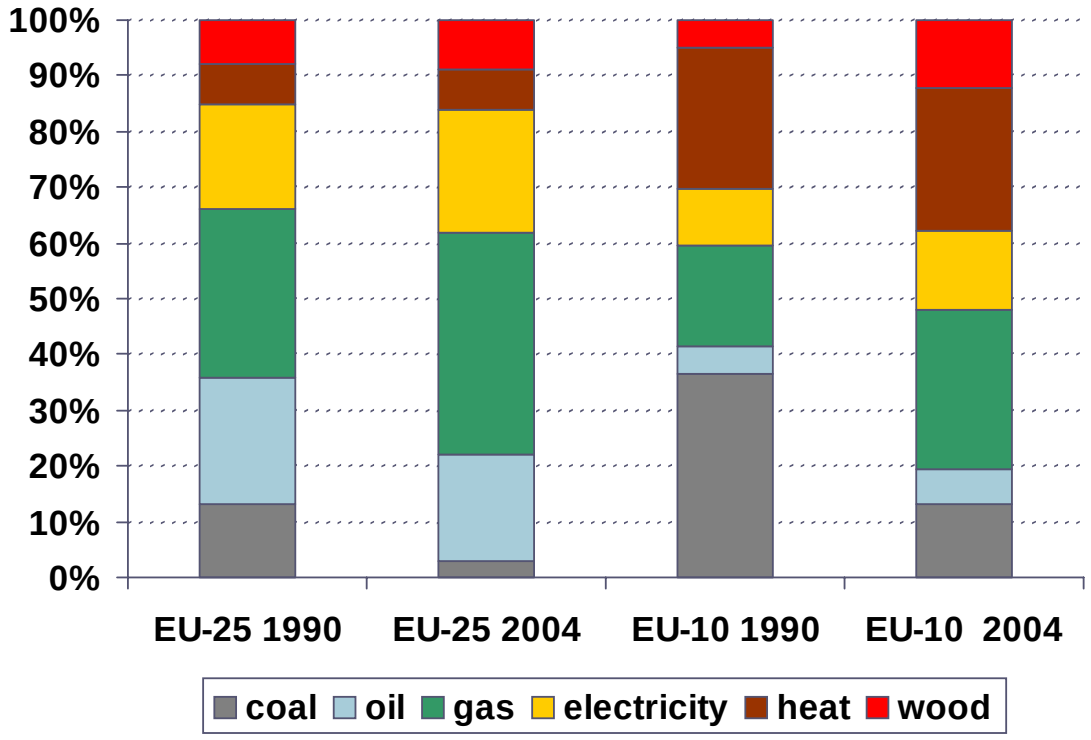
4. Energy Efficiency Trends in the Household Sector

4.1. Energy use pattern

Households consume 26 % of the energy used by final consumers in the EU-25 (298 Mtoe)[46]. Natural gas is the dominant source of energy for households in the EU-25 with 40 % of the market (**Figure 4-1**) and has undergone a net progression since 1990 (30 %). In the EU-10, gas also ranks first, but with a much lower market share (28%), as it is mainly used in 3 countries: in Hungary and Slovakia, with more than half of the market, and in the Czech Republic. Electricity ranks second in the EU-25 and is increasing (22 % in 2004 compared to 19 % in 1990). In the EU-10, electricity uses are less developed (14% of the market in 2004). Heat from district heating represents only 7 % of the total in the EU-25 although it plays an important role in New Member Countries where it ranks second (25% on average and around 40 % in Latvia and Estonia). The contributions of coal and oil have fallen significantly in the EU-25, from 13% to 3% for coal and from 23% to 19 % for oil. The share of coal is still important in Poland, but is in rapid regression (25% in 2004, down from 36% in 1990). Biomass has a stable market share (9 %); it is quite significant in some new member's countries, especially in Baltic countries and in Bulgaria (49 % of the consumption in Latvia, 35% in Estonia, around 30% in Lithuania and Bulgaria. In the EU-10, the share of biomass is slightly higher than in the EU-15 (12% for EU-10 compared to 9% for EU-15).

Figure 4-1: Household energy consumption (EU-25 vs EU-10)



[46] 26% of the final consumption for energy uses in 2004 (under normal climate conditions).

