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PREFACE

This publication is successive edition of the study "ENERGY EFFICIENCY" published by the Central Statistical Office (GUS) as part of the series entitled "Information and statistical papers".

The aim of this publication is to present global and sector energy efficiency indicators with their analysis.

The development of energy efficiency indicators adapting statistics to changing economy conditions and present needs (monitoring of energy economy and controlling its management towards "sustainable development") is realized in answer to European Commission and IEA/OECD documents. These documents recommended joined actions of Eurostat and Member States, aimed at creation of statistical indicators system to assess trends in the field of energy efficiency and supporting decisions making and coordination of these actions with words carried by International Energy Agency.

Realization of this aim served works carried in frames of European Union projects SAVE I and SAVE II and carry at the present in frames of "Intelligent Energy for Europe" programme.

Presented results show potentiality of system created in the EU and IAE/OECD and are not full analysis of present state and trends of energy intensity of Polish economy.

The publication was elaborated by employees of the Polish National Energy Conservation Agency, Energy Market Agency and Central Statistical Office.

Małgorzata Fronk
Director of
Economic Statistics Division

Warsaw, June 2007

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1. Introduction

The increase of energy efficiency of generation, transmission and use processes is a pillar of sustainable energy policy. It is reflected in the law and actions undertaken by national institutions and international organizations. Regulations connected with energy efficiency should be mentioned, including:

- Directives of the European Parliament and of the Council[1] (with the latest 2006/32/EC of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC),
- Renewed Lisbon Strategy,
- National Coherence Strategy for years 2007-2013.

The main aim of the latest directive is achieving economically reasonable improvement of fuels and energy end-use efficiency in Member States of the European Union through: setting goals, mechanisms and incentives; setting institutional, financial and legal frames to cancel existing market barriers having influence on energy end-use efficiency; promotion of programmes aiming at improving energy efficiency; development of high quality energy services for end users; harmonization of methodology of energy savings calculation and verification.

Above mentioned directive obliges Member States to collect and transmit data required to monitor, asses and plan actions towards energy end-use efficiency improvement.

There are two methods of measuring growth of energy efficiency (energy savings). These are: "top-down" method and "bottom-up" method.

- In method „top-down" aggregated data is used and therefore it is called energy efficiency indicators method. This method enables to set indicators of situation development, but it does not ensure detailed measuring on specific level. Mostly, sections, divisions, groups of economy, groups of devices, and types of transport means are the subjects of calculations. Calculated values of energy consumption or intensity are recalculated with reference to such external factors as number of degree days during heating season, structural changes, production profile, etc.

[1] See Annex II

- „Bottom-up" method is more precise way of energy savings calculations resulting from energy efficiency increase. Primary, energy consumption of single end user for instance refrigerator is calculated during defined time period before introducing proefficiency action, obtaining base value[2]. Next, the energy consumption in the following period is compared to the consumption during prior period. The difference between results measures energy efficiency increase. If similar calculations are made for all energy devices, and results sum up, precise result of energy efficiency growth is obtained. When making calculations, it should be remembered also in this case to take into account climate corrections and other factors outnumbered in the description of the method „top-down".

Energy savings can result, apart from increasing energy efficiency actions, from changes in behaviour and lifestyle (the latter can or can not mean changes of services level), uncontrollable weather conditions, as well as structural changes (e.g. production decrease of more energy intensive industrial branches). Unless correction is made, such structural changes impact the energy efficiency improvement.

To correct energy intensity level calculations it should be take into consideration:

1) GDP size according to purchasing power of currency,

2) annual changes of temperature (climatic changes),

3) structural changes of production.

Corrections eliminate significant amount of factors influencing energy consumption changes not connected with energy efficiency improvement.

In directive on energy end-use efficiency it is suggested to use „bottom-up" method to calculate energy savings, in case when such data is not available for several sectors combination of „bottom-up" and „top-down" methods should be used.

[2] In calculations „bottom-up", in case there is no possibility to measure energy consumption earlier, the base level can be reconstructed using parameters of types and share of technologies, which were used when given action was not applied.

2. The projects “Evaluation and monitoring of Energy Efficiency in the New EU Member Countries” and “Monitoring of Energy Demand Trends and Energy Efficiency in the EU” in the framework of Intelligent Energy Europe EC

In the view of introduced EU regulation and in particular in the view of Directive 2006/32/EC, extension of issues related to energy efficiency measurements and greenhouse gas is a necessary condition to implement successfully the new energy policy in Member States and it is necessary to control of the Directive objectives implementation.

To extend the energy efficiency monitoring methods and methods of evaluation of measures for energy efficiency improvement the project of the European Commission was applied entitled: “Evaluation and Monitoring of Energy Efficiency in the New EU Member Countries and the EU-25” with acronym EEE-NMC which was implemented under Intelligent Energy for Europe programme. The project lasted 1.5 year, and it was participated by national energy agencies and statistical offices from the new EU Member States. From the Polish side Central Statistical Office (GUS) and the Polish National Energy Conservation Agency (KAPE) are participating in this project coordinated by ADEME[3].

The direct objectives of the project are the following:

- monitoring of energy efficiency and CO_2 emissions in New Member Countries, utilising aggregated indicators;
- comparison between NMC and EU-15 on energy efficiency indicators;
- evaluation of the measures conducting by EU countries aiming at energy efficiency improvement.

The project results are the following:

- Assessment and analysis of energy efficiency improvement and CO_2 emission in EU-25, in new Member Countries and Bulgaria in 1996-2005,
- Comparison of the energy consumption indicators of new EU Member States with the EU-15 - the analysis contains indicators which cover impact of climate, use of purchasing power parities (PPP) and the economic and industry structures,

[3] Agence de l’Environement et de la Maitrise de l’Energie

- Presentation of effectiveness in economic sectors of individual countries with the trends - in graphs, accompanied by comments (rendered available o relevant website),
- Extension of ODYSSEE[4] website on energy efficiency indicators and extension of the MURE[5] data base on energy efficiency measures in all the EU countries and Norway and Bulgaria.
- Project publications.

The issues concerning energy efficiency indicators will be continued in subsequent 2 - summer (2007-2009) project of the Intelligent Energy for Europe programme. "Monitoring of Energy Demand Trends and Energy Efficiency in the EU"**.**

The project aims at:

- Monitoring of changes (improvement) of energy efficiency (CO_2 emission) in the EU Member States.
- Analysis of energy demand trends.
- Comparison of energy efficiency among various countries.
- Evaluation of share of innovative energy efficient technologies and renewable energy sources in implementation of Lisbon Strategy for increase of economic competitiveness of Europe.
- Evaluation of measures for improvement of energy efficiency in EU Member States.

The above objectives are compliant with requirements concerning energy efficiency measurements of the Directive 2006/32/EC. Under the project two tools will be developed and used: ODYSSEE data base containing data and values of energy efficiency indicators, MURE data base with data concerning measures for improvement of energy efficiency.

[4] WWW.odyssee-indicators.org
[5] Mesures d'Utilisation Rationelle de l'Energie, WWW.mure2.com

3. Energy efficiency indicators for Polish economy and its sectors

Indicators presented below are the result of continuation of works connected with the European Commission programme – SAVE and carried out in frames of Intelligent Energy for Europe programme. These indicators were calculated using "top-down" method.

3.1. Indicators of economic development dynamics

Since 1992 all the basic economic indicators in Poland have been improving (Figure 1). The fastest rate of growth of value added at constant was noted in the given period in industry sector though the growth was rather unequal with two declining years (2001 and 2002). Private consumption was increasing at the rate almost similar to the value of GDP (Table 1). The lowest rate of growth was noted in agriculture sector (Figure 2).

Figure 1. Dynamics of basic macro-economic indicators

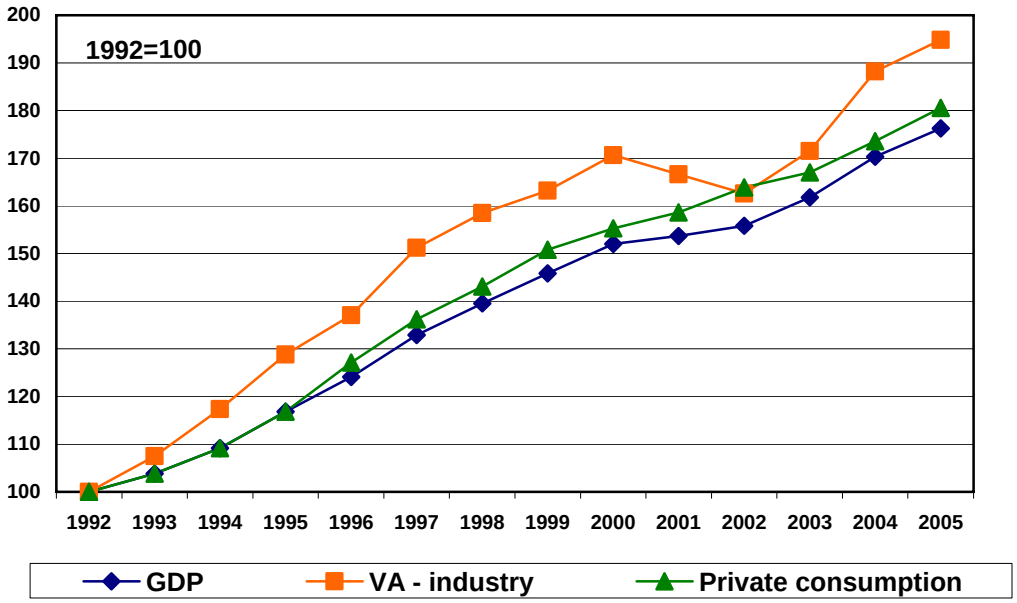
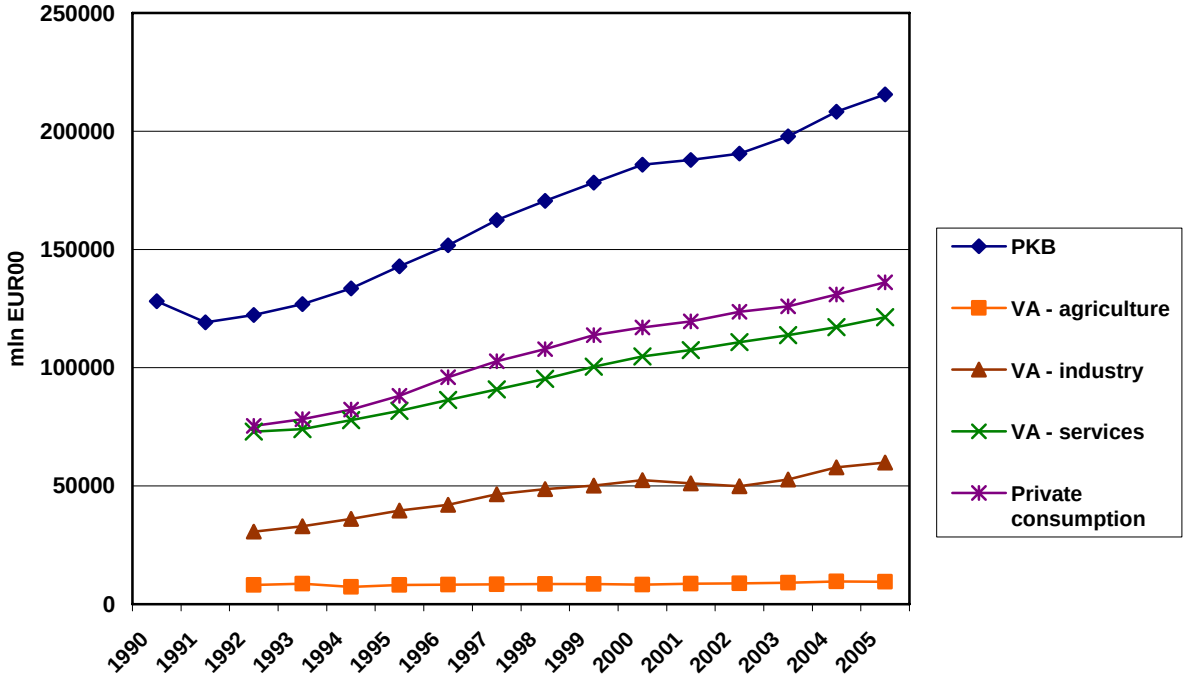


Table 1. Dynamics of basic macro-economic development indicators in Poland in 1992-2005 (%/year)

Items	1992-2000	2000-2005	1992-2005
GDP	5.08	3.01	4.46
Value added in industry	6.73	2.69	5.26
Private consumption	5.40	3.06	4.65

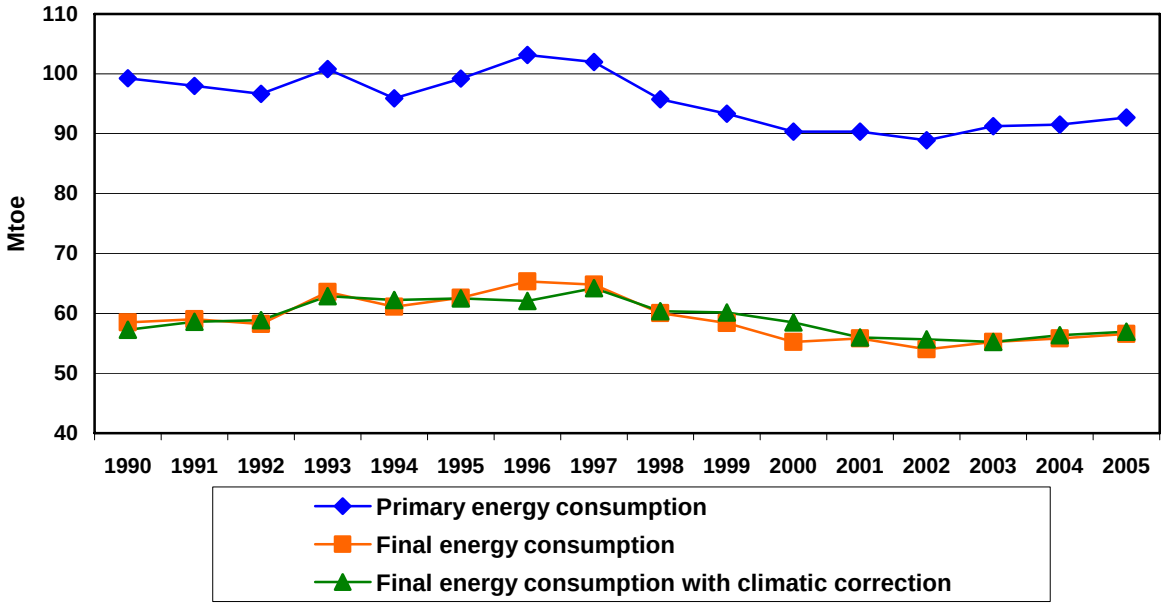
Figure 2. Changes of GDP, Value added in main economy sectors and private consumptions in constant Euro 2000



After growth in first half of the 90's and reaching top in 1996, total primary and final energy consumption had decreasing trend between 1996-2002 (Figure 3) and slowly rose in subsequent years.

Decrease of energy consumption resulted from realization of modernization programmes, restructuring of economy and seasonally lower economic activity. Programmes of energy efficiency improvement and liberalization of energy prices produced also had their share.

Figure 3. Primary and final energy consumption



Function of final energy consumption is slightly modified by climatic correction which increases its value for winters characterized by lower degree days value (warmer). Climatic correction concerns households and service sector. Energy consumption with climatic correction describes its theoretical value for a given year, if the weather conditions were similar to long-term average.

Final energy consumption with climatic correction is counted by deducting from final energy consumption the energy consumption in households and service sector and adding energy consumption in these sectors with climatic correction. The same methodology of energy consumption in households and service sector was used in chapter 3.4.

