRESS), 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.

As a member of the European Union, Greece was required to set a target of total final consumption for 2020 in compliance with the 2012 EU Energy Efficiency Directive. This target established the basis for energy efficiency policies and measures across the Greek economy. The target set by Greece was 18.4 million tonnes of oil equivalent (Mtoe), which represented a 12% reduction on energy consumption levels in 2005, based on IEA's data¹. However, due to the financial and economic crisis, the total final consumption fell to 16.4 Mtoe in 2015, 11% below the 2020 reduction target.

In addition, a key component of Greece's compliance with the Energy Efficiency Directive is Article 7, in which EU member states are required to ensure that energy savings of 1.5% per year are achieved by energy suppliers and distributors due to the implementation of targeted policy measures. Greece had to achieve cumulative energy savings of 3,332.7 ktoe by 2020 through the implementation of energy efficiency policy measures, as part of its compliance with the Article 7. Implemented policy measures had not provided energy savings in line with initial expectations, due to the financial and economic crisis, low public awareness, insufficient data, and lack of funding. This created a need for Greece to achieve larger savings between 2017 and 2020 to comply with Article 7 of the EU Directive, the IEA adds.

In parallel, Greece implemented in January 2017, according to Article 7, an energy efficiency obligation scheme and its first round aimed to provide 10% (332.7 ktoe) of the required energy savings by 2020. The target has been expressed in cumulative energy savings taking into account the lifetime of the implemented measures within the duration of the scheme (2017-2020). The annual targets had been specified with a minimum threshold to be achieved in the target year: 100 ktoe and 30% in 2017, 133 ktoe and 50% in 2018, 67 ktoe and 50% in 2019, 33 ktoe and 100% in 2020. The continuation of the scheme was decided within the framework of Greece's National Energy and Climate Plan (NECP²), while the contribution of the scheme's second round to the national target for the period 2021-2030 amounts to 20%.

¹ IEA (2017), "Energy Policies of IEA Countries: Greece – 2017 Review", <https://iea.blob.core.windows.net/assets/d34b4e20-d340-4563-822e-ae0cbe7e838b/EnergyPoliciesofIEACountriesGreeceReview2017.pdf>

² Greece's Ministry of the Environment and Energy (2019), "National Energy and Climate Plan", https://ec.europa.eu/energy/sites/default/files/el_final_necp_main_en.pdf

1.3.1. ENERGY EFFICIENCY TARGETS

According to Greece's NECP, the objective is to improve energy efficiency in final energy consumption by at least 38% in relation to the foreseen evolution of final energy consumption by 2030, as estimated in 2007 in the context of the EU energy policies ; thus, resulting in final energy consumption levels of not more than 16.5 Mtoe in 2030. There is also satisfactory performance in terms of the relevant evaluation indicators regarding the rate of reduction both with regard to final energy consumption for 2017 (16.8 Mtoe) and the energy savings target for 2020 (18.4 Mtoe), taking into account the increase in final energy consumption in order to reverse the impact of the economic recession of the previous years. This rate of reduction is even higher if adjusted to primary energy consumption, in which case it stands at more than 43%. This demonstrates that the overall objective is to achieve an improvement in energy efficiency across the energy system, attaining a particularly high level of improvement in terms of how energy is made available for consumption, always in the most cost-effective way.

Also, according to Greece's NECP, an additional target is set in respect of the cumulative amount of energy savings to be attained over the period 2021-2030 in accordance with Article 7 of Directive 2012/27/EU on energy savings obligations. According to the available final energy consumption figures, cumulative energy savings of at least 7.3 Mtoe should be achieved over the period 2021-2030. However, the target will be re-calculated on the basis of the final energy consumption figures for the years 2016-2018. In addition to that, a target is set for the annual energy renovation of a total floor area of the thermal zone of central public administration buildings equal to 5,400 square meters, representing 3% of the total floor area, according to Greece's NECP.

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

Save Energy at Home I and II Programme

The "Save Energy at Home" Programme offered citizens who met specific income-related criteria, incentives (subsidies up to 70% and interest-free loans) to carry out major interventions for improving their houses' energy efficiency. The programme also set an energy objective for improving the energy performance of the household by at least one energy class. The number of approved applications were approximately 60,000, while the estimated energy savings stood at 1,000 GWh.

Citizens eligible for participating in the programme were only persons who had the right of ownership or usufruct to an eligible residence and met specific income-related criteria. The programme started on February 1, 2011 and applications were submitted until the programme budget per region had been spent. The initial budget was €396 million, co-financed by ROPs and OPs "Competitiveness and Entrepreneurship" and "Environment and Sustainable Development", with regional distribution, according to the funding agreement "Exoikonomo kat'oikon Fund" – (Holding Fund) and the number of old buildings and households. The programme was implemented through banks that were co-financing 2/3 of the loan.

The "Save Energy at Home II" Programme was designed as a follow-up to the "Save Energy at Home" Programme. The design of the programme took into account the integrated energy saving intervention in the residential building sector and had as its main objective:

- the reduction of the energy needs of buildings,
- the reduction of greenhouse gas emissions,
- the environmental protection

The programme provided incentives for energy-saving interventions in the residential buildings. It concerned buildings that had a building permit or other legitimisation document, were used as the main residence and whose owners met certain income criteria. In particular, there were seven (7) categories of incentives in which the Beneficiaries were classified, according to their personal or family yearly income.

The programme was funded by the European Regional Development Fund (ERDF) and national resources, and provided incentives in the form of a grant (direct support) and a loan (the "Saving II" Fund) with an interest rate subsidy. The beneficiary of the programme and operator of the "Saving II" Fund was the Hellenic Development Bank (HDB).

2. ENERGY EFFICIENCY IN BUILDINGS

2.1. ENERGY EFFICIENCY TRENDS

The building sector, which is consisting of the residential and tertiary sector, consumed 44% of the final energy in Greece in 2019 (Figure 8). As these sectors show a different behaviour during the examined period (2000-2019) concerning the trends in energy consumption, they are examined separately in this section of the report.

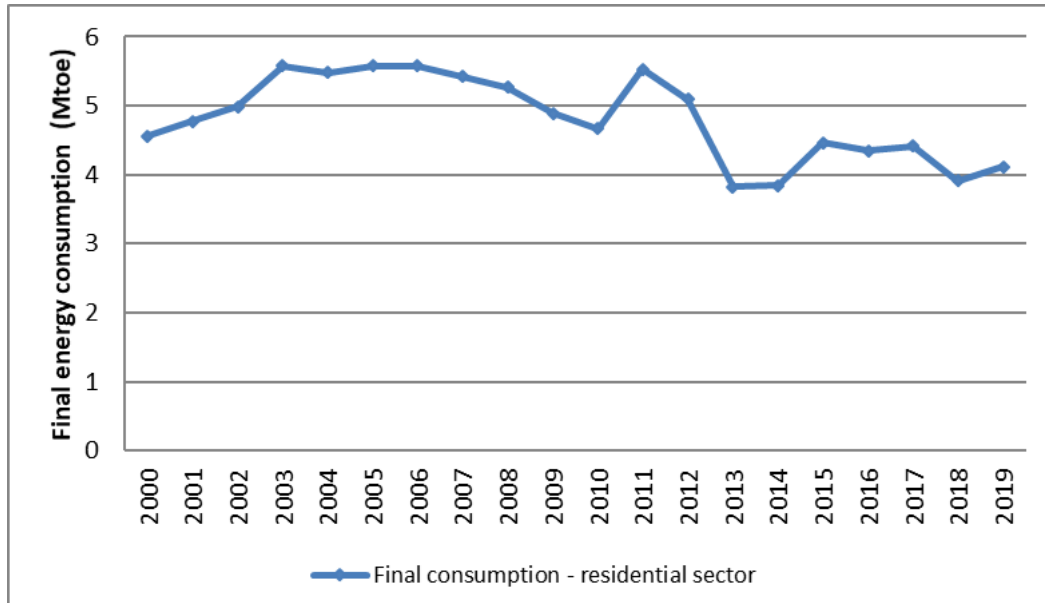
2.1.1 RESIDENTIAL SECTOR

Since 2000 to 2019, the final energy consumption in households has decreased by 10% from 4.6 Mtoe in 2000 to 4.1 Mtoe in 2019.

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 11).