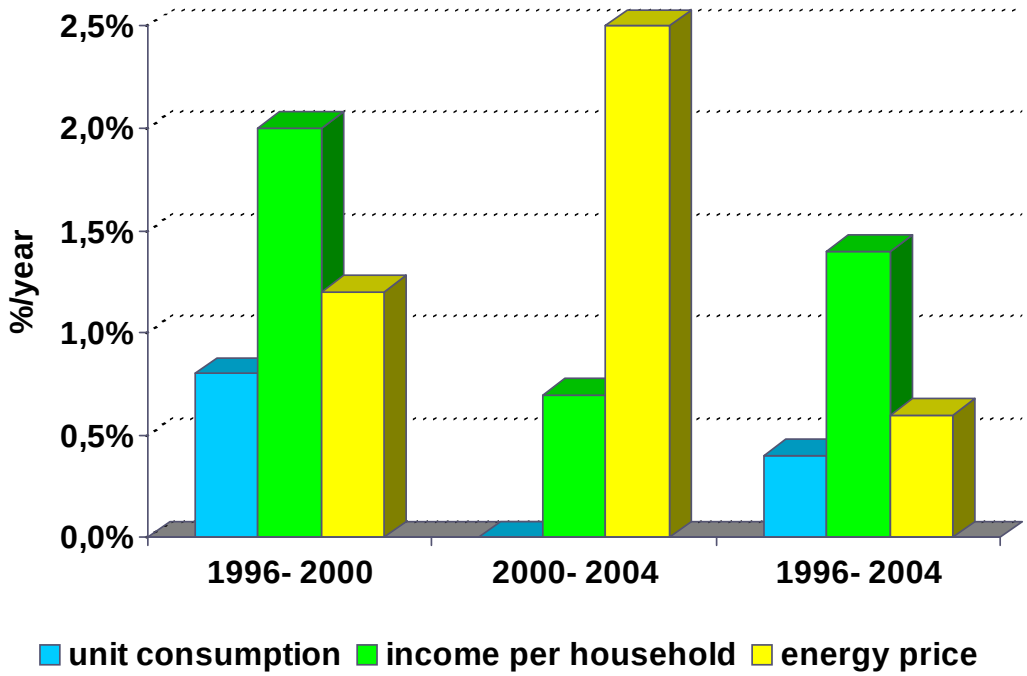
Household energy consumption is mainly driven by the growth in the number of dwellings. These have increased 2.5 times more than the population (1 %/year versus 0.3 %/year) because of a steady reduction in the number of persons per dwelling (from 2.8 to 2.5 between 1990 and 2004).

Data by end-uses are still limited for most new EU member countries; therefore it is not possible to provide reliable estimates on the energy consumption by end-use (e.g. for space heating, water heating, cooking and electrical appliances).

4.2. Trend in the average consumption per dwelling

The average energy consumption[47] per dwelling in the EU-25 increased between 1996 and 2000 and then remained almost stable. As a result, it was slightly above its 1996 level in 2004 (by 3%). Since 1996, this unit consumption increases regularly (0,8%/year), whereas there was a slight decrease from 1990 to 1996 (-0,2%/year) **(Figure 4-2)**. The rise until 2000 (0.8 %/ year) was driven by a rapid increase in the average income per household (2 %/ year); the stability after 2000 can be explained by the economic slowdown, at least in most EU-25 countries, and higher energy prices (+2.5 %/year between 2000 and 2004).

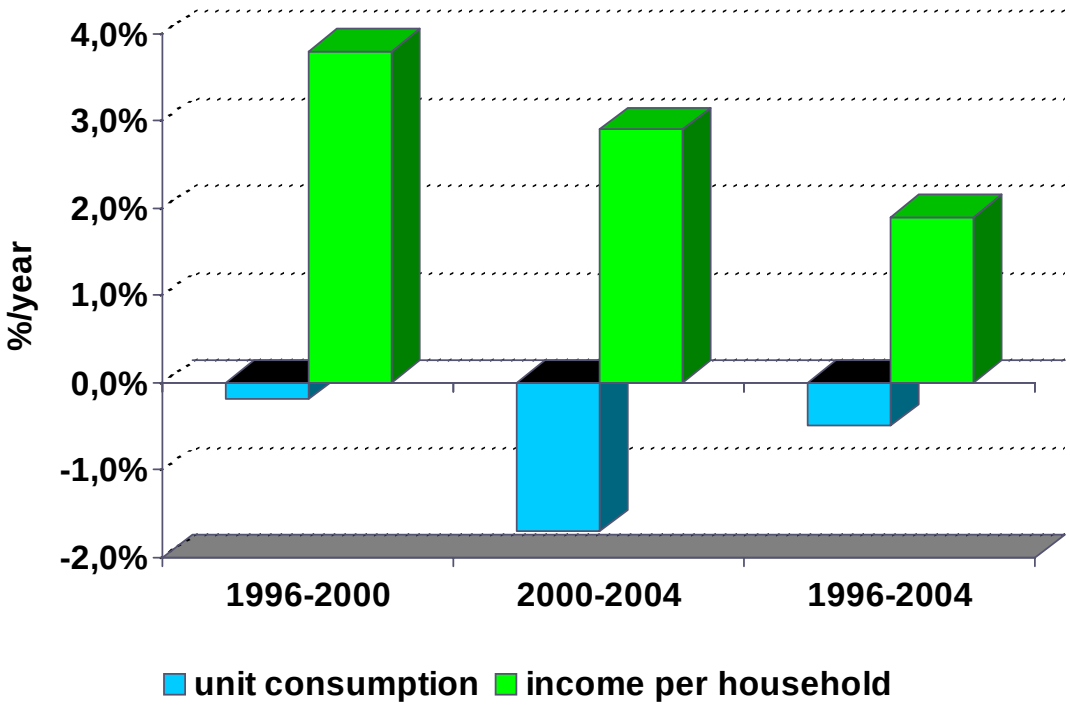
Figure 4-2: Average consumption per dwelling in the EU-25



In New member countries, the general trend is towards a reduction in the average consumption per dwelling, which is reinforced after 2000, with the higher energy price and a certain economic slow down (**Figure 4-3**). In 2004, households consumed on average in EU-10 7% less energy than in 1996.