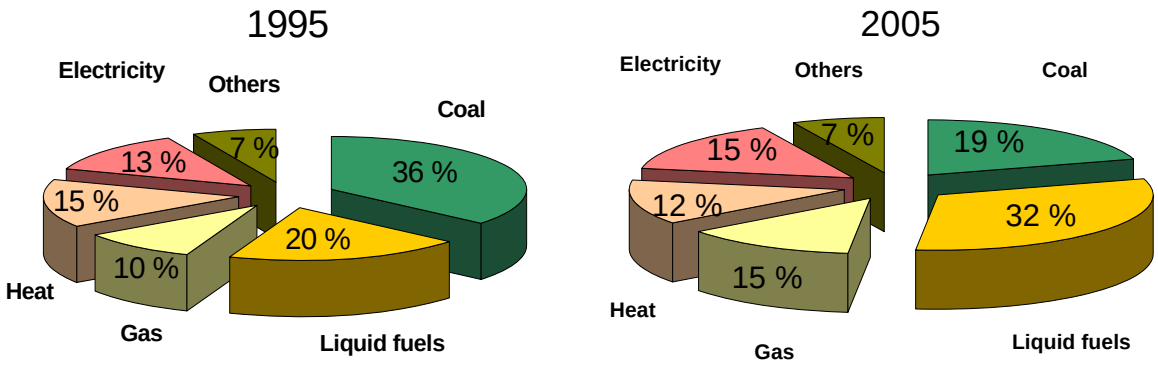
Decrease of energy consumption resulted from realization of modernization programmes, restructuring of economy and seasonally lower economic activity. Programmes of energy efficiency improvement and liberalization of energy prices produced also had their share.

3.2 Consumption and prices of energy

In the energy field, Poland has traditionally been a supply-oriented country with important hard coal and lignite sector. However, the share of coal in country energy consumption had decreased systematically from 36% in 1995 to 19% in 2005 (Figure 4). Comparison of final energy consumption by energy carriers between 1995 and 2005 shows the increase role of oil fuels which became dominant in the balance with the share of 32% in 2005. Gas consumption

slightly rose and reached 15% of energy consumed in 2005. Similarly, consumption of electricity increased in 1995-2004 and amounted to 15% in 2005.

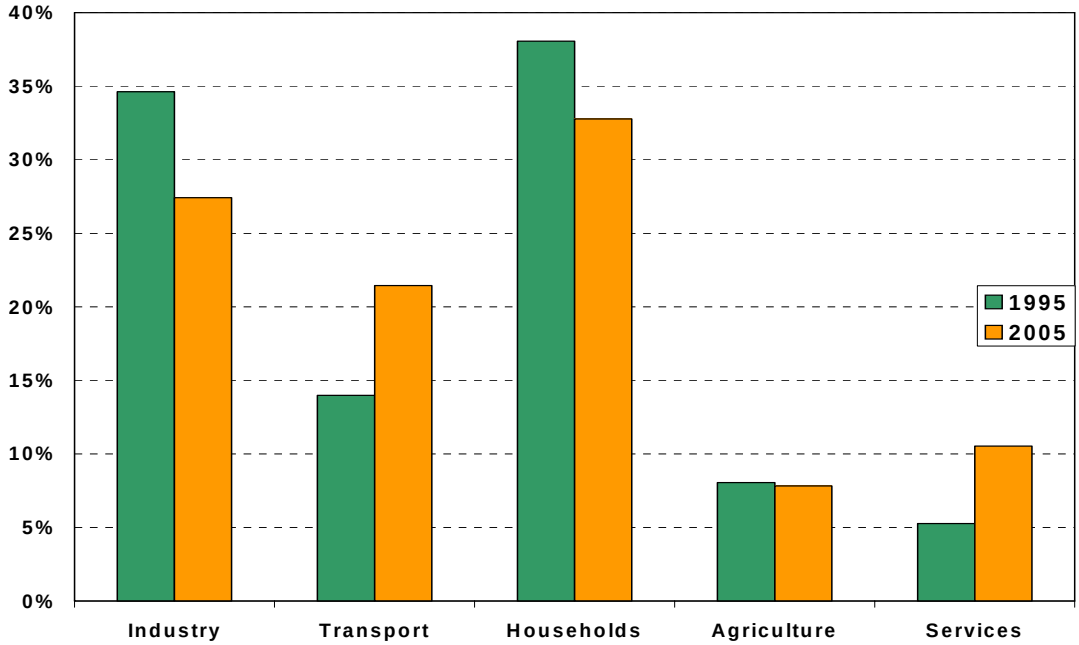
Figure 4. Final energy consumption by energy carrier in Poland



Changes of final consumption structure in main sectors of ecmonomy (Figure 5) reflect the directions of ecnomy development. Restructuring of industry affected the energy consumption reduction, which was also accompanied by energy saving measures in companies. The development of road transport and services influenced the increase of energy consumption of these sectors. The households experienced the activities as thermo-modernization, improving efficiencies of heating systems and totally obtained almost 20% reduction of its energy consumption during 1995-2004.

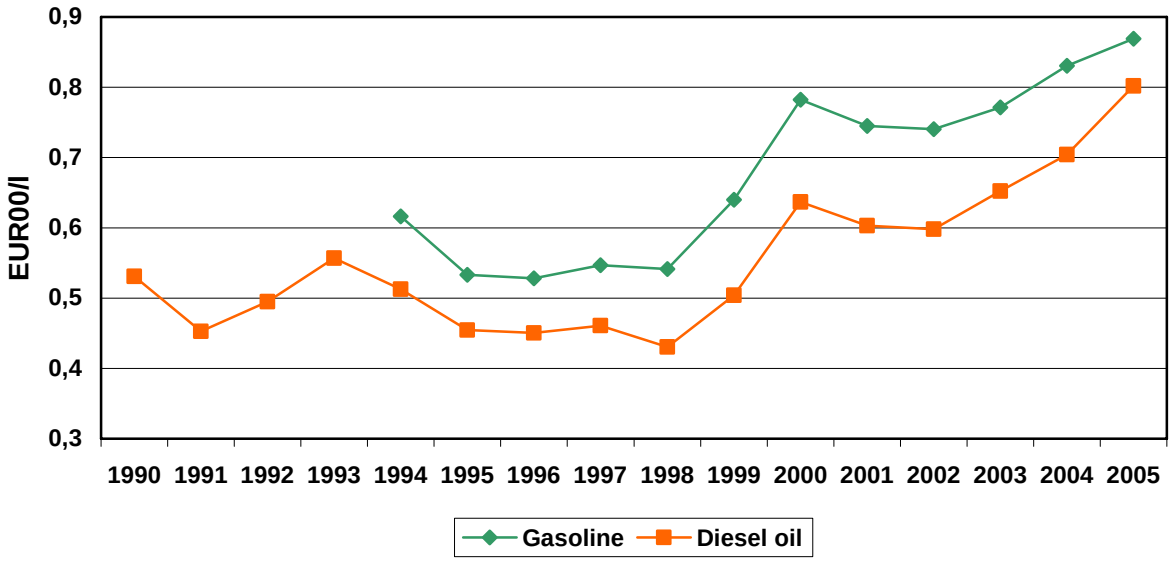
Changes in agriculture sector, consisting in liquidation and privatisation of state-owned agriculture holdings, and building modern large-size farms, did not contribute to save energy, which consumption stays on stable level.

Figure 5. Final energy consumption by energy sectors in Poland



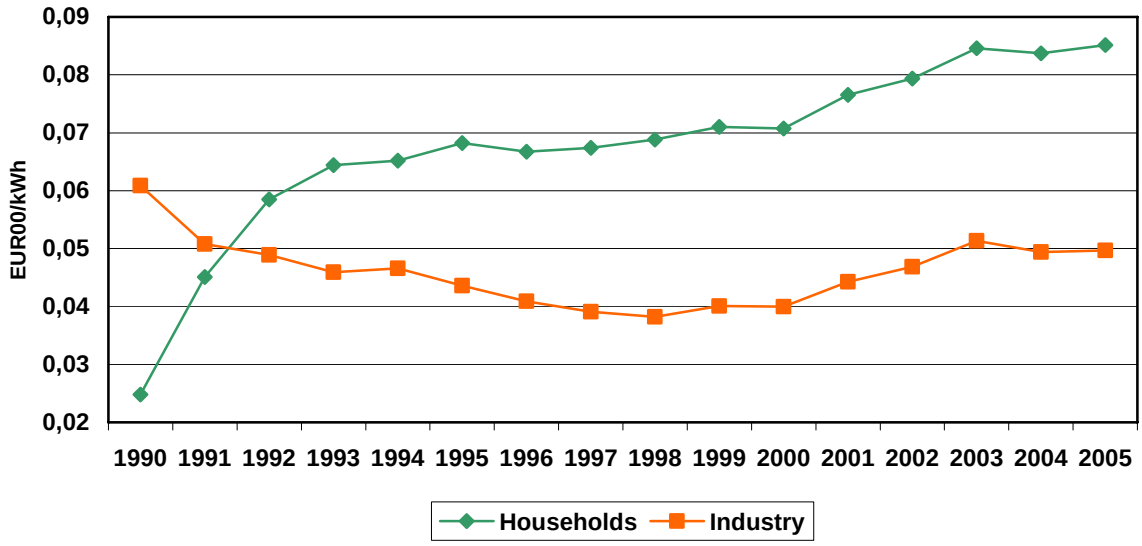
Prices of gasoline and diesel expressed in constant of 2000 have dynamically grown since 1998 with the periodical corrections of the trend (Figure 6.) The main factors influencing level of these prices is the level of tax contained in fuel prices (significant increased of excise tax took place at the end of the 90's) and prices of raw materials on world markets (oil prices have been growing since 1999).

Figure 6. Changes of gasoline and diesel prices



Poland has completed the difficult task of cross subsidies in the electricity sector elimination, which has been achieved by increasing the tariff for household from 0.0248 for 1kWh in 1990 up to 0.0664 in 1993: 160% of growth expressed in Euro in constant. And also for next years 1993-1999 the price of household electricity has been increasing slowly and more sharp growth again is observed for 2001-2003. Electricity for industry has been decreasing during the years 1990-2000 (4.12%/year) - Figure 7. And in 2001-2003 the prices increased by 28% and then become stable.

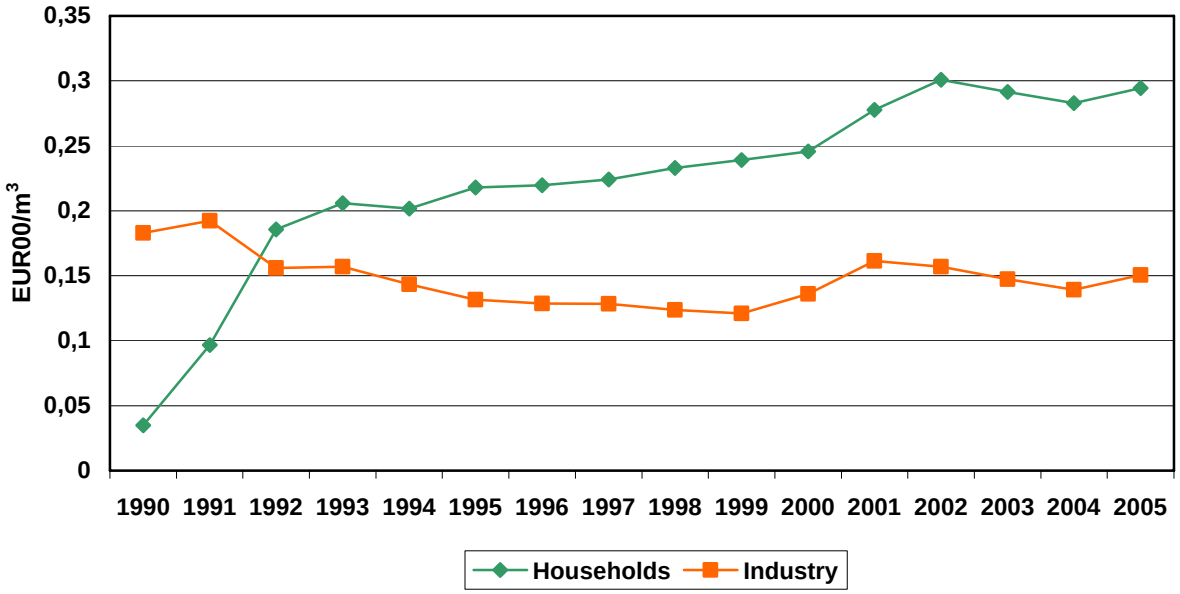
Figure 7. Changes of electricity prices for households and industry



The prices of gas reflected the tendencies observed for electricity prices. In case of gas prices the growth for households expressed in constant Euro 2000 was much sharper from 0.0349 in 1990 up to 0.2058 in 1993: 490% of growth at constant Euro 2000 (see in Figure 8) and up to year 2000 price was steadily growing. In 2001 and 2002 gas prices jumped and next years the prices fluctuated.

In years 1990-1999 gas price for industry declined systematically, then it jumped in 2000-2001. Since 2002 these prices have slightly fluctuated.

Figure 8. Changes in gas prices for households and industry



Figures 9, 10, 11 present tendencies of indicators changes in years 1990-2005:

- Figure 9 - GDP energy intensities (i.e. primary energy use/GDP),
- Figure 10 - GDP final energy intensities (i.e. final energy use/GDP),
- Figure 11 - Ratio of GDP final energy intensities to GDP primary energy intensity.

Indicators concerning energy consumption with climatic correction are calculated according to EUROSTAT and IEA methodology. Introduction of climatic correction aims to eliminate influence of different weather conditions next years on energy consumption and related energy efficiency indicators.

