**REPUBLIC OF CYPRUS**
MINISTRY OF ENERGY, COMMERCE,
INDUSTRY AND TOURISM

# Energy Efficiency Trends and Policies in Cyprus

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## EXECUTIVE SUMMARY

This report presents the case study of Cyprus for the IEE project "Monitoring of energy efficiency in the EU (Odyssee-Mure 2012)". Firstly it provides the economic and energy background to energy efficiency and then presents an assessment of energy efficiency trends in Cyprus in the period 2000-2013. Energy efficiency measures and policies are presented and evaluated with emphasis on new and innovative measures that are included in the 3rd National Energy Efficiency Action Plan of Cyprus that was submitted to the European commission in spring 2014. The report is based on indicators produced from the Odyssee database and measures extracted from the Mure database; both databases are available on line.

Cyprus has enjoyed sustained economic growth since the early 1980s, averaging more than 5% per year since 1980, mainly due to the development of financial services and tourism. Its per capita Gross Domestic Product exceeded 22 000 Euros in 2011. The economy has changed path during the last years, because of the need for fiscal adjustment and restructuring of the domestic banking sector in order to attain sustainable levels of public debt. An economic adjustment programme was implemented, which led to a strong contraction of the national economy in years 2013-2014; national GDP is not expected to reach pre-crisis levels before the year 2021. In terms of GDO composition, industry and agriculture have experienced a strong decline during the last two decades. The country's economy depends essentially on the services sector, whose real value added more than doubled between 1995 and 2011, and accounts for more than 80% of national economic output.

Energy consumption has historically been growing in line with national income. After the occurrence of the economic crisis, this trend has been reversed, but fuel shares have remained essentially unchanged. There is a clear electrification trend throughout the economy of Cyprus, which would be even more pronounced if transport (that remains entirely dependent on petroleum) did not account for more than half of total final energy demand. The share of renewable energy – primarily solar thermal installations for water heating – has also risen considerably, from 2.9% in year 2000 to 5.5% in 2013. Primary and final energy intensity have fallen considerably (by more than 25%) during the last two decades. This declining trend implies both energy efficiency improvements and structural changes in the economy.

Over the period 2000-2013, the energy efficiency index for the whole economy (ODEX) decreased (i.e. improved) by 10%. A large part of this improvement came from industry, particularly from installations subject to the Emissions Trading Scheme (ETS) (cement and brick industry). Energy efficiency has also improved in the building sector in recent years, thanks to implementation of the EPBD Directive and due to financial support schemes for refurbishing the existing building stock. The transport sector, which is the largest final energy consumer, contributed the least to energy efficiency improvements.

The efficiency in the industrial sector improved by more than 32% in 2012 compared to 2010. In the non-metallic minerals branch, which consumes more than half of final energy consumption in industry and falls under the scope of the EU ETS, the energy efficiency index had decreased in 2012 by 50% compared to 2010. This is mainly reflecting the efficiency improvement in the cement industry, which has undergone major renovation. As far as households are concerned, their gross

energy efficiency index has improved by 32% between 2000 and 2013. The technical ODEX has improved by 24%, mainly from 2006 onwards. This is due to the fact that Cyprus has entered the EU in 2004 and implemented policies and measures in energy efficiency after EU accession, which started to yield energy savings some years later. Finally, the transport sector has exhibited a mere 2% improvement in the period 2000-2013. In fact, energy efficiency of road transport has remained almost constant, but efficiency of trucks has clearly deteriorated. Despite technological progress that has led to the penetration of more efficient cars, and despite regulatory changes which resulted in the phasing out of old vehicles, the average size of the car stock has not changed. Measures that were applied in recent years, such as grants for scrapping old vehicles or vehicle taxation based on $CO_2$ emissions, were of little effectiveness. Public transport (buses) is not well developed and its use has remained low during this period. Aviation has a high share (~27% of final energy consumption). The index for aviation has improved by 29%, due to more fuel efficient fleet and most probably higher passenger occupancy of aircraft. Thanks to this improvement, the deterioration of efficiency in trucks has been counterbalanced so that overall transport efficiency has shown the 2% improvement mentioned above.

The above indicate that Cyprus has still a significant potential for energy savings in buildings and transport. According to the 3rd National Energy Efficiency Action Plan, measures to be implemented until 2020 will yield primary energy savings of 375 ktoe (or 14.5%) in year 2020, compared to a reference scenario. The emphasis is firstly to provide incentives to existing buildings for efficiency improvements (grant scheme for energy renovation of existing residential and tertiary buildings) and then to develop an efficient, environmentally friendly public transport system. The government is also planning to introduce LPG fuel for cars in 2016, providing low fuel tax for seven years.

The second priority, indirectly linked with energy efficiency, is that Cyprus is exploiting its economic exclusive zone (EEZ) for hydrocarbons and has completed two rounds of authorising rights in the 12 sea blocks of the EEZ. Thus far the verified results from research drillings have indicated that there are significant reserves of natural gas, and it is expected that these will start being extracted by 2020. Agreements with Israel and Egypt are under way for this purpose. The option of building an LNG terminal in Cyprus has been abandoned, and other ways are explored as to how to transfer gas to the island.

With regard to the institutional framework for energy efficiency, a major development has been that the Cyprus Institute of Energy, which has been a partner of the Odyssee-Mure project, has been shut off since March 2015 and all of its activities have been transferred to the Ministry of Energy, Commerce, Industry and Tourism.

# 1. ECONOMIC AND ENERGY EFFICIENCY CONTEXT

## 1.1. ECONOMIC CONTEXT

Cyprus is an island in the Eastern Mediterranean with an area of 9250 square kilometres and a population of about 900 000, which became a member of the European Union in 2004 and a Eurozone member in 2008[1]. The country has enjoyed sustained economic growth since the early 1980s (averaging 5.6% per year in real terms in the 1980-2010 period years and 5.3% between 1995 and 2010) mainly due to the development of financial services and tourism. Its per capita Gross Domestic Product exceeded 22 000 Euros in 2011.

Since the global financial crisis, the economy has changed path. Cyprus experienced one year of recession (2009), followed by two years of slow GDP growth. Economic activity was further hit in 2011 by an accident that destroyed half of the country's total electricity generating capacity. A worsening external environment and tightening financial and fiscal conditions reinforced the adverse effect on economic activity. More stringent bank lending conditions and deteriorating public finances exerted pressure on the economy. As a result, the government had no access to international capital markets and requested financial aid from the European Stability Mechanism and the International Monetary Fund in 2012. After some dramatic events in spring 2013 and requirements for fiscal adjustment as well as downsizing and restructuring of the domestic banking sector in order to attain sustainable levels of public debt in the medium term, an economic and financial adjustment programme for Cyprus was agreed between the national authorities and the 'Troika' (European Commission, European Central Bank and International Monetary Fund). This adjustment programme led to a strong contraction of the national economy in years 2013-2014, while a slow rebound of economic growth was expected from 2015 onwards. According to official forecasts, national GDP is not expected to reach pre-crisis levels (i.e. those of the period 2008-2011) before the year 2021.

Figure 1.1 shows GDP and sectoral value added for the period 1995-2013, and Figure 1.2 presents the same results in the form of indices (with 2000 as the base year) thus demonstrating relative changes. Industrial sectors experienced an upward trend between 2000 and 2008 (their real value added increasing by 30% over the 1995-2000 period of stagnation), but their activity fell sharply afterwards – more than 40% below 2008 levels. Industry's contribution to national GDP has been continuously declining as a result of its diminishing importance for the national economy: the share of industry (excluding construction) in national GDP dropped from 14% to around 8.5% during this period, while that of construction decreased from about 10% to less than 5% - mainly as a result of the serious financial crisis post-2010. Agriculture has also shrunk considerably (from over 4% in 1995 to around 2% in 2013), with real value added falling by 25% in recent years compared to 2000. The dominant economic sector – services – has gained further in importance, its real value added more than doubling between 1995 and 2011, and its share of total GDP rising from 72% to about 84%. Real estate activities, wholesale and retail trade as well as financial intermediation are the most important subsectors, accounting for almost half the value added of the total tertiary sector. Despite fears that

[1] The information provided here refers only to the area controlled by the government of the Republic of Cyprus.

these activities would be particularly hit by the economic adjustment programme of years 2013-2015, the tertiary sector has retained its strong share in the economy.

Figure 1.1: Evolution of Gross Domestic Product and sectoral value added in Cyprus.

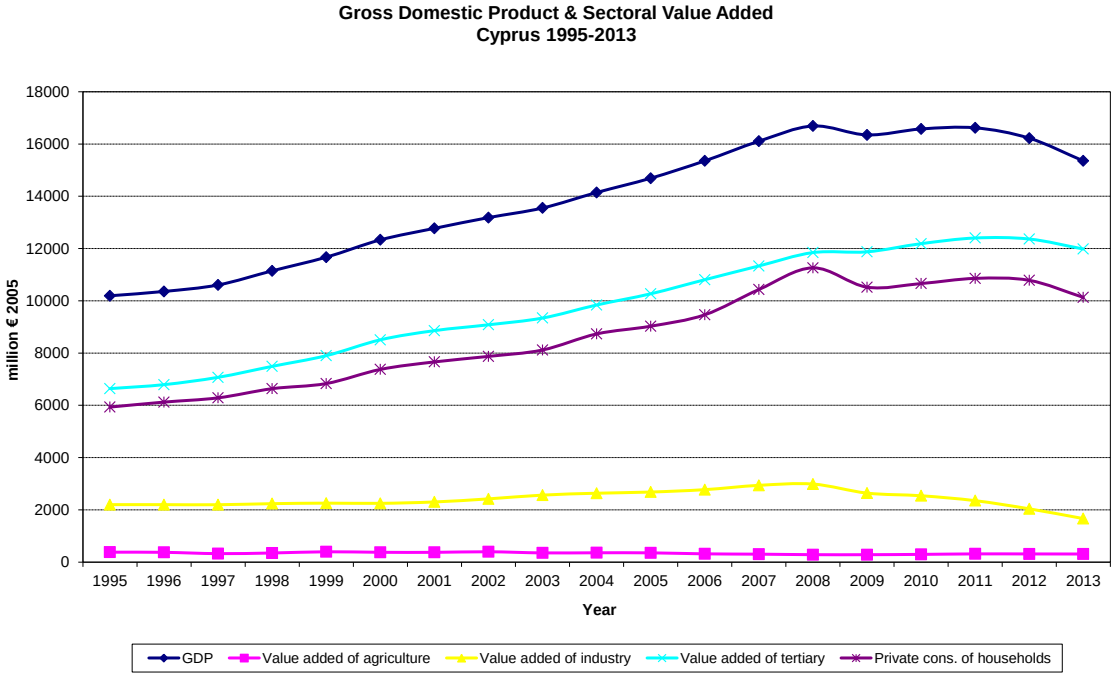
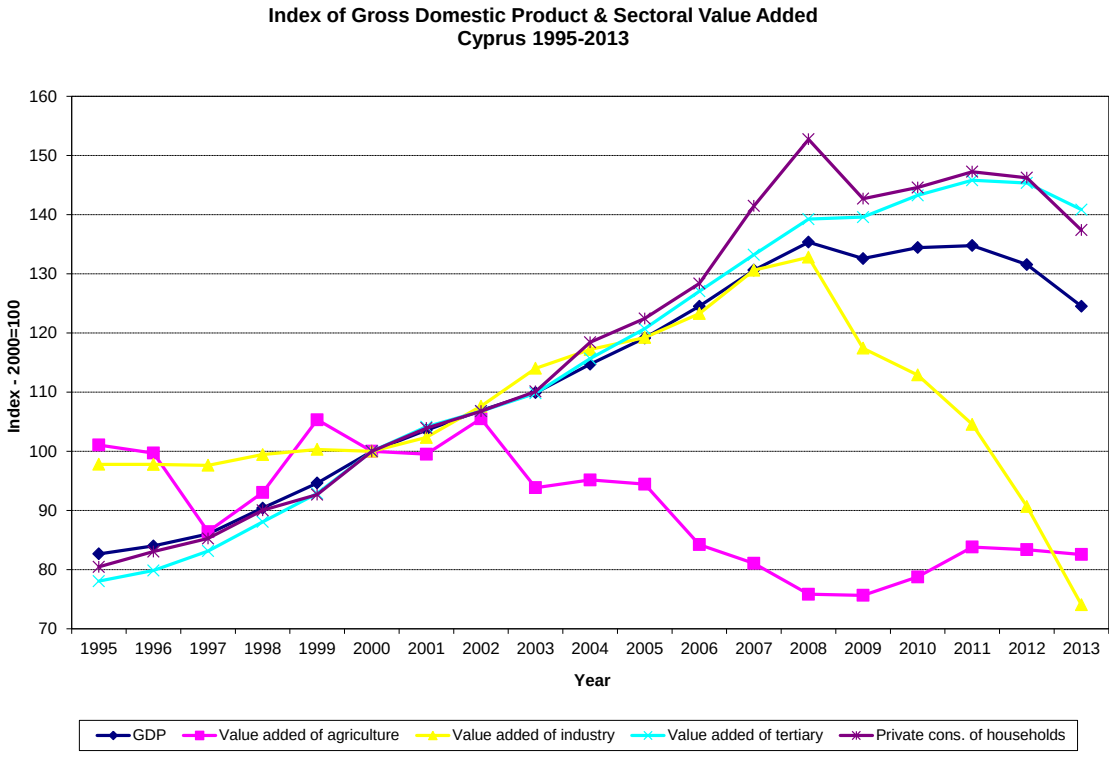



Figure 1.2: Evolution of real GDP and sectoral value added in Cyprus, 1995-2013.



## 1.2. TOTAL ENERGY CONSUMPTION AND INTENSITIES

### 1.2.1. ENERGY CONSUMPTION TRENDS

Cyprus has a small and isolated energy system that is not interconnected with other energy networks (oil, natural gas or electricity). There are no fossil fuels presently produced on the island. However the exploration of hydrocarbons in the Exclusive Economic Zone of Cyprus has recently shown significant offshore reserves of natural gas. The Cyprus government has already granted – after tendering procedures – permits for research and exploitation of hydrocarbons in certain blocks of the EEZ and has completed successfully a second round of tendering procedure for authorising rights in eleven out of the twelve sea blocks of the EEZ. The interest from many major international oil/natural gas companies is large due to the fact that there are already proven reserves from the drilling data in one of the blocks during the first round. The Government and foreign energy institutes estimate that there may be up to 200 tcf of natural gas recoverable in the national EEZ.

Energy consumption has historically been growing in line with national income. After the occurrence of the economic crisis, this trend has been reversed. As Figures 1.3 shows, this decline has become quite evident since year 2013. Despite the crisis, trends in fuel shares have remained essentially unchanged. As shown in Figure 1.4, there is a clear electrification trend throughout the economy of Cyprus, which would be even more pronounced if transport (that remains entirely dependent on petroleum) did not account for more than half of total final energy demand. The share of renewable energy – primarily solar thermal installations for water heating – has also risen considerably, from 2.9% in year 2000 to 5.5% in 2013.

Figure 1.3: Final energy consumption by energy source.

