



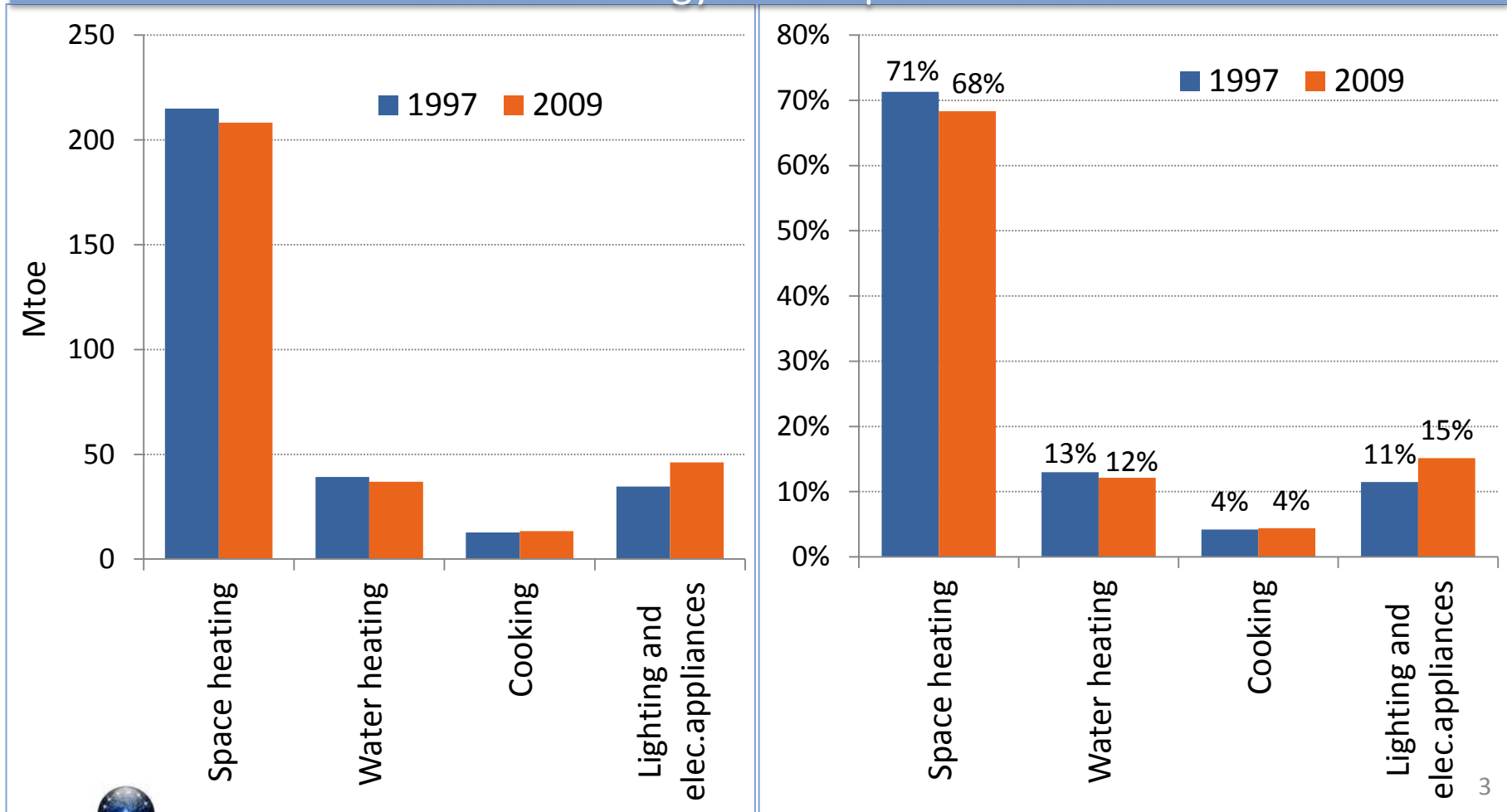
# Energy efficiency trends for household in the EU

Bruno Lapillonne, Carine Sebi, Karine Pollier      Enerdata

- ▶ **1. Overall energy consumption and drivers**
- 2. Heating
- 3. Water heating (solar)
- 4. Electrical appliances and lighting
- 5. Large appliances
- 6. Lighting
- 7. Air conditioning
- 8. Energy efficiency trends

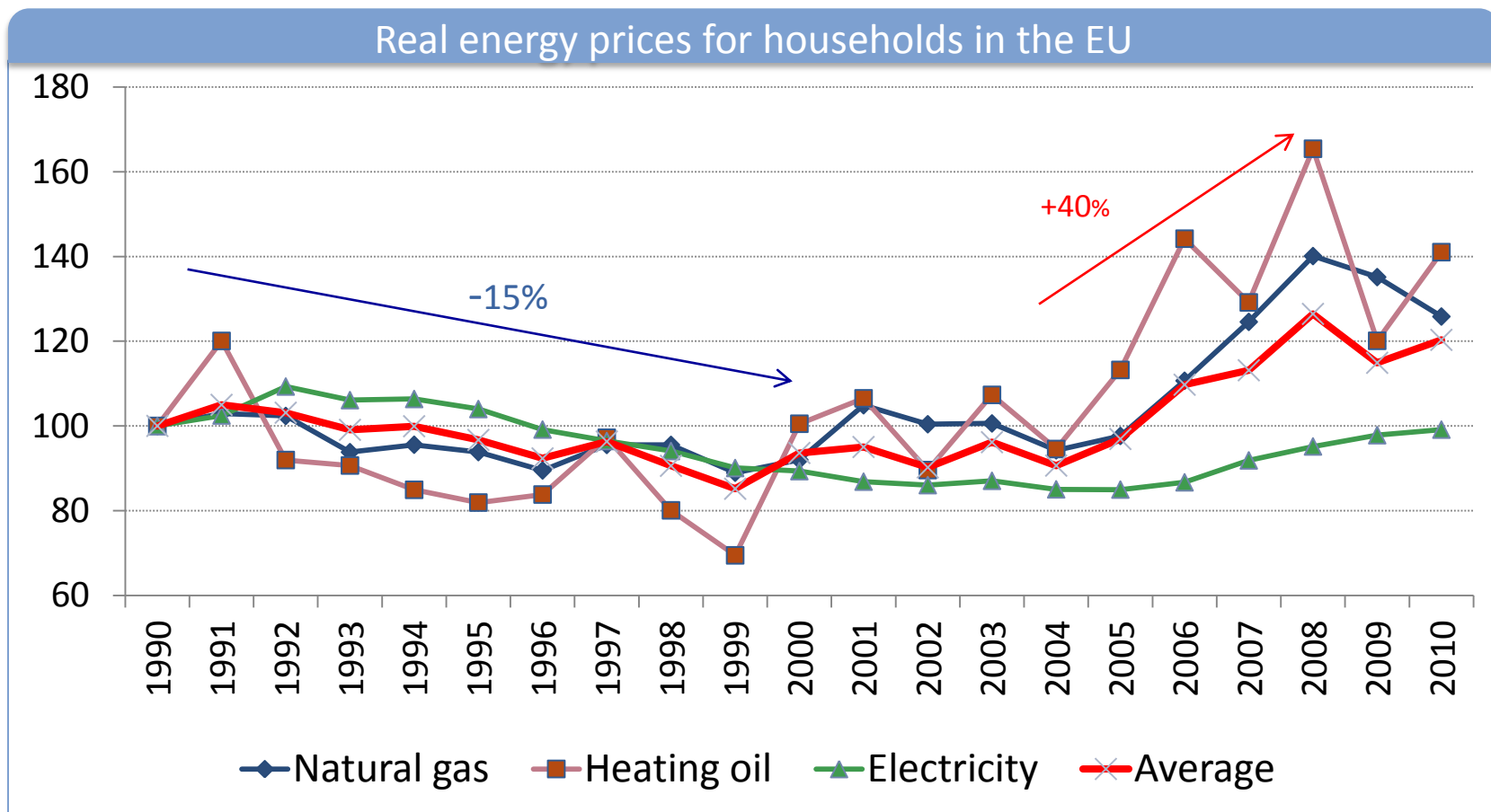
- Declining share for space heating;
- Second end-use: water heating with a stable share (12%)
- Increasing weight for electrical appliances and lighting

