



Energy Efficiency Policies and Measures in Greece

ODYSSEE- MURE 2010

Monitoring of EU and national energy efficiency targets

CRES

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1 Executive Summary

This report represents the case study of Greece for the EEI project “Monitoring of Energy Efficiency in EU 27, Norway and Croatia (ODYSSEE-MURE)”. It introduces an analysis of energy efficiency trends in Greece in 1990 – 2010 period. 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. Finally, into two annexes are given a concise presentation of Greek policy measures which are included in the MURE database, tabulated in each sector separately (Annex 1) as well as the brief analysis of Country Profile (Annex 2), are presented.

Overall Trends

The energy efficiency index (ODEX) for all sectors in Greece decreased regularly by 32%, between the years 1990 and 2010. Because of the energy efficiency measures that started to apply since 2008 and the economic crisis, the total energy efficiency index is gradually decreasing after 2008. The most crucial fact both in terms of analysing the achieved energy savings in end-use in Greece, and in analysing and evaluating the success of implementing specific measures to improve energy efficiency, is mainly due to the economic recession, whose impact is visible to a greater or lesser extent, in all sectors of final energy consumption in Greece, especially from 2009 onwards.

Industry

An increase of the global energy efficiency index is remarked in 2010, compared to 2009 because of a rapid increasing in the energy efficiency index in non-metallic (39%) industry which absorbs almost 30% of the energy consumed in the industrial sector. The efficiency index of the energy intensive branches has rapidly decreased, because these sectors were the first that the impact of the economic recession became apparent. Specifically, the efficiency index of chemical, paper and steel industry decreased by 40%, 35.4% and 33% respectively, in 2010 compared to 2008.

Households

Between 1990 and 2010, the energy efficiency index in the household sector decreased, which means an improving of energy efficiency. The energy efficiency for large electrical appliances improved by 13% during the period 1990-2010, and is the dominant factor, which determines the overall energy efficiency in households. The little decreasing of energy efficiency index (ODEX) for households is attributed mainly to the continuous replacement of the old building stock with newer and bigger dwellings based on the stringent requirements of new building regulation on better insulation and more efficient

household electrical appliances. Loans acquisition with low interest-rates helped the growth of renovation of older buildings and their replacement with new dwellings, especially in the urban areas. Moreover, given the economic recession, the actions to inform consumers on energy saving issues and tax incentives to promote energy efficient technologies/interventions, contributes to the improvement of household energy efficiency index.

Transport

In 2010, the overall energy efficiency of the transport sector has improved by 28% compared to 1990. However, after 2005 the index is slightly increased, because of the rapid increasing of trucks and light vehicles energy efficiency index. The lack of incentives for the replacement of this type of vehicles, leads to the increasing of the inefficiency fleet of trucks and light vehicles. On the other hand, the energy efficiency index of cars is steady decreasing mainly because of new, more energy efficient cars which led to the improvement of energy efficiency by 26.4%. Moreover, as the transport sector is contributing to a greater extent in final energy consumption in Greece than other sectors, it was the one where most of the measures specified in the first national EEAP were implemented. This, coupled with the economic recession, has resulted in this sector presenting the greatest savings achieved during the period 2007-2010. The measures that contributed to the significant energy savings that seem to be achieved in the transport sector are 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).

Tertiary

The energy consumption in service sector almost tripled from 0.7 Mtoe in 1990 to 1.91Mtoe in 2010. Until 2008, the service sector final energy consumption was steadily increased; the impact of economic recession was obvious, the final energy consumption decreased over the last 2 years. In 2010, energy and electricity intensity has decreased by 6.7% and 7.8% respectively compared to 1990, although the typical characteristic for services in Greece during the period 1990-1998 was the continuously increasing of energy and electricity intensity.

2 Key messages

The total energy efficiency index is gradually decreasing after 2008, for the reason that the energy efficiency measures were already started to apply since 2008 and when the economic crisis had been started making its appearance. The most crucial fact both in terms of analysing the achieved energy savings in end-use in Greece, and in analysing and evaluating the success of implementing specific measures to improve energy efficiency, is mainly due to the economic recession, whose impact is visible to a greater or lesser extent, in all sectors of final energy consumption in Greece, especially from 2008 onwards.

However, it should be considered that the impact of the economic recession, to the extent that it leads to no phenomena of energy poverty, may be a cause for adopting a more rational behaviour in the use of energy, and strategic planning of new energy efficiency improvement tools (or adaptation of old ones) to be used to the benefit of both society and market in the new economic circumstances (e.g. energy services market, increase of guided transport systems share).

3 The Background to Energy Efficiency

3.1 Overall economic context

During the period 1990-2009, GDP in Greece has almost doubled, (in constant € 2000 prices) following an annual growth rate between 2.5% to 9%, each year. For the same period, the increase of added value most of all sectors was also substantial (Figure 3.1). This increase is mainly due to the stimulus for major investment and infrastructure construction for the Olympic Games and the inflow of EU structural funds has contributed to this economic performance, during the period 1990-2009.

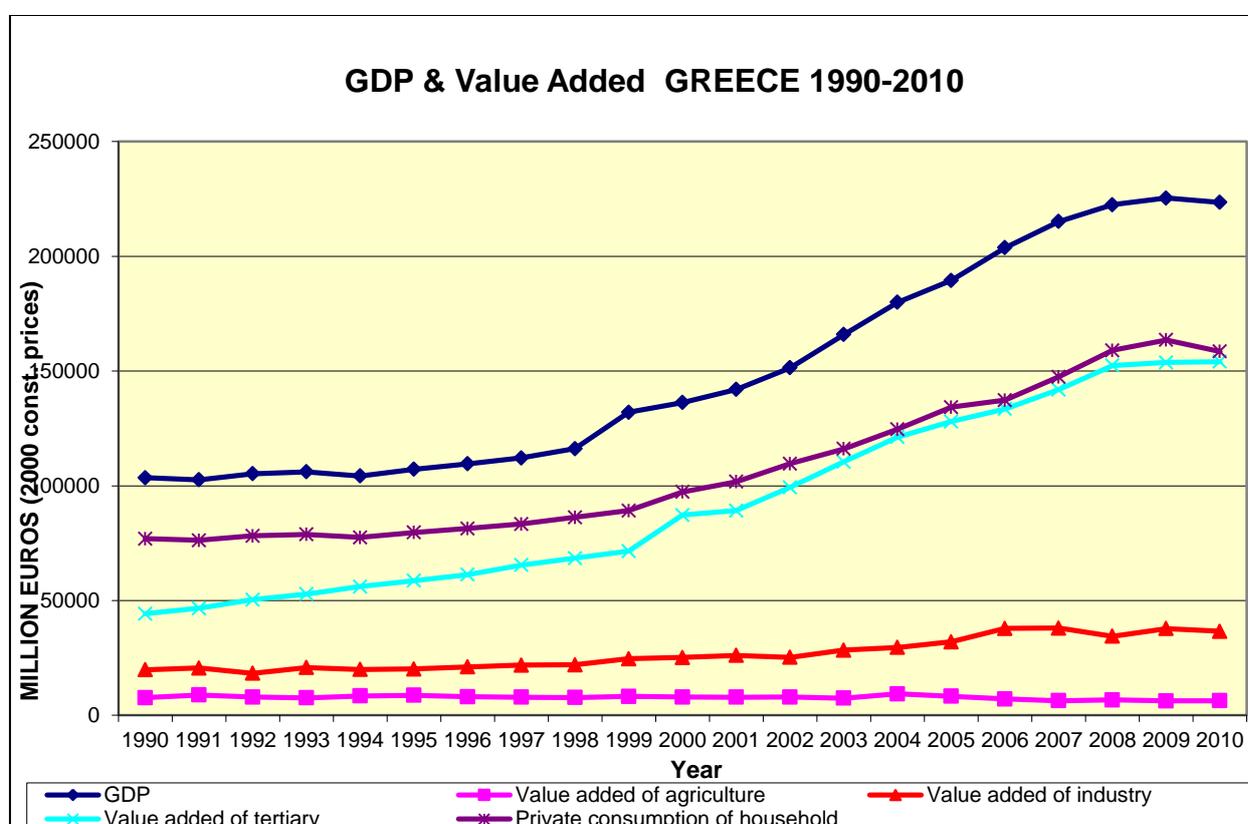


Figure 3.1: GDP and Added Value trends in Greece 1990-2010 (Mil. € in constant 2000 prices)

The situation of Greek economy has reversed after 2009, because of the economic crisis. The impact of the economic recession is visible in 2010, to a greater or lesser extent in all sectors in Greece. The two sectors that the results of the economic recession are stronger, is the tertiary and household sector. Although the growth of Value Added in these sectors was between 3.5%-18% and 2.5%-9% per year, until 2009, respectively, the decreasing between 2009 and 2010 is 3.3% and 3% correspondingly.

3.2 Energy consumption trends: by fuel and by sector

Since 1990, final energy consumption in Greece has increased by 30% from 14.7 Mtoe in 1990 to 19.4 Mtoe in 2010, following the course of both the figures of economic growth and new consumer habits adopted by final consumers. This growing trend mainly comes from the increase of oil consumption by 22.1% (10.2 Mtoe in 1990 to 12.5 Mtoe in 2010) and a major increase in electricity consumption by 86.3% (2.45 Mtoe in 1990 to 4.6 Mtoe in 2010). Since 1998 by the introduction of Natural Gas in the energy mix the final consumption has six times increased and this rapidly growing trend in the near future is expected to be sustained. The final energy consumption of renewable energy sources has also increased by 29 % over the last 20 years, mainly because of the measure to promote the renewable energy sources in all sectors.

However, both the implementation of measures to improve energy end-use efficiency and the recession have resulted in a significant reduction of final energy consumption in 2008-2010. The total final energy consumption during the period 1990-2007 shows an increasing trend of about 2.41% per year, mainly due to the increased consumption of petroleum products by 2.16% annually, which account for the largest share in the energy mix of Greece, and the average increase of electricity consumption by 4% per year.

As shown in Figure 3.2. below, energy consumption is maximized at 21.9 Mtoe in 2007 followed by a sharp decrease in the coming years, reaching 19.3 Mtoe in 2010, a decrease of 11.8% compared to 2007 and reaching in absolute terms the energy consumption in 2001 (19.2 Mtoe).

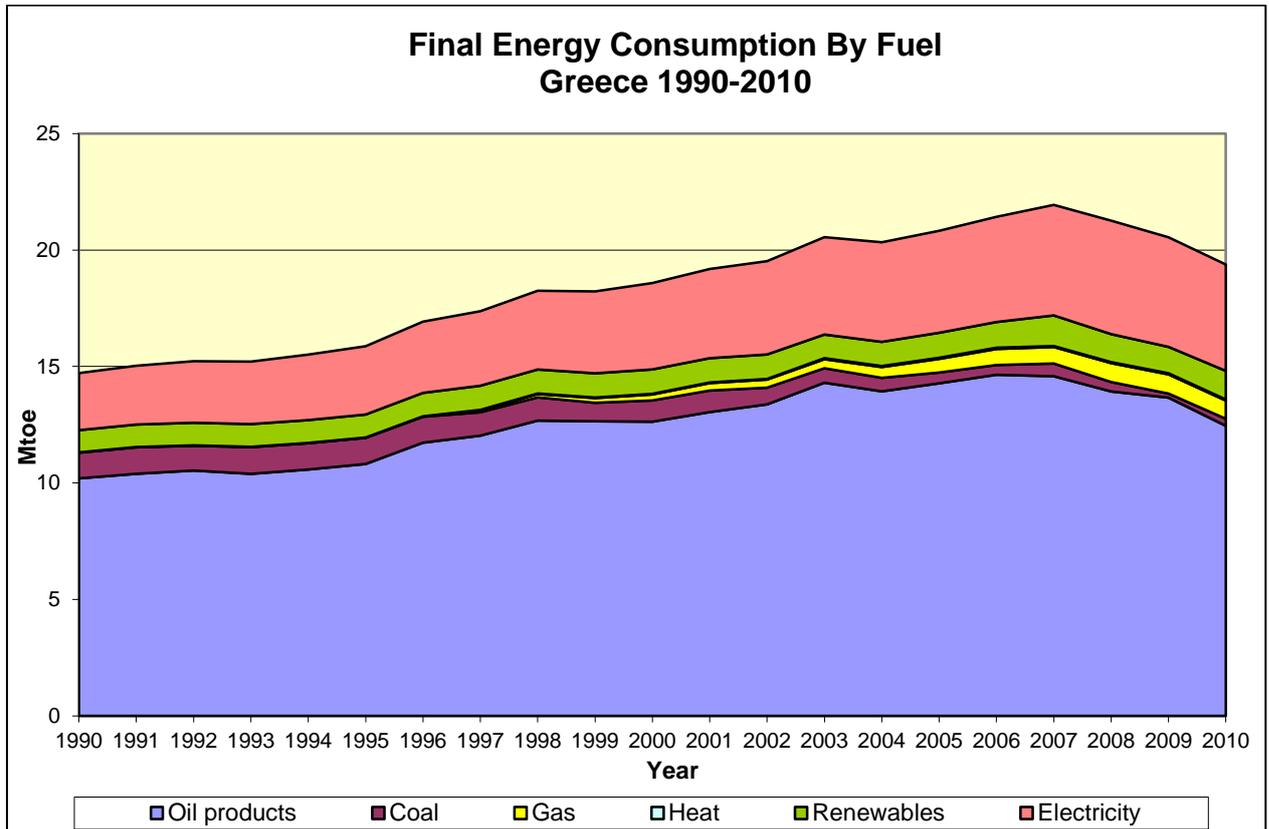


Figure 3 2: Final Energy Consumption by Fuel in Greece (1990-2010)

The share of oil products has decreased by 4.9% since 1990; however oil remains the dominant energy source of final consumers in Greece (Figure 3.3). The energy share of oil has decreased mainly due to the penetration of natural gas in the country's energy market since 1998 and the growth of the electricity share by 6.9%. Renewables still remain a relatively small share of final energy consumption and the energy share of coal presents a constant shrinking trend.

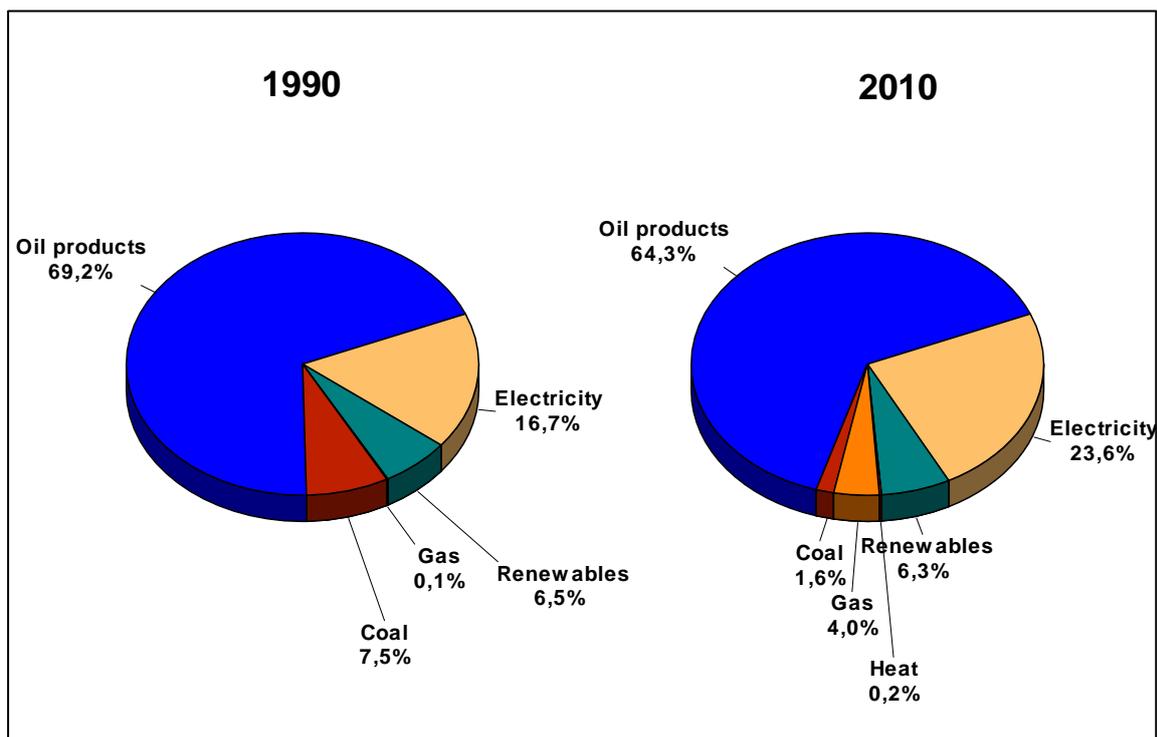


Figure 3.3: Share of Final Energy Consumption by Fuel in Greece (1990 vs.2010)

The transport sector consumes the biggest part of final energy consumption in Greece with 8.2 Mtoe in 2010 (Figure 3.4). The amount of energy consumed from transport activities has increased by 39.8% since 1990; due to the higher energy demand of the tertiary and residential sector. Households in 2010 consumed 4.6 Mtoe against 3.1 Mtoe in 1990; namely a 48.6% total growth in households energy consumption. Nevertheless, the most rapidly growing sector in terms of energy consumption has been the tertiary sector: Energy consumption of the tertiary sector has almost tripled since 1990, following an average growing trend of 6.7% per year. The energy consumption of industry and agriculture remains almost constant and near 1990 levels,

However, in years 2008 and 2009, and much more in 2010, there was a reduction in consumption specifically in the industrial, residential and tertiary sector, which is possibly due to the fact that these sectors were the first to sustain the effects of the economic recession in final energy consumption, which is further enhanced by the increase in energy prices. This decrease in consumption is particularly noticeable in the transport sector, where although there was an 8.1% increase in energy consumption in 2009 compared to 2008, the reduction of fuel consumption in the activities of the transport sector in 2010 was 11.5%, compared to 2009.