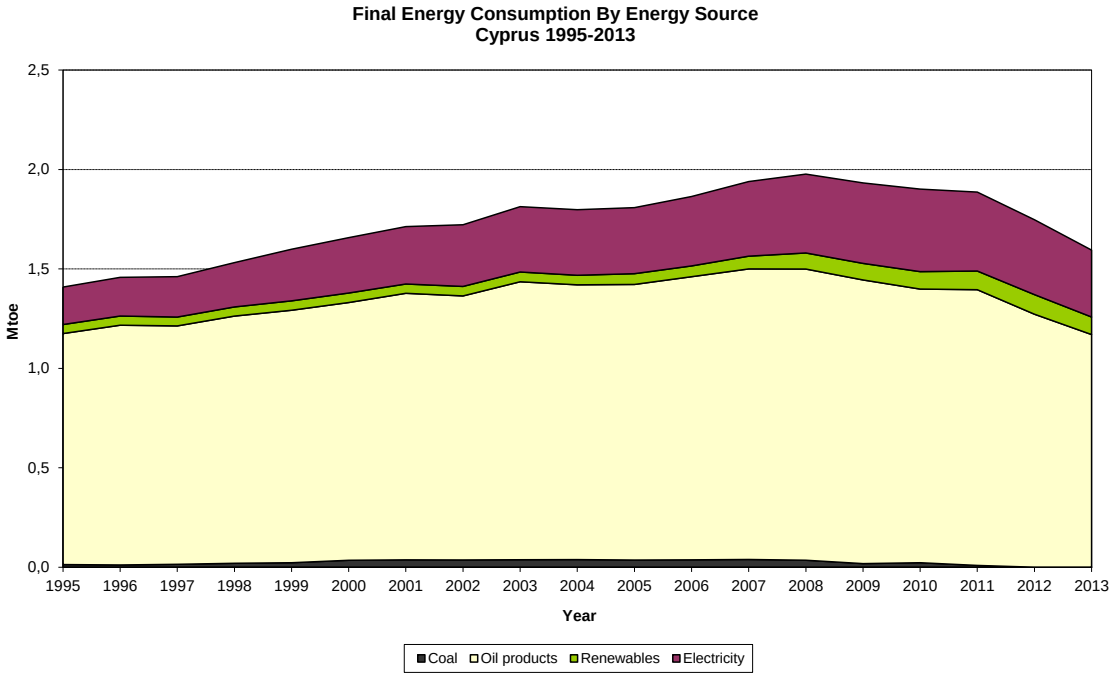



Figure 1.4: Shares of final energy consumption by energy source in 2000 and 2013.

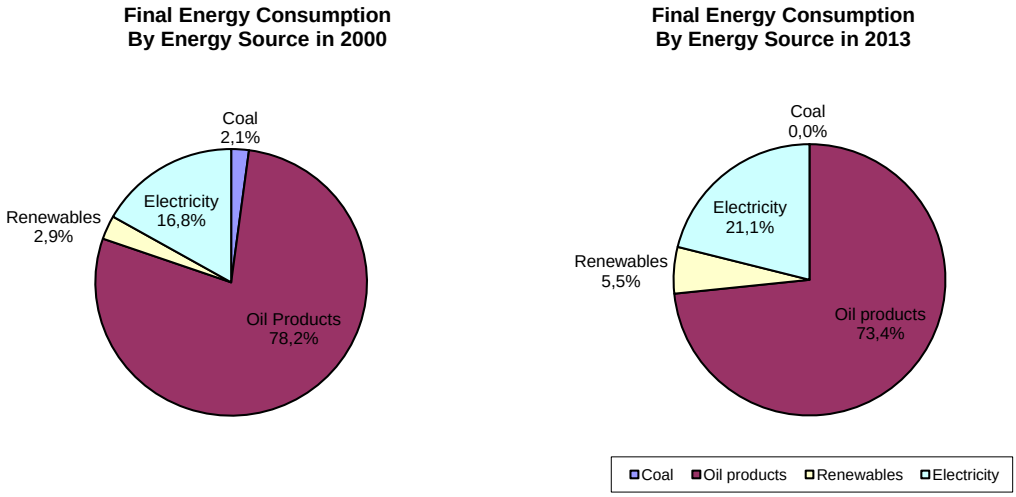



Figure 1.5 presents trends in energy use by sector. Due to the shrinking importance for the national economy, industry has experienced a steady decrease in energy consumption: as shown in Figure 1.6, from 21% of total energy use in the year 2000, it dropped to just 11% in 2013. Transport consistently accounts for more than half of total energy use, while residential and tertiary sector are responsible for one third of energy use (13% and 17% respectively in 2013).

Figure 1.5: Final energy consumption by sector.

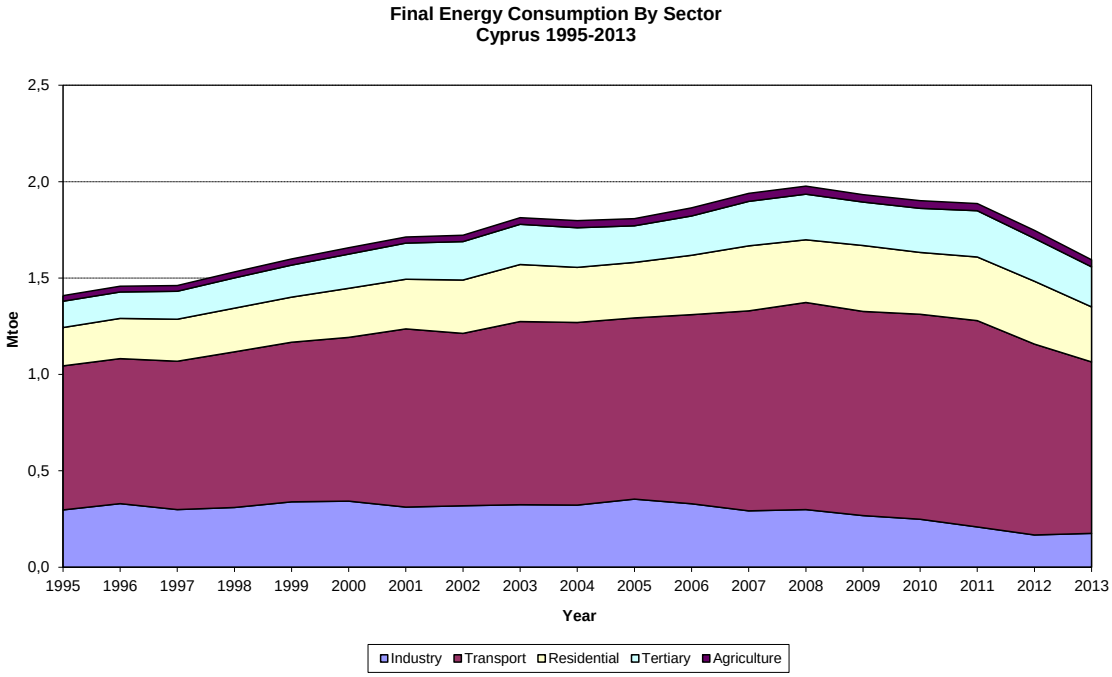
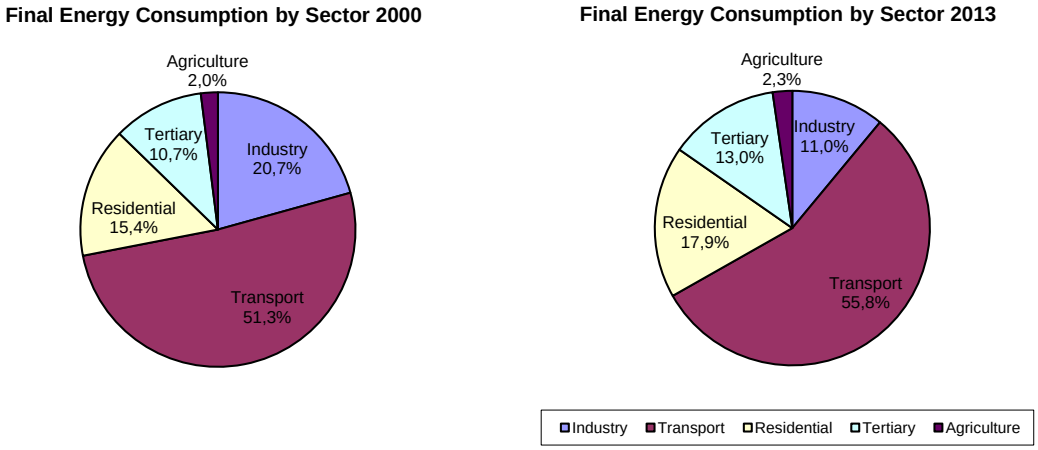



Figure 1.6: Shares of final energy consumption by sector in 2000 and 2013.




Electricity use has historically grown faster than economic activity – until the year 2010 as displayed in Figure 1.7. Initially it was not mainly the economic downturn but another development that reduced electricity needs: In July 2011 a major accident happened on the south coast of Cyprus because of the explosion of ammunition containers at a naval base next to the largest and most modern power plant of the country. As a result, around 700 MWe, or 60% of the total national power generating capacity, was destroyed. In response to acute power shortages after the accident, the national utility company imported large generators and also utilised an old power plant that was being phased out to cover some of the electricity demand. This had a serious effect on both economic activity in general and specifically on electricity consumption during the second half of

2011. Signs of the economic crisis became stronger from 2012 onwards, thereby further reducing electricity consumption. In terms of sectoral shares, which are shown in Figure 1.8, the trend has been similar to that of total energy demand: de-industrialization during the last fifteen years has led industry to consume an even smaller fraction of total electricity – from 22% in 2000 to just over 15% in 2013. Households and services are responsible for around 80% of total electricity use.

Figure 1.7: Electricity consumption trends by sector.

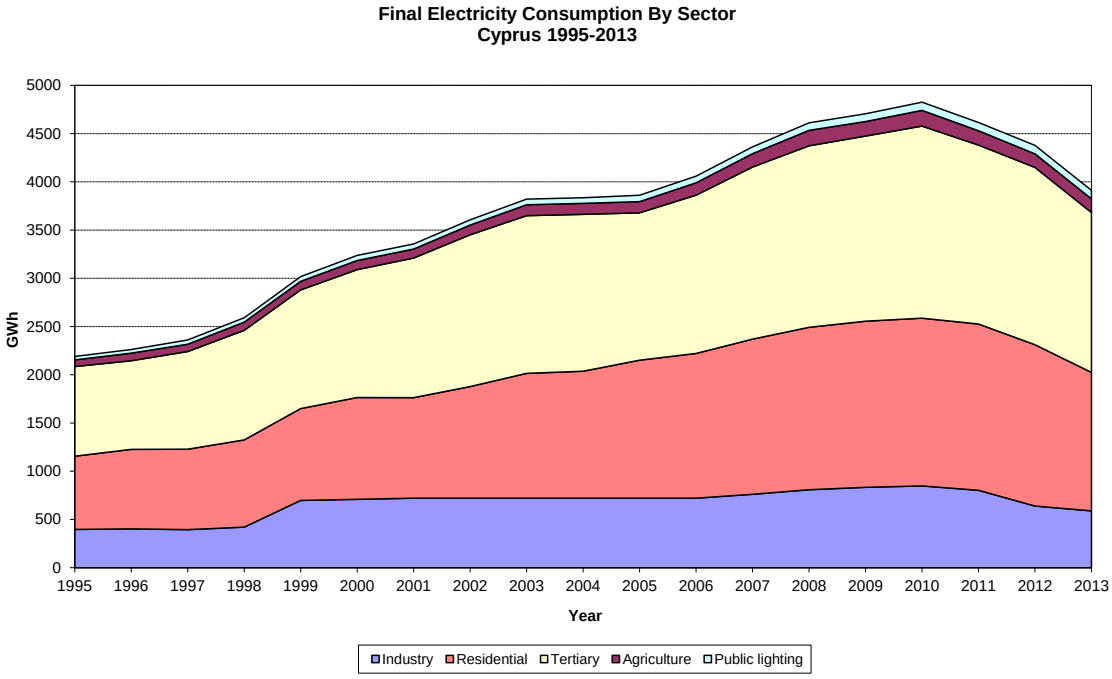
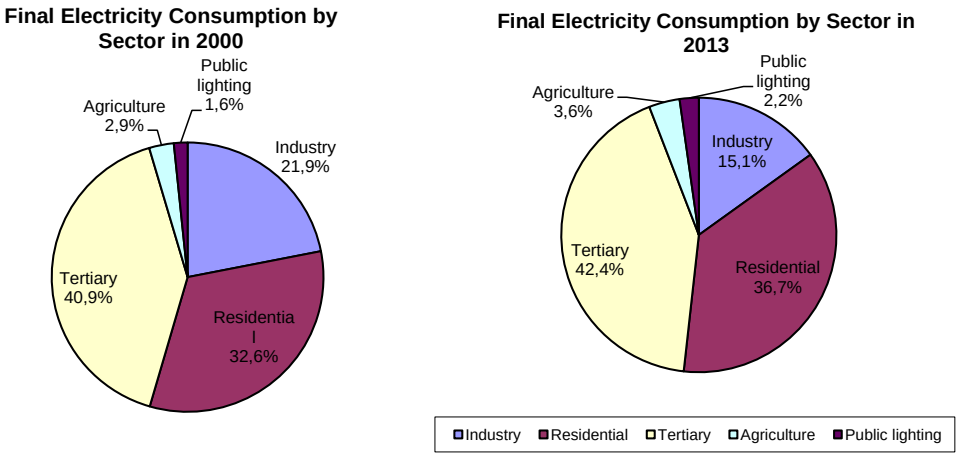



Figure 1.8: Shares of electricity consumption by sector in 2000 and 2013.



## 1.2.2. TRENDS IN AGGREGATE ENERGY INTENSITY

There are two macro indicators which are often used to describe the overall energy efficiency of an economy: the primary energy intensity and the final energy intensity, i.e. the ratio of the primary or final energy consumption to Gross Domestic Product. Primary energy intensity describes the energy productivity of the whole economy. Final energy intensity expresses the energy productivity of final consumers only and excludes losses in transformation and supply. Non-energy uses are also excluded from final consumption. Primary energy consumption in Cyprus rose from 1.9 Mtoe in 1995 to 2.8 Mtoe in 2008, a 43% increase, and then receded again down to 1.9 Mtoe in 2013. Final energy consumption increased from 1.4 Mtoe in 1995 to 1.9 Mtoe in 2009/2010 and then dropped to 1.6 Mtoe in 2013.

Figure 1.9 illustrates the evolution of these indicators. Primary energy intensity fell by 28% between 1995 and 2013. In the same period final energy intensity has decreased by 25%. The declining trend in both intensities over these two decades implies both energy efficiency improvements and structural changes in the economy. Especially the significant decline of year 2013 may be temporary because 2013 has been the first year of very strong economic recession. Whether energy intensity may somewhat rebound in the coming years remains an open question.

The relative variation of the primary and final energy intensity is described by the ratio of final to primary intensity. In Cyprus, this ratio has ranged between 60% and 74% throughout the 1995-2013 period.

The corresponding evolution of primary and final energy intensity after taking into account climatic differences between years is shown in Figure 1.10.

Figure 1.9: Primary and final energy intensity and their ratio in Cyprus, 1995-2013.

