ENERGY EFFICIENCY POLICIES AND MEASURES IN HUNGARY

Monitoring of EU-level and national energy efficiency objectives

National Environmental Protection and Energy Center Nonprofit Ltd.

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Written by: dr. László Elek
Szommed Bt.
Tel.: 36-1-204-36-82
E-mail: laszlo.dr.elek@gmail.com

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1.) Executive summary

In 2010 the primary energy consumption of Hungary was 25,85 Mtoe, which is a 4% drop compared to the level in 1991.
In 2010 the final energy consumption of Hungary was 16,52 Mtoe, which is a 13,4%-drop compared to the level in 1990.
By 2010 the industry's share in the total final consumption had dropped from 34,2 % (level of 1990) to 17,4 %. Following the regime change, production fell substantially in several energy-intensive industries, whereas in the machinery and transport equipment industry production rose dramatically. This induced important changes in the structure of the industry. In the manufacturing industry the structural effect was pronounced between 1992 and 2000, while one could witness a slight decline between 2000 and 2010.
By 2010 the share of transport in the total final consumption had increased from 15,8% (level of 1990) to 26 %. This growth is explained by the solid growth in car traffic and a robust upswing in freight transport. Since 2008 due to the economic crisis car traffic has been on the decline, while there has been a stagnancy in freight transport. Since 2008 a slump in the car stock and in the average annual mileage could have been witnessed. In freight transport performance indices have been stagnating, annual mileages have decreased.
By 2010 the share of households in the total final consumption had increased from 33,1% (level of 1990) to 34,8%. The final energy consumption of the household sector shrank by an annual 0.5 % on average, yet due to the change in the weighting of other end-user sectors, the share of the household sector has increased in proportionate terms. By 2010 space heating per m2 had risen to 12.8 koe/m2 from 11.9 koe/m2 (1990). The worsening of heating per m2 ratio is in contrast to European trends. The reasons for this are the breaking up of households which translates into higher unit consumption figures and the steadily low rate of renovation of old dwellings. Between 2006 and 2010 in parallel with the elimination of price subsidies for natural gas destined for household consumption, the climatically corrected household unit consumption slightly decreased.
By 2010 the share of the tertiary within total final consumption had risen from 11% (1990) to 18.9%. Due to the constant increase of business services final consumption had risen until 2005. As a consequence of the government's austerity measures in 2006 (merging of schools, hospital closures) the level of final consumption dropped but by 2010 it had virtually attained the level of 2005.
In 2010 natural gas had the largest share (36.7%) in the fuel mix. The consumption of natural gas is predominant in the households and in the tertiary sector for the space heating of premises, yet it also has a major role in the power plant industry as a fuel. Natural gas means an efficient and controllable way of space heating, nevertheless its major use raises supply problems as 82% of the natural gas consumption is from imported sources, hence its widespread use increases energy dependency.
The second most important fuels in the fuel mix are oil products with a 28.7% share. 70% of the oil products are used in the transport sector predominantly in the form of diesel oil and petrol. There has been a major setback in the need for oil from the industry's side, while boilers burning oil have virtually disappeared from households.
The third most important player of the fuel mix is electricity with a share of 17.8%. Electricity is more and more penetrating the industrial processes thanks to the ever-growing use of process characteristic measurements and the growing ability to control industrial processes. In the household sector electricity consumption had been on the increase until 2003, while it has been stagnating ever since. Household consumers are price sensitive to hikes in electricity prices.

Primary intensity fell by an annual 2.37% on average between 1991 and 2010.
There has been a substantial structural change in electricity production. In 1991 gross electricity production was comprised of nuclear energy (46.6%), natural gas (16.6%) and coal (26.6%). In

2010 gross electricity production was comprised of nuclear energy (42.2%), natural gas (31%), coal (17%) and renewable energies such as biomass, wind, water (8.5%). Capacity enhancements of natural gases were executed mostly via 65-70% efficiency CHP investments.
The composition of electricity production has been reoriented for the use of higher efficiency production methods.

Final intensity dropped by an annual 2.62% on average between 1991 and 2010.
Final industrial intensity dropped by an annual 5.8% on average including the rather substantial changes in manufacturing industry.
Transport intensity for total GDP rose by an annual 0.3% on average, the intensity of the tertiary sector dropped by an annual 0.3% on average.

The ODEX energy efficiency index improved by 17% between 1998 and 2010.
Industrial energy efficiency improved by 40.3%. Energy efficiency improved in all industry sectors. Energy intensity improved by 9.4% in machinery and fabricated metals industry , while the intensity in manufacturing industry improved by 5.8%. The improvement of industrial intensities does not include the shift towards less energy intensive structure. The share of machinery industry and transport vehicle manufacturing rose from 33% to 64.4%.
The energy efficiency of transport fell by 11.3 % between 1998 and 2010. The energy efficiency of cars improved to only a small degree, while that of trucks and vans improved moderately.
A significant shift could be experienced from railway traffic to road traffic in the case of freight transport. In passenger transport the car stock and the annual mileages had been on the increase up to 2009 but they have been declining ever since.
Household energy efficiency improved by 4% between 1998 and 2010. Between 1990 and 1998 substantial shifts occurred in terms of fuel consumption. The share of natural gas grew from 25% (1990) to 54.2% (1998). The substantial shift in fuel choices was underpinned by the subsidization of household's natural gas prices. Heating per m2 rose from 11,9 koe/m2 to 12,8 koe/m2-re between 1998 and 2010 i.e.: by an annual rate of 0.6% on average. Due to demographic reasons the average size of household shrank continuously, furthermore the renovation rate of old houses remained constantly low.
Sector and macro-level energy savings can be directly derived from the ODEX energy efficiency index.
Based on this calculation in the manufacturing industry 1.6 Mtoe, in the transport sector 0.6 Mtoe, while in the household sector 0.6Mtoe energy saving could be experienced between 1998 and 2010. This means a 2.8 Mtoe energy saving at national level.

2.) Key messages

- Final consumption fell from 19.1 Mtoe to 16.5 Mtoe between 1990 and 2010, which is a 13.6% drop in 20 years.
- The share of industry in total consumption dropped from 34.2% to 17.4% between 1990 and 2010.
- Few years after the regime change machinery- and transport equipment industry became significant manufacturing industries as several multinational companies settled some of their production phases in Hungary.
- The share of transport within the total final consumption rose from 15.8% to 26% from 1990 to 2010 mainly due to the significant increase in the unit consumption of cars.
- The share of buildings (household and tertiary sector) within the total final consumption was 53.7% in 2010 which was the highest in EU-27.
- The drop in final energy intensity for the entire country was an annual 2.87% on average between 1992 and 2000, while between 2000 and 2010 it was an annual 1.66% on average.
- The share of structural impact in the drop in final intensity was 26.1% between 1992 and 2000 which diminished to 19.9% between 2000 and 2010.
- Transition towards less energy intensive consumption structures continued in the first decade of the millenium, yet at a slower pace than previously.
- The engines of industrial development were machinery and transport equipment industries which attracted significant operating capitals exploiting well-trained and relatively cheap labour force.
- Car stock and annual average mileage increased in the passenger transport. Even rising oil prices on the international front could not stop the growing use of domestic cars.
- Freight transport shifted significantly from railway to road as multinational companies prefer road transport to rail transport due to its higher flexibility and lower volume independence.
- The climatically corrected household consumption by m2 was 19.5koe/m2 in 1990 which dropped to 11.9 koe/m2 in 1998 and then increased to 12.8 koe/m2 in 2010. Between 1990 and 1998 the shift towards natural gas was significant in the household sector, between 1998 and 2006 fuel shifts in the household sector abated and due to the breaking up of households attributable to demographic reasons an increase in consumption could be experienced, while between 2006 and 2010 due to the elimination of price subsidies for natural gas, consumption was on the decline promoting the consumption of alternative fuels.
- In Hungary total CO2 emissions dropped by 28% between 1990 and 2010. This drop in CO2 emission is attributable to the demise of socialist large-scale industries, to the pre-eminent role of machinery- and transport equipment industry in manufacturing and the rising role of natural gas as the primary energy commodity.

3.) The economic and legal background of energy efficiency

3a) General economic relationships

The regime change encompassed those institutional changes which were indispensable for the establishment of the free market. The most important changes in terms of the economy were the transformation of markets, privatisation and economic opening.

Transformation of markets: elimination of authoritative, central planning system, liberalisation of prices and wages, elimination of comprehensive, individual price subsidy and product curtailment system.

Privatisation: privatisation of a significant part of state property, legal regulation of the operation of the various companies, guarantee of property rights

Economic opening: liberalisation of external trade, paving the way towards currency convertibility, establishment of the legal and economic conditions for the involvement of foreign operating capital

Rewriting of the rules governing the activities of the government and the municipalities, transformation of the relationship between ministries and companies, transformation of the characteristics of administration

Right after the regime change severe economic recession hit the country, the GDP level had fallen sharply until 1993. Following the elimination of the central planning system, it turned out that many people abandoned buying certain products mainly due to the liberalisation of import. The previous obligation of concluding contracts was eliminated, many companies chose to import from Western Europe instead of precarious manufacturing.

Being a small and open economy, the adverse effects of the economic crisis in 2009 were more accentuated in Hungary compared to other parts of Europe. As a consequence of the crisis GDP fell by 6.3% in 2009 and despite a 1.3% growth in 2010 it did not attain the level before the crisis. The most severe impact was sustained by the industry as it recorded a 19% regression in GDP in 2009, nonetheless the crisis took its toll on the tertiary sector as well.

Between 1991 and 2010 the average economic growth was 2.1%. During the transition period following the change of regime there were three recession years 1991, 1992 and 1993, furthermore 2009 (the year of the crisis), when GDP contracted.
The engine of growth was industrial growth where the average growth rate of GDP at constant price level was 2.8% between 1991 and 2010.
In the same period the average growth of GDP was 1.5% at constant price level in the tertiary sector, while in the agriculture a 0.4% annual decline was registered at constant price level.
The annual average growth of household private consumption was 1.3% which was below the 2.1% GDP growth on average.

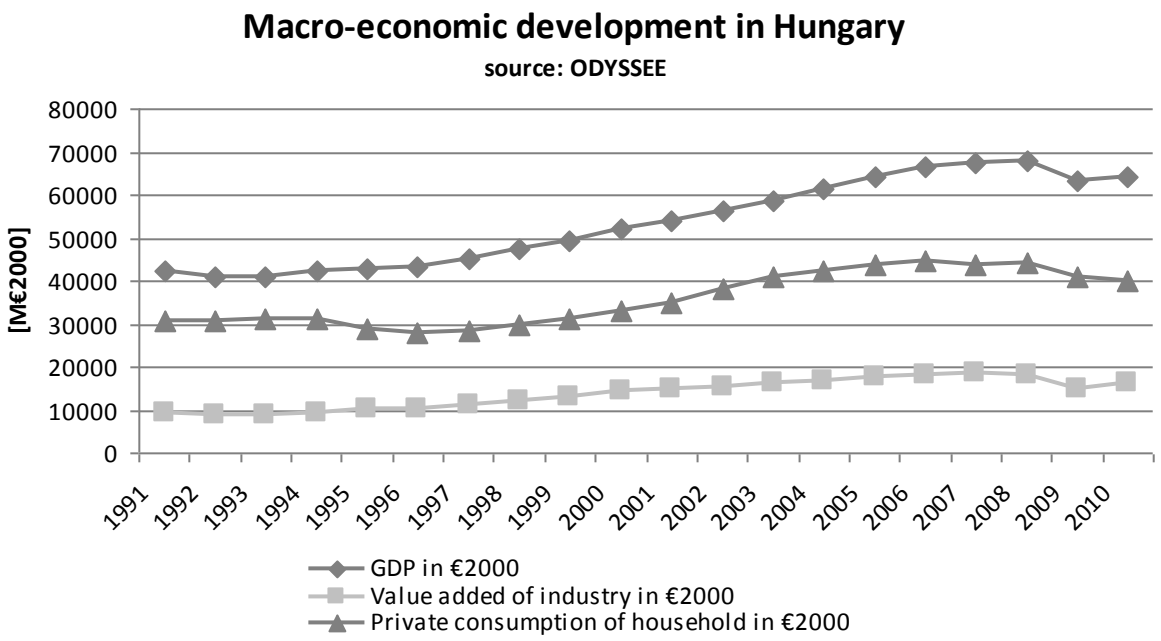

Figure 1

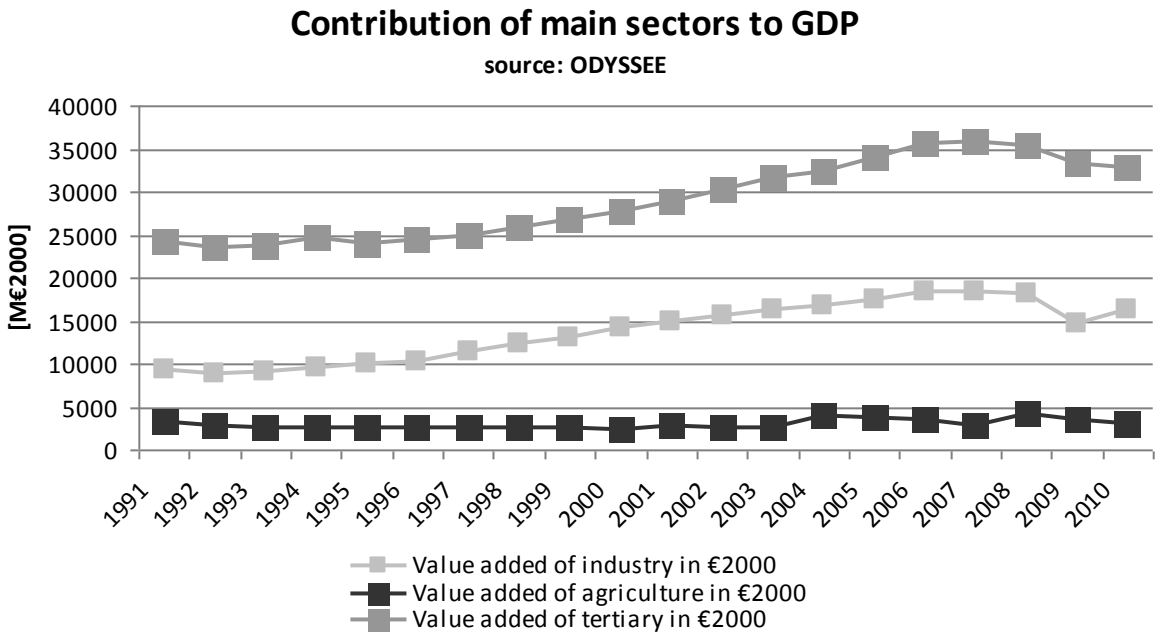

Figure 2

In a slight contrast to international tendencies, the structural change of the economy of the analysed 20 years can be described by the industry's increasing share as a result of massive investment of foreign operating capital, while the share of services dwindled. In the crisis year of 2009 the share of the industry fell.

The energy sector was entirely privatised in 1995-1996 by Western European investors. As a result of privatisation, well-organized energy companies were established well-endowed with capital, being able to make good use of business experiences. Currently, in order to ensure the firm vindication of domestic interests, the repurchasing of some of the flagship companies of the energy sector is on the agenda so that the state can somehow influence the decision-making of the companies in the energy sector.

Agriculture's share of wealth generation fell from 7.6% to 4.6% of GDP between 1991 and 2010 measured at constant prices. The required developments are aided by several state funds channeling EU grants, yet the lack of capital is significant. In agriculture many people use agricultural machines which were depreciated to zero.

The engine of industrial development was foreign capital investment as during the analysed period besides the privatisation of state property significant greenfield investments were implemented.
In manufacturing the development of machinery and the transport equipment industries were key issues. Before the regime change the machinery and transport equipment industries were mainly focused on exports to the Soviet market, only few products could fulfil the requirements of the world market. At the time of the regime change the traditional Soviet markets collapsed.
Within a few years machinery and the transport equipment industries became key industries as many multinational companies established a part of their production phases in Hungary making use of cheap and qualified labour force. On the other hand the settlement of the various production phases in different countries substantially increased the transportation needs.
Multinational companies dominating the economy preferred transportation on road to railway transportation in freight transport due to its higher flexibility and insensibility to volume. This factor generates the growth of energy needs for freight transport.

3b) Trends of energy consumption by fuel types and final consumption sectors

Total final consumption shrank from 19.1 Mtoe to 16.5 Mtoe between 1990 and 2010 which is a 13.6% drop in 20 years.
Due to the transformation of the economy induced by the regime change total final consumption dropped by 17% between 1990 and 1992, then increased by 0.2% on average between 1992 and 2010.
During the analysed period between 1990 and 2010 final consumption diminished by an annual 0.7% on average.
In industry final consumption dwindled by an annual 4.0% on average. Following the regime change production declined significantly in several energy intensive industries, while in less energy intensive industries production gained significant momentum. Consequently there were firm structural changes between 1992 and 2000 which somehow dampened between 2000 and 2010.

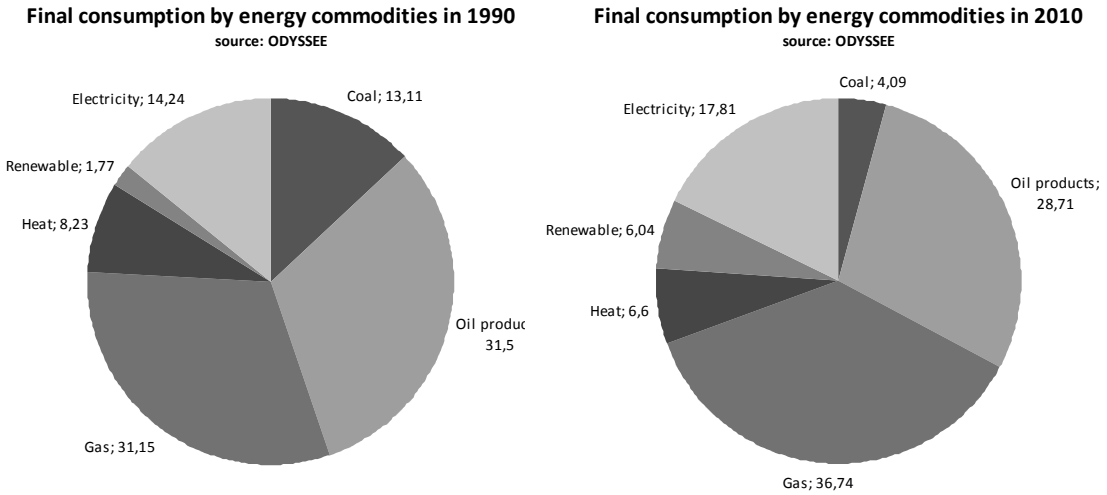

Figure 3

The share of industry within total find consumption fell from 34.2% to 17.4% between 1990 and 2010. Among the various sectors, industry sustained the greatest annual average decline (-4.0%), the scale of the decline was less in the household sector (-0.5%), while the tertiary sector and the transport sector recorded 2.0% and 1.8% growth respectively.
The share of transport in total final consumption increased from 15.8% to 26% from 1990 to 2010 primarily due to the substantial increase in the consumption of cars in passenger transport.
In transport despite the growth in its share in total final consumption has been decreasing since 2008. This is attributable in passenger transport to diminishing family incomes which was translated into diminishing car stock and average annual mileages, while in freight transport the transport demands were stagnated. This is presumably a temporary phenomenon in the sense that traffic final consumption will start to grow again once the impacts of the economic crisis have faded away.

The share of the household sector in total final consumption grew from 33.1% to 34.8% from 1990 to 2010. The final energy consumption of the household sector diminished by an annual 0.5% on average, yet due to the restructuring of the share of the various sectors, the share of the household sector increased. The strengthening of thermal regulation's standards for new dwellings in 1994 and 2007 had a positive impact on consumption which reduced per unit consumption by 15% respectively.
Space heating per m2 increased from 11.9koe/m2 to 12.8 koe/m2 between 1998 and 2010. The worsening of the per unit space heating figures is in contrast to European household's tendencies for space heating.
The reason for this is the continuous fall in average household sizes due to demographic reasons coupled with the constantly low rate of renovation of old dwellings. In the last 4-5 years the price of household's natural gas reached 90% of the average European natural gas price. In parallel with the increase of household's natural gas prices, natural gas consumption in the lower income decile dwindled as in these income categories more and more people heat with biomass (maily firewood) instead of natural gas.

The share of the tertiary within total final consumption grew from 11% to 18.9% between 1990 and 2010. Up until 2005 ground spaces had grown continuosuly in the tertiary sector, in parallel with this final consumption grew drastically. As a consequence of the government's austerity measures in 2006 (merging of schools, hospital closures, rationalisations at municipality level) the level of final consumption dropped but by 2010 it had virtually attained the level of 2005. Shopping malls and bank branches had saturated by 2010.

The aggregated consumption of the household and tertiary sector, its share within the end consumption of buildings was 53.7% in 2010, the highest in EU-27. In 2010 the average EU-27 consumption for buildings was 41% of the total final consumption which shows that the Hungarian building has a significantly higher consumption than the European average for building.

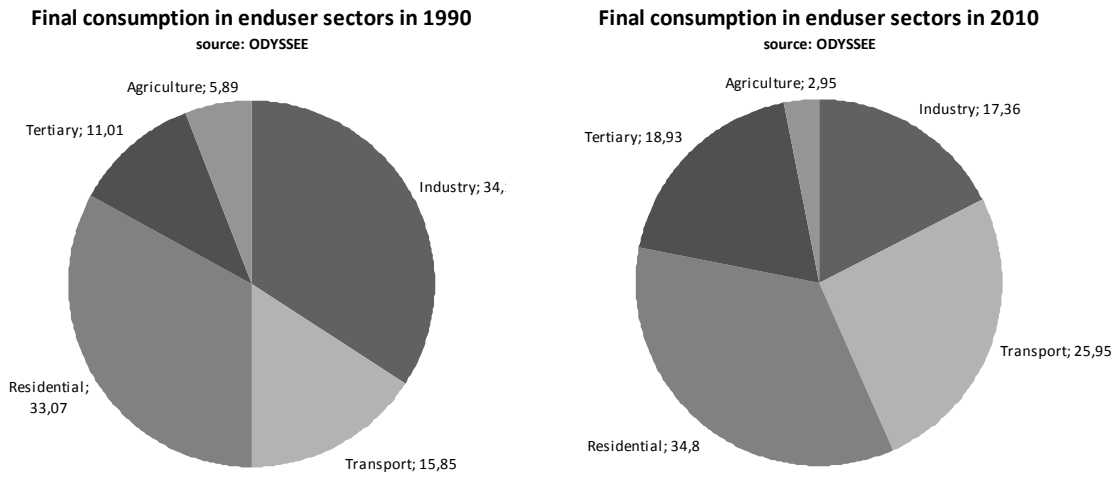

Figure 4

As for the composition of final consumption by fuels: the use of oil and oil products fell from 31.5% to 28.7% between 1990 and 2010. Demand for oil from the industry's side has abated significantly. In the transport sector demands for diesel oil have increased significantly both in passenger and freight transport. In the household sector the use of fuel oil (which was still in use in 1990) was abandoned. In the energy sector the use of heavy fuel oil is also very rare.

The share of natural gas grew from 31.2% to 36.7% from 1990 to 2010. It is predominantly used in the household, tertiary and energy sectors. Natural gas has a major role in household and tertiary sector for space heating. This meant the establishment of highly efficient boilers using natural gas which translates into more efficient space heating which is easier to be regulated.
On the other hand the safety stocks were not prepared for the large-scale penetration of natural gas, thus the construction of reservoirs became necessary so that the existing safety stocks sufficient for 30-35 days can be accessed.

The share of renewable energy in the final consumption grew from 1.8% to 6% between 1990 and 2010. In the context of Hungary the use of renewable energy predominantly means biomass.
Yet, it should be borne in mind that the energy balance only records commercial use, this can be corrected with the estimated use of renewables. According to the study conducted by CSO on Household Energy Consumption published in 2009, household biomass consumption is six times as much as indicated in the energy balance. (The registration of data by CSO records household biomass consumption based on uncontrolled self-declaration which is overestimation from statistical point of view).
The commitment to attain 14.6% by 2020 is for the consumption of primary energy and cannot be directly compared with the share of renewables for final consumption.

The share of electricity in final consumption grew from 14.2% to 17.9% between 1990 and 2010. Demands for electricity have increased in every sector. In the past three years household electricity demands decreased to a small extent, small-scale savings were recorded as a result of the substantial increase in household energy prices. Due to the increasing industrial electrification, industrial electricity demands are on the rise which is linked to the ever growing controllability of industrial processes and the increase in the demands for measurements.

The share of coal in final consumption fell from 13.2% to 4.2% between 1990 and 2010. Demands for coal have dropped significantly in all sectors. Its use for heating purposes has significantly dwindled in the household and tertiary sectors. Demands from the industry have substantially decreased too, yet in the case of certain industrial processes it is still in use.

3c) The energy policy background of energy efficiency

In the past 13 years the work was very intensive regarding the drafting of the energy efficiency and climate protection strategies. These measures aim to reduce greenhouse gas emissions and to mitigate the impacts of climate change.
The following strategic documents are considered as the most important milestones:

- Strategy for the enhancement of energy efficiency 1999
- Promotion of small and medium CHP 2002
- Energy tax for natural gas and electricity 2003
- Act on the trading of greenhouse gas emission units 2005
- Strategy to enhance the use of renewable energy sources in Hungary 2007
- Hungary's National Action Plan for Energy Efficiency 2008
- National Strategy for Climate Change 2008
- National Action Plan for Renewable Energies 2010
- 2nd National Action Plan for Energy Efficiency 2011
- National Energy Strategy 2030 2012

1999 **1107/1999. Strategy to enhance energy efficiency by 2010**
- reducing energy intensity 3,5%/year
- 75 PJ/year saving in primary energy
- 5 Mt/year reduction in CO2 emission
- increasing the use of renewable energies from an annual 28 PJ to 50PJ

The related Action Plan lists 15 concrete actions for energy efficiency :
- improvement of the energy management of municipalities
- improvement of the efficiency of industrial energy use
- modernisation of transport
- financial grant for the promotion of household's energy savings
- promotion of the penetration of renewable energies
- renewal of district heating

2002 **Promotion of the establishment of small and medium CHPs**
- the use of CHP means energy saving compared to the separately produced electricity and heat generation
- the use of CHP promotes supply safety and contributes to the diversification of the fuel mix
- CHP is a cost-effective solution:
  - The loss of the electric network is reduced
  - CHP increases competition between producers as it increases the choice offered to consumers
  - The use of CHP is economical if the electricity ratio is low
  - Electricity generated by CHP has to be taken over at a mandatory takeover price (basic decree 56/2002)
  - The rate system prescribes minimum energy efficiency for the CHPs

2003 **Energy tax for natural gas and electricity** (Government Decree 138/2003)
The energy tax is levied on non-household consumers

Its fundamental concept is to make fossil energy sources expensive and to render the renewables more competitive

The energy tax should be paid:

- based on the consumption of natural gas and electricity supplied by the energy supplier, household consumers being exempted
- based on the quantity of natural gas and electricity sold to the consumers licenced by the energy supplier, household consumers being exempted
- if the licensed consumer buys natural gas or electricity from other member states of the EU, except for purchase by household consumer
- if the licensed consumer buys natural gas or electricity from a non-EU state, except for purchase by household consumer

The tax base is:

- the quantity of electricity measured in MWh
- the quantity of natural gas measured in GJ

The amount of the tax:

- for electricity 252Ft/MWh
- for natural gas 76,50Ft/GJ

2005 **Act on the trading of greenhouse gas emission units** (Government Decree 15/2005.)

In accordance with directive 2003/87/EC combustion installations exceeding 20MW may be used for CO2 emitting operations only in case the relevant licence has been issued. 229 businesses from the energy-intensive sectors participate in the trade system of EU emission.

The act on the Hungarian implementation of the trading system of greenhouse gas emissions was promulgated in 2005. In spring 2006 the National Allocation Plan and List containing the sector limits and the institutional allocations was issued.

By 2005 the Ministry of Environment and Water Protection had allocated 30.2 million quotas in total of which 17 million in the electricity sector alone. Based on the data gathered so far it can be concluded that the state has substantially over allocated the emission units to the market players. The overallocation could occur as previously output data were not available to the authorities. Before the start of the system, the government had no choice but to use declarations made by the concerned companies and the companies-being afraid of the lack of quota in the future- tried to have the highest quota accepted by the state.

Similar situation occurred in several member states, thereby by 2007 the price of CO2 per tonne had dropped to 0,5-1 EUR from 30 EUR.

On 16 April 2007 the European Commission decided that the Hungarian Allocation Plan does not comply with the relevant EU directive from several aspects and lowered Hungary's quota by 4 million tonnes of CO2.

2007 **Strategy to enhance the use of renewable energy sources in Hungary**

The use of renewable energy sources can be quite comprehensive in Hungary. The most important area of application is heat consumption for heating. However electricity generation has also become quite substantial recently. EU assigns an important role to its use as fuel in the transport sector as well.

Renewables puts less load on the environment and facilitate employment in the agriculture.

The strategic document analyses the main trends of the use of renewables, electricity generation and heat generation based on renewable energy sources.

It enumerates the prospects for each energy source such as
- biomass
- biogas
- biofuels
- wind
- geothermal energy
- solar energy
- hydraulic energy

It analyses then state means of the incentives of renewables thoroughly including the subsidy of electricity generation based on renewables.

2008 **National Energy Efficiency Action Plan no. 1**

Energy Service Directive prescribes the introduction of cost effective energy efficiency measures by stipulating energy saving obligations.
The directive extends to every end-use sector (households, tertiary sector, non-energy intensive industry, transportation and agriculture).
The energy saving to be achieved is 9 percent in 9 years on the basis of five-year uncorrected final energy consumption.
Every energy efficiency measure must be capable of verification, measurement or estimation.

The objectives involve the most important sectors:
- building stock of household sector
- household appliances
- building stock of tertiary sector
- office equipment of tertiary sector
- transportation and conveyance
- non-energy intensive industry

The National Energy Efficiency Action Plan outlines the measures planned or in progress with the application of which annual 1 percent energy saving can be achieved calculated on the basis of five-year uncorrected final energy consumption.
The measures can be distributed in the following groups:
- existing measures
- measures requiring legislation
- measures requiring financial support

2008 National Climatic Change Strategy (NÉS)

According to NÉS the most important areas of the reduction of emission are as follows:
- increase of energy efficiency in the households and in the tertiary sector
- power plant efficiency enhancement, extension of combined heat and power generation
- enhancement of the spreading of renewable energy sources in the end use
- implementation of industrial energy rationalisation projects
- reconstruction of transport structure
- making public transport more attractive compared to individual transport
- development of combined transport on road & rail
- facilitation of carbon-dioxide adsorption by means of the forest plantation

Adaptation to climate is the task of the whole society.

The responsibility of climatic adaptation must be born not only by the state but also by the business sector, civil organisations and the population.

Households
Household consumers can do the most for changing the structure of consumption.
- economical household material and energy use (space heating, hot water and cooking)
- climate-aware household consumption

Transport
- repression of individual transport (prioritisation of public transport (trains, buses))
- diversion of road freight transport to rail
- development of combined transport on road & rail

Business sector
- saving of resources, material and energy with relation to own business operation
- use of energy efficient office equipment
- voluntary agreements with the interest group organisations of energy intensive industries for the reduction of energy consumption
- participation in awareness-raising programmes; cooperation with NGO's.

2010 National Renewable Action Plan

The National Renewable Action Plan published in December 2010 targets the achievement of 14.65 percent share of renewable energy sources compared to primary energy consumption. The Action Plan projects a renewable structure more diversified than it is today. The Action Plan calculates with surprisingly low proportion of electricity and surprisingly high proportion of heat energy in the scenarios outlined until 2020. However the significant growth of heat demand is not supported by the statistical data. The electricity demands shall increase faster than they are outlined in the Action Plan.