## Household energy consumption in the EU



Energy prices for households have increased by 40% between 2004 and 2009 (9%/yr). In 2009, they have dropped by 9% with the economic crisis (-27% for oil, -3.5% for gas). In 2010 the trend is reversed (+5%).

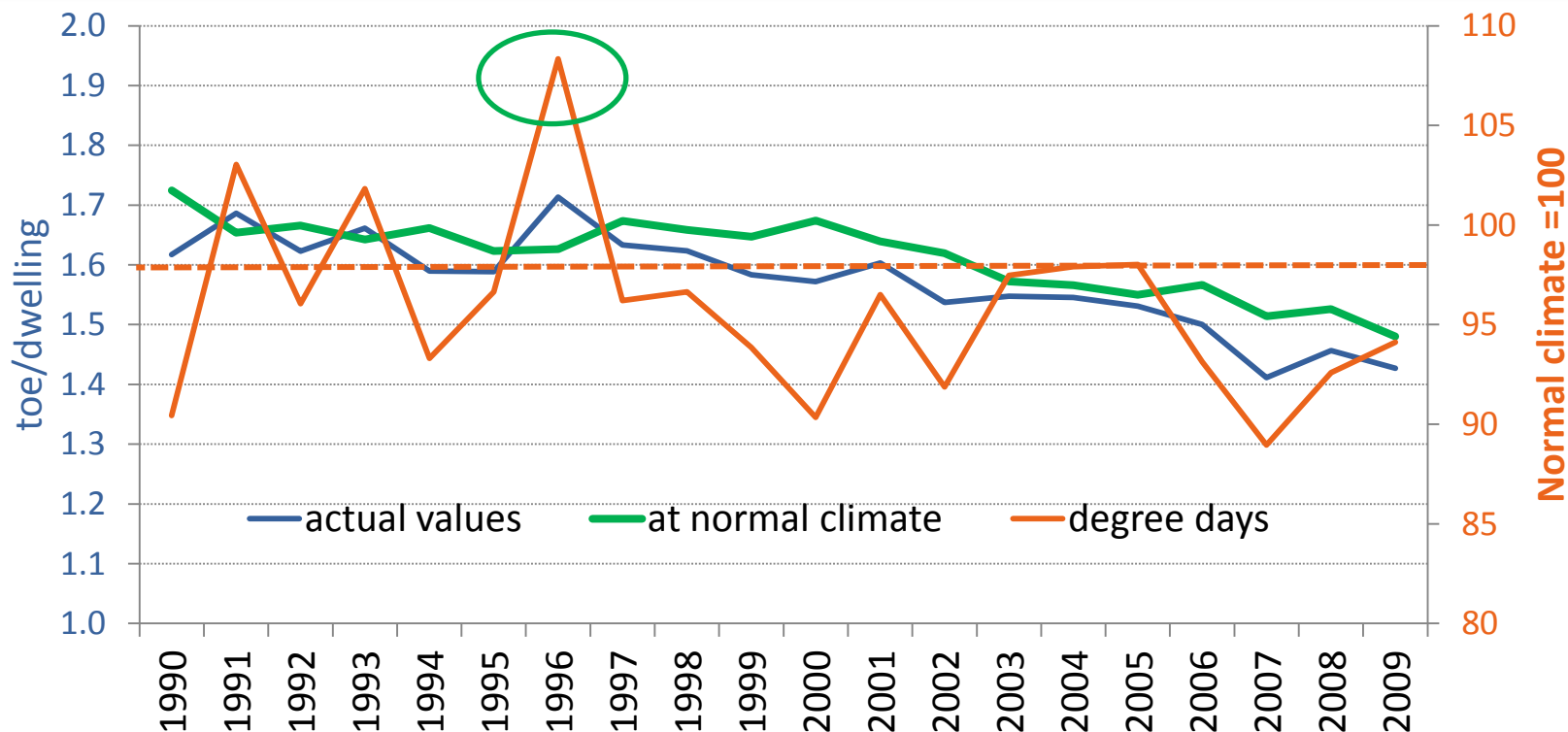
Since 2005, the price of electricity is increasing (+17% between 2005 and 2010). Regular decline before 1999 (-15%) followed by a relative stability until 2004;



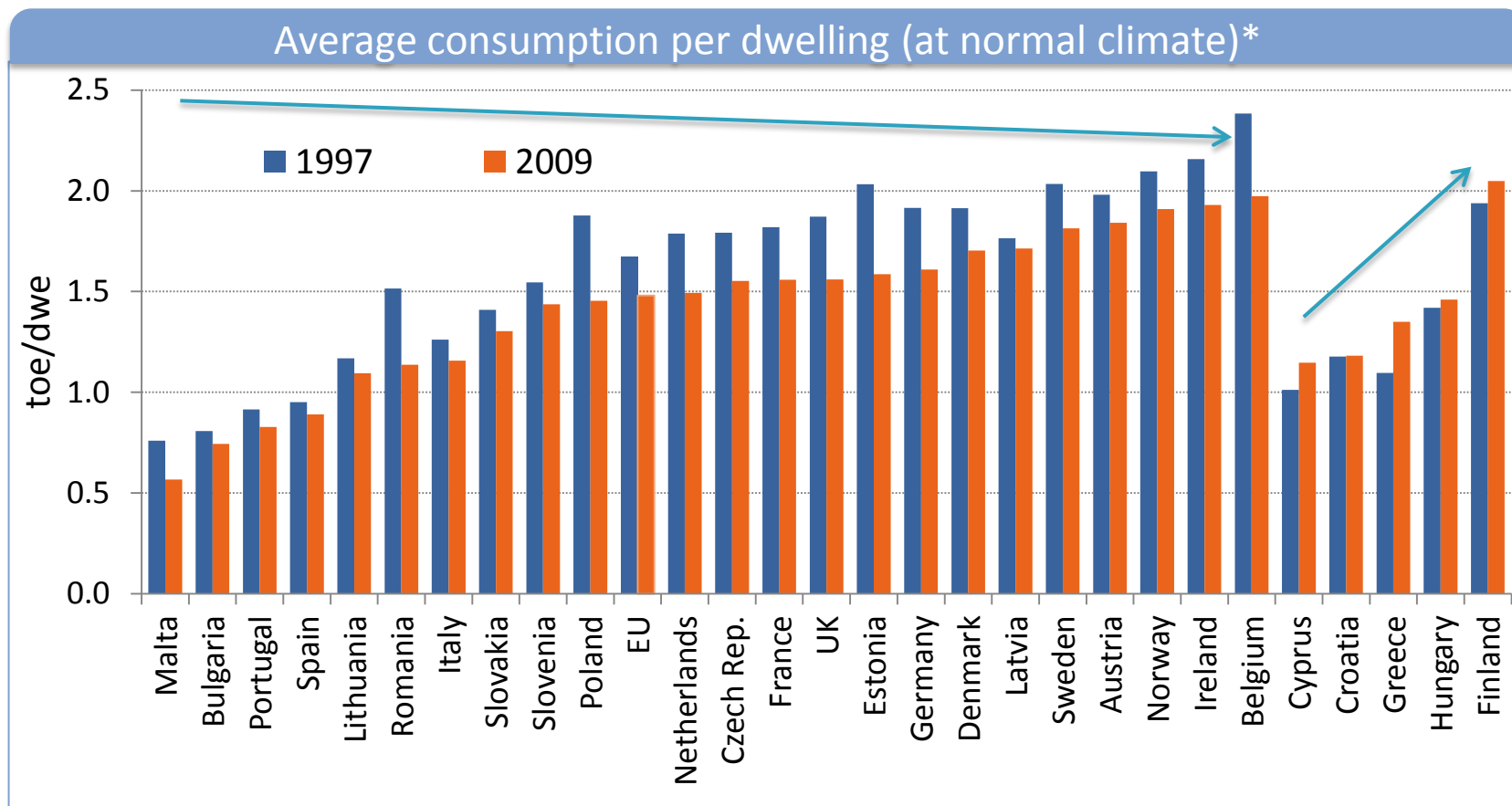
\*Price index at constant prices calculated from nominal prices for the EU (source: DG-TREN Statistical Pocketbook 2010 for 1990-2008; 2009-2010 Enerdata) ; average price weighted on the basis of energy market shares