Figure 9. Changes in GDP energy intensities indicator

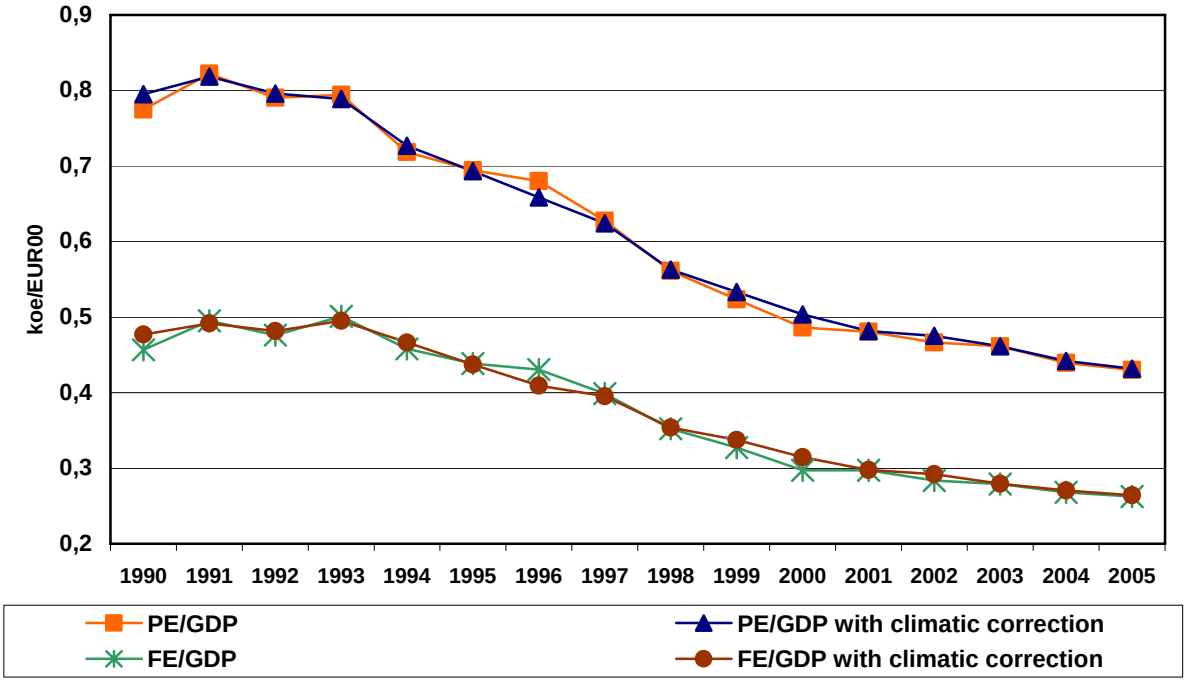


Figure 10. Changes in GDP final energy intensities indicator

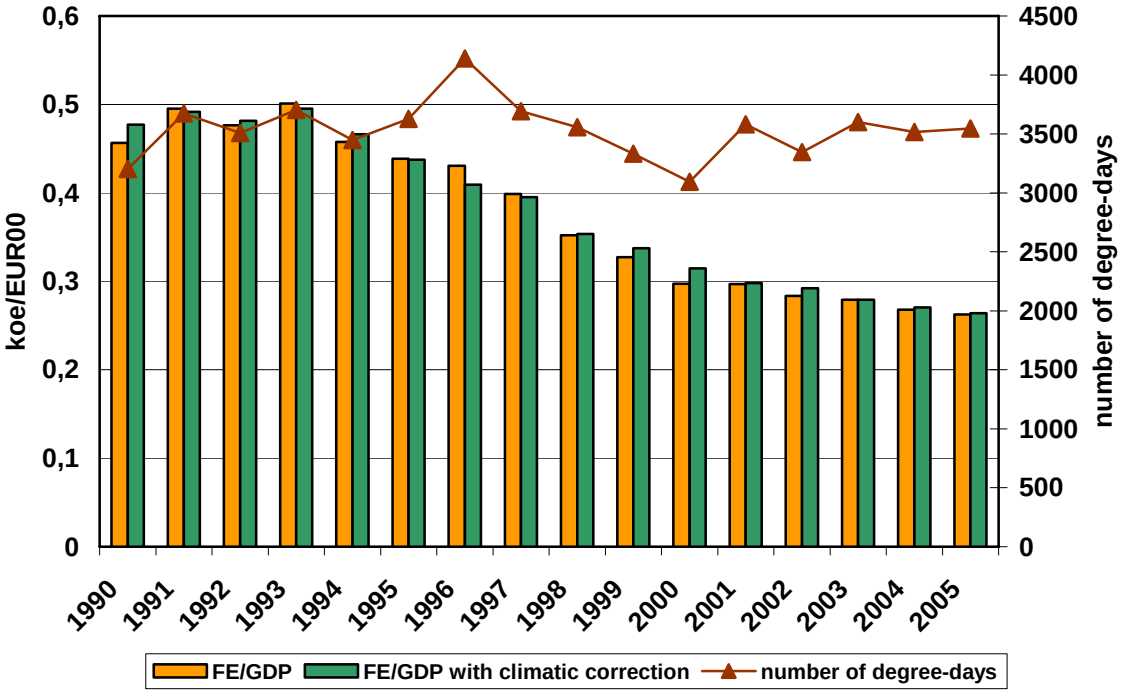
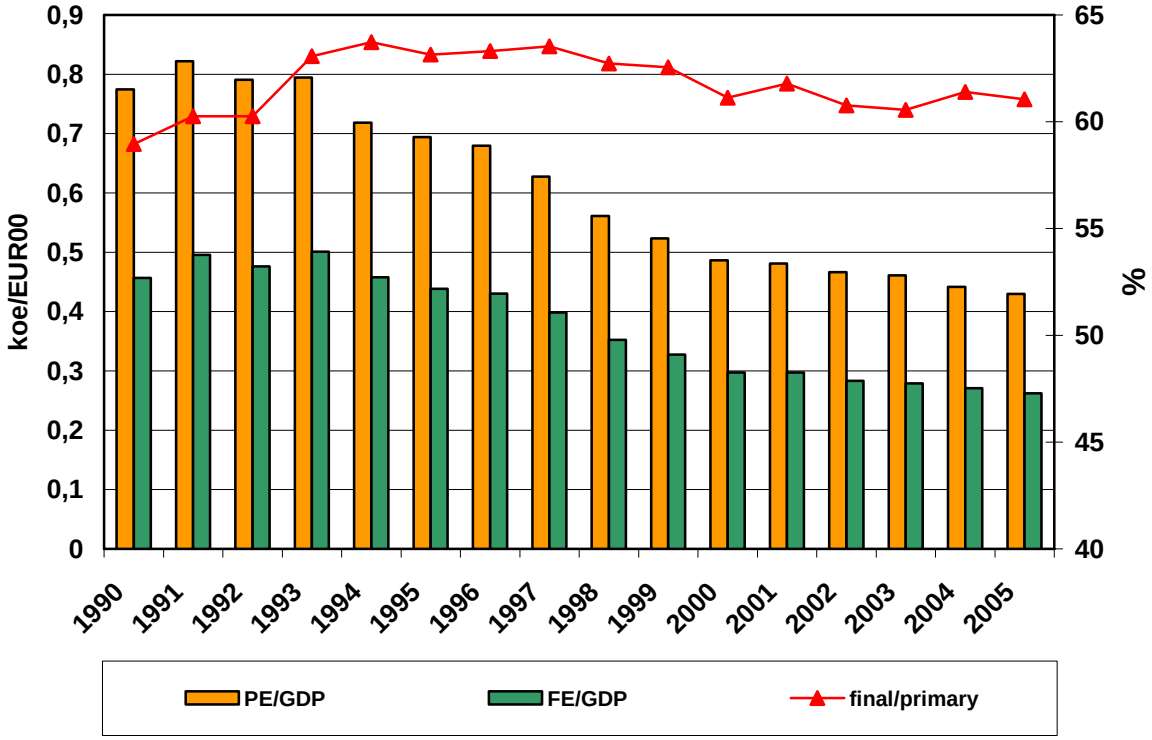


Figure 11. Ratio of final energy GDP indicator to primary energy GDP indicator



While analysing changes in energy intensities, it is necessary to bear in mind the specific situation before 1990s in the Central European countries, including Poland. In those countries of the central planning, energy prices were very low, which resulted in energy wastage reaching in extreme cases even 60 to 70% of the energy consumed. This caused a habit of excessive energy consumption, which is very difficult to overcome but creates the possibilities to utilise this potential.

In the period of 1990-2005 primary and final energy intensity tended to decrease. It resulted from both energy consumption decline and rising GDP. Data on variations in primary and final energy intensities are presented in table 2**.**

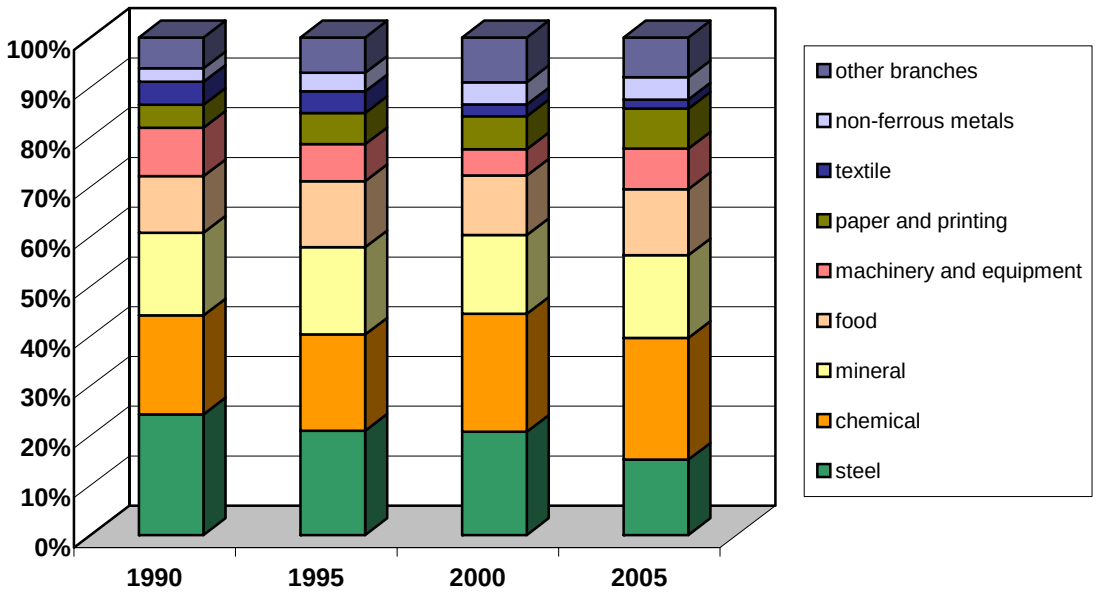
Table 2. An average annual rate of changes in GDP energy intensity indicators (%/year)

Rate of changes	1990-1993	1993-2000	2000-2005	1993-2005	1990-2005
GDP final energy intensities	3.14	-7.19	-2.45	-5.24	-3.63
GDP primary energy intensities	0.84	-6.77	-2.43	-4.99	-3.85

3.3. Industry

Energy consumption of manufacturing by branch presents Figure 12. More than 60% of energy is consumed by following industrial branches: primary metals (iron and non-ironic metals), chemicals and minerals. Consumption of energy by sectors of textiles, minerals, machinery and equipment slightly declines. Significant drop of energy consumed was observed in case of steel industry. The drops are caused mainly by limiting production (steel, sulphur), and not by modernization of enterprises aiming at reduction of energy consumption. There occurred significant jump of shares of other industry divisions (optical industry, computers, etc.) and food. Structural changes are rather slight and do not exceed few percentage points.

Figure 12. Energy consumption in manufacturing by branch



Figures 13 and 14 present energy intensity (final energy consumption/value added) of selected industrial branches in years 1993-2005.

Figure 13. Changes of energy intensity indicators in energy intensive industry branches

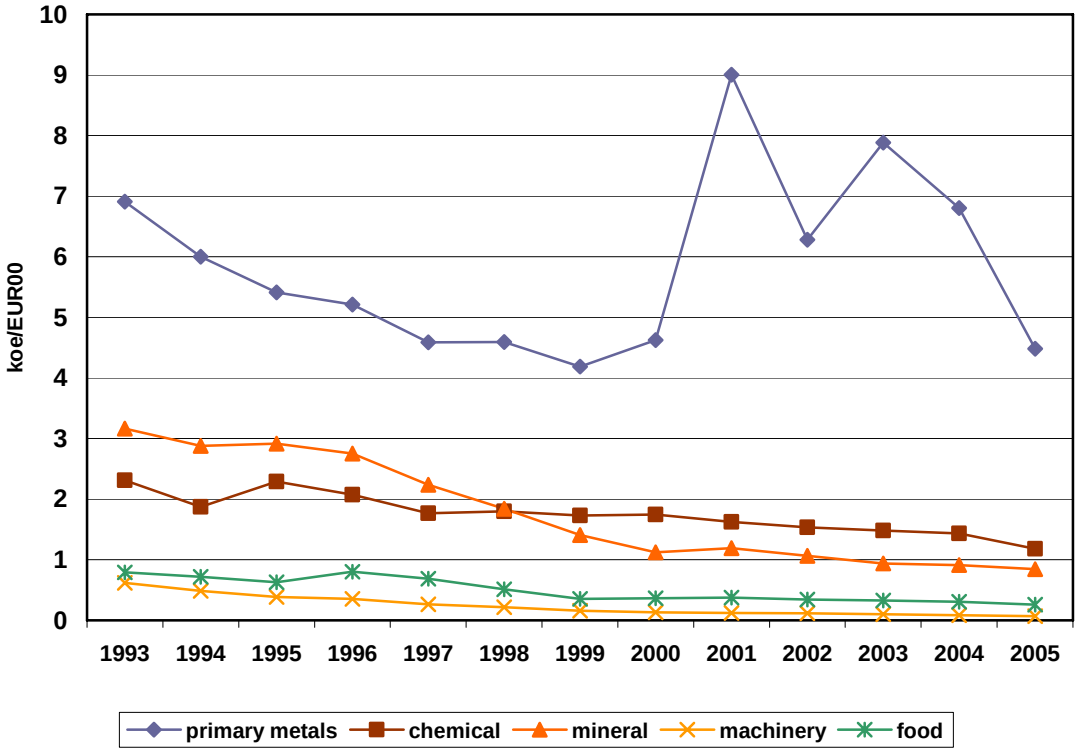


Figure 14. Changes of energy intensity indicators in low energy intensive industry branches

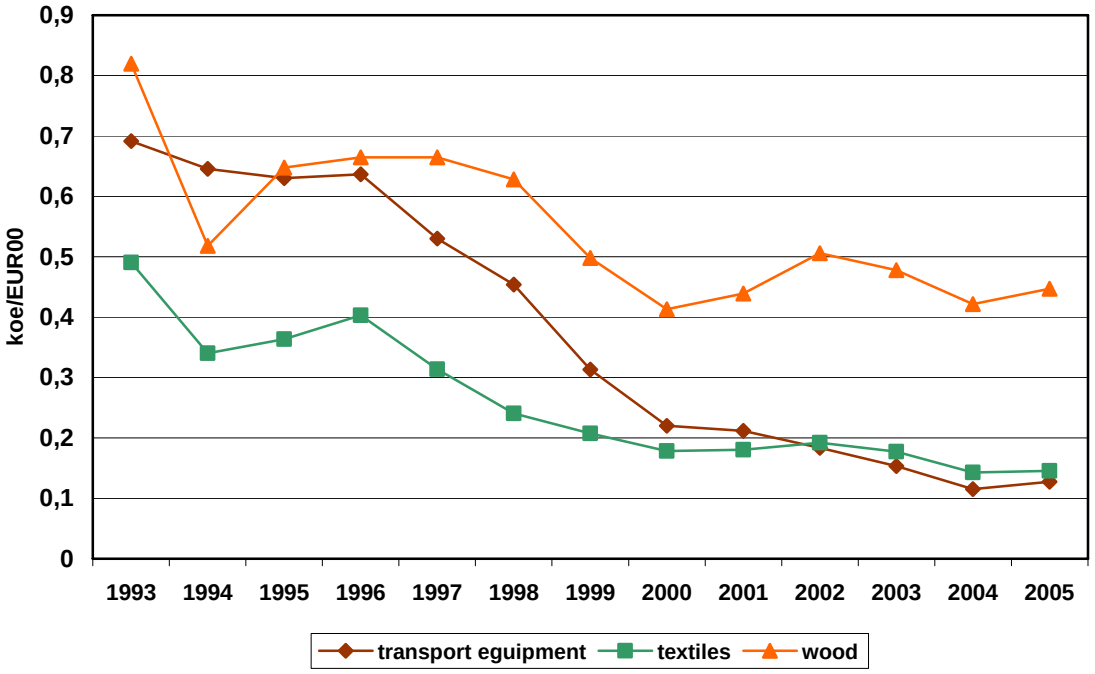


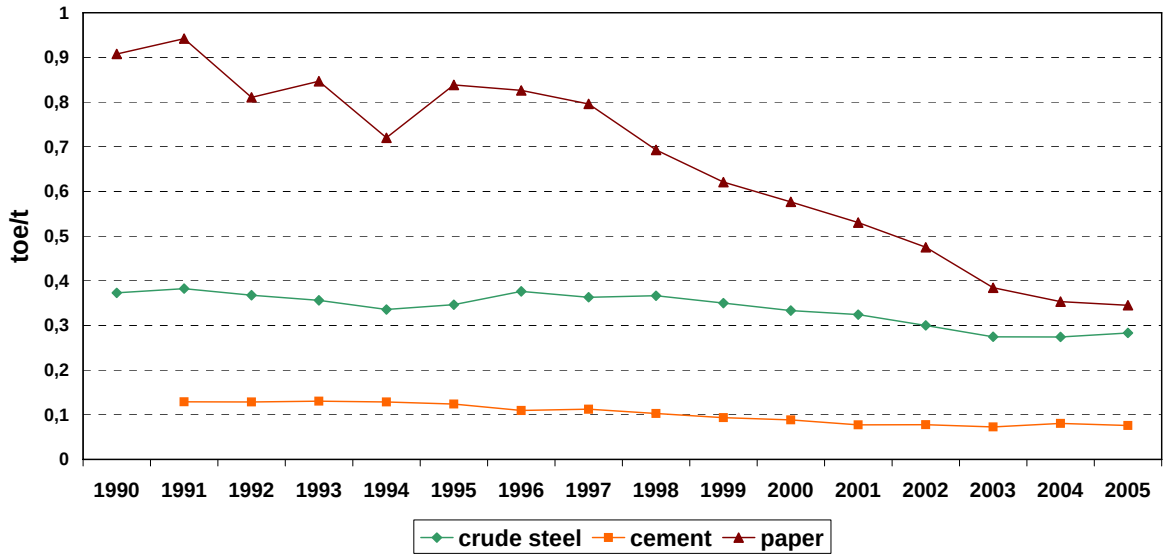
Table 3. Dynamics of changes of energy intensity indicators of selected industry branches

Items	2005/1995 [%]	Dynamics of changes (%/year)
Industry	45.59	-7.56
Manufacturing	32.92	-10.52
Chemical	62.99	-4.52
Mineral	29.35	-11.54
Machinery and equipment	16.39	-16.55
Food	35.76	-9.77
Paper and printing	44.47	-7.78
Textiles	42.76	-8.15

In most cases improvement of intensity indicator can be observed, however the pace of changes is different. It is connected, among others, with new investment, which results from stable activity conditions of enterprises.