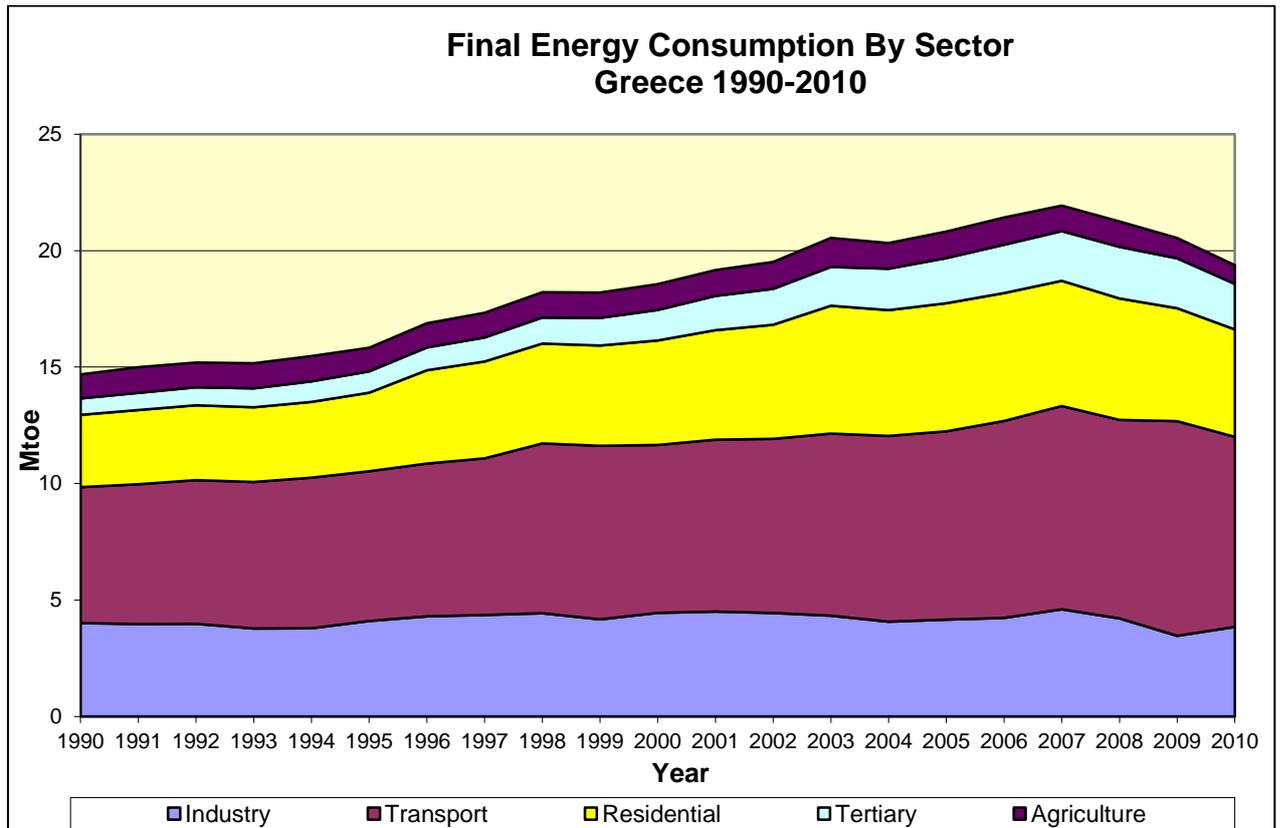


Figure 3.4: Final Energy Consumption by Sector in Greece (1990-2010)

The analysis of the share of final energy consumption by sector for the period from 1990 to 2010 yields significant conclusions regarding the evolution of energy consumption and efficiency of the individual economic activity sectors in Greece.

The energy share of transport and residential sectors has been increased by 2.3% and 2.7% correspondingly (Figure 3.5). On the other hand, the energy share of industry and agriculture has decreased by 7.5% and 2.7% respectively. This is due to the significant increase in the contribution of the tertiary sector in Greece's final energy consumption (4.9%), which is consistent with the orientation of the Greek economy, which is increasingly evolving into a service economy, where the tertiary sector is gaining an ever increasing market share.

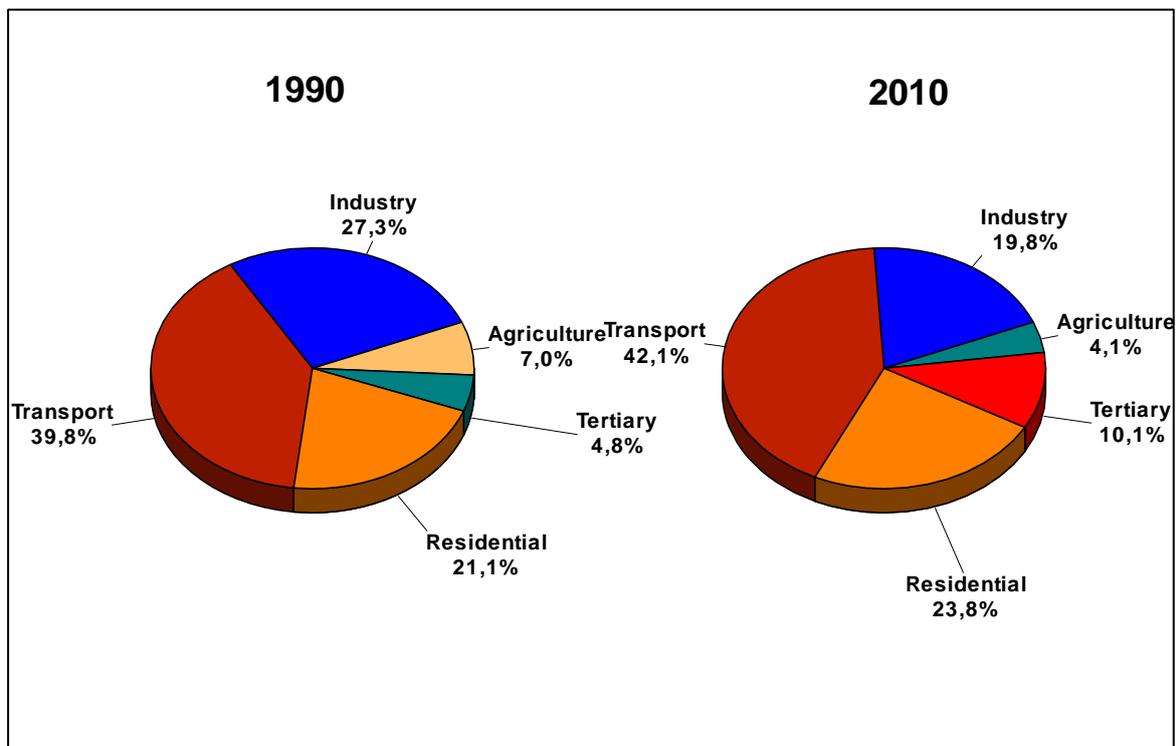


Figure 3.5: Share of Final Energy Consumption by Sector in Greece (1990 vs.2010)

3.2 *The policy background to energy efficiency*

The political strategy, in 2009, has sets one of its main overarching policy initiatives “green” sustainable development. This political choice has been translated in institutional reform and policy measures that include the establishment of a new Ministry for the Environment, Energy and Climate Change (YPEKA) in order to bring under a single administrative structure the respective bodies involved in the licensing of power plants taking into account energy, environment and fiscal considerations including the long term requirements to address climate change.

Furthermore, new functions were delegated to the newly established Special Secretariat for the Environment and Energy Inspectorate (SSEEI) of YPEKA to oversee and coordinate the competent departments at local and regional level in implementing the relevant environmental and energy legislation. The Special Service of Energy Inspectors (SSEI) forms part of the SSEEI and is in charge of controlling and monitoring the implementation of Law 3661/2008 and the measures stipulated therein concerning reduction of energy consumption of buildings, and issuing energy efficiency certificates. The Green Fund also plays a key role in monitoring the collection, control and allocation of Green Resources for the implementation of measures and actions to improve energy efficiency.

The main pillar of all the efforts towards achieving the EU target of improving energy efficiency is Directive 2006/32/EC, transposed into Greek legislation by means of Law 3855/2010. Under this Directive, and by extension the aforementioned Law, the National Energy Efficiency Action Plans (NEEAPs) provide a framework for the development of a strategy at national level, to further improve energy end-use efficiency through the implementation of concrete measures and policies in the various energy end-use sectors.

In this context, national EEAPs consist of useful policy tool not only for meeting the obligation of reporting to the EU on the applied and planned measures for energy end-use and savings achieved, but also as a national energy policy tool focusing on the improvement of energy efficiency. Moreover, they can also be used as an energy policy tool both at Community level, to help extract aggregate and comparative results at EU level, and will contribute to developing a common European energy policy.

This 2nd Energy Efficiency Action Plan is issued as part of the implementation of Directive 2006/32/EC on energy end-use efficiency and Law 3855/2010 (Government Gazette, Series I, No 95) “Measures to improve energy end-use efficiency, energy services and other provisions”, has been prepared by the Centre for Renewable Energy Sources (CRES) and incorporates the methodology of Ministerial Decision D6/7094/2011 “Framework methodology for measuring and verifying energy savings for achieving the national indicative energy end-use savings target-List of indicative eligible measures to improve energy efficiency-Energy content of fuels for end use” in order to monitor the progress in achieving the national energy savings target by 2016. This methodology is based on the European methodology for evaluation of energy savings, according the Directive 2006/32/EC “*Recommendations on measurement and verification methods in the framework of Directive 2006/32/EC on energy end-use and energy services*”

The main actions and measures that were launched from 2007 onwards as part of achieving energy savings target at a rate of 9% in end-use until 2016, were implemented at national level and mainly involved the development of the institutional and regulatory framework for adopting policies, obligations and strategies in all end-use sectors, as part of improving energy efficiency.

Specifically, a comprehensive institutional framework for the energy efficiency and certification of buildings, the technical specifications of new buildings, the obligations of the public sector and energy providers, and the mechanism to monitor and assess progress in the achievement of the national target was developed.

Emphasis was put on developing the appropriate structures (records, databases, technical guides), necessary for implementing the regulatory framework developed, as well as on public consultation with market players, with a view to ensure that this regulatory framework is widely accepted.

However, the most crucial fact both in terms of analysing the achieved energy savings in end-use for the period 2007-2010 in Greece, and in analysing and evaluating the success of implementing specific measures to improve energy efficiency, is nothing but the economic recession, whose impact is visible to a greater or lesser extent, in all sectors of final energy consumption in Greece, especially from 2009 onwards.

4 Overall Assessment of Energy Efficiency Trends

4.1 Overall trends in energy intensity

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.

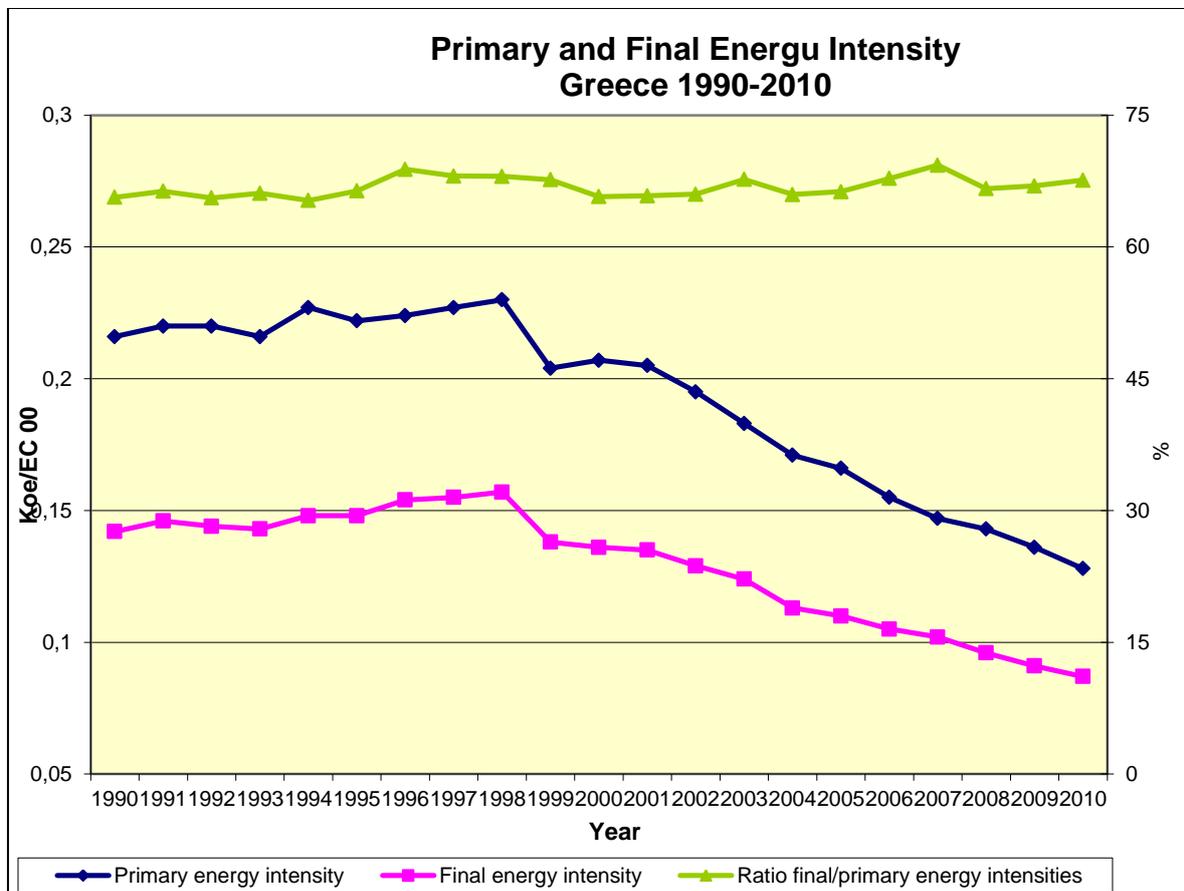


Figure 4.1: Primary and Final Energy Intensity in Greece (1990-2010)

The typical characteristic for Greece during the period 1990-1998 was the continuously increasing intensity of final energy and primary energy (Figure 4.1). However after 1998 both primary and final intensity have been decreasing until 2010, ending at a value of 0.13 koe/EC00 and 0.09 koe/EC00 correspondingly. It is noted that the significant reduction of primary and final intensity from 1998 to 1999 was due to changes in calculation methodology in GDP, VA and some others economic indexes. Both primary and final energy intensity decrease during the period 1999-2010 per 37.3% and 37%, respectively.

In 2010, primary and final energy intensity has decreased by 40.7% and 38.7% respectively compared to 1990.

The different variations between primary and final intensities from 1990 to 2010 are understandable by the ratio final to primary intensity, which remains almost steady during this period.

% / year	1990-1998	1999-2010	1990-2010
Primary intensity	6.5%	-37.3%	-40.7%
Final intensity	10.6%	-37%	-38.7%

Table 4.1: Variations in primary and final energy intensities in Greece (%/year)

4.2 Industry:

Since 1990, the final energy consumption in industry has decreased slightly by 4% from 4.0 Mtoe in 1990 to 3.85 Mtoe in 2010 (Figure 4.2). Although until 2007 the industry's final consumption was steadily increased, the industry sector was one of the first sectors which sustain the effects of the economic recession in final energy consumption. This fact led to the decrease of final consumption of industry, over the last 2 years. The oil remains the main fuel in industry, and the reduction of oil consumption by 4% (1.75 Mtoe in 1990 to 1.68 Mtoe in 2010) leads to the reduction of the total energy consumption of the sector. Electricity consumption continues to increase from 1.04 Mtoe in 1990 to 1.21 Mtoe in 2010. Since 1998 by the introduction of Natural Gas in the energy mix the final consumption has three times increased and this rapidly growing trend in the near future is expected to be sustained. The final energy consumption of renewable energy sources has also increased by 60% over the last 20 years.

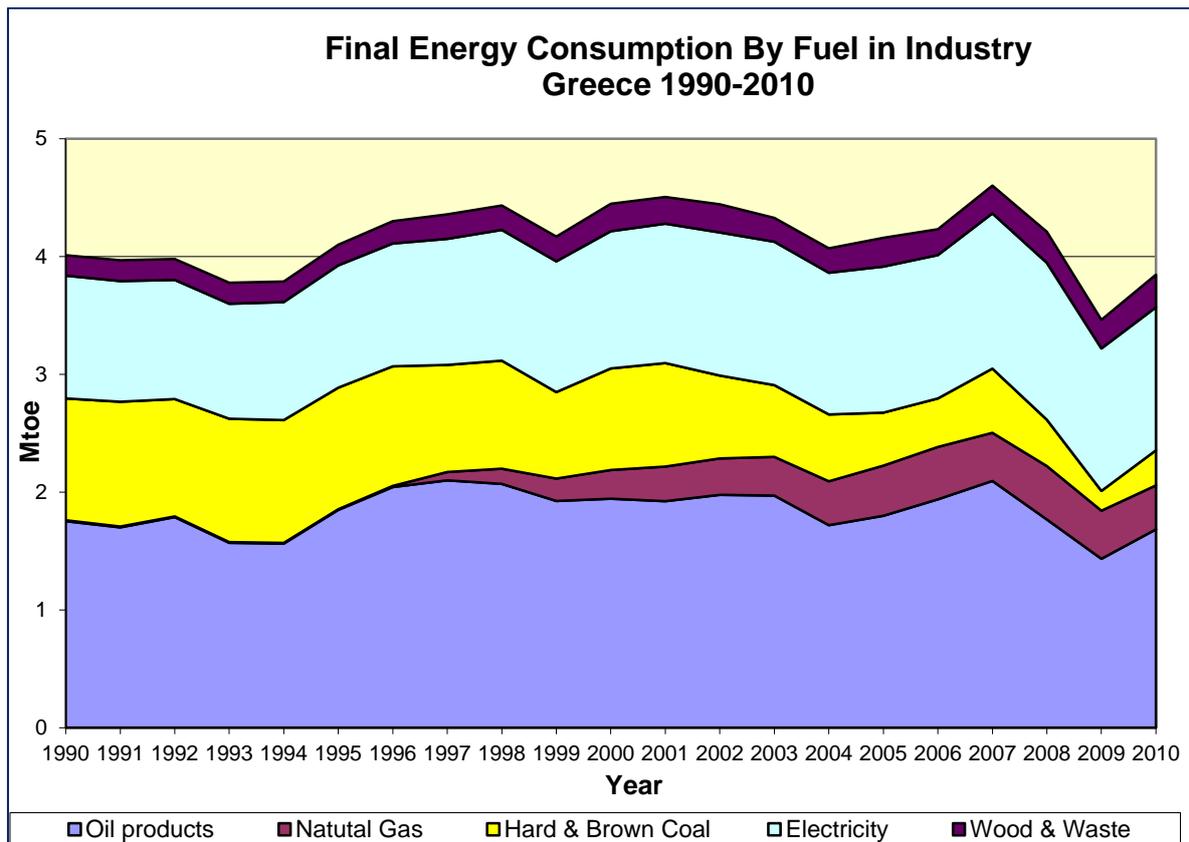


Figure 4.2: Final Energy Consumption by Fuel in Industry in Greece (1990-2010)

The share of oil products is remains constant for the years 1990 and 2010 (43.7%) and oil remains the dominant energy source of final consumers in Greece (Figure 4.3). Renewables still remain a relatively small share of final energy consumption.