- To avoid annual fluctuations in energy indicators due to climatic variations and to have consistent trends, all indicators are given at normal climate (i.e. with climatic corrections).
- Three winters have been colder than the normal climate (30 years long term average )
- As 1996 was a very cold winter and the climatic correction over corrects the consumption → the analysis will start in 1997/1998.

### Specific consumption per dwelling : actual value vs climatic corrected

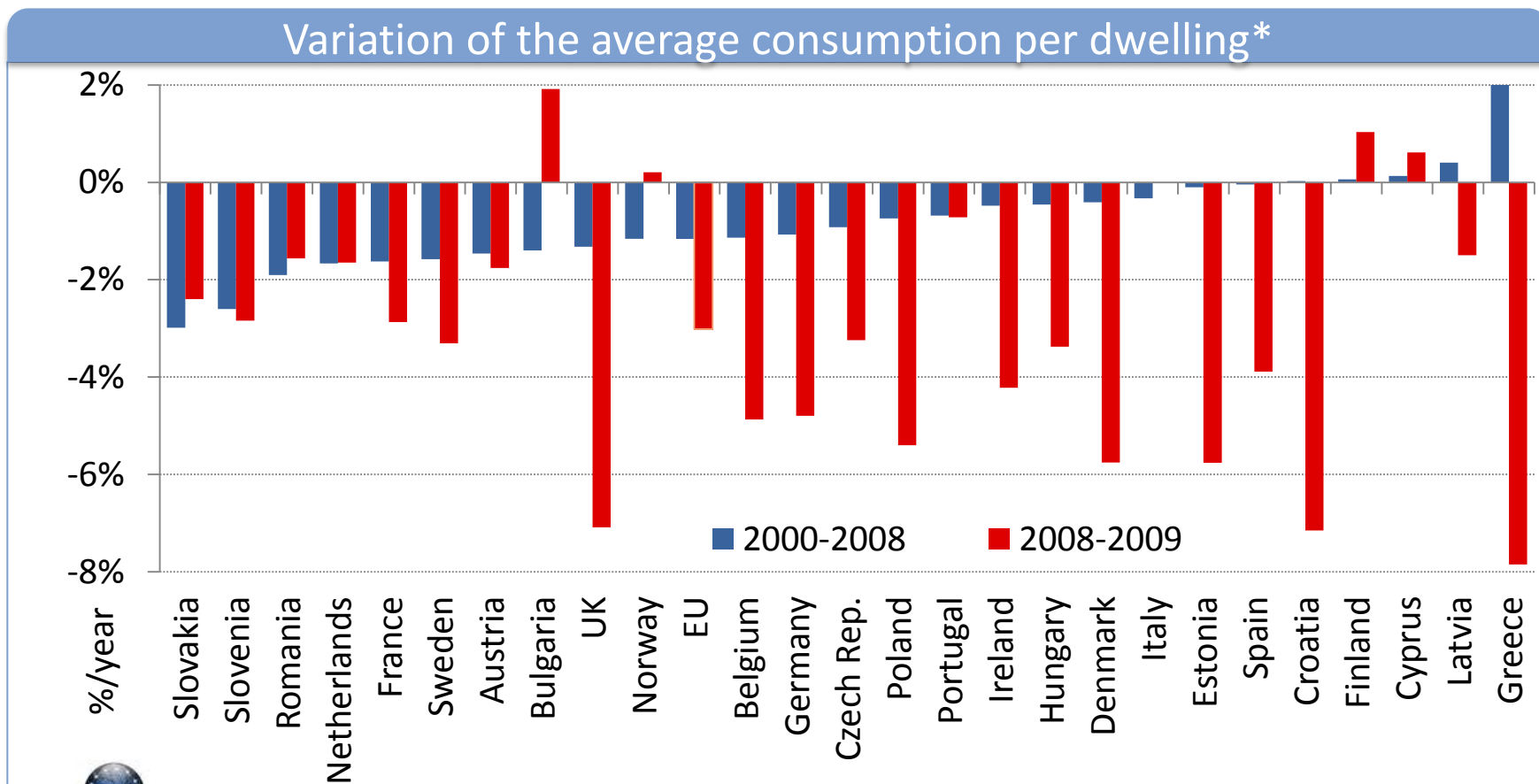


Different trends across countries. Reduction of the average energy consumption per dwelling in almost 2/3 of countries, in particular in most new member countries; large increase in southern Europe; values in a range of 1 to 2 toe/dwelling (except southern countries)