Figure 15 presents energy intensity of steel, cement and paper production in years 1990-2005. Energy intensity of cement production declines systematically. Old-fashioned wet method of production was abandoned what resulted in decline of energy intensity below 0.1 toe/t already in 1999 to achieve in next years the level below 0.08 toe/t i.e. value close to European average. Little decline of energy intensity of steel production results from delays in privatisation process and modern technologies implementing. Paper industry was thoroughly modernized after privatisation, which resulted in further decrease of intensity to level of 0.35 toe/t in 2005. In years 1990-2005 energy intensity of crude steel production declined by 24.12% (1.82%/year), paper by 61.96% (6.24%/year) and cement by 41.34% (3.49%/year).

Figure 15. Changes of energy intensity indicators in production for selected industrial products



Changes in structure of industry in 1993-2005 had significant impact on energy intensity changes (Figures 16 and 17); the lowest in years 1993-1996 and the highest in years 2000-2005. Structural changes decreased energy intensity of processing industry by 2.24%/year (Table 4).

Methodology of taking structural changes of processing industry into account to calculate its energy intensity is as follows:

energy intensity of processing industry in year "k" at constant structure of 2000 („E^k2000") is counted as follows:

$$E^k_{2000}=\sum_i^n E^k_i * VA_i^{2000}/VA^{2000}, \text{ where:}$$

E – intensity, VA – value added, i – industry division, k – year, n- amount of divisions of processing industry.

Table 4. Dynamics of changes of energy intensity and impact of structural changes (%/year)

Items	1993-1996	1996-2000	2000-2005	1993-2005
Energy intensity (1)	-5.87	-13.07	-9.58	-9.88
Energy intensity at constant structure	-5.44	-12.19	-5.19	-7.64
Impact of structural changes (1)-(2)	-0.42	-0.88	-4.38	-2.24

Figure 16. Changes of energy intensity of manufacturing - role of structural changes

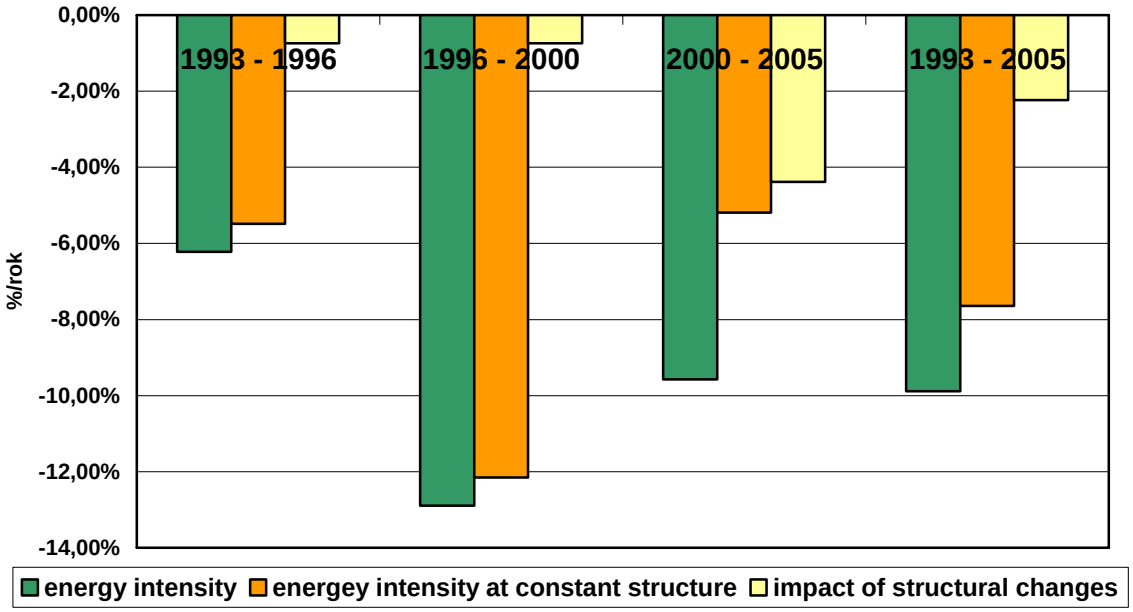
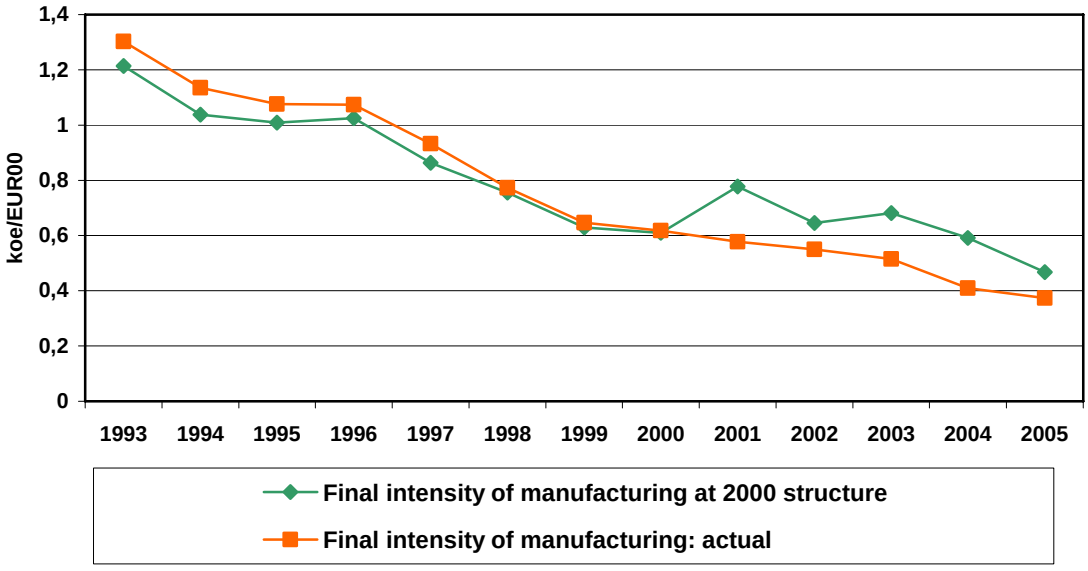


Figure 17. Variation of energy intensity of manufacturing



3.4. Households

Share of energy consumption in households in final energy consumption amounts to 32-33% and tends to grow. The structure of consumption by end use, surveyed by CSO in 1993 and 2002 presents Figure 18 and Table 5. Decreasing share of energy consumption for heating and cooking results from replacing low-efficient coal with gas and electric ovens. Growth of consumption by electrical appliances and lighting is connected with richer equipment of households in electrical appliances and behaviour changes (e.g. changes in intensity of appliances use - washing machines, dish washers, TVs, computers).

Figure 18. Structure of energy consumption in households by end use

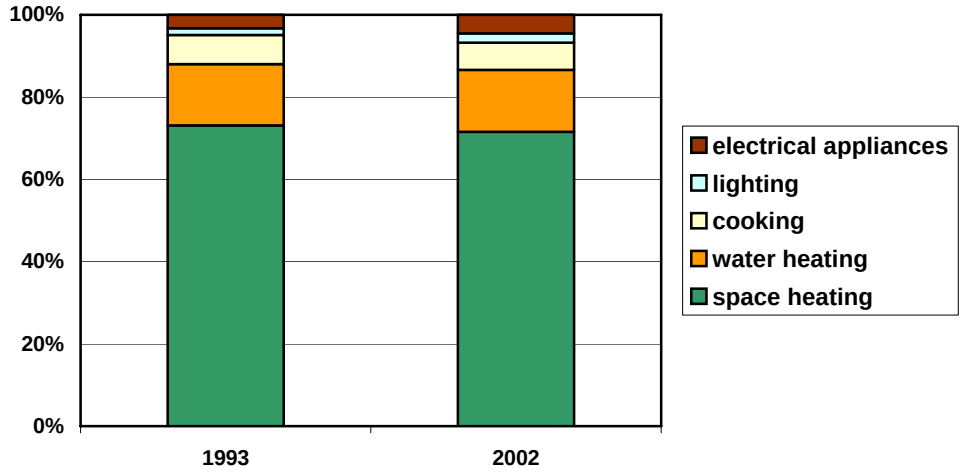
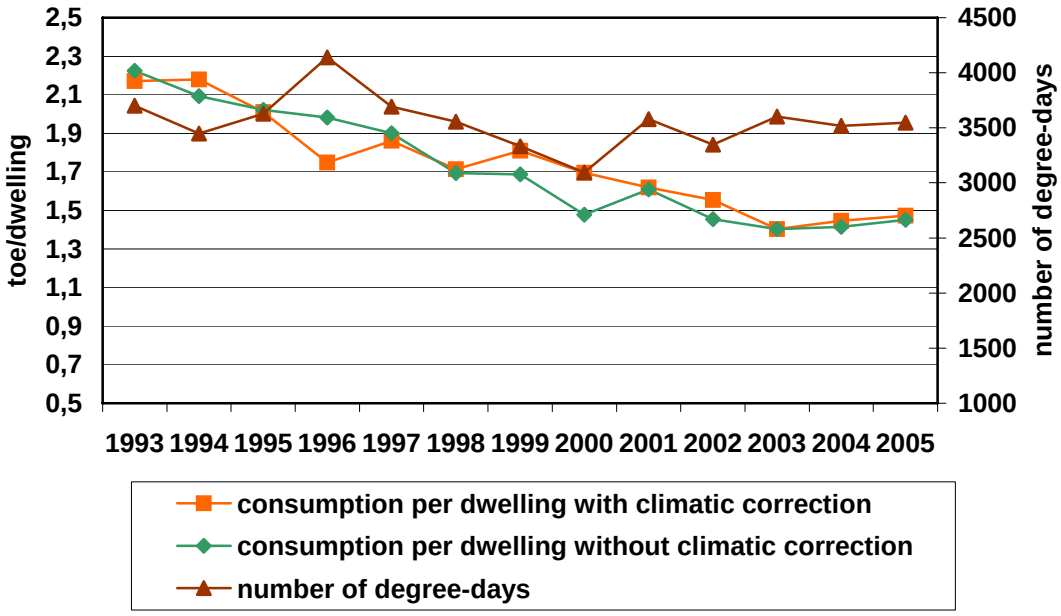


Table 5. Changes in structure of energy consumption in households by end use

Items	1993	2002
Total	100.0	100.0
Heating	73.1	71.2
Water heating	14.9	15.1
Cooking	7.1	6.6
Lighting	1.6	2.3
Electrical equipment	3.3	4.5

Figure 19 presents changes of energy consumption per dwelling. The value of indicator with climatic correction tends to decrease with annual decrease rate of 3.18%. Decrease of unit energy consumption in dwellings is related to buildings thermomodernization, reduction of losses in central heating systems, improvement of efficiency of newly installed devices.

Figure 19. Changes in indicator of energy consumption in households per dwelling



The method for the climatic correction of final energy consumption is based on the correlation between energy consumption and outdoor temperature. The consumption is proportional to the Heating Degree Days (SD). The constant heating share approach in calculating of final energy consumption with climatic correction ZEF^{kk} is based on the following formula:

$$ZFF^{kk} = \frac{ZFF}{1 - 0{,}9 \cdot \alpha \cdot \left(1 - \frac{Actual\ SD}{Long - term\ average\ SD}\right)}$$

where: ZEF - final energy consumption, SD - degree days number, α - heating share in total energy consumption in dwelling sector.

Heating Degree Days is introduced to enable control and comparison of energy consumption for heating. It expresses a product of number of heating days and difference between the average temperature of heated room and average outdoor temperature. Numbers of SD degrees in a given year according to Eurostat methodology is calculated as follows:

$$Sd = \sum_{n=1}^{N} \begin{cases} 18^{o}\mathrm{C} - t_{śr}(n) & dla \quad t_{śr}(n) \le 15^{o}\mathrm{C} \\ 0 & dla \quad t_{śr}(n) > 15^{o}\mathrm{C} \end{cases}, \text{[day} \cdot \text{deg/year]}$$

where: $t_{śr}(n) = \frac{t_{\min}(n) + t_{maks}(n)}{2}$ - mean outdoor temperature for n day, [°C]; $t_{\min}(n)$, $t_{maks}(n)$ - minimum and maximum temperature of the n day, [°C]; N - number of days per year.

According to formula and the Eurostat assumption, the mean outdoor temperature of the heating day should be less than 15°C.

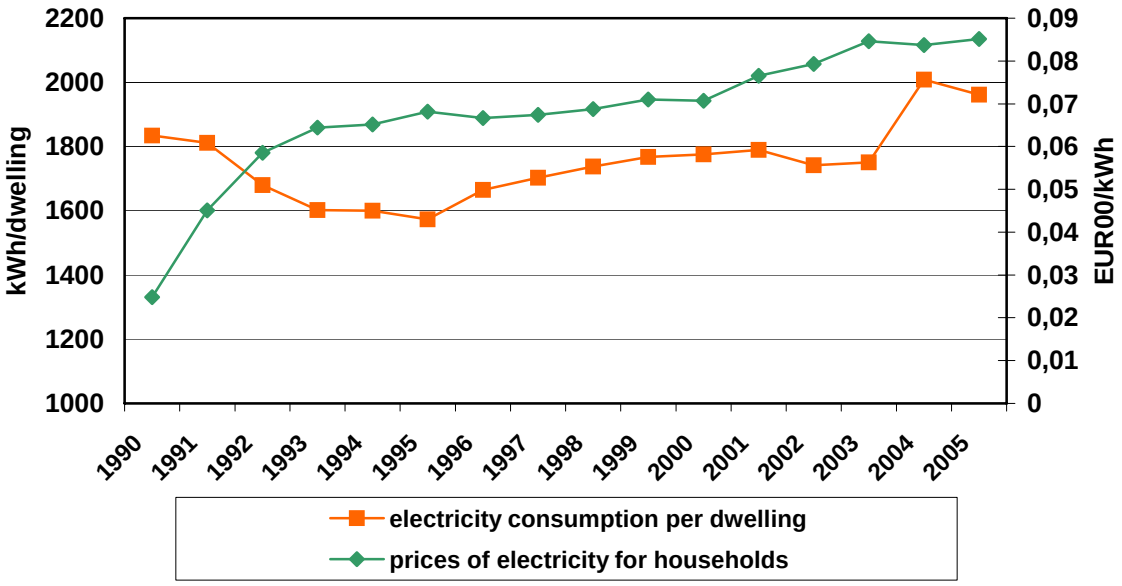
The values of heating degree days (*SD*) for 1991-2005 and long-term average are presented in the table below.

Table 6. Heating degree days for 1991-2005

Sd	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Sd- annual	3673	3509	3703	3448	3627	4139	3693	3556	3332	3094	3580	3347	3602	3518	3547
Sd - long-term average	3605	3605	3605	3605	3605	3605	3605	3605	3605	3605	3605	3605	3605	3605	3605

Energy consumption by the households is shaped by various factors. The most significant are price level and economic situation of households which is reflected in so called behaviour changes resulting *inter alia* in different intensity of household appliances. Increase of prices at the beginning of the 90's resulted in sudden drop of electricity consumption which was compensated thanks to increasing incomes of population at the beginning of the next decade. Subsequent increases contributed to another limitation of electricity use. Sudden growth in 2004 has not been explained yet.