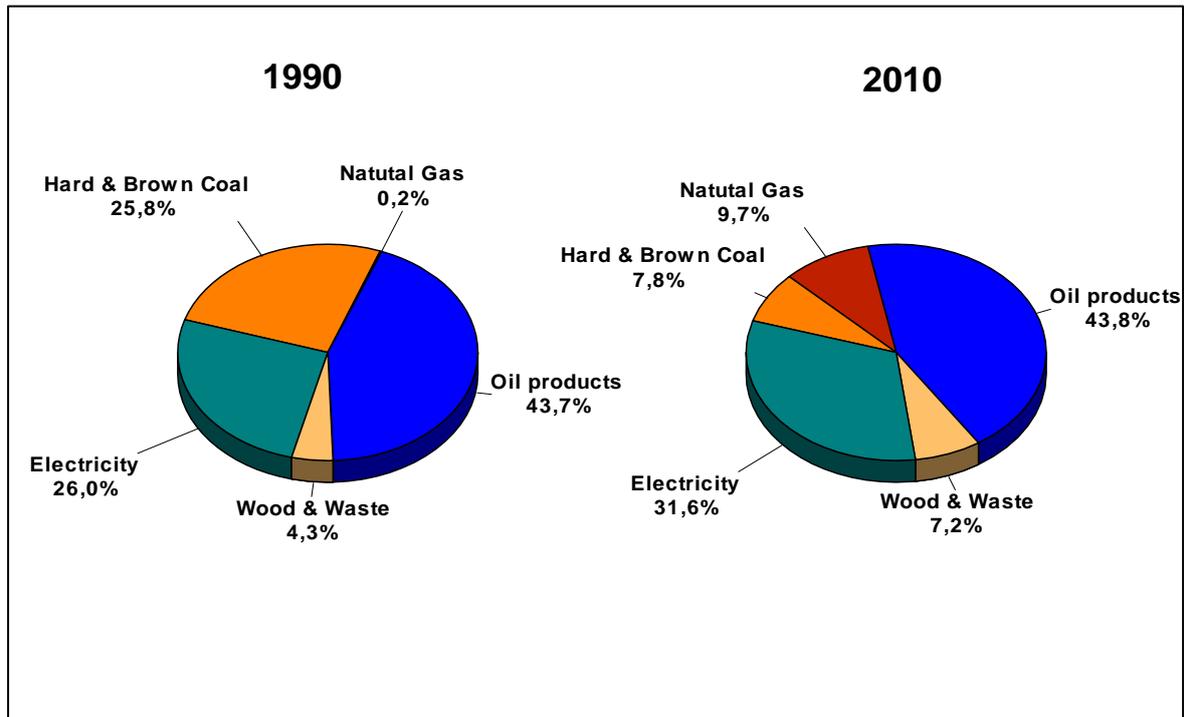


Figure 4.3 Share of Final Energy Consumption by Fuel in Industry in Greece (1990 vs.2007)

The Non Mineral Metallic industry consumes the biggest part of final energy consumption in Greece with 1.02 Mtoe in 2010 (Figure 4.4). However the energy share of Non Mineral Metallic Industry has been slightly increase by 2.5% (Figure 4.5). The most rapidly growing branch in terms of energy consumption has been the food industry: Energy consumption of the food industry has almost doubled since 1990. As a result, the energy share of the food industry was 17% in 2010 against 8% in 1990. The energy consumption of paper industry remains almost constant and near 1990 levels. On the other hand, the energy consumption of Chemical industry decreased by 37%.

The increase of final consumption that is noticed in 2007, is due to the increase of cement production because of the increase in construction activity. This increase is obliged to the future implementation of new VAT code for these kind of activities.

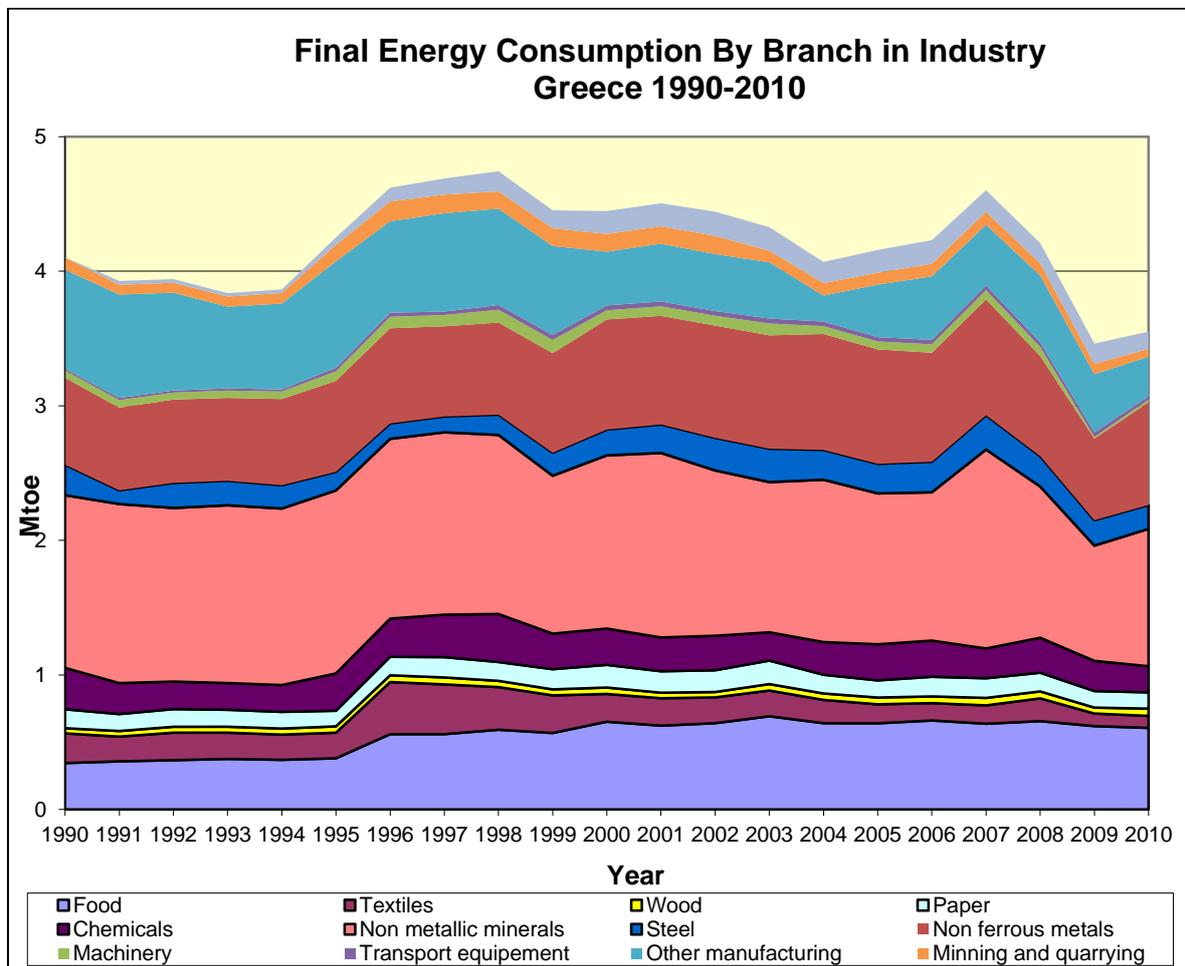


Figure 4.4: Final Energy Consumption by Branch in Industry in Greece (1990-2010)

Energy Efficiency Policies and Measures in Greece in 2012

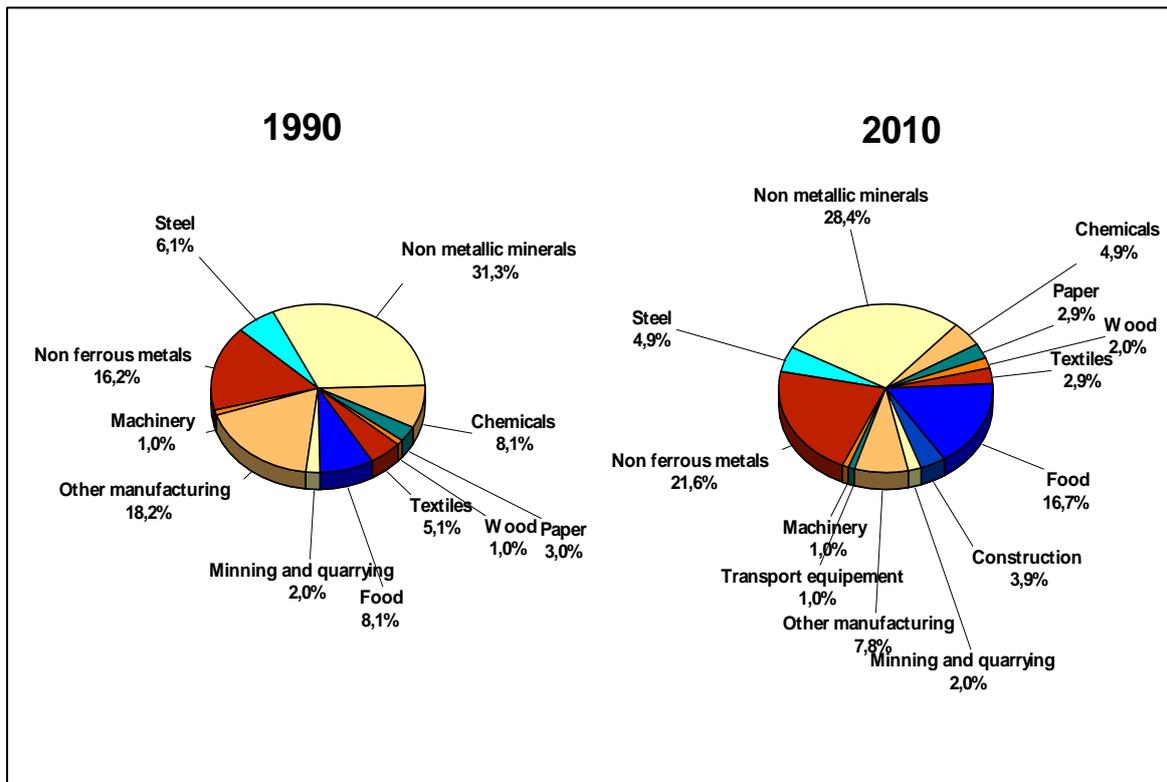


Figure 4.5: Share of Final Energy Consumption by Branch in Industry in Greece (1990 vs.2010)

Over the period 1990-2010, the efficiency in the industrial sector (measured at the level of 10 branches - in terms of energy used per production index or per ton - and aggregated to the whole sector) improved by 24.3% compared to 1990. This improvement in the energy efficiency index was the result of major decreases in chemical including rubber & plastics (64.5%) steel (57%) and non-ferrous (16.1%) industry. On the other hand, energy efficiency in textile, food and paper industry has been rapidly reduced with the corresponding efficiency indexes increasing (Figure 4.6).

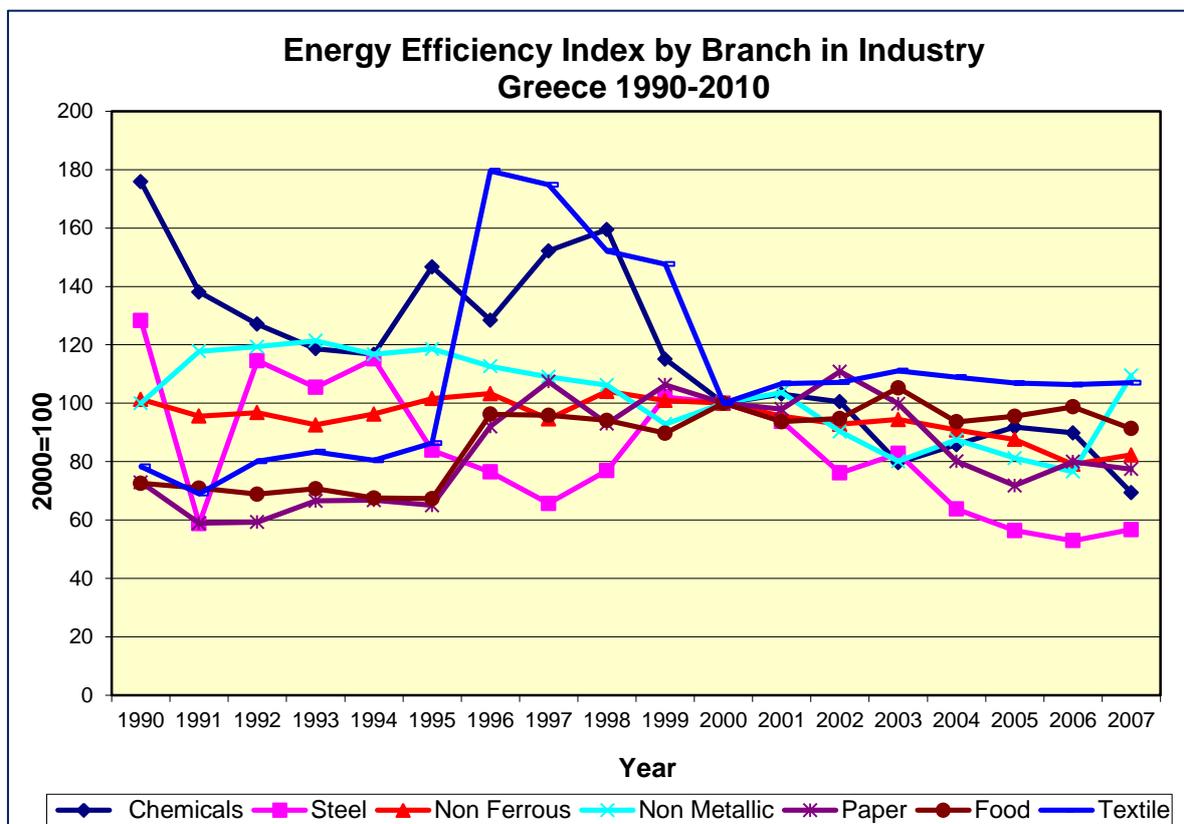


Figure 4.6: Energy Efficiency Index by branch in Industry in Greece (1990-2010)

4.3 Households:

Since 1990, the final energy consumption in households has increased by 48% from 3.1 Mtoe in 1990 to 4.61 Mtoe in 2010 (Figure 4.7). This growing trend mainly comes from the increase of oil consumption by 30% (1.5 Mtoe in 1990 to 2 Mtoe in 2010) and a major increase in electricity consumption; electricity consumption almost doubled since 1990 (0.78 Mtoe in 1990 to 1.6 Mtoe in 2010).

Although until 2007 the households' final consumption was steadily increased, the households sector was one of the first sectors which sustain the effects of the economic recession in final energy consumption. This fact led to the decrease of final consumption of household sector, over the last 2 years. The consumption of oil products, which are the main fuel that is used by the household sector, decreased by 25.7% between 2007 and 2010

Since 1998 by the introduction of Natural Gas in the energy mix the final consumption has rapidly grown (3.8 ktoe in 1999 to 255 ktoe in 2007) and this rapidly growing trend in the near future is expected to be sustained.

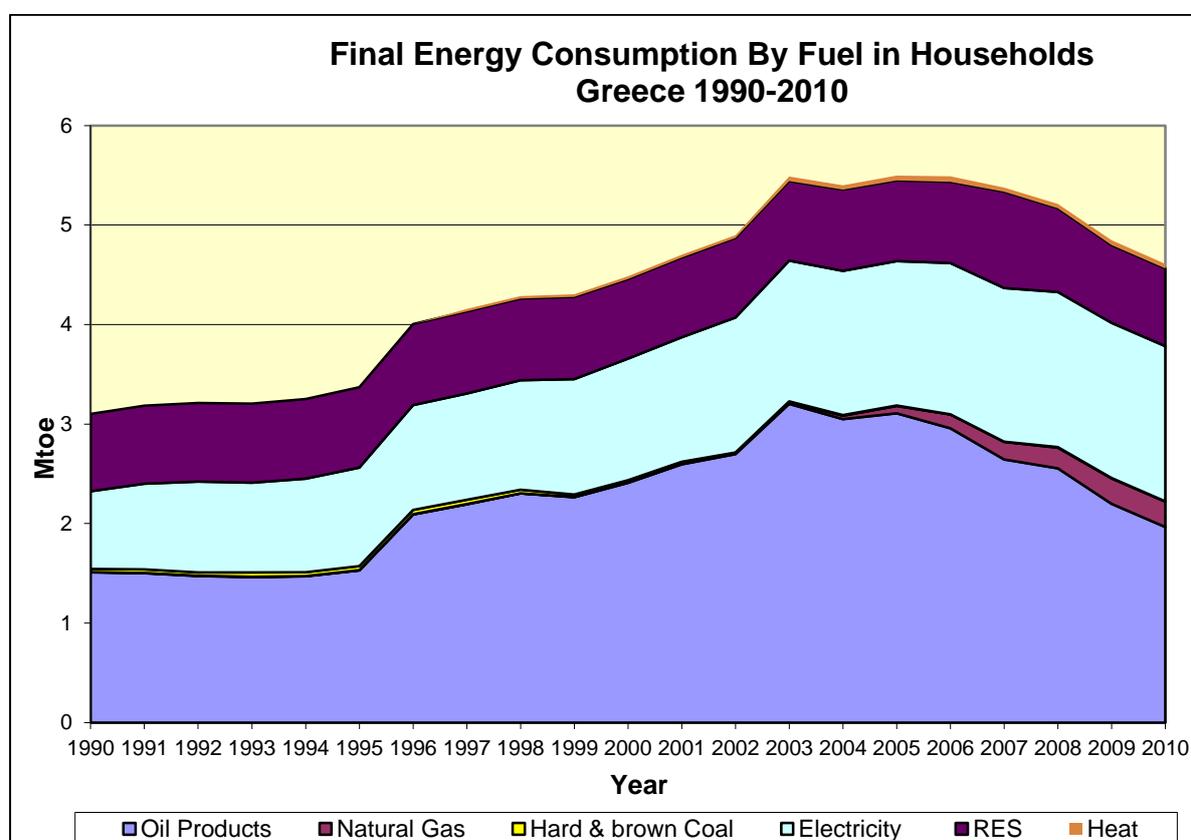


Figure 4.7: Final Energy Consumption by Fuel in Households in Greece (1990-2010)

The share of oil products has slightly increased by 6% since 1990 (Figure 4.8). The penetration of natural gas in the country's energy market since 1998 led to the growth of natural gas share in final consumption of households.