Electricity generation based on biomass is expected to fall as the result of the restructuring of Compulsory Takeover System (KÁT) which has an impact on the whole proportion of renewable energy sources. Until 2020 340 MW capacity is expected to be driven out of the electrical energy system causing a generation drop of 1800 GWh. As a result the Action Plan expects 3 to 5 years of run-up only after 2015. In case of solid biomass the Action Plan envisages run-up not only after 2015 but also sets a strong limit according to which only combined heat and power generation can be subsidised in untis above 10 MW. Electricity generation may not be subsidised in case of electricity producers above 20 MW. Regulation change means that biomass firing shall disappear in case of generation units above 20 MW thus improving the average efficiency of the electricity system.

The introduction of the new compulsory takeover system (METÁR) was planned by launching the implementation of the Renewable Action Plan. However the introduction of the new compulsory takeover system was postponed for a year due to the difficult situation of the budget and the necessity of keeping the household prices low.

In parallel with the reformation of the compulsory takeover system the district heating prices had to be regulated again. The district heating tariffs were regulated by the municipalities before 2011 under the supervision of the Hungarian Energy Office.
Act 126/2011 on the price regulation of district heating regulates the framework of subsidy of district heating sector and the relevant tasks of the Hungarian Energy Office. During the bargains between the district heating service providers and the producers the contract

concluded at a price higher than the established price is invalid; agreement under established price is possible by mutual consent.
Decree 50/2011 of the Ministry of National Development regulates the established prices dictated during the transactions between the district heat producers, district heat traders and district heat service providers. On the seller's side the district heat service provider's prices shall remain also unchanged on the previously blocked level for the domestic sector and the specially treated institutions. On the consumer's side the district hating provider pays performance tariff and heat tariff to the seller of the heat, however the vindication of other tariff items is not possible.
Decree 51/2011 of the Ministry of National Development regulates the subsidy of the district heating service providers. The decree aims at the prevention of the increasing of tariffs due to purchase from high cost combined heat and power producers and the increase of own costs. The system manager of electrical industry shall grant the subsidy to the district heat service providers from the normative subsidy of 1.2 HUF/kWh collected from electricity consumers.

2011 **National Energy Efficiency Action Plan no. 2**

The Energy Service Directive prescribes the introduction of cost efficient energy saving measures with the stipulation of energy saving obligations.
The objectives involve the most important branches:

- building stock of household sector
- household appliances
- building stock of tertiary sector
- office equipment of tertiary sector
- transportation and conveyance
- non-energy intensive industry

NEEAP II. explores enumeration problems regarding energy savings and elaborates measures for eliminating shortages.
In case of enumeration it breaks with the regular nomenclatures of energy statistics and elaborates new enumeration system for the branch. Therefore the TD-methods of European level worked out for the savings can be interpreted only with certain modifications.
NEEAP II. presents the calculation methods worked out for the evaluation of energy savings.
Enumeration system of energy savings:

- Energy savings in the household sector
- Energy savings in the public building sector
- Energy savings in the production sector (industry and agriculture)
- Energy savings in the transport sector
- Summary of the final savings

NEEAP II. lists the governmental officers in charge and governmental coordinators and the monitoring of implementation.

2012 **National Energy Strategy 2030**

Energy strategy material National Energy Strategy 2030 was uploaded to the website of the Ministry of National Development in February 2012. Major pillars of the issued energy strategy are: supply safety, sustainability and intensification of economy. The strategic

material manages employment creation and further development of national green industry with highlighted importance and points at the importance of the required technological developments that traces out the new areas for energy research & development and innovation. The document assesses the possible paths of energy development in a 20-year time horizon, takes the least-cost principle into consideration and endorses environmental aspects.

In order to fulfil the objectives the document outlines five highlighted efforts:

- enhancement of energy efficiency
- increase of the share of renewable energies
- integration of Middle European transmission network
- preservation of the current capacities of nuclear energy
- development of Hungarian coal and lignite resources in an environmental friendly way

A strong part of the strategic document is that it outlines the scope of action of the energy policy to be followed along a long-term concept avoiding the restriction by short-term budgetary constraints.

The document deals with the strengthening of the participation of the state with highlighted importance or with the reconstruction of state positions if necessary.

One of the major objectives of the document is to provide affordable energy supply for the consumers.

The formulated objective of the document is that the action plans of the various partial areas should be prepared and the regulation environment should be adapted to the objectives on the basis of the National Energy Strategy.

The document outlines the boundary conditions of national energy market to be established in the middle-term:

The competition for the energy sources is continuously increasing however this global impact can be reduced by the integration within the EU by means of the applied measures of solidarity.

The risks of the availability of energy sources are increasing on the long run and in case of liquid carbon hydrogen there may be unbalances even in the next 20 years.

The environmental regulations regarding energy consumption are getting gradually stricter making the exploitation and utilisation of various types of energy more and more expensive. Stricter environmental regulations result lower CO2 emission.

Electric technologies are becoming gradually more widespread in the industry due to the more and more demanded control of industrial processes and due to the application of more and more auxiliary equipment. Households use newer and newer electric appliances among which the proportion of low energy consumption is increasing. The office application is increasing in the tertiary sector together with the proportion of air conditioning.

As the result of the emissions the impacts of climatic change can already be observed. The frequency of extreme weather situations is increasing (e.g. extreme heat, frost, large rainfalls, floods) while the reliability of weather forecast is decreasing making economic planning more difficult and reducing the safety of agricultural production.

Future energy policy means the establishment of certain rationalised energy demand. The supply of energy market represented by energy infrastructures and energy services must be developed in parallel. The demand and supply ensures the availability of services in the same time together with prices affordable for the majority of the consumers. Making economy even greener has substantial latitude on the supply side which goes together with the reconstruction of the supply energy structure of which the impacts on employment creation are also significant.

National energy economy must be infiltrated in the uniform internal market of the European Union. Due to the valid system of the European directives special attention must be paid to the increase of energy efficiency and to the utilisation of renewable energies.
The reserves of fossil energy sources, biomass and geothermal potential mean national treasures thus they must be treated as strategic reserves.

For the energy sector and the energy consumers the business conditions shall be determined by the competition in the national and uniform EU markets for which the national regulatory environment supporting the enhancement of the competition must be ensured:

- Provision of transparent conditions free from discrimination for the market actors and consumers.
- Provision of attractive investment environment with long-term stable and effective regulation and with simplification of the necessary administration.

Competition must result a cost level acceptable for the economy within the energy sector. Competition may force energy market actors to operate more effectively.

Sustainable development must be established in such a way that it should satisfy its present needs without restricting future generation in being able to satisfy their own needs.
For the sake of sustainable energy management:

- The harmony between the environmental, social and economic dimensions of sustainability must be established.
- The moderation of energy consumption must be endeavoured.
- Required energy must be generated and transported in the most efficient way together with the fulfilment of the criteria of sustainability,
- Critical revision of the consumer habitudes is also necessary meaning the launch of consumer attitude management programmes.
- Low CO2 emission technologies must be supported.
- The fulfilment of the above conditions ensures sustainable development on the long run.

Hungary is an open, export oriented country poor in fossil energy sources thus it cannot endeavour to reach full energy independence.
Energy strategy outlines the possible tools of loosening energy dependence:

- Diversification of natural gas procurements (Nabucco line, Southern Stream, AGRI line, Adriatic liquefied natural gas terminal (LNG-terminal).

- Management of energy efficiency as national priority. (Reduction of energy consumption is the means of increasing supply safety.)
- Utilisation of renewable energy sources generated nationally and in a decentralised way (biomass, biogas, water, wind, geothermal energy and biofuels).
- Sustenance and extension of safe nuclear power generation in electricity generation (currently 42 percent of Hungary's electricity generation comes from nuclear energy).
- Utilisation of natural gas storage capacities (that are high even in international comparison) for the sake of the creation of natural gas supply safety.
- Utilisation of fossil energy sources for environmental friendly technologies.
- Connection to European energy infrastructure and European energy markets. (The objective is to increase price stability, diversification of resources and the increase of supply safety.)
- Energy Strategy assigns an important role to natural gas (power plant fuel, domestic and tertiary heating) and considers the available coal and lignite reserves as the strategic buffer of national energy. Coal and lignite reserves can be utilised even in crisis situation but it can be useful as strategic buffer in case of an unexpected natural gas price explosion.

Energy strategy outlines the Nuclear-Coal-Green scenario:

- Long-term sustenance of nuclear energy in the energy mix
- Keeping coal based energy production steady
- Linear extension of Renewable Action Plan after 2020 with relation to renewable energy sources (increase of the targeted proportion must be endeavoured in the function of economic load bearing capacity and in the function of the capability of system regulation)

Biannual revision of the Energy Strategy is also an important element even enabling the change of governmental preference in case of the fulfilment of the conditions of internal and external economic policy.

Energy Strategy aims at making the economic actors carbon conscious to be achieved with the increase of energy efficiency and the application of innovative technologies.
The carbon consciousness of energy generation is considered national priority that is thought to be achieved with the selection and support of alternatives that adapt to the local aptitudes the most. Thus the national supply safety is to be improved and the external impacts on the market prices are to be mitigated.

The following actions must be implemented during the change of the energy structure:

- Energy efficiency measures embracing the full supply and consumption chain.
- Increase of the share of low CO2 intensive electricity generation.
- Development of renewable-based heat generation.
- Development of energy efficient modes of transport (public transportion in towns, rail transportation, bus transportation).

It is identified as a fundamental problem by the Energy Strategy that almost 70 percent of the building stock dose not meet the up-to-date functional technical and thermal regulation requirements. As the consequence of the energy efficiency programmes implemented during the recent years the situation has improved a little nevertheless the household energy efficiency index is in the last position in the European rank.

Among the outlined energy efficiency programmes Energy Strategy envisages 30 percent reduction of the heating demands of the building stock by 2030. Reduction is intended to be achieved basically by means of building energy programmes. Besides required building energy modernisations, influencing of consumer attitude is of special importance as well in which each energy consumer group is intended to be involved including school education and adult education. Awareness raising requires information materials that point out possible energy saving options taken from the examples of everyday life.

4.) General evaluation of energy efficiency trends

4a) General trends of energy intensities

General trends

Energy intensity trends can be characterised with two indicators.
Primary intensity indicates the proportion of primary energy consumption to GDP.
Final intensity indicates the proportion of energy end consumption (industry, transport households, tertiary and agriculture) to GDP.
The final intensity decreased by 2.62 percent on average annually between 1991 and 2010; primary intensity decreased by 2.37 percent.
If the decrease of final intensity is quicker than that of primary intensity, it means that the restructuring of final utilisations was quicker than the restructuring of primary energy generation. Final intensity showed the fastest decrease in industry where a strong structural change took place in the nineties and a moderate one in the 2000's exerting influence on the development of the less energy intensive industrial sectors.

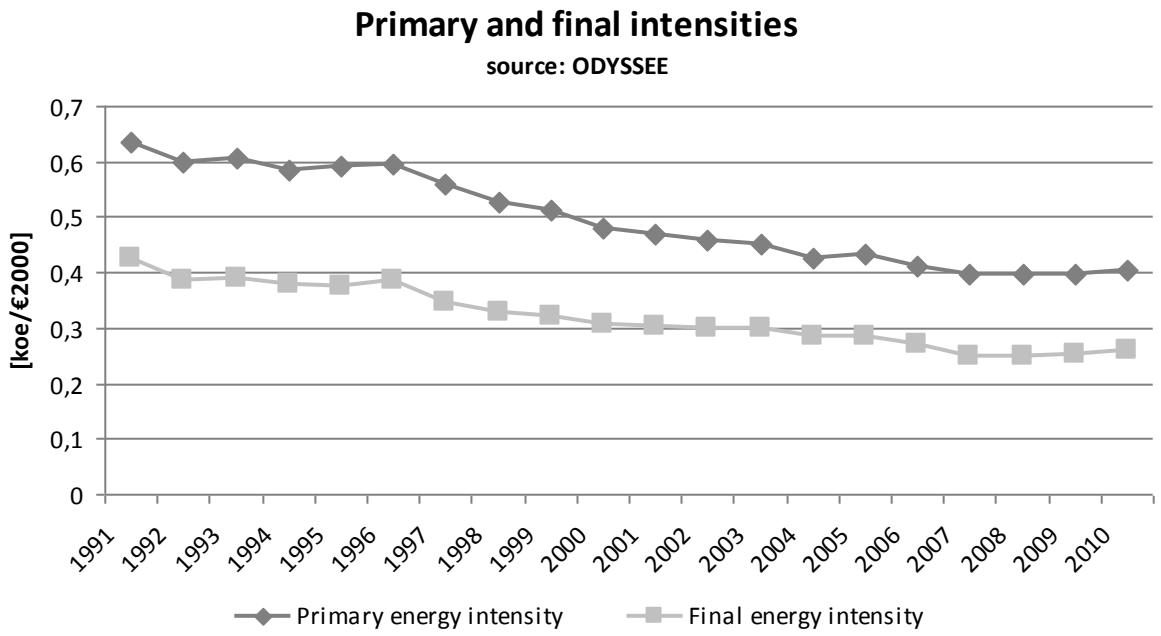

Figure 5

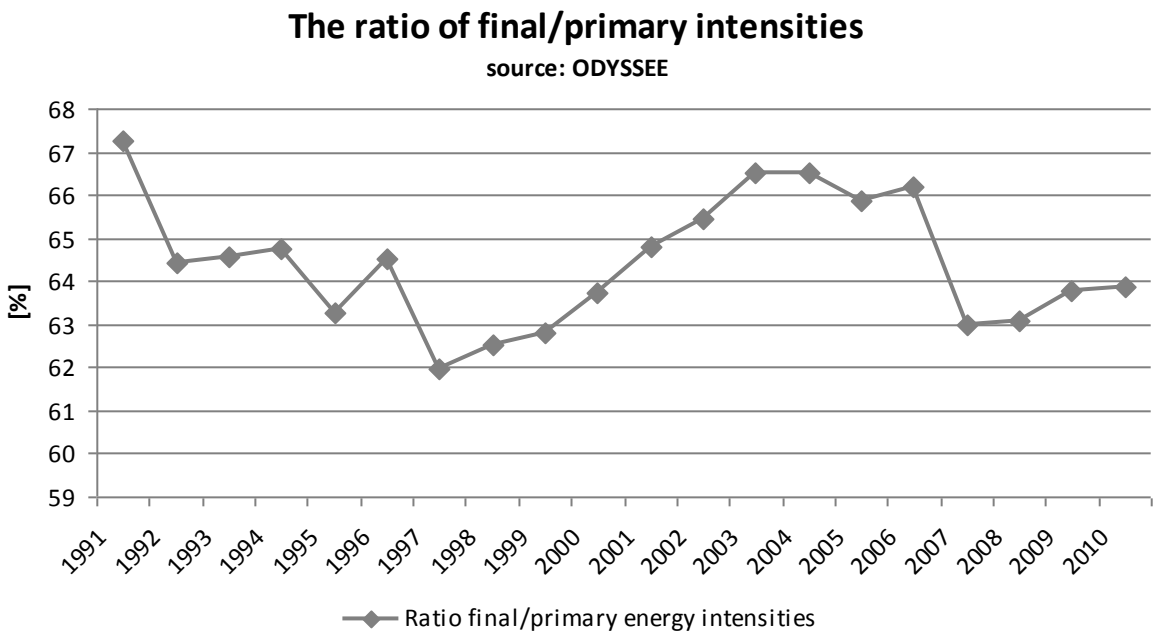

Figure 6

Primary intensity showed the quickest reduction between 1998 and 2002 since the compulsory and advantaged takeover price of electricity generated by CHP units was introduced in 1997.

The structure of electricity generation has undergone substantial change. In 1991 nuclear energy constituted 46.6 percent of gross electricity generation, natural gas gave 16.6 percent whereas coal constituted 26.6 percent. In 2010 gross electricity generation consisted of 42.2 percent nuclear energy, 31.0 percent natural gas, 17.0 percent coal and 8.5 percent renewable energy sources (biomass, wind, hydro). Conventional efficiency of the nuclear power plant is 33 percent.
The majority of natural gas fired capacity developments were implemented via CHP units of 65 to 70 percent efficiency.
The efficiency of coal fired power plants generating only electricity varies between 36 and 38.
The composition of the fuels of electricity generation has shifted towards higher efficiency generation.
Biomass has been present in the fuel mix since 2004. Biomass for electricity generation was used with 28 to 30 percent efficiency therefore deteriorating national average slightly.

Final intensity showed the quickest reduction between 1991 and 1994 when significant generation capacities were closed down in the energy intensive sector (metallurgical plants, chemical plants). Capacity developments in the machinery and vehicle industry have become more and more significant since the mid-nineties having an impact on the reduction of final intensity. Capacity developments in the less energy intensive branches continued in the 2000's with a pace more moderate than before.

The share of electricity within the total end use increased from 14.2 percent (in 1990) to 17.9 percent (in 2010).
The penetration of electricity into end use has a double impact:
- it reduces the increase of end use because replacement of fossil fuels with electricity constitutes energy saving on the level of the users.
- it increases the demand for electricity that increased conversion loss in the energy conversion sector.

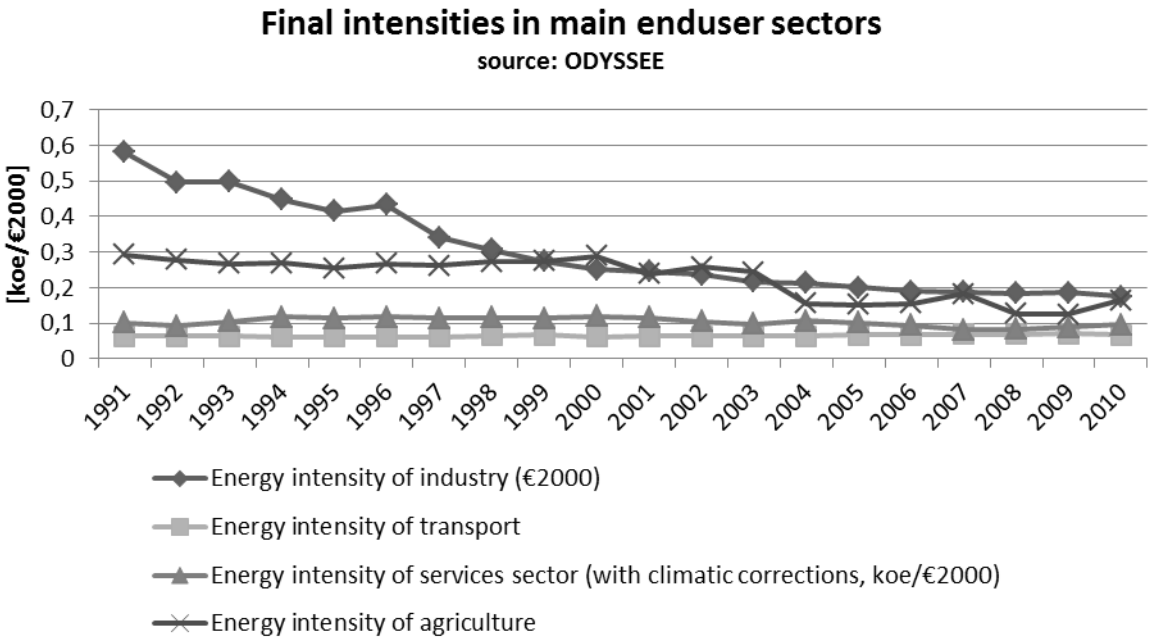

Figure 7

Analysing the development of final intensities for each branch it can be established that the various branches have gone through various paths of development.
Industrial intensity decreased by 5.8 percent on an annual average that constituted 69.7 percent reduction of intensity in the analysed 20 years, The reduction of the intensity of industry was stronger in the 90's but the reduction of intensity remained even in the 2000's. Slight increase of intensity was observed only in the crisis year of 2009.

Transport intensity is projected to total GDP because transport services serve the whole economy.
Transport intensity increased by 0.3 percent on annual average. Transport intensity stagnated until 1998 then started to increase slightly after that. The increase of the number, power and running performance of passenger cars was responsible for the increase of intensity. Regarding freight transport traffic shifted to transport on road from transport on rail.

The intensity of the tertiary was calculated with temperature correction because energy end use for space heating is dominant.
Tertiary intensity decreased by 0.3 percent. Substantial developments took place in the sub-branches providing services of business purposes (shopping malls, service centres, bank branches), while the proportion of deteriorated buildings for institutions of municipal ownership (schools, hospitals, sport centres) is still high. New developments with favourable energy indicators caused intensity reduction of the tertiary sector.

The intensity of agriculture strongly fluctuates in comparison with the other branches because the yield results of crop farming also show large fluctuation due to the weather.
The intensity of agriculture decreased by 2.8 percent annually showing moderate development of the equipment stock. Multinational companies are hardly found in the agriculture of Hungary. The majority of modernisation was implemented by national and European development funds. It is obvious that the development of agriculture is always behind that of the industry because foreign investors are less present here, but the European development funds still facilitate the development of agriculture and the retention of population in the country. As the result of the performed actions long-term reduction of intensity could be indicated.

Structural impact on the whole economy

Final intensity can be cleared from the impacts of the structural changes of the economy. Structural impact depends on the extent of restructuring of the economy.
Slight decrease of the proportion of tertiary sector, slight increase of the proportion of the industry and slight fluctuation of the agriculture could be observed in the Hungarian economy on the basis of value added at unchanged costs.
In the same time the value added at unchanged prices increased continuously in both the industrial and the tertiary sector between the regime change and the economic crisis in 2009. While industrial value added decreased by 19 percent in 2009 as the result of the economic crisis, the recession in the tertiary sector was only 6.1 percent. The industrial value added increased by 10.8 percent in 2010 while the value added decreased further by 1.1 percent in the tertiary sector. This phenomenon was caused by the fact that tertiary sector is far less exposed to the fluctuations of market orders. Though the performance of education and health does not decrease during the crisis, sub-branches of business purposes also show reduction of performance.
Energy intensity is reduced by the proportion reduction of tertiary sector and increased by the proportion increase of industry.
The extent of structural impact depends on the shifts between the branches.
Current final intensity and the final intensity calculated in the economic structure of 2000 must be calculated to filter out structural impact. The higher is the difference between the two kinds of final intensity the larger structural change is observed.

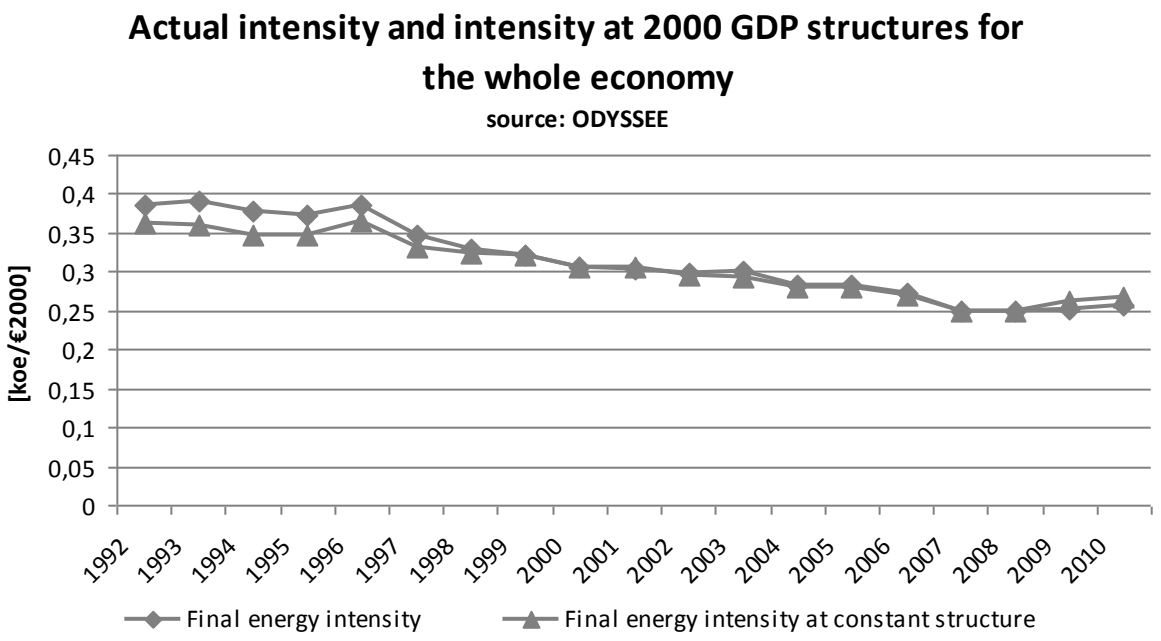

Figure 8

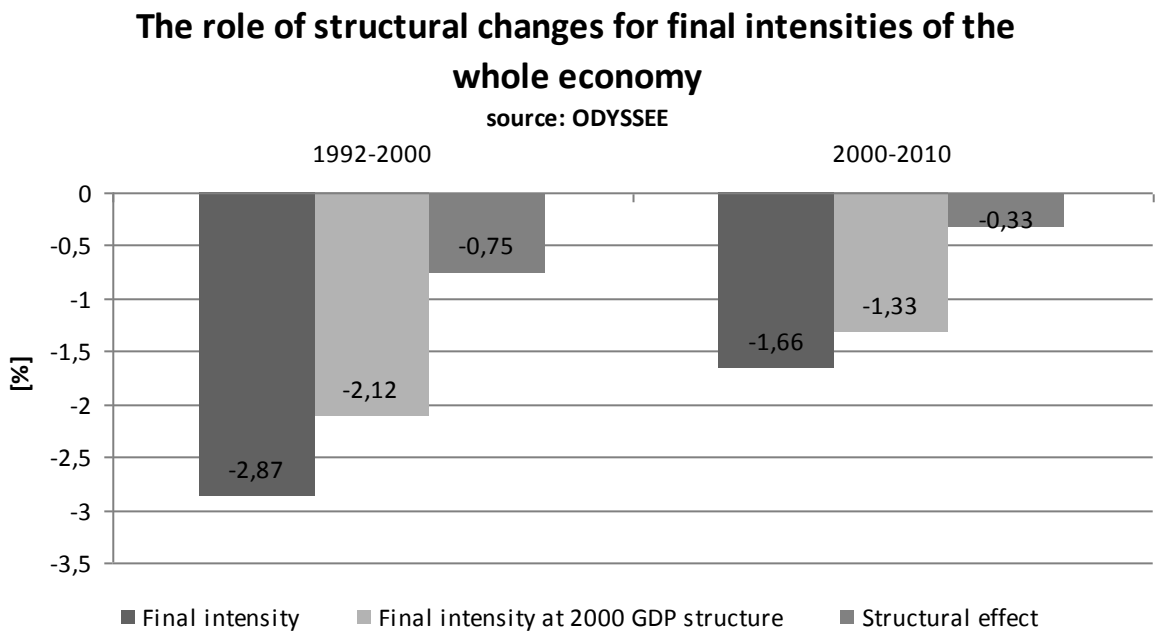

Figure 9

The average annual reduction of the final intensity was 2.87 percent between 1992 and 2000 while 1.66 percent between 2000 and 2010. The reduction of final intensity was determinant in the industry thanks to considerable deterioration of energy intensive industrial branches (primary metals and chemical industry) and the strong development of the less energy intensive branches (machinery, transport equipment). In parallel final intensity increased slightly in the transport sector due to the substantial increase of passenger car transport and freight transport on road whereas it decreased slightly in the tertiary sector due to the spawning shopping malls and business services. The proportion of structural impact decreased from 26.1 percent of between 1992 and 2000 to 19.9 percent of between 2000 and 2010 on the level of the whole economy, i.e. structural changes were slightly "beheaded" on the level of whole economy. The phenomenon was caused by the one-time phenomenon of the collapse of socialist large industry in the 90's however the transformation towards less energy intensive branches continued in the 2000's as well except for transport sector. Though the end uses of transport have decreased since the economic crisis as well, it is possibly a temporary phenomenon.

The final intensity of industry decreased to less than one third between 1991 and 2010.
The motors of development were branches of machinery and transport equipment industry where significant operating capital arrived, utilising well-trained and cheap work force. Substantial production capacities entered machinery and transport equipment industries. Installed machinery and transport equipment industry capacities normally implement one production phase at a time; they are assembled as final product in another country of the region. As a result international cooperation has strengthened freight transportation demands in connection with industrial production have increased significantly as well.
In parallel the energy consumption of manufacturing has not increased thus the energy efficiency of the manufacturing has improved.

Tertiary sector has been expanded by substantial new units with favourable energy indicators (e.g. shopping malls, business services, hotels, etc.). In the same time a lot of school and hospital buildings are in deteriorated condition and need to be renovated.
The majority of the building stock of the tertiary sector has not been assessed in terms of building energy.

According to the survey of the Architect's Chamber about 6000 public buildings can be found for which energy certification must be prepared in accordance with Directive 91/2002 on Energy Performance of Building.
However, in absence of surveys we have no information on the composition, age and energy performance of these buildings.

According to Government Decree 176/2008 on Energy Certificate, the issuance of energy certificate is required for the occupancy and leasing of the newly built real estates. In accordance with the energy certificate the energy performance of certain buildings can be compared with one another and the buildings can be classified into quality groups in energy performance point of view accordingly.

The final energy intensity of the transport sector increased between 1991 and 2009 apart from minor fluctuations.
The significant increase of passenger car transport lies in the background of intensity increase. The stock of passenger cars has grown together with the average annual running mileage and also with the average engine volume to slight extent. The world market oil price increase experienced since 1999 could not prevent the increasing use of passenger cars.
Freight transport shifted significantly from railway to road as multinational companies prefer road transport to railroad transport due to its higher flexibility and lower volume independence. "Just-in-time" deliveries have become common that can be implemented only by means of trucks or light duty vehicles.
Stocks of passenger cars and annual mileages started to decrease as the result of the crisis of 2009 in parallel with the deterioration of the financial situation of households. The increase of energy consumption of transport is expected to continue after the crisis.

Final energy consumptions for each end-user sectors

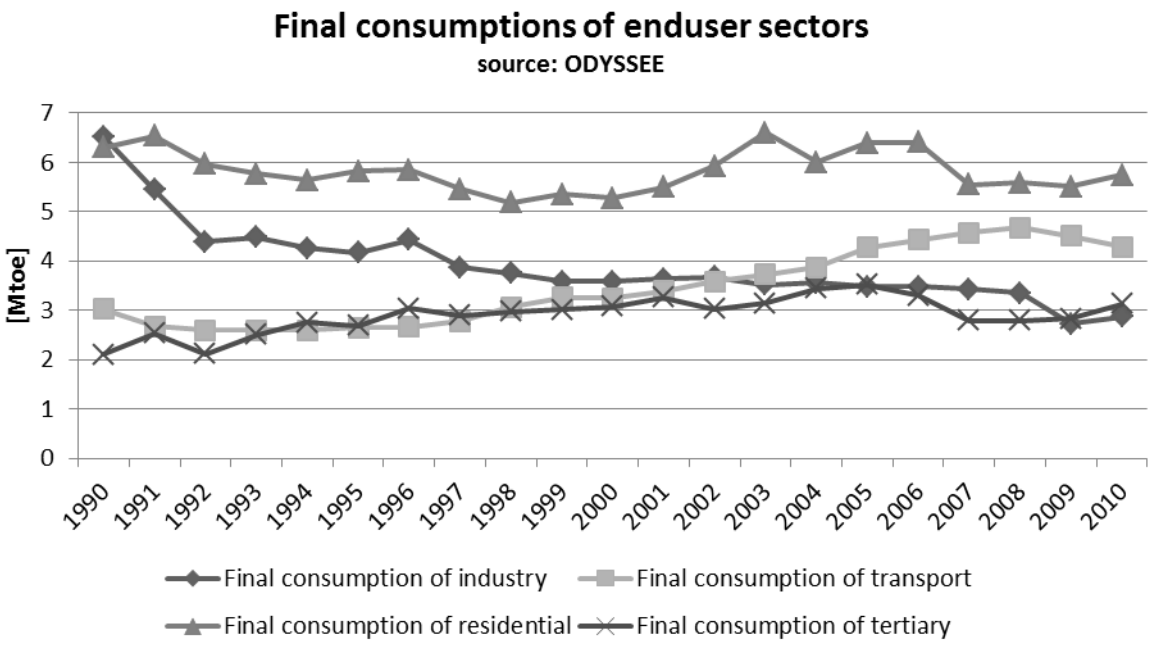

Figure 10

The period between 1990 and 1992 bringing large-scale transformations should be assessed as a separate term for formulating a realistic picture since that period was the introductory part of the implementation of market economy. The subsequent period between 1992 and 2010 must also be assessed when the regulating mechanisms of market economy already operated.