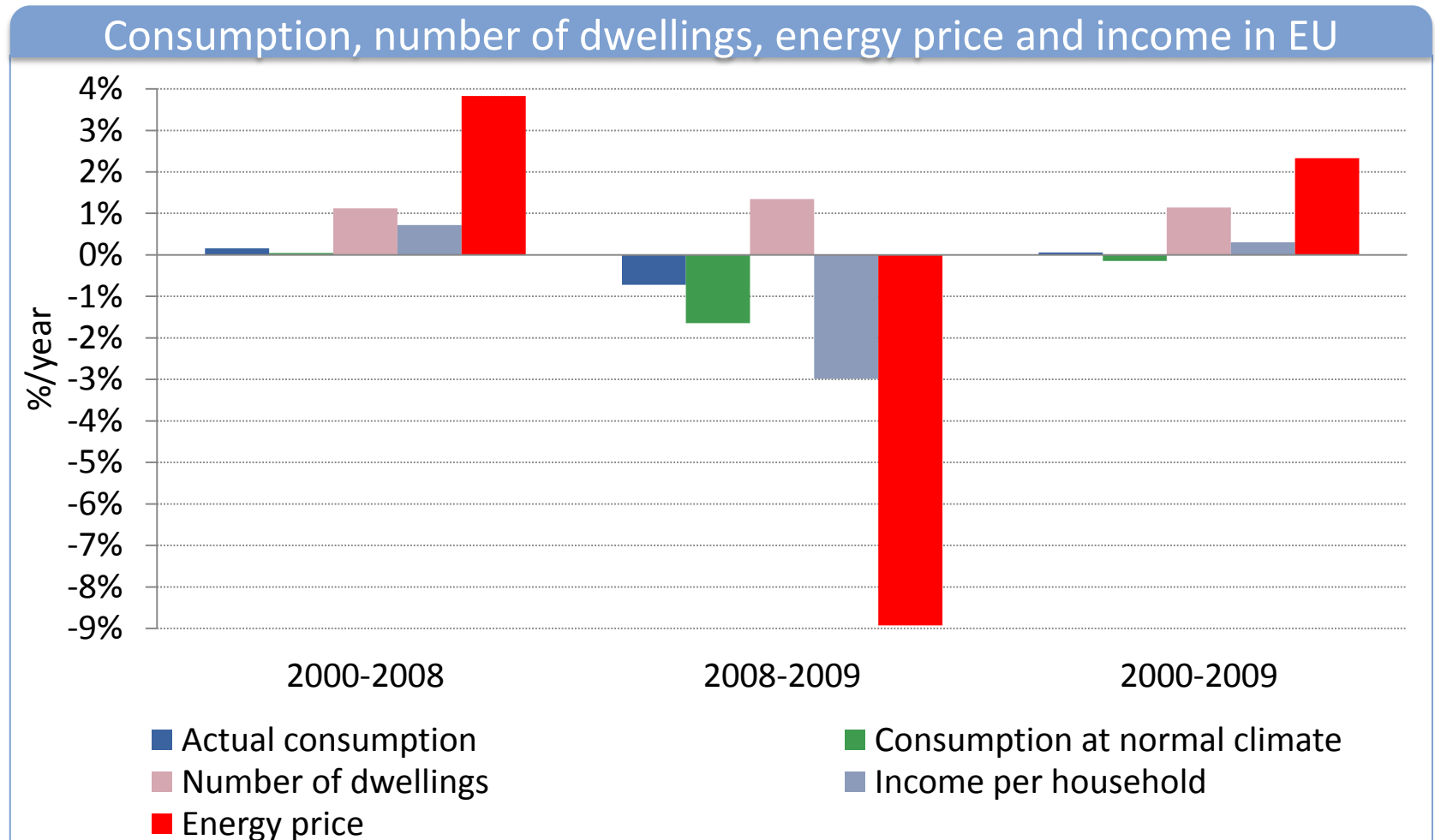


\*2007 for Lithuania and 2008 for Malta

- Strong reduction of the average consumption per dwelling in 2009 in most countries: -3% at EU level compared to -1.1%/yr over 2000-2008; large contraction (closed to 5% or >5%) in 8 countries (Belgium, Germany, Poland, Denmark, UK, Estonia, Ireland & Croatia)
- Energy consumption per dwelling below 2000 level in almost 2/3 of countries in 2009; strongest reduction in Slovakia and Slovenia (-20%), followed by Sweden, France and The Netherlands (~-15%); above 2000 level in 6 countries (Greece, Cyprus, Malta, Finland, Latvia & Czech Rep.).

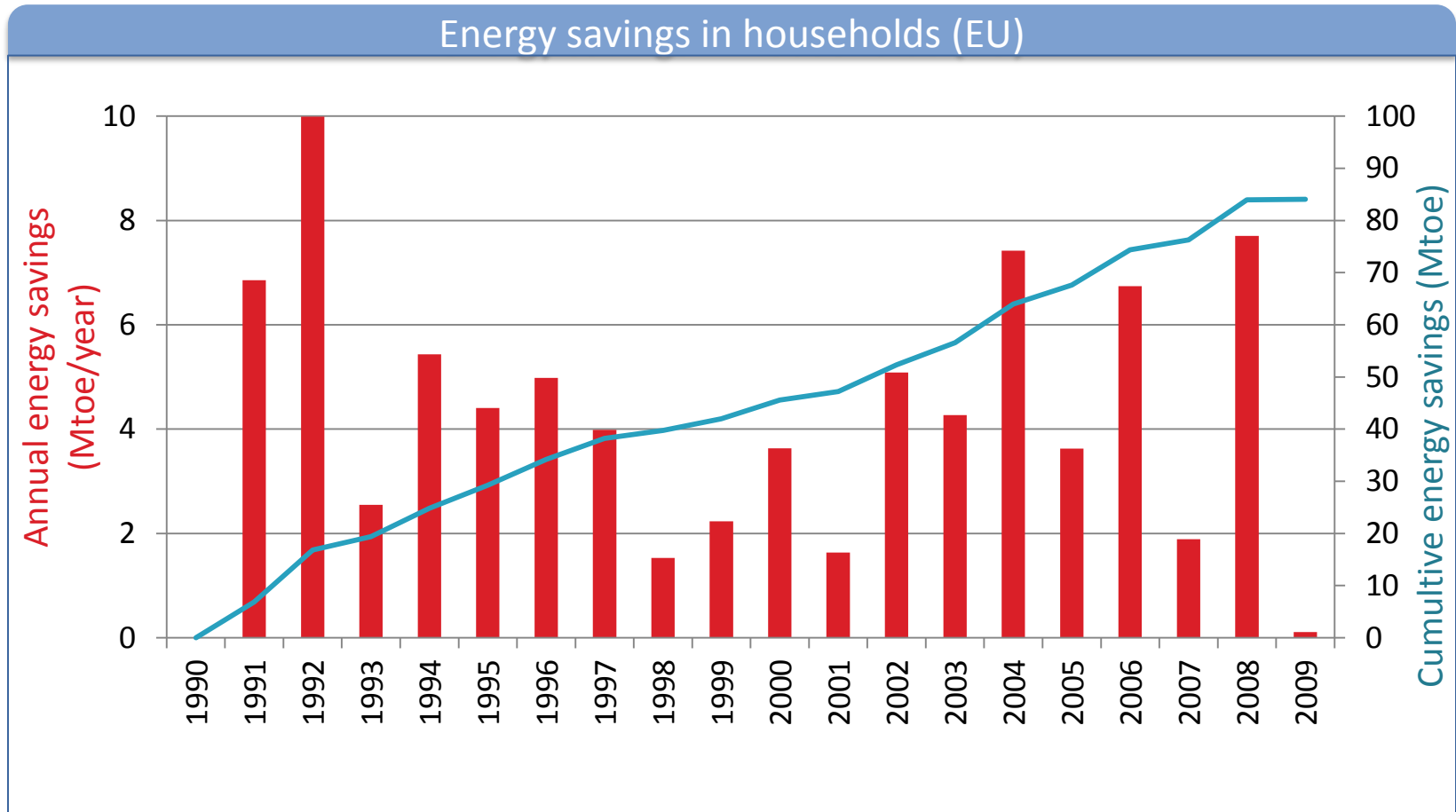


- Decrease of the energy consumption in 2009 by 0.7% (1.6% at normal climate) as a result of a decrease of income (-3%) and despite a drop in energy price (-9%)
- Consumption in 2009 (or 2008) closed to its 2000 level, despite a 1% growth in the number of dwellings and a slight progression of incomes