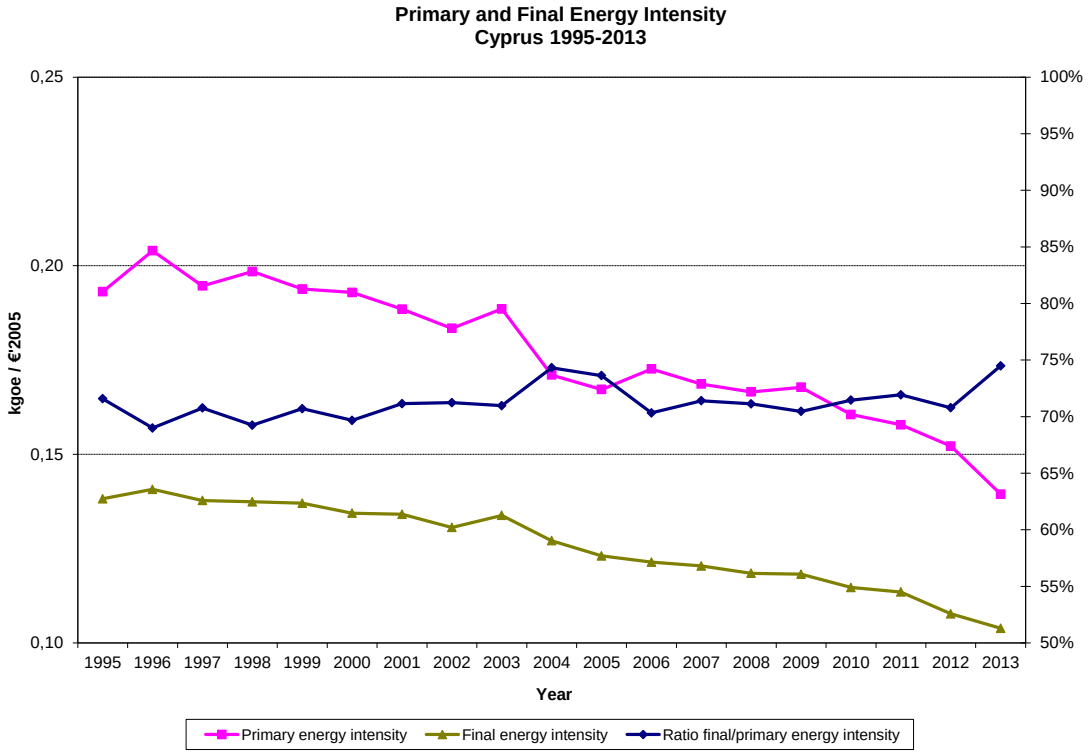
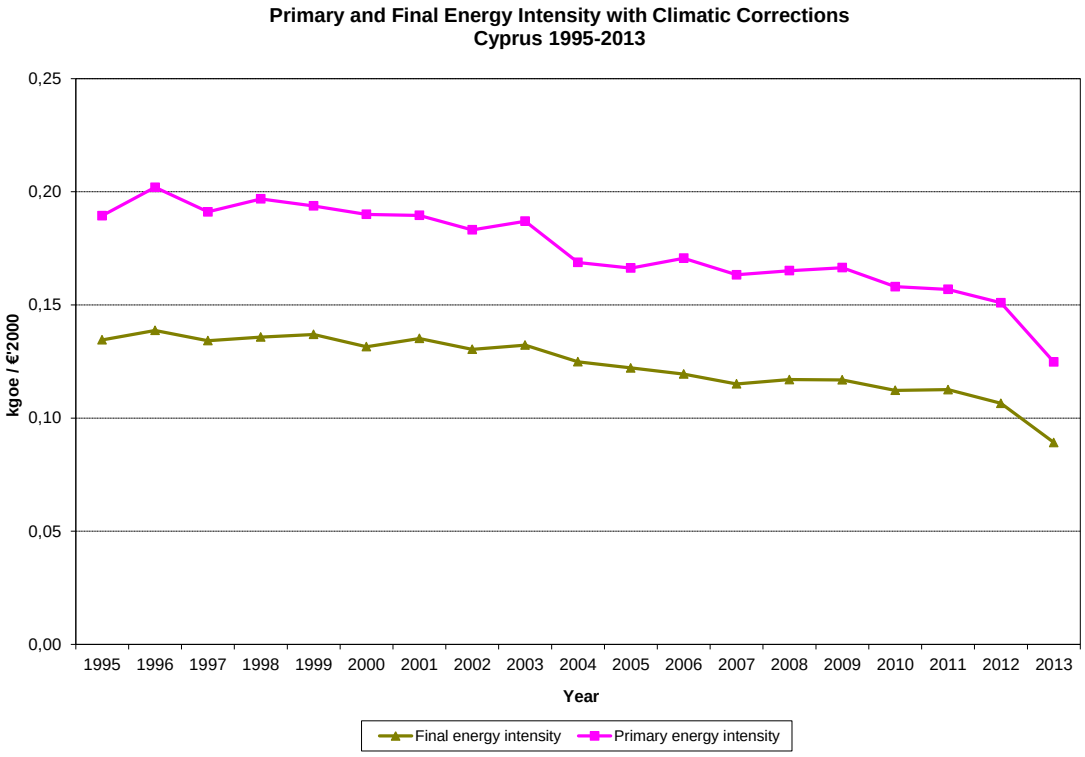


Figure 1.10: Primary and final energy intensity with climatic corrections, 1995-2013.




## 1.2.3. TRENDS IN ENERGY EFFICIENCY

In order to evaluate real energy efficiency trends, an aggregated energy efficiency indicator (ODEX) was developed in the Odyssee database. Its calculation is based on a detailed analysis of more than 30 branches, sub-sectors and end uses, using unit consumption figures (kwh/$m^2$, kwh/appliance, litres/100km, toe/ton of product etc). The different branches / end-uses are weighted according to their share in final energy consumption. ODEX is calculated as a 3-year moving average to normalise for factors like climate and structural changes not related to energy efficiency. For the base year 2000 the ODEX is set to a value of 100.

ODEX is calculated for three final consumption sectors (transport, households, manufacturing) and for the economy as a whole. It summarises the energy efficiency improvement per sector. For example, an index of 85 means a 15% improvement of the energy efficiency compared with the year 2000.

Figure 1.11 illustrates the evolution of this index by sector and for the whole economy of Cyprus. Over the period 2000-2013, the energy efficiency index for the whole economy (ODEX) decreased by 10%, but since 2009 it has remained essentially stagnant. A large part of this energy efficiency improvement came from industry (despite a short-term deterioration in year 2013), particularly from

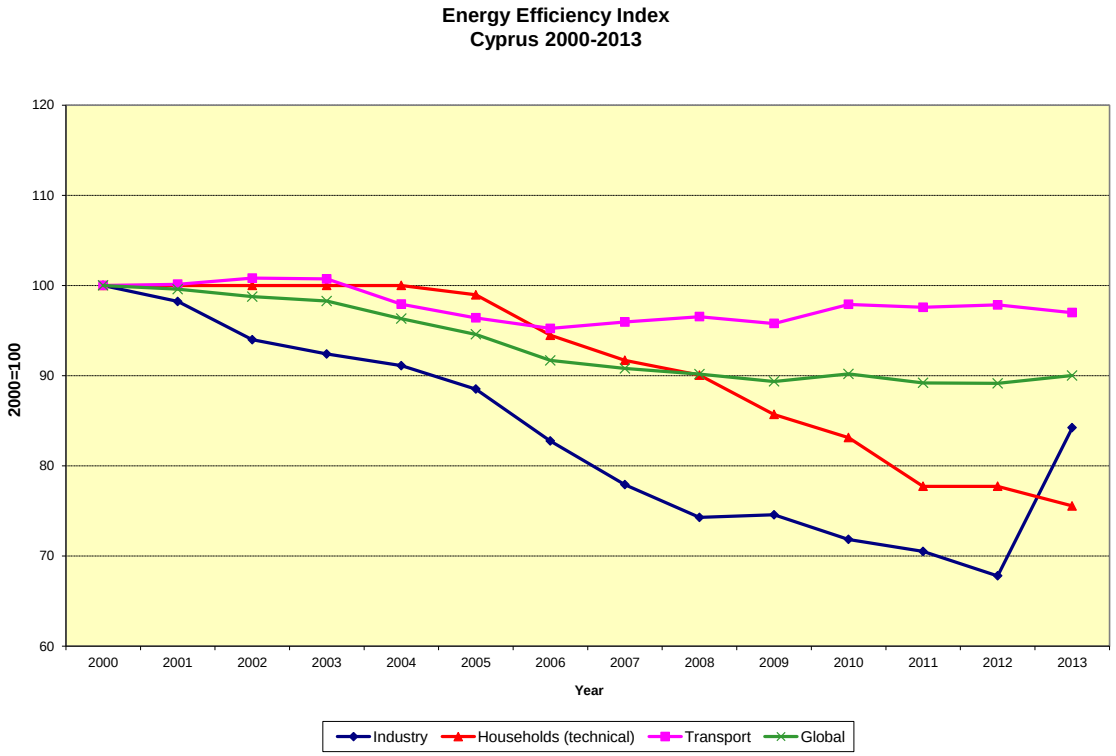
installations subject to the Emissions Trading Scheme (ETS) (cement and brick industry). Energy efficiency has also improved in the building sector in recent years, thanks to implementation of the EPBD Directive and due to financial support schemes for refurbishing the existing building stock. The transport sector, which is the largest final energy consumer (~56% of final energy consumption), contributed the least to energy efficiency improvements.

The efficiency in the industrial sector improved by more than 32% in 2012 compared to 2010. In the non-metallic minerals branch, which consumes more than half of final energy consumption in industry and falls under the scope of the EU ETS, the energy efficiency index had decreased in 2012 by 50% compared to 2010. This is mainly reflecting the efficiency improvement in the cement industry, which has undergone major renovation. The sector has adopted new efficient processes, CHP technology, waste heat recovery and also use of waste as biomass for production of electricity and heat. The food branch, second most energy consuming industrial sector and not subject to ETS, has shown deterioration in energy efficiency. Industrial efficiency demonstrated an abrupt deterioration in 2013, but this should be attributed to short-term effects of the serious economic downturn in that year; the sector will most probably revert to its long-term energy efficiency trend soon.

As far as households are concerned, their gross energy efficiency index has improved by 32% between 2000 and 2013. The technical ODEX has improved by 24%, mainly from 2006 onwards. This is due to the fact that Cyprus has entered the EU in 2004 and implemented policies and measures in energy efficiency after the accession, which started to yield energy savings some years later. Prior to EU accession there was no energy efficiency legislation such as mandatory building codes. The improvement since 2007 should mainly be attributed to efficient electrical appliances, free CFL lamps, use of solar water heaters (85% of households) and – more recently – the impact of the EPBD (minimum energy efficiency requirements in building shell and heating/cooling equipment) which started to be implemented in 2008. Stricter efficiency requirements have been imposed recently for new buildings in view of the road map for nearly zero energy buildings set by the EPBD recast Directive.

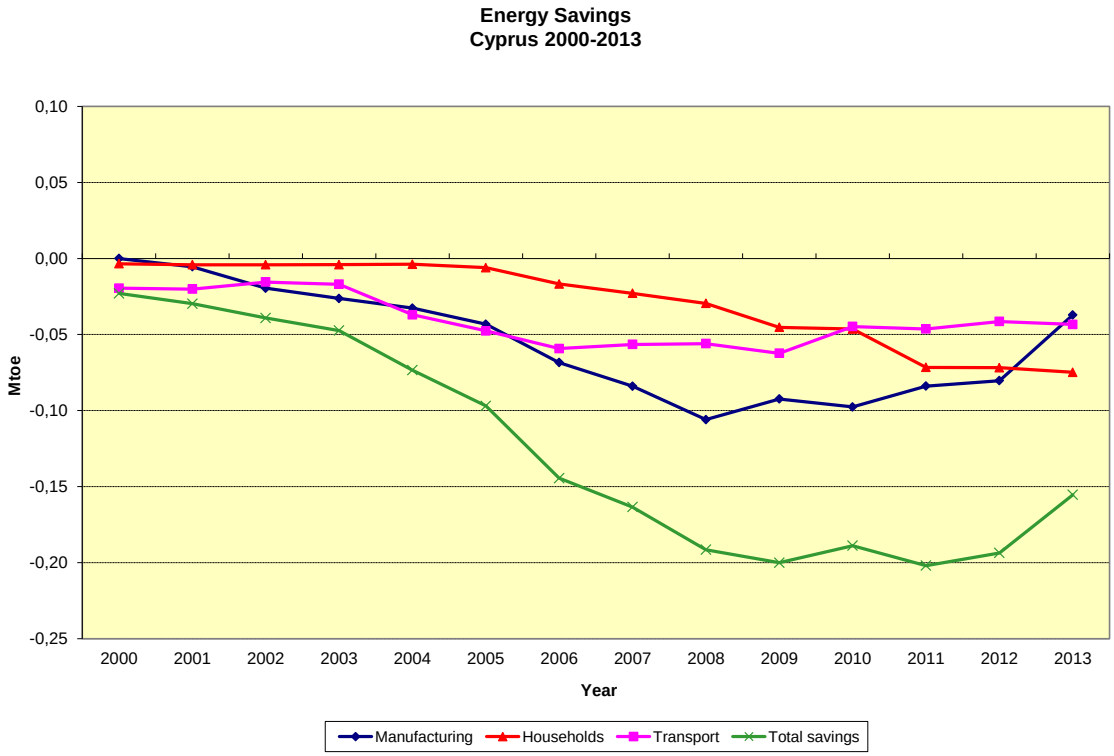
Finally, the transport sector has exhibited a mere 2% improvement in the period 2000-2013. In fact, energy efficiency of road transport has remained almost constant, but efficiency of trucks has clearly deteriorated. Despite technological progress that has led to the penetration of more efficient cars, and despite regulatory changes which resulted in the phasing out of old vehicles, the average size of the car stock has not changed. The import of second-hand cars has been a noticeable trend in recent years, which may have helped keep the average car size almost stable. Measures that were applied in recent years, such as grants for scrapping old vehicles or vehicle taxation based on $CO_2$ emissions, were probably of little effectiveness in improving average fuel economy. Public transport (buses) is not well developed and its use has remained low during this period. Aviation has a high share (~27% of final energy consumption). The index for aviation has improved by 29%, due to more fuel efficient fleet and most probably higher passenger occupancy of aircraft. Thanks to this improvement, the deterioration of efficiency in trucks has been counterbalanced so that overall transport efficiency has shown the 2% improvement mentioned above.

Figure 1.11: Energy efficiency index of Cyprus, 2000-2013.




Energy savings attained since 1996 are presented in Figure 1.12. Before the onset of the economic downturn of Cyprus, i.e. in 2011-2012, these savings amounted to around 0.2 Mtoe, or about 12% of that year's total final energy consumption. The savings have receded to about 0.15 Mtoe in 2013, mainly as a result if the above mentioned deterioration in the industrial sector (although this is considered to be temporary). As explained above, most of the energy savings during the 2000-2013 period came from improvements in manufacturing and households.

Figure 1.12: Energy savings by sector in Cyprus, 2000-2013.




## 1.3. ENERGY EFFICIENCY POLICY BACKGROUND AND TARGETS

Current national energy efficiency targets have been set out in line with the relevant EU legislation, such as the 'recast Buildings Directive' (2010/31/EC) and the 'Energy Efficiency Directive' (2012/27/EU). They foresee:

- 14.5% savings in national energy consumption by 2020 compared to a 'reference scenario'
- 3% annual refurbishment of the stock of government-owned buildings

Energy efficiency policy started to exist after the accession of the Republic of Cyprus to the European Union in 2004. According to the 1st National energy Efficiency Action Plan (NEEAP) submitted by the Republic of Cyprus to the European Commission in 2008, average final consumption in the 2001-2005 reporting period was calculated at 1,842,730 toe, taking into account all the assumptions mentioned therein. The final indicative target adopted for 2016 was 185,000 toe, or 10% energy savings as compared to consumption in the reference period, in line with the EU legislation of that time. The target was expressed in primary energy terms.

Based on the end-use energy savings target set out in the 1st NEEAP, Cyprus appears to have achieved its target for 2016, as energy savings through the measures implemented by 2013 and those expected to be implemented in the period 2014-2016 are estimated to amount to 238,908 toe in 2016, or approximately 13% of energy consumption in the reporting period. The 2nd NEEAP of

Cyprus was submitted in 2010 and included further measures, with emphasis on the buildings sector.