[47] All consumption figures are climate-corrected.

Figure 4-3: Average consumption per dwelling in the EU-10



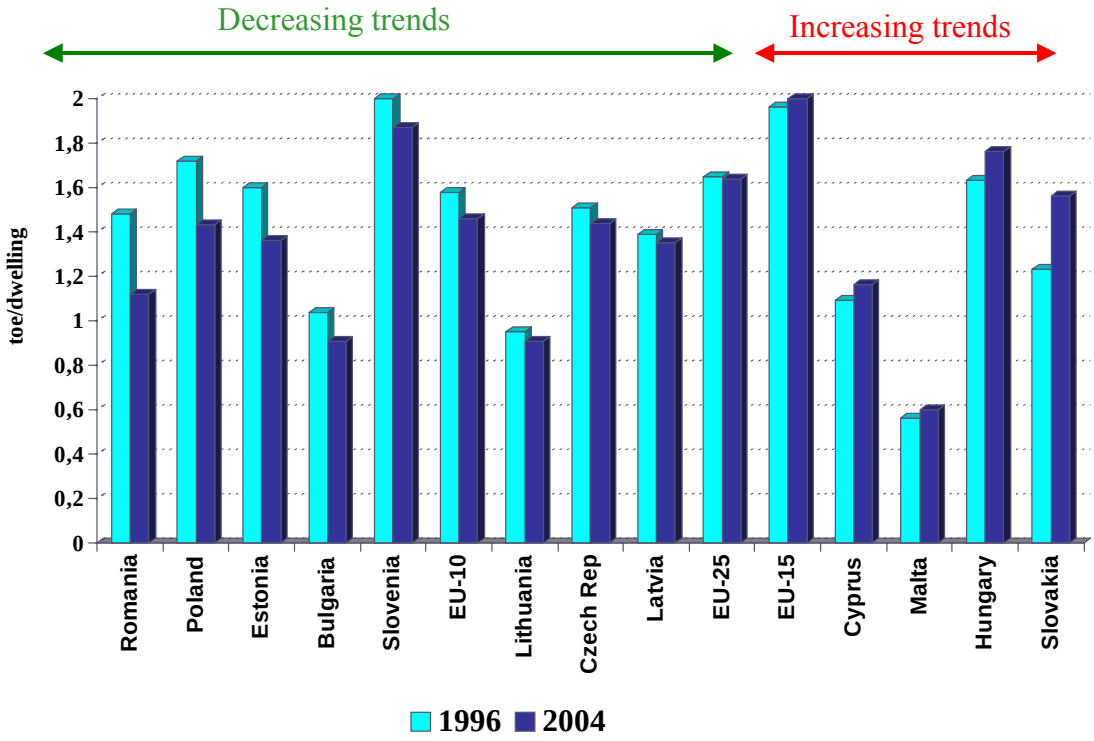
Decreasing energy consumption per dwelling in most new EU members

The average energy consumption per dwelling[48] was below its 1996 level in the majority of countries in 2004 (**Figure 4-4**) except for Cyprus, Estonia, Hungary and Slovakia; this unit consumption is presently in the range of 1 to 2 toe/year, except Malta; the EU-25 average stands at 1.6 toe/dwelling. In EU-15 countries, we observed a slight increase in the unit consumption per dwelling (0.3%/year).

The difference in unit consumption per dwelling may be explained by different size of dwellings; therefore it is more relevant to compare the consumption per m^2 and to remove the electricity consumption that depends more on the level of equipment ownership than on the dwelling size. This unit consumption per m^2, excluding electricity, can be considered as a proxy for thermal uses in the absence of data by end-use. In a second step, we will compare the average electricity consumption per household.

[48]The data shown in this graph are adjusted to the EU-25 average climate to improve the comparison, except fro Malta and Cyprus. This is done by adjusting the space heating consumption to the same assumed underlying climate conditions. For Cyprus and Malta, the adjustment was not made because of the particular mild climate in these two countries compared to the EU average.