Figure 20. Changes of prices and indicator of electricity consumption in households per dwelling



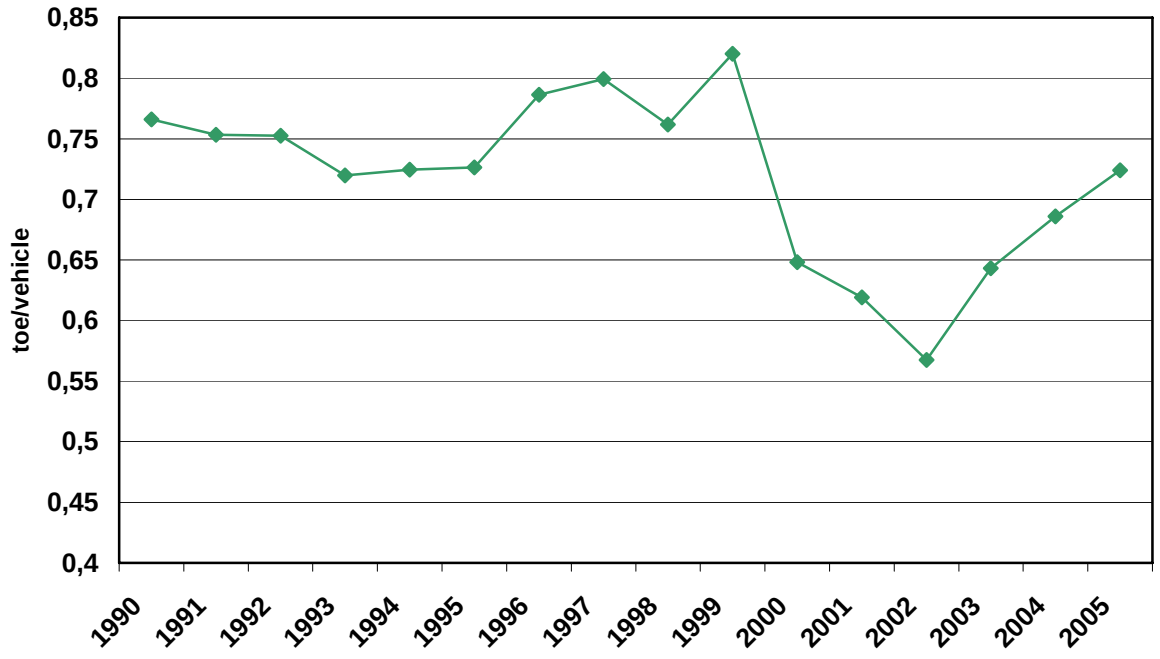
3.5. Transport

In Poland about 89% of energy consumed in transport consumes road transport, around 5.6% rail transport. Another 5% is consumed by airplanes and the rest is consumed by inland and inshore water transport.

In years 1990-2005 steady growth of fuel consumption in road transport (2,5% annually) is observed, accompanied by significant drop of energy consumption by rail transport.

Figure 21 presents unit consumption of fuels by vehicle. The indicator is influenced mainly by country economical situation and increasing efficiency of new cars.

Figure 21. Changes in indicator of fuel consumption per vehicle



3.6. Service sector

Service sector has the most stable energy consumption efficiency indicators. Value added energy intensity, after drop at the beginning of the 90's shows slight fluctuation and in 2005 it has the same value as in 1994. Improvement rate is lower than the global value and is significantly lower than improvement e.g. in industry but at the same time it is the sector of national income creation that is the most efficient in respect of energy. The energy intensity

indicator is characterized by larger changes but similarly to the previous case it is stable (Figure 22).

In case of changes of unit consumption of energy and electricity per employee one can observe irregular decrease trend which ended in the second half of the 90's (Figure 23.) First to occur was the increase of unit consumption of electricity and after 2 years increase of total energy consumption. At the beginning of the following decade the increase trends stopped which could result from increase of energy carriers prices. Increase of significance of the electricity is related to increasing equipment of service sector enterprises in electronic devices.

Figure 22. Changes of energy intensity and electricity intensity indicator in service sector

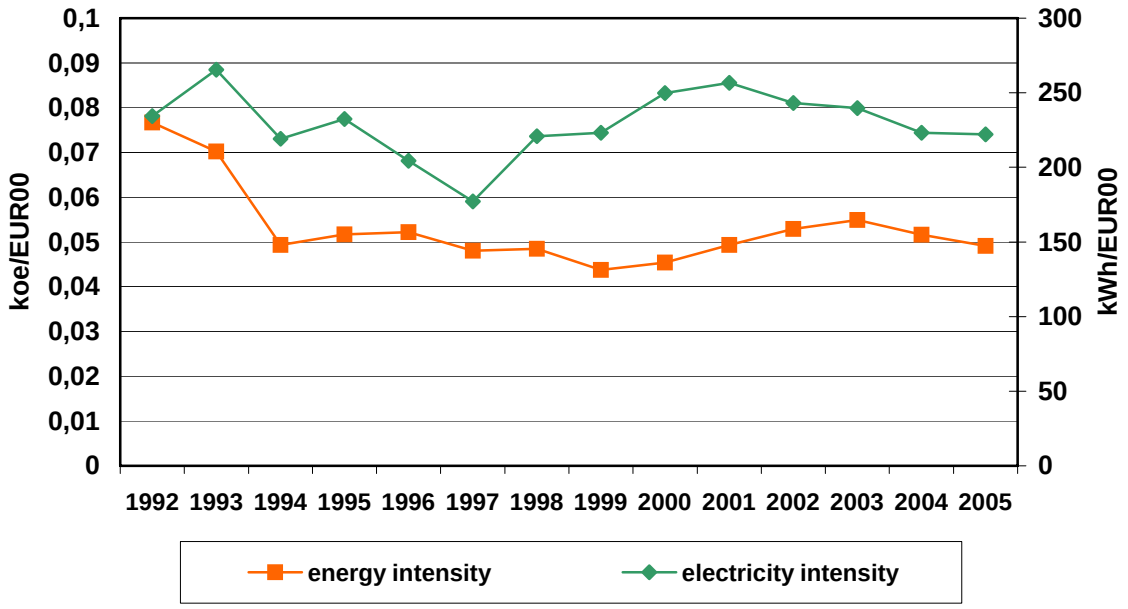
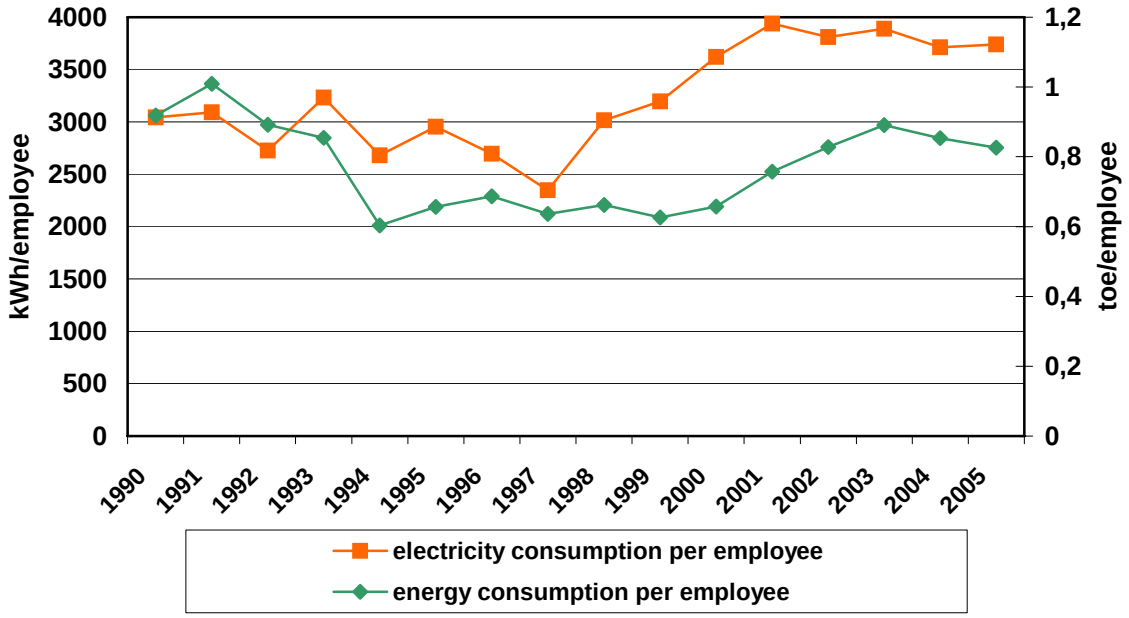


Figure 23. Changes in indicator of energy consumption and electricity consumption per employee of the service sector



3.7. Heat plants and heat and power generating plants

Figures 24 and 25 present changes of efficiency of heat plants and combined heat and power plants. In 2005, in heat plants a slight growth of indicator value was observed after few years of decline. Heat and power generating plants achieved growth to the highest level in history.

Earlier, in effect of modernization the growth of efficiency of heat plants (years 1992- 2001) and heat and power-generating plants (years 1995-2003 without 1999-2000) can be observed.

Figure 24. Changes of Heat plants efficiency

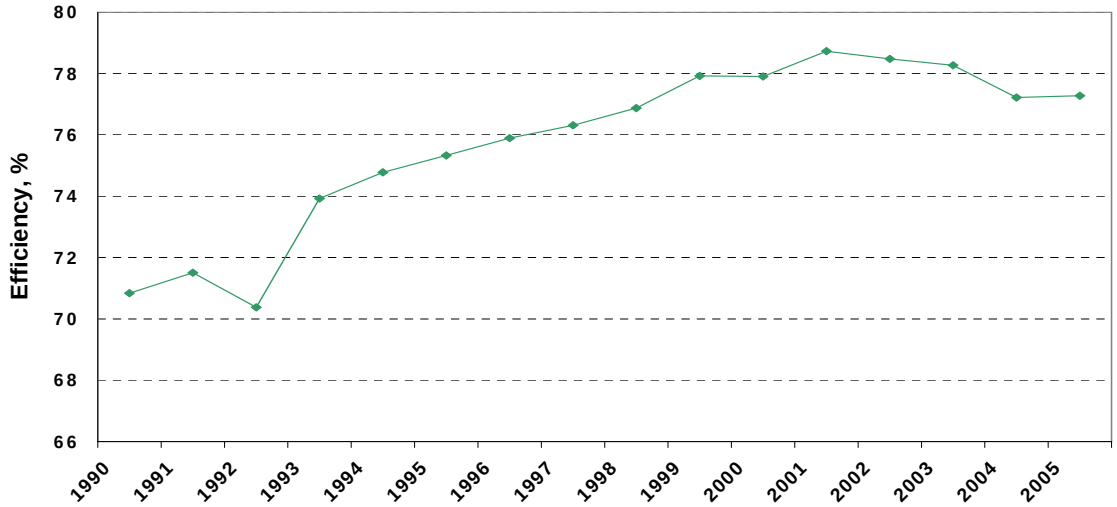
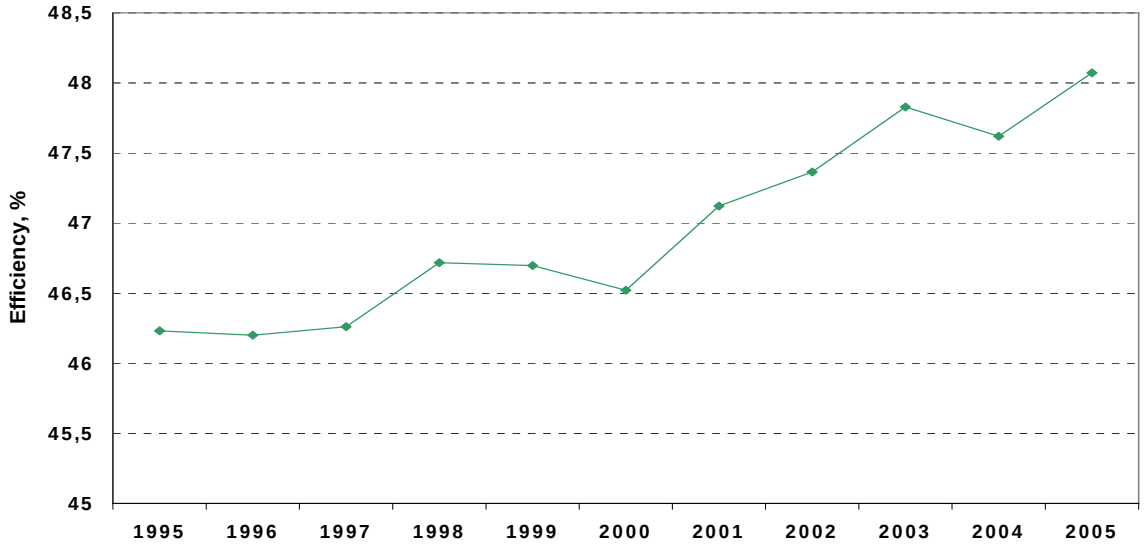


Figure 25. Changes of heat and power-generating plants efficiency



4. Polish energy efficiency in the system of ODEX indicators

ODEX indicator is an aggregated energy efficiency indicator. It was elaborated to meet the needs related to monitoring of energy effectiveness and in order to obtain understandable, simple to elaborate and comparable indicator reflecting progress in respect of energy efficiency in the European Union Member States. The indicator is obtained through aggregation of changes in unit energy consumption observed in a given period of time at the specified levels of end-use. By application of reference physical parameters, the ODEX indicator illustrates progress in respect of energy efficiency. ODEX is an alternative for monetary indicators of energy intensity which depend on many factors related - not directly - to energy efficiency. ODEX indicator does not show current level of energy intensity but the progress in respect of the base year. The ODEX indicators are useful for monitoring of indicative target implementation in the scope of energy efficiency laid down in Directive 2006/32/EC.

The methodology of ODEX indicators calculation is currently being elaborated *inter alia* under the programmes of the European Commission named ODYSSEE which is participated by GUS and KAPE S.A. At present, two alternative methods of ODEX calculation are applied which give the same result. The first method (aggregation method based on unit consumption effect) combines the progress in energy efficiency achieved in all sub-sectors on the basis of saved energy quantity (e.g. Mtoe): it is based on „unit consumption effect". The second method (weighted indicator method) weighs a separate unit consumption indicator of each sub-sector on the basis of its share in energy consumption for the entire sector.

- ***Aggregation method based n the unit consumption effect***

Unit consumption effect (*EFCU)* measures the impact of changes in unit consumption on consumption between year *t* and or previous year (*t-1*) or base year. For example, unit consumption effect -1000 ktoe in 2000 means that with application of energy technologies and practices from 1990 the consumption would be by 1000 ktoe higher than in 2000.

for given sub-sector or end-use *"i"* the unit consumption effect in year "*t"* is calculated by multiplication of the level of activity in year "n year "*t*" and changes in unit consumption between year "*t*" and reference year. Subsequently, the unit consumption effects (all expressed in the same unit Mtoe) are aggregated for all sub-sectors and end-use in order to

obtain aggregated unit consumption effect at the sector level. For example, in industry the overall unit consumption effect is obtained through aggregation of unit energy consumption effects in individual division. ODEX is calculated per each year as the quotient of actual energy consumption E_t and theoretical energy consumption without taking into account unit consumption effect (i.e. without energy savings obtained through decrease if unit energy consumption as a result of measures for improvement of energy efficiency in production process of a given product). If the energy efficiency indicator was 85 in 2000 this means an improvement of energy efficiency by 15% comparing to the energy technologies and practices applied in 1990. Table 7 illustrates calculations in case of one class 26.51 - cement production.