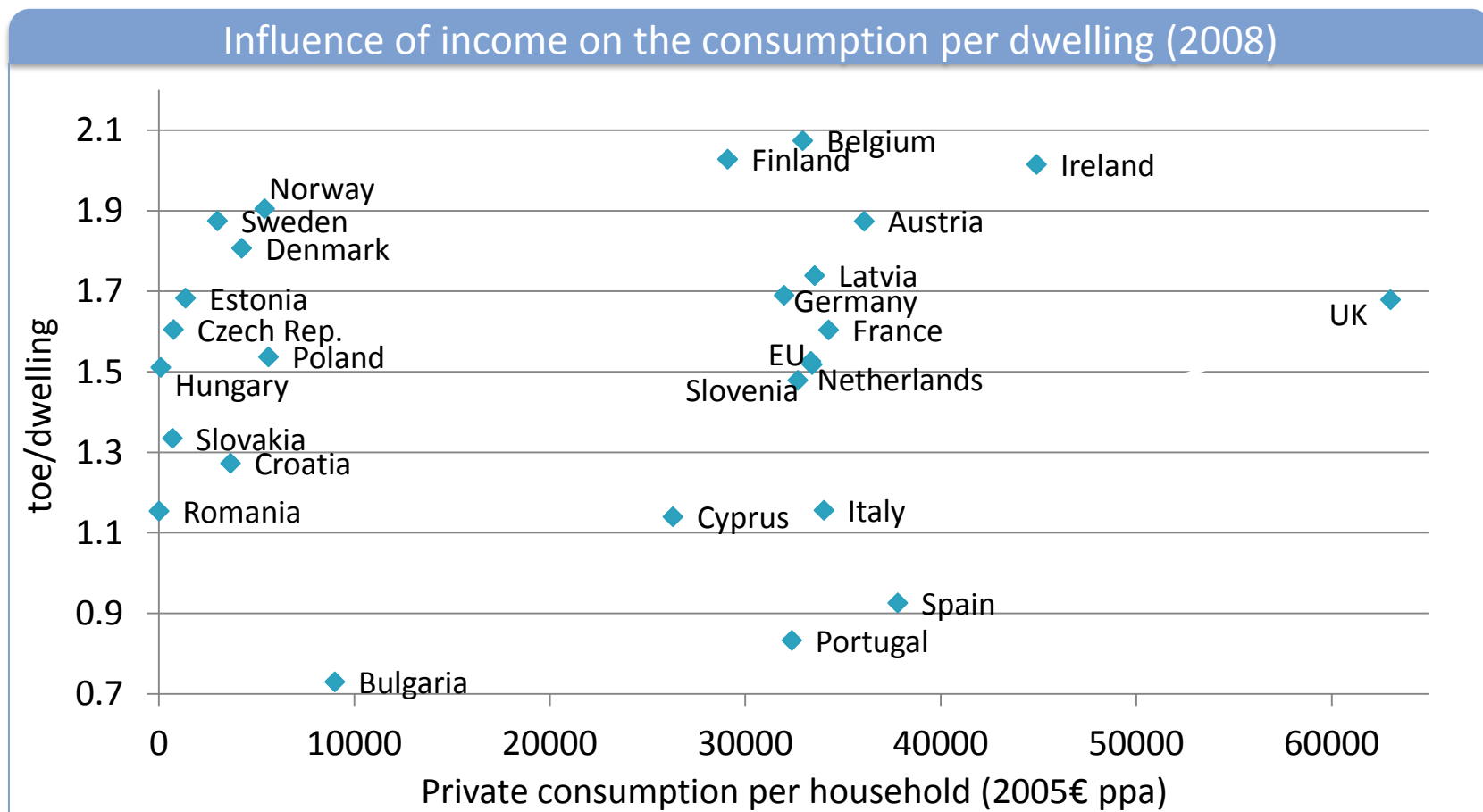


Energy price: weighted average

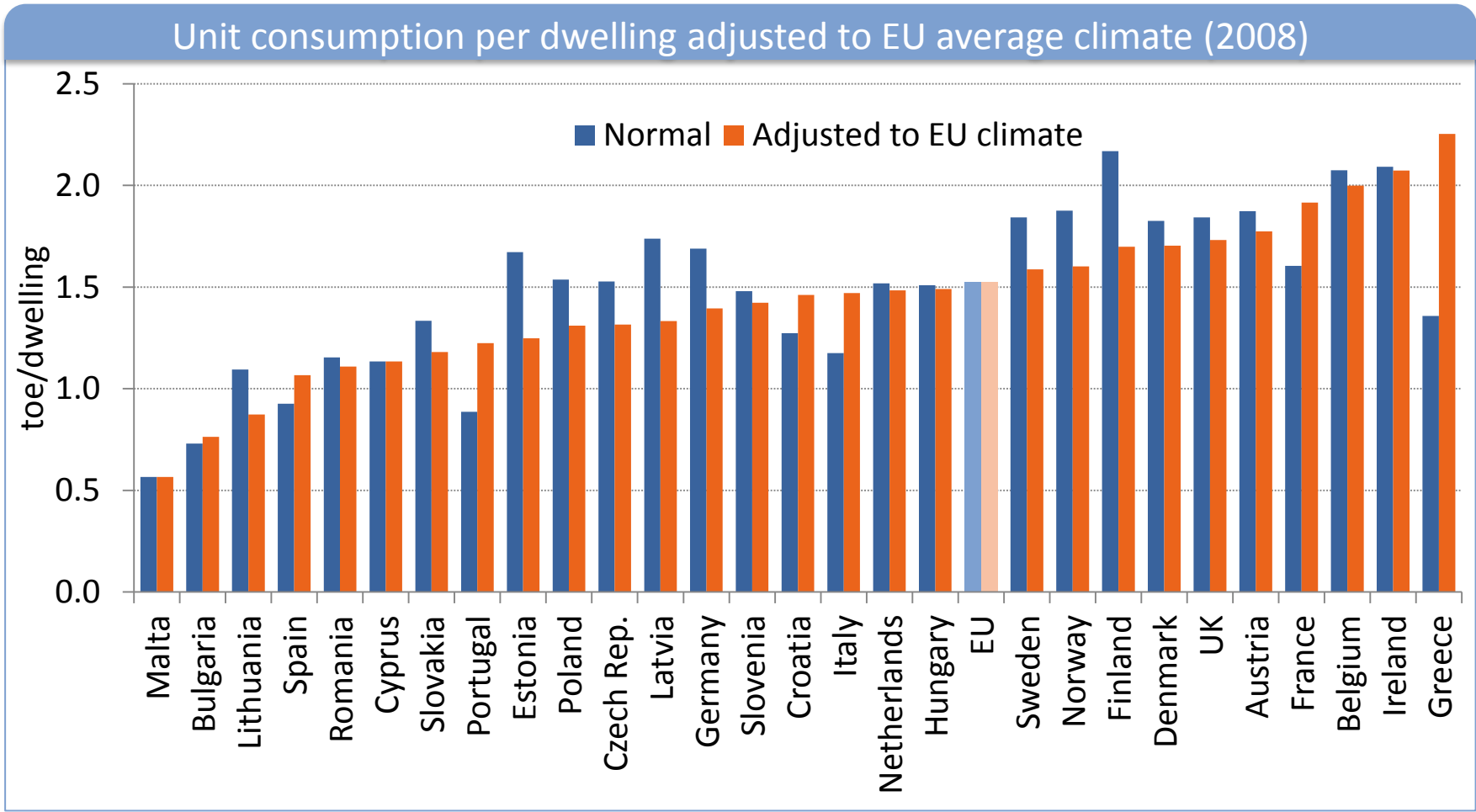
- Energy savings in households almost reached almost 85 Mtoe in 2009 compared to 1990: without energy efficiency improvement, the energy consumption would have been higher by 85 Mtoe