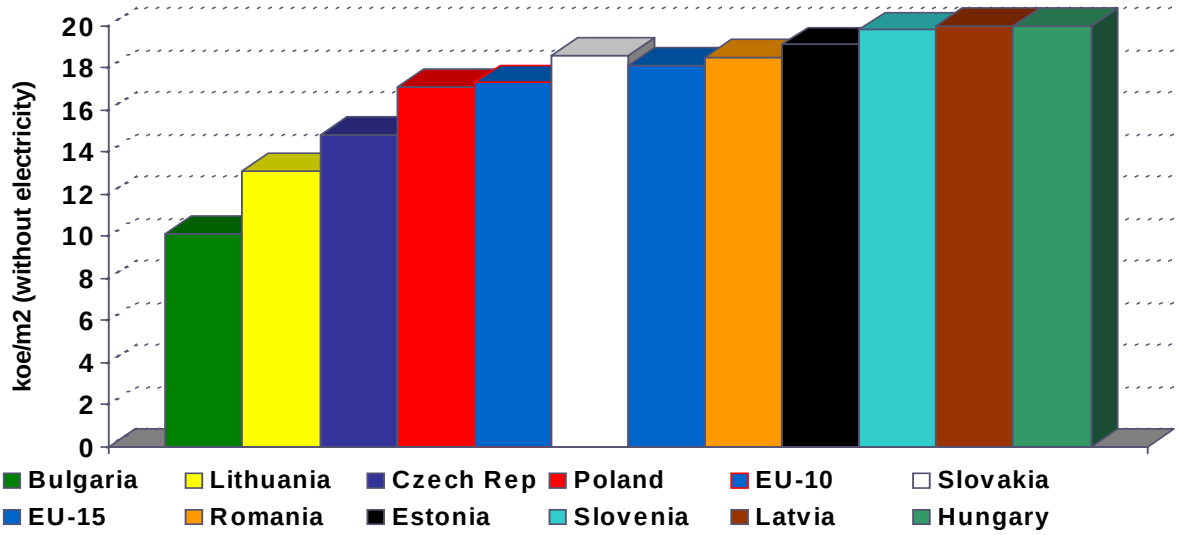
Figure 4-4: Unit consumption per dwelling (adjusted to EU-25 climate)



4.3. Energy consumption for thermal uses

The average consumption per m^2 for thermal uses (electricity excluded) and adjusted to EU-25 average climate is around 17 koe/m^2 for EU-10 countries, slightly less than in the EU-15 (18 koe/m^2) (**Figure 4-5**).

Figure 4-5: Unit consumption per m^2 for thermal uses[49]



[49] Adjusted to EU25 climate and electricity excluded (2004)

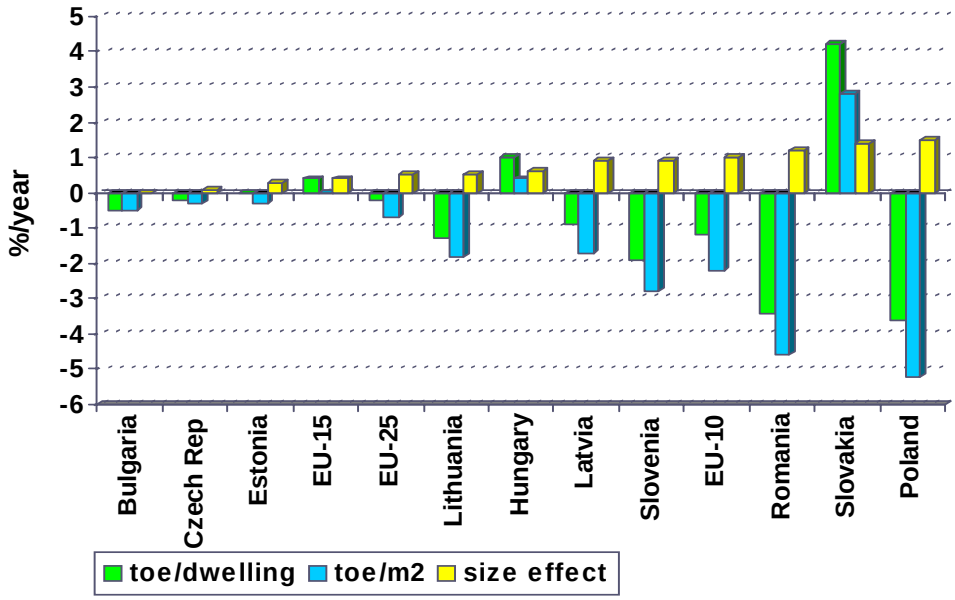
Bulgaria, Lithuania and to a lesser extent the Czech Republic have much lower levels of energy consumption per m^2. This situation may not necessary reflect high energy efficiency, but may be the result of high price and restriction of comfort. Three countries, Slovenia, Latvia and Hungary, have the highest value (around 17 koe/m^2): this may indicate poorer efficiency but the lack of detailed data by end-use really limit a good interpretation of the differences observed.

With the increase in the average income of households, dwellings are larger; this phenomenon was already significant for EU-15 countries, it is even more rapid in New Member Countries, due a lower average size than in EU-15 (72 m^2 in 2004 for EU-10 compared to 91 for EU-15). On average, in the EU-10, the average dwelling size increased from 66 to 72 m^2 (i.e. by 9%[50]). In the EU-25 average, the dwelling size increased by 3 m^2 between 1996 and 2004, from 85 to 88 m^2.

Increase in the size of dwellings offset part of reduction in the consumption per m^2

As a result, energy consumption per m^2 for thermal uses decreases more rapidly than the consumption per dwelling. In the EU-25, the consumption per dwelling decreased by only 0.2%/year between 1996 and 2004, whereas the reduction is more significant for the consumption per m^2 (0.7%/year): this means that 70% of the energy efficiency progress for thermal uses has been offset, all things being equal, by the fact that dwellings are becoming larger (**Figure 4-6**). For all countries, a similar effect can be seen.