In March 2014, Cyprus provided to the European Commission the 3rd NEEAP, revising its national energy forecasts for the period 2014-2020, taking into account its new energy and economic data. In this context, there was a revision of both the national reference scenario and the national energy efficiency scenario. The country's new 'energy efficiency scenario' that was published included projections on all energy sectors through the adoption of additional measures to the ones implemented up to 2010. This means that it provides for the adoption of energy-saving grant schemes for the next ten years, the broader development and use of public transport and the transposition and implementation, at the national level, of the recent EU Directives on energy saving (such as the Energy Efficiency Directive, the Energy Performance of Buildings Directive, etc.). As far as primary energy consumption is concerned, this scenario assumed the use of natural gas instead of HFO for power generation from 2016 onwards, in accordance with estimates of that time.

According to the 3rd NEEAP, the national target for primary energy savings is 375,000 toe for 2020. The energy savings achieved through the measures implemented in the period 2010-2013, and which will remain in force in 2020, amount to 23,272 toe or 6.2% of the target. Following the implementation of the additional measures in the period 2014-2020 foreseen in the 3rd NEEAP, the estimated energy savings for 2020 are expected to amount to 381,372 toe or approximately 102% of the target.

The overall savings foreseen in the 3rd NEEAP amount to reduction of 14.5% in primary energy consumption in 2020, as compared to the national reference scenario. This percentage is approximately equal to the one set out in the 2nd NEEAP (14.3%).

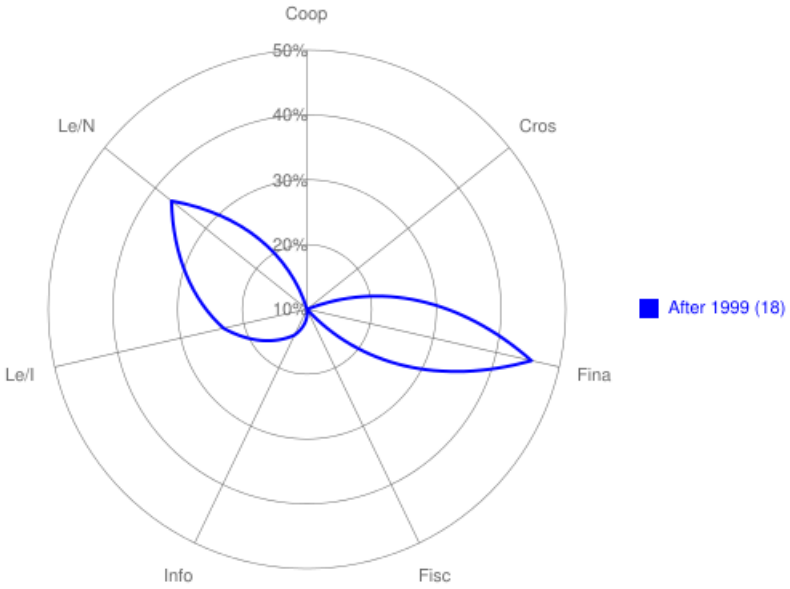
The national objective of 14.5% energy savings, amounting to 375 ktoe in 2020, are expected to be met by adopting end-use measures for energy savings of 182 ktoe and primary energy measures for energy savings of 192 ktoe.

Figure 1.13 presents spider graphs that illustrate the patterns of energy policies and measures in Cyprus by sector. More information on these measures is presented in subsequent chapters of this report.

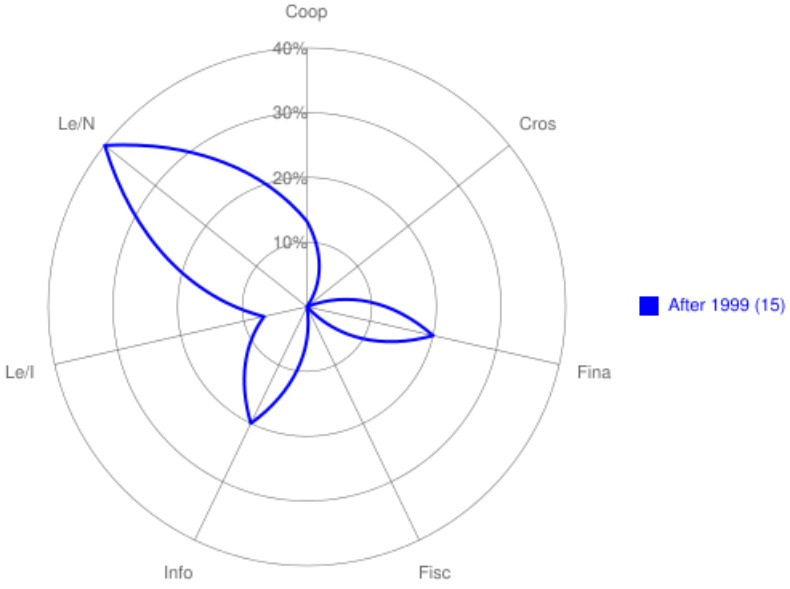
Spider diagrams are a graphical representation of the distribution of energy efficiency policies. They provide an overview of the type of measures a country has implemented. Spider diagrams are constructed by assigning each energy policy and measure in each sector to one of the following categories: Financial, Fiscal, Information-Education, Legislative-Normative, Legislative-Informative, Infrastructure, Social Planning/Organisational, Cooperative Measures, and Cross-cutting Measures with sector-specific characteristics.

Figure 1.13: Energy efficiency measures by sector and type of measure in Cyprus.

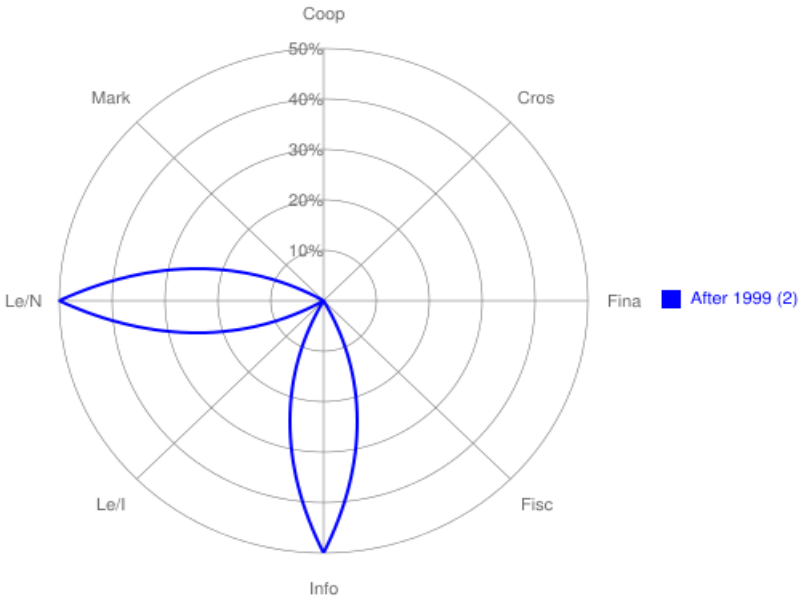
a) Residential sector



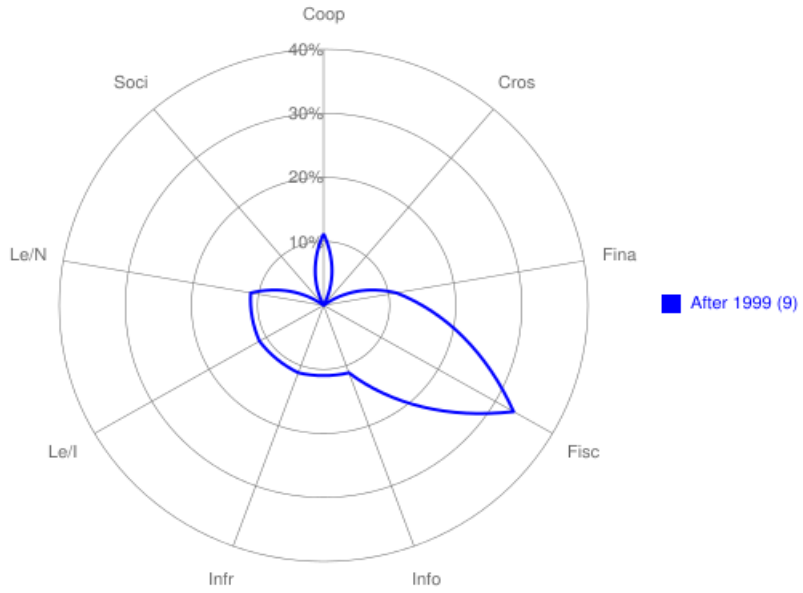

b) Tertiary sector



c) Industry




d) Transport




Legend:

Coop: Co-operative Measures
Cros: Cross-cutting with sector-specific characteristics
Fina: Financial
Fisc: Fiscal/Tariffs
Info: Information/Education/Training
Le/I: Legislative/Informative
Le/N: Legislative/Normative

# 2. ENERGY EFFICIENCY IN BUILDINGS

## 2.1. ENERGY EFFICIENCY TRENDS

### 2.1.1. HOUSEHOLDS

As shown in Figure 2.1, final energy consumption increased considerably in the late 1990s and 2000s: from 199 ktoe in 1995 and 255 ktoe in 2000 it reached 342 ktoe in 2009. The economic crisis of recent years had a significant effect, so that household energy use receded to 285 ktoe in year 2013. The sector's share in final energy demand has been continuously increasing – from 14.1% in 1995 to 17% in 2000 up to 18% in 2013. Figure 2.2 clearly illustrates that the energy mix has changed in favour of electricity consumption whereas the oil consumption has decreased. The share of renewables – mainly solar thermal water heaters – has also increased to 21% in 2013.

Electricity consumption has increased by about 150% during the last 10-15 years. The main reason, displayed also in Figure 2.3, is the installation of air conditioners and the increasing number of home electric appliances. Space heating energy consumption has reached a peak in the mid-2000s (exceeding 110 ktoe) and has dropped in recent years following the economic downturn. It has to be noted, however, that the use of electric heat pumps (in heating mode) is not included in this figure. The share of space cooling, almost entirely based on electricity, has gone up over the years.

The implementation of the EPBD has started in 2008 with the setting of minimum energy efficiency requirements for new buildings (building shell) and the first energy certificates were issued in 2009. The energy performance indicator of the reference residential building is 180 kwh/$m^2$/year (heating, cooling, hot water, lighting). This result is derived from the official national calculation methodology tool and is designated as the asset rating (based on standardised conditions and typical occupancy).

After reaching a peak in the early 2000s, the unit consumption of dwellings in Cyprus has dropped from 1.16 toe/dw in 2000 to 0.85 toe/dw in 2013. The unit consumption of space heating has declined very substantially from 0.47 toe/dw (corresponding to 3.5 kgoe/$m^2$) in 2000 to 0.20 toe/dw (1.4 kgoe/$m^2$) in 2013. This decrease may partly be attributed to improved energy performance of new buildings, but the main reason for this decline must be the reduced use of heating systems by residents for economic reasons.

Electricity consumption per dwelling has also been increasing in the 1990s and early 2000s, reached a peak in 2007-2008 exceeding 5600 kWh/dw, and started falling afterwards, down to 4010 kWh/dw in 2013. The economic crisis must have played the most important role here too.

Figure 2.1: Final energy consumption in households by energy source.

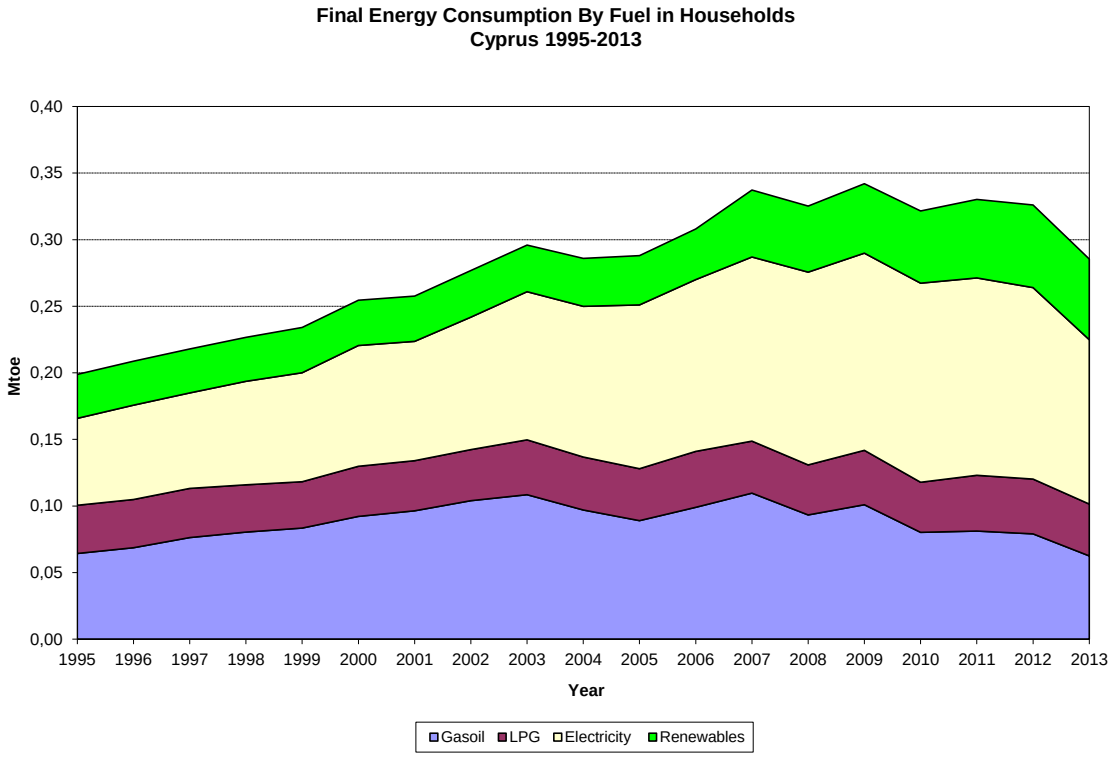



Figure 2.2: Shares of final energy consumption in households by energy source, 2000 & 2013.