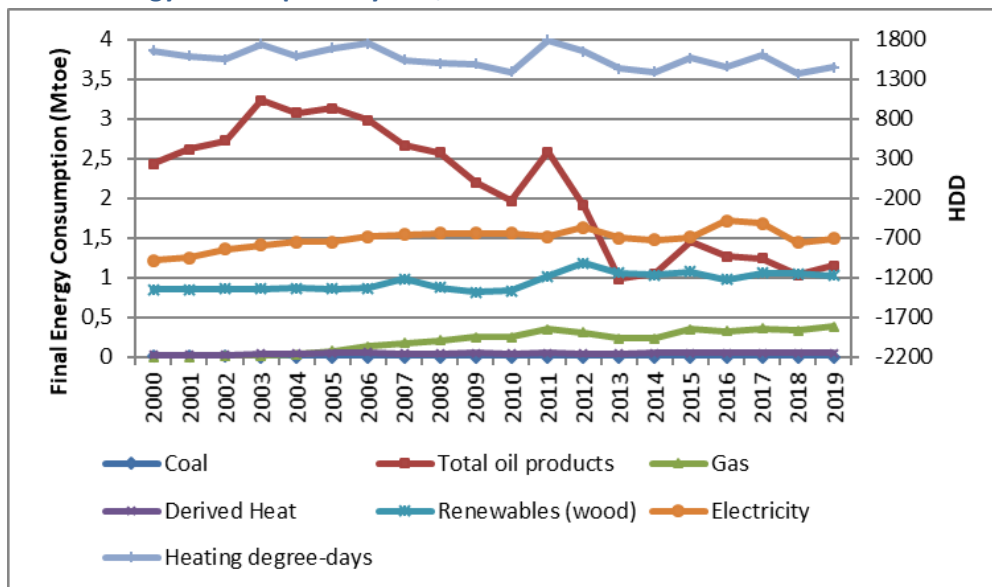
An increase in residential final consumption occurred in 2011 mainly because of the colder winter (Figure 12). Another reason is that this year the government announced that a new tax in heating oil will be implement in 2012, that would led to the increase of heating oil cost by 50%. These facts led 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 11: Final Energy Consumption in Residential 2000-2019



Source: ODYSSEE

Figure 12: Final Energy Consumption by fuel, Residential 2000-2019

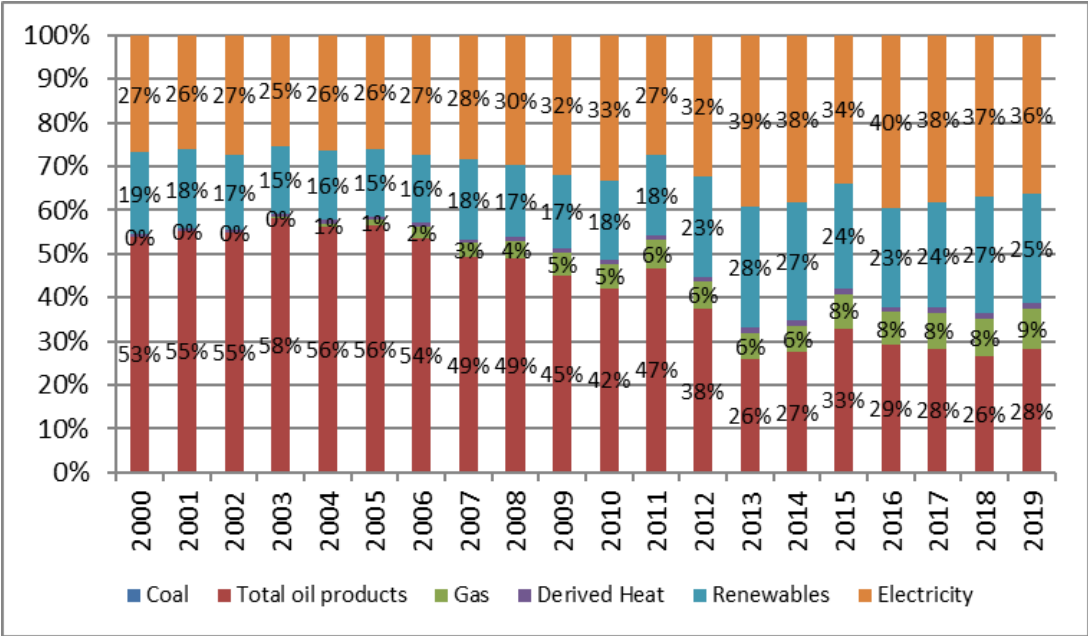


Source: ODYSSEE

During the period 2000-2013, the energy mix of residential sector changed. From 2000 to 2006, the oil products were the main fuels that were used by the residential sector (more than 50%, Figure 13). After 2006, by 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 2019, because of measures for promoting the renewable energy sources, the percentage of these increased by 8%, compared to the average percentage of the period 2000-2010, from 17% to 25% respectively (Figure 13).

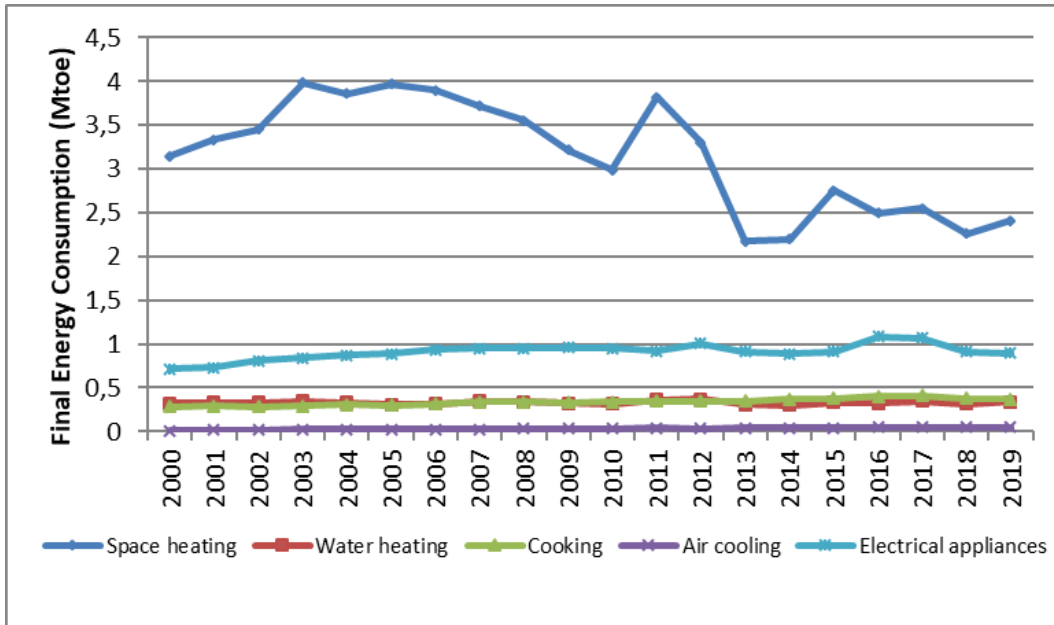
Figure 13: Share in final Energy Consumption by fuel in Residential 2000-2019



Source: ODYSSEE

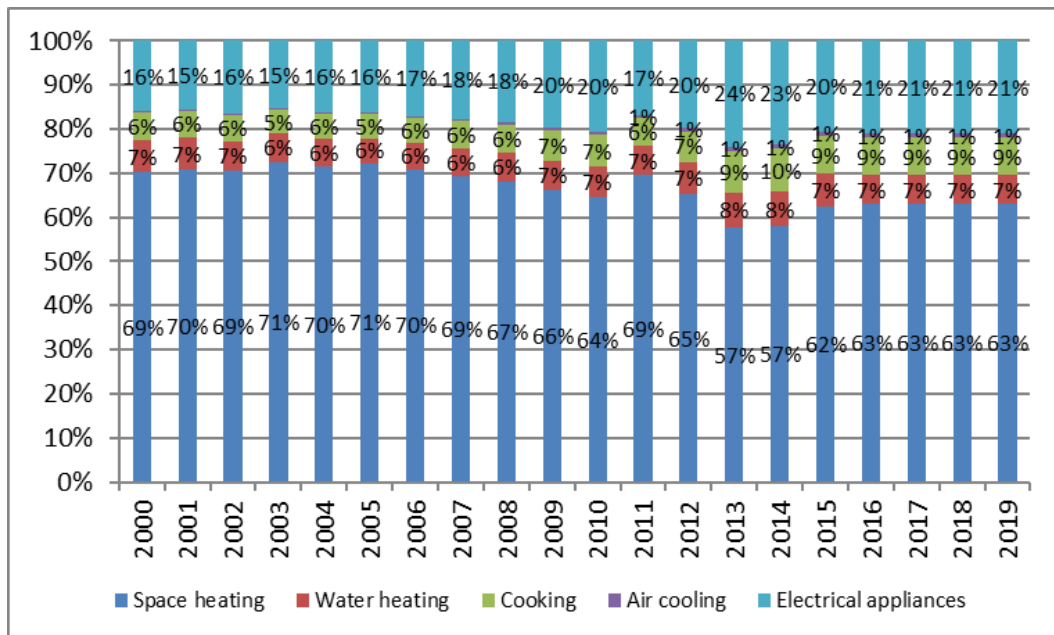
The biggest part of final energy consumption in households was consuming for space heating (Figure 14). Households in 2000 consumed for space heating 3.1 Mtoe against 2.4 Mtoe in 2019; namely a 24% total reduction in space heating energy consumption. The energy share of electric appliances between the years 2000 and 2019 increased by 25% (Figure 15) because of the increase of their number and size. The energy consumption for cooking and water heating remains almost constant during the period 2000-2019, with an increase for cooking in the period 2013-2019 (Figure 15).