National final consumption decreased by 17 percent between 1990 and 1992 due to the collapse of socialist large industry. Final consumption increased by 0.2 percent annually on average between 1992 and 2010. However development trends have varied significantly for each sector.

Final consumption of industry decreased by 22.6 percent between 1990 and 1992. Industrial consumption decreased by 5.4 percent on average annually between 1992 and 2010 in almost 40 percent of the industrial use due to the structural impacts of the changes of industrial structure, since energy-intensive industrial branches were cut back whereas less energy-intensive industrial branches developed strongly.

Final consumption of transport decreased by 14.0 percent between 1990 and 1992. Final energy consumption increased by 2.5 percent on average annually between 1992 and 2010 due to the vast increase of passenger car traffic and furthermore because freight transport shifted from transport on rail to transport on road which is much more energy intensive.
Modal split shifted towards more energy intensive modes in both passenger and freight transport causing the highest annual rate of increase on average among all the end-user sectors.

Final consumption of households decreased by 5.4 percent between 1990 and 1992 but it is less correlated with political transformation but rather natural gas started to penetrate into the space heating systems of households. Final consumption of households decreased by 0.5 percent on average annually between 1992 and 2010. However average reduction was not steady because final consumption of households had been decreasing until 1998 due to the penetration of natural gas. The penetration of natural gas did not continue after 1998 but the consumption increase resulting from the dissipation of households due to demographic reasons.
The subsidised natural gas prices in the household sector facilitated the large-scale spreading of natural gas compared to alternative energy sources.
The renovation rate of dwellings used in the household sector is restricted mostly to the state subsidy campaigns that are lower than desired. Current EU-regulations prohibit the use of EU-funds for the subsidy of private individuals therefore only national financial funds are available for the purpose of dwelling renovations.

Final consumption of tertiary sector increased by 1 percent between 1990 and 1992. Final consumption of tertiary sector increased by 2.2 percent on average annually between 1992 and 2010. Tertiarisation of the economy showed substantial progress between 1992 and 2010. Business services, shopping malls, hotels & restaurants, sport and recreation centres spawned as the result of the establishment of market economy. Increase of consumption is originated substantially by the entry of new units. Modernisation of educational and health institutions was less significant; many of them are units operating in buildings in bad conditions in energetic terms.

4b) Energy consumption trends of manufacturing industry

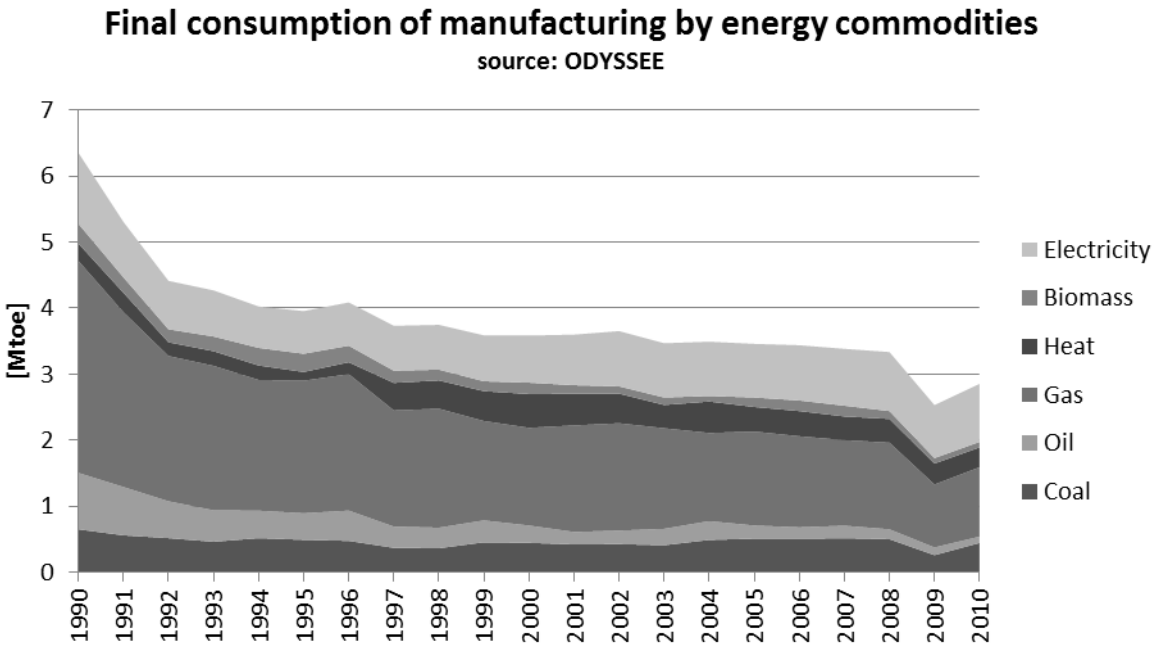

Figure 11

Final consumption of manufacturing decreased by 2.4 percent on average annually between 1992 and 2010. When final consumption is analysed for each energy commodity it can be established that the use of each primary energy commodity decreased and only electricity and heat consumption as secondary use of energy commodities increased. Consumption of coal decreased by 0.9 percent on annual average, oil consumption by 10.6 percent on annual average, natural gas consumption by 4.1 percent on annual average whereas the consumption of biomass decreased by 4.6 percent on annual average.

Against that electricity consumption increased by 1 percent on annual average and that of heat increased by 2.1 percent on annual average. Electricity and purchased heat penetrates the industrial processes more and more due to the progress of industrial electrification which correlates with the measurement of more and more widely applied process characteristics and with the increasing controllability of industrial processes.

The increasing penetration of electricity and heat into the industrial processes reduces the demands of directly used fossil energy sources but increases electricity and heat demand that acts in the direction of electricity generation on the other side and to less extent in the direction of the increase of the losses of heat generation.

The reduction of industrial final consumption was caused partly by the spreading of less energy intensive industrial branches and partly by its penetration to the industrial processes of electricity that acted in the direction of the increase of energy efficiency.

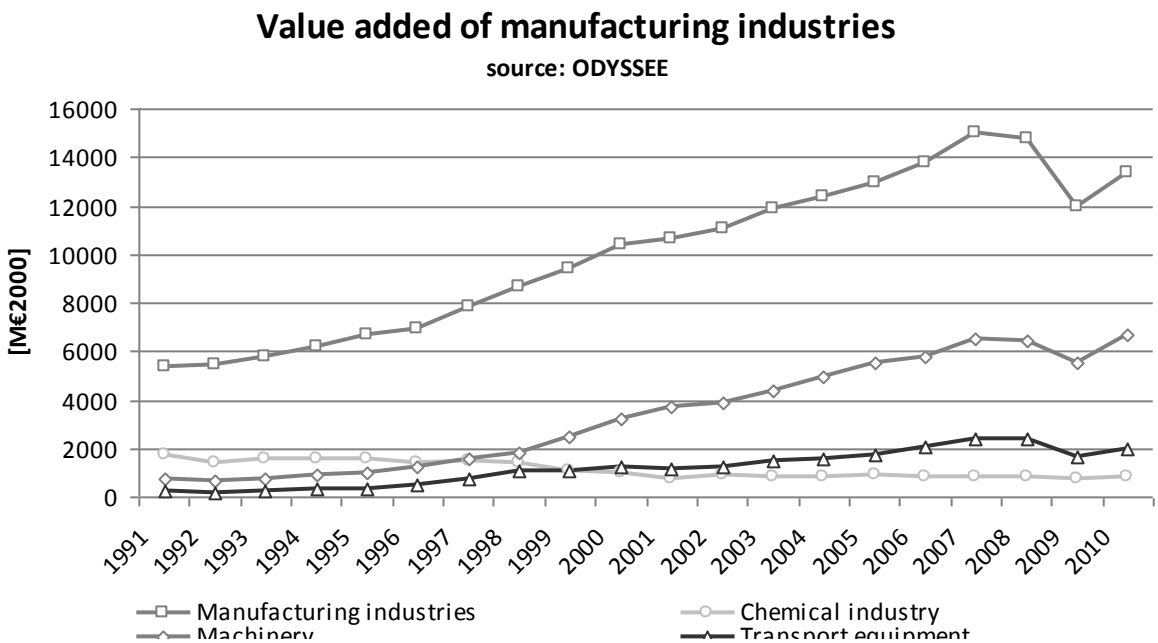

Figure 12

Value added of manufacturing increased by 5.1 percent between 1992 and 2010. The growth of each industrial branch has varied significantly depending on the followed policy of investment incentives. State investment policy encouraged the installation of rather labour-intensive and less energy-intensive industrial branches since the country is poor in energy sources but well-trained and relatively cheap labour force is available.

Machinery and transport equipment industries (of which only a few products were competitive at the time of the political transformation) developed very quickly due to the inflow of operating capital and produces more and more machine parts and transport equipments many of which are exported. The value added of machinery increased by 13.5 percent on annual average between 1992 and 2010 whole that of transport equpment industry increased by 13.5 percent on annual average.
Nevertheless both machinery and transport equipment production was cut to quick due to the economic crisis. The value added of machinery decreased by 14.6 percent in 2009 then increased by 20.7 percent in 2010. The value added of transport equipment decreased by 30.6 percent in 2009 then increased by 18.1 percent in 2010. Both machinery and transport equipment industries are reacting sensitively to the world economic crisis.

Heavy chemical industry regressed considerably due to the collapse of Soviet markets and the manufacturing of primary metals increased only moderately. The value added of chemical industry decreased by 2.9 percent on annual average between 1992 and 2010 whereas that of the production of primary metals increased by 2.1 percent on annual average.

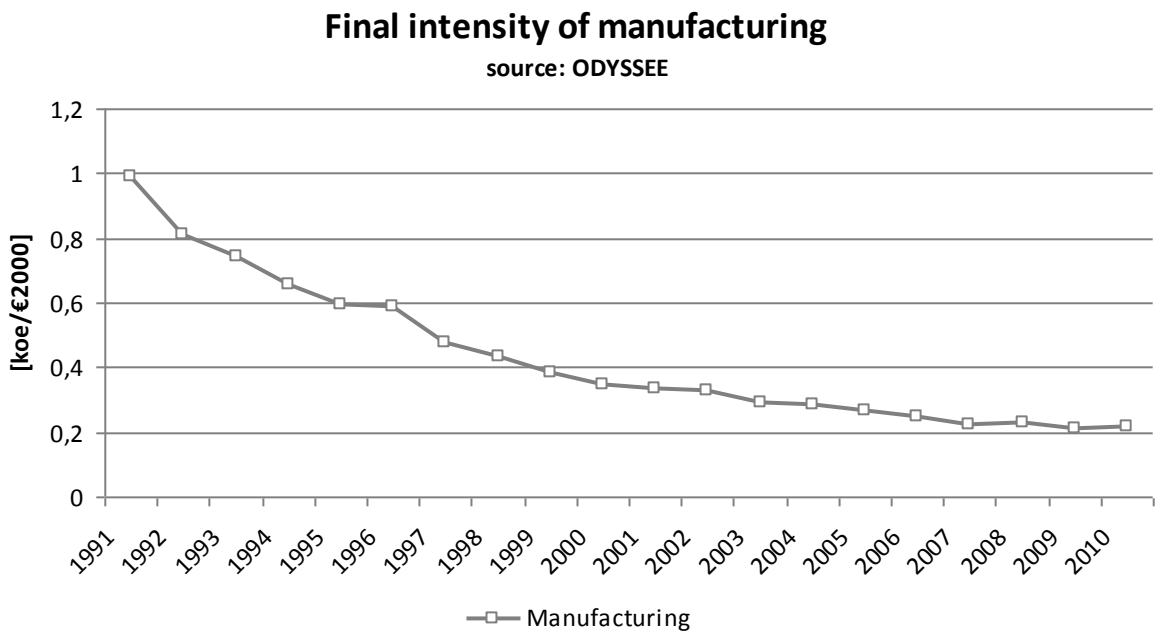

Figure 13

Final intensity of manufacturing decreased by 0.8 percent on annual average between 1992 and 2010. The intensity of manufacturing decreased more strongly between 1992 and 2000 when the drop of intensity was 11.0 percent mainly due to the collapse of socialist large industry and the developments implemented in the emerging less energy intensive branches. In the second decade the reduction of the intensity abated to 4.7 percent annually because by then the capacities of energy intensive branches degraded substantially but investments continued in the less energy intensive branches.

Economic crisis broke the continuous final reduction of intensity registered earlier. In 2009 final intensity dropped by 6.2 percent whereas final intensity increased by 0.9 percent in 2010 for the first time after 20 years.

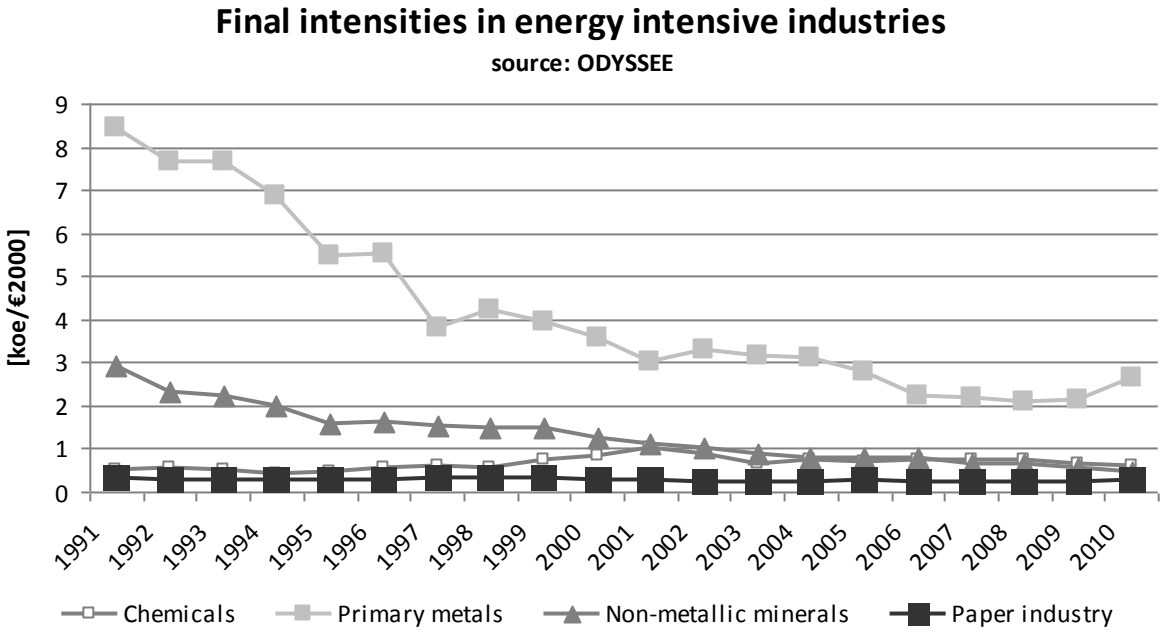

Figure 14

The decrease of final intensity was below the average of manufacturing in the energy intensive industrial branches. In these industrial branches technological recurrence may reduce energy intensity considerably.
Intensity of chemical industry increased by 0.2 percent on annual average between 1992 and 2010. Considerable capacities of heavy industry degraded; structure of production shifted slightly towards less energy demanding technologies.
The intensity of primary metals decreased by 5.8 percent on annual average between 1992 and 2010. Several traditional metallurgical companies were liquidated after the political transformation; the product range shifted strongly towards less energy intensive rolled products.
The intensity of non-metallic minerals decreased by 8.6 percent on annual average between 1992 and 2010, which is over the average of manufacturing industry. Several out-of-date small-scale brick factories and cement plants were stopped. Cement plants were technologically renovated after privatisation; computerised process management operates in almost all of them. The production of flat glass was renovated technologically; one of the hollow glass ware plants was closed.
The renovations in the industrial technology had a positive impact on the energy consumption of the branch.
The final intensity of paper industry decreased by 0.6 percent on annual average between 1992 and 2010. Paper mills were built in the 80's and 90's therefore only small-scale renovations could be achieved. Printing capacities had become excessive which resulted the close-down of a few printing presses.
Intensity of food industry increased by 0.1 percent on annual average between 1992 and 2010. No significant technological renovation was possible in the food industry because most of the capacities were already up-to-date in the beginning of the 90's. Canned food industry suffered from considerable market loss as the result of the collapse of the soviet markets; some of the canneries had to be closed down because of the market loss.

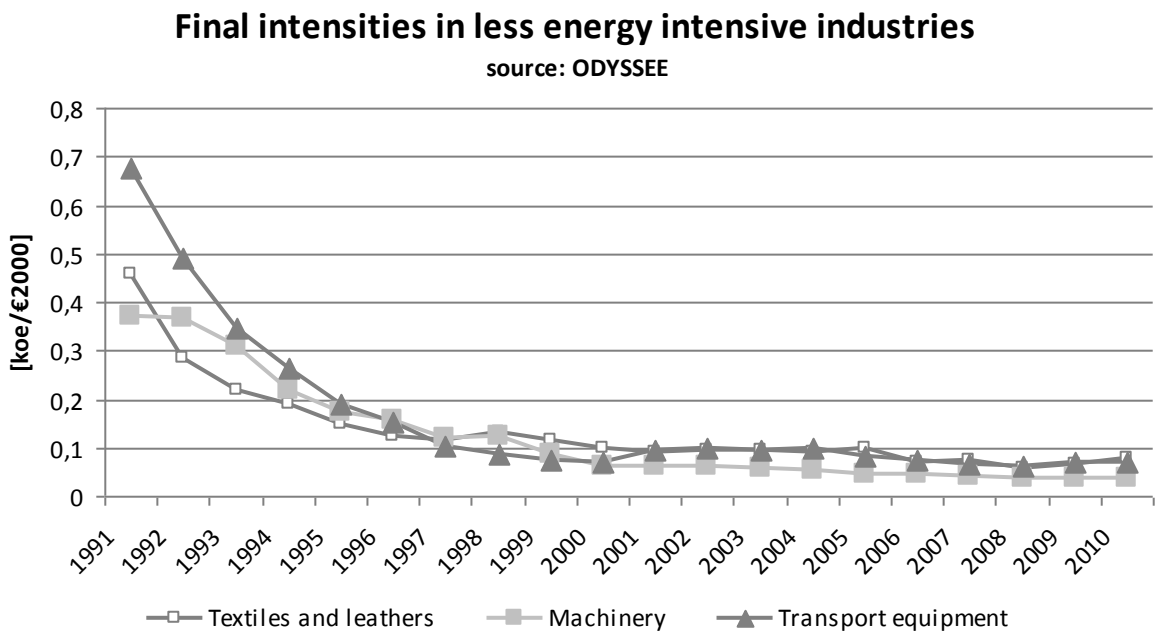

Figure 15

In the less energy intensive branches the reduction of final intensity was above the manufacturing branches. Technologically up-to-date plants producing large batches were built in these industrial branches that had positive impact on energy efficiency.

The energy intensity of machinery and transport equipment dropped by 11.7 percent on annual average between 1992 and 2010. Single phase production is typical in machinery and transport

equipment industry when the national plant is specialised on one production phase and the final assembling is performed in the central plant of the company group. Machinery industry contract work is considerable when multinational companies have parts or partial units manufactured in their national plants.
Most up-to-date technologies and modern assembly halls and the application of modern organisational methods are typical of the production of machinery and transport equipment.
Large-scale reduction of intensity was made possible by up-to-date technologies, large batches of the relevant parts and specialisation to the specific machinery production phase.
Production of machinery for international market makes the branch vulnerable to the economic crisis because the drops of the orders of multinational companies due to the crisis may not be supplemented. The production batches must be reduced during the economic crisis together with the number of shifts if the production department in the worst case.
The energy intensity of transport equipment dropped by 11.6 percent on annual average between 1992 and 2010. The energy intensity of transport equipment is also characterised by the fact that production is restricted to a single unit (e.g. manufacturing of engines for passenger cars). Up-to-date car manufacturing technologies and modern organisational methods are also typical here; industrial robots are often used on the production lines. Assembling of passenger cars are performed at Suzuki and Audi as well.
The transport equipment industry reacts sensitively to the economic crisis because orders drop considerably. Number of shifts was reduced at Suzuki due to the drops of orders.

Energy intensity of textile industry dropped by 6.8 percent on annual average between 1992 and 2010. Several companies manufacturing traditional textile raw materials closed. Small and medium-sized companies manufacturing small and medium batches of ready-made clothes were established as replacement.
Contract work is typical of the branch when ready-made clothes are manufactured from base material provided by the client according to given patterns. The shift of the production structure improved the branch energy intensity from base material production towards production of ready-made clothes.

The energy intensity at 2000 GDP structure is a fictive intensity which assumes that every branch of manufacturing grows in a pace identical to that of GDP therefore its calculation enables the extraction of structural changes.

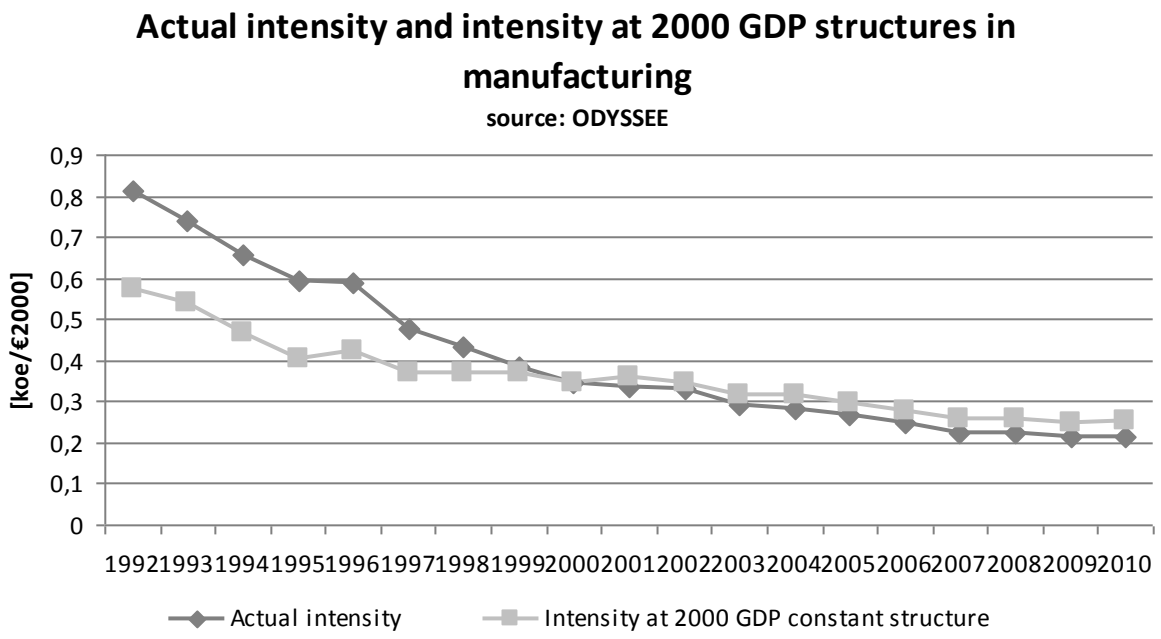

Figure 16

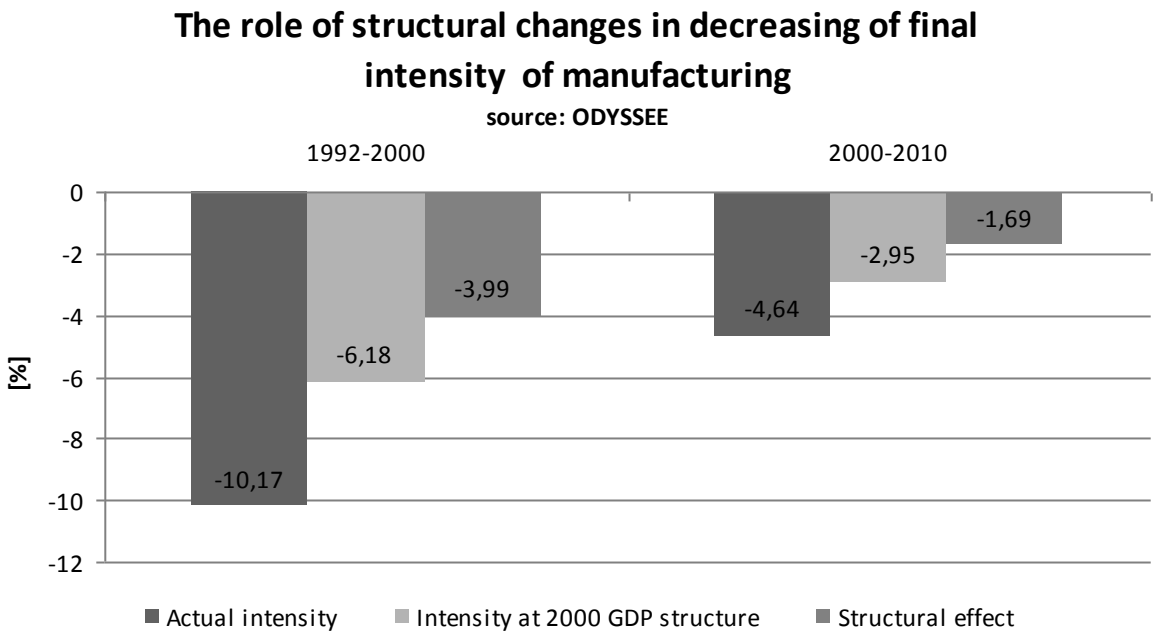

Figure 17

According to the comparison of actual and at constant structure energy intensities the structural changes have always been substantial in the Hungarian manufacturing. According to the calculation 39.2 percent of the reduction of energy intensity was explained by structural changes between 1992 and 2000 whereas 36.4 percent of the reduction of energy intensity was explained by structural changes between 2000 and 2010.

Spreading of less energy intensive branches was typical all through the assessed period however its extent was slightly higher between 1992 and 2000 than between 2000 and 2010.

The reduction of the final energy intensity of manufacturing was 10.17 percent on annual average between 1992 and 2010. In this period large-scale reduction involved the collapse of socialist large industry and the emerging developments of machinery and transport equipment industries.

Final intensity of manufacturing dropped to 4.64 percent on annual average between 2000 and 2010 which means that the deterioration of energy intensive industrial branches had finished by then but developments in machinery and transport equipment industries continued.

By 2010 machinery gave 49.7 percent of value added while transport equipment gave that of 14.1 percent. Therefore within machinery and transport equipment industry prevailed within the manufacturing since the joint proportion of the two branches is 64.6 percent. The increase of machinery and transport equipment industry strongly contributed to the reduction of the final intensity of the whole manufacturing.

The proportion of structural changes decreased from 39.2 percent of the period between 1992 and 2000 to 36.4 percent of the period between 2000 and 2010 but it is considered high in international comparison.

Structural changes were the result of investments made in the machinery and transport equipment industries. These investments brought up-to-date technologies and modern organisation al methods thus producing substantial value added with minor supplementary energy consumption.

Production in machinery is usually not of full verticum but it implements a single production phase of multinational companies because the related phases are in different countries and production of machinery has become more transport intensive.

4c) Trends of household energy consumption

Household energy consumption depends on many factors.
These can be divided into 4 main groups:

1. Stock of households
   - Stock of households per dwelling types
   - The age of dwellings
   - The area of dwellings
   - The average size of dwellings
   - Whether people live in the dwellings
2. Space heating
   - Rate of district heating
   - Internal and external temperatures
   - Used fuels
   - Thermal regulations
3. Economic factors
   - Household energy prices
   - Energy costs as a percentage of dwelling's maintenance costs
4. Other factors
   - Orientation of dwellings
   - Penetration of household equipments
   - Rate of household equipments with „A" energy label per household equipment
   - Share of electricity consumption per total household consumption

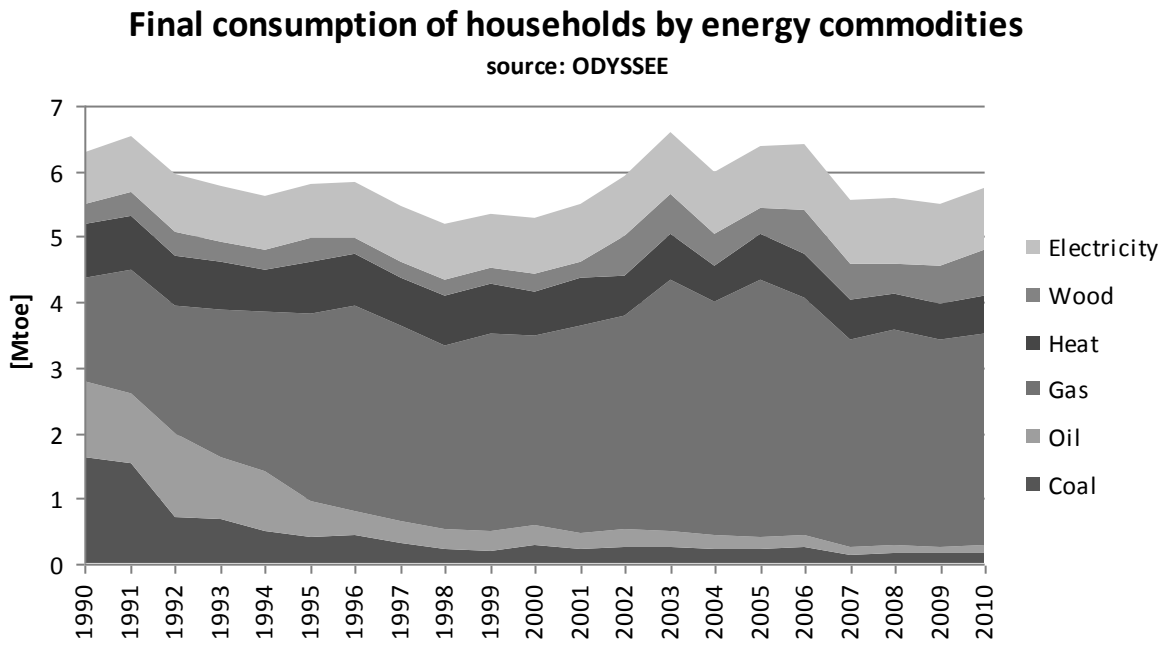

Figure 18

The consumption structure of the household sector underwent substantial changes between 1990 and 2010. With the installation of the natural gas network between 1990 and 1998 the penetration of natural gas into the household sector was pronounced. The share of natural gas increased from 25% to 54.2% from 1990 to 1998. The large-scale penetration was promoted by natural gas price subsidies.

In parallel with the penetration of natural gas consumption also decreased as coal-oil boilers and tile stoves were substituted with natural gas boilers with 80% efficiency. By 1998 household natural gas consumption had saturated and further penetration has dropped to a minimum since then. In parallel with the saturation of natural gas household final consumption started to increase as fuel changes towards natural gas decreased and due to the dissipation of households consumption increase started to dominate.

Between 1998 and 2010 changes in household fuel-mix were moderate. In 1998 the share of coal was 3.1%, the share of oil was 6.2%, the share of natural gas was 54.2% the share of purchased heat was 15.6%, the share of biomass was 4.0%, the share of electricity was 16.5%. In 2010 the share of coal was 2.6%, the share of oil was 2.3%, the share of natural gas was 56.3% the share of purchased heat was 9.4%, the share of biomass was 12.1%, the share of electricity was 16.5%. Coal and oil consumption declined, the use of natural gas increased moderately, while the use of biomass increased steadily, consumption of electricity remained constant.

From 2006 price subsidies for natural gas were eliminated which were followed by substantial price hikes until 2009 in several stages. As a result of this the price of household's natural gas increased from 50% of EU-average to 90% of EU-average.

Between 1998 and 2006 household natural gas consumption increased by an annual 3.2% on average. Due to subsidized prices natural gas outplaced alternative energy commodities. Between 2006 and 2010 parallel with the elimination of price subsidies natural gas consumption decreased by an annual 3.9% on average, the elimination of price subsidies stimulated the use of alternative energy commodities, predominantly that of biomass. Due to the elimination of price subsidies regarding natural gas many families living in the country chose not to switch on their natural gas boilers but to use their biomass boilers (if it is available) instead.