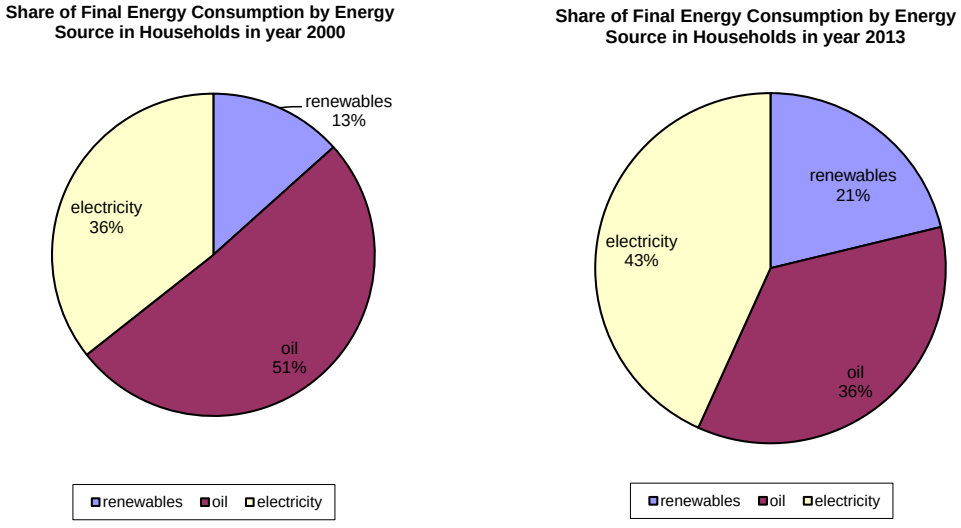
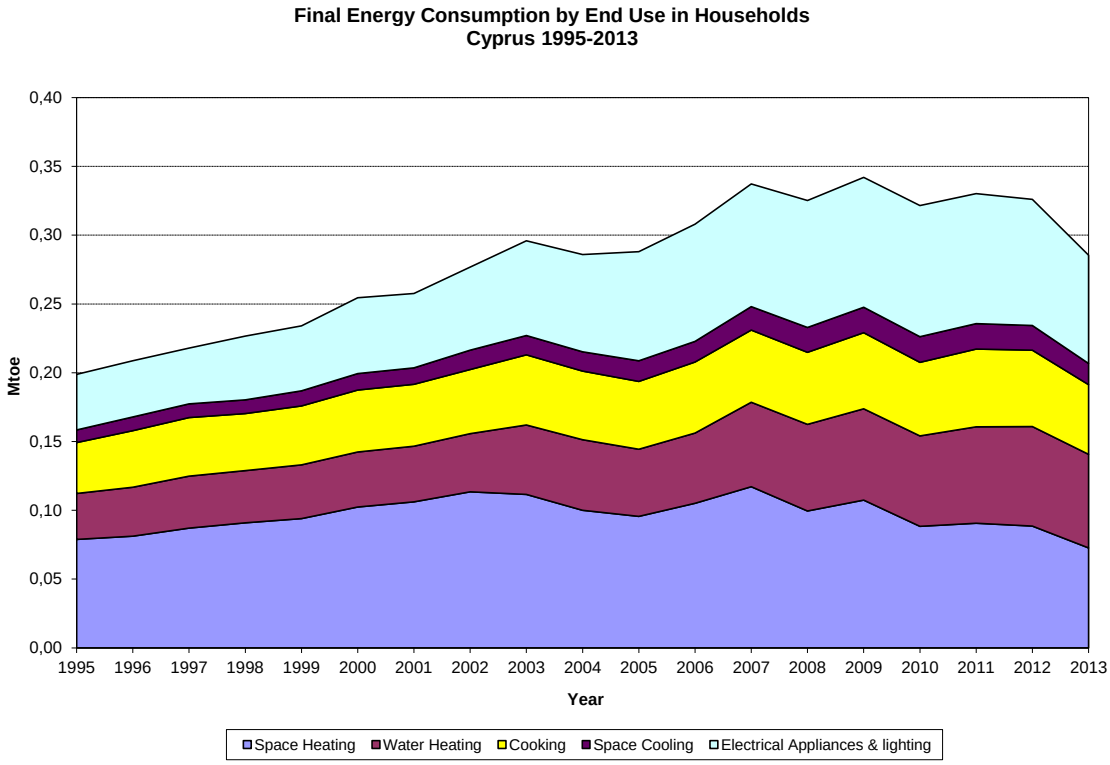


Figure 2.3: Final energy consumption in households by end use.




## 2.1.2. TERTIARY SECTOR

The economy of Cyprus depends heavily on services. The value added for the services sector has almost doubled in 2011-2012 compared to the mid-1990s. The contribution of the services sector to national GDP has been constantly rising even despite the economic crisis of the post-2009 period, and exceeded 80% in 2010. The most important branches in terms of value added are hotels & restaurants and the financial sector. Public administration has also experienced significant growth due to the strong expansion of the government sector and the employment of thousands of civil servants in the 2000s – although this branch has a relatively low share in energy consumption. The education branch has experienced a significant increase as well, which can be explained by the significant expansion of private universities.

As shown in Figures 2.4 and 2.5, electricity has always been the dominant energy source in the tertiary sector, accounting for at least two thirds of total final energy demand. The rest involves some use of LPG and gasoil (mainly in hotels and restaurants) and renewable energy (primarily solar energy for water heating).

Figure 2.6 illustrates that the overall energy consumption per employee in the tertiary sector has increased in the past but has declined in the post-crisis era to slightly higher than from 0.7 toe/employee. The annual consumption of electricity per employee has also dropped to almost 0.5

toe (or 6000 kwh/employee) in 2013. To what extent this decrease is sustainable even under a growing economy is an open question.

The energy intensity of the tertiary sector has been decreasing since the early 2000s: from 0.021 kgoe/€2005 in 2000 to 0.017 kgoe/€2005 in 2013. The post-crisis drop in electricity intensity has been stronger: from a peak of 181 kwh/€2005 in year 2003 it has fallen to less than 150 kwh/€2005 in 2013. Total electricity consumption, had more than doubled in 2009 compared to the mid-1990s, which is explained by the high use of air-conditioning and the construction of thousands of new touristic buildings; however it receded in recent years and is now a mere 27% higher than in the year 2000.

Figure 2.4: Final energy consumption by energy source in the services sector.

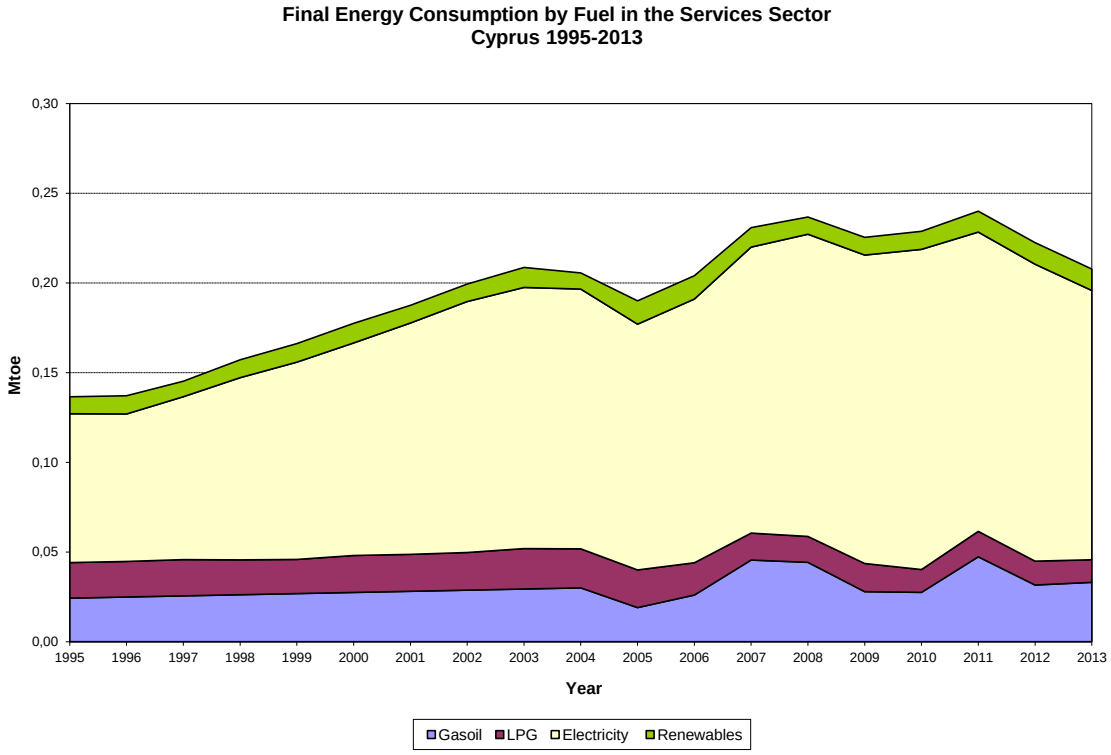


Figure 2.5: Shares of final energy consumption in the services sector by energy source.

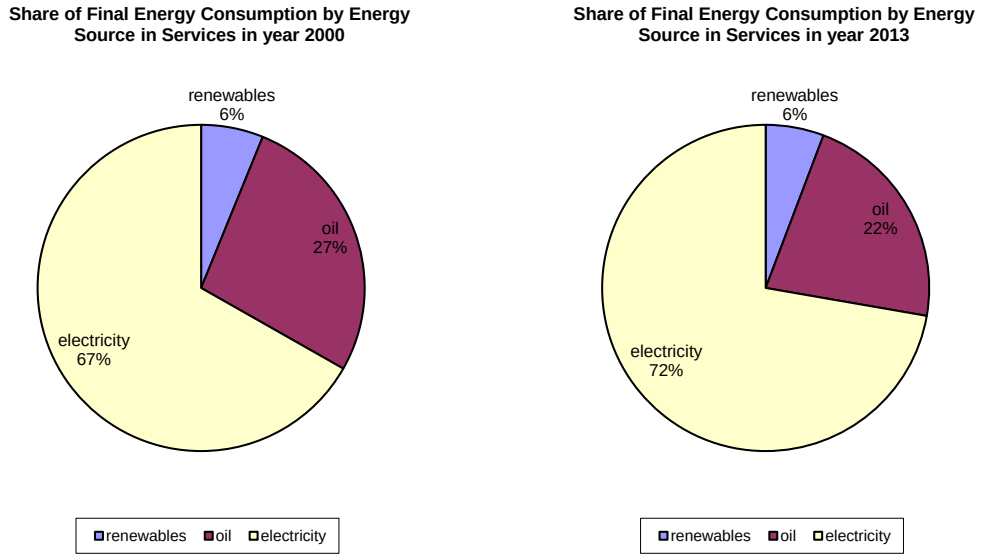



Figure 2.6: Unit consumption trends in the services sector.

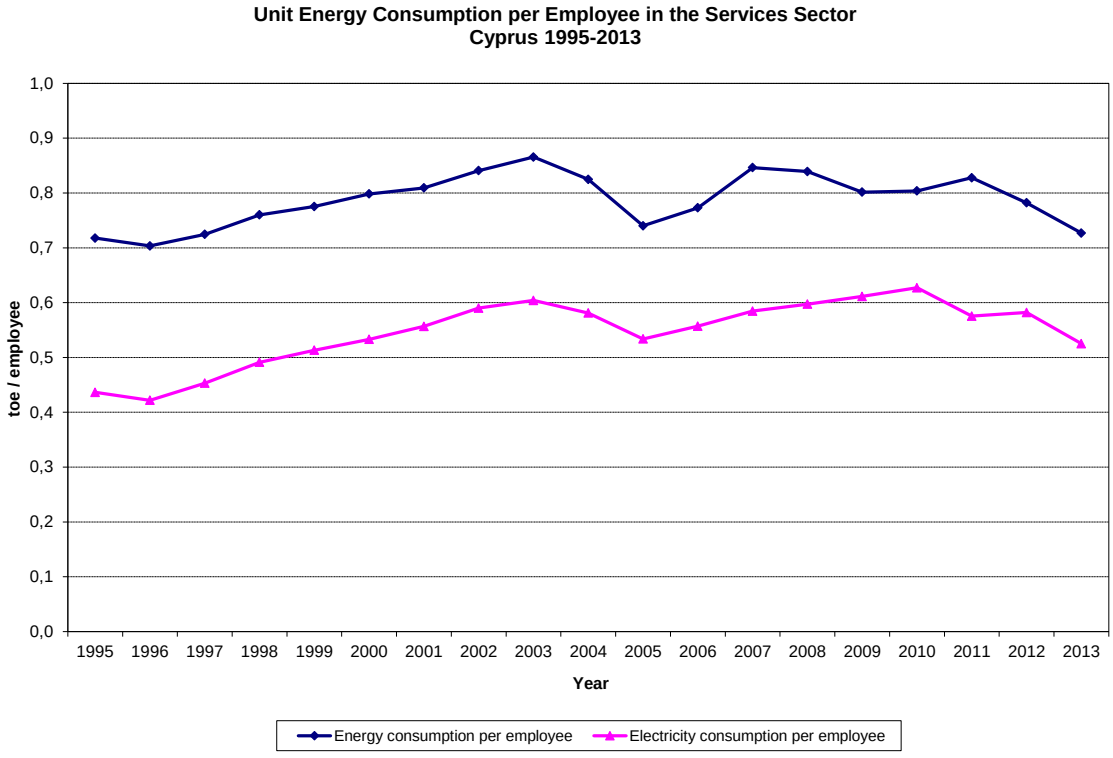
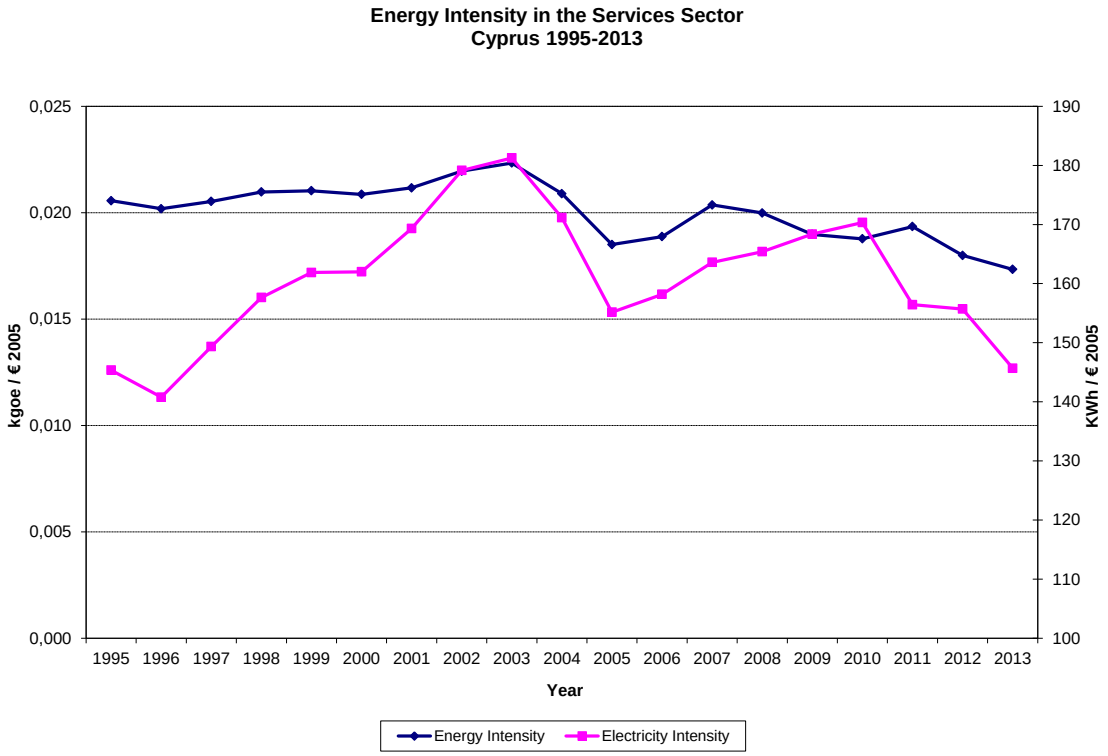


Figure 2.7: Final energy and electricity intensity in the services sector.




## 2.2. ENERGY EFFICIENCY POLICIES

Governmental financial support schemes for financing energy saving investments are used extensively in the buildings sector. Since 2004 there have been thousands of applications and grants provided. For the household sector, subsidies apply to investments in thermal insulation and installation of solar thermal heaters, geothermal heat pumps and photovoltaic panels. For the tertiary sector, all technologies are eligible provided they yield at least 10% in primary energy savings. Since the operation of the programme more than 50,000 applications for investments have been received and the majority of them have been approved.

Cyprus has enacted a primary legislation for the energy performance of buildings (in compliance with Directive 2002/91/EC). Secondary legislation for setting minimum efficiency requirements and thermal building codes are enforced since 1/1/2008. Prior to accession to the EU, Cyprus did not have any mandatory building codes on energy efficiency. Therefore after the full implementation of the EPBD the impact in terms of energy savings is expected to be high.

A new grant scheme for energy renovation of existing buildings is currently in place, with a budget of 15.3 million Euro for the period 2014-2020 for SMEs and 16.5 million Euros for households. It covers measures to improve the energy class building certificate to B or to make a building a nearly-zero energy one.