Figure 14: Final Energy Consumption by End Use in Residential 2000-2019



Source: ODYSSEE

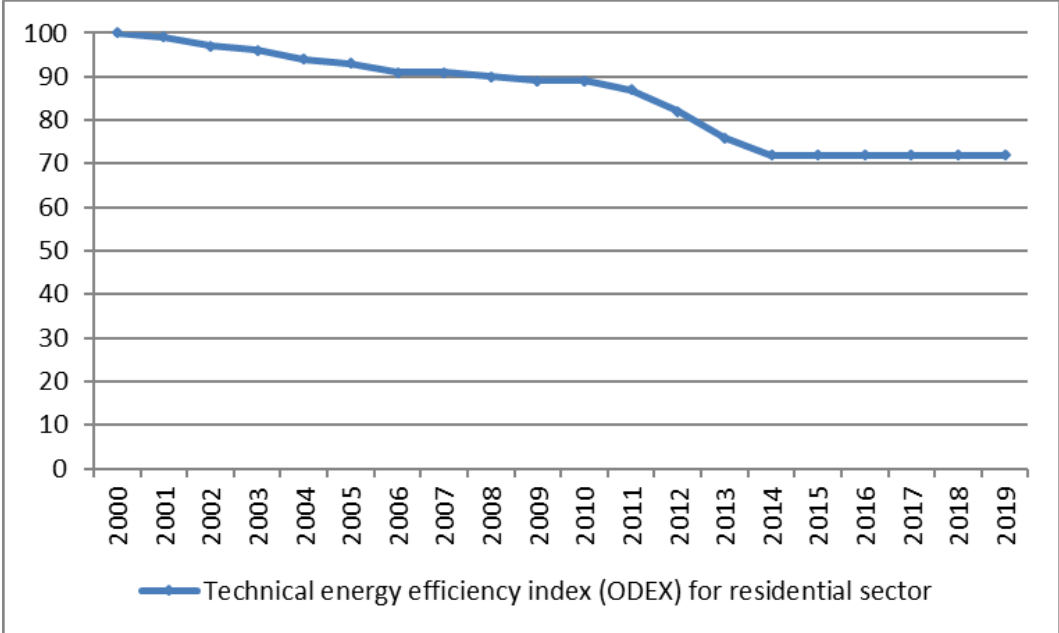
Figure 15: Share of Final Energy Consumption by Energy Use in Residential 2000-2019



Source: ODYSSEE

The technical energy efficiency index (ODEX) for residential sector in Greece decreased regularly by an average of 1%, in the period 2000-2019, 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 30% over these years (Figure 16).

Figure 16: Residential Energy Efficiency Index-ODEX, in Greece 2000-2019

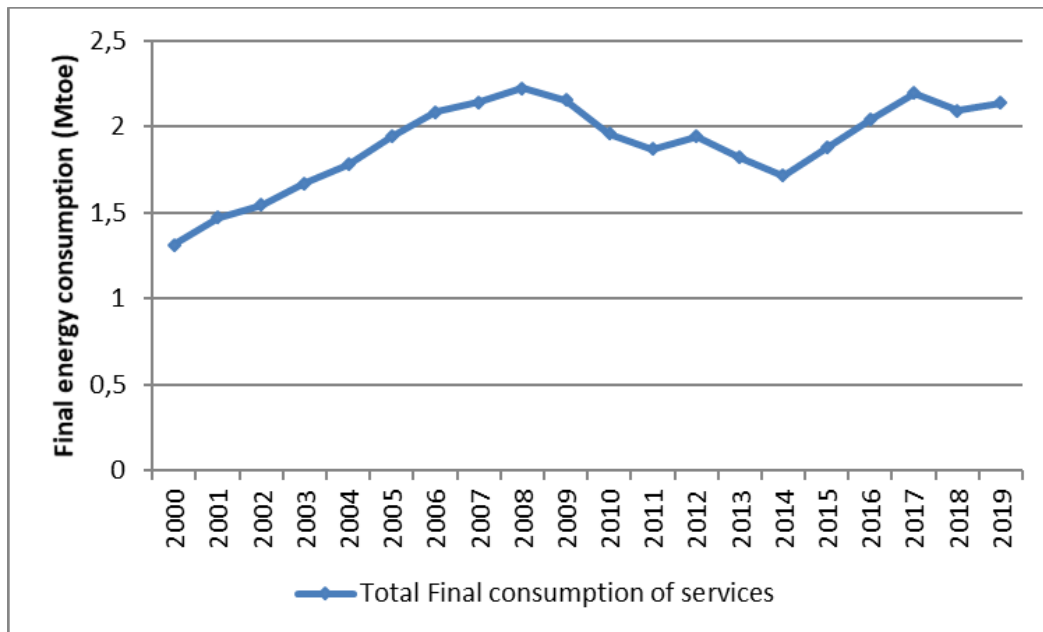


Source: ODYSSEE

2.1.2 SERVICE SECTOR

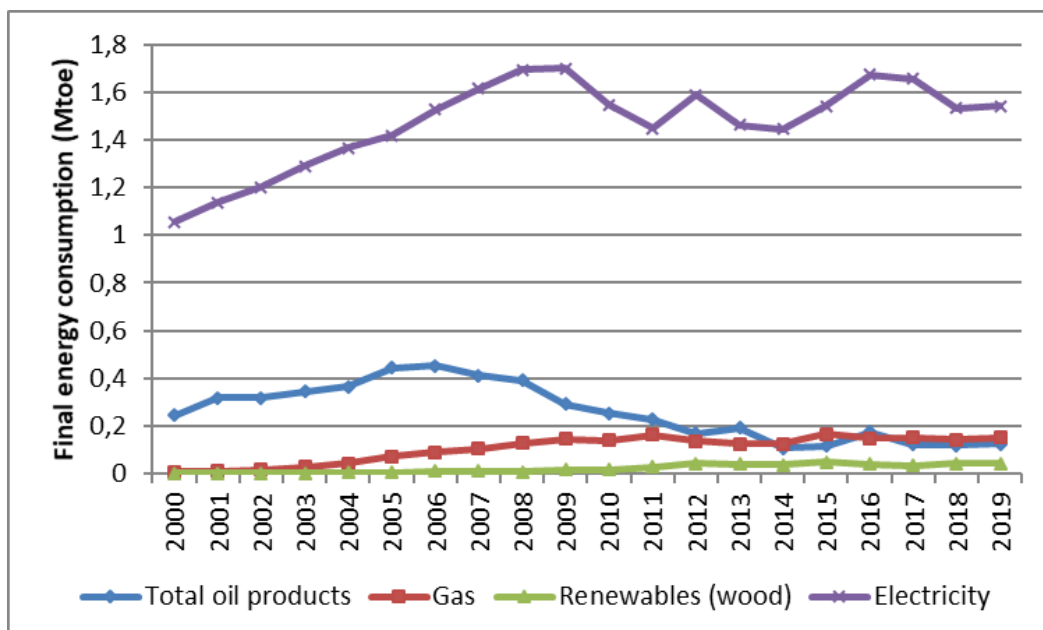
Although until 2008 its final consumption was steadily increased by 6% on average per year, the service sector was one of the first sectors which sustained the effects of the economic recession in final energy consumption (Figure 17). This fact led to the decrease of final consumption of the sector, since 2009, with exemption 2012 where a slight increase recorded, mainly because of the increase of electricity consumption (Figure 18). Also, an increase was observed in the period 2014-2019, with an average increase of 5% per year (Figure 17).

Figure 17: Final Energy Consumption in Services in Greece 2000-2019



Source: ODYSSEE

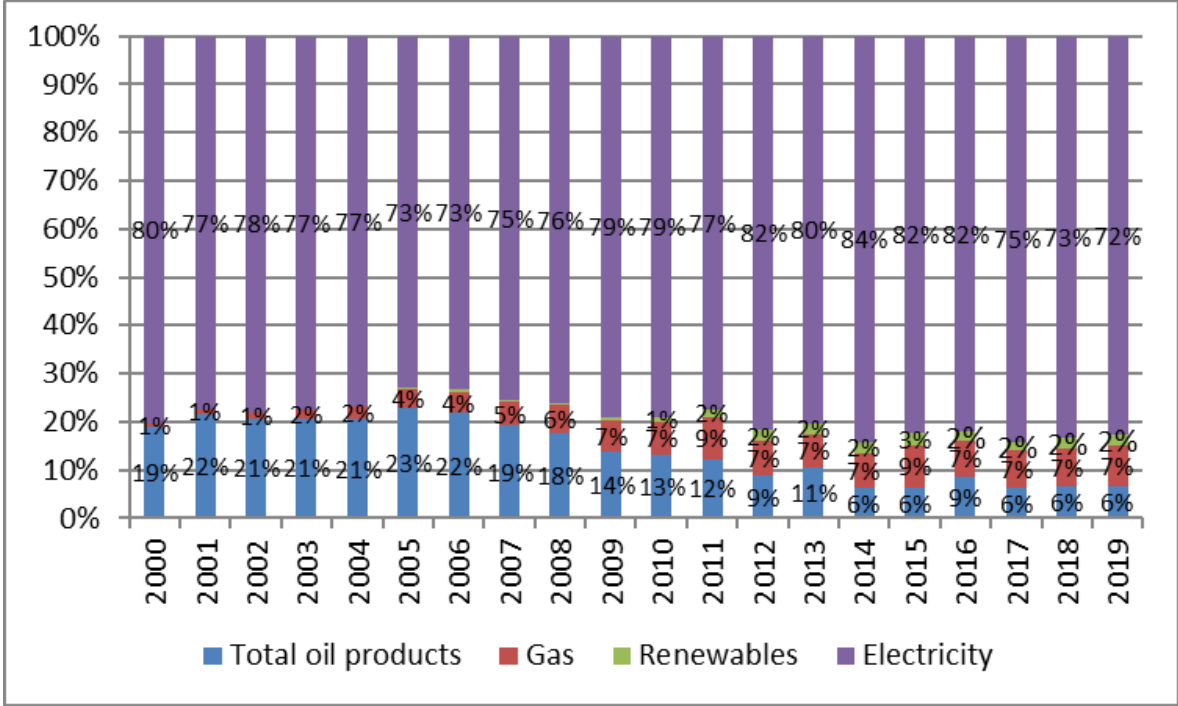
Figure 18: Final Energy Consumption by Fuel in Services in Greece 2000-2019