Table 7: Impact of unit consumption in cement production

		t_o=1990	t=2000
Cement production (A)	Mt	25	30
Unit energy consumption (UC)	toe/t	0.076	0.070
Total energy consumption (E)	Mtoe	1.9	2.1
Changes in consumption	Mtoe		+0.20
Unit consumption effect (EFCU)	Mtoe		-0.18
Efficiency indicator (I)	100		92

Unit consumption effect (EFCU) measures impact of the unit energy consumption change at production of tonne of cement. It is calculated by multiplication of the cement production volume and change in unit energy consumption (UC) in year t=2000 and base year 1990 (UC_t-UC_o). Therefore, the changes in unit energy consumption led to decrease of consumption by 0.18 Mtoe comparing to 1990 ($EFCU_t=A_t*(UC_t-UC_o)$= (0.076-0.07)*30). Energy efficiency indicator in cement industry in 2000 was 92, which means that the energy efficiency improved by 8%.

$$I_t = \frac{E_t}{E_t - EFCU_t} \cdot 100 = \frac{2,1}{2,1 + 0,18} \cdot 100 = 92$$

- ***Weighted indicator method***

With this method ODEX is calculated as the weighted mean of unit consumption indicators for sub-sectors. Its interpretation is easier because the obtained value is directly related to observation of changes in energy efficiency in each sub-sector. Changes of the weighted indicator of unit consumption between period t-1 and t are as follows:

$$\frac{I_{t-1}}{I_t} = \sum_i \left(EC_{i,t} \cdot \frac{UC_{i,t}}{UC_{i,t-1}} \right)$$

Where UC_i is the unit consumption indicator for type of activity and EC_i is the share of this type of activity in the total consumption. Table 8 illustrates calculations on simple example of two types of transport.

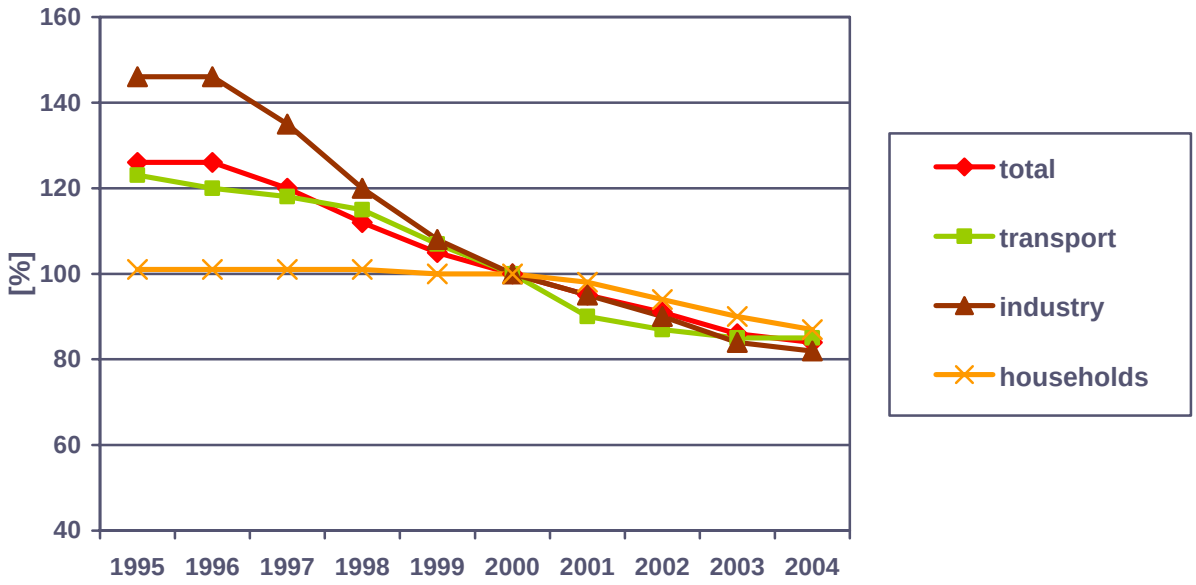
Table 8: Weighted indicator: Transport

	Unit	**1990**	**1991**	**1992**	**1993**
Energy consumption					
Cars	Mtoe	135	136	140	142
Airplanes	Mtoe	28	29	30	32
Unit energy consumption					
Cars	l/100 km	8.7	8.5	8.4	8.3
Airplanes	koe/ passenger	80	79	74	73
Unit consumption indicator (*UC_i*)					
Cars	[-]	100	97.7	96.6	95.4
Airplanes	[-]	100	98.8	92.5	91.3
Share in consumption *(EC_i)*					
Cars	[-]	0.828	0.824	0.824	0.816
Airplanes	[-]	0.172	0.176	0.176	0.184
Efficiency indicator					
Weighted average	I_{t-1} / I_t		1.0215	1.0214	1.0127
	I_t / I_{t-1}		0.9789	0.9791	0.9875
	t				
Indicator (1990=100)		100	97.9	95.8	94.6

Examples of calculation results.

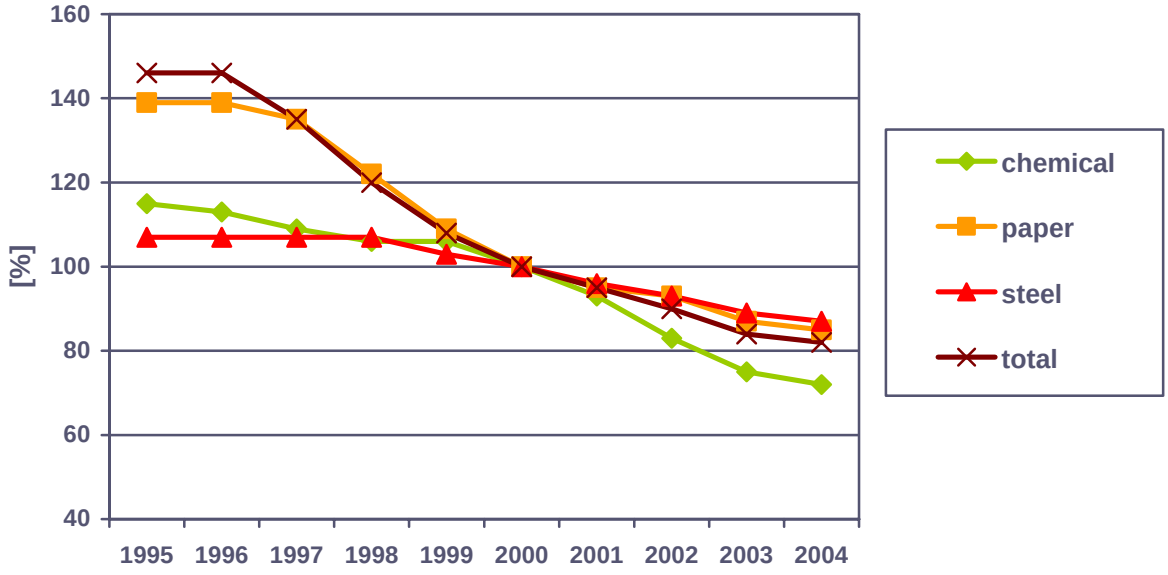
For Poland, the value of global ODEX indicator decreased from 126 in 1995 to 84 in 2004. The reference value equal to 100 is obtained by the indicator in 2000. The decrease means improvement of energy efficiency by 33%. The fastest improvement rate was noted by industry (decrease from 146 to 82) and the slowest was noted in households (decrease from 101 to 87). Efficiency improvement noted by transport was close to improvement in the entire economy (decrease from 123 to 85). After 2000 the improvement was more evenly spread between individual types of activity and it was close to an average of the entire economy.

Figure 26. ODEX indicator value for main sectors in 1995-2004



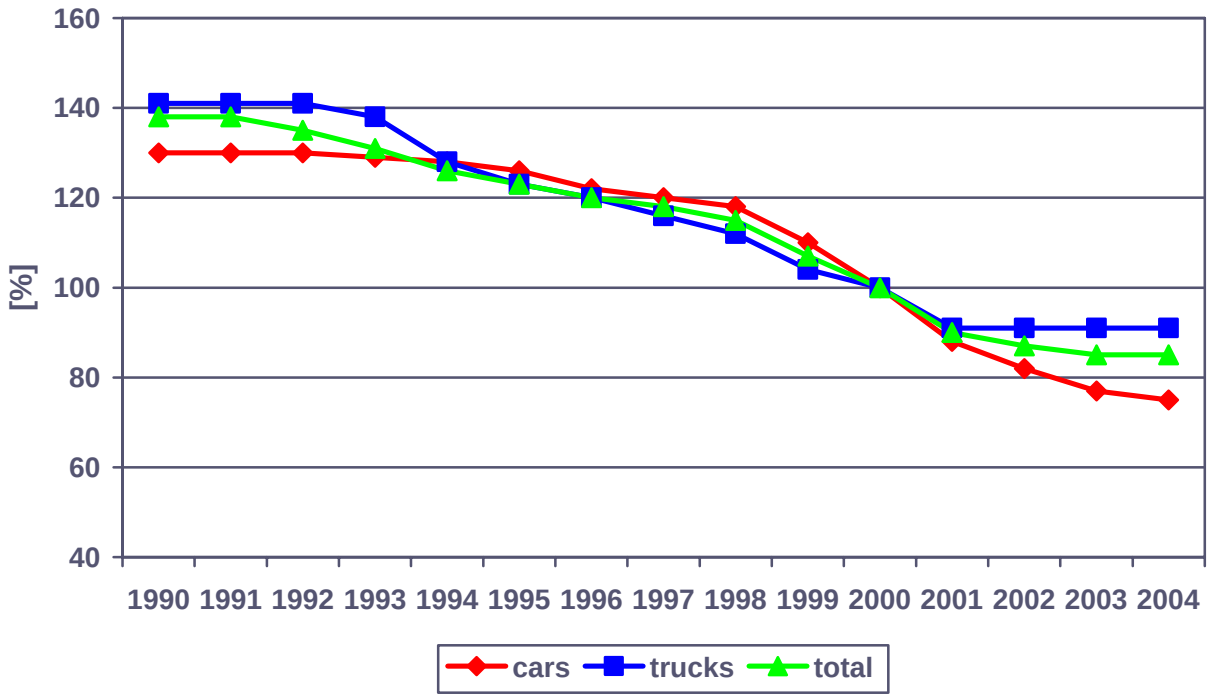
In industry the improvement rate for the entire sector was higher from the improvement rate in selected energy intensity measures. The slowest decrease rate of ODEX indicator was noted by steel industry (from 107 to 87).

Figure 27. ODEX indicator value for industry in 1995-2004



ODEX indicator in transport decreased from 138 in 1990 to 83 in 2004. the decrease rate was similar both in respect of cars and trucks.

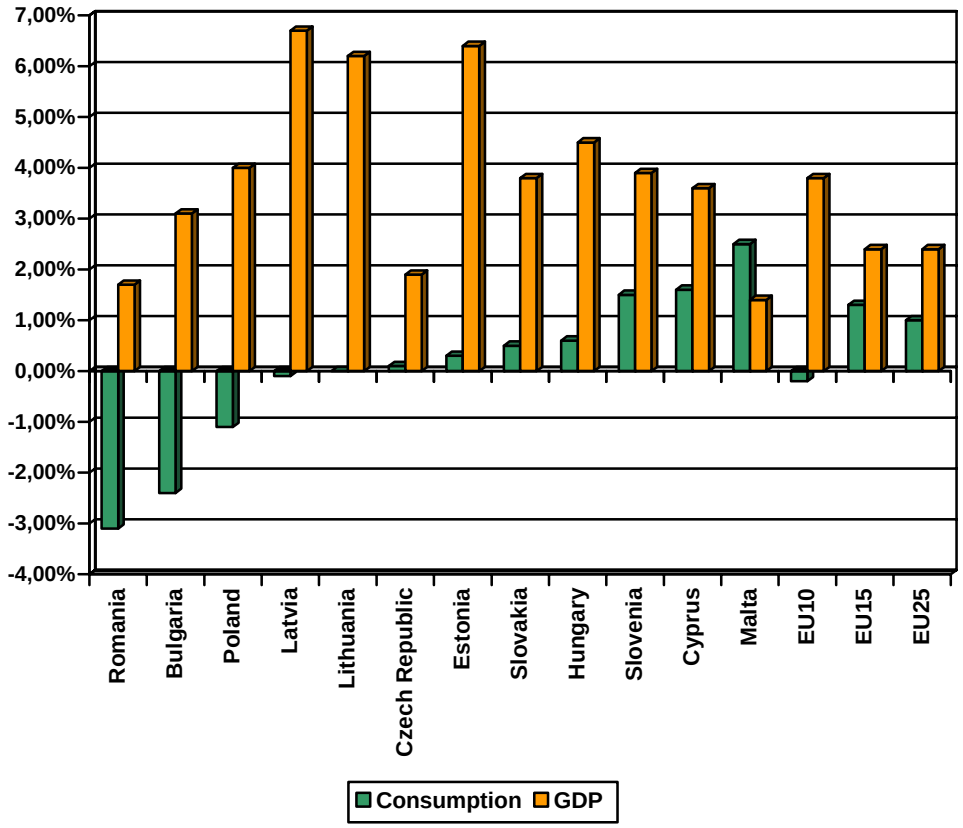
Figure 28. ODEX indicator value for transport in 1990-2004



5. Poland against a background of other EU countries[6]

In 1996-2004 the economic growth rate in Poland exceeded and average growth rate achieved both by the old and new Member States. In case of primary energy consumption the decrease in consumption noted in Poland was one of the highest among 10 new Member States. Higher energy consumption decrease was noted only in Romania and Bulgaria. Consequently, Poland ended up at 3 place among the EU Member States in respect of improvement of primary energy consumption GDP in the period in question.

Figure 29. Average annual change of primary energy consumption and GDP growth rate in 1996-2004

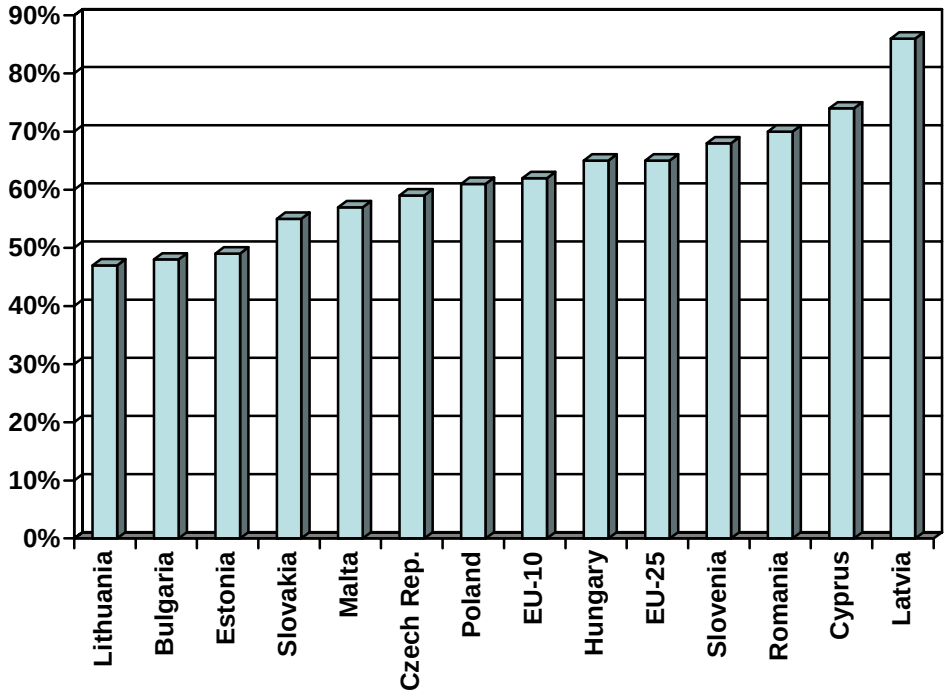


Final energy consumption trends are slightly different which mostly results from change of energy sector efficiency (efficiency of energy transformations) and growth rate of electricity consumption.

In Poland, the ration of final energy consumption to primary energy consumption is placed below average in the new Member States and the entire European Union.