Furthermore, a number of horizontal measures that are most relevant to the buildings sector have been implemented. These comprise the following actions:

- Appointment of Energy Savings Officers. The aim is to appoint at least one ES Officer in each building (owned or leased), which is used by the services of the public or broader public sector. ES Officers ensure that energy-saving measures are implemented in the building as much as possible, especially zero-cost measures. In addition, they draw up an annual Report on Energy Consumption and Actions in relation to the building under their responsibility. An event and training meetings of ES Officer groups are organised on an annual basis by the Energy Department, for the training and information of ES Officers.

- Officers of the Energy Institute and of the Energy Department perform inspections in buildings used by services of the public sector (owned or leased), aiming to provide advice on energy saving to staff-members. If necessary, in addition to building inspections, officers may make presentations on energy savings and RES.

Preparing and publishing information leaflets on:

'Guide on fuel economy and the reduction of carbon dioxide emissions in passenger vehicles'.

'Zero-cost measures for energy savings at the workplace and at home'.

'Ecodesign'

'Technical guide on nearly zero-energy buildings'

'Cogeneration of heat and power'

'Energy efficiency in end use and energy services'

'Energy savings guide'

'Energy star labelling guide'

'Energy auditors - energy audits'

# 3. ENERGY EFFICIENCY IN TRANSPORT

## 3.1. ENERGY EFFICIENCY TRENDS

Being an island and utilising a very small share of public transport modes, Cyprus has a very energy-intensive transport sector, which accounts for more than half of total final energy consumption – see Figure 1.6. Aviation accounts for between one third and one fourth of this energy use, and the rest is consumed by passenger and freight road transport modes – mainly cars and trucks.

Figures 3.1 and 3.3 show that transport energy consumption has increased by 43% in the 1995-2010 period, mainly due to the strong increase in the stock of private vehicles and the use of trucks; after the economic crisis, however, energy use has receded considerably, declining by 20% compared to the pre-crisis levels. The drop in freight transport activity has contributed most to this decline.

As Figure 3.2 illustrates, the shares of fuels in the energy balance of transport in year 2013 were 41% gasoline, 30% diesel, 27% jet fuel and 2% biofuels. The share of biofuels is expected to increase in the next few years due to compliance with the EU Renewable Energy Directive 2009/28/EC. The target is for 10% renewable fuels, which should be realised either by using renewable electricity or (primarily) by blending biofuels in the imported diesel and gasoline for road transport. Another factor which plays a role in the transport energy consumption - and particularly in aviation fuel use – is the fact that Cyprus is a popular touristic destination with over 2 million tourists visiting the country every year (compared with a permanent population of Cyprus of about 900 000). Also the number of Cypriot residents travelling abroad for tourism is significant, which is another reason for increased air travel.

Figure 3.1: Final energy consumption in transport by energy source.

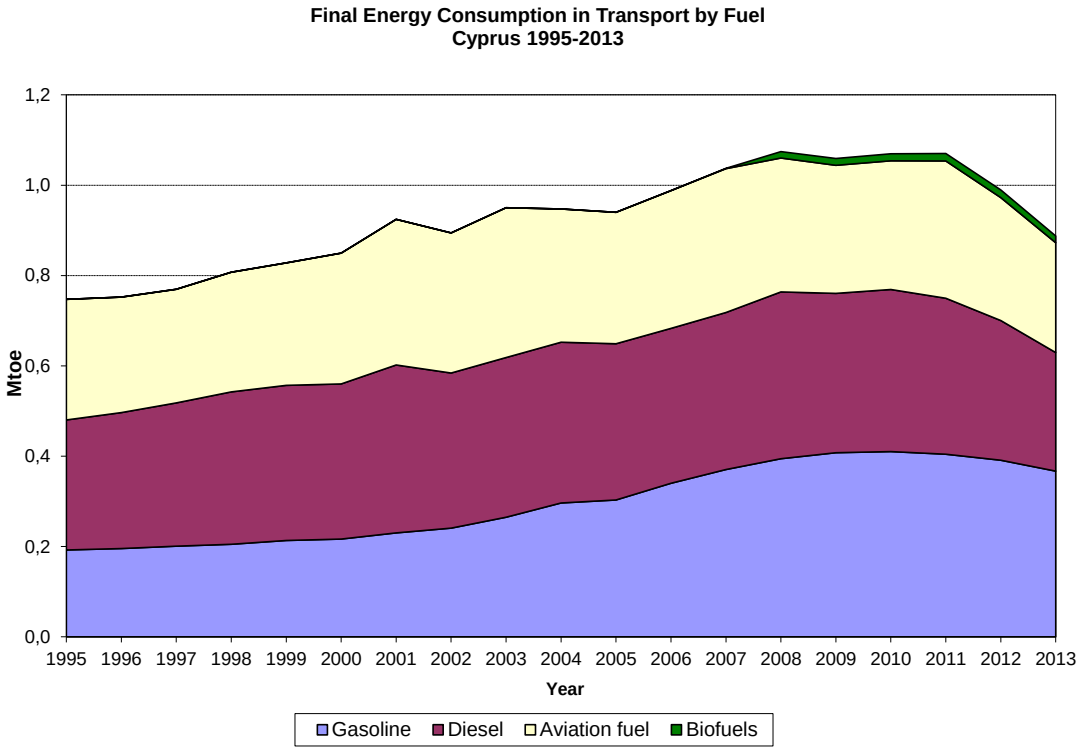


Figure 3.2: Shares of final energy consumption in transport by energy source.

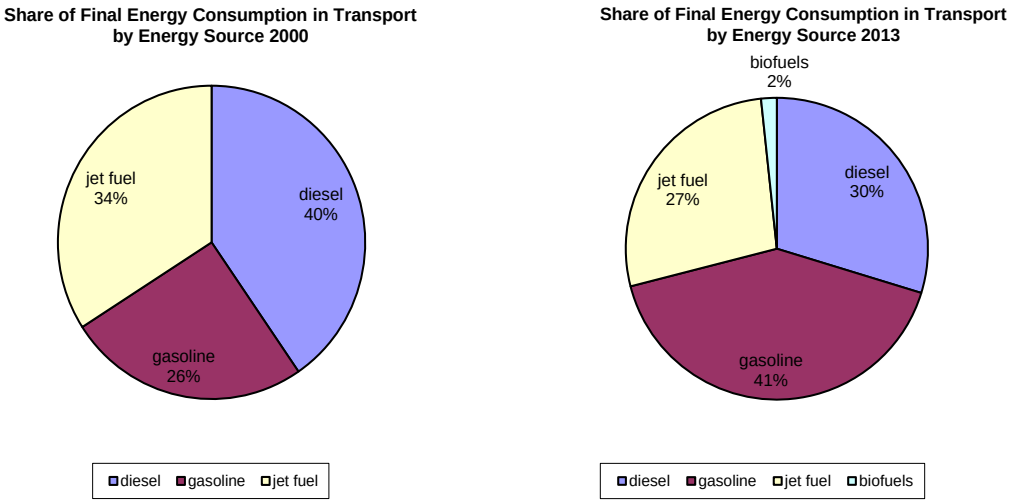
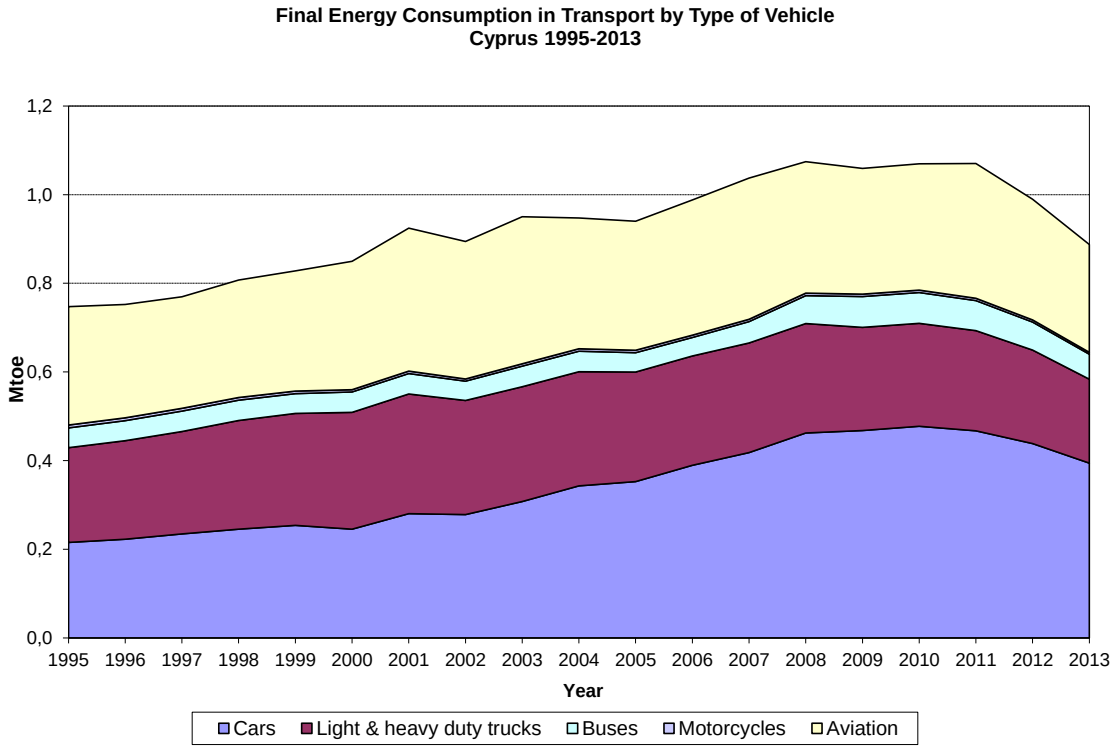



Figure 3.3: Transport energy consumption trends in Cyprus by type of vehicle.




The stock of vehicles, as shown in Figure 3.4, was 374 000 in 1995 and reached 634 000 in 2012. Gasoline vehicles rose from 203 000 in 1995 to 425 000 in 2012. Diesel cars were 17 000 in 1995 and reached 50 000 in 2013. Diesel light duty vehicles were 78 000 in 1995, reached 103 000 in 2009 and dropped slightly to 92 000 in 2013. It is obvious that private cars have more than doubled throughout

the last two decades, which basically explains the increase in transport fuel consumption.

The evolution of new registrations of passenger cars, presented in Figure 3.5, explains to a large extent the stagnation of the vehicle stock that was already shown in Figure 3.4. Sales of new cars have dropped very substantially after 2008 because of the serious economic downturn in the country. 80-90% of newly registered cars have always been gasoline powered and the rest mainly diesel powered, with a very small fraction of sales of hybrid cars.

According to Figure 3.6, specific fuel consumption for different types of vehicles has changed to a small extent. In the case of passenger cars, fuel efficiency has slightly deteriorated since the late 1990s – after some small decline in intermediate years. More specifically, fleet-wide fuel consumption of gasoline cars was 9.3 lt/100 km in 1995 and 9.4 lt/100 km in 2010; in diesel cars the corresponding numbers were 8.6 lt/100 km in 1995 and 8.7 lt/100 km in 2013. Following the economic crisis, and the rapid decline in new registrations that was demonstrated in Figure 3.5, the small improvement in fuel economy that was observed in the early 2000s has been reversed.

As regards light duty vehicles, there has been a slight improvement in fuel economy of diesel vehicles as opposed to some deterioration for gasoline vehicles. Average fuel consumption of diesel light duty vehicles changed from 10.6 lt/100 km in 1995 to 9.8 lt/100 km in 2013. For gasoline light duty vehicles the change was between 13 lt/100 km in 1995 and 14.6lt/100 km in 2013. These trends should be attributed to a combination of three factors: the rate of renewal of the vehicle fleet; technological improvements of new vehicles; and changes in the size and power of newly purchased vehicles.

Fleet-wide fuel consumption of heavy duty vehicles has clearly declined, from 28.4 lt/100 km in 1995 to 24.4 lt/100 km in 2013. This was evidently due to more fuel efficient diesel engines.

For the aviation sector the unit consumption has declined substantially between 1995 and 2013 - from 0.05 kgoe per passenger-kilometre to 0.035 kgoe per passenger-kilometre. More energy efficient aircraft and better flight management must have contributed to this improvement.

Figure 3.4: Trends in the stock of motor vehicles of Cyprus.

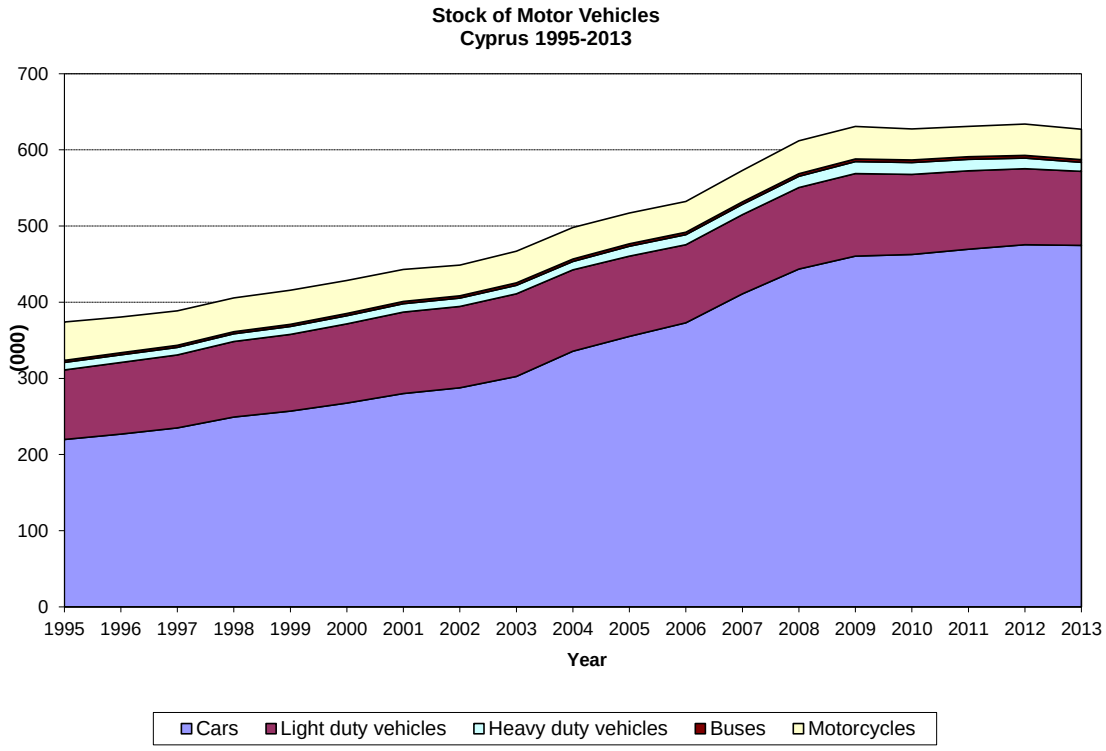



Figure 3.5: Evolution of new passenger car registrations by engine size.