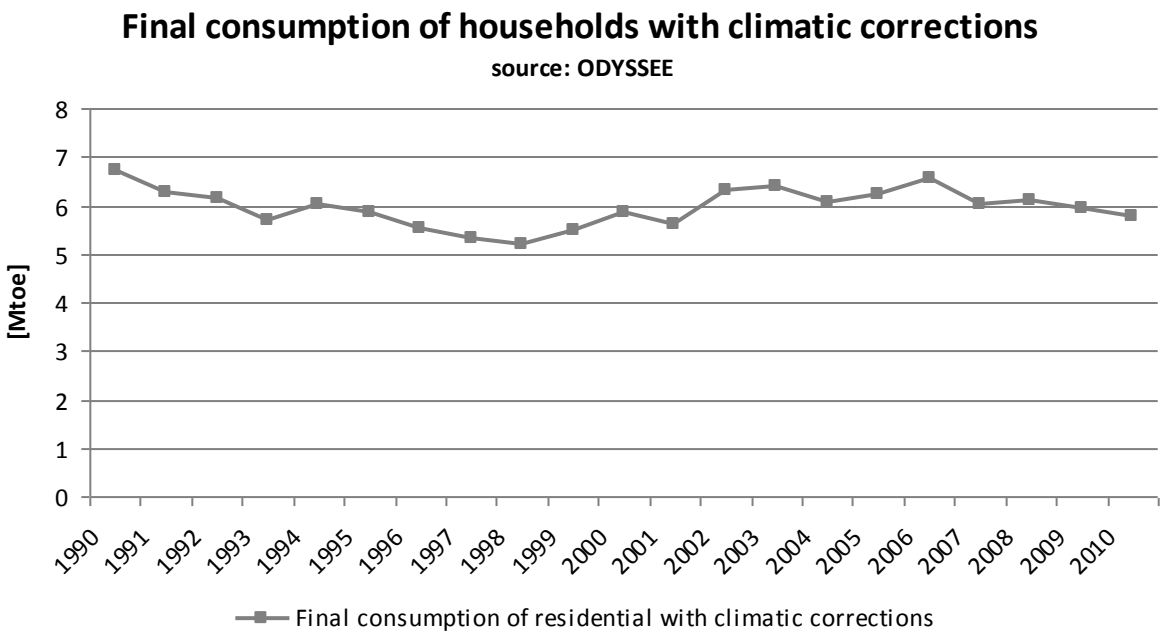

Figure 19

In order to be able to make a more realistic assessment it makes more sense to analyse the final consumptions corrected with climatic corrections instead of using the uncorrected values, this index filters the impact of degree-days among the various years due to the gravity of winters. (The actual degree-days are compared to reference degree-days of last 50 years average.)

The household final consumption corrected with climatic correction decreased by an annual 3.9% on average between 1990 and 1998, primarily due to the penetration of high-efficient gas boilers. Between 1998 and 2006 household final consumption corrected with climatic correction increased by an annual 2% on average, due to a drop in the change of fuel-mix, the increase of consumption

attributable to the dissipation of households, while between 2006 and 2010 the corrected final consumption decreased by an annual 4% on average due to the elimination of price subsidies on natural gas and an increase in the use of alternative energy commodities.
From energy policy point of view it is also important to decrease the predominant role of natural gas in the household sector as by doing so safety natural gas supplies can be moderately mitigated, and in case of energy supply crisis situations it is easier to organise the supply of alternative energy commodities. (see the Russian-Ukrainian gas dispute in 2009)

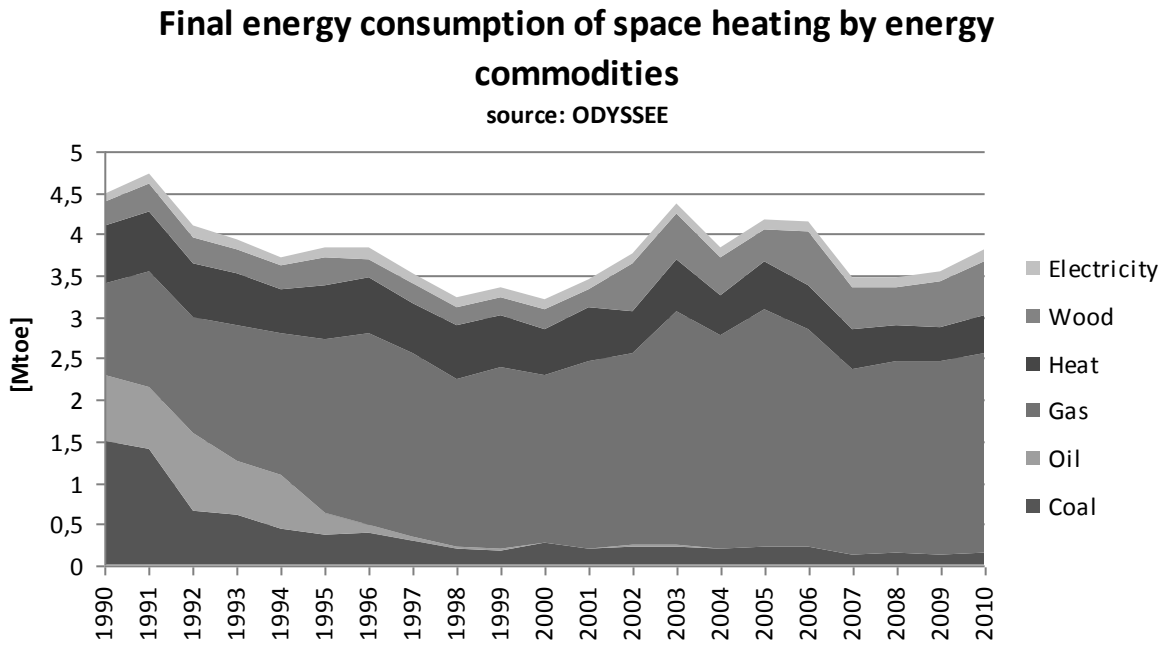

Figure 20

The increase in household's natural gas price had the biggest impact on space heating. Only those households could change their space heating habits where alternative space heating systems were available.
In 1998 the share of coal in final consumption was 5.4%, the share of natural gas was 63%, the share of purchased heat was 19,9%, the share of biomass was 6%, the share of electric heating was 3.4%. In 2010 the share of coal in final consumption was 3.6%, the share of natural gas was 63.1%, the share of purchased heat was 12%, the share of biomass was 17.3%, the share of heating with electricity was 3.5%.
The share of natural gas did not change a lot, while the use of biomass increased substantially.
Between 1990 and 1998 climatically corrected space heating decreased by an annual 5% on average, between 1998 and 2006 it increased by an annual 3.6% on average, while between 2006 and 2010 it decreased by an annual 1.6% on average.
As a result of the above mentioned trends the share of space heating in unit consumption per dwelling decreased from 72.1% (1990) to 62.3% (1998), then increased to 66.3% in 2010.
The share of hot water usage in unit consumption per dwelling increased from 13.9% to 18.5% between 1990 and 1998, then decreased to 17.7% in 2010.
Compared to household total consumption, household consumption can be better characterised by climatically corrected unit consumption per dwelling and climatically corrected unit consumption per square meter. Consumption per square meter provides a better picture on the trend of unit consumption, it is not distorted by changes for dwelling areas.
Climatically corrected unit consumption per dwelling decreased by an annual 4% on average between 1990 and 1998, it increased by an annual 2.1% on average between 1998 and 2006 while between 2006 and 2010 it decreased by an annual 2.9%.

Climatically corrected unit consumptions per square meter show a more pronounced picture than that. Climatically corrected unit consumption per square meter was 19.5koe/m2 in 1990 which dropped to 11.9koe/m2 in 1998 which went up to 12.8koe/m2 in 2010. Between 1990 and 1998 unit consumption per square meter decreased by an annual 5.9% on average, between 1998 and 2006 unit consumption per square meter increased by an annual 2.4% on average, while between 2006 and 2010 unit consumption per square meter decreased by an annual 3.9% on average.
The reasons for this have common backgrounds. Between 1990 and 1998 penetration of natural gas to the household sector was substantial, which resulted in a drop in consumption due due to natural gas boilers with high efficiency. Between 1998 and 2006 changes in fuels were reduced to a minimum, increase in consumption became more pronounced due to the dissipation of households. Between 2006 and 2010 the elimination of price subsidies for household natural gas slowed down consumption.
The drop in unit consumption between 2006 and 2010 provides hopes, yet the National Energy Strategy 2030 foresees a very ambitious goal, i.e.: a 30% reduction in unit consumption between 2012 and 2030. The engine for the reduction in unit consumption was the elimination of price subsidies for household natural gas between 2006 and 2010. Yet it is questionable whether this can work in the long run. In order to reach this ambitious goal energy efficiency programmes need to be promulgated which are highly accessible in order to improve household energy efficiency.

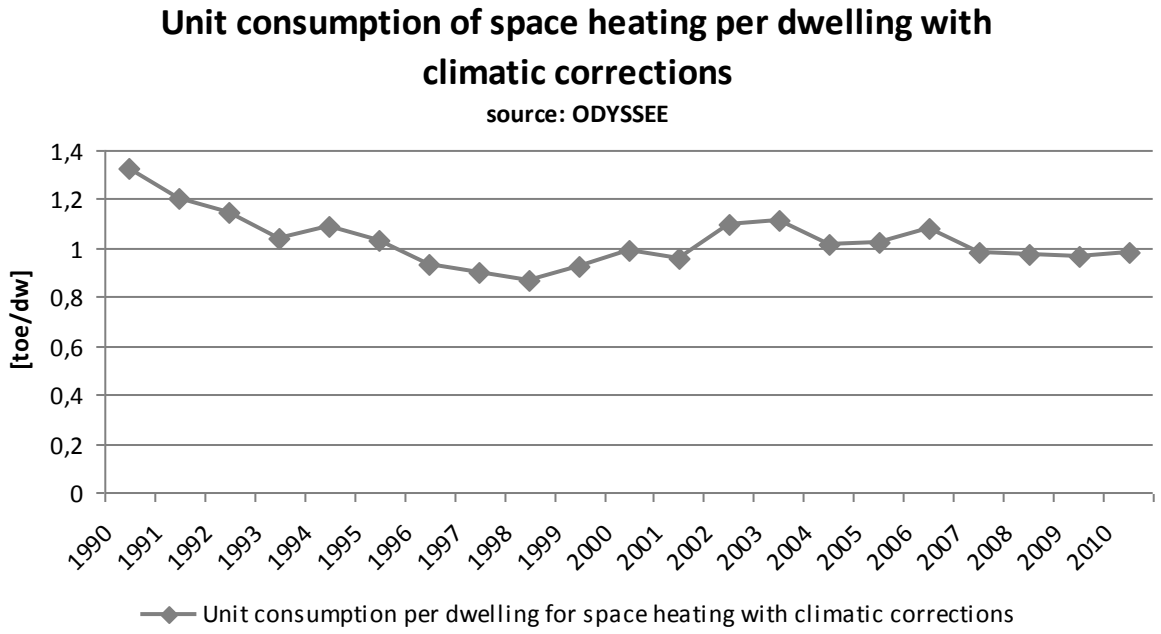

Figure 21

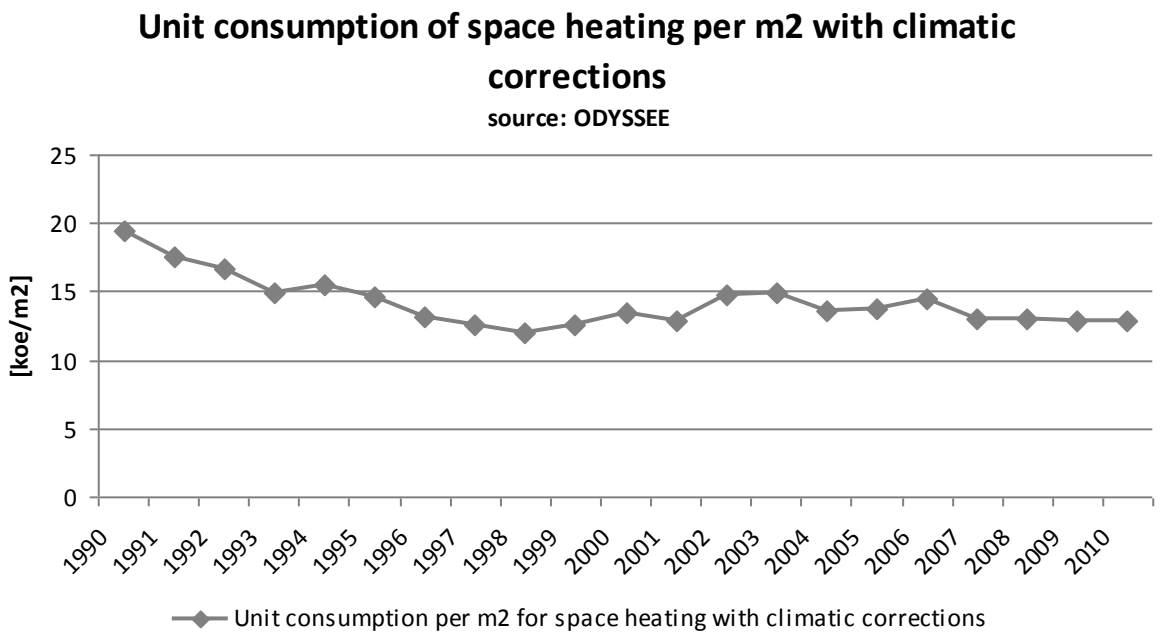

Figure 22

By 2003 electric consumption per household had increased continuously with slight fluctuations due to the increase in the stock of household appliances. Since 2003 electricity consumption per household has been stagnating as price hikes in electricity have direct impact on households as they reduce their consumption. Several energy efficiency campaigns promoted the change of obsolete household appliances with high consumption rate, yet state subsidies for the change of household appliances were granted to very low-cost energy efficiency programmes.

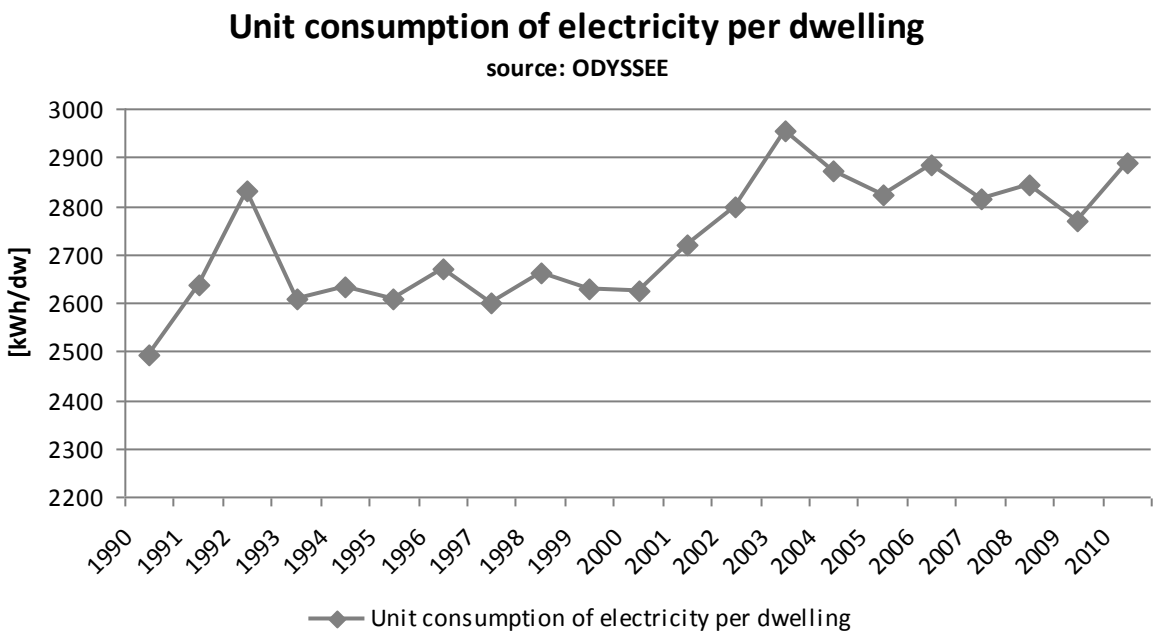

Figure 23

Besides space heating and electricity consumption the other elements of household consumption are the use of hot water and cooking. The consumption of household hot water shows smaller fluctuations than space heating as a result to changes in regulations.

Between 1990 and 1998 the consumption of household hot water increased by an annual 0.1% on average, between 1998 and 2006 it increased by an annual 1% on average, while between 2006 and 2010 it decreased by an annual 2.7% on average.
The consumption of household hot water within the unit consumption of a household was 13.9% in 1990, while its share within household unit consumption was 17.7% in 2010. The increase of its share is due to the stagnation of household hot water and to the reduction of household unit consumption by 18.5 % between 1990 and 2010.
The share of cooking within unit consumption per apartment was 6.9% in 1990 and 5.7% in 2010.

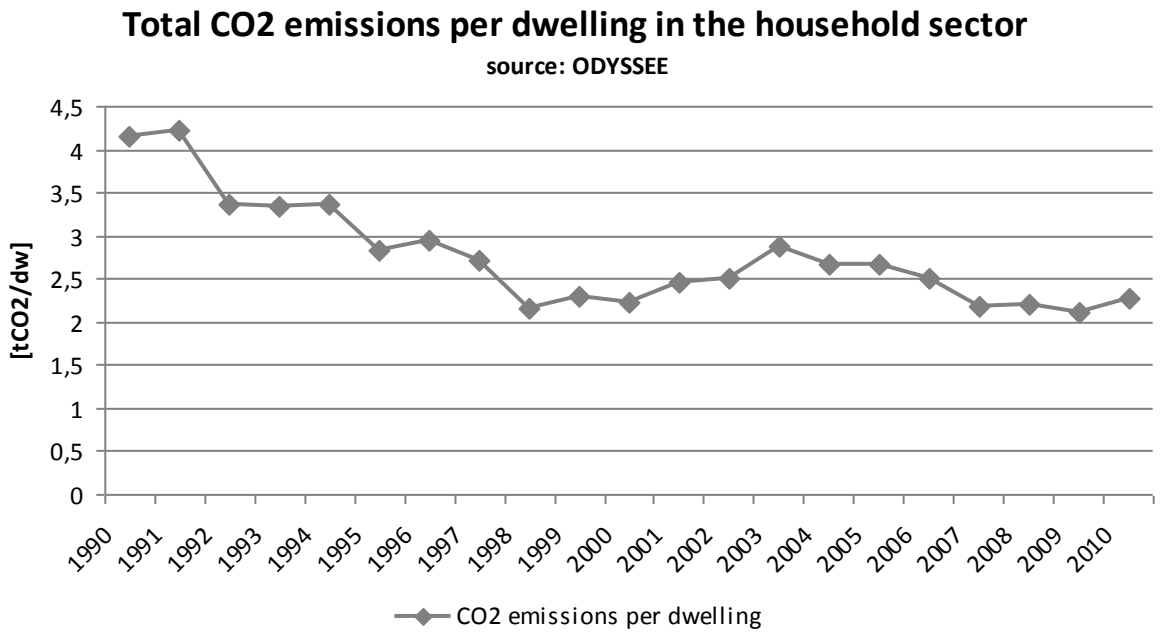

Figure 24

Household total emissions including electricity consumption per dwelling decreased by 41.5% between 1990 and 2010 in total, which means an annual 2.7% drop on average. The reasons for the reduction were the changes in fuel-mix due to the penetration of natural gas and the reduction in the unit consumption of households while the number of household with permanent stays and the size of an average household both increased during the period in question. Total emissions decreased by an annual 3.9% on average between 1990 and 1998, the reason for the reduction was the change in fuel-mix. Total emissions increased by an annual 2% on average between 1998 and 2006, then changes in fuels decreased and unit consumption per household increased. Between 2006 and 2010 total emissions decreased by an annual 3.6% on average predominantly due to the drop in unit consumptions per dwelling.
In total the drop in household total emissions is mainly due to transfer towards fuel mix with lower carbon content (increase in the share of natural gas, drop in the share of coal, disappearance of oil-based fuels) and to a smaller extent it is attributable to the drop in unit consumption per dwelling.

4d) Trends of energy consumption in the tertiary sector

The energy consumption of the tertiary sector increased by an annual 1.5% on average between 1990 and 2010 while employment in the tertiary sector grew by an annual 1.3% on average. The reason for the growth in final energy consumption was the growth in the employment of the tertiary sector as new jobs were created in trade and business services. In the tertiary sector energy consumption for heating purposes was substantial, thus climatically corrected final consumption should be analysed.

Climatically corrected final energy consumption between 1990 and 2005 grew by an annual 3.1% on average. Austerity measures introduced in 2006 (mergers in hospitals and schools, layoffs in public administration) resulted in a slump (annual growth of 2% on average) in climatically corrected final consumption between 2005 and 2010.

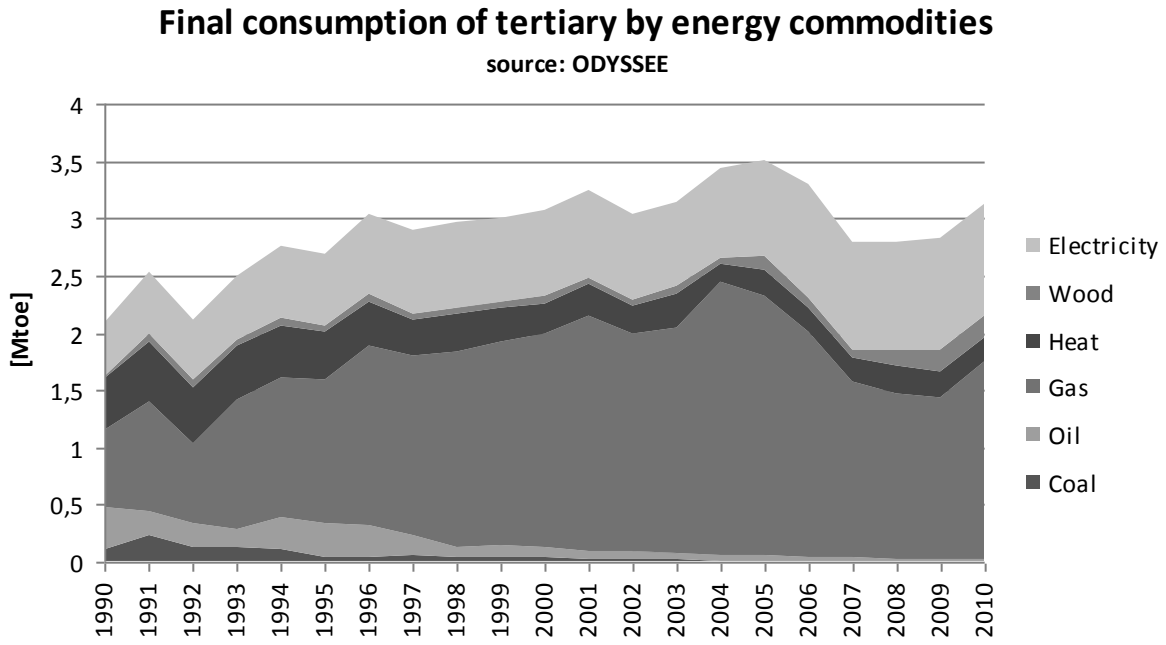

Figure 25

The structure of final energy consumption changed between 1990 and 2010.

The consumption of coal reduced from 5,3%-to 0%. The consumption of oil products dropped from 17,4% to 0,7%. This practically means that coal and oil boilers practically disappeared from the tertiary sector.

The consumption of natural gas grew from 32,3% to 54,9% between 1990 and 2010. In this period many people changed their coal and oil boilers, tile stoves to natural gas boilers. Natural gas is mainly used for room heating, yet use for water heating purposes is also substantial.

The share of electricity consumption grew from 21.1% to 31.2% between 1990 and 2010. The reason for the growth was attributable to the penetration of office appliances using electricity (computers, xerox machines, air conditioning)

Natural gas became the main fuel due to the spread of space heating using natural gas, but also the spread of office equipments strongly contributes to the increase in electricity consumption.

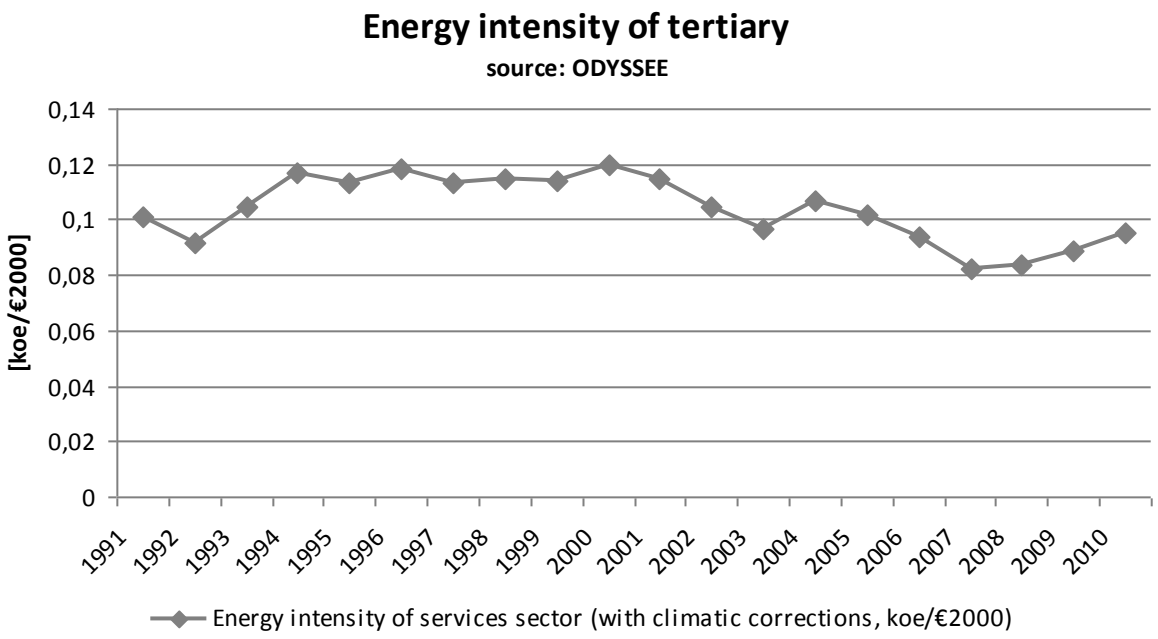

Figure 26

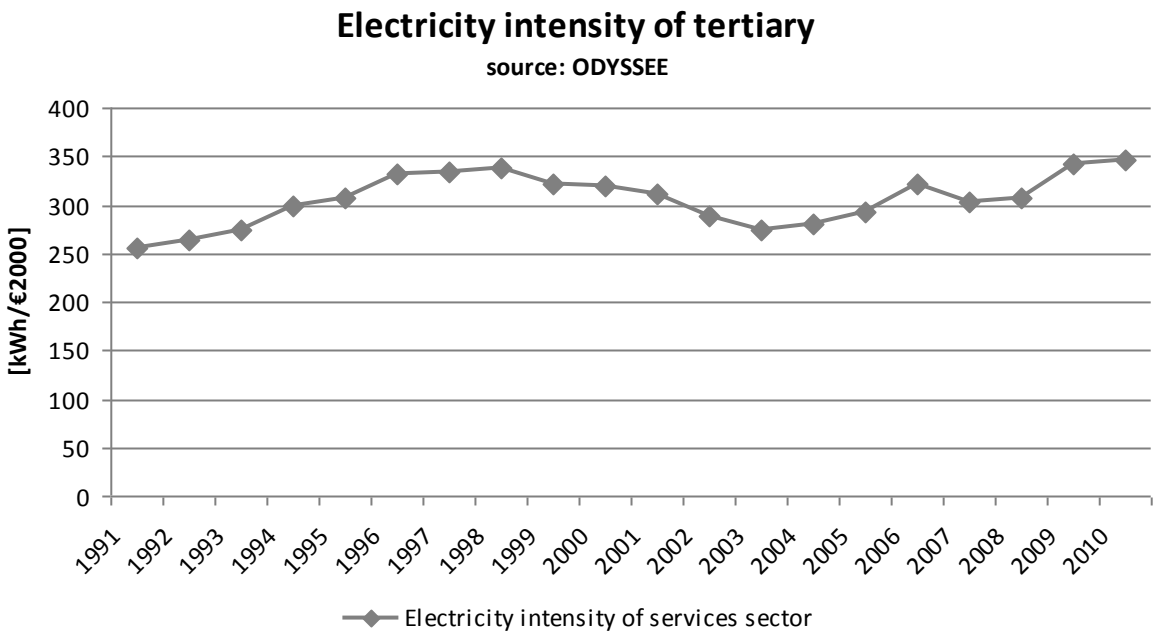

Figure 27

The energy intensity of the tertiary sector decreased by an annual 0.9% on average between 1991 and 2010. The intensity of the tertiary sector grew by an annual 0.1% on average between 1991 and 2005 and decreased by an annual 1.4% on average between 2005 and 2010. Moderate growth between 1991 and 2005 was attributable to consumption growth due to the tertiarisation of the economy as IT equipments and air conditioning is heavily used in shopping malls and in businesses. The slump between 2005 and 2010 was attributable to the austerity measures aiming at curtailing state administration as hospital and school mergers, the rationalisation of municipality institutions resulted in a decrease in energy intensity.

The intensity of electricity in the tertiary sector grew by an annual 1.5% between 1991 and 2010 on average. Electricity intensity grew by an annual 4.1% on average between 1991 and 1998, then by an annual 0.2% on average between 1998 and 2010. The massive growth in intensity between 1991

and 1998 was attributable to the penetration of new units massively using electricity, between 1998 and 2010 there was only small-scale growth.