Source: ODYSSEE

The energy mix that was consuming in tertiary sector remained almost stable over 2000-2019, with the exemption of the introduction of Natural Gas and the increase in the contribution of renewables, especially over the last three years (2017-2019). The electricity remains the main energy carrier with a percentage of 72% in the overall energy consumption of the sector in 2019 (Figure 19).

Figure 19: Share of Final Energy Consumption by Fuel in Services in Greece 2000-2019



Source: ODYSSEE

2.2. ENERGY EFFICIENCY POLICIES

The main energy policy measures that affect the energy efficiency of building stock have been established through Greece’s compliance with the EU Energy Efficiency Directive and the Energy Performance of Buildings Directive. Measures include mandatory energy efficiency requirements for public buildings and minimum requirements for energy efficiency in new and existing buildings.

Greece has also sought to overcome ongoing information barriers and limited access to finance, which have hindered the ability of homeowners to implement energy efficiency measures. For example, Greece implemented in 2010 the “Save Energy at Home” programme and the Save Programme for Local Authorities. Especially, in the “Save Energy at Home” programme, bank loans were combined with government financial support in order to cover the costs of energy efficiency measures. For these programmes, the requirement for applicants to receive pre-approval for a bank loan before applying for government funding added to processing delays and a gap between the number of applicants (over 250,000) and loan agreements (around 51,000), based on IEA’s data.

Nevertheless, it remains significant potential to improve the efficiency of building stock, as the effectiveness of building energy efficiency measures implemented in Greece has been hindered, due in part to the limited new construction since 2010. According to the IEA, efficiency measures, such as

improvements to thermal insulation and replacement of oil heaters, will create multiple economic and social benefits, including the following:

- opportunities for the development of a domestic energy service company industry
- increase in the domestic gas market due to potential fuel switching
- improved living conditions linked with affordable access to energy services
- increase in the likelihood of on-time payment of electricity bills, due to a reduction in the cost of energy services.

The large percentage of building stock in Greece that is either unoccupied or temporarily occupied presents challenges. However, the high rate of building ownership also presents opportunities as barriers to renovation that result from split incentives, where the capital cost is paid by one party but the benefit obtained by another, are reduced.

As described in Greece's NECP, the future development of energy efficiency policy measures will be influenced by compliance with new EU obligations for 2030. Greece should not use the reduction in energy use following the financial and economic crisis as an excuse for limiting energy efficiency measures, as energy use reductions have masked minimal improvements in energy intensity since 2000, due to low take-up of efficient products and low levels of efficiency within Greece's old building stock.

The energy savings potential related to the correct implementation of the EU legislative framework for ecodesign and energy labelling of products is utilised through systematic controls of their implementation. Information actions on energy efficiency are also contribute to awareness-raising and, ultimately, to encouraging final consumers to adopt more rational practices of energy use. Both upgrading the role of energy performance certificates — by looking into alternative ways of converting them into tailored roadmaps for the energy upgrading of buildings or building units — and developing new certification schemes for installers to ensure the proper implementation of energy savings interventions and the maximum utilisation of the options offered by the relevant technologies are expected to make a contribution in this direction.

Additional horizontal actions contributing to the implementation of energy upgrades in the building sector are both the development of a common and open database and the establishment of a legislative framework for setting up innovative technology procurement groups, as well as the use of innovative digital models for the construction and management of buildings over their lifecycle. The aim of the database will be to better identify the relevant savings potential of the projects under preparation and to facilitate benchmarking between similar buildings through the available energy features of listed buildings and ex-post data of energy savings projects with a view to mitigating the risk of relevant investments. Accordingly, the setup of innovative technology procurement groups will lead to lower costs for the design and implementation of energy savings measures.

As mentioned in Greece's NECP and in order to mobilise the required investments, a specific package of policy measures is envisaged to improve the energy efficiency of public and private buildings, through the long-term strategy for the renovation of the building stock or the renewal of end-of-lifecycle buildings along with recycling of the construction and demolition waste produced, in accordance with the requirements of Directive (EU) 2018/844. The long-term strategy for the

renovation of the building stock aims to ensure the technical-financial analysis and determination of optimally efficient measures for attaining the high renovation rate set for the building stock, according to Greece's NECP.

In particular, the financing programmes for the renovation of both residential and tertiary sector buildings in the context of the new programming period will be implemented by adjusting and improving the existing financing model, with a view an increase in the existing leverage levels by beneficiaries. These programmes aim to:

- increase the number of potential beneficiaries
- simplify the certification of interventions, using unit cost data
- ensure more active involvement of domestic financial institutions in the financing of necessary interventions and
- promote innovation in the domestic construction and manufacturing industry.

Successful financing programmes for improving the energy efficiency of residential buildings will continue, and their operating framework will be duly modified by streamlining the incentives for maximising energy benefits, while at the same time supporting households which are vulnerable in terms of finances and energy.

According to Greece's NECP, in the case of public buildings, the redrafting of the financing model for energy upgrading actions has been completed, while in the case of other tertiary sector buildings focus will be given to adopting new smart technologies and an effort will be made to achieve an optimal cost-benefit ratio and ensure equal access for all interested parties. Meanwhile, alternative financing mechanisms, such as energy performance contracts, will be adopted.

Upgrading the role of energy managers of public buildings is expected to make a significant contribution, as a relevant clause will be added in financing programmes for the energy upgrading of public buildings. The electronic platform for monitoring the energy behaviour of public buildings, which has been completed, aims to assist energy managers in carrying out their functions. The revision of the relevant regulatory framework aims to upgrade their role, in order to ensure the rational use of energy. Continued improvement of the energy efficiency of public buildings will also be strengthened through the implementation of the Action Plans for Sustainable Energy and the Action Plans for Energy Efficiency of Buildings, which must be drawn up by regions and municipalities, supported by targeted financing programmes, according to Greece's NECP. In addition, the implementation of energy management systems will make a substantial contribution in this direction. In any case, a key priority for public buildings is based to promote measures and programmes that are technically feasible and optimal in terms of social cost and result.

The new minimum requirements will be incorporated in the revised Regulation on Energy Efficiency of Buildings and emphasis will be placed on increasing the number of near-zero energy buildings in accordance with the requirements of Directive 2010/31/EU. The adoption of new regulatory measures (also in the context Directive 2010/31/EU, as amended by Directive (EU) 2018/844) will aim both at elaborating an appropriate framework and creating incentives for maximising the number of buildings which would exceed the minimum energy efficiency requirements.

For example, the following regulatory provisions will be promoted:

- After 31 December 2023, all buildings housing public authorities must be classified under energy category B or higher on the basis of the energy performance certificate.
- As of 1 January 2021, all new buildings or building units rented or purchased by central government bodies must be near-zero energy buildings (energy category A or higher).
- As of 1 January 2021, for each building or building unit that is available for sale or rent, the energy efficiency index shown in the energy performance certificate should be declared in all commercial advertisements.

As also referred in the NECP, the successful and efficient policy measures, such as the mandatory installation of solar thermal systems in new buildings and those undergoing major renovation, will be continued and improved as appropriate. Finally, the new regulatory framework, coupled with tax, financial and town planning incentives, is expected to increase the pace of energy upgrading of private buildings.

Improving the energy efficiency of public buildings through energy performance contracts and generally through PPPs will be one of the key policy measures over the next years. Therefore, an immediate priority is to adjust the relevant framework of support financing programmes and of support structures in order to address the technical and administrative difficulties detected, with a view to further developing energy services in public buildings.

Moreover, the further development of energy services should contribute towards putting in place sustainable solutions for improved energy efficiency of private buildings. The regulatory framework will be completed and improved taking into account the experience gained to date, whereas the necessary framework for easier access to funding under favourable terms for the parties involved will be developed.