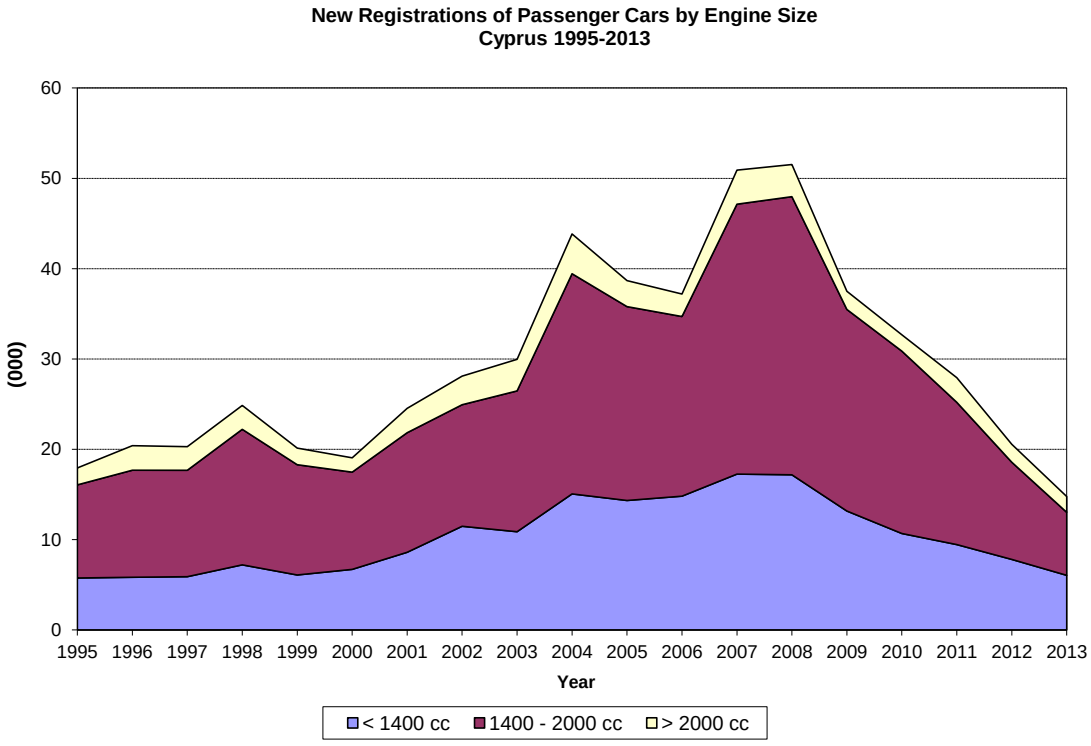
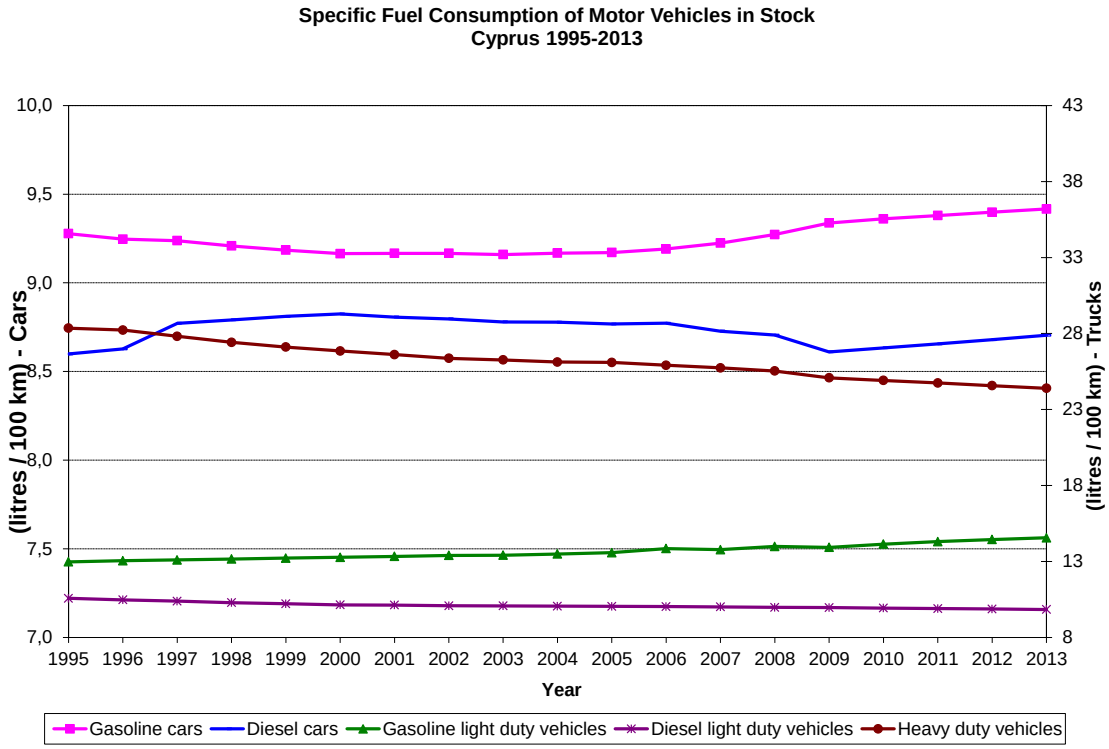


Figure 3.6: Specific fuel consumption of motor vehicles in stock.




## 3.2. ENERGY EFFICIENCY POLICIES

A national action plan for public transport upgrading was adopted by the government in the late 2000s. It included new legislation with requirements for all public transport operators (bus companies). Among others it foresees a radical improvement of the existing infrastructure such as 1000 new environmentally friendly buses replacing old polluting ones, new bus routes, modern stations, bus lanes etc. Up to 2009 the action plan had been partially implemented, but more time and significant investment is required mainly for the purchasing of new modern buses.

A financial support scheme has been in place for purchasing of electric, hybrid and low-carbon cars. Moreover, taxation of new vehicles is partly based on $CO_2$ emissions. Finally, a support scheme providing grants for the scrapping of old cars was implemented during some years of this period. More specifically, the following policies were adopted in the transport sector in recent years:

- According to the 2013 (Amending) Law on Motor Vehicles and Road Traffic, which entered into force on 1 January 2014, the annual circulation tax for each category M1 motor vehicle and the annual circulation tax for each category N1 motor vehicle, resulting from a category M1 motor

vehicle and classified under the category of light lorry (VAN type), is calculated on the basis of the carbon dioxide emissions of the vehicle's engine. In addition, as from 1 January 2014, category N2 and N3 vehicles (lorries) and M2 and M3 vehicles (buses) are registered in so far as they have been proven to comply with the 'EURO VI' requirements on the emission of pollutants.

- The launch of the 4th Old Vehicle Scrapping and Replacement Scheme was announced on 11 October 2010, whereas the scheme was implemented in 2011. Applications were admitted for a period of 2 months with final date on 13 December 2010. The 4th Scheme related to the payment of a grant equal to EUR 1800 and covered the scrapping of M1 category motor vehicles, older than 15 years old, under the condition that a new car with $CO_2$ emissions lower or equal to 165 g/km would be purchased.

- The new public transportation system was put in force in the second half of 2010. The new public transportation bodies replaced part of their vehicles with new ones that have low fuel consumption and pollutant emissions, as compared to the old vehicles that were replaced. Provincial urban companies have reorganised their routes, aiming to optimise their efficiency in this sector. Their websites contain a detailed map of the routes and the timetable of buses in order to facilitate passengers.

- In addition, a project relating, inter alia, to the construction of the first bus lane in Cyprus for the amount of over EUR 18 million started to be implemented on 17 October 2008 and was completed within 2011. The project is expected to contribute to the reinforcement of Public Transport and was co-financed by the European Structural Funds.

- Before the end of 2011, the widening of the motorway leading from south Cyprus to the capital of Nicosia from four to six circulation lanes was completed. The project was co-financed by the Trans-European Transport Networks Fund.

- In the context of the implementation of Regulation (EC) 1222/2009 on the labelling of tyres with respect to fuel efficiency and other essential parameters, delegated inspectors of the Energy Ministry perform market surveillance checks in order to identify cases of non-compliance with these provisions. In addition, presentations on energy savings in the transport sector and on eco-driving are made in the context of the seminars addressed to unemployed engineers of all specialisations organised by the Energy Ministry and the Productivity Centre, with the support of the Human Resources Development Authority of Cyprus.

- The municipalities of Nicosia have founded the Inter-municipal Bicycle Company of Nicosia (DEPL), aiming to change the way things work on Cypriot roads via an automated 3rd generation bike rental system. The installation of this innovative system will be combined with the design of new bicycle lanes, which will be used by a large part of the population and by tourists to commute from and to the city centre. In particular, the Nicosia Municipality has installed 100 bicycles in 5 stations, the Aglantzia Municipality, 50 bicycles in 4 stations, the Strovolos Municipality, 80 bicycles in 8 stations, the Dali Municipality, 20 bicycles in 3 stations,

the Aghios Dometios Municipality, 20 bicycles in 2 stations, the Latsia Municipality, 15 bicycles in 2 stations and the Engomi Municipality, 30 bicycles in 3 stations. There is one single system for all municipalities that participate in the programme, whereas each user can take a bicycle from the station of one municipality and return it to the station of another municipality. The programme aims to promote the use of bicycles among citizens as an alternative means of transport in the city.

- In addition, the government has decided to use resources from the European Structural and Investment funds to promote and develop electric vehicle infrastructures in Cyprus. The establishment of a network of charging infrastructures will be promoted under this project. Charging points and infrastructures for electric vehicles will be installed in public buildings and roads, whereas installation costs in private buildings, single-family houses and undertakings will be subsidised under specific criteria and specifications.

The energy savings arising from specific/individual actions under the Vehicle scrapping plan and the Grant Scheme for Electric, Hybrid and Low-Pollutant Vehicles, with the corresponding contribution to the years 2012, 2016 and 2020 in end and primary use are shown below.

**Energy savings from specific/individual actions in the transport sector.**

| S/N | Description of the measure | Implemen-tation Period | End use | | | Primary Use | | |
|---|---|---|---|---|---|---|---|---|
| | | | 2012 TOE | 2016 TOE | 2020 TOE | 2012 TOE | 2016 TOE | 2020 TOE |
| 1 | **Vehicle Scrapping Plan** | **2008-2010** | **2 822.8** | **2 822.8** | x | x | x | x |
| | **Vehicle Grant scheme** | **2004-2009** | **1 073.5** | **1 073.5** | x | x | x | x |
| 2 | **Vehicle Scrapping Plan** | **2008-2010** | x | x | x | **167** | x | 167 |
| | **Vehicle Grant scheme** | **2004-2009** | x | x | x | x | x | x |

In addition, energy savings from the implementation of additional measures in the transport sector are expected to amount to 10,000 TOE (transport and air transport) in 2016 and 50,000 TOE (transport and air transport) in 2020.

# 4. ENERGY EFFICIENCY IN INDUSTRY

## 4.1. ENERGY EFFICIENCY TRENDS

The importance of industry for the Cypriot economy has been declining throughout the last two decades. Following the financial crisis of the post-2009 period, the two subsectors that remained strong (construction and cement industry) have also experienced a substantial decline due to the decrease in demand for new houses (to be used either as main residences or as holiday houses). However, these subsectors are expected to rebound if the national economy reverts to a sustainable growth path. Final energy demand has declined even further as a result of both the drop in economic

activity and progress in energy efficiency measures.

As Figure 4.1 demonstrates, the value added of industry reached a peak in 2008, rising by 36% compared to 1995, and has been declining ever since; this recent drop has been very significant: economic output in 2013 was only 55% of the output in 2008. The shares of economic activity of various industrial branches in the period 1995-2013, displayed in Figure 4.2, indicate important structural changes. Within manufacturing the most important branches (in terms of value added) are the food and drinks subsector, metal products and machinery and non-metallic minerals (comprising mainly cement production). The non-metallic minerals branch has grown by 60% between 2000 and 2008, but has shrunk drastically in recent years due to the economic crisis that particularly hit construction and the real estate market. The construction branch, which consistently accounted for about half of the economic output of total industry since the 1990s, experienced a strong contraction and accounted for just over a third of the sector in 2013.

Figure 4.1: Historical evolution of economic output (value added) of the Cypriot industry by branch.

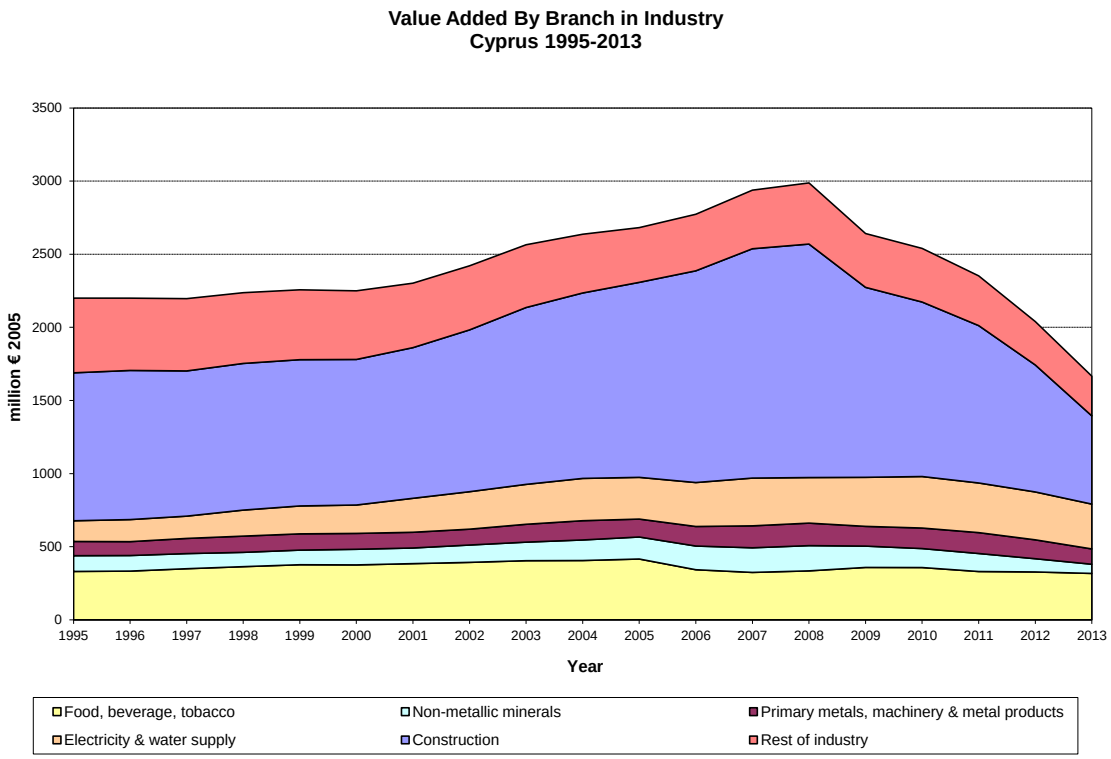
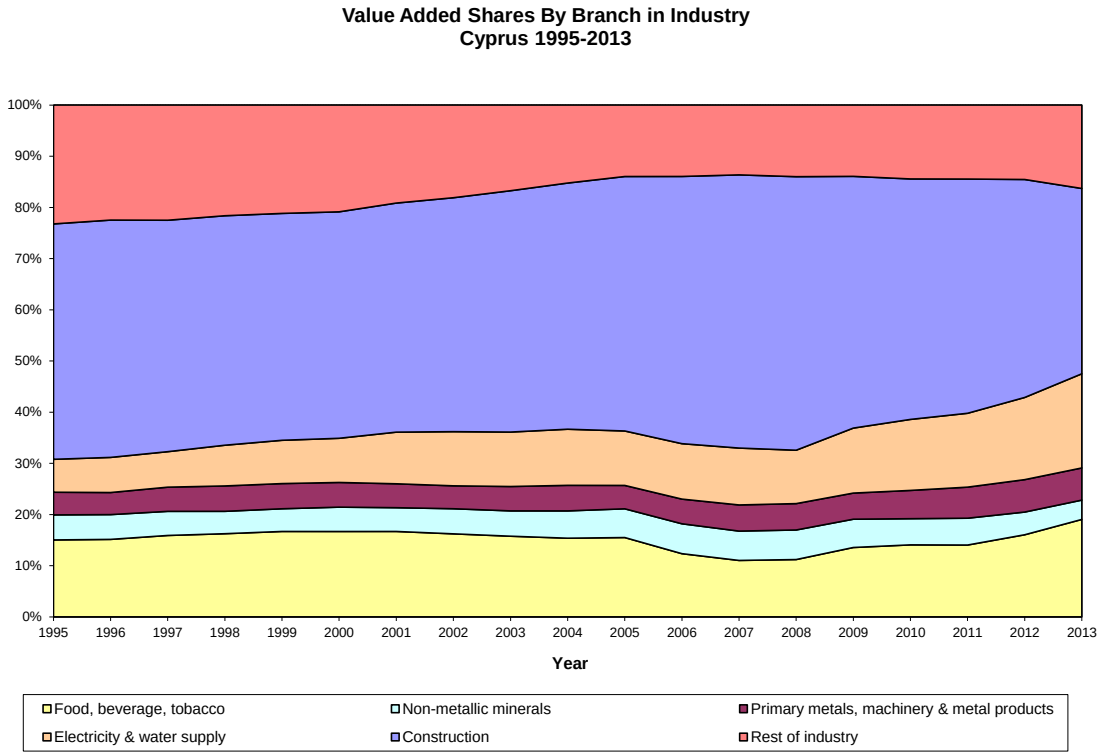


Figure 4.2: Evolution of the share of value added by branch in the Cypriot industry.