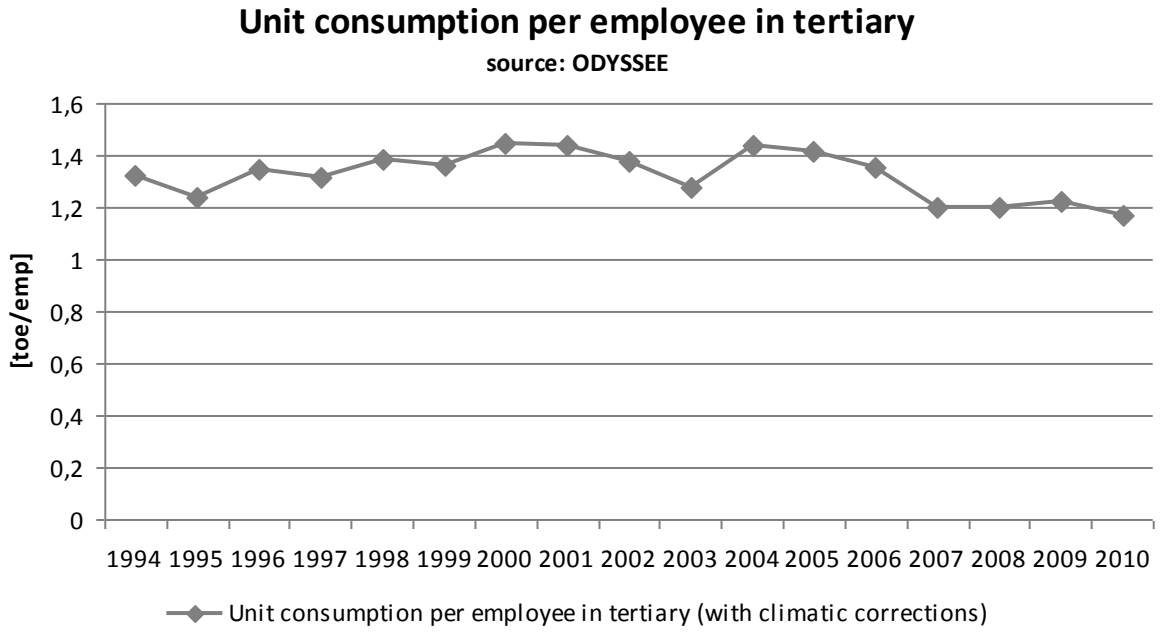

Figure 28

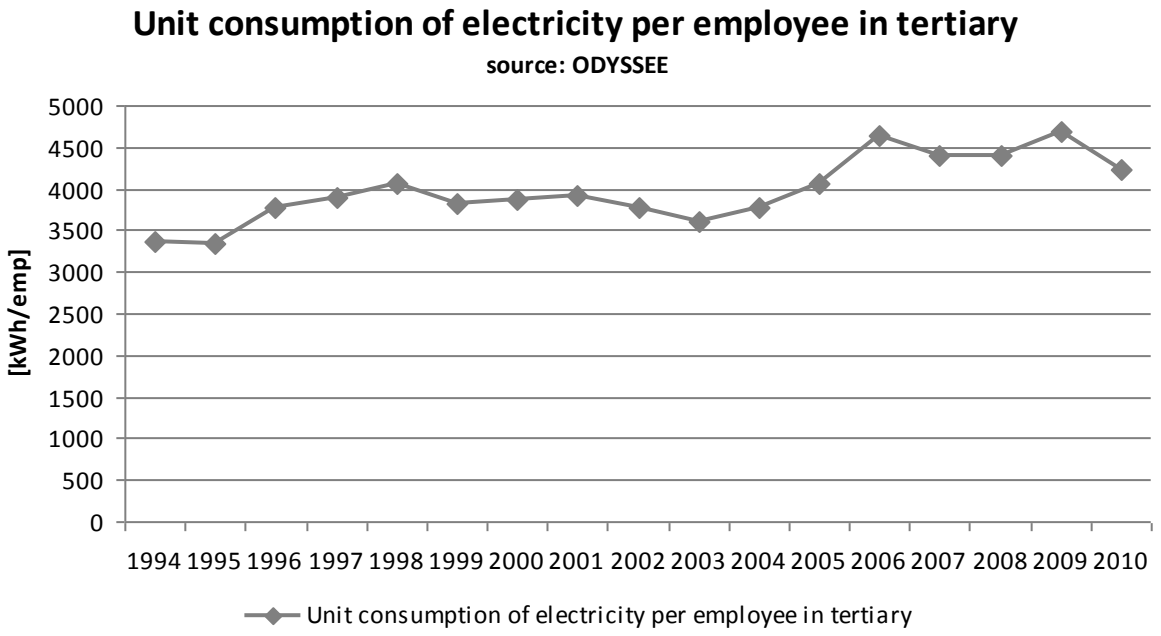

Figure 29

The energy consumption of the tertiary sector per employee decreased by an annual 0.8% on average between 1994 and 2010. Unit consumption per employee grew by an annual 1.5% on average between 1994 and 2000, then decreased by an annual 5.2% on average between 2000 and 2010.

The intensity growth per employee between 1994 and 2000 was attributable to the entry of new energy consuming units with higher energy consumption intensity than the average. The massive decrease in intensity between 2000 and 2010 is attributable to rationalisations made in state sectors, as institutional mergers reduce energy intensity. Unit energy consumption per employee grew by an annual 1.4% on average between 1994 and 2010 due to the ever-growing use of electric

equipments. Between 1994 and 2000 electricity unit consumption per employee grew by an annual 2.2% on average. Between 2000 and 2010 unit consumption per employee grew by an annual 0.9% on average. At the start of this period the growth in electricity unit consumption was more pronounced due to the entry of new units, then rationalisations in the state sector slowed down the growth of electricity unit consumptions.

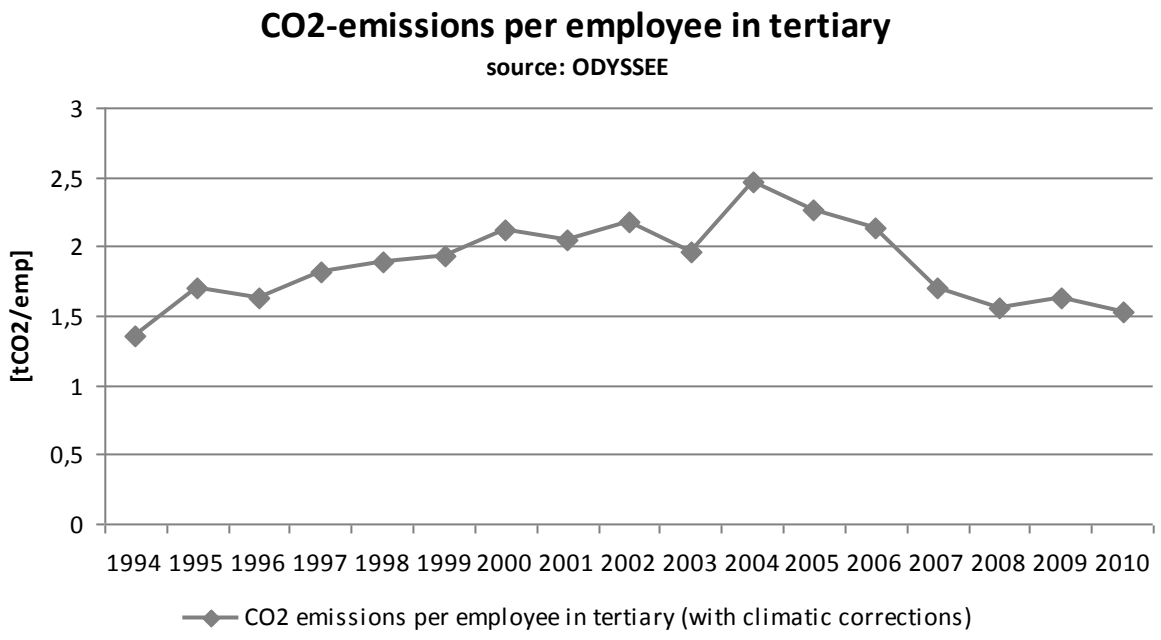

Figure 30

In the tertiary sector CO2 emission per employee grew by an annual 0.4% on average between 1994 and 2010.
Between 1994 and 2000 CO2 emission per employee grew by an annual 7.4% on average which was attributable to unit consumption per employee and unit electricity consumption per employee and a fuel mix with higher carbon content. Between 2000 and 2010 CO2 emission per employee decreased by an annual 3.9% on average which was attributable to the reduction in unit consumption per employee and to the fuel mix with lower carbon content due to natural gas penetration.

4e) The energy consumption trends of the transport sector

The total energy consumption of the transport sector grew by an annual 1.4% on average between 1990 and 2010. Transport energy consumption reached its peak level in 2008 (year before the crisis). Between 1990 and 2008 annual average growth was 2.5%. Between 2008 and 2010 annual average decrease was 4.3%. The reduction had an impact on passenger and freight transport. In passenger transport the slump was attributable to the reduction of family incomes due to which the annual average mileages decreased and the purchase of new cars also slowed down substantially. In freight transport demands decreased moderately due to a slow-down in industrial production.
Between 2000 and 2010 the energy consumption of passenger transport increased by an annual 3%, while that of freight transport increased by an annual 5.4% on average between 1990 and 2010.
The energy consumption of passenger transport grew by an annual 5.5% between 2000 and 2008, while that of freight transport grew by an annual 6.5% on average between 1990 and 2010. As a result of the economic crisis between 2008 and 2010 the energy consumption of passenger transport decreased by an annual 3% on average while that of freight transport decreased by 6.2%.

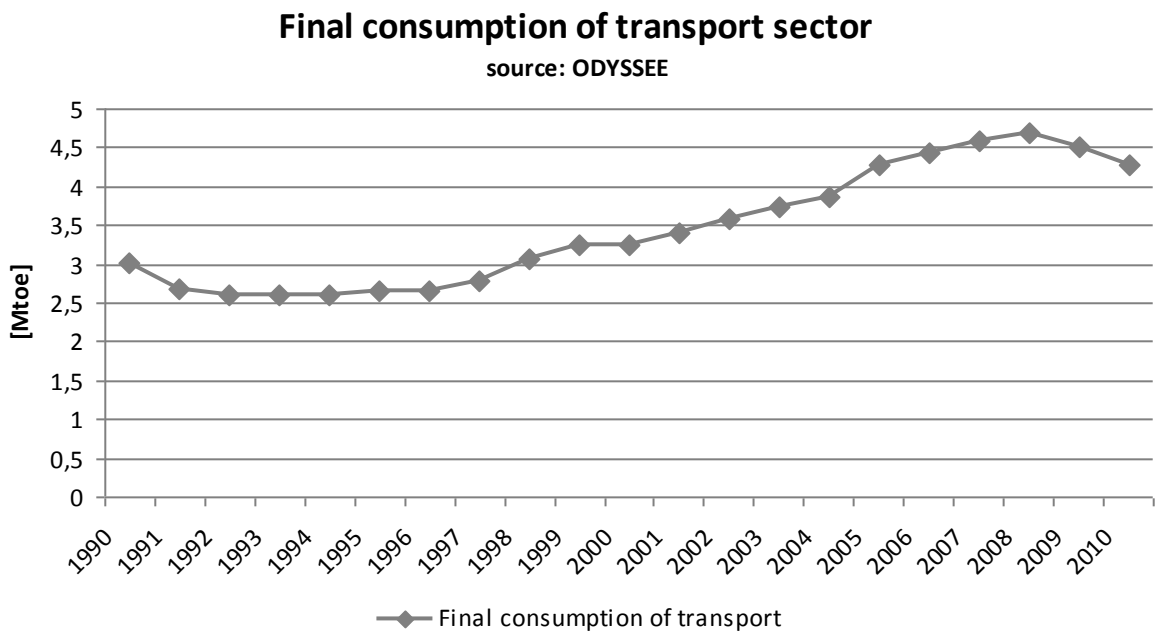

Figure 31

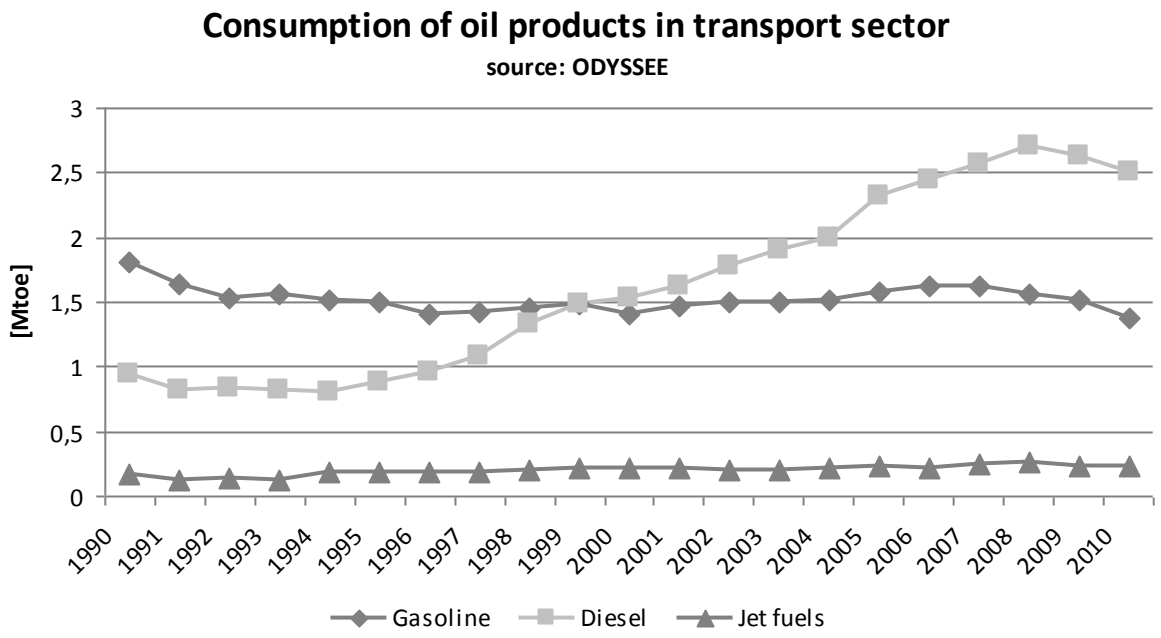

Figure 32

By examining transport consumption by oil products it can be concluded that growth had different impacts on fuels.
The consumption of petrol decreased by an annual 1.9% between 1990 and 2010.
Diesel oil consumption grew by an annual 1% between 1990 and 2010.
Kerosene consumption grew by an annual 1.4% between 1990 and 2010.

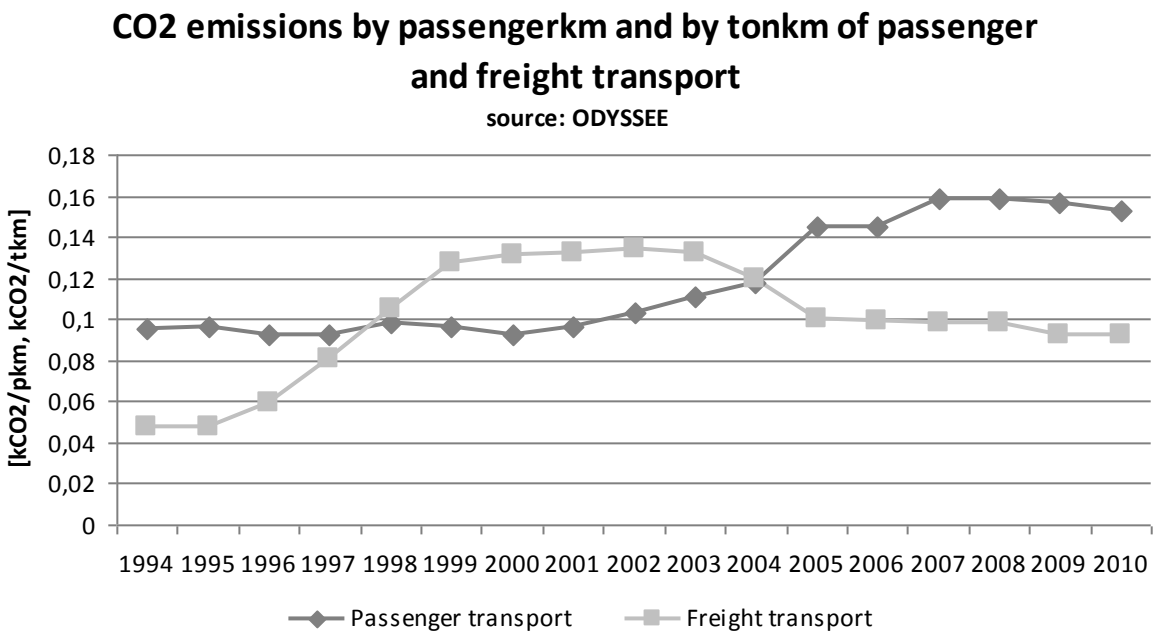

Figure 33

The difference in the growth rate of the various fuels changed the structure of consumption. In 1990 the consumption of oil products followed the following pattern: 62.2% was petrol, 32.1% was diesel oil, 5% was kerosene. In 2010 the consumption of oil products followed the following pattern: 32.9% petrol, 59% diesel oil, 0.5% propane-butane, 5.4% kerosene.
The various fuels are used by various consumer groups.
80% of the cars owned by individual, most taxis and a smaller part of vans run on petrol.
Diesel oil is used by most of the trucks and buses, some vans, non-electric railway traction and 20% of cars owned by individuals.
A smaller part of the cars owned by individuals use propane-butane.
Kerosene is used by air traffic.

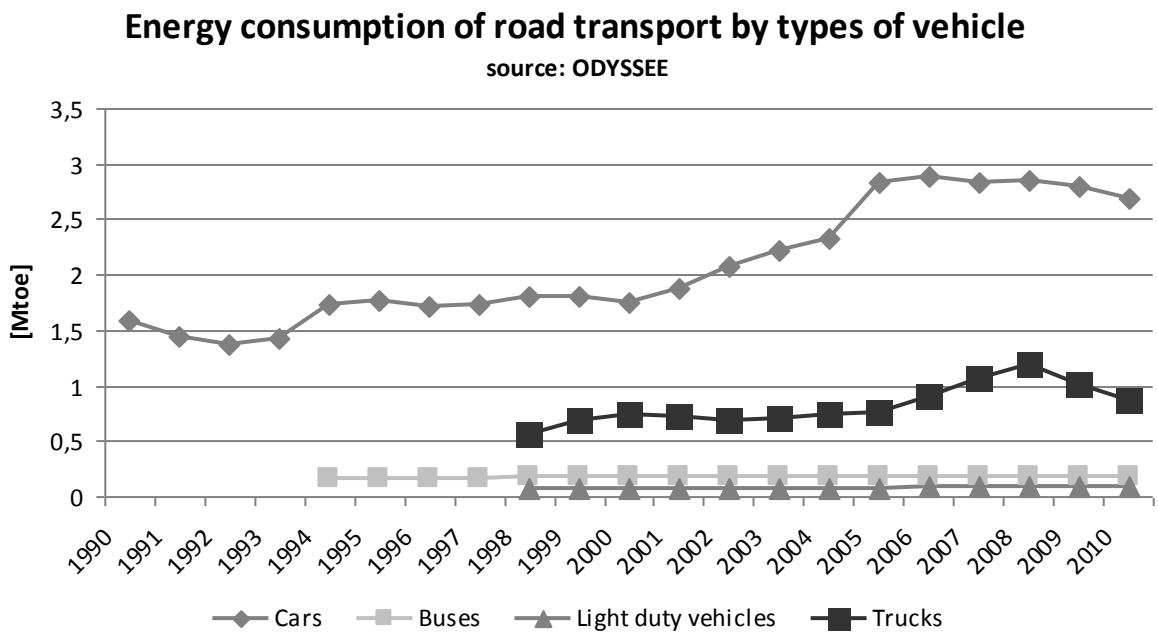

Figure 34

The energy consumption of road traffic increased by an annual 2.3% on average between 1990 and 2010.
The energy consumption of cars grew by an annual 2.1% on average, that of buses by 0.4%, that of light duty vehicles by an annual 0.1% on average, while the consumption of trucks grew by an annual 3.5% on average.
The consumption of cars includes the energy consumption of transit transportation, which we could not filter due to the lack of data in this regard.
The growth in the passenger transport was attributable to the growth in the number of cars until 2008 and to the growth in average annual mileage and to a smaller extent to the growth in cubic capacity. As a result of the economic crisis the number of cars and the average annual mileage of the cars started to decrease and as a consequence the total consumption of cars started to decrease.
The reason behind the growth in the consumption of freight transport was the massive growth in merchandise tonkm between 1998 and 2008 and the average mileage of trucks which occurred due to the fact that multinational companies prefer road transport due to its flexibility and lower volume independence.

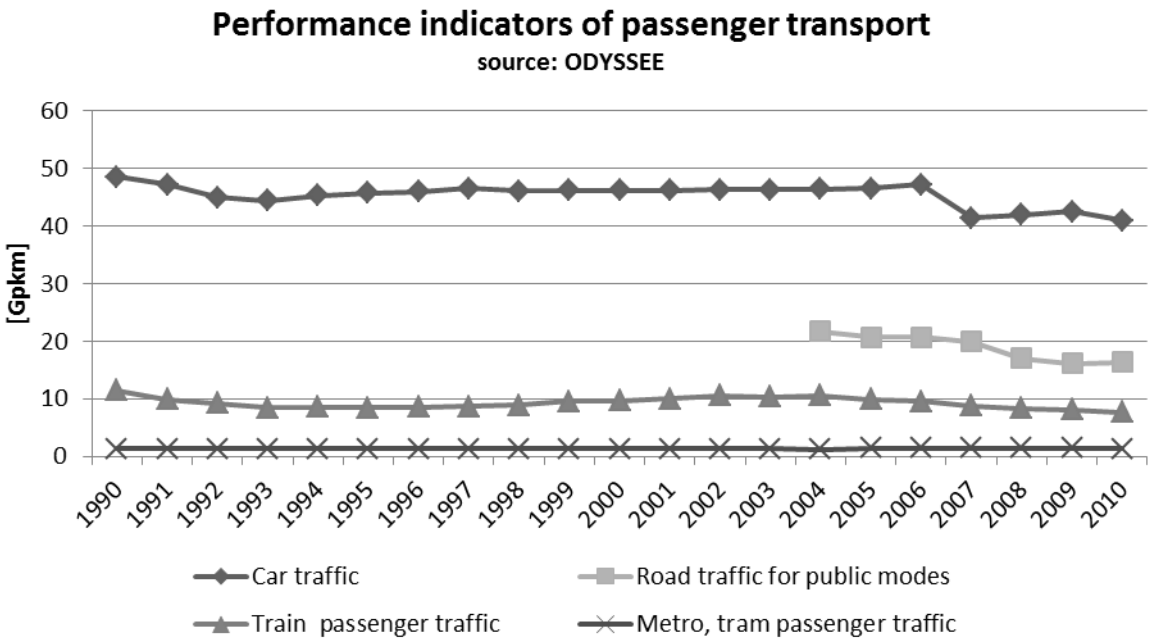

Figure 35

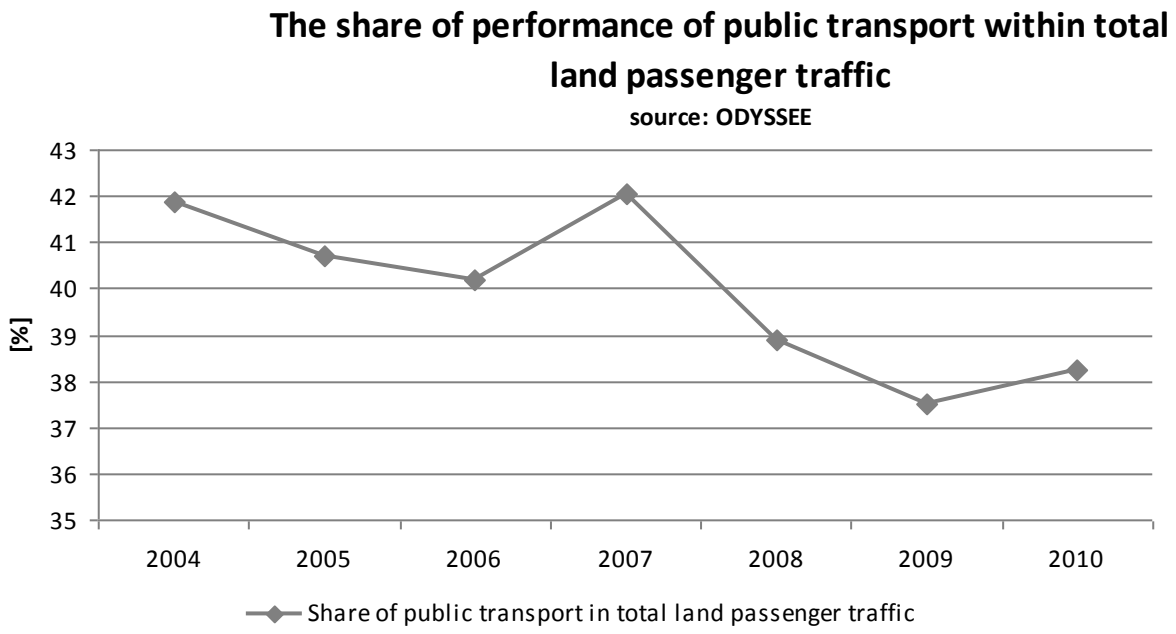

Figure 36

At the regime change passenger traffic was characterised by a well-developed public transport. All major Transdanubian cities can be accessed from Budapest and some major cities in the region of the Great Plains may be accessed by direct, daily bus transfers. By railway all county seats can be accessed via comfortable Intercity trains. Currently there are three underground lines in Budapest, the fourth one is being constructed. In the 5 biggest cities tram traffic runs at least on two lines.

The aim of transport policy is to maintain the previous share of public transport. This goal is also advantageous from energy consumption point of view as the means of public transport (train, bus, underground, tram) consume much less energy than the use of car (individual transport). On the other hand it is much more difficult to obtain state subsidies for the maintenance of public transport. Despite the fact that several types of taxes strive to restrict the use of cars (excise tax on petrol, VAT on petrol, registration tax on new cars, annual tax based on the size of the engine, obligation to pass a roadworthy test every three years) the share of passengerkm for cars within total passengerkm increased from 58% to 61.7% from 2004 to 2010.

On the other hand it is the success of transport policy that the share of public transport (passengerkm for bus, train, underground, tram) within total passenger km dropped from 41.9% in 2004 only to 38.2% in 2010. The relatively low extent of this drop shows the success of transport policy which tried to maintain the previously achieved level of standard. A substantial drop in the share of public transport would have meant a reorientation to car traffic.

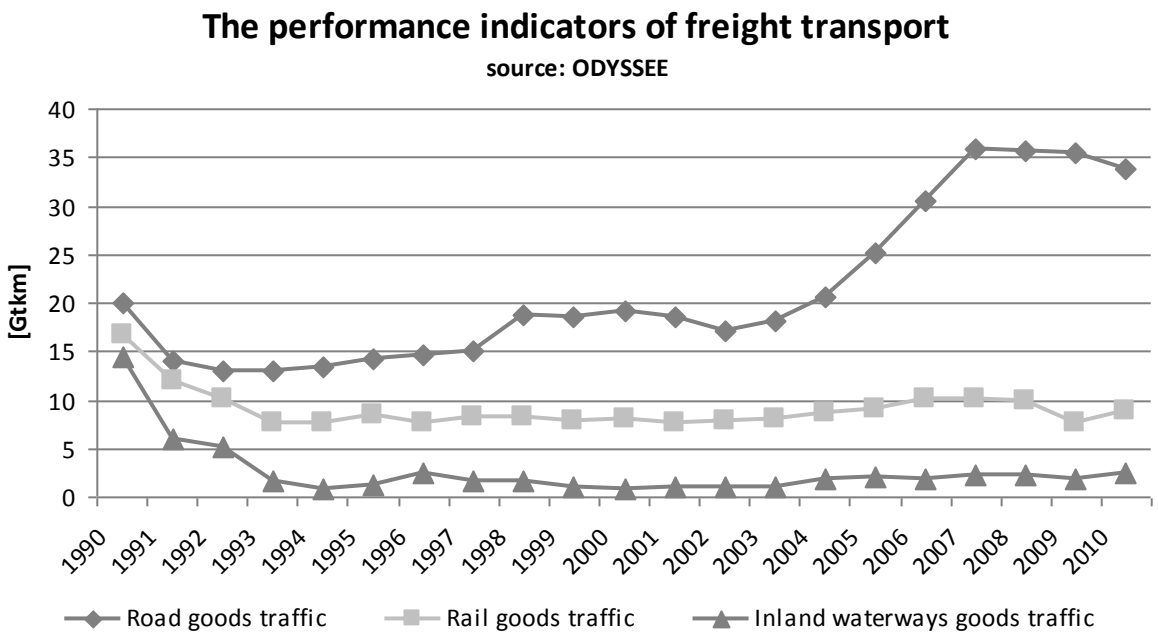

Figure 37

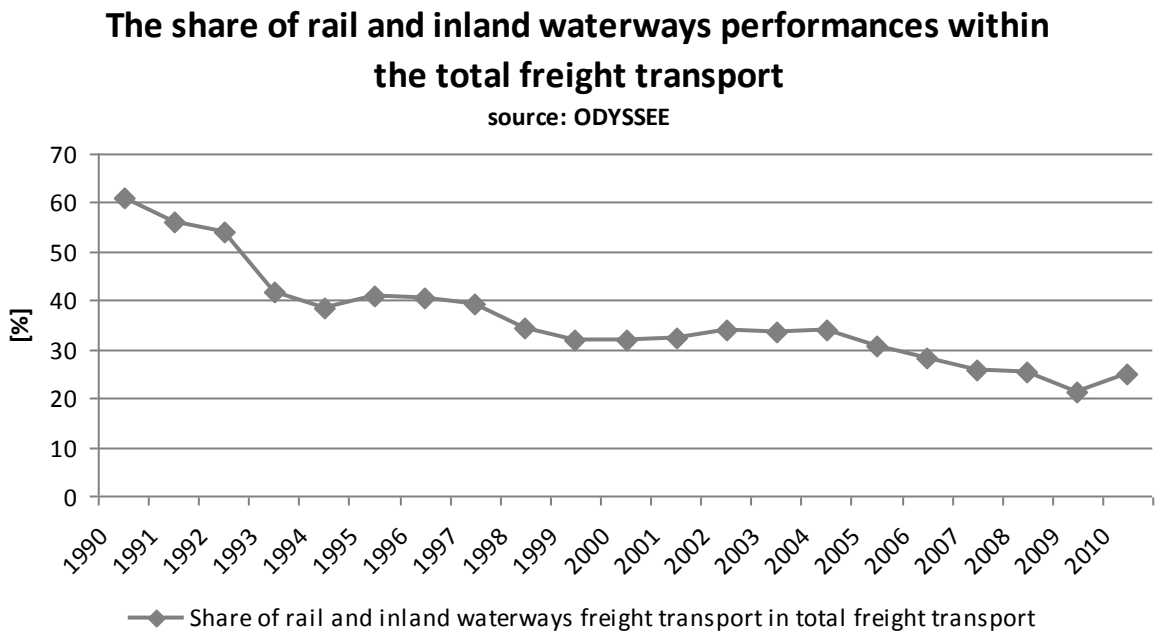

Figure 38

The structure of freight transport underwent substantial changes during the transition towards market economy. During the planned economy railway and inland waterway transport was well-developed and well-organised. In the market economy railway transport lost ground, while road transport gained substantial ground.

The performance of road transport grew by an annual 2.3% on average between 1990 and 2010 using tonkm index and during the big upswing between 2002 and 2008 expansion amounted to an annual 13% on average.

In parallel with this railway transport shrank by an annual 4% on average between 1990 and 2010, the drop was drastic between 1990 and 1994.

The reorientation of freight traffic was attributable to the fact that multinational companies prefer road traffic to railway traffic due to its higher flexibility and volume independence. Many

companies use the „just in time" supply system when shipments arrive in line with the use thereby avoiding storage capacities.
Due to the above freight transports were oriented towards road transport requiring the most energy.
The orientation of freight transport towards road transport is well characterised by the rate of railway and inland waterway transport compared to total freight transport.
The share of freight traffic on railway and inland waterway compared to total freight transport decreased from 60.9% (1990) to 24.9% (2010). This resulted in the substantial increase in the energy consumption of freight transport.
Within transport development investments road construction, especially motorway construction became predominant. These developments require substantial amount of capital, yet they are necessary as the frequency of motorways in Hungary does not attain the European level.
On the other hand in more developed EU states more money is dedicated to railway development than to road development due to the reduction in transport energy needs and transport emissions.