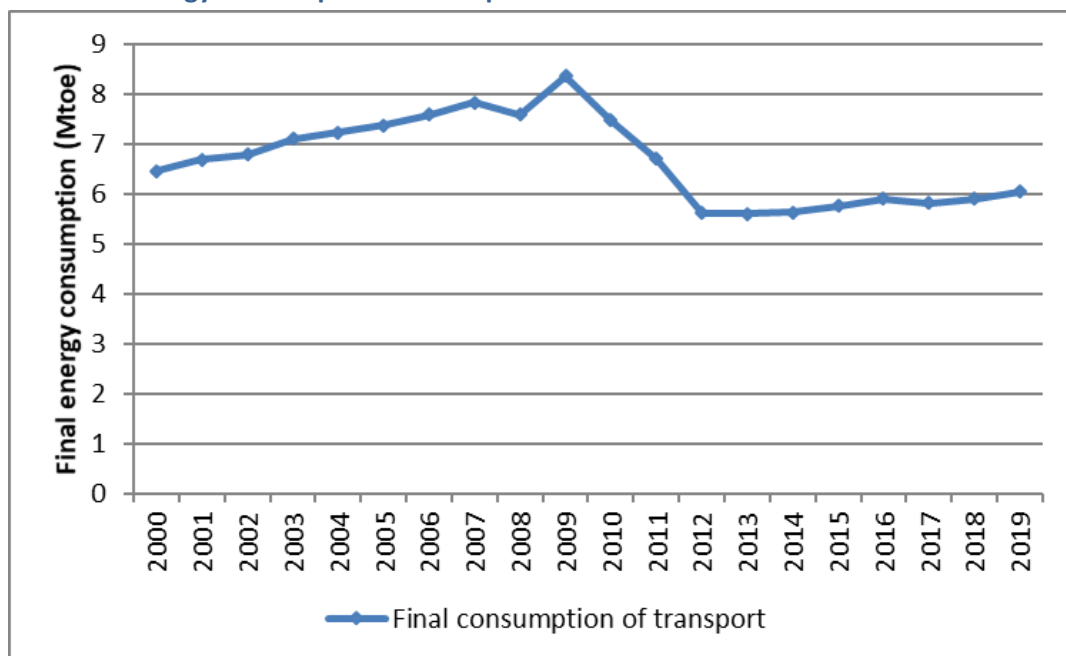
3. ENERGY EFFICIENCY IN TRANSPORT

3.1. ENERGY EFFICIENCY TRENDS

Since 2000 to 2009, the final energy consumption in transport increased by 29% from 6.5 Mtoe in 2000 to 8.4 Mtoe in 2009 (Figure 20). This growing trend mainly came from the increase of oil consumption by 28% (6.4 Mtoe in 2000 to 8.2 Mtoe in 2009) (Figure 21).

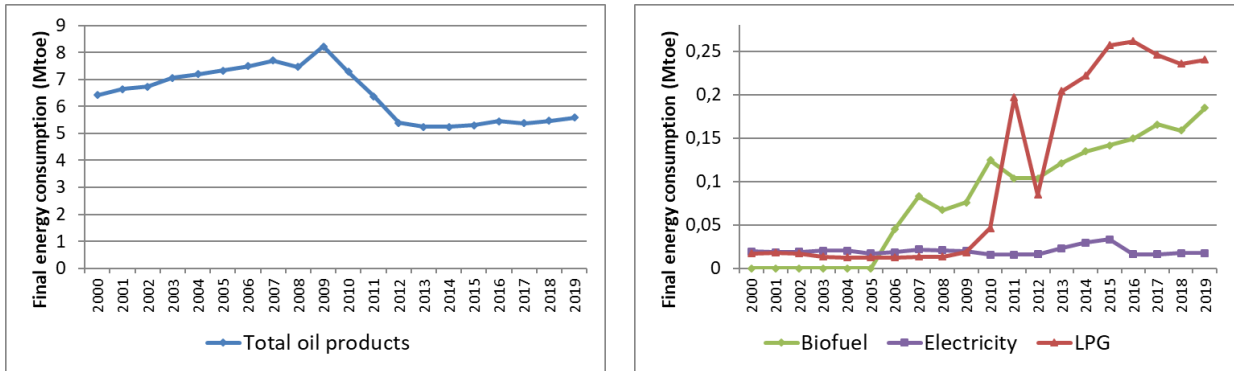
Due to economic recession and the energy efficiency measures that were implemented after 2007, the steadily increase of final energy consumption until 2009, with the exception of 2008, reversed after this year (Figure 20). The total energy consumption of the sector has been reduced by 33% in the period 2009-2013, mainly because of the reduction of oil products consumption by 34% (Figure 21). In the period 2013-2019, an increase of 8% was observed.

Figure 20: Final Energy Consumption in Transport in Greece 2000-2019



Source: ODYSSEE

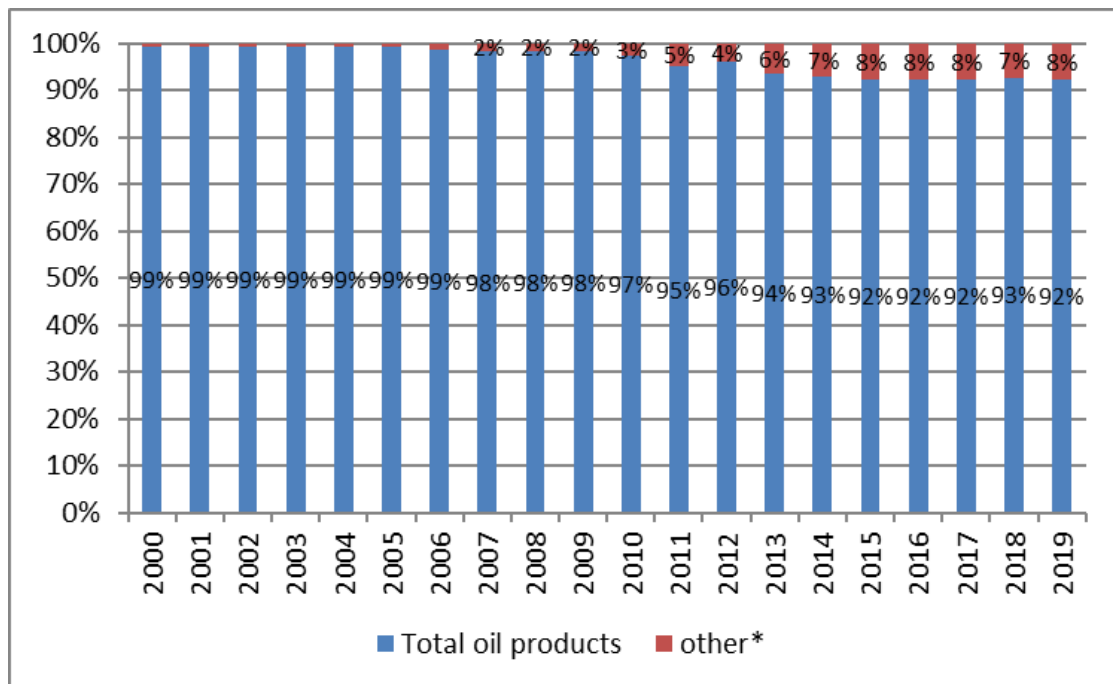
Figure 21: Final Energy Consumption by fuel in Transport in Greece 2000-2019



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 22).

Figure 22: Share of Final Energy Consumption by Fuel in Transport, Greece 2000-2019