Although the average household income determines energy consumption, either directly (e.g. affordable comfort level for space heating) or indirectly (e.g. size of dwelling and number of appliances), there is no robust relationship between private consumption per household and energy consumption per household



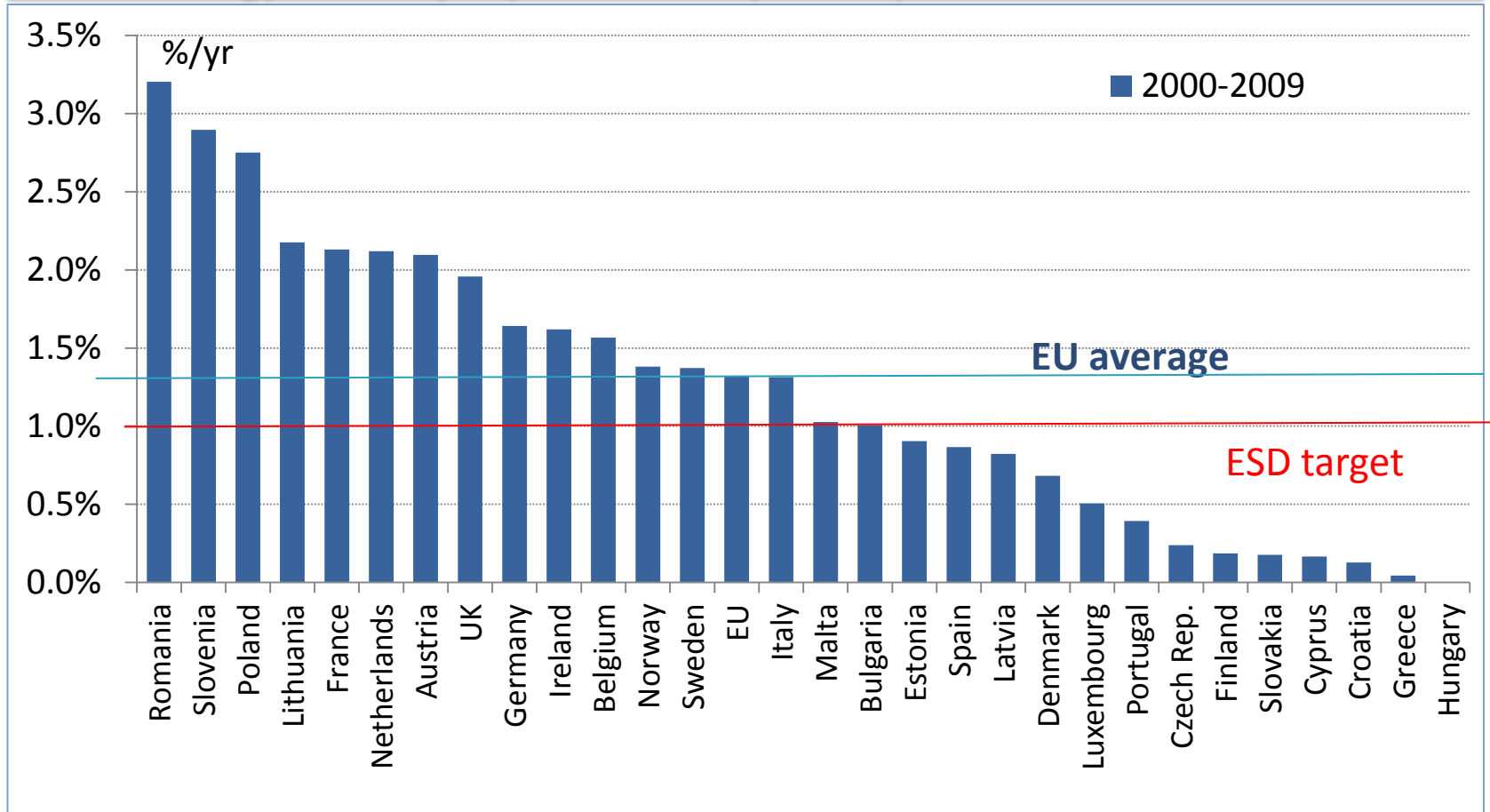
The comparison between countries is more relevant if the heating consumption is adjusted to the EU average climate; this adjustment narrows the differences between countries; for 9 countries with a climate warmer than the EU average the adjusted consumption is higher



No adjustment for Cyprus and Malta

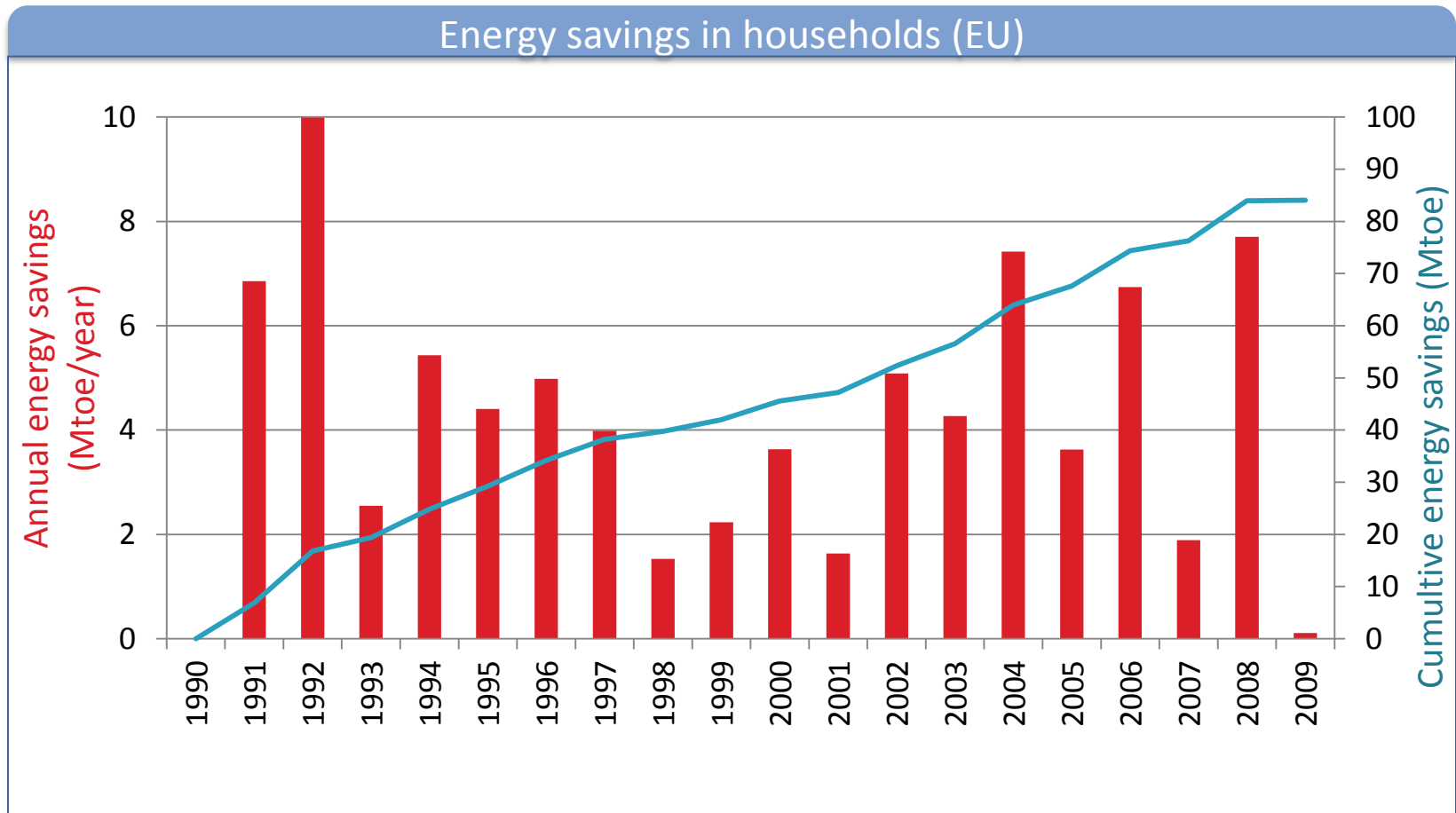
- 1.3%/year on average in EU between 2000 and 2009.
- Large discrepancies among countries : from few improvements for Hungary, Greece to great improvements for new members such as Slovenia, Poland and Romania.