Figure 4-6: Unit consumption per dwelling: size effect



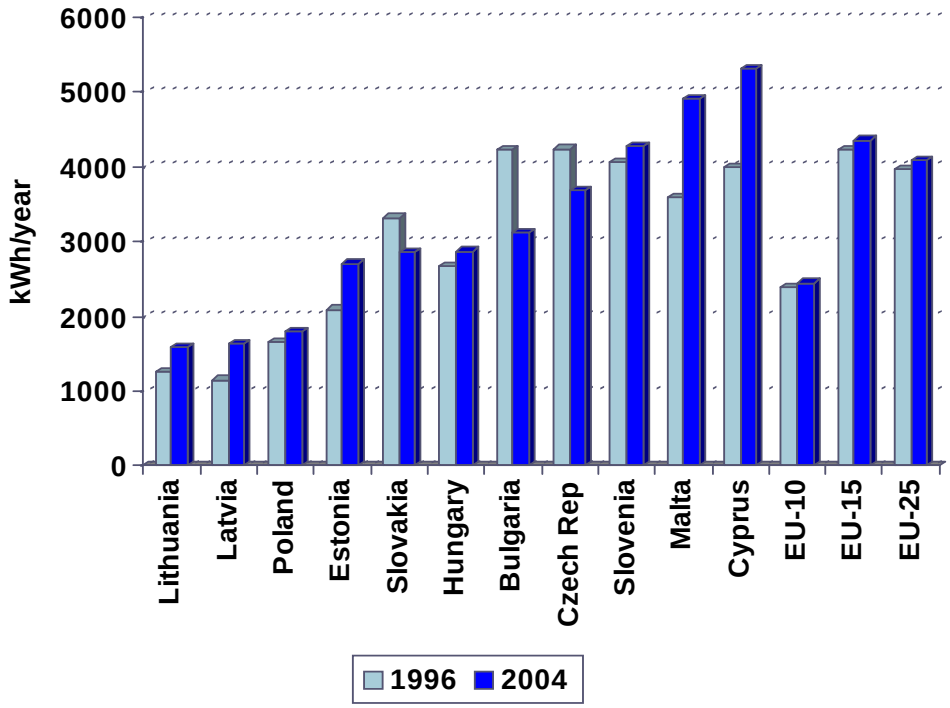
[50] The progression was 2% in Estonia, 4% in Lithuania, 5% in Hungary, 8 % in Slovenia and 14% in Poland.

4.4. Trend in the average electricity consumption per dwelling

Large dispersion in the electricity consumption per household in NMCs

The average electricity consumption per household has very different level and trends in New Member Countries. In 2004, the electricity consumption per dwelling is around 2400 kWh/year in the EU-10, which is 40% lower than in the EU-25 average (around 4100 kWh/year) (**Figure 4-7**). This unit consumption is a range of 1600 kWh/year in Lithuania and Latvia to values around 5000 kWh in Malta and Cyprus (i.e. a factor 3).

Figure 4-7: Electricity consumption per dwelling



Very rapid progression of the electricity consumption per household in Baltic and Mediterranean New Member Countries

There is a very rapid progression of the electricity consumption per dwelling in Malta and Cyprus: around 4%/year on average between 1996 and 2004, i.e. ten times more rapidly than the EU average (**Figure 4-8**). Such a rapid trend is probably due to the diffusion of air conditioning. In Baltic countries, the progression is very rapid also, as these countries start from a low level and are catching up with other EU countries in terms of equipment ownership (**Figure 4-10**).

In Bulgaria, the Czech Republic and Slovakia, the trend is reverse, partly due to substitutions of electricity for other fuels in thermal uses and also as a reaction to price increases, particularly in Slovakia and the Czech Republic (price increase of respectively 18%/year and 10%/year between 1996 and 2004) (**Figure 4-9**). In

Slovenia, Hungary and Poland, the slow progression in the electricity consumption by dwelling is also linked to price increases.

Figure 4-8: Electricity consumption trends per dwelling (1996-2004)