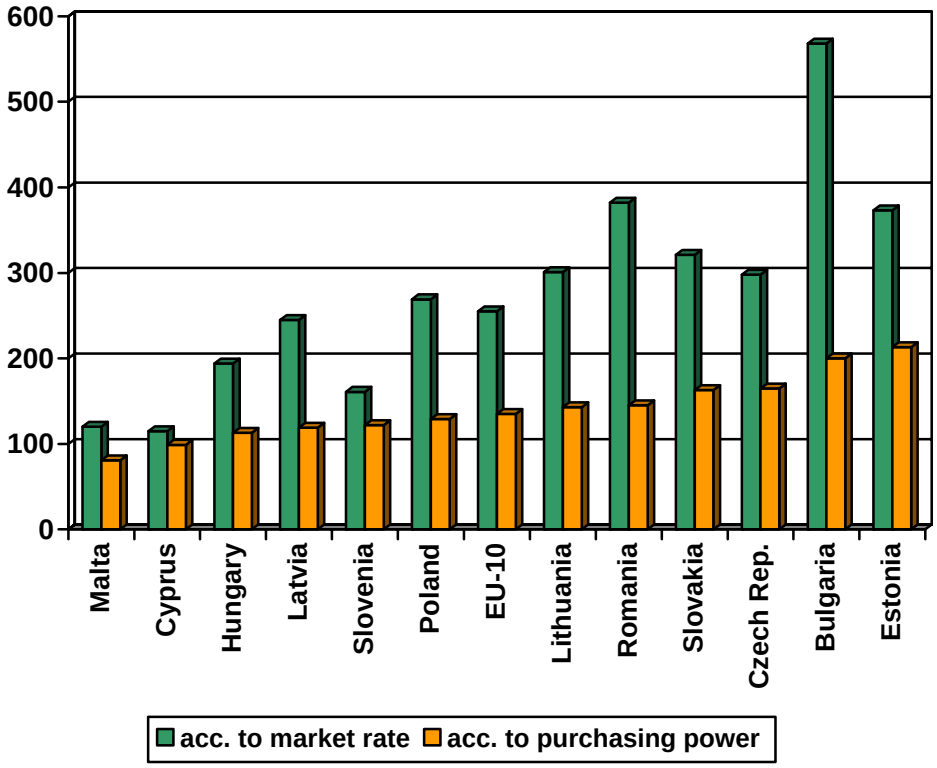
[6]Data used in this chapter origin from publications of the French company ENERDATA acting as EEE-NMC project technical coordinator

Figure 30. Ratio of final energy consumption to primary energy consumption in 2004



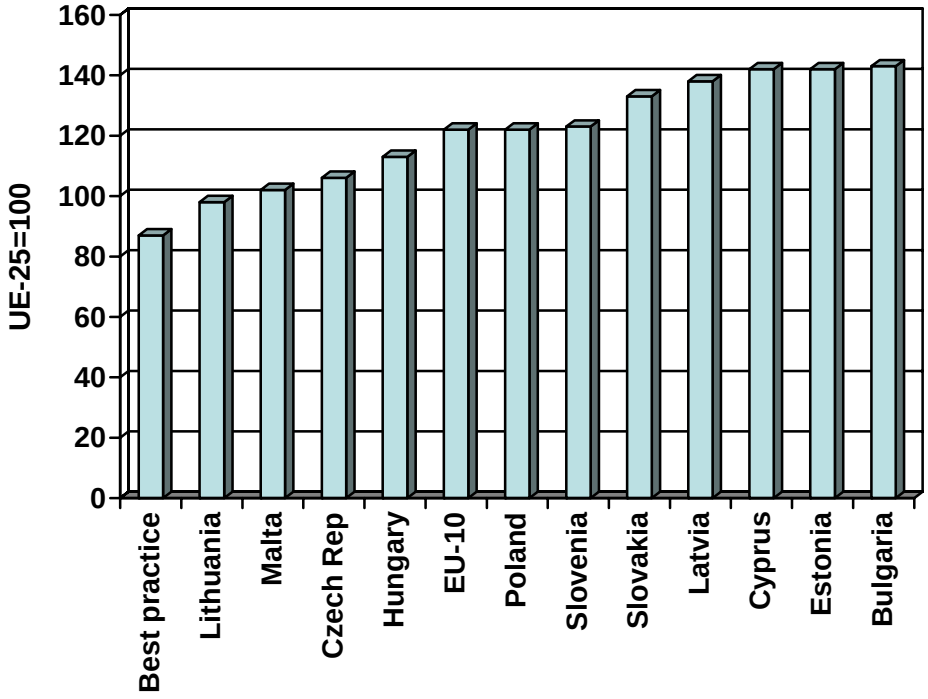
In order to obtain comparable international results so called compensatory procedures aiming at elimination of external factors impact. One of them is application of purchasing power parities in place of nominal values.

Figure 31. Energy intensity of economies in 2004 with application of market rates and purchasing power parities



Energy intensity of Polish economy with consideration of the purchasing power parities is placed below the average of the 10 new Member States. After consideration of all the compensatory procedures (an average European structure of consumed fuels, an average climate, economy and industry structure, international air traffic, application of purchasing power parities) the position of Poland in the ranking is weakened - the energy intensity exceeds an average of the new Member States. This means that the economic structure in Poland is less energy intensive than the average or that the improvement takes place only in the fields which have a significant share and in other fields the progress is rather small. On the other hand this means that there is a wide space for implementation of pro-efficiency measures.

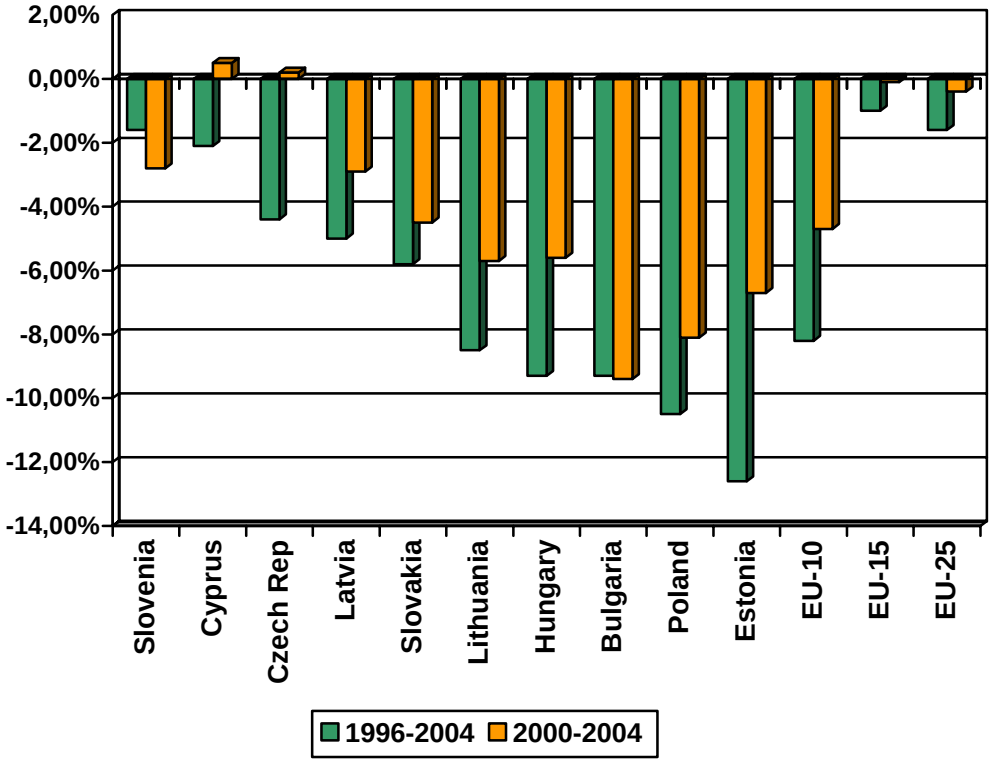
Figure 32. Primary energy intensity (all adjustments)



* lower value for final energy intensity and losses during transformations

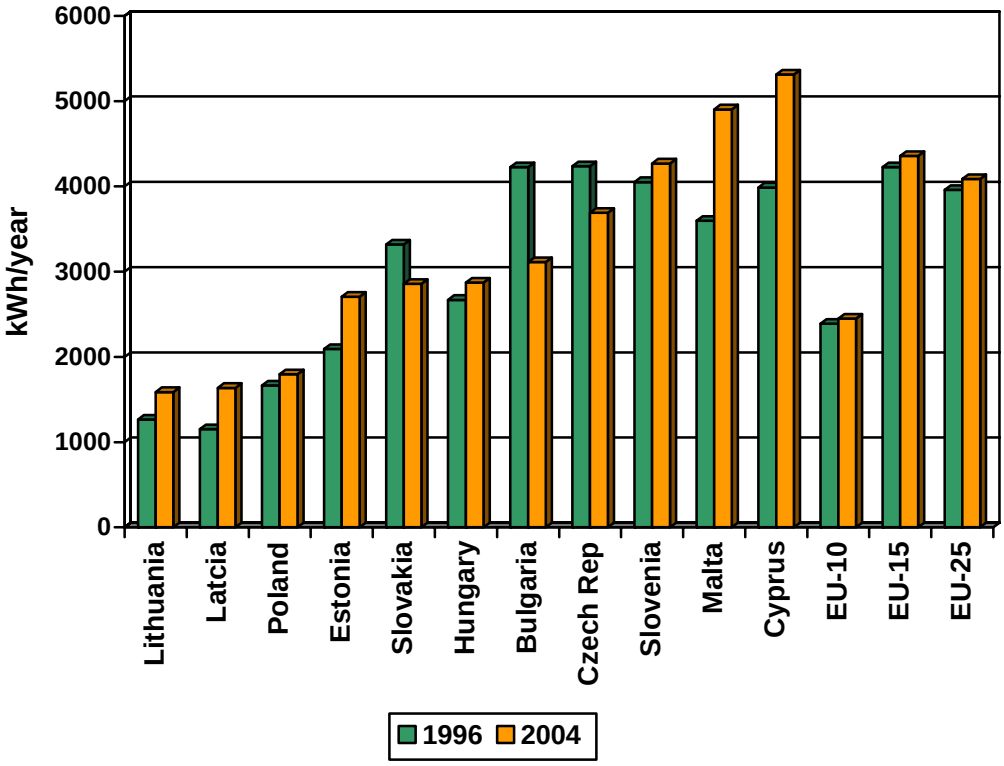
While analysing the division by sectors one can notice an improvement that took place among the new Member States in the industry sector. The average annual decrease of energy intensity exceeds 8% comparing to 1% decrease in case of old EU countries. In this case, Poland, with result of 10.5% in 1996-2004 is preceded only by Estonia (12%). After 2000, the energy efficiency improvement rate in this sector was lower than in the entire period for most of the countries.

Figure 33. Changes of energy intensity of industry sector



Electricity consumption by households in Poland is one of the lowest among the EU Member States.

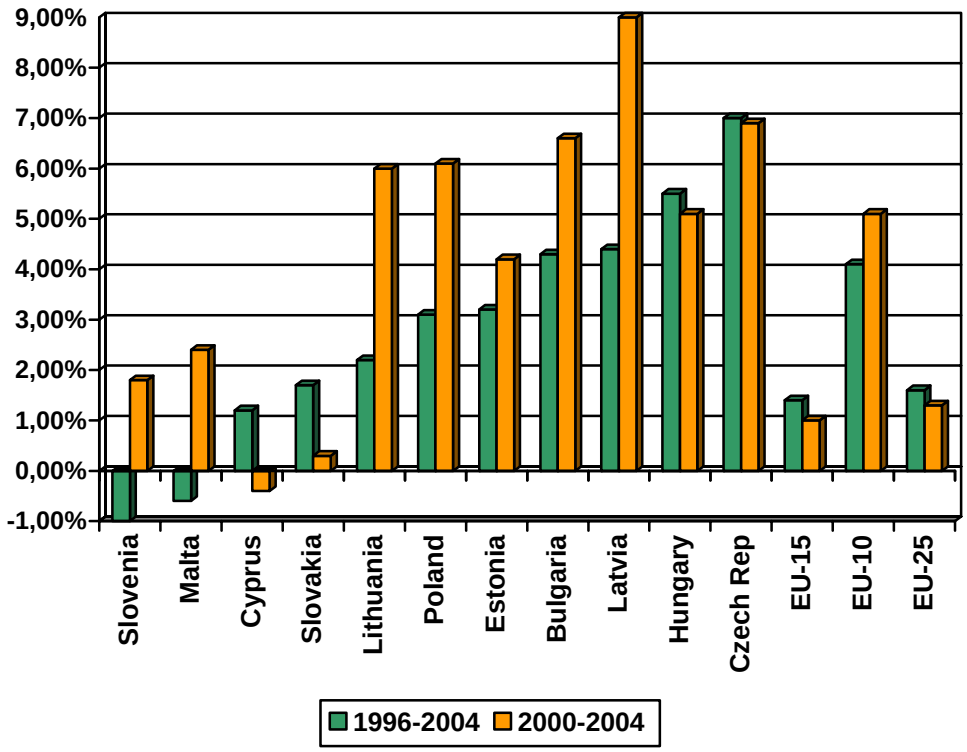
Figure 34. Electricity consumption by households



Consumption is over two times lower from the average consumption in the European Union. Lower consumption is noted only in Lithuania and Latvia. In Poland, similarly to most of the countries, electricity consumption tends to grow.

Energy consumption in road transport has been increasing in most of countries since 1996. In Poland, the growth rate does not exceed the average growth rate in the new Member States. Dynamics accelerated after 2000.

Figure 35. Change of energy consumption by road transport



6. Conclusions

New policy of the EU, expressed through new directives, especially directive on energy end-use efficiency and energy services, obliges to monitor energy efficiency. According to the articles energy savings should be counted as decrease of energy consumption as a result of organization activities and achieved as a result of realization of investments or modernizations.

At the present, statistical data obtained in frames of public statistics statistical surveys, do not allow to calculate all proposed in the directive indicators.

The necessity of monitoring effects of actions towards energy efficiency improvement, described in Directive 2006/32/EC, endeavour to harmonization and making international comparisons possible, force to introduce changes in respect of collection of statistical data i.e. enlarge subject and object scope of surveys, as well as to supplement administrative data bases (administrative sources).

Works carried in the European Union and Poland on further harmonization in scope of energy efficiency indicators, prepare necessary tool to asses realization of sustainable development policy and sustainable energy policy with energy and environment protection taken into account.

7. List of figures

8. List of tables

9 List of variables necessary to calculate energy efficiency indicators

1. General data

Gross Domestic Product at constant and current prices (in PLN)

Value Added at constant and current prices (in PLN)

- Agriculture, forestry and fishing
- Industry (sections C+D+E+F)
- Services

Private consumption at constant and current prices (in PLN)

Ranking exchange rate of EURO

Purchasing power of EURO

Population

Primary energy consumption divided into:

- Hard coal and lignite*
- Crude oil*
- Natural das
- Wood, biomass, wastes (industrial and municipal)
- Electricity trade balance
- Nuclear energy**
- Water energy**
- Solar and wind energy**

Caution:

*Including foreign trade balance and stock exchange of derived carriers (coke, briquettes, oil products)

** Value calculated according to IEA-OECD, UN and EUROSTAT methodology

Final (direct) consumption divided into:

- Oil products (gasoline, oils, liquid gas, etc.)
- Natural das
- Hard coal and lignite (including derived fuels)
- Electricity
- Heat
- Wood, biomass, industrial and municipal wastes

In the following sectors:

- Industry (excluding non-energy use and transformation)
- Transport
- Small users sector
- Households
- Services (public and private)
- Agriculture

Number of degree days in year (base 18^0C)

Long-term average of degree days (base 18^oC)

2. Industry

Value Added at constant prices for:

- Mining and quarrying (NACE REV.1 10-14)
- Processing industry (NACE REV.1 15-37)
- Energy sector (NACE REV.1 23, 40, 41)
- Construction (NACE REV.1 45)

And the following classes of processing industry:

- Food (NACE REV.1 15-16)
- Textiles, clothes and leather (NACE REV.1 17, 18, 19)
- Paper and printing (NACE REV.1 21, 22)
- Chemical (NACE REV.1 24)
- Rubber and plastics (NACE REV.1 25)
- Mineral (NACE REV.1 26)
- Steel (NACE REV.1 27.1, 27.2, 27.3, 27.5)
- Non-metallic minerals (NACE REV.1 27.4)
- Machinery and equipment (NACE REV.1 28-35)
- Other industry classes (NACE REV.1 36, 37)
- Non-energy mining and quarrying (NACE REV.1 13, 14)
- Construction
- Cement (NACE REV.1 26.51 or 26.5)
- Glass (NACE REV.1 26.1)

Production size:

- Crude steel

- Martin and converter steel
- Electric steel
- Cement
- Paper
- Glass

Energy consumption divided into:

- Electricity
- Heat
- Natural das
- Liquid fuels (oil)
- Solid fuels (coal etc.)
- Wood, wastes, biomass

For sections and classes mentioned above.