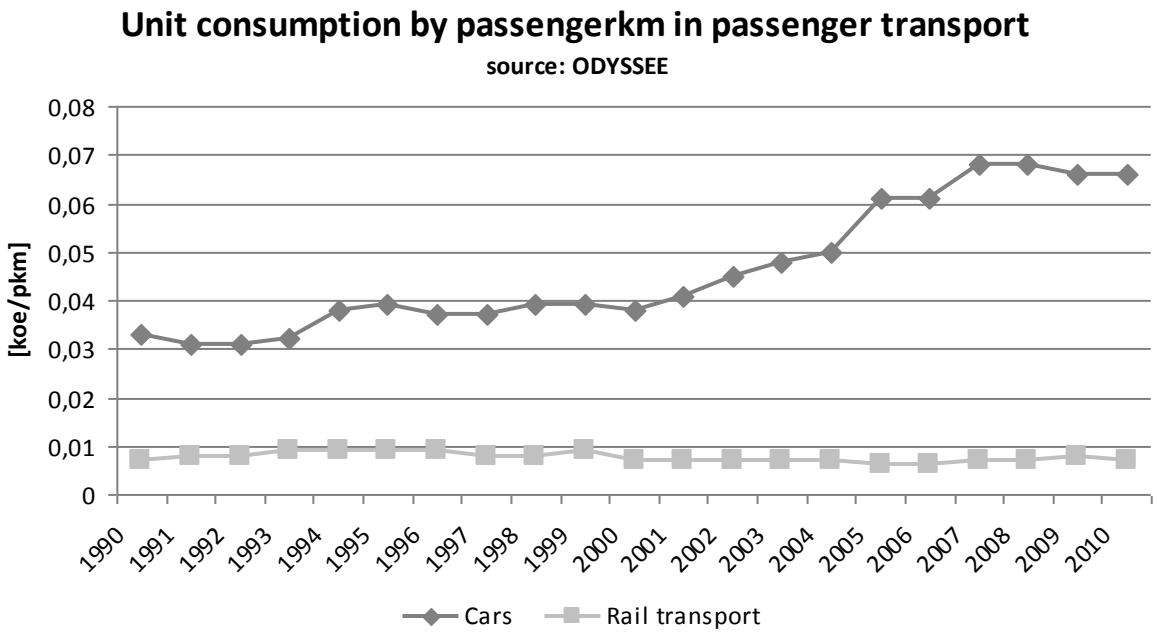

Figure 39

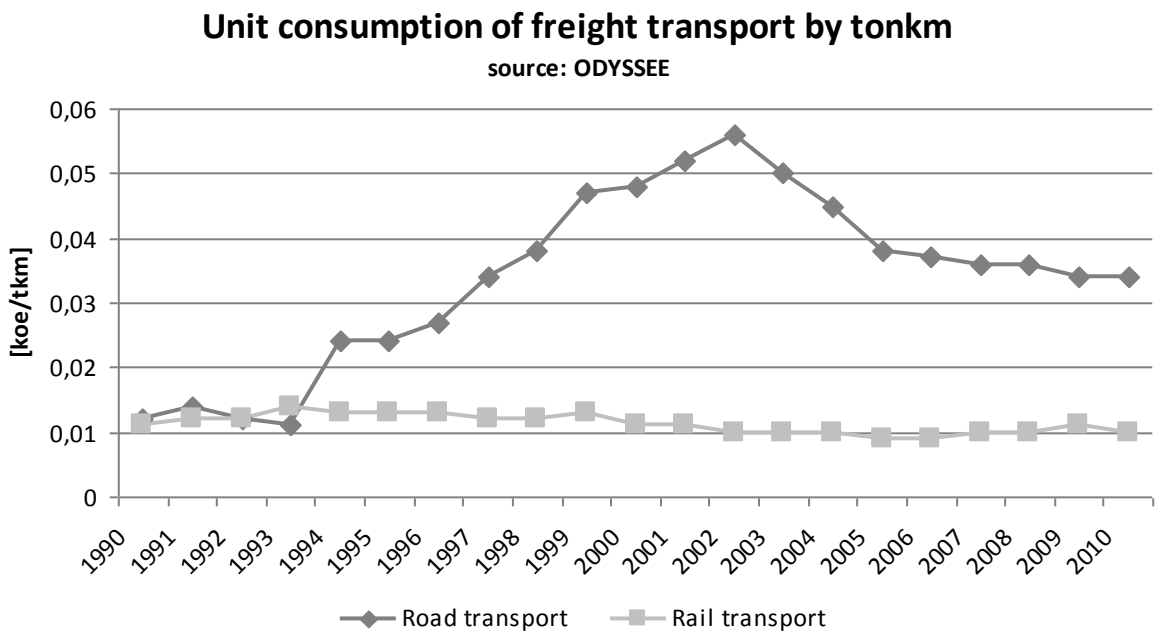

Figure 40

The unit consumption of passenger transport per passengerkm grew by an annual 3% on average between 1990 and 2010. The growth was attributable to the growth in the number of cars and annual average mileages and to the moderate drop in passengerkm for cars.

The unit consumption of freight traffic per tonne km increased by an annual 4.9% on average between 1990 and 2010. The reason for the growth was attributable to the fact that the average annual mileage of the moderately decreasing number of trucks grew more rapidly than the transport index characterised by tonkm.

In passenger transport the unit consumption of cars grew by an annual 3.5% on average between 1990 and 2010, while the unit consumption for railway passenger transport stagnated between 1990 and 2010.

In freight transport the unit consumption of trucks and vans measured in koe/tkm grew by an annual 5.2% on average between 1990 and 2010. The unit consumption of railway freight transport measured in koe/tkm decreased by an annual 0.5% on average.

In passenger transport the unit consumption of cars per passengerkm was 9.4 times as high as the unit consumption of railway passenger transport per passengerkm.

The unit consumption of road freight transport per tonkm was 3.4 times as high as the unit consumption of railway freight transport per tonkm.

It is due to the substantial discrepancy in specific energy consumption that the cars in passenger transport have substantial excess consumption compared to railway passenger transport, and in freight transport trucks and vans have substantial excess consumption compared to railway freight transport.

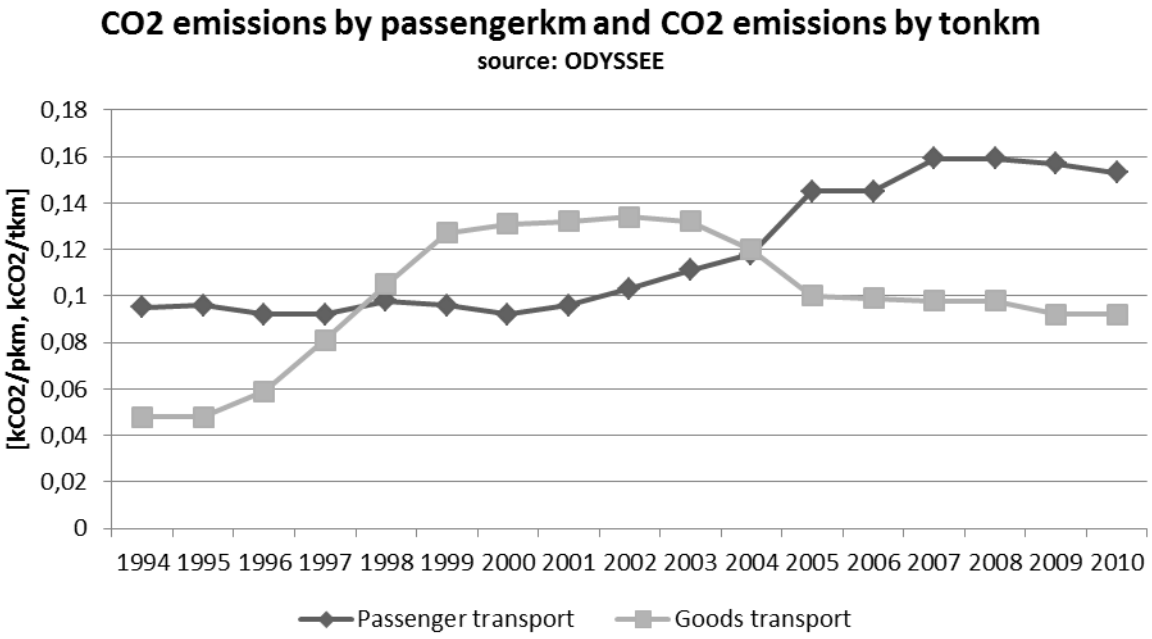

Figure 41

CO2 emissions from transport increased in parallel with the energy consumption in transport during the analysed period.

The CO2 emissions per passengerkm and freight transport tonkm increased which shows that the transport sector is becoming an ever bigger CO2 emitter. The specific emission of passenger transport measured in kCO2/pkm grew by an annual 3% on average between 1994 and 2010 while the specific emission of freight transport measured in kCO2/tkm grew by an annual 4,1% on average.

The rise in transport CO2 emissions was attributable to the rise in car traffic, while in freight transport it was due to the orientation of railway and inland waterway freight transport to road transport.

Transport policy uses several instruments in passenger transport to restrict the traffic of cars and to reorient road freight transport to railway and inland waterways, yet these instruments have only limited success due to the higher flexibility of cars and due to the higher flexibility and volume sensitivity of road freight transport.

4f) National and sectoral energy efficiency indices

The national energy efficiency index shows the sectoral progress of final consumer energy efficiency.

The ODEX index aggregates the final consumer consumptions per sector. It measures the energy efficiency of sectoral unit consumptions in physical units: toe/m^2, kWh/electric household equipment, toe/ton, l/100km.

The calculation of energy efficiency indices is a better way to be used for the calculation of energy efficiency trends at aggregated level than the calculation of energy intensities as the energy efficiency indices do not include those structural changes which are not directly linked to energy efficiency. Energy efficiency indices compare main final consumer consumption categories in order to assess final consumer energy efficiency trends. The various final consumer indices are weighted with their share in total consumption.

The calculation of energy efficiency indices is an alternative statistical method compared with the calculation of energy intensities.

Sectoral level savings may be derived directly from the calculated sectoral energy efficiency indices, which well characterise the success of energy efficiency policies in the given sector.

In industry the energy efficiency indices of 10 sectors are calculated with the consumed energy/ production index or consumed energy/ manufactured volume index.

The energy efficiency of the following 7 main categories in transport:
- cars
- trucks and vans
- air traffic
- railway
- inland waterways
- motorcycles
- buses

are calculated.

In households it examines the energy efficiency of 8 main categories:
- space heating
- water heating
- cooking
- refrigerators
- freezers
- washing machines
- dishwashers
- TV-s

The ODEX–index is an aggregated indicator for presenting the development of sectoral energy efficiency.
The inverse of the index shows aggregated energy savings in sectoral energy consumption.

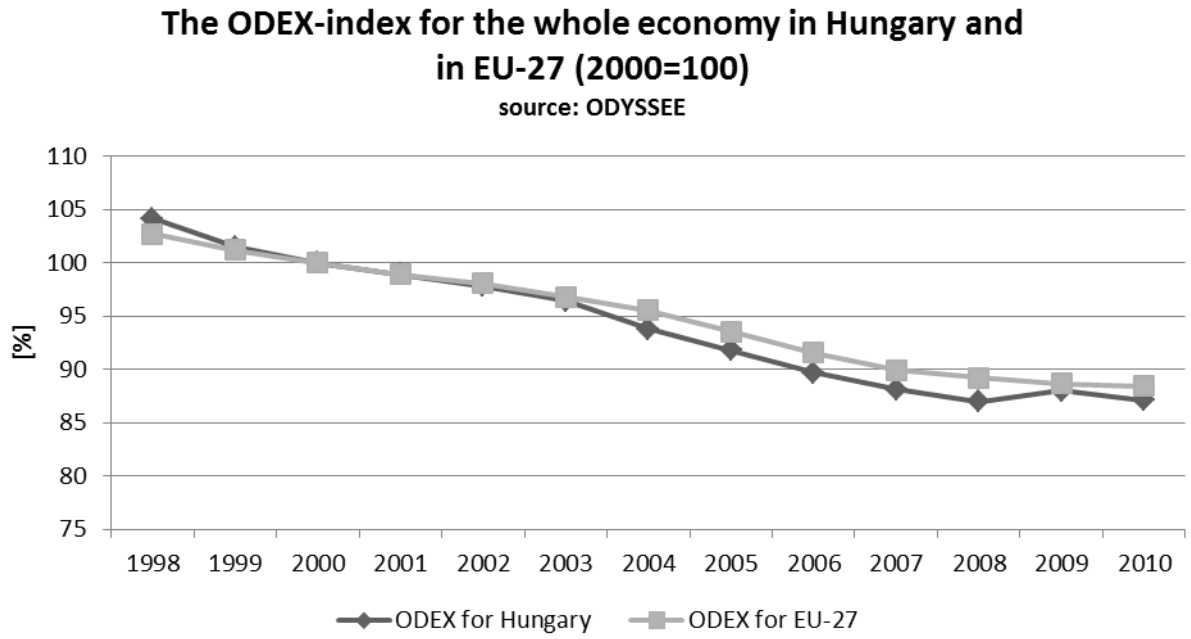

Figure 42

Between 1998 and 2010 the national ODEX-index improved by an annual 1,5% on average.

The national ODEX index improved from 104,1 to 87,1 while the EU-level ODEX improved from 102.7 to 88.4. The improvement in energy efficiency at national level is slightly above the European average. The improvement of industrial energy efficiency is well above the European average, the improvement of energy efficiency in transport is slightly above the European average, while the improvement of the energy efficiency of the household sector is well below the European average.
The national industrial ODEX improved from 114.1 to 73.9, the national transport ODEX improved from 96 to 84.7 while national household ODEX improved from 101 to 97.
In the analysed period the improvement in efficiency was mostly due to improvement in industry and to a lesser extent to the improvement of energy efficiency in transport sector, while the energy efficiency of households improved only slightly.
Sectoral and macro-level energy savings may directly be derived from ODEX index. (Energy saving = Energy consumption(1-(1/(ODEX/100)))
Based on this calculation between 1998 and 2010 in the manufacturing industry 1.6 Mtoe, in transport 0.6Mtoe in household sector 0.6Mtoe saving could be detected, which meant 2.8Mtoe saving at national level.

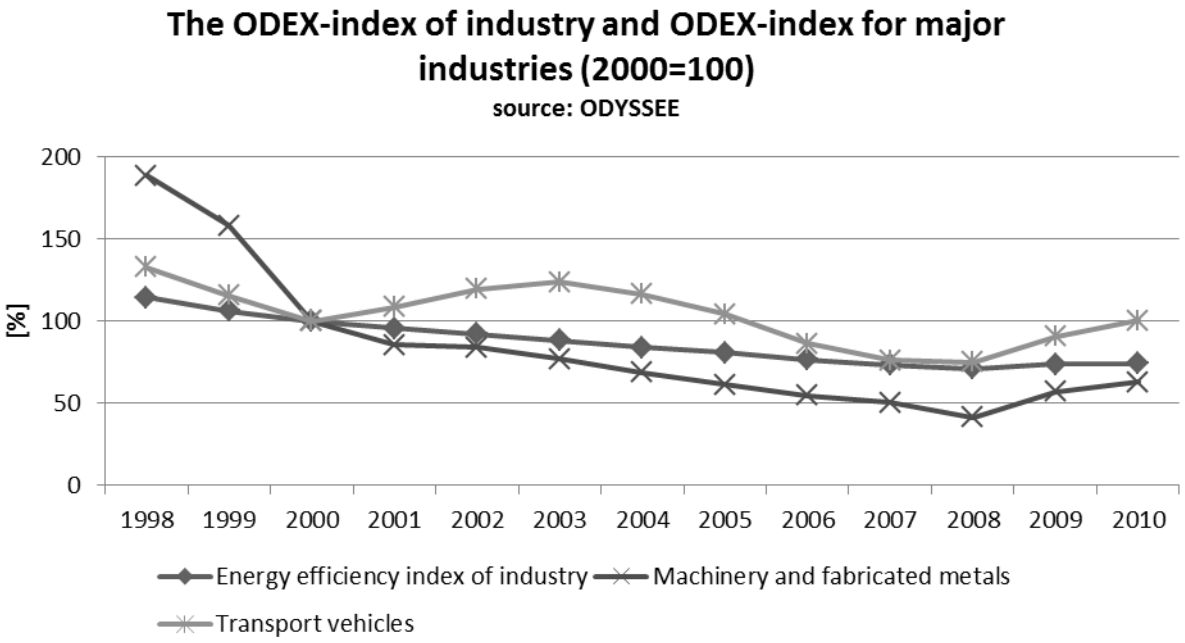

Figure 43

In the industrial ODEX-index grew by an annual 3.6% on average between 1998 and 2010. In less energy-intensive sectors besides the substantial growth of production indices final energy consumption stagnated.
Energy efficiency improved in all manufacturing sectors while manufacturing oriented towards less energy intensive structure.
The ODEX in machinery performed better than expected, i.e.: it improved by an annual 8.8% on average, as machinery production indices grew substantially, while energy consumption only grew slightly.
The improvement in transport equipment industry ODEX was an annual 2.9% on average which was below the average of that of the manufacturing. The reaction of the machinery and tranport equipment industry to the crisis was more pronounced, due to the decrease in production the energy efficiency indices of both industries deteriorated.

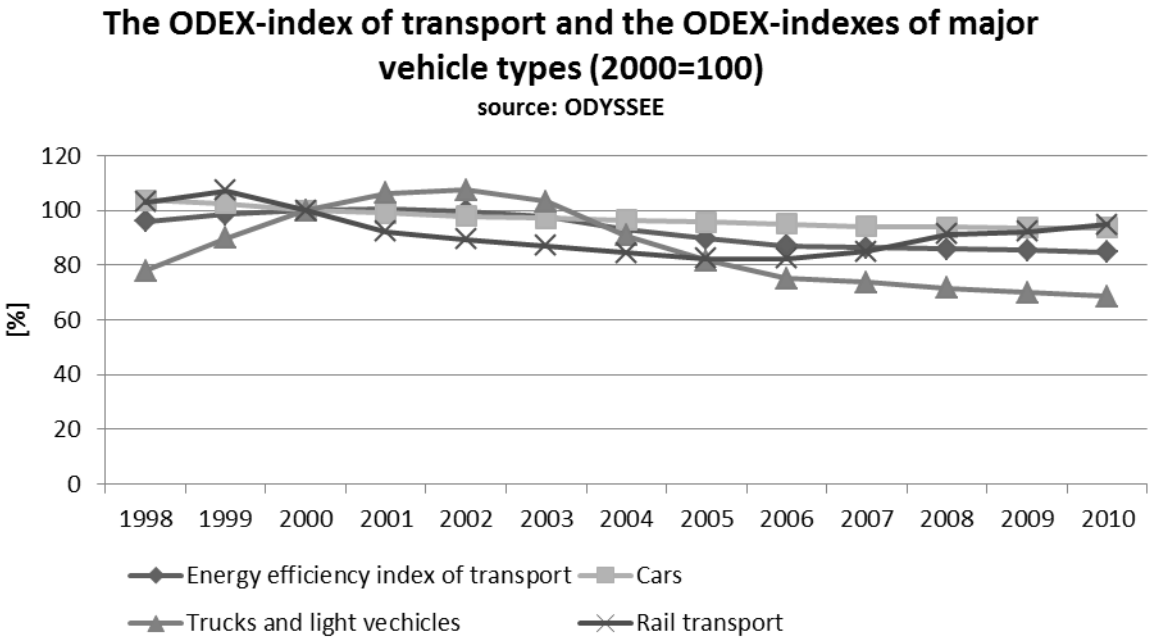

Figure 44

In the transport sector the ODEX index improved by an annual 1% on average. The index of road unit consumption deteriorated by an annual 1.5% on average, the index of the unit consumption of railway transport improved by an annual 0.8% on average, the index of inland waterway improved by an annual 2.4% on average, the index of air traffic improved by an annual 4.6% on average.
Most of the car stock was changed as at the regime change the obsolete car fleet was changed to low-consumption modern cars.
In freight transport besides increasing transport volumes the efficiency of freight organisation improved.
Railway passenger transport moderately decreased, railway freight traffic lost ground compared to road freight transport, yet railway operates in an organised way.
Combined road-railway transport is used for about 10% of the transported goods, these goods are reoriented from road to railway.

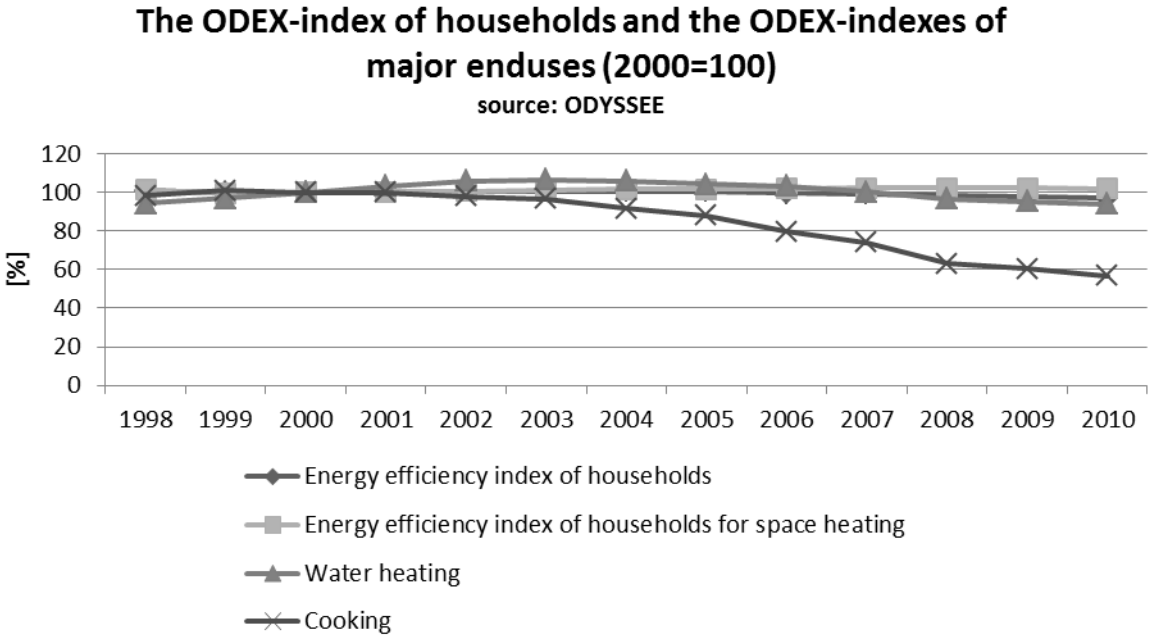

Figure 45

In the household sector the ODEX-index grew by an annual 0.3% on average between 1998 and 2010. Yet the index of unit consumption of room heating stagnated, the unit consumption index of water heating improved by an annual 0.9% on average, the unit consumption index of cooking impoved by an annual 4.9% on average.
It is an alarming sign for the energy policy that the unit consumption index of space heating at national level stagnated between 1998 and 2010. In order to achieve the 30% increase in the efficiency of room heating by 2030 set by the National Energy Strategy 2030 new substantial household energy efficiency programmes need to be introduced as in contrast with most European countries the efficiency of household space heating did not improve between 1998 and 2010.

4g) The trends of CO_2 – emissions

In ODYSSEE emission can be calculated in two ways: direct emissions and total emissions.
Direct emissions are emissions from the direct burning of oil, gas and coal. This complies with the official CO2 inventory submitted to UNFCCC.

Total CO2 emissions contain indirect emissions and the electricity consumptions used by the various sectors besides direct emissions. Thus total emissions contain sectoral indirect and direct emissions, i.e.: electricity consumption is imposed on the various final consumer sectors.

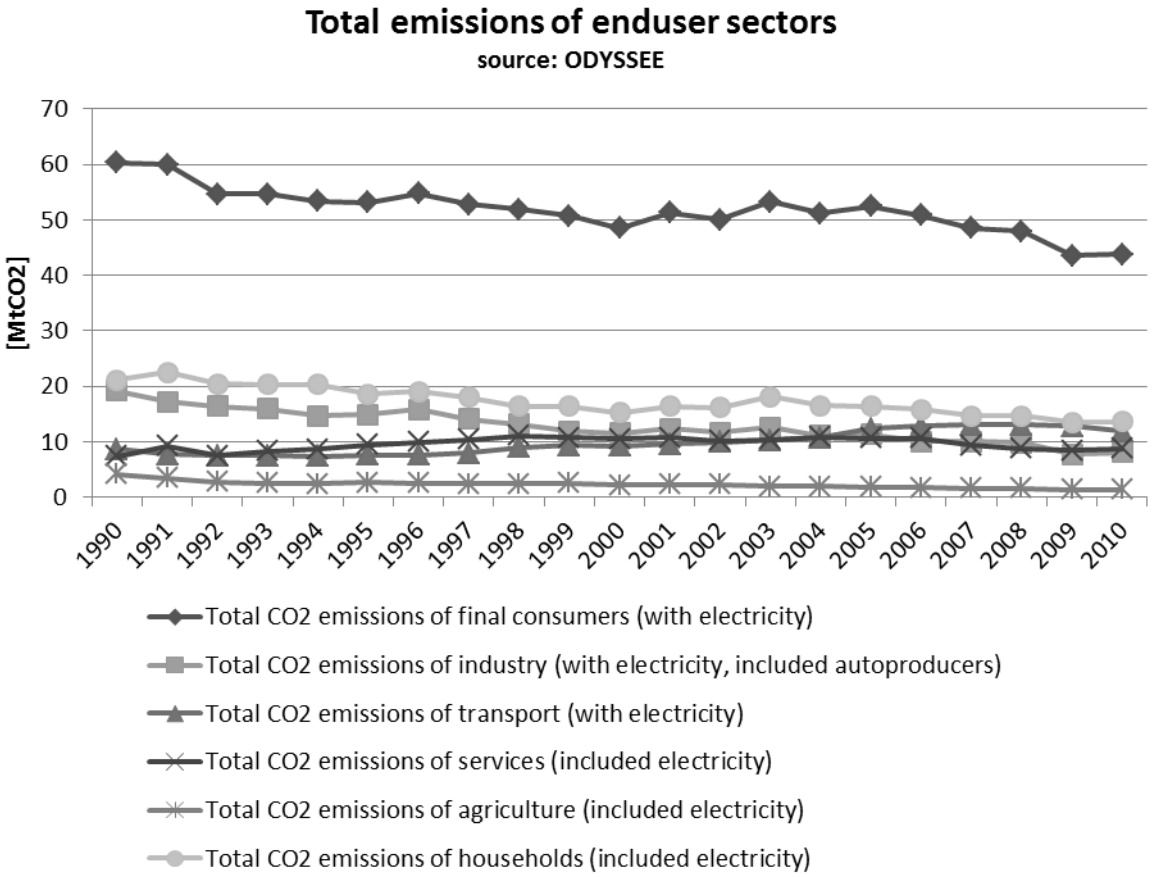

Figure 46

National total emissions decreased by 28% between 1990 and 2010.
Hungary's Kyoto environmental engagements concern the direct emissions and the average of 1986-1988.

The reduction of total emissions demonstrates the structural changes in consumption resulting in the reduction of CO2, the decline of socialist industry, the substantial development of machinery and transport equipment industries within the manufacturing, the increase of emission in passenger and freight transport in the transport sector and the evolution of natural gas as the main household fuel. In industry emissions decreased by 58.9%, in transport emissions grew by 38.1%, while in households total emissions decreased by 36% between 1990 and 2010.
The reasons for the change in CO2- emissions vary from sector to sector.

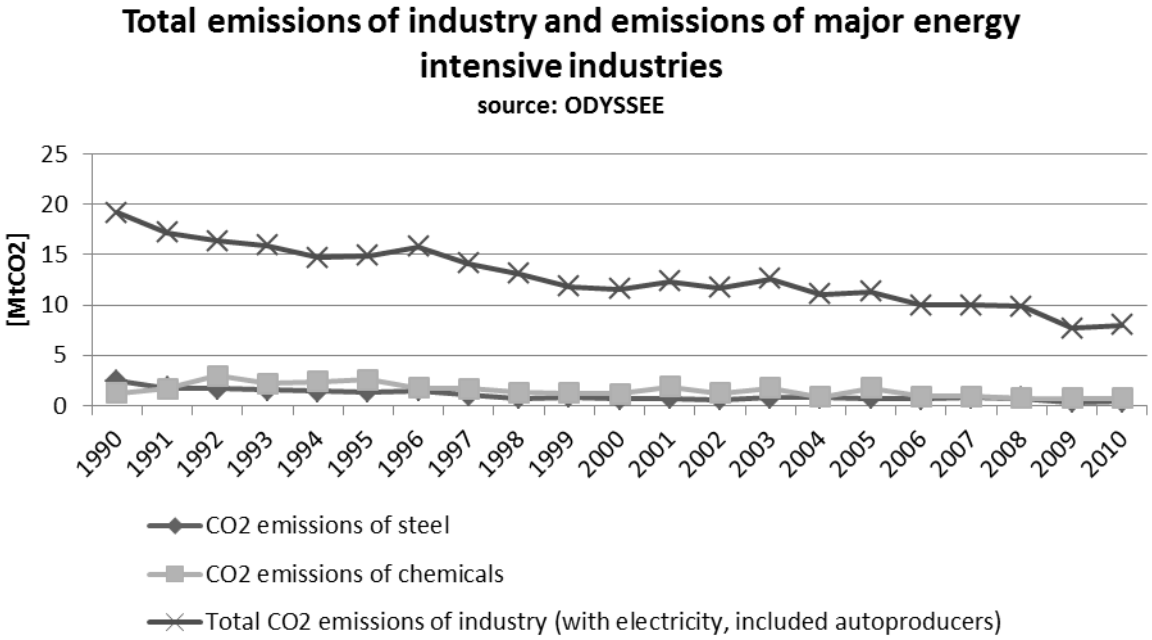

Figure 47

CO2 emissions in the industry decreased by 58.9% between 1990 and 2010 which meant an annual 7.9% reduction on average. The reduction was attributable to the decline of energy intensive industries and to the general improvement of industrial energy efficiency.
The emissions of the primary metals decreased by an annual 8.9% on average. Several metallurgical sites were closed down, production was oriented towards rolled articles.
The emissions of the chemicals decreased by an annual 2.8% on average. Several heavy chemical plants closed down, the pharmaceutical industry substantially increased its production.
Emissions in paper industry remained stable, paper factories use similar technology as at the beginning of 1990s.

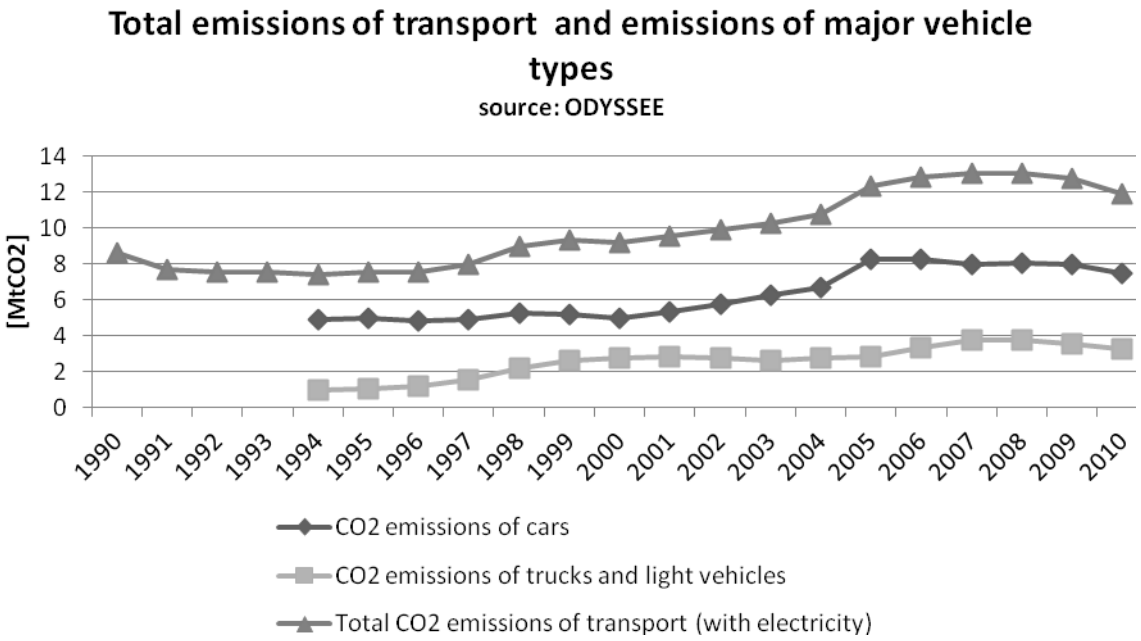

Figure 48

The emissions of the transport sector increased by 38.1% between 1990 and 2010 which means an annual 1% growth on average.
The emissions of cars grew by an annual 2% on average as the number of cars and the annual mileage grew rapidly.
The emissions of trucks and vans grew by an annual 8% on average as tonkm and yearly mileage grew steadily and rapidly.
In the analysed period freight transport was oriented from railway to road.