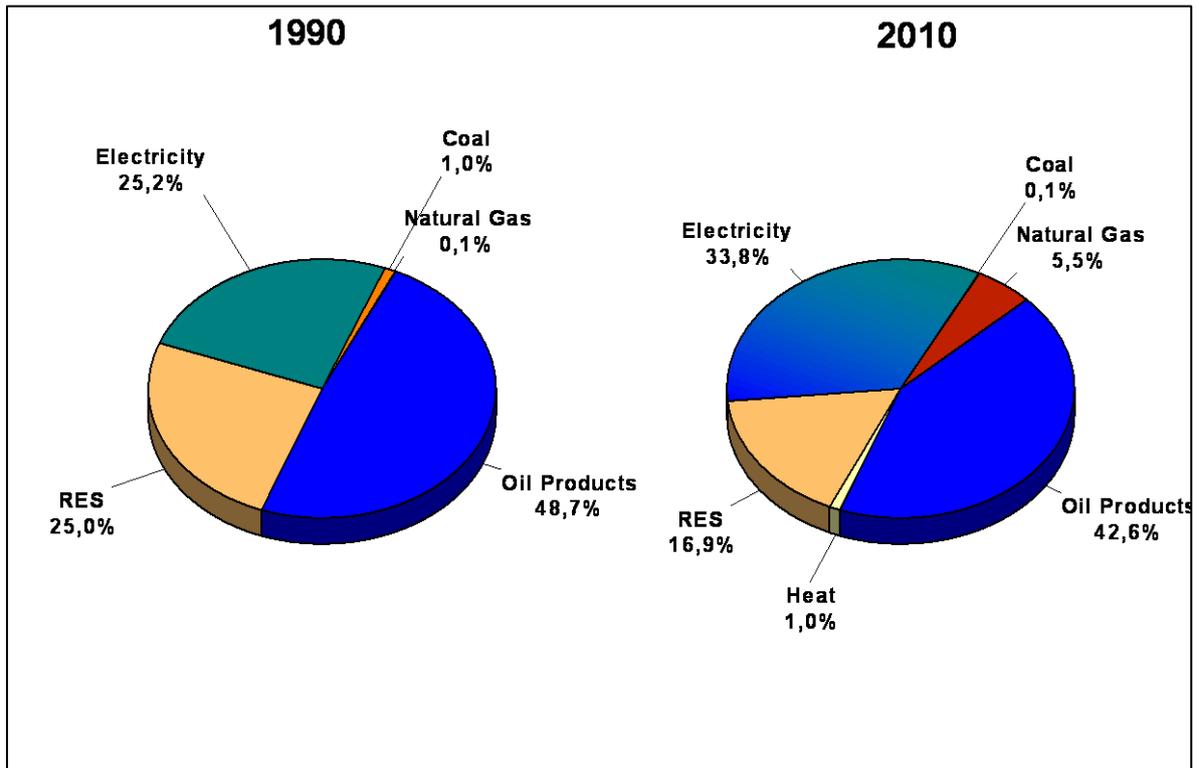


Figure 4.8: Share of Final Energy Consumption by Fuel in Households in Greece (1990 vs2010)

The biggest part of final energy consumption in households is consuming for space heating (Figure 4.9). Households in 2010 consumed for space heating 3 Mtoe against 2.2 Mtoe in 1990; namely a 32% total growth in space heating energy consumption. The amount of energy consumed from electric appliances and lighting has almost tripled since 1990 and the energy share has been increase by 9.8%. The energy consumption for cooking remains almost constant and near 1990 levels, therefore the energy share has decreased by 3% (Figure 4.10).

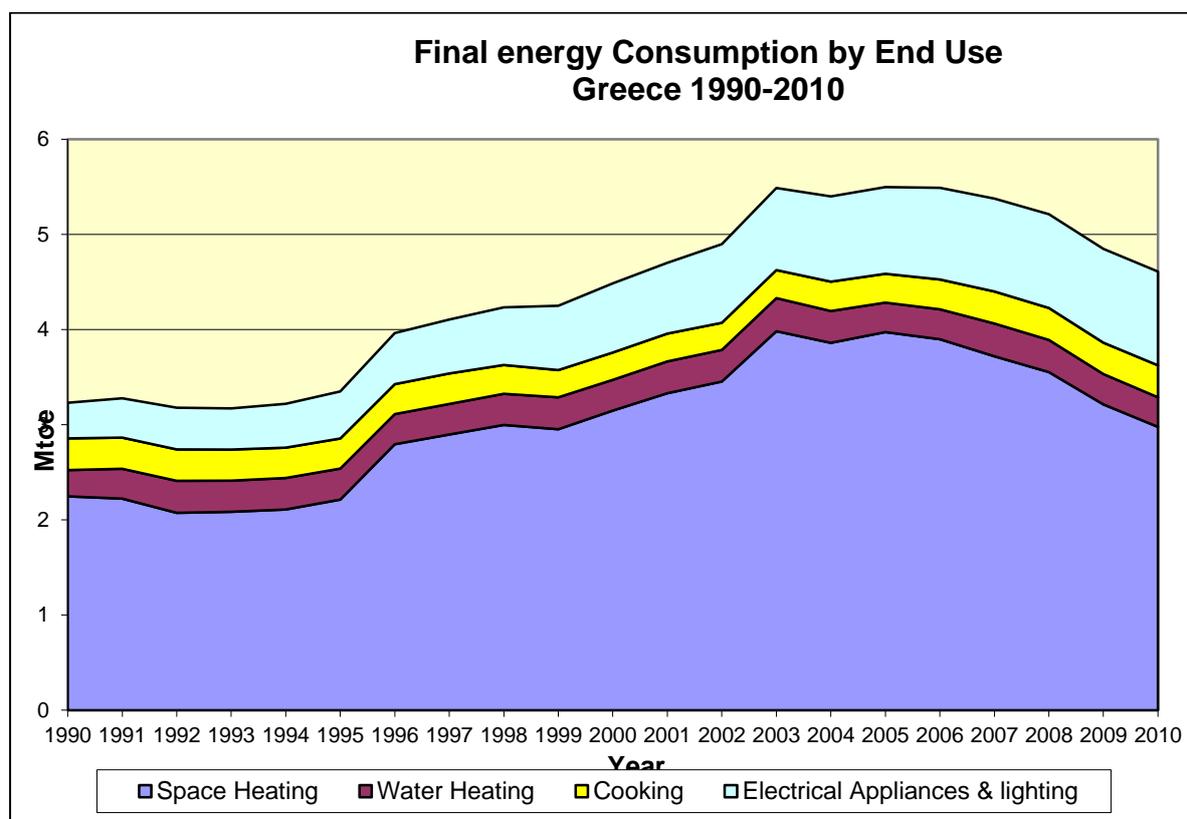


Figure 4.9: Final Energy Consumption by End Use in Households in Greece (1990-2010)

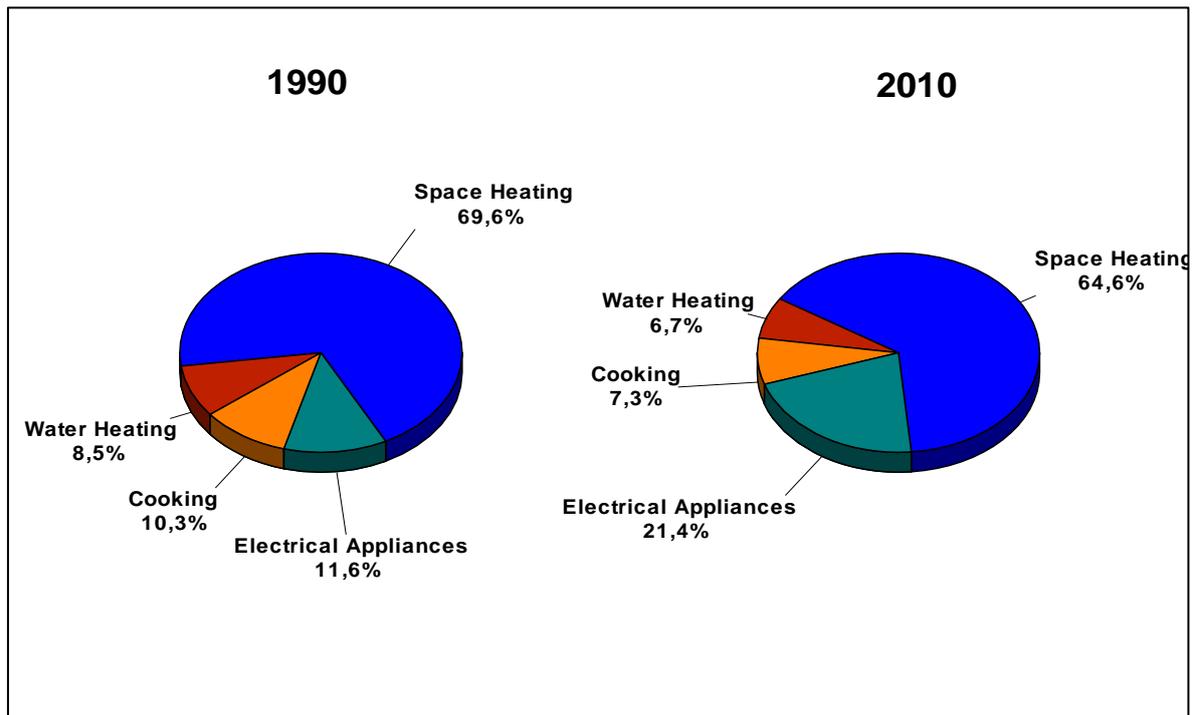


Figure 4.10: Share of Final Energy Consumption by Energy Use in Households in Greece (1990 vs2010)

4.4 Services:

The typical characteristic for services in Greece during the period 1990-1998 was the continuously increasing of energy and electricity intensity (Figure 4.13). It is noted that the significant reduction of energy and electricity intensity from 1998 to 1999 was due to changes in calculation methodology in GDP, VA and some others economic indexes.

In 2010, energy and electricity intensity has decreased by 6.7% and 7.8% respectively compared to 1990.

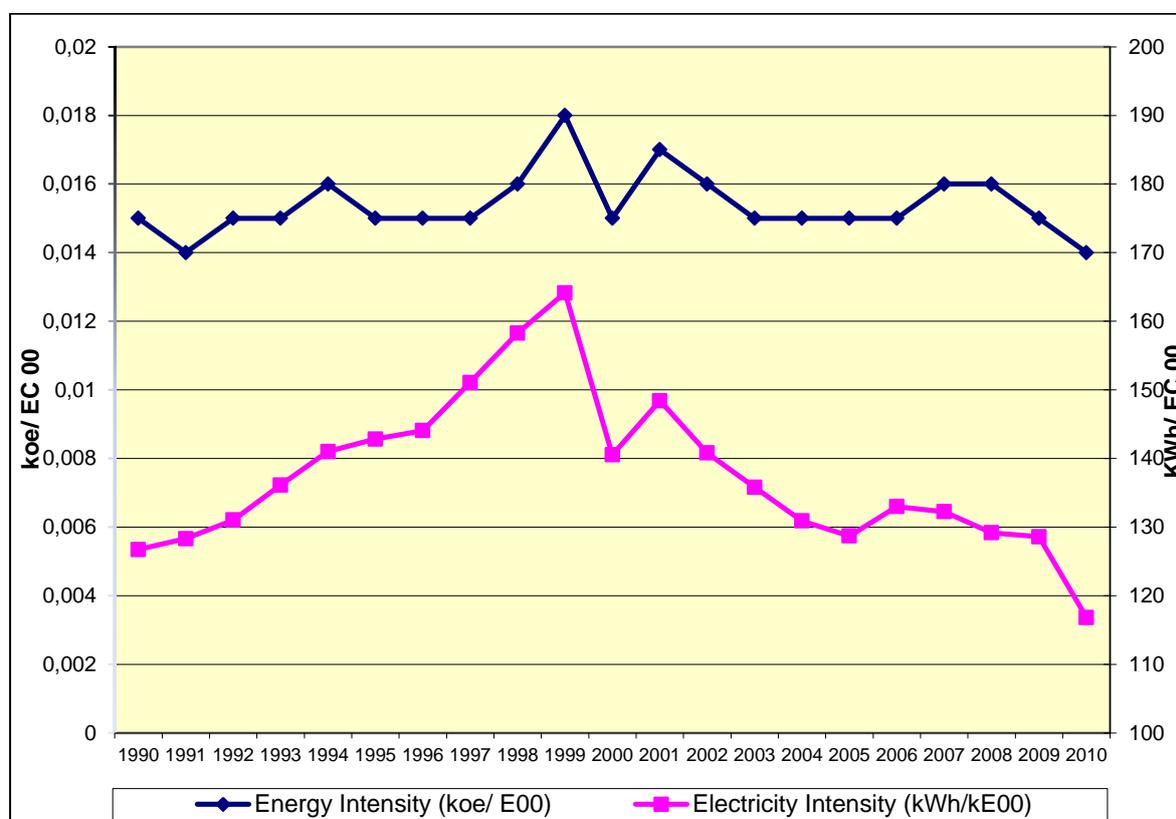


Figure 4.11: Energy Intensity Service Sector in Greece (1990-2010)

Final energy consumption in service sector almost tripled from 0.7 Mtoe in 1990 to 1.91 Mtoe in 2010 (Figure 4.14). This growing trend comes from the increase of electricity consumption (0.48 Mtoe in 1990 to 1.5 Mtoe in 2010). Since 1998 by the introduction of Natural Gas in the energy mix the final consumption has rapidly increased and this rapidly growing trend in the near future is expected to be sustained.

Although until 2008 the service sector final consumption was steadily increased, the service sector was one of the first sectors which sustain the effects of the economic recession in final energy consumption. This fact led to the decrease of final consumption of the sector, over the last 2 years. The consumption of oil products, which are the main fuel that is used by the household sector, decreased by 8.6% between 2008 and 2010.

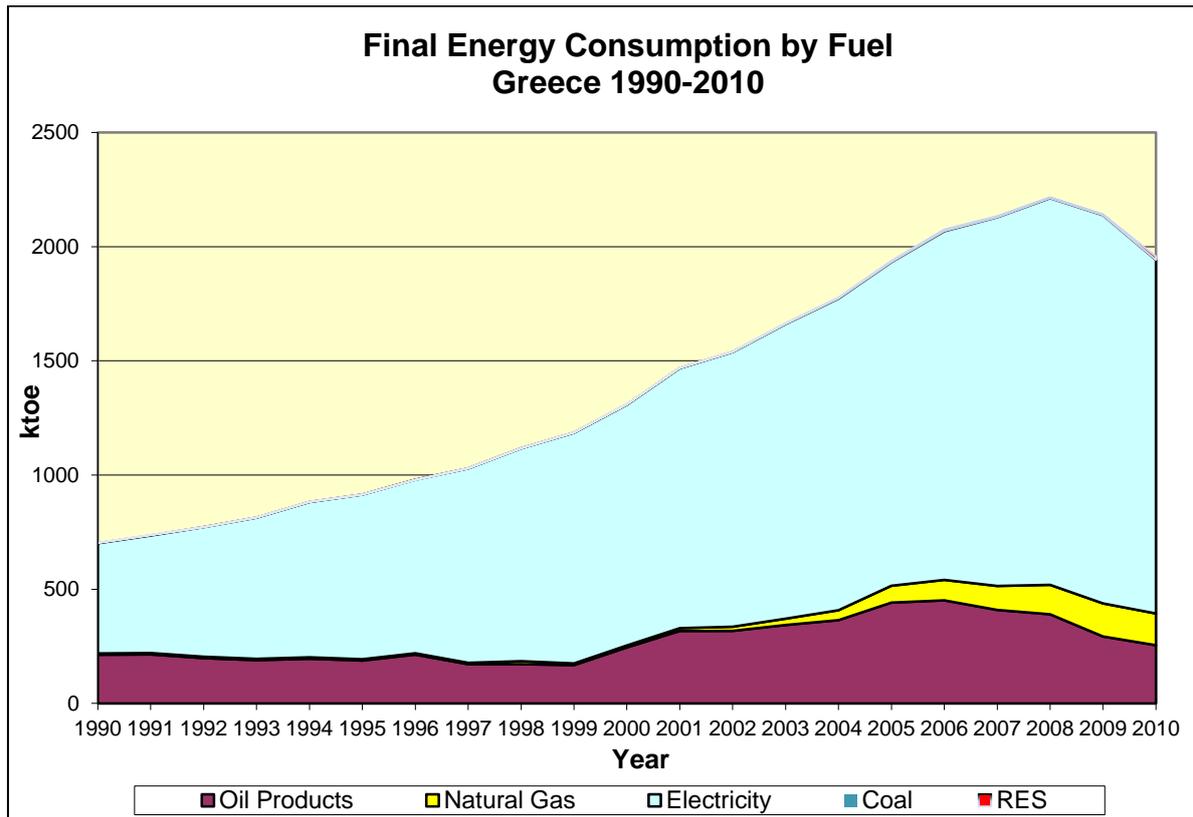


Figure 4.12: Final Energy Consumption by Fuel in Services in Greece (1990-2010)

The share of oil products has decreased by 17.3% since 1990 (Figure 4.15). The energy share of oil has decreased mainly due to the penetration of natural gas in the country's energy market since 1998 and the growth of the electricity share by 10.5%.

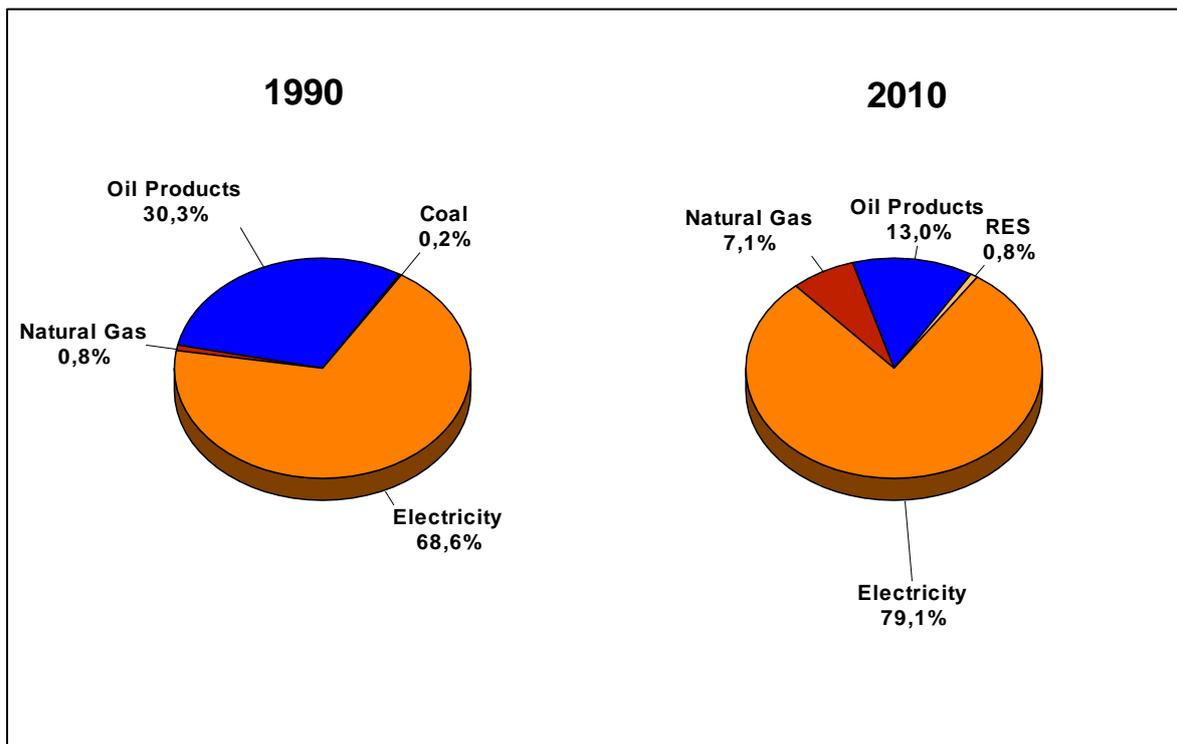


Figure 4.13: Share of Final Energy Consumption by Fuel in Services in Greece (1990vs 2010)

4.5 Transport:

Since 1990, the final energy consumption in transport has increased by 39.8% from 5.83 Mtoe in 1990 to 8.2 Mtoe in 2010 (Figure 4.16). This growing trend mainly comes from the increase of oil consumption by 37.4% (5.82 Mtoe in 1990 to 8 Mtoe in 2010).