Caution: Consumption of solid, liquid and gaseous fuels excluding non-energy consumption.

Consumption:

- Fuels (solid, liquid and gaseous fuels excluding non-energy consumption)
- Electricity

For production of:

- Electric steel
- Other steel and pig iron

3. Transport

Stock of cars

Stock of heavy and light trucks

Stock of light trucks

Stock of heavy trucks

Stock of buses:

- total
- gasoline
- diesel
- gas liquefied and compressed

Stock of motorcycles

Annual distance covered by cars

Annual passenger transport in pas-km

- Cars
- Motorcycle
- Rail transport
- Buses
- In domestic air transport (number of passenger per year)
- Total air transport (number of passenger)

Annual goods transport in ton-km

- Rail transport
- Road transport
- Inland and inshore transport

Energy consumption in transport divided into:

- Road transport
- Cars
- Rail transport
- Air transport
- Inland and inshore transport

Energy consumption in specific types of transport divided into:

- Types of energy

  Oil products (gasoline, diesel, LPG, jet fuels)

  Electricity
- Average unit consumption per car

  Total

  Gasoline
- Average unit consumption per new car

  Total

  Gasoline

Energy consumption in municipal public transport (capital)

Energy consumption in rail transport (trams, metro)

Diesel consumption by buses

Passenger transport in municipal public transport (capital) (number of passengers)

Rail transport in capital (trams, metro) (number of passengers)

Vehicle transport in municipal public transport (capital)

Rail transport in capital (trams, metro) (vehicle/km)

4. Households and services

Dwellings

Stock of households

Stock of dwellings

Permanently occupied number of dwellings

- in multifamily houses
- in multifamily buildings

Stock of newly built dwellings

- in single family buildings
- in multifamily buildings

Dwellings parameters

Average surface of dwelling

- new dwelling
- new family house
- new dwelling in multifamily building

Household equipment with electrical appliances

Stock of refrigerators

Stock of freezers

Percentage of households equipped with refrigerators

Percentage of households equipped with freezers

Annual sale of refrigerators

Annual sale of freezers

Dwellings heating

Consumption for heating of:

- oil
- gas
- coal
- district heat
- wood
- electricity

Consumption of heat by district for heating and boiling

Stock of dwellings with access to district heat

Electricity consumption in households

Electricity consumption by lighting and electrical appliances

Electricity consumption for lighting of households

Unit consumption of new refrigerators (weighted average of sold devices)

Unit consumption of new freezers (weighted average of sold devices)

Unit consumption of newly built dwellings (according to standards) in MJ/m^2

Theoretical energy consumption for heating for newly built single family houses

Theoretical energy consumption for heating for newly built multifamily buildings

5. Energy-economical data

Energy prices

- gasoline (lead free)
- diesel
- electricity for households
- electricity for industry
- gas for households

6. Heat plants and heat and power generating plants

Oil consumption in heat plants

Gas consumption in heat plants

Hard coal and lignite consumption in heat plants

Wood and wastes consumption in heat plants

Heat production in heat plants

Oil products consumption in heat and power plants

Gas consumption in heat and power plants

Hard coal and lignite consumption in heat and power plants

Wood and wastes consumption in heat and power plants

Heat production in heat and power plants

Electricity consumption in heat and power plants

10. Abbreviations

kgoe - kilogram of oil equivalent

toe - ton of oil equivalent

euro2000- market value of euro in 2000

europpp - value of euro according to purchasing power parity

pkm - passenger-km

tkm - tonne-km

tkbr - gross tonne-km

kWh - kilowatt hour

Annex I. List of energy efficiency indicators

The presented below priority list of indicators were selected by EUROSTAT from the 250 indicators, which had been worked out by SAVE I programme. These priority indicators enable coherent and complete presentation of the achievements in the field of energy efficiency and enable the overall evaluation of energy efficiency measures.

The indicators can be gathered in 3 groups:

- Headline indicators that mainly describe overall energy efficiency trends, from a macro-economic point of view, and are calculated as a direct ratio between energy consumption and a macro-economic variable.
- Issue indicators, that go into more details and aims at explaining trends observed for the headline indicators.
- Comparison indicators that are adjusted for structural differences between countries to enable more accurate cross-country comparisons. The reference level, necessary for calculations, could be arbitrary set although average EU is commonly adopted.

7.1. Macro-economy energy efficiency indicators

Macro-economic indicators are being used for energy efficiency overall evaluation of Member States and European Union economies. They are calculated as a ratio between (primary or final) energy consumption and macro-economic variable (GDP value). GDP is calculated in constant prices adapting 2000 as the base year - Euro of 2000. In case of comparison indicators the Purchase Power Parity (ppp) is used.

Macro-economic indicators	**Unit**
• Headlines indicators	
Primary energy intensity GDP (energy intensity of Gross Domestic Product referred to primary energy consumption)	kgoe/euro2000
Final energy intensity GDP	kgoe/euro2000
Primary and final energy intensity GDP with climatic correction	kgoe/euro2000
Ratio final/primary GDP energy intensity	%
• Issue indicators	
Final energy intensity at constant GDP structure (with climatic corrections)	kgoe/euro2000
• Comparison indicators	
Primary and final energy intensity at current purchasing power parities (ppp)	

Primary energy intensity by sector (ppp)	kgoe/europppp
Final energy intensity at reference climate (ppp)	kgoe/europppp
Final energy intensity at reference economic structure (ppp)	kgoe/europppp
Final energy intensity at reference economic structure and climate (ppp)	kgoe/europppp
	kgoe/europppp

Data required for calculation of indicators as above are collected as follows:

- Energy consumption is being possessed from the Questionnaires: G-02a, G-02b, G-03 of secondary use of data and from other surveys, as well as from: administrative databases of Urząd Regulacji Energetyki (Energy Regulatory Authority); Agencja Rynku Energii S.A. (Energy Market Agency); international goods trade system; internal information system of Agencja Rozwoju Przemysłu S.A (Agency for Industrial Development); Nafta Polska S.A (Polish Oil Company,) Polska Izba Paliw Płynnych (Polish Chamber of Liquid Fuels); licensed operators and distributors of liquid and gas fuels, electricity and heat.
- Data for GDP calculation is being obtained from reports: SP, SP-3, F-01/I-01, F-01/k, F-01/m, F-01/s, F-02, F-03, H-01s, H-01a, H-01g, R-05, R-06, R-07, R-08, R-09, R-10, SG-01, DG-1; agricultural census; SAD system; INTRASTAT system – in the scope of goods export and import; information of Ministry of Finance (questionnaires Rb); Ministry of Health (Mz-03), Agricultural Market Agency; Material Reserves Agency; National Bank of Poland.

7.2. Energy efficiency indicators for industry

Indicators for industry	**Unit**
• Headlines indicators	
Energy intensity of industry	kgoe/euro2000
Energy intensity of processing industry	kgoe/euro2000
Energy intensity of metal industry	kgoe/euro2000
Energy intensity of chemical industry	kgoe/euro2000
Energy intensity of non-metallic minerals industry	kgoe/euro2000
Energy intensity of machinery & equipment industry	kgoe/euro2000
Energy intensity of food & tobacco industry	kgoe/euro2000
Energy intensity of paper, pulp and printing industry	kgoe/euro2000
Energy intensity of textiles & leathers industry	kgoe/euro2000
Unit energy consumption in steel production	toe/t
Unit energy consumption in cement production	toe/t
Unit energy consumption in paper production	toe/t
Unit energy consumption in glass production	toe/t

• Issue indicators	
Energy intensity in processing industry at constant structure	kgoe/euro2000
• Comparison indicators	
Energy intensity of industry at reference economic structure (ppp)	kgoe/europpp
Energy intensity of processing industry at reference economic structure (ppp)	
Unit consumption of steel as a function of share of electric steel	kgoe/europpp
	toe/ton

Data required for calculation of the indicators in the scope of:

- energy consumption - are obtained from the same surveys which are sources for macro-economic indicators,
- production values (size value) - are obtained from reports: F-01/I-01, DG-1, SP, SP-3 and from information systems of Ministry of Finance (reports Rb-30 and Rb-31),
- physical production outputs - are obtained from reports: P-01, P-01m and P-02.

7.3. Energy efficiency indicators for transport

Indicators for transport	**Unit**
• Headlines indicators	
Energy intensity of transport related to GDP	kgoe/euro2000
Unit consumption of gasoline vehicles	toe/vehicle
Unit consumption of rail transport per passenger, goods	kgoe/tkbr
Unit consumption of air transport	kgoe/passenger
Unit consumption of domestic air transport	kgoe/pkm
Unit consumption of water transport	kgoe/tkm
Unit consumption of urban transport	kgoe/pkm
• Issue indicators	
Unit consumption of road transport per equivalent car	kgoe/car
Specific fuel consumption of new cars (test values)	l/100km
Specific fuel consumption of cars	l/100km
Unit consumption of cars	toe/car
Unit consumption of cars per passenger and kilometre	kgoe/pkm
Unit consumption of diesel heavy vehicles	toe/vehicle
Unit consumption of trucks (or trucks and light vehicles)	
Unit consumption of road transport of goods	toe/vehicle
Unit consumption of passenger transport	kgoe/tkm

Unit consumption of goods transport	kgoe/pkm
Unit consumption of passenger transport at constant modal split	kgoe/tkm
Unit consumption of goods transport at constant modal split	
• Comparison indicators	kgoe/pkm
Unit consumption of passenger transport at reference modal split	kgoe/tkm
Unit consumption of goods transport at reference modal split	
	kgoe/pkm
	kgoe/tkm

Unit consumption of transport is calculated on the basis of data obtained from questionnaire G-03; also the necessary data are obtained from: Central Statistical Office reports: T-03, T-03r, T-04, TD-E, T-06, SG-01, ST-P, ST-W, DG-1t and SP-3; information system of Ministry of Infrastructure concerning the international transport licences; internal information system of PKP (Polish Railways Company) concerning entities with licences for rail transport and rendering available the traction vehicles; and from Metro Warszawskie Spółka z o.o. (Warsaw Subway) data system.

7.4. Energy efficiency indicators for households

Indicators for other users	**Unit**
• Headlines indicators	
Unit energy consumption per dwelling	toe/dwelling
Unit electricity consumption per dwelling	kWh/dwelling
Unit energy consumption per dwelling with climatic corrections	toe/dwelling
Unit energy consumption per m^2 with climatic corrections	kgoe/m^2
• Issue indicators	
Unit energy consumption for heating per dwelling with climatic corrections	
Unit energy consumption for heating per m^2 with climatic corrections	toe/dwelling
Unit energy consumption in new dwellings (multifamily/single family buildings)	kgoe/m^2
Unit energy consumption of lighting and electrical appliances per dwelling	toe/dwelling
Unit energy consumption of electricity of new refrigerators and freezers	kWh/dwelling
• Comparison indicators	
Energy consumption for heating per m^2 (or per dwelling) per degree-day	kWh/dwelling
Consumption for heating of useable space per m^2 (or per dwelling) per degree-day	
Unit energy consumption per dwelling (or per m^2) scaled to European	kgoe/dwelling/d

average climate	egree kgoe/dwelling/degree toe/dwelling

The data concerning flats number and area is obtained from: CSO reports - M-01, M-02, SG-01, reports GKM-11 and GKM-12 on regional dwelling resource and dwellings equipment, surveys on household budgets, Ministry of Finance taxes system for natural and legal persons, and report B-07 and from municipalities' information system in the scope real estate taxes database.

Fuels and energy consumption by households, agriculture and services is evaluated on the basis of households and services questionnaires. The surveys are being performed once per few years (last surveys were performer in 2002 and 2003)

7.5. Energy efficiency indicators for service, agriculture and transformation sectors

Indicators for service, agriculture and transformations	**Unit**
• Services	
Energy intensity of services: total, electricity	kgoe/euro2000
Unit consumption of services sector per employee: total, electricity	
Unit energy consumption of service sector per m^2 with climatic corrections total, electricity	toe/empl.
Energy intensity of service sector at ppp	kgoe/m^2 kgoe/europpp
• Agriculture	
Energy intensity of agriculture	kgoe/euro2000
• Transformations	
Efficiency of heat power plants	%
Efficiency of district heating	%
Efficiency of cogeneration	%

Data necessary for indicators calculations are obtained from:

- the same sources as for GDP calculation presented before,
- energy reports as presented before,

- questionnaires Z-03 and Z-06 and from information systems of Ministry of Interior and Administration of the Republic of Poland and from experts evaluation concerning the energy consumption by services and agriculture.

Annex II. List of acquis communautaire

EU documents concerning issues related to energy efficiency are as follows:

1) Gren paper for a European Union Energy Policy (1995)
2) Energy Charter Treaty and Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects (PEEEREA). (1994)
3) White Paper Energy for the Future: RES. (1997)
4) Council Resolution on energy efficiency in the European Community (1998).
5) Action Plan to Improve Energy Efficiency in the European Community. (2000)
6) European Climate Change Programme (ECCP). (2000)
7) A sustainable Europe for a better world – A European Union strategy for sustainable development.*Gothenburg European Council (2001)*
8) Green Paper - Towards a European Strategy for Energy Supply Security. (2001)
9) White Paper. European Transport Policy for 2010: Time to Decide.(2001)
10) Directive 2006/32/EC of the European Parliament and of the council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC.

Directives concerning energy efficiency of appliances:

1. Council Directive 78/170/EEC of 13 February 1978 on the performance of heat generators for space heating and the production of hot water in new or existing non - industrial buildings and on the insulation of heat and domestic hot-water distribution in new non-industrial.
2. Council Directive 79/531/EEC of 14 May 1979 applying to electric ovens Directive 79/530/EEC on the indication by labelling of the energy consumption of household appliances.
3. Council Directive 92/42/EEC of 21 May 1992 on efficiency requirements for new hot-water boilers fired with liquid or gaseous fuels.
4. Council Directive 92/75/EEC on the indication by labelling and standard product information of the consumption of the energy and other resources by household appliances.

5. Commission Directive 94/2/EC of 21 January 1994 implementing Council Directive 92/75/EEC with regard to energy labelling of household electric refrigerators, freezers and their combinations.
6. Commission Directive 95/12/EC of 23 May 1995 r. implementing Council Directive 92/75/EEC with regard to energy labelling of household washing.
7. Commission Directive 95/13/EC of 23 May 1995 implementing Council Directive 92/75/EEC with regard to energy labelling of household electric tumble driers.
8. Directive 96/57/EC of the European parliament and of the council of 3 September 1996 on energy efficiency requirements for household electric refrigerators, freezers and combinations thereof.
9. Commission Directive 96/60/EC of 19 September 1996 implementing Council Directive 92/75/EEC with regard to energy labelling of household combined washer-driers.
10. Commission Directive 96/89/EC of 17 December 1996 r. amending Directive 95/12/EC implementing Council Directive 92/75/EEC with regard to energy labelling of household washing machines.
11. Commission Directive 97/17/EC of 16 April 1997 implementing Council Directive 92/75/EEC with regard to energy labelling of household dishwashers.
12. Council Directive 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps.
13. Directive 2000/55/EC of the European Parliament and of the Council of 18 September 2000 on energy efficiency requirement for ballasts for fluorescent lighting.
14. Commission Directive 2002/31/EC of 22 March 2002 implementing Council Directive 92/75/EEC with regard to energy labelling of household air-conditioners.
15. Commission Directive 2002/31/EC of 22 March 2002 implementing Council Directive 92/75/EEC with regard to energy labelling of household air-conditioners.
16. Commission Directive 2003/66/EC of 3 July 2003 implementing Council Directive 92/75/EEC with regard to energy labelling of household electric refrigerators, freezers and their combinations.