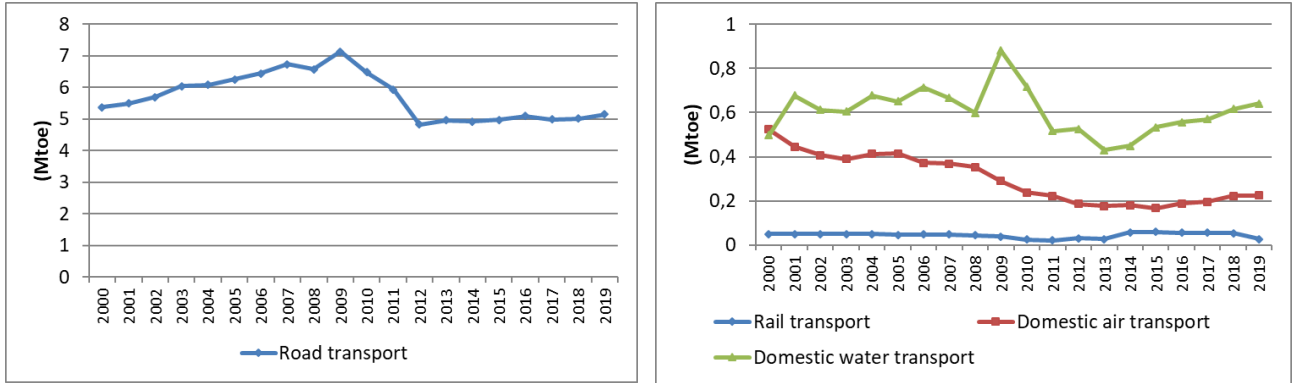


*Gas, electrical energy, renewable energies

Source: ODYSSEE

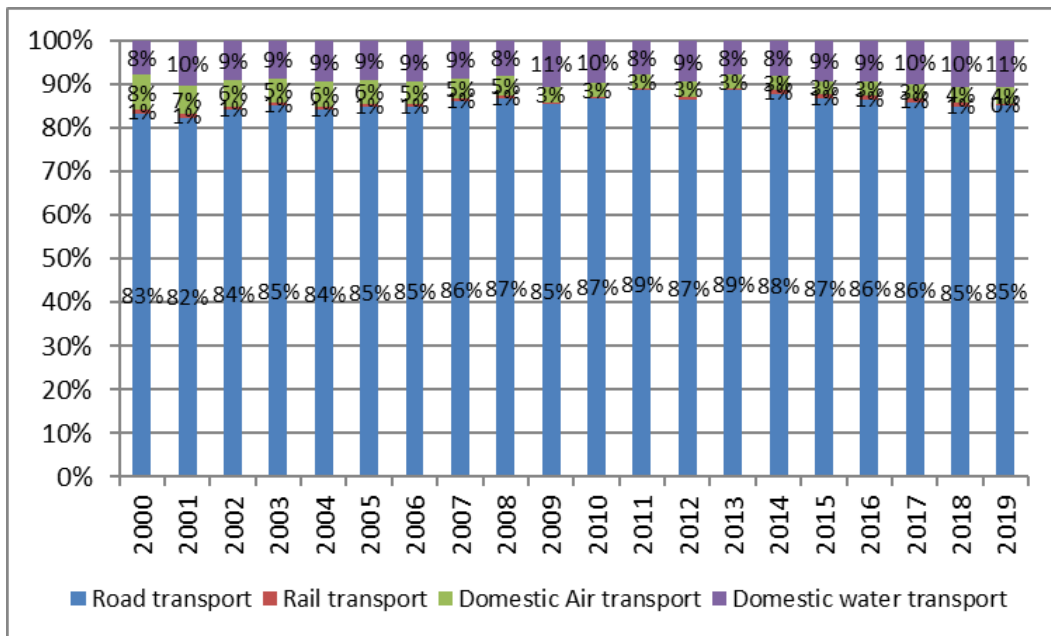
Over 2000-2019, the energy consumption in all transport modes decreased following the trends of the total sector (Figure 23). The biggest part of final energy consumption in transport was consumed by road transport with an average share of 86% at the total final consumption of the sector during this period (Figure 24). The trend in the fuel mix remains almost stable over this 20-year period.

Figure 23: Final Energy Consumption by mode in Transport 2000-2019



Source: ODYSSEE

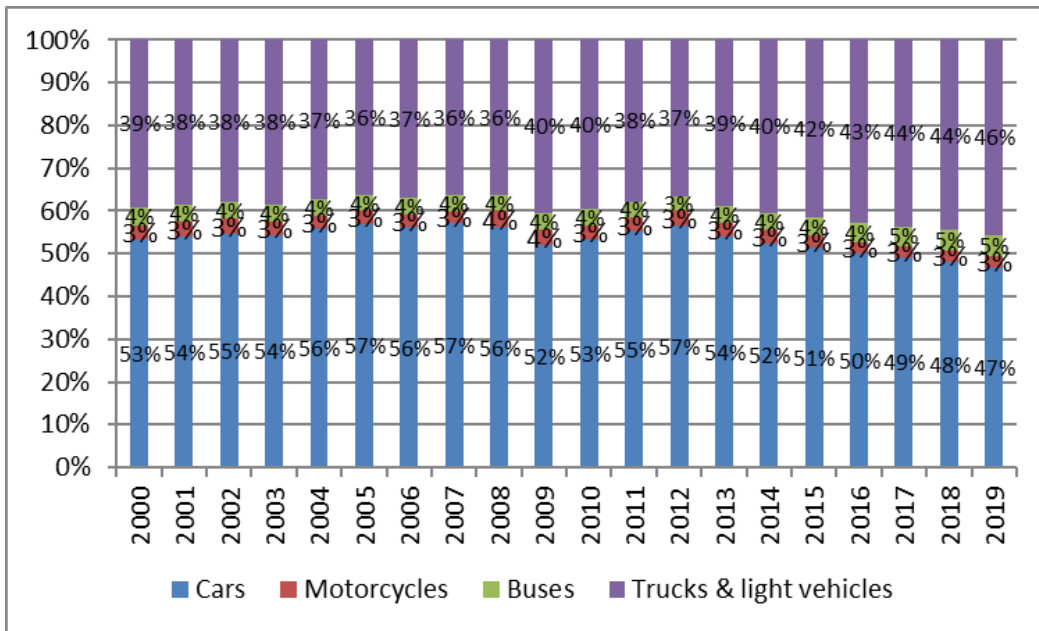
Figure 24: Share by mode in Transport 2000-2019



Source: ODYSSEE

The share by type of vehicles remained basically constant during the period 2000-2019. The cars were responsible for the biggest energy consumption of the road transport with an average share of 53% in the final consumption of the mode during this period. Trucks and light vehicles consumed the 39% of the total consumption of road mode over 2000-2019 (Figure 25).

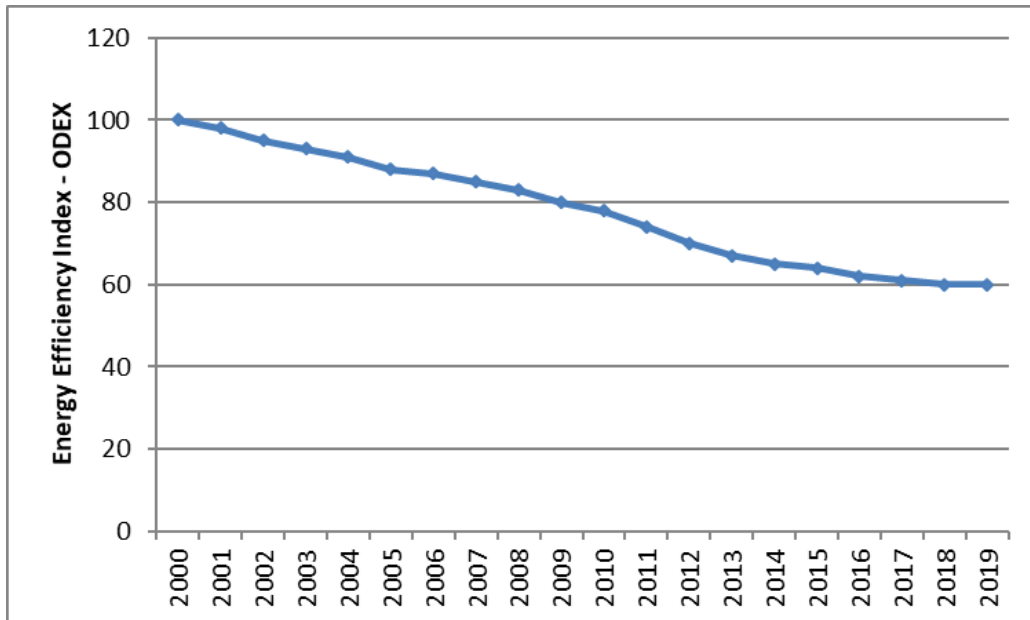
Figure 25: Share by vehicle in road transport in Greece 2000-2019



Source: ODYSSEE

In 2019, the overall energy efficiency of the transport sector has improved by 40%, compared to 2000 (Figure 26).

Figure 26: Energy Efficiency Index in Transport 2000-2019



Source: ODYSSEE

3.2. ENERGY EFFICIENCY POLICIES

The ongoing compliance with European vehicle fuel efficiency standards is the main regulatory driver for the fuel efficiency of passenger vehicles in the country. In this context, measures have also been implemented to incentivise the replacement of old private passenger vehicles. The existing energy efficiency obligation scheme also covers oil suppliers and subsequently the transport sector. Energy savings in the transport sector have also resulted from past reductions in activity following the economic and financial crisis, which has contributed to a shift from passenger vehicles to public transport, supported by new infrastructure and eco-driving training programmes.

Policy measures in the transport sector are a priority for Greece, just like the completion of the infrastructure needed to promote alternative fuels in transport, the consideration of new regulatory measures, the revision of the existing institutional framework for the development of a market in alternative fuel infrastructures and the adoption of tax incentives for all types of alternative fuels.

More specifically, the promotion of electromobility is a key priority in the transport sector. In respect of the use of natural gas in road transport, the use of liquefied natural gas (LNG) as fuel for heavy vehicles is of particular interest. In this context, plans are being made to deploy a network of 8 LNG refuelling stations by 2030, according to the NECP. The network of compressed natural gas (CNG) refuelling stations for vehicles is being deployed, whereas provision has been made for 55 CNG stations to be in operation throughout the country by 2030, to meet the relevant demand. Finally, the relevant institutional framework has already been drawn up, and there is appropriate know-how in the market in such matters as the establishment and operation of CNG stations, vehicle retrofit shops, technicians, car repair shops and technical control centres (KTEOs) for CNG vehicles, as well as transport of CNG by road to users outside the gas pipeline network.

Moreover, the implementation of infrastructure projects in the field of road and rail transport, combined with the drafting of plans for a shift in commercial transport operations, is expected to significantly improve energy efficiency in the sector.