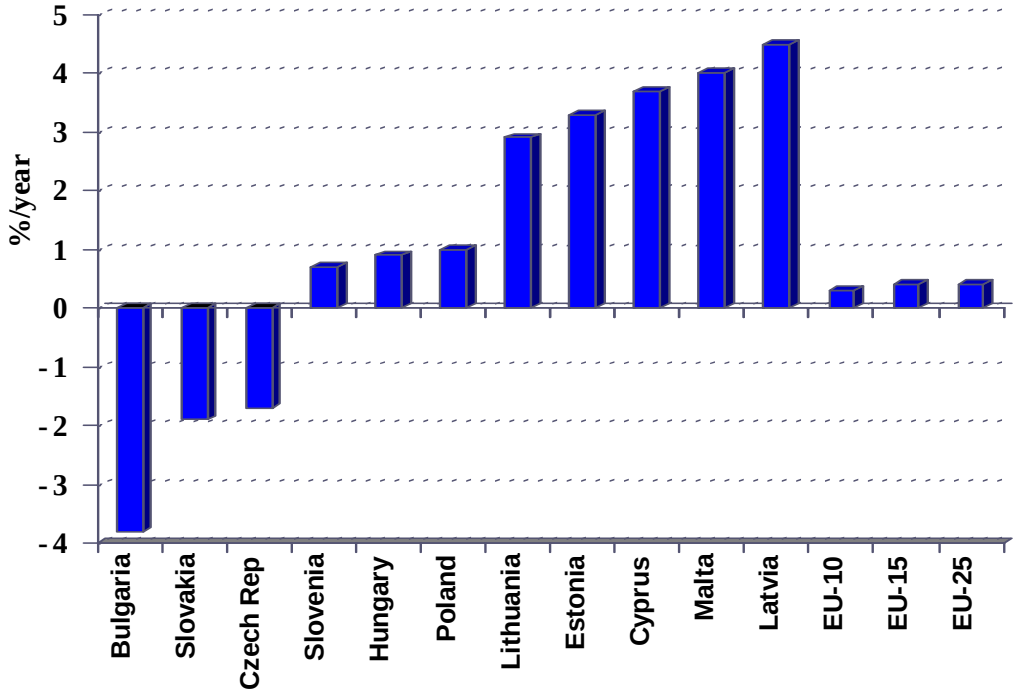
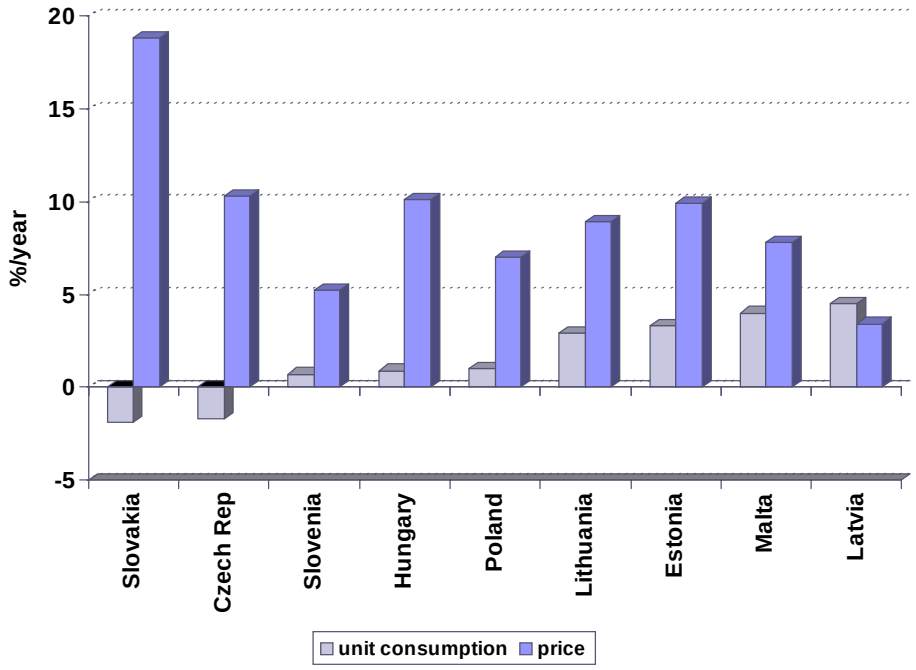