### Energy efficiency improvements by country in the household sector



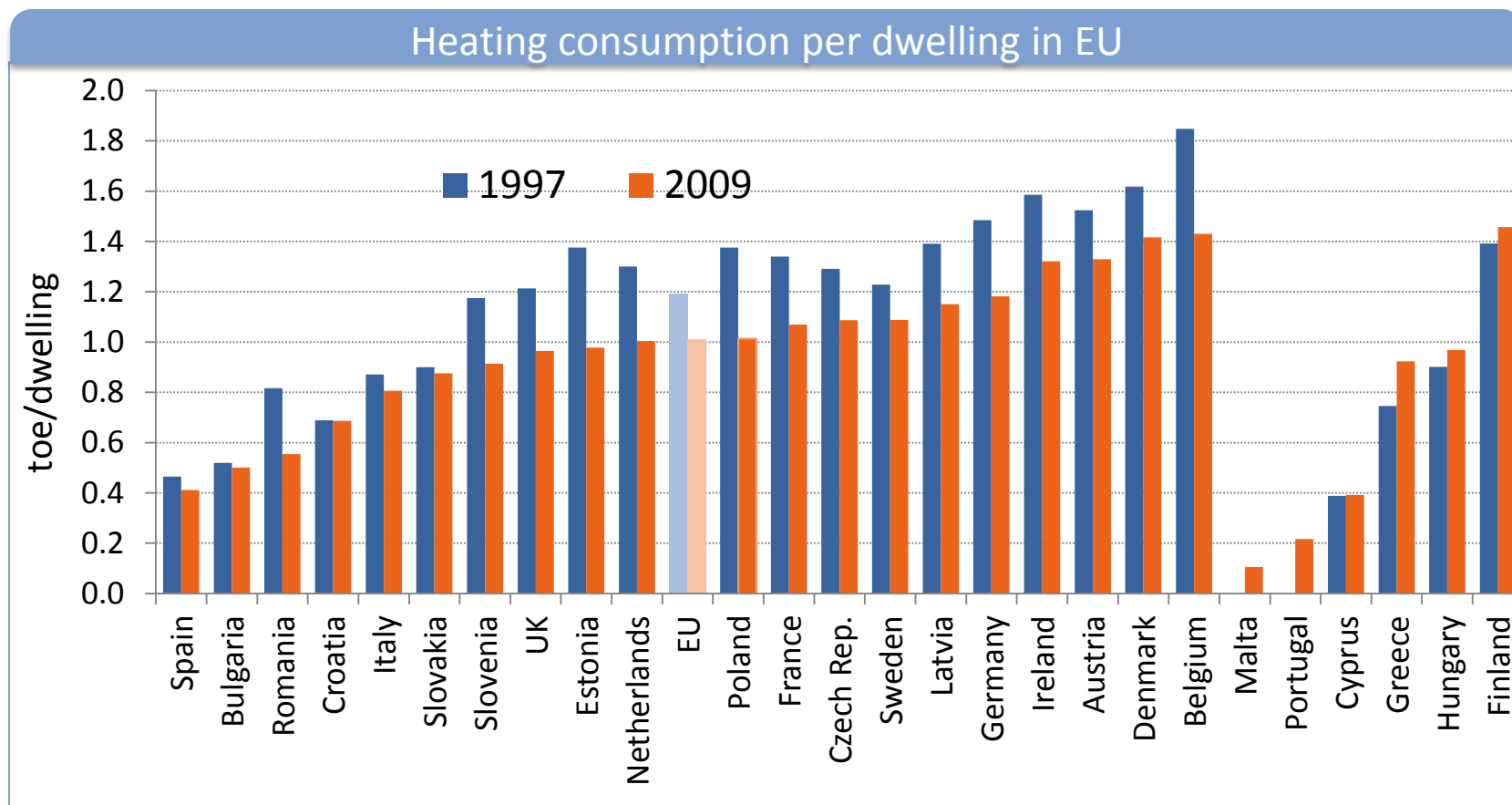
Period of analysis: 2000-2008 for Spain, Luxembourg, Czech Rep, Romania, Slovakia, Slovenia  
(2000-2007 for Lithuania)

- Energy savings in households almost reached almost 85 Mtoe in 2009 compared to 1990: without energy efficiency improvement, the energy consumption would have been higher by 85 Mtoe