Sustainable urban mobility plans play a major role in improving energy efficiency in the transport sector by incorporating the key principles of circular and cooperative economy. Sustainable urban mobility plans cover all modes and means of transport, including public transport and active modes of travel, such as walking and cycling, as well as shared means of movement and smart mobility. On a complementary basis, targeted actions, such as bioclimatic restructuring programmes, will be launched in conjunction with sustainable urban mobility plans, according to Greece's NECP.

Furthermore, priority will be given to the definition of a compulsory quota of vehicles with higher energy efficiency in public agencies and organisations by setting higher energy efficiency limits, while at the same time making plans for upgrading public transport by the use of new technology vehicles to the extent that this is efficient in financial, technological and energy terms.

Finally, the replacement of passenger vehicles and light goods vehicles with new high energy efficiency ones will be promoted through a combination of measures such as planning a targeted programme for passenger vehicle scrapping, putting in place a more effective legislative framework to link vehicle taxation to energy efficiency and CO₂ emissions, and implementing a broader financing programme

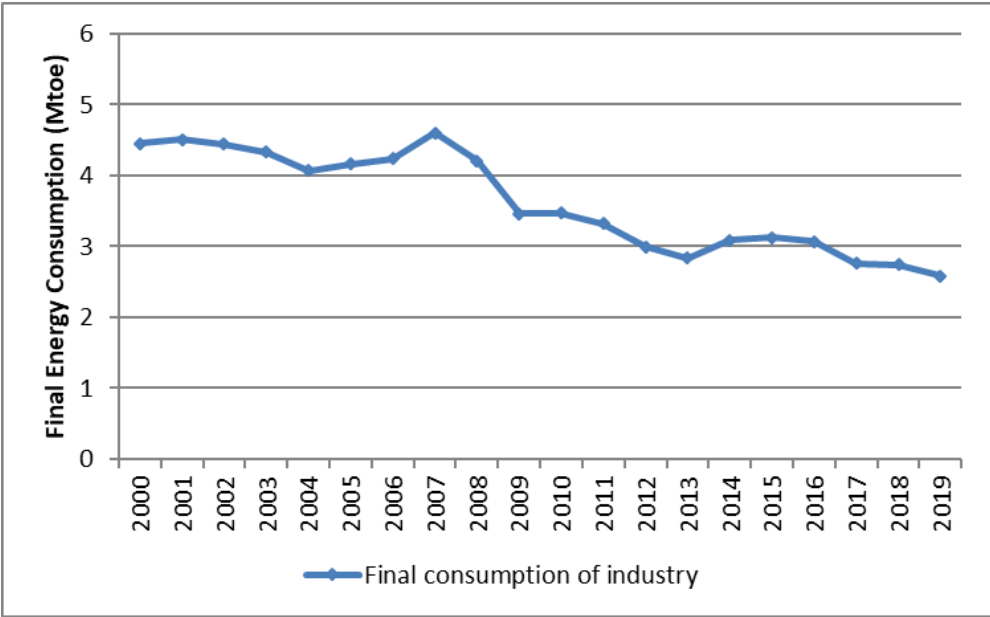
for the replacement of public and freight vehicles with low-emission ones. Please note that the market in vehicles using alternative fuels will contribute significantly towards improving energy efficiency in the road transport sector. As regards converting existing vehicles to use alternative fuels, it is necessary to put in place an appropriate institutional framework for certifying the conversion of such vehicles, according to Greece’s NECP.

4. ENERGY EFFICIENCY IN INDUSTRY

4.1. ENERGY EFFICIENCY TRENDS

Since 2000, the final energy consumption in industry has significantly decreased by 42% from 4.5 Mtoe in 2000 to 2.6 Mtoe in 2019 (Figure 27). 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 a decreasing trend of final energy consumption of industry until 2013, which continued up to 2019, recording a fall of 9% between 2013 and 2019, with the exception of the period of 2014-2016, where an increase was observed.

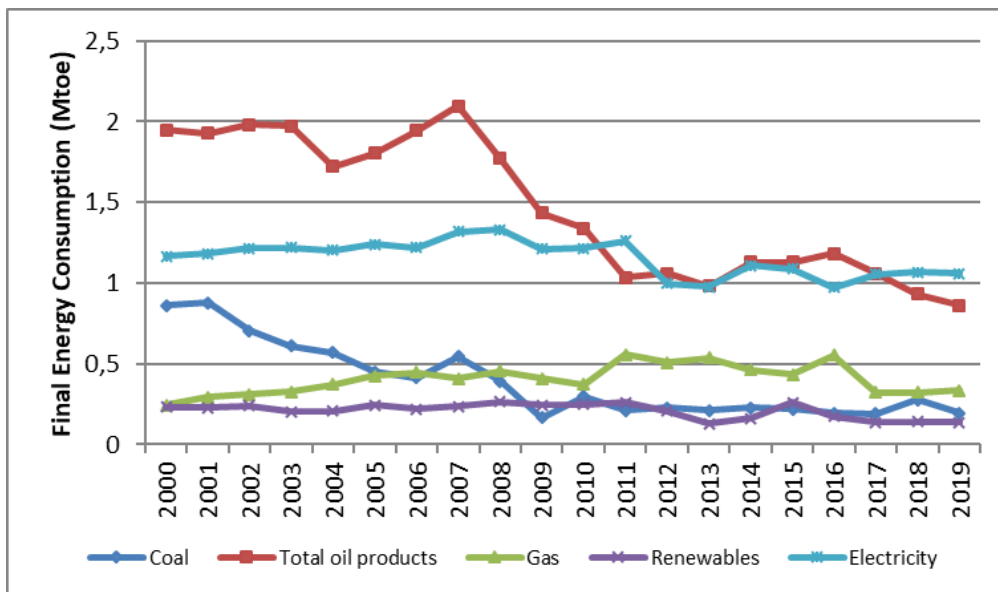
Figure 27: Final Energy Consumption in Industry 2000-2019



Source: ODYSSEE

Over 2000-2019, the oil products remained the main fuels in industry, and their reduction by 56% (1.95 Mtoe in 2000 to 0.86 Mtoe in 2019) was the main driver for the reduction of the total energy consumption of the sector. A slight increase was observed in the period 2014-2016, reaching 1.2 Mtoe in 2016. Moreover, a significant reduction in coal and renewable energy sources by 77% and 40% respectively was noted from 2000 to 2019. Electricity consumption also decreased by 9%, from 1.17 Mtoe in 2000 to 1.06 Mtoe in 2019. The only fuel that was increasing was the Natural Gas from 0.24 Mtoe in 2000 to 0.33 Mtoe in 2019 (Figure 28).

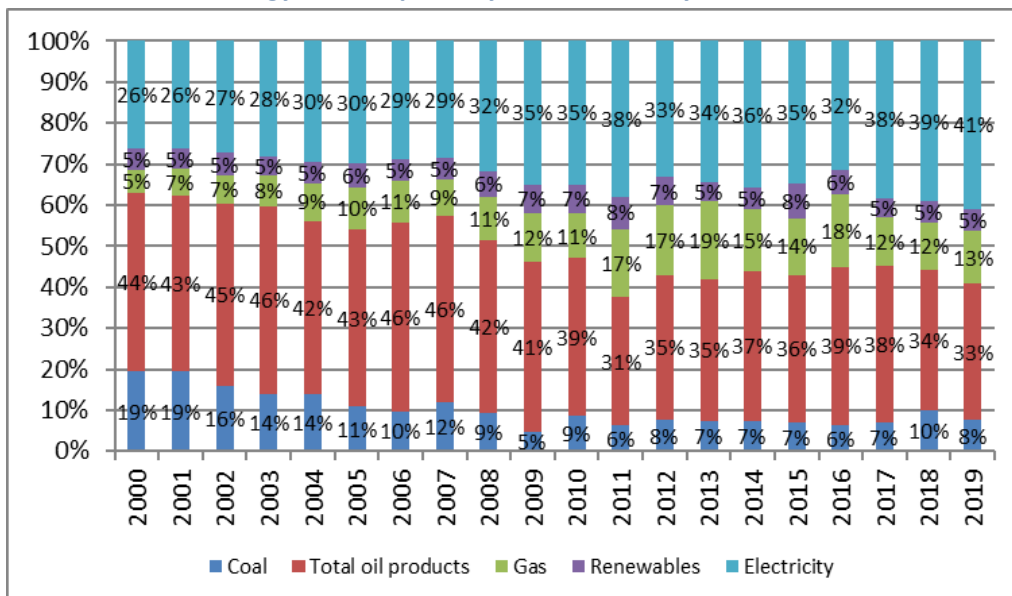
Figure 28: Final Energy Consumption by fuel in Industry 2000-2019



Source: ODYSSEE

Over 2000-2019, oil products remained the dominant fuel that was consumed in the industrial sector. Nevertheless, the share of oil products in the energy mix of the sector was decreasing during the period 2000-2019 (reduction of 11% from 2000 to 2019). The main reasons for this reduction was the introduction of Natural Gas in the energy market and the use of cheaper electricity, which led to increase of their consumption by 8% and 15% respectively in 2019, compared to 2000. The infiltration of renewables remains stable, and they represented around 5% of the total consumption of the industrial sector (Figure 29).