Due to economic and the energy efficiency measures that implemented after 2007, the steadily increase of final energy consumption until 2007, has reversed after this year. The consumption of oil products, which are the main fuel that is used by the transport sector, decreased by 7% between 2007 and 2010. This reduction also ought to use of public transport instead of private cars by the passengers.

Since 1998 by the introduction of Natural Gas in the energy mix the final consumption has doubled and this rapidly growing trend in the near future is expected to be sustained, as natural gas is used by public buses. Moreover, the introduction of biofuels in fuel oil is obvious. Oil products remain the dominant fuel in transport.

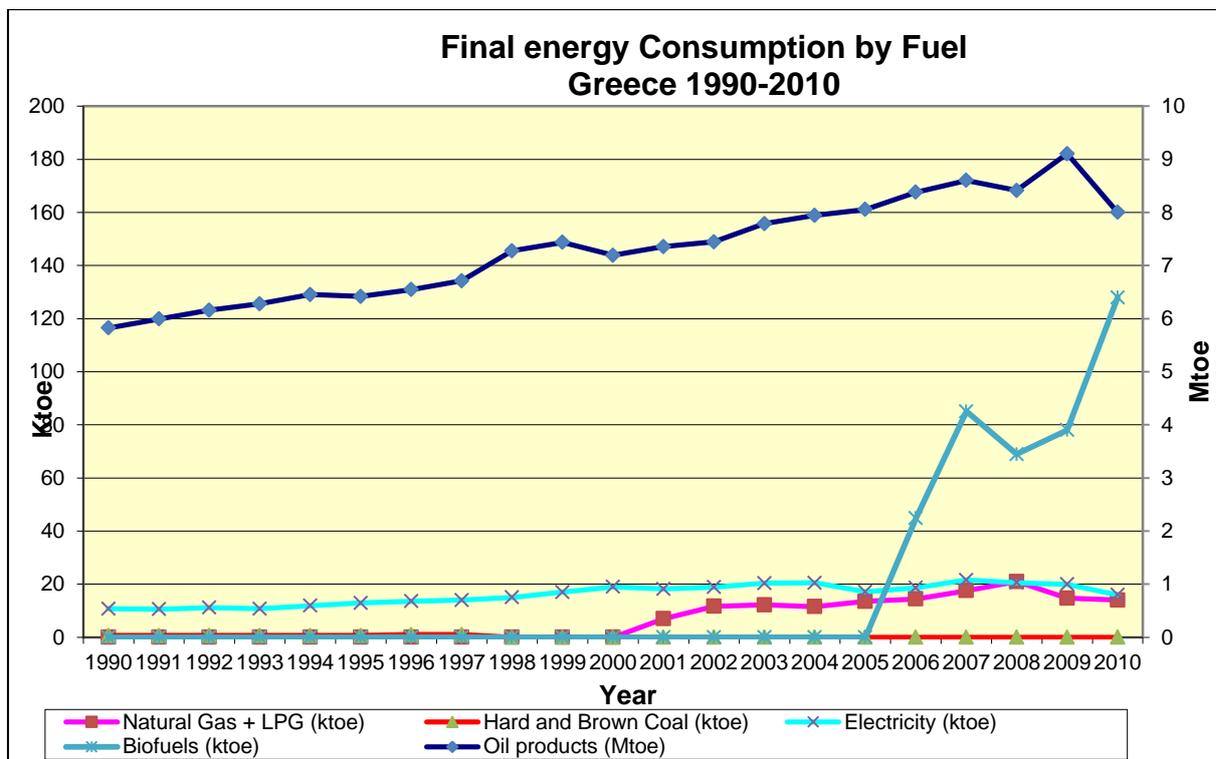


Figure 4.14: Final Energy Consumption by Fuel in Transport in Greece (1990-2010)

The biggest part of final energy consumption in transport is consumed by road transport (Figure 4.17). The amount of energy consumed from road transport activities has increased by 71.6% since 1990 because of the increase of private cars stock, the improvements in road transport infrastructure and the low cost of fuels. Cars in 2010 consumed 3.6 Mtoe against 2 Mtoe in 1990.

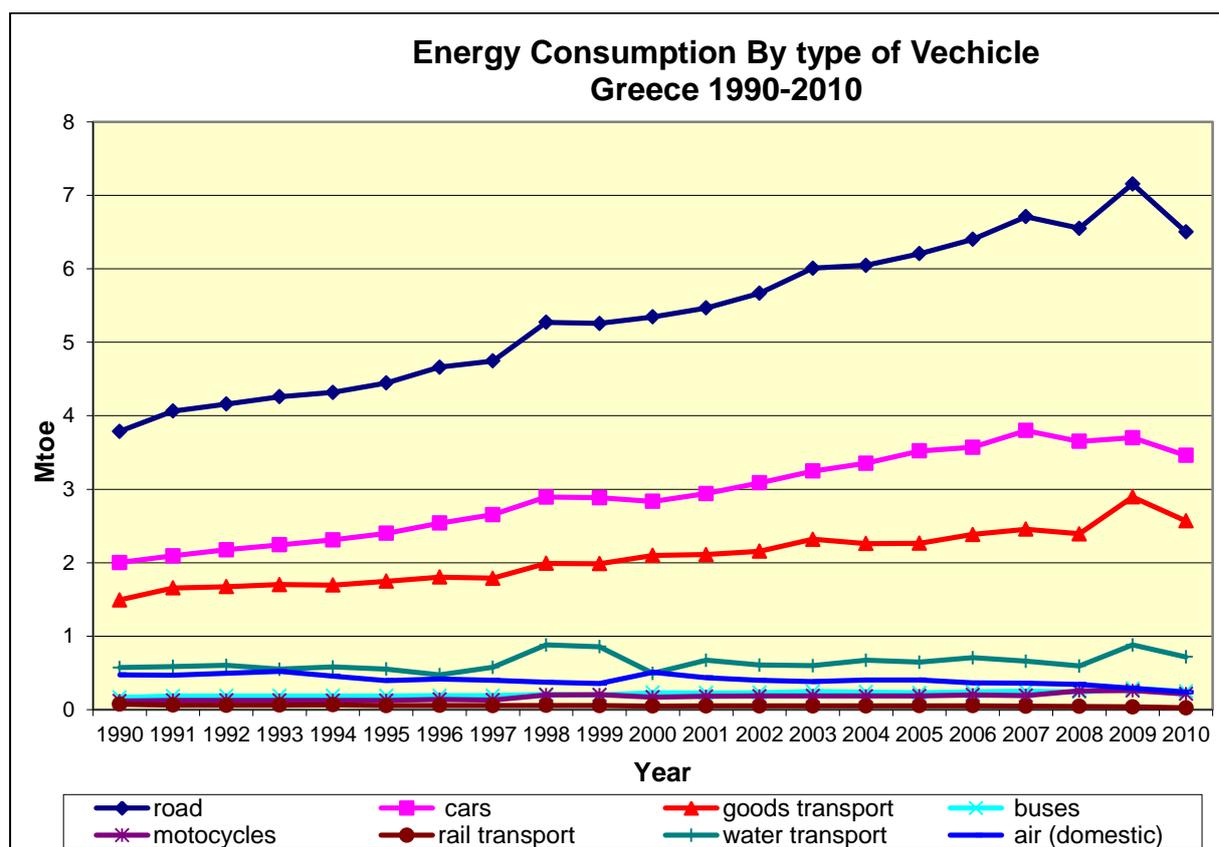


Figure 4.15: Final Energy Consumption by Type of Vehicle in Greece (1990-2010)

In 2010, the overall energy efficiency of the transport sector has improved by 28.4% compared to 1990. The efficiency improvement in road transport (15.8%) was mainly caused by the penetration of new, more energy efficient cars and heavy vehicles as well as because of the more rational use of them because of the recent taxes in fuels which led to the increase of fuel costs, and the adoption of eco driving from the new drivers. The energy efficiency of air and rail transport also improved significantly by about 74% and 60% correspondingly due to more efficient means and better management of routes schedules (reduction of routes per destination in accordance with the passenger traffic, etc.) (Figure 4.18).

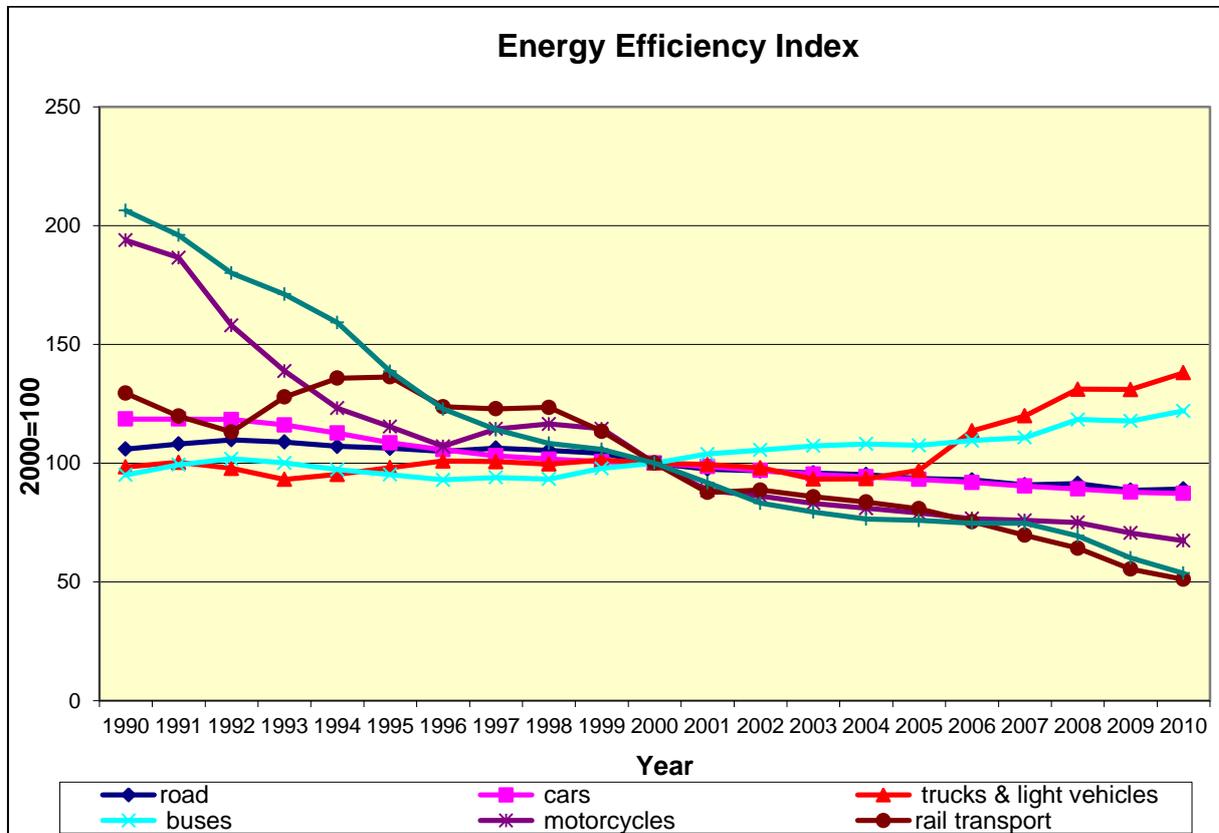


Figure 4.16: Energy Efficiency Index in Transport in Greece (1990-2010)

4.6 Assessment of energy efficiency/savings through ODEX: total and by sector

ODEX is the index used in the ODYSSEE-MURE project to measure the energy efficiency progress by main sector and for the whole economy. ODEX indicators represent a better proxy for assessing energy efficiency trends at an aggregate level than the traditional energy intensities, as they are cleaned from structural changes and from other factors not related to energy efficiency

For each sector, the index is calculated as a weighted average of sub-sectoral indices of energy efficiency progress; sub-sectors being industrial or service sector branches or end-uses for households or transport modes.

The energy efficiency index (ODEX) for all sectors in Greece decreased regularly by 32%, between the years 1990 and 2010. Because of the energy efficiency measures that started to apply since 2008 and the economic crisis, the total energy efficiency index is gradually decreasing after 2008. The most crucial fact both in terms of analysing the achieved energy savings in end-use in Greece, and in analysing and evaluating the success of implementing specific measures to improve energy efficiency, is mainly due to the economic recession, whose impact is visible to a greater or lesser extent, in all sectors of final energy consumption in Greece, especially from 2008 onwards.

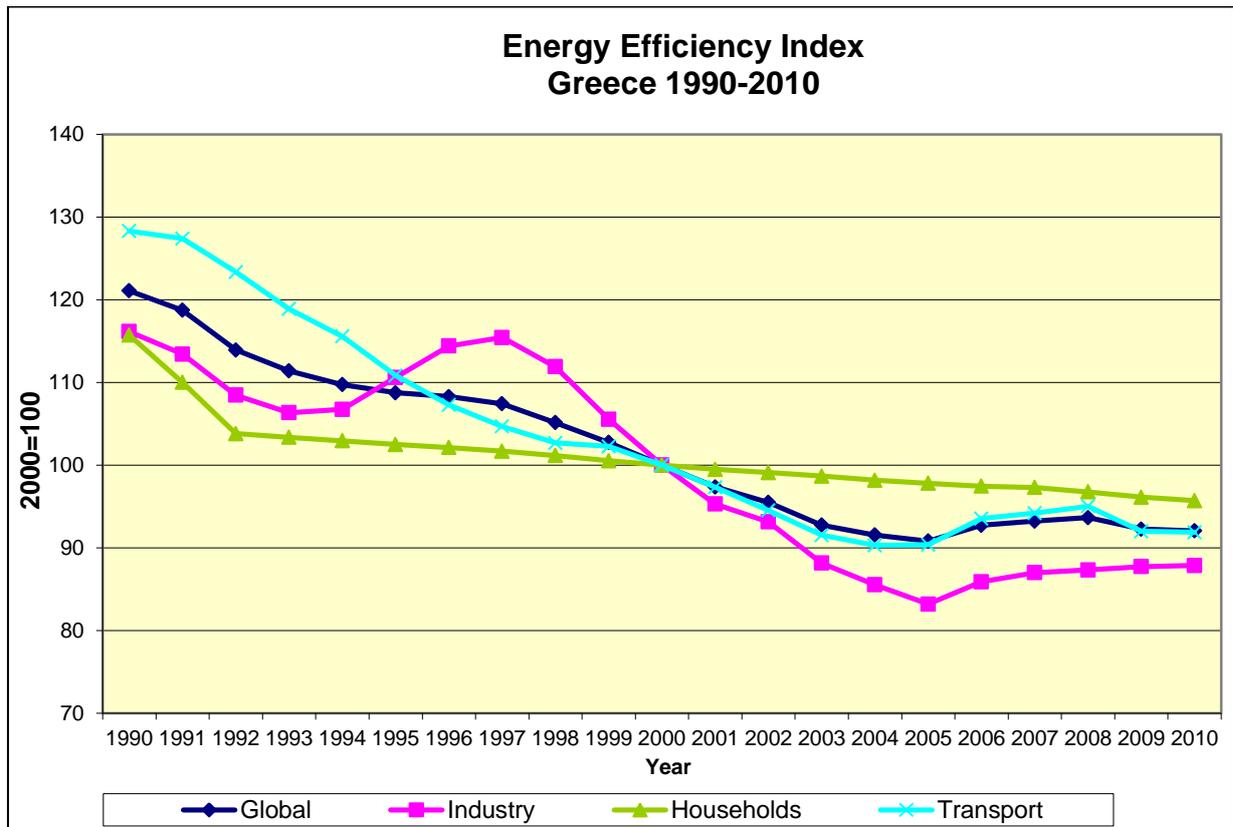


Figure 4.17: Energy efficiency index in Greece (1990-2010)

4.7 CO₂-emissions trends: total and by sector; role of fuels substitutions and of energy efficiency

During the period 1990-2010 total CO₂ emissions -including electricity- have been increased by 17.8% in Greece. Figure 4.21 indicates the trend of CO₂ emissions and the distribution of CO₂ emissions by sector. After 2007, because of both the reduction of energy consumption in most of the sectors in Greece, a reduction of CO₂ emissions is extended.

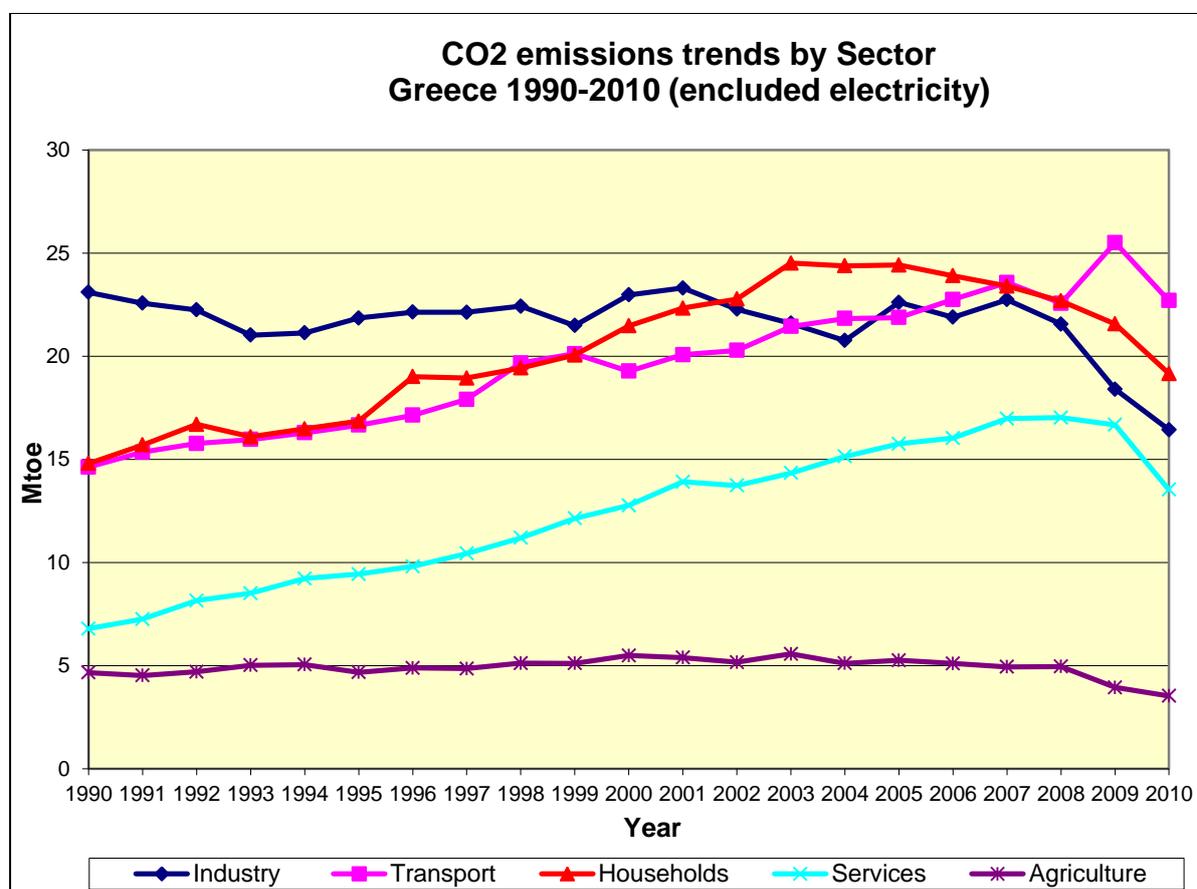


Figure 4.18: CO₂ emissions trends by Sector in Greece (1990-2010)

In 2010, the most CO₂ intensive sector was transport which generates 30.1% of the total CO₂ emissions. The corresponding CO₂ share in 2010 for households was 25.5%, industry 21.8%, tertiary 18% and agriculture 4.7%. In 1990 the respective percentages were 23.1% for households, 22.9% for transport, 36.1% for industry, 10.6% for tertiary and 7.3% for agriculture (Figure 4.22).