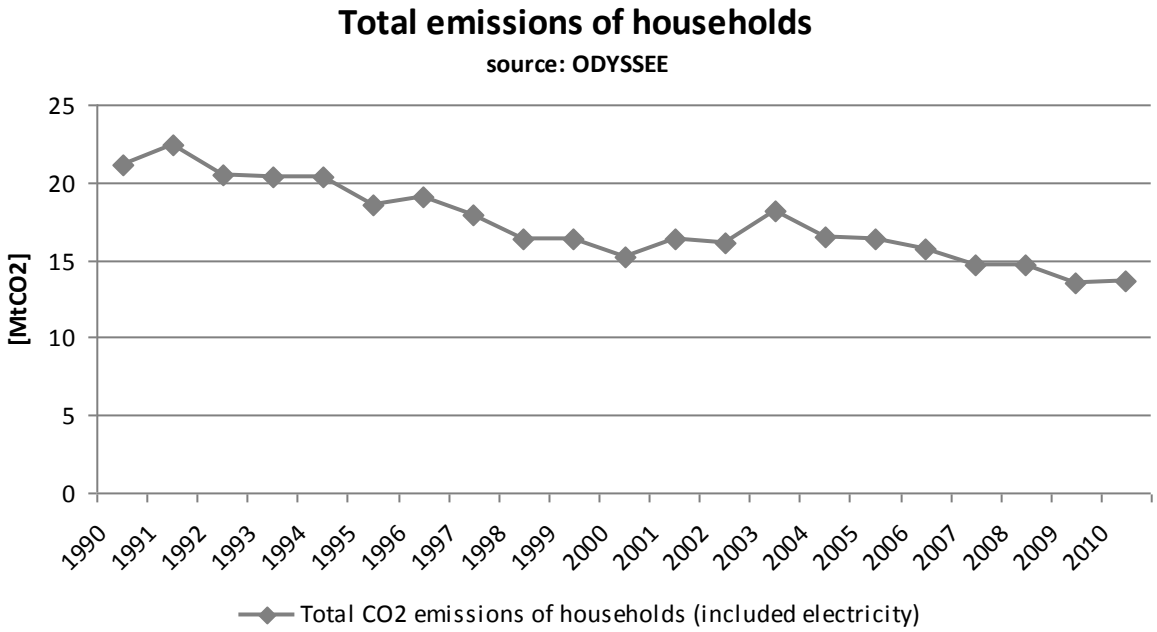

Figure 49

The emissions of the household sector decreased by 36% between 1990 and 2010.
In the household sector the energy efficiency index of space heating (which has the highest share) stagnated in the analysed period, but substantial changes occurred in fuel use. Low-CO2 emission natural gas penetrated, while coal and oil lost their importance.

5.) Energy efficiency measures

5a) Current energy efficiency measures

The detailed description of energy efficiency measures can be found in the MURE database. (www.mure2.com/Hungary)

5.aa)Household sector

1.) Green Investment System Climate Friendly Home-Blocks of Flats sub-programme

Within the Green Investment System all energy efficiency measures can be promoted which result in a documented CO2-emission reduction or the impact on energy efficiency can be proven by the heat technic standard issued by the minister without portfolio under Decree 7/2006. Following the investment the building must have much better CO2 emissions.

Blocks of flats, associations for the maintenance of flats may submit their request for grant for blocks of flats owned by themselves. Local municipalities may also be the beneficiaries of the grant.

Types of energy efficiency measures to which blocks of flats may submit a tender:

- Subsequent heat insulation of facades and ceilings
- Change or renovation of doors and windows
- Renovation of heating and water heating systems resulting in energy savings
- Substitution of carbon energy sources with renewable energy sources
- Improvement of the summer heat protection of blocks of flats with the installation of shading systems
- Glass installation of the loggia of blocks of flats

2.) „For a successful Hungary" energy efficiency grant and loan scheme NEP 2009

The scheme provides grants and/or loans with low interest rate for the energy-efficient renovation of houses built before 1994. (A more stringent heat technic standard was introduced in 1994).

Energy efficiency measures to which grant can be provided:

- Subsequent heat insulation of building structures
- Renovation or change of windows and doors
- Modernisation of heating and water heating systems (existing heating systems operating with renewable energy cannot be changed for carbon-based energy sources)
- Substitution of carbon energy sources for renewable energy sources

Beneficiaries in case of traditional technologies:

- Natural persons
- Associations for the maintenance of blocks of flats
- Blocks of flats

In case of flats built with industrialised technology only natural persons could submit their request for grant.

3.) Energy certificate for new flats

The Building Energy Directive (2002/91/EC) dealing with the energy characteristics of buildings was transposed into Hungarian legislation in 2008 by Government Directive 176/2008.

In accordance with the above-mentioned legislation it is mandatory to have an energy certificate for the occupancy or renting of new flats. The aim behind the regulation of the certificate is to improve the energy efficiency of buildings in the long run.

- The energy certificate must be filled out based on a sample elaborated for this purpose. The qualification classes range from A+ to I.
- The energy calculation of the construction-technical and implementation documents need to be attached to the summary sheet of the energy certificate.

Sample for energy certification:

- Name and address of the client
- Address, registration number of the building
- Name, address and identification number of the certifier
- Specific primary energy consumption of the building kWh/m2a
- Reference values based on Decree 7/2006 issued by the minister without portfolio on the determination of the energy characteristics of the building
- The reference value for the requirement is kWh/m2a
- Factor for specific heat loss as a percentage of requirement value
- Classification based on energy quality

Apart from that the document makes proposals regarding the types of investments with which the examined flat may be part of a higher category of energy efficiency
The energy certificate is a document serving the interests of the customers which classifies the given flat from building energy efficiency point of view, thereby promoting its classification in the real estate market.
Based on the certificate flats with energy certificate can be easily compared from building energy efficiency point of view.

4.) Defining stricter conditions for thermal regulation of buildings (7/2006. decree of the minister without portfolio)

7/2006 Decree issued by the minister without portfolio prescribes stricter conditions for the minimum requirements of heat transmission regarding the renovation of building structures for new buildings and the renovation of buildings which are bigger than 1000m2. The new heat technics standard takes into consideration the energy source as well.
The stricter conditions were introduced based on 2002/91 Building Energy Directive. The 2010 amendment of the Energy Performance Building Directive must be transposed into national building energy legislation by the end of 2013.

5.) The revision of household heat generating equipments and household air conditioning

Government Decree 264/2008 prescribes energy revision for heat generating equipments with effective power exceeding 20 kW, for air condition systems with nominal power exceeding 12 kW, for heating systems older than 15 years and operating with effective nominal power exceeding 20kW.
The aim of the energy revision of heat generation equipments and air condition systems in the scope of the decree is to provide information on the energy efficiency of the equipment and system.
The energy revision focuses on the examination of documents, identification of equipments and systems, checking of the conformity of dimensioning, checking of professional operation, checking of professional maintenance, definition of proposed modifications.
The steps for the energy revision of heat generation equipments: identification of the boiler, compilation of documents, inspection in a guided way, definition of maintenance status, checking of operational safety, assessment of regulatory functions, noting down the consumption indicated by the meters, definition of the performance of the boiler, issuance of the revision certificate for the boiler and making suggestions

6.) Programme for the change of household electric appliances entitled Forgó-Morgó (Spinning Grumbler)

In Hungary 37% of the household electric appliances are older than 10 years. In EU-27 Hungary has one of the oldest stock of household appliances. Many consumers are not interested in the fact that old equipments are energy wasters. In the lower income decile household consumption is very price sensitive, consumers only care about the price of an equipment and do not care about the energy savings which can be achieved by new appliances.
Being aware of the above-mentioned situation CECED Hungary Association initiated the Forgó-Morgó campaign for the change of household appliances. The most important aim of the Forgó-Morgó campaign was the development of energy consciousness in households. In the various campaign items the differences between the electric consumption of old and new household appliances were presented and awareness was raised for the energy savings which can be achieved.
The TV spots presented energy wasting refigerators, washing machines, electric ovens, vacuum cleaners. A competition was announced for collecting the oldest yet still working refrigerator and washing machine. (The oldest refrigerator in Hungary was a Soviet ZIL Moszkva refrigerator manufactured in 1955).
The declared aim of the campaign was to form consumer consciousness. It provided information to consumers on the energy savings which can be achieved by changing the electric household appliances.
The secondary aim was the promotion of the change of household appliances. From the financial grant provided by sponsors a 20 € discount could be redeemed when switching to an energy-efficient household appliance.

7.) Planned measures of the National Energy Efficiency Action Plan

Introduction of heat quantity measurement per dwelling in district heating
Act 18/2005 on district heating sevices enables heat quantity measurement at the heat receiving station. Former act on district heating services made measurement on the level of heat centres compulsory thus it is currently general.
The introduction of measurement for each dwelling enables the invoicing of consumer costs proportionate to the service and facilitates the implementation of regulation for each dwelling.

Development of energy efficiency consultation network

- provision of information with relation to energy investments and energy efficiency consultation
- implementation of inspections and qualifications with relation to energy investments
- more effective application coordination in the area of energy applications
- provision of county application consultation offices with professional materials and energy related information
- implementation of awareness raising campaigns which present the application possibilities for energy efficiency and renewable energies
- implementation of nation-wide road shows that present the available application opportunities, state-of-the-art technologies and innovations

Energy efficiency labelling of household electric and gas boilers
Water heating comprised 17.7 percent of household consumption in 2010. For water heating 35 percent of population used electric boilers and the same used gas boilers. Boilers used for water heating are not labelled currently and the stock of boilers is quite aged.
Energy efficiency labelling could help the orientation of consumers for the procurement of energy efficient types. The establishment of a financial fund for subsidising the replacement of boilers could stimulate the replacement of out-of-date water boilers.

Spreading of energy efficient lighting equipment in the households
The share of compact fluorescent lamps applied by Hungarian households is less than desired. Presumably the trade of traditional light bulbs will be finished by 2013 therefore it would be advisable to organise campaigns for the demonstration of the electric consumption of traditional light bulbs and compact fluorescent lamps. The spreading of compact fluorescent lamps must be accelerated.

Elaboration of energy efficiency training materials in primary and secondary education
School education plays a fundamental role in the development of energy awareness of the society. Therefore basic methods of energy consumption must be elaborated and included in the school subjects. Educational programmes must extend to the basic factors influencing the energy consumption of various sectors.
The aspects of energy efficiency must be vindicated when leaving the school desk and entering real life.

5.ab) Industrial sector

1.) KEOP Construction for Efficient Energy Use
1.1. Modernisation of the buildings of central budgetary institutions and municipalities
1.1.1. Modernisation of outdoor and indoor lighting systems

- modernisation of light sources and light bulbs
- implementation of technical solutions adapted to the demands in space and time (e.g. isolations, motion detectors)

1.1.2. Improvement of the heat technology aptitudes, reduction of heat losses of buildings
- subsequent heat insulation of buildings
- replacement or renovation of external doors and windows of buildings
- modernisation of hot water system for heating and sanitary purposes

1.1.3. Modernisation, replacement, efficiency improvement of heat and electricity generation, transmission and conversion equipment as well as making them capable of regulation
- replacement of boilers to up-to-date and high efficiency devices (e.g. installation of low temperature or condensation boilers, implementation of radiation heating)
- implementation of automatic central (heat source side) and local (exothermal) regulations
- modernisation of heating and sanitary hot water systems and making them capable of regulation, implementation of individual measurement possibilities, application of energy saving solutions
- energy efficient modernisation of cooling systems
- waste heat utilisation possibilities

1.2. Reduction of public lighting energy consumption

1.3. Reduction of the energy consumption of small and medium size enterprises:
- Modernisation of outdoor and indoor lighting systems
- Modernisation of light sources and light bulbs
- Implementation of technical solutions adapted to the demands in space and time (e.g. isolations, motion detectors)

- Improvement of heat technology aptitudes of buildings; reduction of heat losses with subsequent heat insulation and the replacement of external doors and windows

1.4. Modernisation, replacement, efficiency improvement of heat and electricity generation, transmission and conversion equipment as well as making them capable of regulation:

- replacement of boilers to up-to-date and high efficiency devices (e.g. installation of low temperature or condensation boilers, implementation of radiation heating)
- implementation of automatic central (heat source side) and local (exothermal) regulations
- modernisation of heating and sanitary hot water systems and making them capable of regulation, implementation of individual measurement possibilities, application of energy saving solutions
- energy efficient modernisation of cooling systems
- waste heat utilisation possibilities
- implementation of small-scale local cogeneration or tri-generation
- establishment of the conditions of connection to district heating system

1.5. Improvement of energy efficiency of technological systems, reduction of their energy demand:

- subsequent heat insulation of hot and cold technologies
- waste heat utilisation possibilities
- energy efficiency improvement of technological equipment
- modernisation of drives (installation of high efficiency electric motors, motor control with variable speed)

1.6. Investments enabling the utilisation of renewable energy sources implemented together with energy efficiency improvement; implementation of complex investments

- replacement of fossil energy sources with renewable energy sources
- organisation of complex investments embracing several activities

2. System of emission trade

Directive 2003/87/EC on the trade system of community emission units of green house gases has been compulsory for Hungary since its accession to the European Union. In accordance with the Directive facilities with firing equipment of capacity larger than 20 MW can perform CO2 emission activity in the possession of licence. As many as 229 Hungarian enterprises of energy intensive sectors (power plants, oil refineries, coking plants, ferrous metallurgical plants, steel plants, cement plants, calcination plants, glass plants and paper mills) participate in the emission trade of the EU.

The act on the national implementation of the emission trade system of greenhouse gases (Government Decree 15/2005) originates from 2005.

National Allocation Plan and List including the branch limits and the allocation of institutions (Government Decree 66/2006) was published in spring 2006 (almost a year later than planned originally).

Ministry of Environment and Water (KVVM) distributed altogether 30.2 million quotes by 2005 of which as many as 17 million were in the electricity sector. According to the data so far it can be established that the government substantially over-allocated the emission units to the market actors.

Over-allocation of the quotes could take place because emission data had not been available to the authorities earlier. Before the launch of the system the government had been forced to rely on the self declarations of the involved companies when the quotes were calculated; the companies themselves had tried to make the government accept the highest possible number of quotes being afraid of future lack of quotes.

Preparation of National Allocation Plan and List for the period between 2008 and 2012 was started in 2006.

In his resolution dated 16 April 2007 the European Commission decided that the Allocation Plan had not fulfilled the criteria formulated in Directive 2003/87/EC on the trade system of community emission units of greenhouse gases in several aspects (mostly with respect to the total amount to be allocated). The Commission reduced Hungary's quote by almost 4 million tonnes of CO2. The Hungarian Government submitted a petition against the above resolution to the European Court of Justice (the procedure is still in progress). In accordance with the effective EU law the appeal has no postponed annuity on the execution of the resolution therefore the National Allocation Plan 2 had to be redesigned taking the CO2 amount capable of allocation included in the resolution of the Commission into consideration. Lack of quotes is expected in Hungary in the second trading period.

3. Planned measures of National Energy Efficiency Action Plan

Facilitation of ESCO-type investments

With their complex services ESCOs cover an energy efficiency market area that would remain unexploited due to the consumers' unpreparedness, incapability of decision or lack of resources.

By implementing the regulation environment and by its further development the government implements the operation conditions of ESCO enterprises that achieve real energy efficiency improvement.

Within its framework

- it defines ESCO enterprises and differentiates them from other enterprises (definition of the sphere of eactivities, legal status, etc.) and
- implements financial possibilities supporting their operation.

Voluntary agreements with energy intensive industries

The state enters into agreements with important groups of energy management:

- with more energy intensive industrial branches of manufacturing
- with the energy sector,
- manufacturers of certain end-user devices.

Within the framework of the agreements the said groups oblige themselves to efficient energy consumption:

- to the reduction of energy consumption,
- to the application of more efficient energy supply technologies,
- to the development of products with better energy efficiency indicators.

For the set-off of undertakings the state provided favourable publicity for the groups signing the agreement and disregard from the application of "compulsory" regulations and grants financial subsidy for the implementation of measures stipulated in the agreements. Negotiation partners with suitable mandate and credibility are required on both sides for the application of voluntary agreements.

Compulsory application of energy management specialist at large industrial consumers

In the area of energy management it is important that the persons in charge of energy management must have adequate preparedness. The improvement of the standard of energy management can generally facilitate the saving of considerable amount of energy in case of large energy consumers.

The energy management specialist system operated in the industrial and tertiary sector in the socialism which was favourable in terms of professional aspects. The energy management specialists employed at the major industrial companies and public institutions represent an energy management culture that was useful fort the energy consuming institutions.

The instruction on the compulsory employment of energy management specialist was withdrawn within the framework of economic liberalisation. In absence of compulsory regulation most of the energy consumer organisations terminated the status of energy management specialist for the sake of saving salaries. No energy management specialists are employed today except for some

employed by industrial companies and the institutions; people having the most diverse degrees deal with the issues of energy management.
The standard of energy management can be increased considerably by the compulsory restoration of the energy management specialist system at the large industrial consumers.

Compulsory energy consumption report at the large industrial consumers
Large customers are responsible for the major proportion of the energy consumption of Hungary. It is an important national interest to have proper energy management at the large customers and to have efforts for the improvement of the energy efficiency.
Though the economic interest of large customers theoretically exists, international experiences also show that administrative binding is also justified besides economic interests.
For its achievement it is advisable to bind the large consumers over given annual consumption in a legal regulation to submit sufficiently detailed report on their data regarding their energy consumption and energy efficiency improvement.
They should prepare energy efficiency improvement work plan and prepare regular report on its implementation.

5.ac)Transport sector

1.) Energy efficiency labelling of new passenger cars (Decree 12/2002 GM-KövVIM-KöM)
The distributors of passenger cars must indicate the consumption classes of the traded passenger cars.
The announcement regarding the consumption must include the following:
- type of fuel
- official consumption in l/100 km
- official CO2 emission
(Hungarian equivalent of EU-directive 1999/94/EC)

2.) Imposition of road toll on highways and on main national roads
(GKM Decree 36/2007)
The decree distributes the vehicles into categories according to their net weights (categories D1, D2, D3, D4). Road toll must be paid on the freeways and national main roads per vehicle categories to a differentiated extent.

3.) Imposition of registration taxes for new passenger cars (Government Decree 110/2003)
In accordance with the decree registration tax must be paid after the passenger cars to be put into traffic. The extent of the tax depends on the environmental class of the passenger car to be put into traffic.

4.) Facilitation of the procurement of energy efficient road vehicles in the public sector (Government Decree 48/2011)
Government Decree 48/2011 extends to the vehicle procurement contracts of the public sector (passenger transport performed by means of bus according to timetable, railway and other passenger transport services on road)
The fuel consumption and CO2 emission of the vehicles must be taken into consideration at the time of the procurement of vehicles for the public sector.
If public procurement procedure must be applied at the time of the procurement of vehicle, energy efficiency evaluation must be taken into consideration as an aspect of judgement.

If the procurement is not performed within the framework of public procurement procedure, the cost of energy consumption projected to the whole lifespan of the vehicle must be calculated and it must be taken into account during the procurement decision on the given vehicle.

5.) Subsidy of the use of renewable energy sources for transport
The extent of the biofuel share is determined by the Government by means of decree for three years in advance. Biofuels produced, procured and sold for distribution must be registered and certified in accordance with the provisions of the government decree.
The fuel distributor is obliged to submit a report to the customs authority on the fuels and biofuels sold in the given month until the 20th day of each month following the reference month in accordance with the provisions of the government decree. The customs authority imposes fine on fuel distributors trading less biofuel than the compulsory biofuel proportion.

6.) Speed limits of passenger cars, trucks, buses in accordance with the Highway Code
The fuel consumption of the vehicles substantially depends on their speed. The rules of the Highway Code stipulate speed limit for the various road types and vehicle categories which the vehicles must fulfil.
Section 26 of the Highway Code includes the rules on speed:

a.) for passenger car, motorcycle, passenger not exceeding 2500 kg highest allowed gross weight
- on motorway 130 km/h
- on freeway 110 km/h
- on other roads outside inhabited areas 90 km/h
- on inhabited areas 50 km/h

b.) for bus fulfilling requirement stipulated in special legal regulation
- on motorway 100 km/h
- on other roads outside inhabited areas 70 km/h
- on inhabited areas 50 km/h

c.) for other vehicles (except for motored tricycle suitable for freight transport) and for vehicle consisting of hauler and trailer)
- on motorway 80 km/h
- on other roads outside inhabited areas 70 km/h
- on inhabited areas 50 km/h

Vehicles of which the highest allowed speed was defined lower in the course of the mechanical inspection (and if it was registered in the registration certificate of the vehicle) can take the maximum speed defined in the document.

7.) Planned transport measure
<u>Imposition of kilometre-proportionate electronic road toll for vehicles heavier than 3.5 t</u>
The payment of kilometre-proportionate road toll means payment of usage-proportionate road toll. For achieving its introduction up-to-date computerised system must be introduced regarding the users of the roads. Currently it is under tender procedure.
The introduction of kilometre-proportionate road toll is expected to reduce very strong truck traffic.

5.ad) Tertiary sector

Efficient energy consumption construction of KEOP described in the industrial sector operates in the tertiary sector. The energy efficiency measures for the tertiary sector are identical to the measures described for industrial sector.
The energy efficiency project supported by UNDP/GEF specially organised for the development of municipal energy efficiency operated between 2001 and 2008.
Within the framework of the UNDP/GEF project energy audits for 1200 public buildings of municipal ownership were performed. These energy audits on municipalities revealed several energy saving possibilities. The disclosure of bank financing opportunities of feasibility studies on the municipalities are still in progress.

5.ae) Energy efficiency measures over branches

1.) Energy tax on electricity and natural gas (Government Decree 138/2003)
Energy tax is imposed on electricity and natural gas, the most important two energy sources in the circle of non-domestic consumers.
According to its philosophy energy tax makes the consumption of fossil fuels more expensive thus making the use of renewable energy sources more competitive.
The extent of tax:
electricity 252 HUF/MWh
natural gas 75,60 HUF/GJ

2. Environmental load tax (Government Decree 139/2003)
The objective of the decree is to facilitate the reduction of the emission of material or energy into the environment
The emitter is obliged to pay environment load tax on every unit of material emitted
- to the air
- to the surface waters
- to the soil

exposing load on the environment.
The air load fee is imposed on the emitter whose fixed air polluting point source must be reported in accordance with special legal regulation.

5.b) System of currently running energy efficiency measures

The net diagrams outline the system of measures currently applied in the various branches.
Household sector
Legal informative and legal normative measures dominate household sector. Out of the currently running measures 9 are of intermediate effect and 4 are of small-scale effect. The only measure with far-reaching effect (system of household energy certification) is an informative measure.

Transport sector
Legal normative measures dominate transport sector (compulsory publication of consumption norms, road taxes and registration taxes). Infrastructural developments have substantial role (construction of new metro line, combined railway and road traffic).
Information and financial measures have smaller role in the transport sector.
Out of the currently running measures 6 are of intermediate and 11 are of small-scale effect.

Industrial sector

Financial measures dominate industrial sector in the form of direct subsidies. Emission trade system is a tool organised on market basis.

Out of the currently running measures 4 are of intermediate and 2 are of small-scale effect.

Tertiary sector

Tertiary sector is dominated by financial measures as well in the form of direct subsidies. Out of the currently running measures all 4 measures are of small-scale effect.

Measures above branches

General energy efficiency and climatic protection measures are important among the measures above branches. Fiscal measures regulating CHP takeover price and taxes imposed on natural gas and electricity consumption are significant; they are financial measures.

Out of the currently running measures 4 are of large-scale affect, 7 are of intermediate effect and 2 are of small-scale effect.

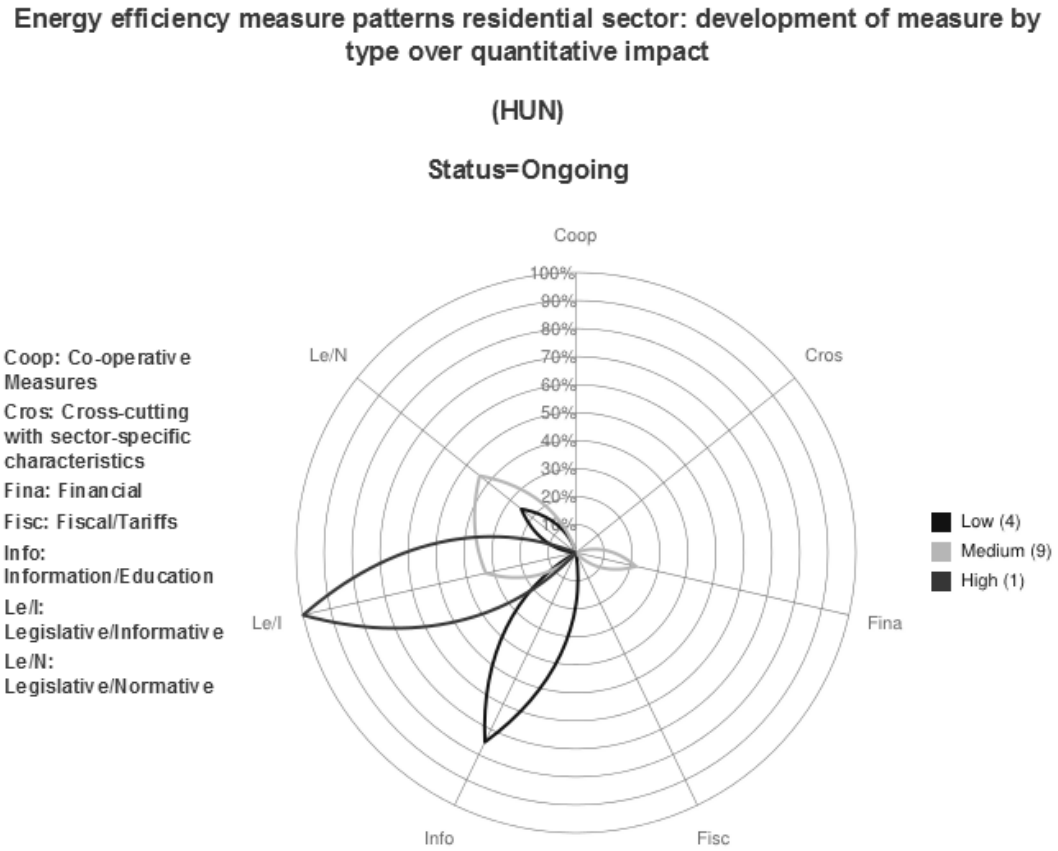

Figure 50

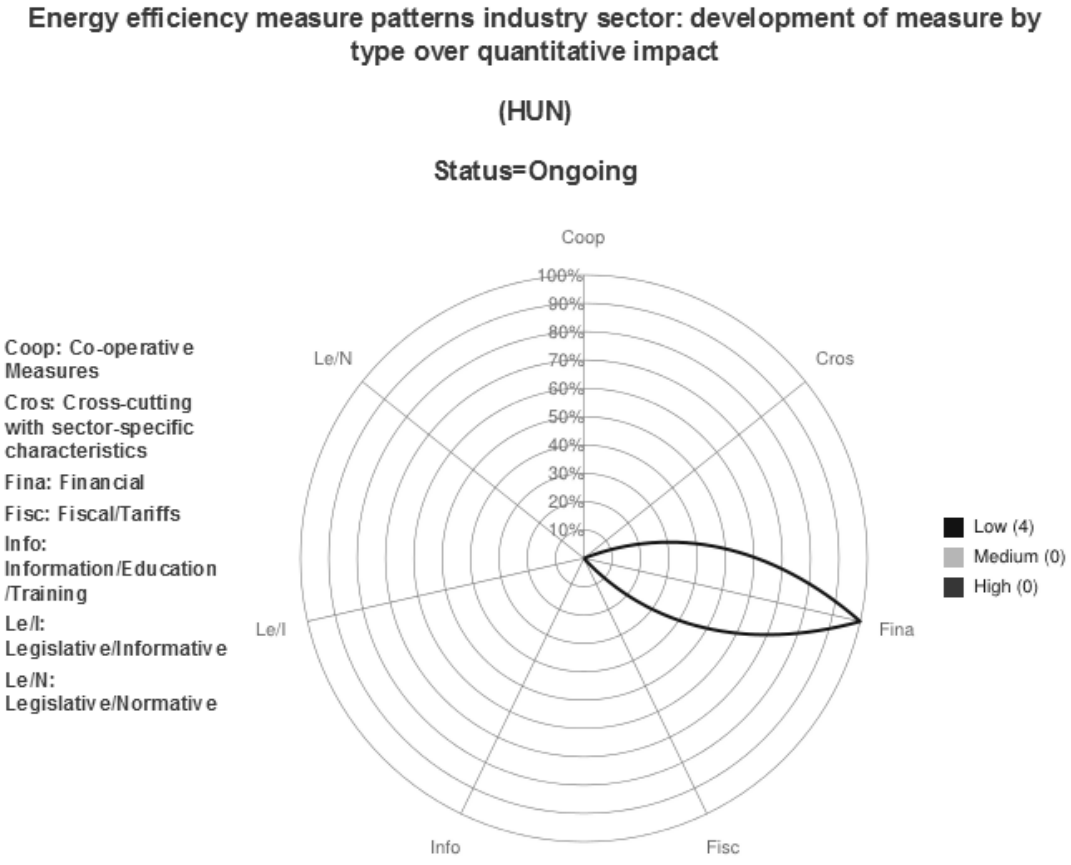
Energy efficiency measure patterns industry sector: development of measure by type over quantitative impact
(HUN)
Status=Ongoing
Coop: Co-operative Measures
Cros: Cross-cutting with sector-specific characteristics
Fina: Financial
Fisc: Fiscal/Tariffs
Info: Information/Education /Training
Le/I: Legislative/Informative
Le/N: Legislative/Normative
Coop
Cros
Fina
Fisc
Info
Le/I
Le/N
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
Low (4)
Medium (0)
High (0)