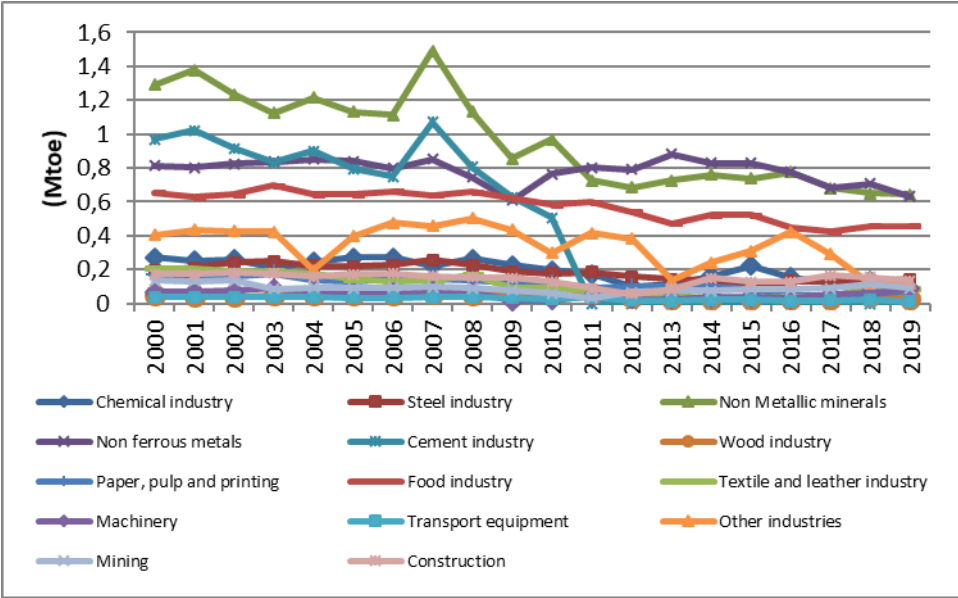
Figure 29: Share of Final Energy Consumption by Fuel in Industry in Greece 2000-2019



Source: ODYSSEE

During this period, the energy consumption reduced or remained almost stable in all industrial branches (Figure 30). The branch with the greatest reduction in energy consumption was transport equipment and its consumption decreased from 0.04 Mtoe in 2000 to 0.008 Mtoe in 2019.

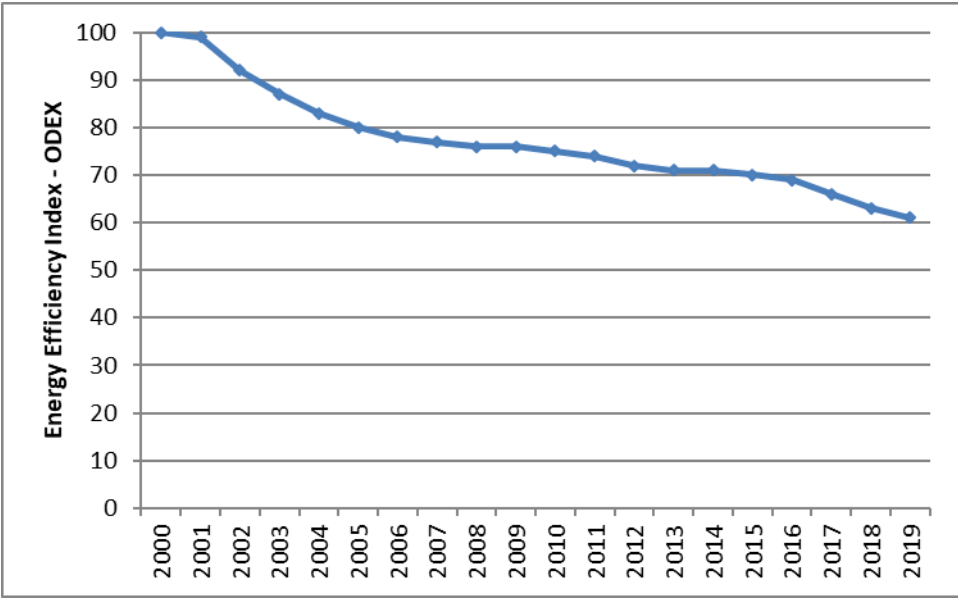
Figure 30: Final Energy Consumption by Branch in Industry in Greece 2000-2019



Source: ODYSSEE

The technical energy efficiency index of the industrial sector improved by 39% in 2019, compared to 2000 (Figure 31). This improvement in the energy efficiency index was the result of major decreases in chemical (67%), textile and leather (58%), paper, pulp and printing (54%) and steel (25%) industry.

Figure 31: Energy Efficiency Index-ODEX in Industry 2000-2019



Source: ODYSSEE

4.2. ENERGY EFFICIENCY POLICIES

There have not been extensive energy efficiency policies covering industry in Greece prior to 2016. However, in compliance with Article 8 of the EU Energy Efficiency Directive, Greece implemented in December 2016 a requirement for large industry to either conduct an energy audit every four years, or implement an energy or environmental management system. Small to medium-sized enterprises will also have access to quality energy audits due to these policies, according to the IEA.

Energy efficiency opportunities identified and implemented within Greek industry can also contribute towards the obligations of energy suppliers and retailers under the energy efficiency obligation scheme. This represents a source of energy savings that could be exploited by parties obligated by the programme to meet legislated requirements. It is therefore of benefit to maximise the relationships among industrial energy users and energy retailers to provide mutually beneficial updates for the energy audits and obligation programme participants.

In the industrial sector, the existing programmes for the provision of financial incentives to improve the energy efficiency of industries and manufacturing enterprises will continue in the new programming period and, in addition to that, the measure for the relocation of industrial plants to industrial-business zones will be strengthened. New policy measures will support actions at an industrial-business zone level for better energy management and increased savings, such as central heat production and distribution systems, according to Greece's NECP.

Furthermore, the promotion of natural gas as fuel in industries established far from the high pressure network through the transportation of liquefied natural gas is expected to be important. In the same context, the production of energy from the utilisation of waste heat and the replacement of conventional fuels with alternative ones will be promoted.

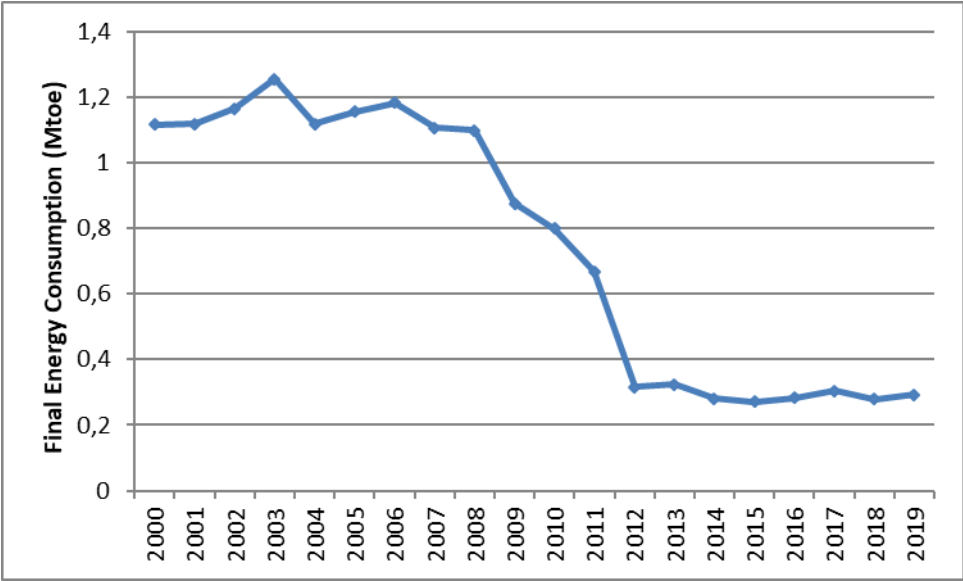
Finally, special financing mechanisms will be designed to strengthen the implementation of energy efficiency improvement measures in the industrial sector through energy performance contracts, such as subsidising borrowing costs and facilitating access of energy services companies to financing.

5. ENERGY EFFICIENCY IN AGRICULTURE

5.1. ENERGY EFFICIENCY TRENDS

A significant reduction by 74% in 2019, compared to 2000, has occurred in the agriculture sector. As a result, the energy consumption in 2019 was 0.29 Mtoe and in 2000 was 1.1 Mtoe (Figure 32).

Figure 32: Final Energy consumption of agriculture sector 2000-2019



Source: ODYSSEE

5.2. ENERGY EFFICIENCY POLICIES

Because of the share (1.9%) of agriculture sector in final energy consumption in Greece, this sector isn't examined for energy efficiency improvements, so no measures have been undertaken for this sector.

A specific package of policy measures aimed at improving energy efficiency in the agricultural sector is currently being considered, according to Greece's NECP. For example, a measure to improve the energy efficiency of pumping stations, as well as new measures such as the energy upgrading of agricultural machinery and the reduction in energy consumption in greenhouses and livestock farms are being planned.

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