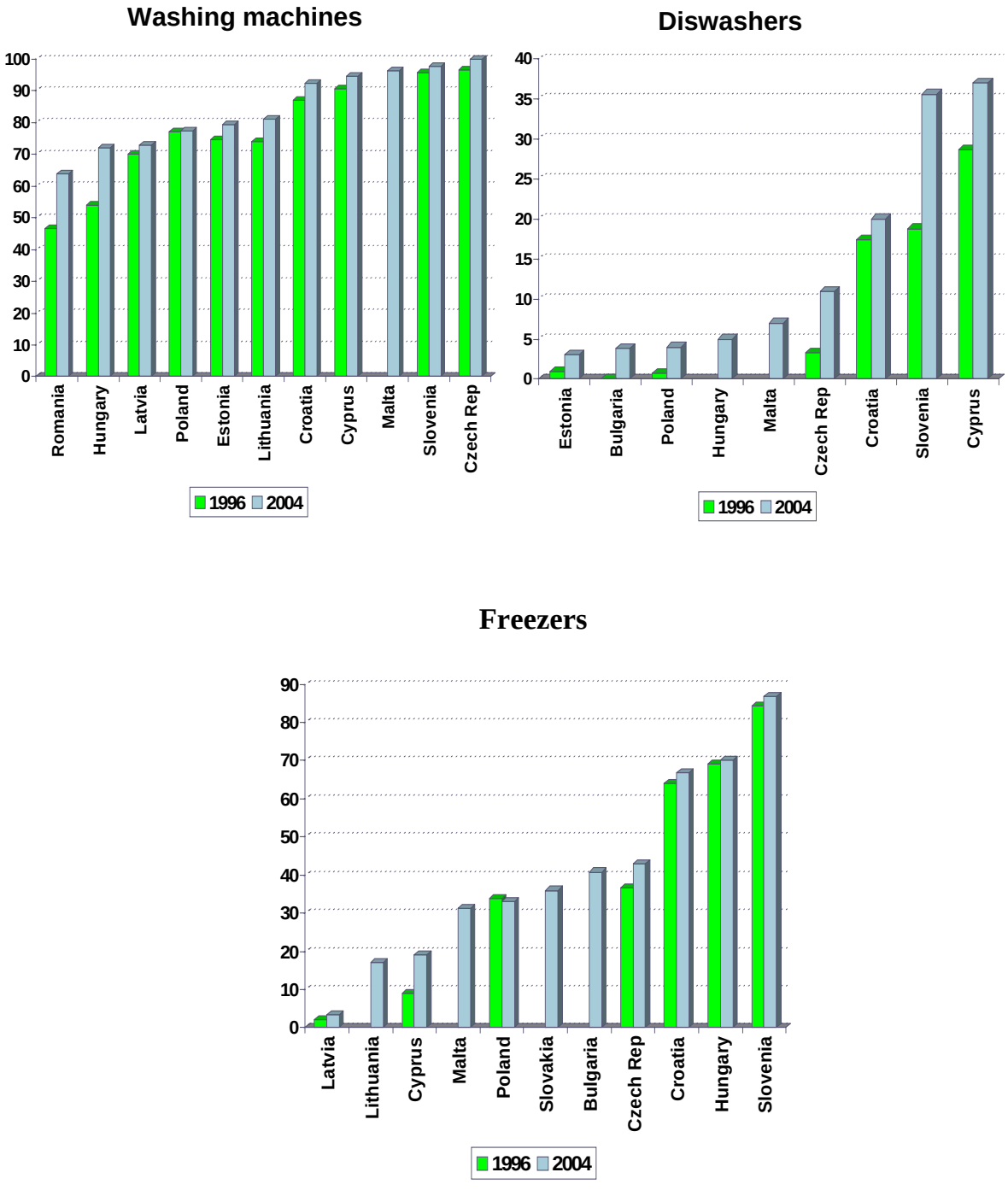
Figure 4-9: Electricity consumption trends per dwelling and price variations[51] (1996-2004)



[51] Price in €/kWh from Eurostat and IEA

As outlined above, the household equipment in basic appliances is progressing rapidly as is shown in **Figure 4-10** for washing machines, dishwashers and freezers. The levels of equipment ownership are also very different among New Member Countries, especially for dishwashers and freezers. Dishwashers have a low penetration in most countries, except in Cyprus and Slovenia. For freezers, Slovenia and Hungary have the highest penetration. Income levels, climatic considerations and lifestyle explain these large differences in household equipment ownership.

Figure 4-10: Trends in equipment ownership



According to market data from GfK, the share of efficient energy labels (e.g. label A and A+) was almost at the same level in new EU members as in the EU-15 average in 2004. However as the penetration of these labels is very new in these countries, the composition of the stock is probably very different, with the EU-15 having a much higher penetration of labels A and A+ in the total stock.

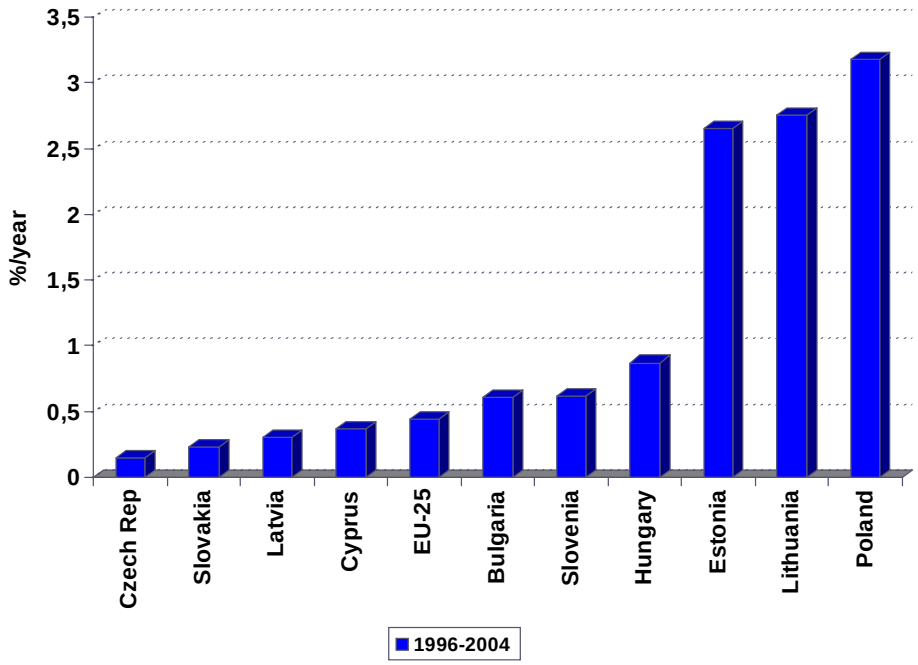
4.5. Overall energy efficiency trends

Moderate energy efficiency improvement for households since 1996 in the EU-25

Energy efficiency[52] only improved by 3 %, i. e. 0.4 %/year in the household sector between 1996 and 2004 in the EU-25 as a whole (**Figure 4-11**). In New Member Countries, the situation is very diverse with 3 countries recording very high-energy efficiency improvements (Poland, Estonia and Lithuania).