Figure 51

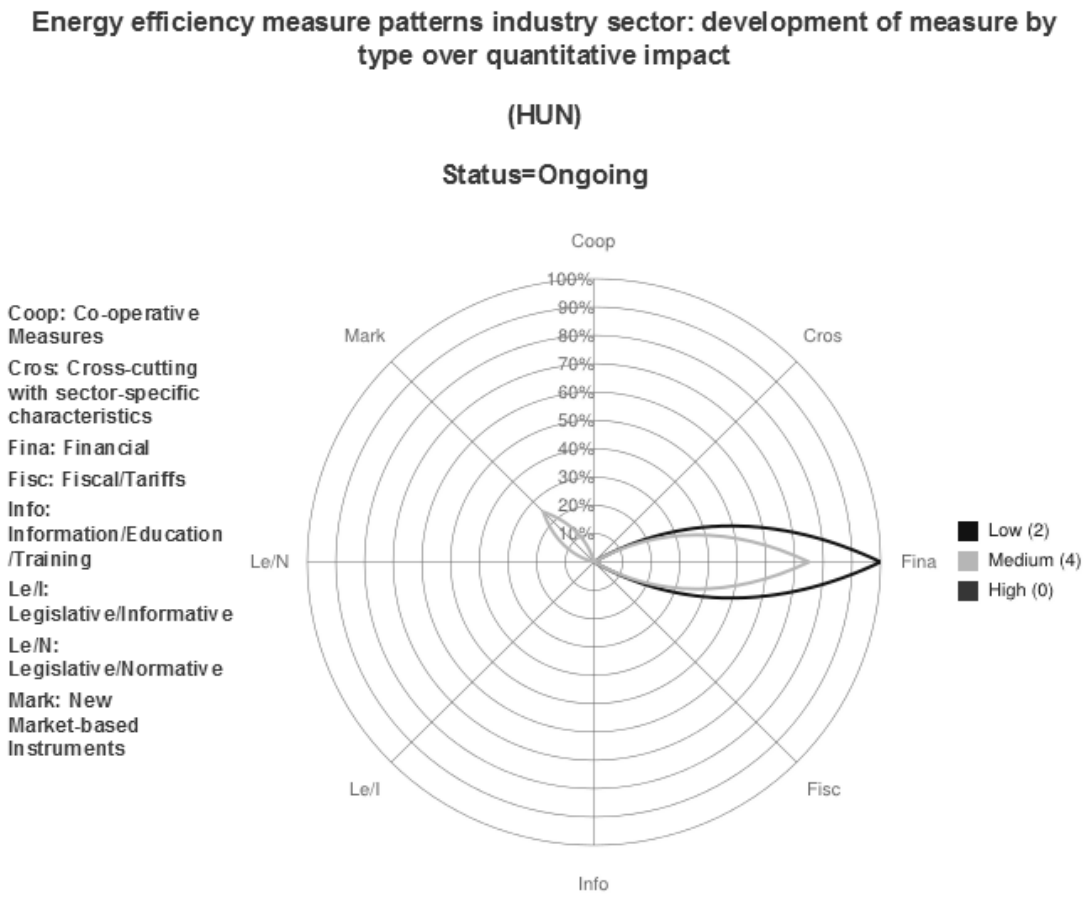

Figure 52

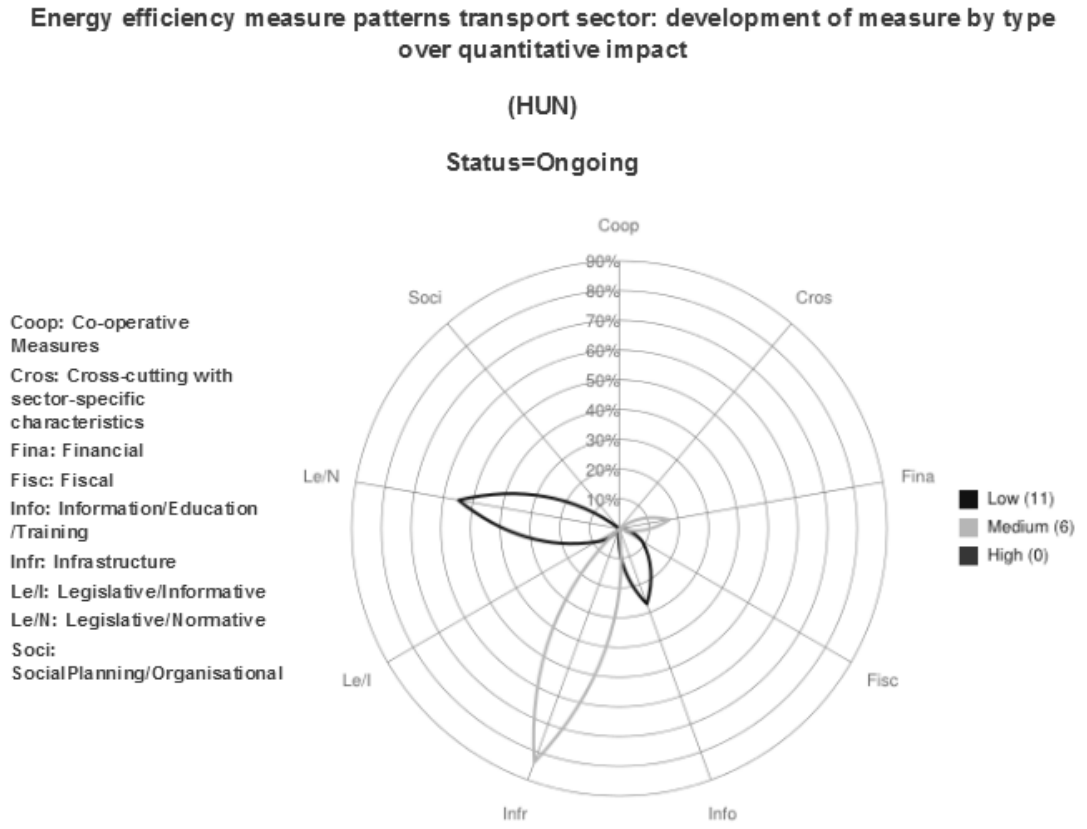

Figure 53

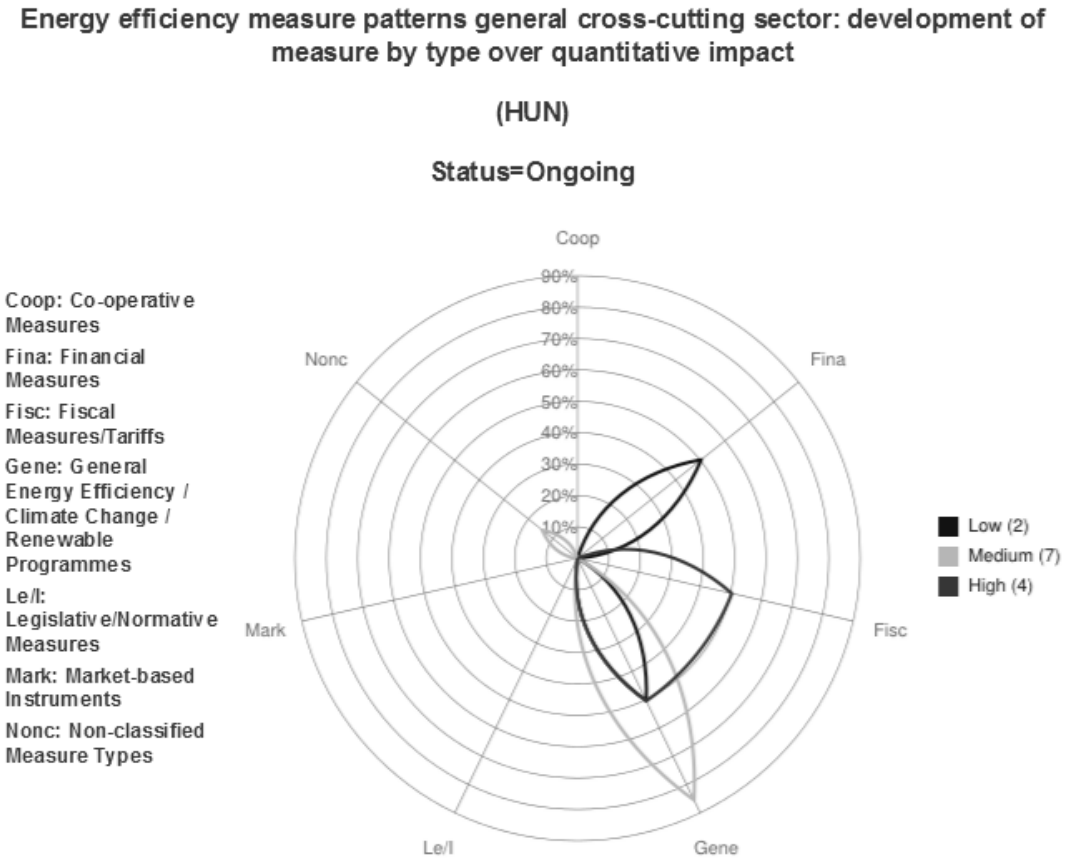
Energy efficiency measure patterns general cross-cutting sector: development of measure by type over quantitative impact
(HUN)
Status=Ongoing
Coop: Co-operative Measures
Fina: Financial Measures
Fisc: Fiscal Measures/Tariffs
Gene: General Energy Efficiency / Climate Change / Renewable Programmes
Le/I: Legislative/Normative Measures
Mark: Market-based Instruments
Nonc: Non-classified Measure Types
Coop
Fina
Fisc
Gene
Le/I
Mark
Nonc
90%
80%
70%
60%
50%
40%
30%
20%
10%
Low (2)
Medium (7)
High (4)

Figure 54

5.c) Innovative energy efficiency measures

Combined rail and road transport

Hungarokombi Kft was established in 1990. Combined conveyance organised by combi-companies has become an important element of European transport market today; in some relations it is an equivalent alternative to (and sometime replacing) road transport.

Combined conveyance means the modal shift of freight transport because it reduces the load of road transport and increases the utilisation of railway transport. It cannot be used in every transport relation because the loading of trucks has certain infrastructural conditions but the transport of trucks on rail has been solved for the most important relations. As the result of the expected increase of taxes imposed on road tax the popularity of combined transport on road and rail will increase.

Denomination ROLA generally widespread and applied in practice in Europe is the abbreviation of the German words "Rollende Landstasse" meaning rolling higway. ROLA is the partial area of combined transport during which the whole set of road vehicles (together with the trailer) make part of their route on rail. The individual wagons, trucks with trailers and the towing trailers travel on a special train consisting of especially low platform wagons. The trucks are rolled on the wagons via a movable ramp and take their final positions one behind another moving along the train. Unloading takes place at the other end of the of the train also via a ramp. The truck drivers (attendants) travel in a passenger carrier with couchettes where they can rest during their journey. The time spent on the train is officially acknowledged as rest period in most of the countries therefore the regulations regarding driving periods can be fulfilled and the working conditions improve as night work is les needed.

Besides the reduction of personal expenditures material expenditures also decrease substantially (fuel and lubrication oil consumption, tyre ware and service cost). Road toll, motorway toll and tax on trucks can be saved; no traffic permission has to be shown on the train and in addition premium licences can also be obtained. Moreover there is no weekend-restriction because trains can run on Sundays and bank holidays.

The social impact of combined transport is also significant: load on public roads, pollution of the air and the noise generated by the trucks are reduced, safety of road transport improves and the utilisation of railway is increased. Railway has less land demand compared to road; it is more energy efficient and uses less fuel.

5.d) Evaluation of energy efficiency measures

5.d1) Semi-quantitative evaluation of energy efficient measures

Only the currently running measures have been evaluated.

Household sector

Out of 14 measures 1 is of large-scale, 9 are of medium-scale and 4 are of small-scale effect.

Transport sector

Out of 17 measures 6 are of medium-scale and 11 are of small-scale effect.

Industrial sector

Out of 6 measures 4 are of medium-scale and 2 are of small-scale effect.

Tertiary sector

Out of 4 measures 4 are of small-scale effect.

5.d2) Conclusions of the quantitative analyses of energy efficiency measures

5.d2.a) Energy savings of building modernisation programmes

MURE simulation for the energy efficiency measures of household sector
Operating Hungarian household measures were capable of sufficient parameterisation with the tools of MURE simulation.

The two programmes are as follows:

- Energy modernisation of blocks of flats built with industrialised technology
- Financial grant for flats built with traditional technologies

Both building modernisation programme include three major actions:

- Subsequent heat insulation of structures bordering buildings; replacement of doors and windows
- Change of fuel in the boilers
- Replacement of out-of-date boilers

The basic assumption of the simulation is that 30 percent energy saving can be achieved by subsequent heat insulation and the replacement of doors and windows.

16 percent energy saving can be achieved by the replacement of out-of-date boilers.

In the scenario without the execution of the measures the household energy demands increased from 5400 ktoe of 2002 to 5800 ktoe by 2025 mainly due to the increase of energy demand due to the frittering of households.

By executing the above measure 329 ktoe energy saving can be achieved by 2025 enabling that household demands increase only slightly (from 5400 ktoe to 5500 ktoe).

During the simulation regarding the traditional building technology we assumed the renovation of 6000 flats annually whereas we assumed the renovation of 30000 flats within the framework of the renovation of prefabricated buildings.

<u>Savings broken down to the various measures:</u>

- energy related renovation of flats built with traditional technology: 32 ktoe
- energy related renovation of flats built with industrialised technology: 297 ktoe

The energy saving parameters of subsequent heat insulation and boiler replacement were considered identical thus the number of flats to be renovated is the only substantial parameter for the decision makers that can be influenced.

MURE simulation proved that the two modelled measures brings only 0.25 percent saving per year thus supplementary new measures are needed.

5.d2.b) Maintenance of developed public transport in passenger traffic

The emerging market economy inherited well-built community transportation system (train, bus, metro, tram) from the state socialist times.
The objective of national transport policy was to try to maintain the formerly achieved very high share of public transport. For the maintenance of high proportion public transport must be made attractive compared to passenger car traffic, and also the network of public transport must be developed in order to cover new accessible cities and districts.
Every county town can be reached from Budapest on rail on Intercity trains with high comfort rate. Every significant town can be reached by bus on the Transdanubian side of Hungary together with the regional centres of Alföld with direct lines starting several times a day.
Currently three metro lines operate in Budapest, the fourth line is under construction now. Tram lines of the regional centres of the countryside shall be renovated with the involvement of substantial European resources between 2011 and 2012 obviously with the objective of making community transportation attractive compared to individual transport.
Public transport is supported by the fact that several large companies and public institutions will buy monthly passes to public transport for their employees as a local initiative thus facilitating the changeover to public transport.

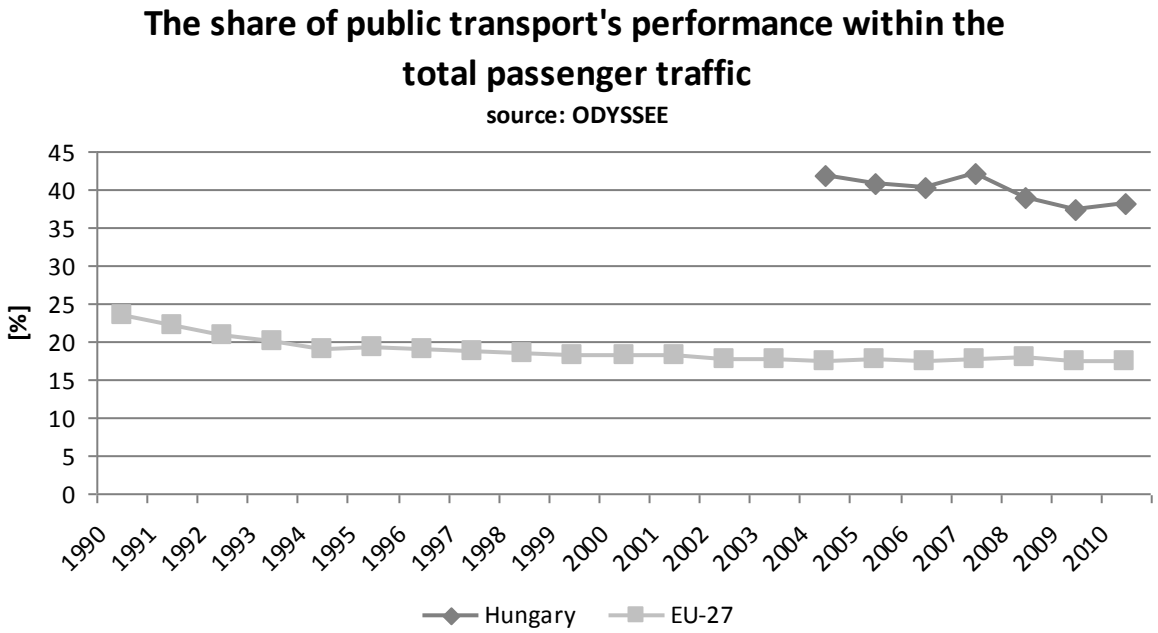

Figure 55

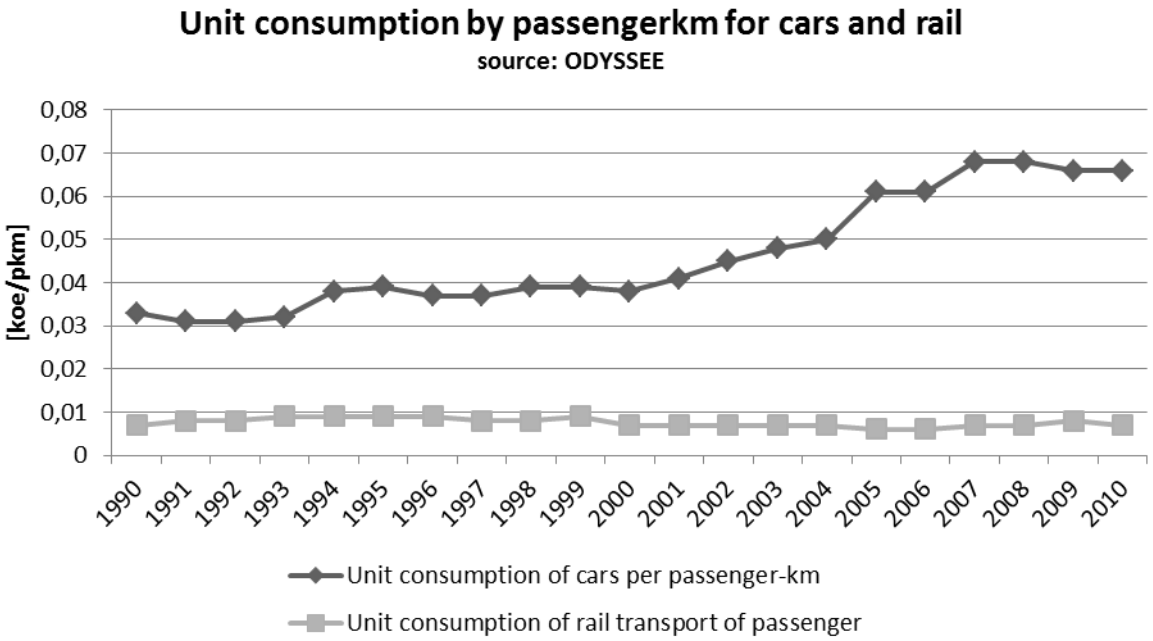

Figure 56

The performance indicator of national public transport decreased from 41.9 percent of 2004 to 38.2 percent by 2010 within total passenger traffic. In the same period the share of public transport dropped from 17.4 percent to 17.3 percent in the EU 27 states.

The share of Hungarian public transport decreased slightly due to the spreading of passenger car traffic but it is more than twice as the European average. The highest rate of public transport can be indicated in Hungary and in the Czech Republic in the EU-27 states.

The rate of public transport maintained on high level can be considered the success of transport policy because the specific consumption of public transport is the fraction of that of passenger cars. The specific consumption of passenger cars projected to passenger kilometres was 0.066 koe/pkm in 2010; whereas the unit consumption of transport on rail projected to passenger km was 0.007 koe/pkm that means that the specific consumption of passenger cars was 9.4 times that as compared to consumption on rail.

Transport policy does not intend to restrict the traffic of passenger cars by means of administrative measures. However the use of passenger cars is burdened with various taxes (excise tax on fuels, VAT on the fuels, registration tax imposed on new passenger cars, performance tax imposed on the basis of the engine power and the obligation of roadworthiness test once in ever three years).

The taxes imposed on the traffic of passenger cars facilitate modal shift of the transport towards public transport. Modal shifts implemented in the traffic (trains or buses replacing passenger cars) reduce the energy consumption of transportation because the specific energy consumption indicators of public transportation are much more favourable than that of passenger cars.

According to the survey of CSO (Central Statistical Office of Hungary) on life standard 22.6 percent of the households are not able to maintain their own passenger car. It is a phenomenon experienced since the economic crisis that the stock of passenger cars has been decreasing since 2009 because the households in the lower income ranges do not afford to maintain a passenger car. Households being able to maintain passenger car has also restricted the use of passenger cars because the annual running mileage dropped from 10100 km of 2008 to 9400 km by 2010.

6.) National outcomes of the introduction of the Service Directive and the outcomes of the 20 percent energy efficiency objectives of EU

The Energy Service Directive 2006/32/EC has become effective on 17 May 2006.
The Directive has set 9 percent indicative energy saving as an objective for the 9 years between 2008 and 2016.
The objective is as follows:

- facilitation of the improvement of energy efficiency in a cost effective way in the EU member states
- termination of institutional, financial and legal obstacles aggravating energy efficiency
- provision of sustainable development for energy efficiency and energy supply services.

In accordance with Government Decree 64/2009 Ministry of National Development supervises the implementation of National Energy Efficiency Action Plan defined in Decree 2006/32/EC.
Ministry of National Development commissioned ÉMI Nonprofit Kft with the coordination of the Service Directive after March 2012.
In the same time ÉMI Nonprofit Kft is responsible for the verification of the progress of the implementation of National Energy Efficiency Action Plan.

Hungarian Energy Office has been responsible for the energy statistics since January 2012. Currently the Hungarian Energy Office does not intend to deal with the monitoring of the Energy Service Directive due to lack of capacity.
Household energy survey implemented in 2009 ought to be repeated in every 4 to 5 years for the supplementation of existing statistical data collection shortages. Currently it is not visible whether financial resources are available for the implementation of the new household energy recording.
The national energy recording currently operated in the tertiary sector is non-EUROSTAT conform. Methodological assistance and possible financial support for EUROSTAT would be necessary for the elaboration of EUROSTAT-conform data acquisition in the tertiary sector.

Ministry of National Development takes part in the EDMC-commission (and its sub-committees) established by DG-ENER for the tracing of the outcomes of the Service Directive.

Ministry of National Development submitted the National Energy Efficiency Action Plan II to DG-GENER in October 2011.

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Annex 1

Energy Efficiency Measure Summary by Country

MURE II All sectors 30 Measures Found

Code	Sector	Title	Status	Type	Starting Year	Semi-quantitative Impact	NEEAP Measure	EU-related Measure
HUN16	Household	Non-Governmental Organisations for Energy Efficiency	Ongoing	Information/Education	1992	Low	Yes	No
HUN12	Household	Building Codes	Ongoing	Legislative/Normative	1994	Medium	No	No
HUN10	Household	Energy efficient renovation of residential buildings built with industrialised technology	Ongoing	Financial	2001	Medium	No	No
HUN14	Household	EU-related: Energy Labelling of Household Appliances (Directive 92/75/EC) - Energy labelling of household appliances	Ongoing	Legislative/Informative	2002	Medium	No	YES
HUN28	Household	Individual measurements, application of mini heat centres in district heating	Ongoing	Legislative/Normative	2005	Low	Yes	No
HUN27	Household	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy review of heat producing sets and air conditioning systems	Ongoing	Legislative/Informative, Legislative/Normative	2008	Medium	No	YES
HUN22	Household	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - HU71 Energy performance certificate for new dwelling	Ongoing	Legislative/Informative	2009	High	Yes	YES
HUN5	Tertiary	Encouragement of reduction of energy use in the Regional Operative Programmes	Ongoing	Financial	2007	Low	Yes	No
HUN4	Industry	Energy Efficiency Loan Fund for the energy efficiency investments of the business sector	Ongoing	Financial	1991	Low	Yes	No
HUN9	Industry	Environment and Energy Operative Programme	Ongoing	Financial	2007	Medium	Yes	No
HUN12	Industry	EU-related: EU Emission Trading Scheme (2003/87/EC) - Emission Trading Scheme in Hungary	Ongoing	New Market-based Instruments	2007	Medium	No	YES
HUN17	Industry	Third party financing within the frame of Environment and Energy Operative Programme	Ongoing	Financial	2007	Low	Yes	No
HUN9	Transport	Combined road-rail transportation	Ongoing	Infrastructure	1990	Medium	No	No
HUN4	Transport	EU-related: Passenger Car Labelling on fuel economy rating (Directive 1999/94/EC) - Energy labelling for newly distributed cars	Ongoing	Legislative/Informative	2002	Low	No	YES
HUN8	Transport	Regular emission inspection of road vehicles	Ongoing	Legislative/Normative	2002	Low	No	No
HUN5	Transport	EU-related: Promotion of Biofuels or other Renewable Fuels for Transport (Directive 2003/30/EC) - Differentiated excise duties for minimum quantity of automotive fuels produced from renewables	Ongoing	Legislative/Normative	2003	Low	No	YES
HUN7	Transport	Registration tax on new cars	Ongoing	Fiscal	2003	Low	No	No
HUN10	Transport	Construction of new metro line	Ongoing	Infrastructure	2005	Medium	No	No
HUN13	Transport	Eco-driving training for the drivers of heavy goods vehicles	Ongoing	Information/Education/Training	2006	Low	No	No
HUN6	Transport	Toll on highways and on selected roads	Ongoing	Financial	2007	Medium	Yes	No
HUN11	Transport	EU-related: Speed limitation devices for certain categories of motor vehicles (Directive 2002/85/EC) - Speed limits for cars, trucks and buses based on Highway Code	Ongoing	Legislative/Normative	2008	Low	No	YES
HUN12	Transport	On the facilitation of the procurement of energy efficient public vehicle	Ongoing	Information/Education/Training, Legislative/Normative	2011	Low	No	No
HUN10	General cross-cutting	Hungarian Energy Efficiency Co-Financing Programme	Ongoing	Financial Measures	1998	Low	No	No
HUN7	General cross-cutting	Energy Saving and Energy Efficiency Action Programme	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes	1999	High	No	No
HUN8	General cross-cutting	Establishing of Energy Efficiency, Environment and Energy Information Agency	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes	2000	Medium	No	No
HUN15	General cross-cutting	Act on Waste Management	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes, Non-classified Measure Types	2000	Medium	No	No
HUN12	General cross-cutting	Energy tax on electricity and natural gas	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes	2003	Medium	No	No
HUN13	General cross-cutting	Fee on environmental pollution	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes	2003	Low	No	No
HUN9	General cross-cutting	Promotion of small scale CHP	Ongoing	Fiscal Measures/Tariffs	2005	High	No	No
HUN16	General cross-cutting	National Climate Change Strategy	Ongoing	General Energy Efficiency / Climate Change / Renewable Programmes	2008	Medium	No	No

Annex 2

Country Profile

Energy Efficiency Profile: Hungary

October 2012

Energy Efficiency Trends

Overview

Between 1998 and 2010 the global energy efficiency of final consumers, as measured from the decrease of the global index (ODEX) improved by 17%, against 14% for the EU as a whole. Most of the efficiency improvements were registered in the industrial and transport sectors, since the energy efficiency of households improved a bit.

Industry

The ODEX decreased by around 40% in the industrial sector between 1998 and 2010. All the ten branches participated to this improvement. The largest improvement was in machinery & metal products (9,4%/year) due to the new investments and installations of more up-to-date production equipment. This trend does not include the effect of the shift of manufacturing industry towards less energy intensive branches, especially the manufacturing of machines and vehicles, whose share increased from 33% to 64% in the value added of the manufacturing.

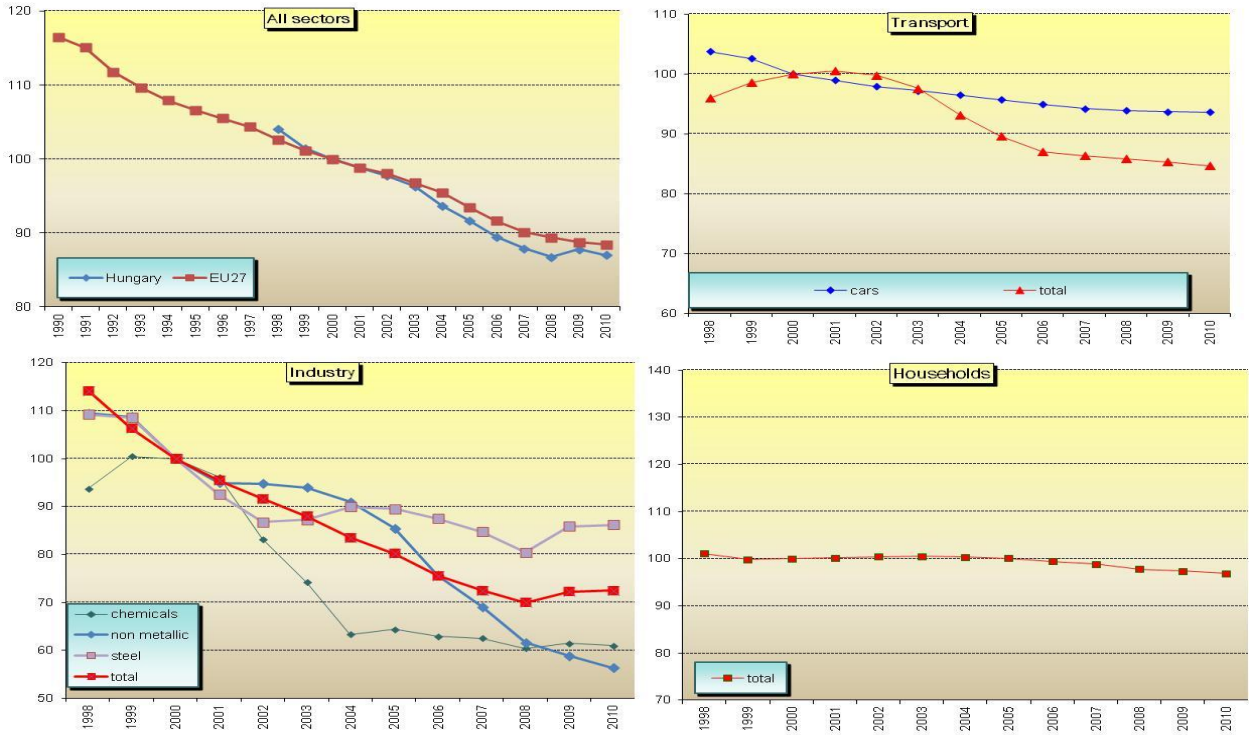
Households

The efficiency of households improved by 4% between 1998 and 2010. There was a massive fuel switching that took place between 1990 and 1998, when the majority of the households replaced tile stoves, coal and oil fuelled boilers with high efficient gas fuelled boilers. As a result the share of natural gas in household's final consumption increased from 25% in 1990 to 54% in 1998 and 56% in 2010. The unit consumption per m2 for space heating deteriorated from 11,9 koe/m2 to 12,8 koe/m2 between 1998 and 2010 (+0,6%/year) This deterioration comes from the fact that that the rate of renovation of dwelling is low. The thermal regulation of new buildings was strengthened in 2007. It is also contributed to the improvement of household's ODEX.
Subsidised household gas prices played an important role in the massive fuel switching.

Transport

Energy efficiency of transport increased by 11% between 1998 and 2010 and by 15% since 2000. The efficiency of cars has increased only moderately The unit consumption of good transport was unchanged between 1998 and 2010. In transport, two phenomena are characterizing trends in the transport sector. On one hand, the majority of the shipment of goods has shifted from rail to road transport, because multinational companies, which are dominating the Hungarian economy, prefer road to rail transport, since it is more flexible and less volume sensitive. On the other hand the stock of cars and the average distance travelled by cars increased relatively rapidly.

Energy efficiency index (base 100=2000)*



*All indicators measured as a three-year moving average
Source ODYSSEE For more information: http://www.odyssee-indicators.org/

Energy Efficiency Policy measures

Institutions and programmes

The energy policy is described in a document named "The Business Model of Energy Sector". The Energy Efficiency Action Plan attached to the document includes specific provisions for the annual reduction of the energy intensity by 3.5 %/year, for decreasing primary energy demand by 1.79 Mtoe per year and for the annual reduction of CO_2 emissions by 5 Mt.

In 2011 and 2012 a, institutional change took place: Hungary's energy efficiency agency, the "Energy Center" Energy Efficiency, Environment and Energy Information Agency Non-Profit Limited Company, as replaced on 17 May 2012 by a new entity, National Environmental Protection and Energy Center Non-Profit Ltd: its main focus is the management of European Union Funds. The implementation of the Energy Service Directive is carried out by ÉMI Nonprofit Ltd. from March 2012.

Industry

The improvement of industrial energy efficiency is facilitated by several programmes: installation of industrial CHP's , that on average are 20-25 % more efficient ; industrial fuel switching , with a shift to natural gas and a wider use of electricity as a result of the increasing demand of precise metering and the controllability of processes. The Environment and Energy Operative Programme provides funds to the business sector and tertiary sector using direct subsidies.

Households, Services

Among the operating building renovation programmes, the most important one is the programme named "Energy efficient renovation of residential buildings built with industrialised technology". The dwellings made of pre-fabricated blocks with weak heat insulation characteristics constitute 19% of the total number of dwellings in Hungary. The programme sets out the thermal renovation and building engineering modernisation of pre fabricated flats. A maximum 30% of the investment cost , with a maximum € 2050 is financed by the state Fund.

For renovation of traditional household's buildings, the operating programme is named "Residential energy saving programme For Successful Hungary".

The introduction of "Accounting based on metering" was a major step in district heating. According to the Act on District Heating of 2005/18 the district heating companies must cease flat-rate based tariffs and payment without metering, and they must establish the conditions of metering by heat centres.

Transport

In order to achieve a high renewal rate and the modernisation of the car fleet; the purchase of new cars was facilitated by preferential financial incentives.

For freight transport, combined road-rail transportation is promoted for decreasing shipment of goods by road.

Selected Energy Efficiency Measures

Sector	Measure	since
Industry	Promotion of CHP (basic decree 56/2002 and amendment 206/2009)	1997-
Industry/ tertiary	Energy Efficiency Loan Fund	1991-2012
Industry/ tertiary	Environment and Energy Operative Programme	2007-2013
Households	Support of the Energy Efficient Renovation of Residential Buildings Built with Industrialised Technology	2001-
Households	Residential energy saving programme "For Successful Hungary"	2001-
Households	Low for District Heating Services 2005/18	2005
Transport	Combined road-rail transportation	1990-

Source MURE
For more information: http://www.isisrome.com/mure/
* after implementing the measures proposed in the audits