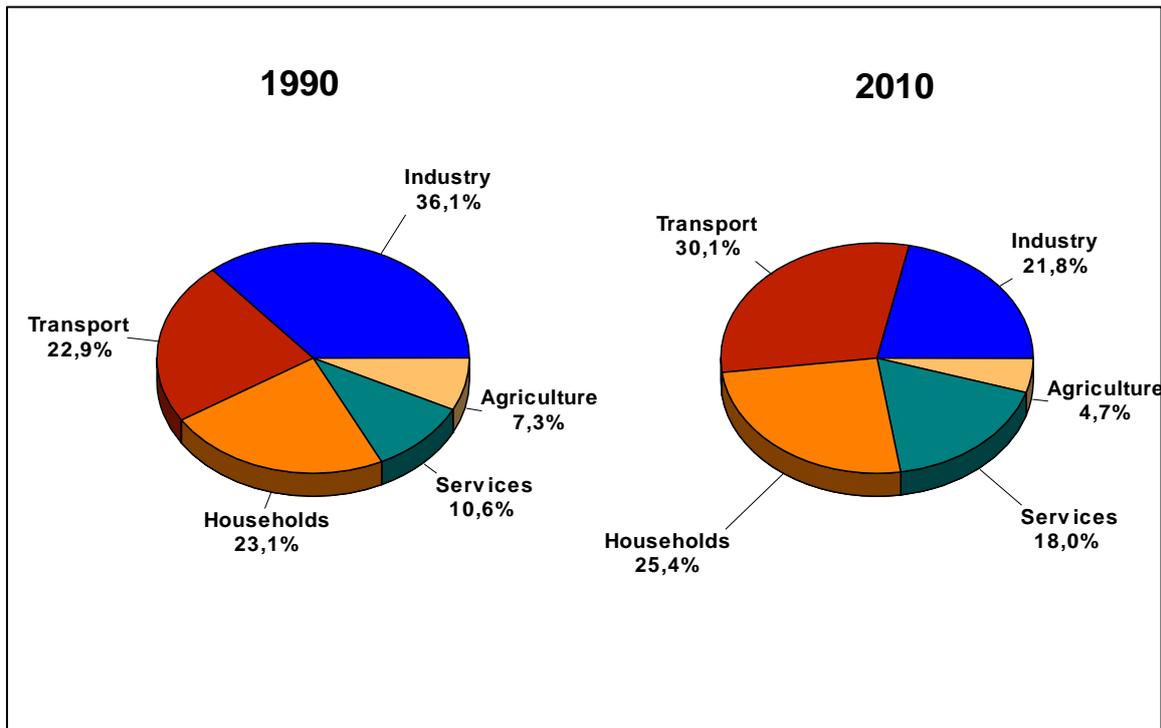


Figure 4.19: Share of CO₂ emissions trends by Sector in Greece (1990-2010)

5 Energy efficiency measures

5.1 *Recent Energy Efficiency Measures*

All measures that are presented in this session are described in MURE database and are those that mentioned in details in the 2nd NEEAP. In the next paragraphs a short description of these measures is given.

Residential Sector

Obligatory Installation of Central Thermal Solar Systems in Residential Buildings.

This measure concerns the obligatorily installation of central thermal solar systems in new and existing buildings, which are totally renovated. The installation of central thermal system becomes mandatory for new and existing buildings, which are totally renovated to cover at list 60% of the requirements for hot water production, by solar thermal systems.

Energy Performance of Residential Buildings: The measure concerns the direct adopting of legislative regulation for harmonization in Greek Law the Energy Performance of Building Directive (EPBD). A regulation, which is called Regulations for Energy Performance of Buildings (KENAK), is implemented since 2009.

"Changing Air-Condition" Program: The program "Changing Air Condition" referred to the grant for replacing and recycling of old energy-intensive household air conditioners. The program was aimed at all citizens / consumers in whole Greece who had old household air conditioners in operation and wished to replaced them. The subsidy was 35% of the retail price of each new device, with a maximum grant of 500 €

Energy Upgrading of Social Housing- The "Green Neighbourhoods" Program: The program aims to the energy upgrade of four social building blocks to almost zero energy consumption buildings, and to optimize the local microclimate. The program will present a pilot-flamboyant and innovative implementation of integrated development and implementation of green and sustainable urban housing units that are occupied by low-income citizens, and are imbedded in an optimized urban environment.

Energy Labelling of Appliances and Minimum Energy Efficiency Requirements- Residential Sector: This measure aims to the penetration of energy efficiency equipment in residential sector. The labelling energy measure concerns all categories of appliances, equipment and luminaries that are included in the relevant legislation. Provision of information to consumers about the financial benefits of the labelling of electrical and electronic appliances and energy equipment.

Installation of Electronic and Intelligent Metering of Electricity and Natural Gas Residential Consumers: The measure aims to the installation of electronic and intelligent metering of electricity and natural gas residential consumers. The use of electronic metering to measure hourly electricity consumption enables effective collection of necessary information about the consumption behaviour of residential consumers and facilitates the promotion of financial or other incentives to promote rational organisation of consumption behaviour

Energy Upgrading of Existing Buildings Through Energy Service Companies: The measure aims to the creation of an institutional framework for third-party financing (TPF) and for operational matters pertaining to energy service companies (ESCO), and regulation of existing public / private joint ventures (PPJV).

"Xtizodas to Mellon" Project- Residential sector: The project is a comprehensive program to improve the energy efficiency of the building stock of Greece. It is a partnership between the public sector, the manufacturing industry and citizens and includes a total of twelve interventions on residential and commercial buildings.

"Energy Savings in Households" Program: The program is based on the exploitation of energy inspectors and the Energy Performance of Buildings Regulations under Law 3661/2008, in order to correctly identify the energy needs of buildings and the necessary interventions that will lead to maximizing energy savings. The combined effect of the program and institutional framework that ensures an integrated approach for energy saving.

Transport Sector

Replacement and promotion of Low Polluting Vehicles: Mandatory use of high efficiency vehicles in public sector: Concerning on the mandatory use of high efficiency vehicles in public sector, 600 new high energy efficiency buses for urban transport, procured, through the Third Community Support Framework 2000-2006. The following obligations are mandatory for public sector:

- Quota clean vehicles
- Procedure for replacement of old medium and heavy vehicles
- Set energy efficiency as a selection criterion in the procurement of public services and agencies.

Urban mobility plans: Car-sharing is a measure that is proposed to apply in National Energy Efficiency Action Plan and functions with institutions or corporate forms that allocate capable fleet of vehicles in members/customers for their transportations between concrete stations of starting line and parking. The costs of purchase, management, maintenance of fleet, overload the institution or the company which is responsible for car sharing while the customer/ member is charged depending on the time of use and the kilometric distance.

Incentives for replacement private vehicles: Subsidies are provided for vehicle scrapping. The amount of subsidy is formed by the displacement of the vehicle withdrawn. Additional funding is given for the purchase of new motor vehicle EURO 4 and EURO 5.

Introduction of Biofuels: Financial incentives are to be given to vehicle owners in order to replace their vehicles with energy efficiency ones. These incentives concern:

- Public subsidies
- Taxation subsidies for vehicles of alternative technology (NG, hybrid vehicles, bio-fuels) or for EuroV vehicles (energy efficient motors)
- Informative and training campaign

Energy Savings in Local Self-Governments. -“ECONomize” program: The objective of program “ECONomize” is the actions and application of proven good practices for energy savings in the urban environment, with emphasis in building sector (municipal buildings) and the upgrade of common spaces. The implementation of these actions is going to be achieved through technical interventions and via sensitization and mobilization of citizens, local self-governments, companies and institutions.

Taxation of New Cars According CO2 Emission: A new taxation scheme has established for passenger cars, by adopting the criterion of engine capacity for the stock of the cars and the criterion of CO2 emissions for cars that classified after 1/11/2010.

Promotion of Economical, Safe and Eco-Driving: Eco-driving is a new way of driving which combines simple driving techniques with rules of maintenance. This leads to a fuel saving of 5-20%, cuts pollutant emissions, causes less noise pollution and reduces the number of accidents.

Industrial Sector

Incentives for obligatory implementation of Energy Management Systems: This measure aims to the implementation of Energy Management Systems (EMS) in all industries that are not included in Energy Services Directive (ESD). In Greece there are a lot of industries that already have implemented Environment Management Systems such as: ISO 14000, EMAS, internal EMS and HACCP. In many industries the energy management is part of these systems. The measure implementation could focus in the direct extension of these systems in order to include the energy management, too.

Promotion of voluntary agreements in industrial sector: This measure aims to set up a Voluntary Agreement Program, based on existing European Projects. The measure will be implemented in all industries that are not included in Emission Trading Scheme (ETS). Core of the agreements is the Action Plan, which will include the goals, the approach of partners selection, the benefits and the incentives (except of subsidies) in which an industry is committed to implement the particular measure in order to reduce the energy consumption. The commitment may cover some or all of the production systems.

Energy upgrading of existing buildings through third-party financing arrangements (TPF), energy performance contracting and public and private joint ventures (PPJV)-Industry Sector: The measure aims to the creation of an institutional framework for third-party financing (TPF) and for operational matters pertaining to energy service companies (ESCO), and regulation of existing public / private joint ventures (PPJV).

Tertiary Sector

Energy Auditing Procedures, Requirements and Guidelines: The Procedures, Requirements and Guidelines for the conduct of energy audits of buildings in the tertiary sector are described in the Joint Ministerial Decision 11038/99. Energy audits had been financed at a ratio of 60% of their cost from the Operational Energy Programme, to support the feasibility study of the proposed investments at their initial stage. Energy audits are also foreseen at the end of each project to measure their impacts on energy consumption and energy efficiency. ***Obligatory Replacement of All Lightning Systems of Low Energy Output in Public Sector:*** The obligatory replacement of all lightning systems of low energy output in the public and wider public tertiary sector are described in the Joint Ministerial Decision 20168/2006.

Obligatory Installation of Central Thermal Solar Systems in Buildings of Tertiary Sector: The installation of central thermal system becomes mandatory for new and existing buildings, which are totally renovated to cover at list 60% of the requirements for hot water production, by solar thermal systems

Energy Savings in Local Self-Governments. -“ECONomize” program-Covenant of Mayors: The objective of program “ECONomize” is the actions and application of proven good practices for energy savings in the urban environment, with emphasis in building sector (municipal buildings) and the upgrade of common spaces. The implementation of these actions is going to be achieved through technical interventions and via sensitization and mobilization of citizens, local self-governments, companies and institutions.

Green Roof Application in Public Buildings: The measure aims to improve the thermal, optical and environmental conditions of the users of public buildings, familiarize citizens with the techniques, advantages and features of the Green Roof, reduce energy consumption and the emission of greenhouse gases and therefore , helping to reverse climate change.

The Program “Bioclimatic Urban Reformation”: The program concerns bioclimatic interventions in areas of significant climate problem and has as main objectives to improve the quality of life, slow and ultimately reverse the urban climate change and improve the economic and social issues associated with it. Eligible are projects that achieve certain climate targets and have fully mature studies.

Installation of High-Efficiency CHP Units in Conjunction with Natural Gas Cooling Systems in Hospitals: The program aims to the energy efficiency improvement in hospitals, through the installation of high-efficiency CHP units in conjunction with natural gas cooling system. The funding will come from the Programmes for improving the energy efficiency of public buildings.

Measures for Energy Efficiency Improvements in School Buildings: Through the program "Bioclimatic Demonstration Schools' the bioclimatic design is promoted in new or under construction public primary and secondary school buildings in order to save energy.

Measures for Energy Efficiency Improvements in Public Buildings: The measure aims to the reduction of energy consumption of public buildings. Through the program "standard demonstration projects for the use of renewable energy sources and energy saving in public buildings" projects for heating and cooling production from RES and ES will be funded, in order to reduce the energy demand for heating, cooling, lighting and hot water production, in public buildings.

Cross-Cutting Measures

Implementation of an Energy Management System (EMS) in the Tertiary and Public Sectors: The penetration of Natural Gas in households, tertiary and industrial sector has direct energy benefit because of the expansion of energy sources in Greece and indirect energy benefits from the replacement of antiquated installations and equipment with energy efficiency ones.

Target Campaigns for Training, Informing and Awarding of Best Practice Activities: The penetration of Natural Gas in households, tertiary and industrial sector has direct energy benefit because of the expansion of energy sources in Greece and indirect energy benefits from the replacement of antiquated installations and equipment with energy efficiency ones.

Information System for Monitoring Energy Efficiency and Achieved Energy Savings: The objective of this measure is the development of an information system, which will be used for the operation of all necessary services for digital energy modeling and statistical databases, to support the national policy for improving energy efficiency in final use, according to the relevant national energy goals.

Financing Environmental Investments - Green Fund: The Green Fund finances programs established by the Ministry of Environment, Energy and Climate Change or other Ministries and their supervised entities. The basic structure of the financial programs may include but not limited to:

- Priority to specify the national environmental strategy.
- Measures that specify their priorities.
- Actions that refine the measures, which included documents and projects implemented by the beneficiaries.

5.2 *Patterns and Dynamics of Energy Efficiency Measures*

In this section the use of spider graphs illustrates the patterns for each separate sector of the energy policies and measures in Greece.

Spider diagrams are a graphical presentation of the distribution of energy efficiency policies. They provide an overview of the type of measures a country has implemented.

Spider diagrams are constructed by assigning each energy policy and measure in each sector to one or more of the following categories:

- Coop: Co-operative Measures
- Cros: Cross-cutting with sector-specific characteristics
- Fina: Financial
- Fisc: Fiscal/Tariffs
- Info: Information/Education
- Le/I: Legislative/Informative
- Le/N: Legislative/Normative
- Soci: Social Planning/Organisational
- Infr: Infrastructure
- Mark: Market-based Instruments
- Gene: General Energy Efficiency / Climate Change / Renewable Programmes

The wider spread the policies in a sector the more equally spread the measures on the different axes.

It is notable, that in all sectors the measures that applied concern more than one of the categories that mentioned above.

Residential Sector

From (figure 5.1.), it is obvious that the residential sector the dominant role in MURE database plays the legislative/normative measures with (35%) and the fiscal tariffs (35%).

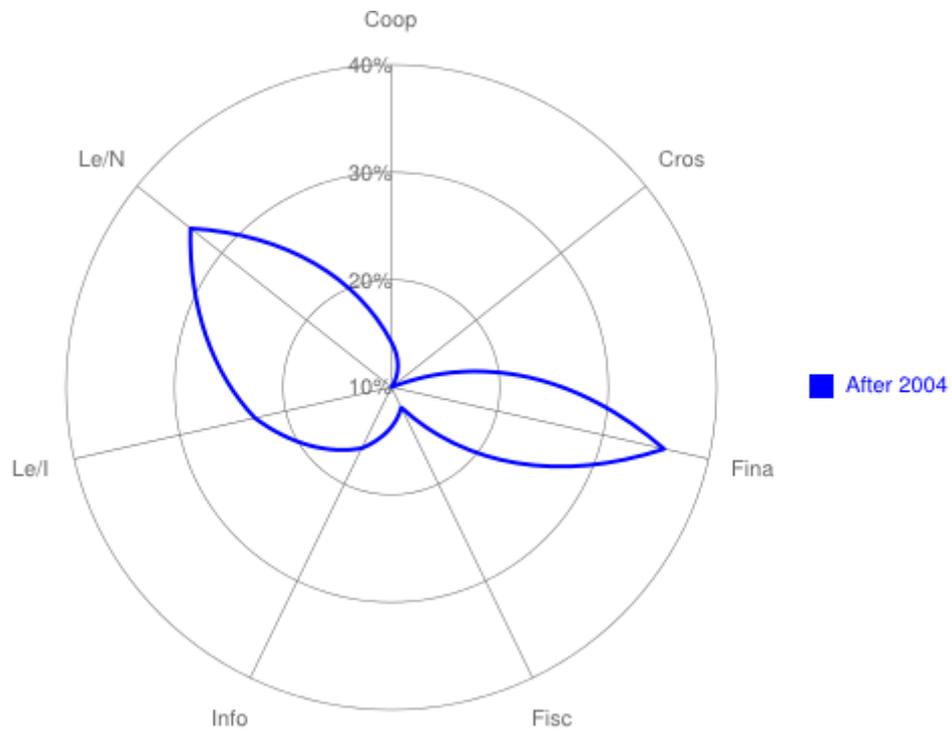


Figure 5 1: Patterns of Residential Sector Policies and Measures – MURE Database

Transport Sector

In the transport sector the residential sector the dominant role in MURE database plays the financial with almost 40% (figure 5.2). For the other measures, it can be seen that the measures are a mixture of Social Planning/Organisational, Infrastructure, Information/Education and Fiscal/Tariffs, with 12% each.