Final energy consumption of industry was 297 ktoe in 1995, reached a peak of 355 ktoe in 1995 and then started falling, down to just 175 ktoe in 2013 – or 50% of its peak value. The share of industry in total final energy consumption has followed the decline of its share in total economic output: from around 21% in the late 1990s it dropped to 11% in 2013. In Figures 4.3 and 4.4 the energy consumption by sector and fuel is presented, while Figure 4.5 shows the percentage shares of energy products. Although electrification has progressed quite fast in this sector (the electricity share has risen to 29% in 2013 compared to 18% in 2000 and 12% in 1995), oil products still dominate. In some years there was also some limited consumption of coal by the cement industry.

It is also evident from Figure 4.3 that the non-metallic minerals branch has historically accounted for more than half of industrial energy consumption. It has to be noted that this is the only branch in Cyprus (apart from power plants) that is subject to the EU Emissions Trading Scheme. It includes nine installations (one cement and eight brick plants). These installations have implemented measures for the reduction of greenhouse gas emissions. Energy efficiency measures and deployment of renewable energy are reflected in the various indicators and unit energy consumption of this sector: Figure 4.6 shows the decrease in the unit consumption of cement in the period as a result of new technological measures adopted in this industry. There seems to be a rebound in the energy intensity of cement production in 213, but this may be a short-term effect of the very strong decline in production levels in this year.

Figure 4.3: Final energy consumption of the Cypriot industry and of its most energy intensive sector (non-metallic minerals).

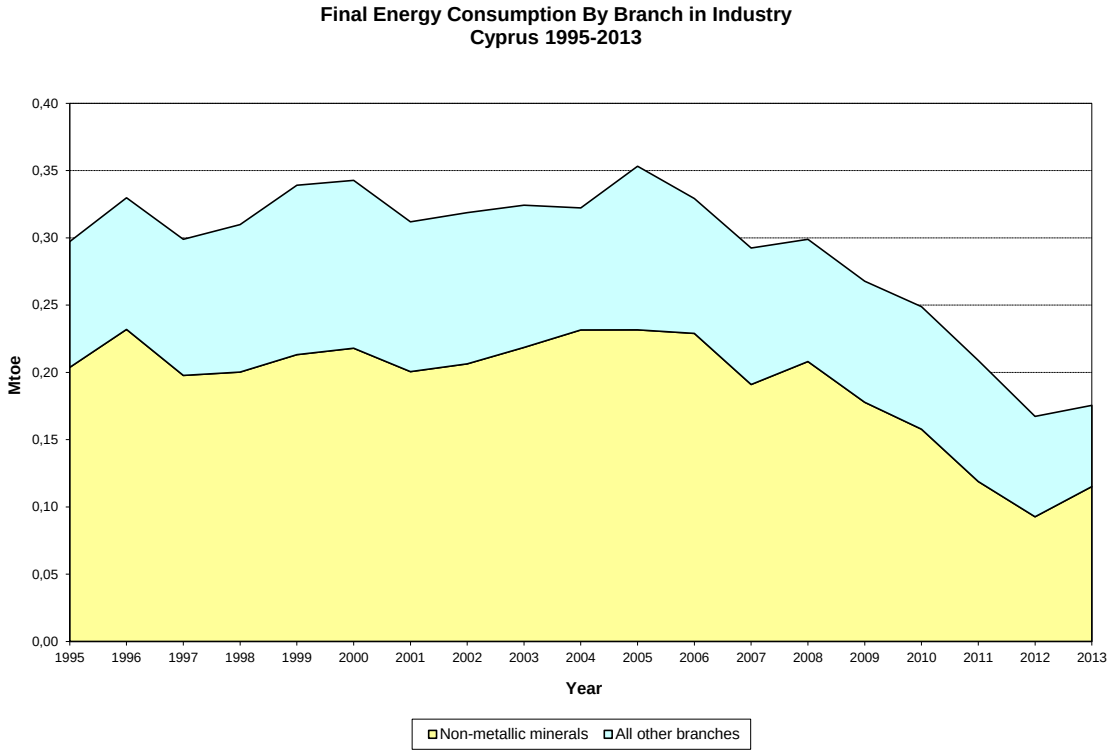



Figure 4.4: Energy consumption of the Cypriot industry by energy source.

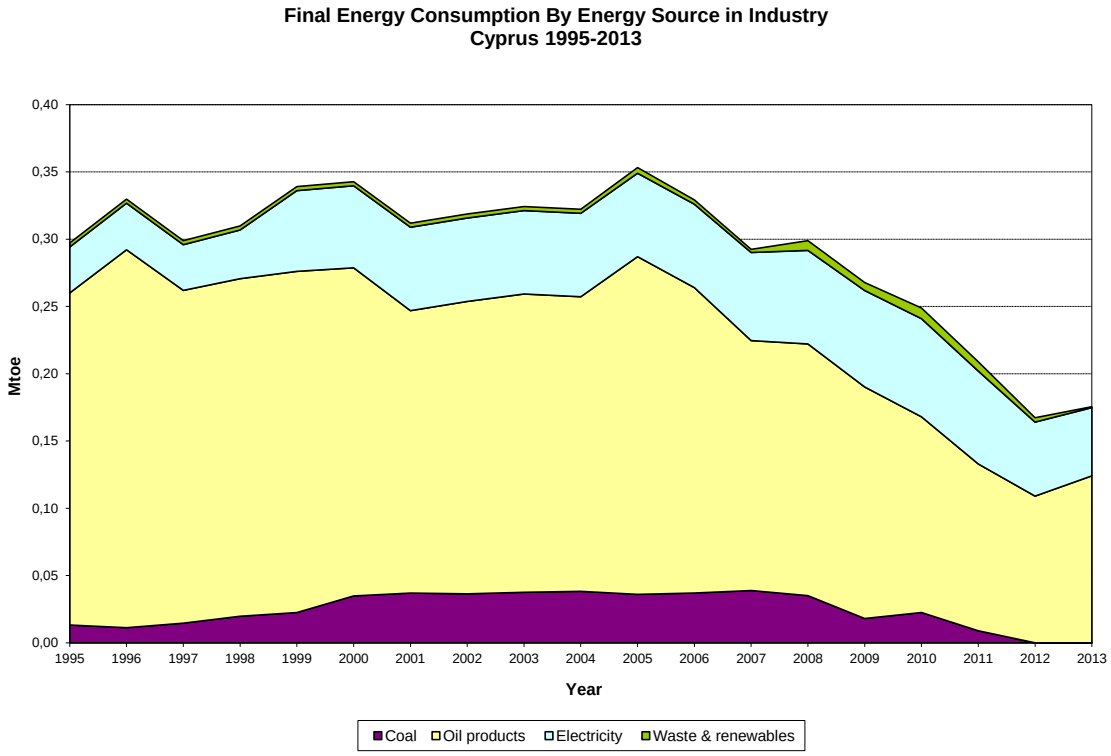


Figure 4.5: Shares of final energy consumption in the Cypriot industry by energy source.

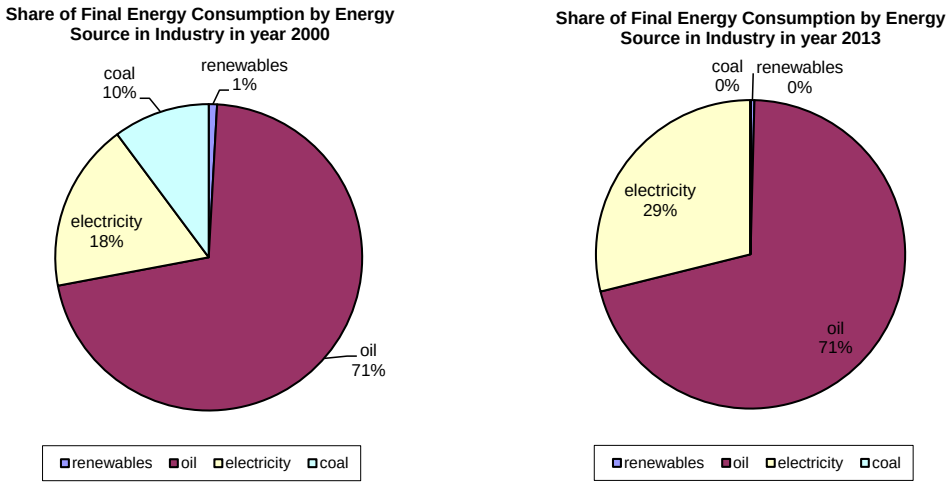
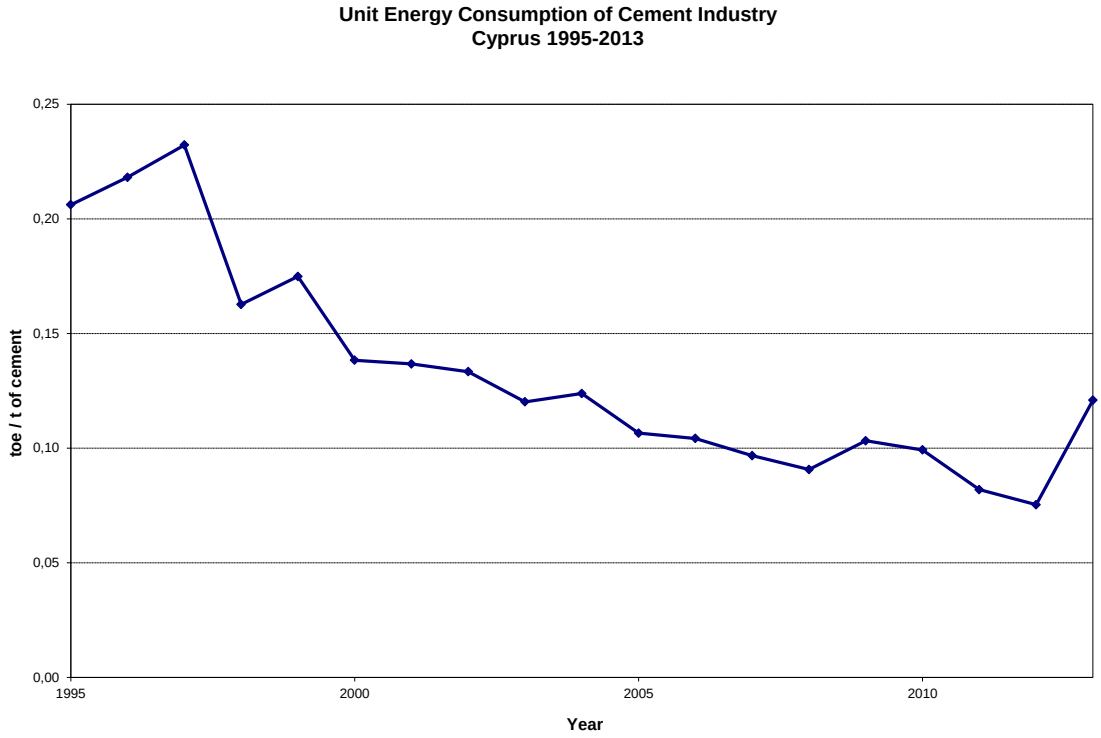



Figure 4.6: Evolution of unit energy consumption in the cement industry.




## 4.2. ENERGY EFFICIENCY POLICIES

An explicit national action plan for improving energy efficiency and/or reducing greenhouse gas emissions in industry has not been implemented up to now.

Legislation for the promotion of combined heat and power has been adopted in conformity with the relevant EU Directive. An action plan to exploit the 200 MWe potential mainly from industry and to a

lesser extent in the commercial building sector has been in place. A financial support scheme is in place providing grants for the investment and also a feed-in tariff system.

A governmental support scheme for energy efficiency investments in industry has also been implemented, including grants of 30% of the investment cost in energy saving technologies.

Training seminars on energy management and renewable energy are held on an annual basis, in cooperation with the Human Resources Development Authority of Cyprus (HRDA), the Productivity Centre and the Energy Ministry. Four (4) seminars were held in 2013. The seminars were addressed to unemployed engineers of all specialties and focused, inter alia, on issues related to energy saving and energy efficiency improvement technologies/systems, ways of operation, selection of an appropriate system and applications in Cyprus (industry, hotels, services, etc.). In addition, examples for drawing up a technical-financial study for the installation of energy-saving systems were presented.

Furthermore, information days were held in main cities addressed mainly to engineers who are members of the Cyprus Scientific and Technical Chamber (ETEK), the Cyprus Employers and Industrialists Federation (OEB), the Cyprus Chamber of Commerce and Industry (KEBE), hotel owners, entrepreneurs, credit institutions, municipalities and communities, contractors and the general public. Information days focused on energy audits, the energy efficiency of buildings, energy labelling, energy-saving technologies used for heating and cooling purposes.

In recent years, the Cyprus Employers and Industrialists Federation (OEB) holds an annual fair called 'Save Energy'. Printed information material on the different energy-saving and renewable energy technologies is distributed at the fairs. In addition, information is provided to the general public with regard to the provisions of the grant schemes. The most efficient energy-saving investments made by natural or legal persons under the grant scheme of the Special Fund for RES and ES are rewarded at the fair.

Within 2013, the Energy Department has approved training institutes to carry out training programmes for energy auditors. Category A relates to all buildings regardless of their surface and air conditioning system and includes, inter alia, ports, airports and street lighting. Category B relates to industrial facilities, as well as agricultural activities and installations. The first category B energy auditors are expected to be entered in the relevant registry within 2014. The first energy auditors have been included in the registry of Category A energy auditors in 2013.

In addition, the 3rd NEEAP of Cyprus establishes, as a measure to achieve the target under Article 7, co- financing for conducting energy audits in industries and for the implementation of the energy-saving investments proposed by the energy audit. The measure will apply to approximately 10 industrial plants per year.

With regard to energy savings for measures implemented in the Industrial Sector in recent years, the following table illustrates estimated energy savings for years 2012, 2016 and 2020 in end use and primary use.

| | Implementation Period | End use | | | Primary Use | | |
|---|---|---|---|---|---|---|---|
| | | 2012 TOE | 2016 TOE | 2020 TOE | 2012 TOE | 2016 TOE | 2020 TOE |
| 1 | **2004-2013** | 2,922 | 2,722 | x | x | x | x |
| 2 | **2010-2013** | x | x | x | 649.72 | x | 650 |

In addition, estimated energy savings from the implementation of the measures of the 3rd NEEAP, in relation to energy audits and the implementation of energy-saving investments proposed by these energy audits, are expected to amount to 1,650 toe in 2016 and to 3,850 toe in 2020.

## REFERENCES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