For new EU members, energy efficiency is difficult to asses in this sector as, due to data limitations, it is not possible to fully correct the effect of improved comfort (or supply constraints), that may lead to an underestimation (or overestimation), of the actual energy efficiency progress[53].

Figure 4-11: Energy efficiency trends by country in the household sector



[52] The energy efficiency index was calculated by weighting the energy efficiency gains for 3 end-uses/appliances: heating (toe/m^2), water heating, cooking (toe/dwelling). For small appliances and lighting, energy savings are difficult to assess and have been neglected.

[53] With higher income, people may increase their heating temperature, the effect of which is hidden in the indicators used. In some countries, supply constraint with district heating have on the other hand reduced the consumption and in that case this overestimate the saving (e.g. Poland or Bulgaria for instance); this factor is difficult to assess and is in addition time dependant

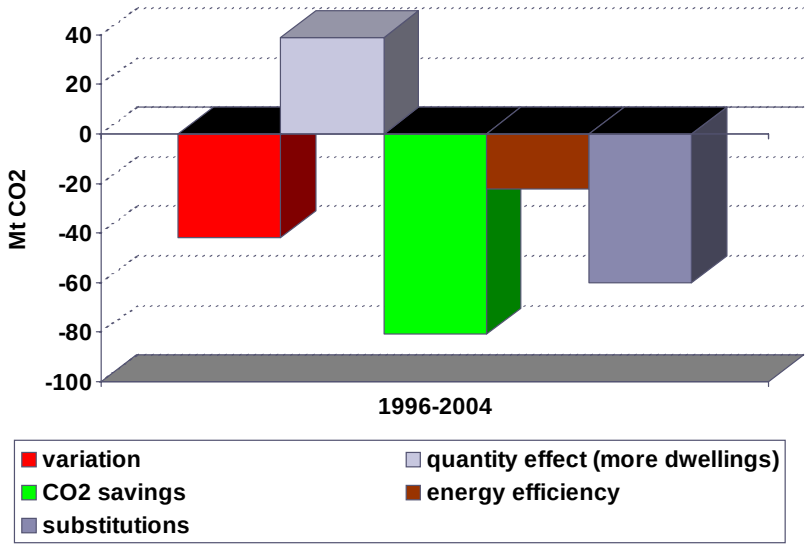
4.6. CO_2 emissions

Significant CO_2 savings, mainly due to from fuel switching reduced CO_2 emissions in the EU-25 between 1996 and 2004

In 2004, direct CO_2 emissions of households were 8% under their 1996 level (decrease of 42 Mt). This result was achieved despite an increase in the stock of dwellings and the number of household appliances owned, two developments that would have implied, all other things being equal, an increase of 39 Mt CO_2. This lower level of emissions was made possible by a reduction in the average emission per dwelling of about 15 % between 1996 and 2004 that resulted in CO_2 savings of around 81 Mt CO_2 (**Figure 4-12**).

This reduction in the average CO_2 emissions per dwelling was much larger than the 8 % decrease in the unit energy consumption per dwelling (in toe per dwelling)[54] because of switches to fuels with a lower CO_2 content (e.g. gas, heat and biomass) and an increasing use of electricity, the emissions of which are not included in the household sector. CO_2 savings from fuel switching and increased electricity use amounted to 60 Mt CO_2, which represent 73% of total savings are mainly linked to energy substitutions (73%) (**Figure 4-12**).

Figure 4-12: Variations in CO_2 emissions from households in the EU 25[55]



[54] All the figures given here are not corrected for climate variations.
[55] 1996-2004 in Mt CO_2.

4.7. Conclusions

- Between 1996 and 2004, the energy efficiency progress in households was assessed as 0.4 %/year in the EU-25 (3.4 % over the period). This is partly the result of the policy measures implemented (EU directives and national measures such as building standards and financial incentives), which have raised the energy performance of new buildings and electrical appliances.

- Large dispersion in the electricity consumption per household in New Member Countries: a factor 3 between the countries with the lowest level (Latvia and Lithuania) and countries with the highest profile. The average consumption in New Member Countries is still 40% lower than in the EU-25 average.

- Electricity use per household is following very different trends. There is as very rapid progression in Baltic and Mediterranean New Member Countries due to a catching up in equipment ownership in Baltic countries and the rapid diffusion of air conditioning in Mediterranean countries. In some countries, there is an absolute reduction. For the EU-25 average, the progression is below 1%/year.

- Between 1996 and 2004, CO_2 emissions of households were reduced by 8% in the EU-25: most of these CO_2 savings (about ¾) were due to fuel switching.

- The data available by end-use are still limited and do not permit a good assessment of energy efficiency trends by end-use.