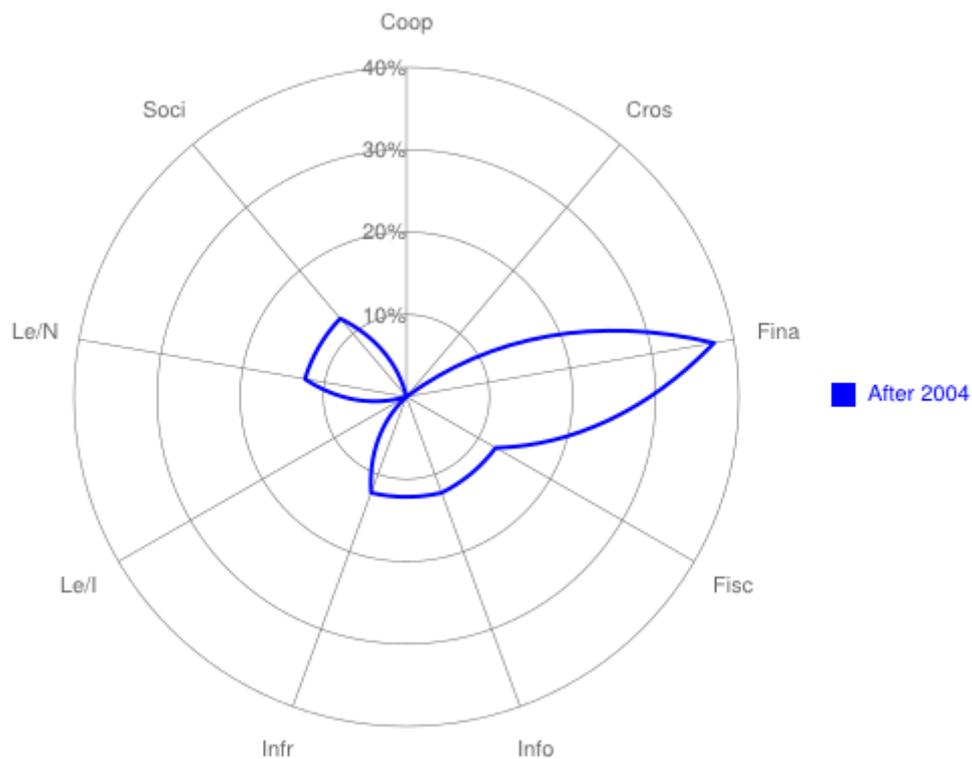


Figure 5.2: Patterns of Transport Sector Policies and Measures – MURE Database

Industrial Sector

In the industrial sector (figure 5.3), it can be seen that the measures are a mixture of Information/Education with 33%, Legislative/Informative with 22%, Legislative/Normative with 10%, and Financial with 33% .

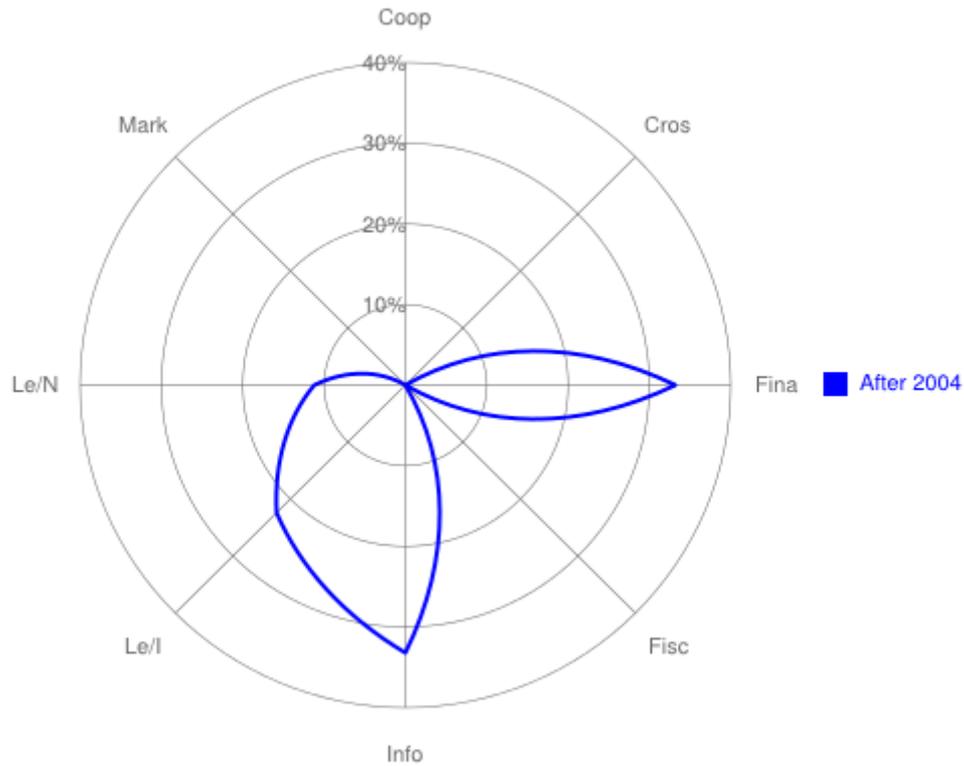


Figure 5.3: Patterns of Industrial Sector Policies and Measures – MURE Database

Tertiary Sector

The most important measures for the tertiary sector (*figure 5.4*) are Co-operative with 30%. The other measures are a mixture of Legislative/Normative with 9%, Legislative/Informative, Information/Education and Financial with 20%, and Fiscal/Tariffs with 3%.

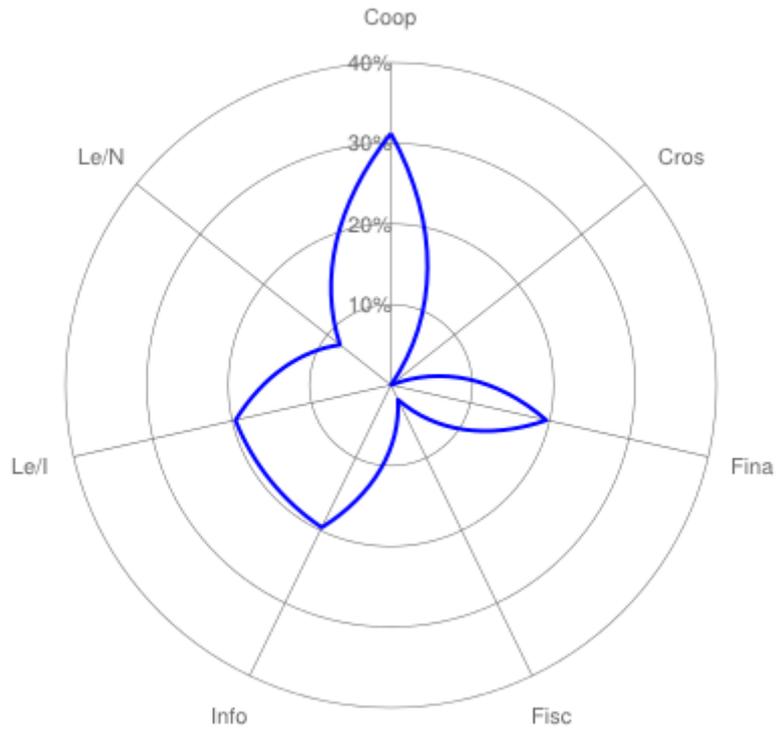


Figure 5.4: Patterns of Tertiary Sector Policies and Measures – MURE Database

Cross-cutting measures

The most important cross-cutting measures (*figure 5.5*) are General Energy Efficiency / Climate Change / Renewable Programmes with 48%. The other measures are a mixture of Legislative/Informative and Market-based Instruments with 20%, and Financial with 10%.

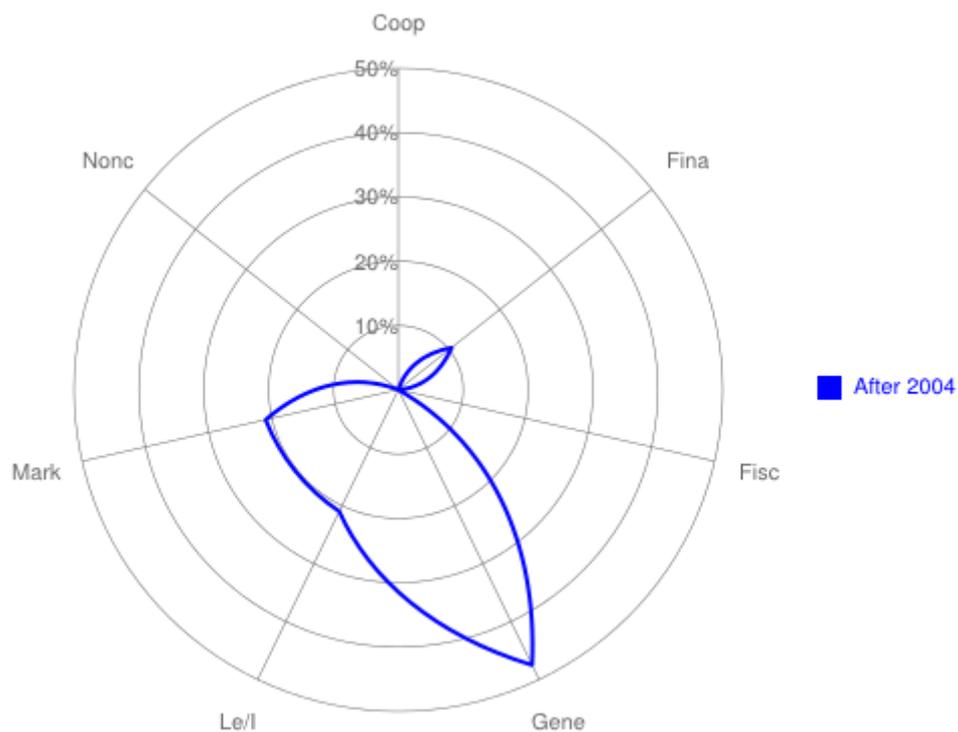


Figure 5.5: Patterns of Cross Cutting Policies and Measures – MURE Database

5.3 *Innovative Energy Efficiency Measures*

- The Ministry of Development recently issued a new program named “EXIKONOMO” (it means SAVE) for municipalities with more than 10,000 citizens. This program aims in the improvement of energy efficiency in local level, in the promotion of energy efficiency/ actions with direct applicable results, in the awareness of citizens and executives of administration and putting questions in energy saving, protection and viable management of urban environment.

Actions are categorized in five (5) Axes, as follows:

1. Projects for energy efficiency improvement in existing buildings, implementation of technological measures in municipal buildings for various categories as Town halls, buildings of municipal services, cultural centers, schools, buildings of multi-sports and training centers, special buildings etc.
2. Projects concerns reconstruction of roads, squares, parks and other public areas of municipalities and building installations energy efficiency improvement.
3. Pilot actions in public urban transport.
4. Technical interventions in others specific urban infrastructures with low cost investments for the improvement of energy efficiency for instance in pump plants, biological waste treatment plants etc.
5. Information dissemination activities to raise public awareness, energy monitoring.

Each approved project will be financed by 70% in its total budget. The municipality will pay the rest 30% of total budget during the period (2009-2012). This program is in progress.

- “Changing air-conditioner” is a new innovative measure concerns the subsidised replacement and recycling old energy intensive domestic air conditioners. It is a new action of Ministry of Development that is part-financed by the European Regional Development Fund (ERDF) and by National Resources. It took place in the framework of National Strategic Reference Framework (NSRF) 2007-2013, via the Operational Program “Competitiveness” (EPAN II)” and the Regional Operational Programs that include Regions of Transient Support. The total budget of action amounted in the 45.000.000 €. The action started on 5th of June 2009 and was completed on 22ed of August 2009. In this period was replaced successfully about 134,000 air conditioners installations by new ones with inverter and class A, A++.

The energy saving is estimated in 49.56 GWh/year and respectively the reduction of CO2 emissions are 43.61 thousands tones/year.

The action was addressed in households and small business consumers use old domestic appliances of air conditioners and they wished to replace them. Each consumer withdrew up to two (2) appliances and bought new technology inverter and high energy class. The subsidy was 35% of retail price of each new appliance, with maximum limit of subsidy the 500 €. All withdrawn appliances are provided by the shops for recycling. The measure was implemented to the whole State.

- The Ministry of Development in cooperation with the Ministries of Finance and Environment, instituted in 4th July of 2009, a special program for the installation of “Photovoltaic Systems up to 10 kWp in building roofs”. The program concerns photovoltaic systems from which the produced energy is injected in mainland electricity distribution network.

The action is addressed in consumers of households and small business buildings which have the ownership of the building. The price of produced energy from the photovoltaic system is 0.55 Euro/kWh, for the Compensation Contracts that will be signed until 2011. The price will be 5% lower for Contracts that will be signed from 2012 to 2019.

The produced energy from PVS in the building is counted together with the consumed one. The consumer will be charged for electricity according the difference of consumed-produced energy and in accordance with the price of electricity from the Energy Producer.

- In transport sector, the economical, safe and eco-driving techniques and rules have included in the training courses for the driving license. Moreover, 100 new CNG garbage collection trucks have inserted in the fleet of selected municipalities. Licenses have been given at private Vehicle Technical Testing Stations (VTS) for MOT testing of private cars and the period for technical inspection was reduced to 2 years for the stock of cars and after 3 years for new ones.

5.4 Energy efficiency measure evaluations

5.4.1 Semi-quantitative Impact Estimates of Energy Efficiency Measures

Annex 1 presents an overview of Greek policy measures which are included in the MURE database, tabulated in each sector separately. The last column shows the respective semi-quantitative impact assessment for all Greek measures in the MURE database.

In Figure 5.6, the number of measures in each qualitative impact evaluation category is summarized. The highest number of high-impact measures is appeared in the transport and tertiary sectors.

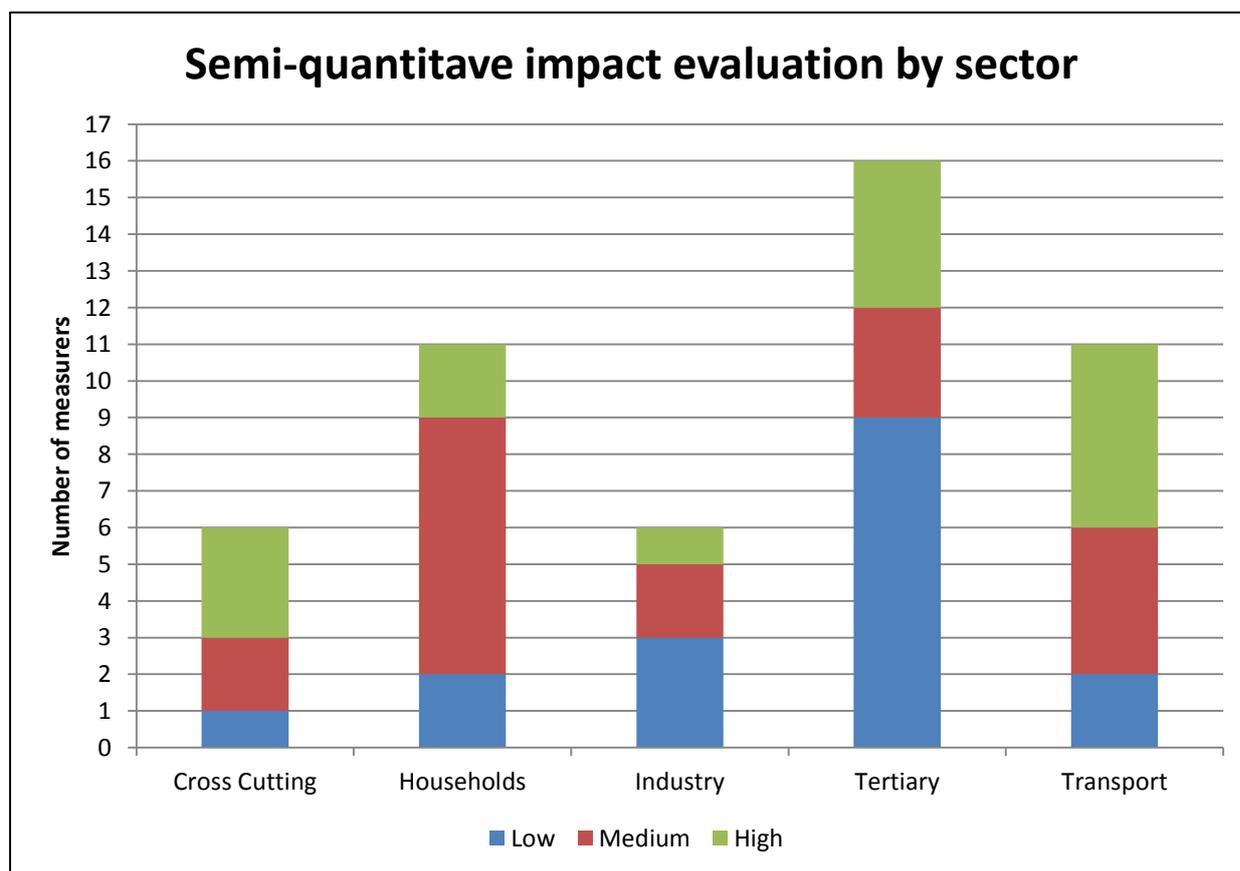


Figure 5.6: Semi-quantitative impact evaluation by sector – MURE Database

5.4.2 Lessons from Quantitative Energy Efficiency Measure Evaluations

During the last years period, emphasis has been given in measures that concern the building (residential and tertiary) and transport sector, because these present the greatest increase in final energy consumption and the average annual increase in energy consumption over the period 1990 to 2007 amounts to 2.4%, 3.4% 6.8%, respectively, and have high potential for energy savings

A comprehensive institutional framework for the energy efficiency and certification of buildings, the technical specifications of new buildings, the obligations of the public sector and energy providers, and the mechanism to monitor and assess progress in the achievement of the national target was developed. Emphasis was put on developing the appropriate structures (records, databases, technical guides), necessary for implementing the regulatory framework developed and measuring the achieved savings, as well as on public consultation with market players, with a view to ensure that this regulatory framework is widely accepted.

Moreover, priority has been given in the implementation of measures in the transport sector, as the transport sector is responsible for the highest amount of final energy consumption in Greece. In the followings paragraphs, two major measures which concern the two mentioned sectors (building and transport sector), are presented.

Evaluation of building regulation

The measure concerns the direct adopting of legislative regulation for harmonization in Greek Law the Energy Performance of Building Directive (EPBD). The regulation, which is called Regulations for Energy Performance of Buildings (KENAK), is implemented since 2008.

The energy performance of building is calculated taking into account the following factors:

- 1) thermal characteristics of building, including air hermeticity
- 2) heating and hot water production and supply systems, including insulation characteristics
- 3) Air conditioning equipment
- 4) Technical and natural ventilation
- 5) Lighting systems
- 6) Placement and exposure of building

7) Passive solar systems and solar protection

8) Internal climatic conditions

Additionally, in some cases, the positive contribution of the following factors is taking account:

1) Active solar systems and alternative thermal, cooling and electricity production systems that based on RES

2) Electricity that produced through CHP

3) Natural lighting

Taxation of new cars according CO2 emission

A new taxation scheme has established for passenger cars, by adopting the criterion of engine capacity for the stock of the cars and the criterion of CO2 emissions for cars that classified after 1/11/2010.

The key elements of the new taxation scheme are the followings:

Passenger cars which have classified until 31/10/2010

Category	Taxes
Up to 300 cm ³	20 €
From 301 to 785 cm ³	50 €
From 786 to 1.071 cm ³	110 €
From 1.072 to 1.357 cm ³ .	120 €
From 1.358 to 1.548 cm ³ .	220 €
From 1.549 to 1.738 cm ³	240 €
From 1.739 to 1.928 cm ³	270 €
From 1.929 to 2.357 cm ³	600 €
From 2.358 to 3.000 cm ³	800 €
From 3.001 to 4.000 cm ³ .	1.000 €
More than 4.001 cm ³ .	1.200 €

Passenger cars which have classified from 1/11/2010. The taxes are calculating by multiplying CO2 gr/km with each amount of the following table.

From 0 to 100 gr. CO2/km	0 €
From 101 to 120 gr.CO2/km	0.80 €
From 121 to 140 gr.CO2/km.	1.00 €
From 141 to 160 gr.CO2/km.	1.50 €
From 161 to 180 gr.CO2/km.	2.00 €
From 181 to 200 gr.CO2/km.	2.25 €
From 201 to 250 gr.CO2/km.	2.50 €
More than 251 gr.CO2./km	3.00 €

6 National Developments under the EU Energy Efficiency Directive and the 20% Energy Efficiency Target of the EU

The 2nd National Energy Efficiency Action Plan (NEEAP) was established and submitted in the European Commission. The 2nd EEAP presents the aggregate data of the national strategy for energy savings in all sectors of final energy consumption.

The intermediate target for energy savings has been exceeded, mainly due to the economic recession and not to the triggering of the measures specified in the first EEAP. The interim final energy savings target for 2010 (5.1 TWh) is achieved. However, energy savings may not be largely attributed to energy efficiency measures. The achievement of the interim target is mainly due to the impact of economic recession in the final energy consumption, which specifically in the residential and industrial sector has been observed since 2009, while in the transport sector the impact has been observed mainly since 2010 onwards.

The main actions and measures that were launched from 2007 onwards as part of achieving energy savings target at a rate of 9% in end-use until 2016, were implemented at national level and mainly involved the development of the institutional and regulatory framework for adopting policies, obligations and strategies in all end-use sectors, as part of improving energy efficiency. A comprehensive institutional framework for the energy efficiency and certification of buildings, the technical specifications of new buildings, the obligations of the public sector and energy providers, and the mechanism to monitor and assess progress in the achievement of the national target was developed.

Emphasis was put on developing the appropriate structures (records, databases, technical guides), necessary for implementing the regulatory framework developed, as well as on public consultation with market players, with a view to ensure that this regulatory framework is widely accepted.

This 2nd NEEAP describes and evaluates all the measures that have been, are being or are planned to be implemented to energy end-use sectors in Greece. It includes an extensive description of the energy savings achieved through energy efficiency improvement measures by direct reference to the 1st EEAP. It also presents the progress in meeting the interim target for energy savings in 2010 based on data and estimates, and makes a forecast on energy savings for 2016.

A great number of measures envisaged concerning either pilot actions or actions that use financial instruments as part of the NSRF, despite the fact that in most cases requests of stakeholders have been designed and evaluated, have not proceeded yet to the implementation phase and therefore are not measured in this plan.

Institutional interventions concerning the energy certification of buildings are expected to contribute significantly to achieving this, and the goal that new buildings should cover their entire primary energy consumption with energy supply systems based on renewable energy sources is expected to radically restructure the energy performance of buildings.

The development of market mechanisms, such as Energy Service Companies (ESCOs) to promote energy efficient services will significantly help in this direction, especially in tertiary sector buildings, where such actions should be supported both financially and regulatorily.

Whatever institutional and financial incentives are ultimately developed, they will not be enough on their own to help achieve the energy saving target, because especially in the building sector, the factor of human behaviour plays a key role in energy consumption. In this context, it is necessary to ensure the continued adoption and implementation of measures related to informing and educating consumers so that they choose highly energy-efficient buildings / products and changes their behaviour regarding energy use and consumption.

Although the study attempts to quantify the impact of the economic recession in final energy consumption, it is necessary to monitor for a longer period of time the economic and energy developments, in order to develop a representative methodology for assessing the impact of economic recession in final energy consumption.

Annex 1

Energy Efficiency Measure Summary

Residential

Code	Title	Status	Type	Semi-quantitative Impact
GRE19	Energy Labelling of appliances and minimum energy efficiency requirements-Residential Sector	Ongoing	Information/Education, Legislative/Normative	Medium
GRE2	Allocation of heating costs in collective buildings	Ongoing	Legislative/Normative	Low
GRE15	Energy Performance of residential Buildings	Ongoing	Legislative/Informative, Legislative/Normative	High
GRE17	"Changing Air-Condition" Program	Completed	Financial	Medium
GRE22	Promotion of Combined heat and power (CHP) and district heating systems- Residential Sector	Ongoing	Financial,	Medium
GRE16	"Energy Savings in households" Program	Ongoing	Financial, Legislative/Normative	High
GRE20	Installation of electronic and intelligent metering of electricity and natural gas residential consumers	Ongoing	Co-operative Measures, Financial, Information/Education	Medium
GRE18	GRE18-Energy Upgrading of social housing- The "Green Neighbourhoods" Program	Ongoing	Financial, Legislative/Normative	Low
GRE23	"Xtizodas to Mellon" Project- Residential sector	Ongoing	Co-operative Measures, Financial, Legislative/Normative	Medium
GRE12	Obligatory installation of central thermal solar systems in residential buildings.	Ongoing	Financial, Fiscal/Tariffs, Legislative/Informative, Legislative/Normative	Medium
GRE21	Energy upgrading of existing buildings through Energy Service Companies	Ongoing	Financial, Legislative/Normative	Medium

Transport

Code	Title	Status	Type	Semi-quantitative Impact
GRE4	Technical Inspection of Vehicles	Ongoing	Legislative/Normative	High
GRE2	Improvements in Road Transport Infrastructure	Ongoing	Infrastructure	High
GRE3	Improvements in Public Transport Networks	Ongoing	Infrastructure	High
GRE8	Replacement and promotion of Low Polluting Vehicles	Ongoing	Fiscal	Medium
GRE5	EU-related: Passenger Car Labelling on fuel economy rating (Directive 1999/94/EC) - Energy and CO2 labelling for new cars	Ongoing	Legislative/Informative	Low
GRE10	Incentives for replacement private vehicles	Ongoing	Financial	High
GRE11	Introduction of Biofuels	Ongoing	Legislative/Normative	Medium
GRE15	Promotion of economical, safe and eco-driving	Ongoing	Information/Education/Training	Medium
GRE13	Taxation of new cars according CO2 emission	Ongoing	Fiscal	High
GRE9	Urban mobility plans	Ongoing	Social Planning/Organisational	Medium
GRE12	Energy savings in Local Self-Governments. -"ECONomize" program-transport	Ongoing	Infrastructure	Low

Industry

Code	Title	Status	Type	Semi-quantitative Impact
GRE6	Incentives for obligatory implementation of Energy Management Systems	Proposed (advanced)	Financial, Legislative/Informative	High
GRE8	Installation of electronic and intelligent metering of electricity and natural gas industrial consumers	Ongoing	Financial, Information/Education/Training	Low
GRE10	Promotion of Combined heat and power (CHP) and district heating systems- Industry Sector	Ongoing	Financial	Medium
GRE7	EU-related: - Promotion of voluntary agreements in industrial sector	Ongoing	Information/Education/Training, Legislative/Informative, Legislative/Normative	Medium
GRE11	Creating a 'Green Business Parks "- Enhancing investment projects in Industrial Business Zones (V.E.P.E.) and Innovation Zones.	Ongoing	Financial	Low
GRE9	Energy upgrading of existing buildings through third-party financing arrangements (TPF), energy performance contracting and public and private joint ventures (PPJV)-Industry Sector	Proposed (advanced)	Financial	Low

Tertiary

Code	Title	Status	Type	Semi-quantitative Impact
GRE1	Energy Auditing Procedures, Requirements and Guidelines	Ongoing	Legislative/Informative	Low
GRE7	Obligatory replacement of all lighting systems of low energy output in public sector	Proposed(medium/long-term)	Co-operative Measures, Legislative/Informative, Legislative/Normative	High
GRE8	Obligatory installation of central thermal solar systems in buildings of tertiary sector	Proposed(medium/long-term)	Financial, Fiscal/Tariffs, Information/Education/Training, Legislative/Informative, Legislative/Normative	Medium
GRE11	EU-related: Energy Labelling Office Equipment (Energy Star) - Energy Labelling of appliances and minimum energy efficiency requirements-Tertiary Sector	Ongoing	Co-operative Measures, Information/Education/Training	Medium
GRE15	Mandatory procurement procedures (for energy efficient technologies and renewable energy technologies – green public procurement) in public buildings	Ongoing	Co-operative Measures, Information/Education/Training	Low
GRE12	Installation of electronic and intelligent metering of electricity and natural gas tertiary consumers	Ongoing	Co-operative Measures, Legislative/Informative	Low

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GRE14	Promotion of Combined heat and power (CHP) and district heating systems- Tertiary Sector	Ongoing	Financial	Low
GRE9	Energy savings in Local Self-Governments. - "Economize" program	Ongoing	Financial, Information/Education/Training	High
GRE10	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy Performance of Buildings of Tertiary sector	Ongoing	Legislative/Normative	High
GRE16	Green Roof Application in Public Buildings	Proposed (advanced)	Co-operative Measures, Information/Education/Training	Low
GRE17	The Program "Bioclimatic Urban Reformation"	Proposed (advanced)	Co-operative Measures, Information/Education/Training	Low
GRE18	Installation of high-efficiency CHP units in conjunction with natural gas cooling systems in hospitals	Proposed (advanced)	Co-operative Measures, Information/Education/Training	Low
GRE19	Measures for energy efficiency improvements in school buildings	Proposed (advanced)	Co-operative Measures, Information/Education/Training	Low
GRE13	Energy upgrading of existing buildings through third-party financing arrangements (TPF), energy performance contracting and public and private joint ventures (PPJV)- Tertiary Sector	Proposed (advanced)	Co-operative Measures, Financial, Legislative/Informative	High
GRE20	Measures for energy efficiency improvements in public buildings	Proposed (advanced)	Co-operative Measures, Information/Education/Training	Low
GRE21	Implementation of an energy management system (EMS) in the tertiary and public sectors	Proposed (advanced)	Co-operative Measures, Financial	Medium

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Cross-Cutting

Code	Title	Status	Type	Semi-quantitative Impact
GRE9	Program for financial support of technological investments in energy efficiency	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes, Legislative/Normative Measures, Market-based Instruments	High
GRE10	Farther penetration of Natural Gas and LPG in Greek market	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes, Legislative/Normative Measures, Market-based Instruments	High
GRE11	Target campaigns for training, informing and awarding of best practice activities	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes, Legislative/Normative Measures	Medium
GRE13	Information system for monitoring energy efficiency and achieved energy savings	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes	High
GRE14	Tax exemptions for energy saving investments	Ongoing	Financial Measures, General Energy Efficiency / Climate Change / Renewable Programmes, Market-based Instruments	Low
GRE15	Financing Environmental Investments - Green Fund.	Ongoing	Financial Measures, General Energy Efficiency / Climate Change / Renewable Programmes	Medium

Annex 2

Country Profile

Energy Efficiency Trends

Overview

The energy efficiency index (ODEX) for all sectors in Greece decreased regularly by 24% between 1990 and 2010 and by 9% since 2000. Since 2005, little progress has been registered, mainly because of the economic crisis. The impact of the economic recession is visible to a greater or lesser extent in all sectors of final energy consumption in Greece, especially from 2009. To the extent that it leads to a phenomenon of energy poverty, it may be a cause for adopting a more rational behaviour in the use of energy, and strategic planning of new energy efficiency improvement tools

Industry

Energy efficiency improved until 2005, mainly due to non-metallic minerals branch (of which cement) which absorbs almost 30% of the energy consumed in the industrial sector. In 2010 the specific energy consumption of energy intensive branches has rapidly decreased with the economic recession.

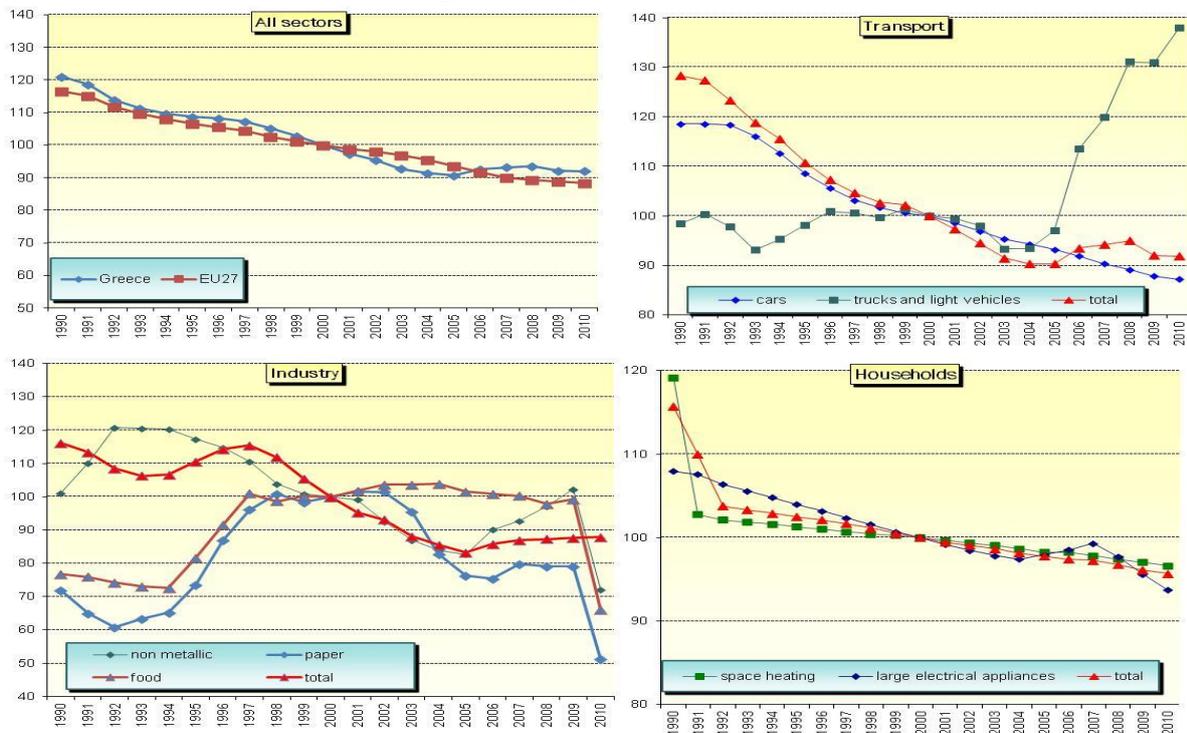
Households

Between 1990 and 2010, energy efficiency in the household sector improved by 17%. The energy efficiency for large electrical appliances improved by 13% over the period, and is the dominant factor, which determines the overall energy efficiency in households. New building regulation, better insulated dwellings and more efficient household electrical appliances participate to energy efficiency improvement in households. Loans acquisition with low interest-rates helped the growth of renovation of older buildings and their replacement with new dwellings, especially in the urban areas. Moreover, given the economic recession, information of consumers on energy saving issues and tax incentives to promote energy efficient technologies/interventions, also contributed to household energy efficiency improvement

Transport

In 2010, the overall energy efficiency of the transport sector has improved by 28% compared to 1990. However, after 2005 the index is slightly increased, because of a rapid increase in the specific energy consumption of trucks and light vehicles per tonne-km, linked to the economic recession (increase in empty running, decrease in load factors). On the other hand, the energy efficiency of cars is steady improving mainly because of new, more energy efficient cars which led to the improvement of energy efficiency by 26%.

Energy efficiency index (base 100=2000)



Source: ODYSSEE

Energy Efficiency Policy measures

Institutions and programmes

The Centre for Renewable Energy Source and Saving (CRES) is the national agency for the promotion and implementation of energy savings, rational use of energy and renewable energy sources. The NSRF (National Strategic Reference Framework) 2007–2013 constitutes the reference document for the programming of European Union Funds at national level. It was elaborated within the framework of the new strategic approach to the Cohesion Policy of the European Union. The country's strategic planning is to be implemented through Sectoral Operational Programmes, Regional Operational Programmes and European Territorial Cooperation Programmes.

Finally, a Green Fund is founded whose purpose is to promote development through environmental protection with the management, financial and technical assistance of programs, measures, interventions and activities designed to enhance and restore the environment and address climate change, to support the environmental policy of Greece and to serve the public and social interest through the administration, management and exploitation of resources.

The Second National Energy Efficiency Action Plan was submitted in European Commission.

Industry

Since 2000 in industry, the dominating instruments to improve the energy efficiency are financial support from structural funds, which enforce investments in the field of rational use of energy, energy efficiency, CHP and drives and the promotion of renewable and other indigenous energy sources.

In parallel the emissions trading scheme implemented to all energy-intensive industrial and power stations installations is the main mechanism to improve the energy efficiency.

Moreover, a legislative framework is in force for the promotion of CHP systems.

Households, Services

Greece adopted the Directive EPBD by the National Law for the reduction of energy consumption in buildings. Additionally, the following actions implemented for improving the energy efficiency of non-residential buildings:

1. Compulsory replacement of all light fittings with low energy efficiency in the public sector and the wider public sector
2. Compulsory procurement procedures with respect to public buildings (green procurement – energy-efficient and RES technologies)

Two major programs give economic incentives for improving energy efficiency in residential sector: the program “Changing Air-Condition” for replacement of old split air-condition units (program run on summer 2009, which led to the replacement of 140.000 units all over Greece), and the program “Energy Savings in households” for insulation refurbishment by components-walls, roofs, windows and replacement of heating and water heating equipment.

Transport

Since 1999, tax reductions exist for electric, alternative and hybrid vehicles. Additionally these vehicles are exempted from traffic restrictions e.g. access in the Athens city centre. In January 2002, the fuel consumption and CO2 emissions label for new cars has been introduced. A legislative framework for replacement of old polluted private vehicles, has been established. The taxation of vehicles is connected with CO2 emissions. Moreover the basic principles of Eco-Driving are inserted in the theoretical training of new drivers. Furthermore, the L.3855/2010, in which the Energy Service Directive is transported in National Legislation, provides energy efficient vehicles in the public sector.

Selected Energy Efficiency Measures

Sectors	Title of Measure	Since
Households	“Energy Savings in households” Program	2010
Households	“Changing Air-Condition” Program	2009
Tertiary	Energy savings in Local Self-Governments. -“ECONomize” program	2010
Tertiary	Energy Performance of Buildings	2010
Transport	Improvements in Road Transport Infrastructure	1998
Transport	Technical Inspection of Vehicles	2008
Transport	Promotion of economical, safe and eco-driving.	2008
Transport	Replacement and promotion of Low Polluting Vehicles	2009
Transport	Taxation of new cars according CO2 emission	2010

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Cross Cutting	Program for financial support of technological investments in energy efficiency	2000
Cross Cutting	Promotion of Combined heat and power (CHP) and district heating systems	2006
Cross Cutting	Energy labelling of appliances and minimum energy efficiency requirements	2008
Cross Cutting	Installation of electronic and intelligent metering of electricity and natural gas consumers	2009
Cross Cutting	Promotion of cogeneration of high-efficiency heat and power (CHP) and district heating systems	2009

Source: MURE