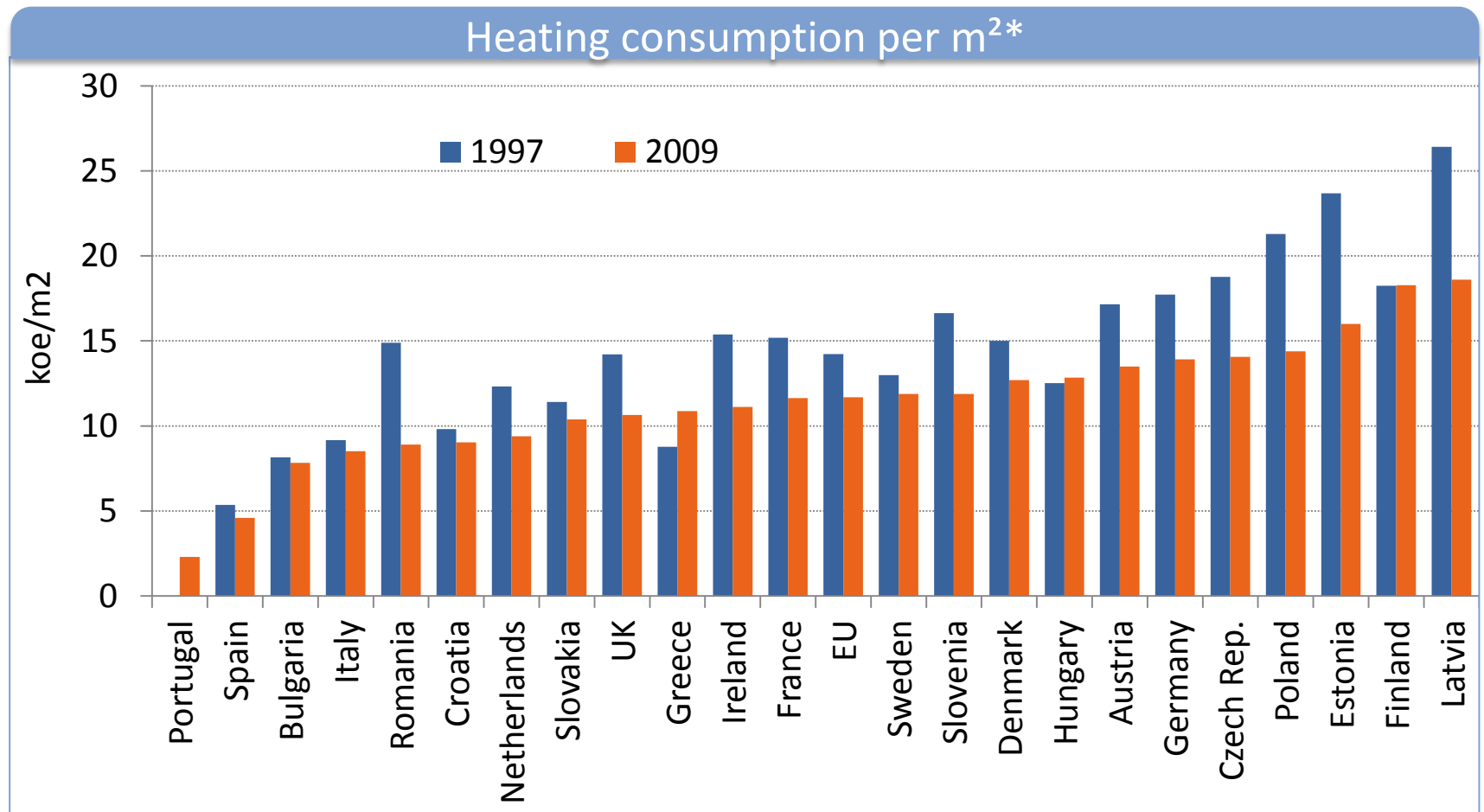
1. Overall energy consumption and drivers
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Decreasing heating consumption per dwelling in most countries (-0.9%/year for the EU average). New dwellings built in 2009 consume “in theory” ( i.e. according to the standards) 40% less than in 1990 but this impact is limited due to the fact that dwellings built since 1990 only represent 20% of total stock in 2009



\*2008 for Spain, Romania and Slovenia

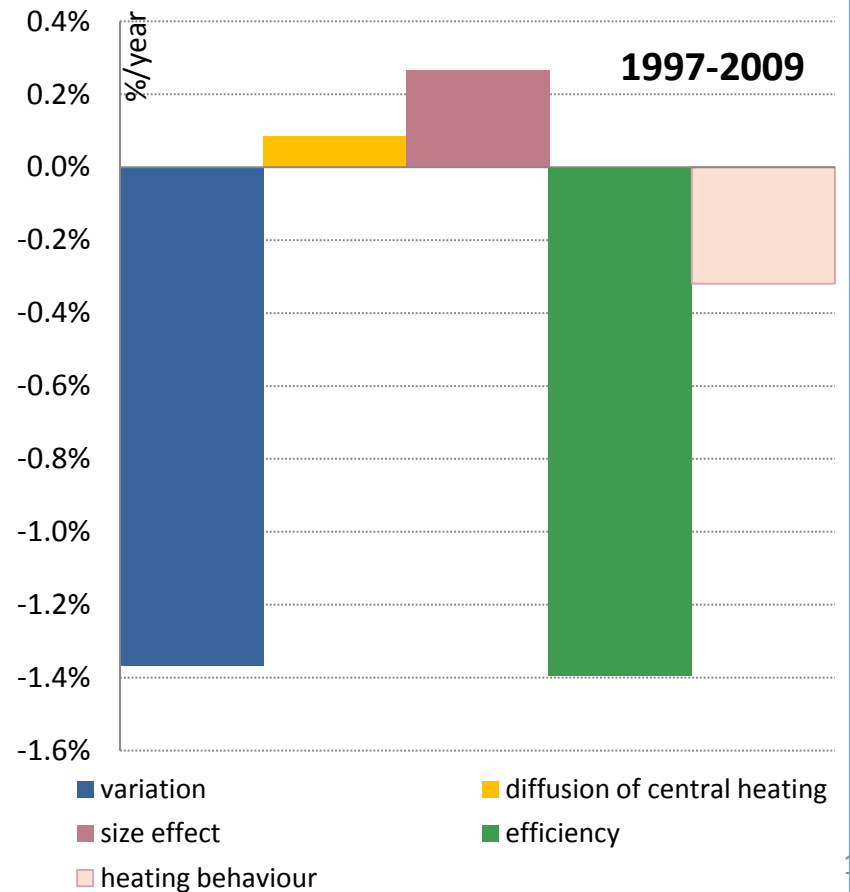
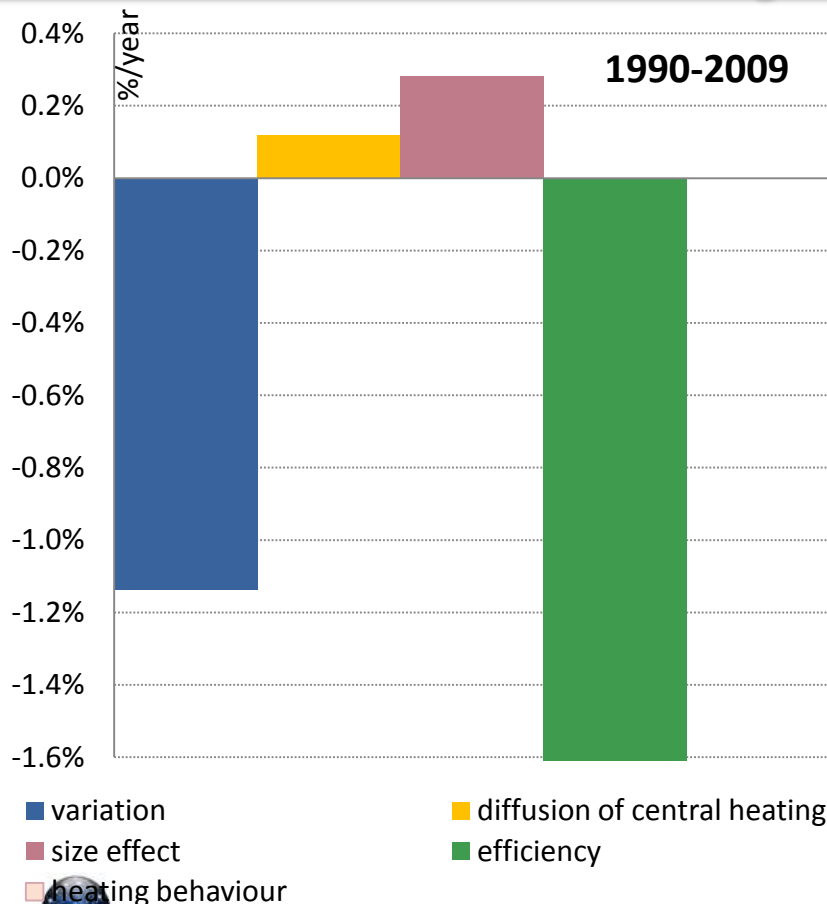
Decrease in all countries, except Greece and Hungary; significant reduction in some EU-15 countries (e.g. The Netherlands, Ireland and France) and in some new member countries (combined effect of higher price and efficiency improvements);



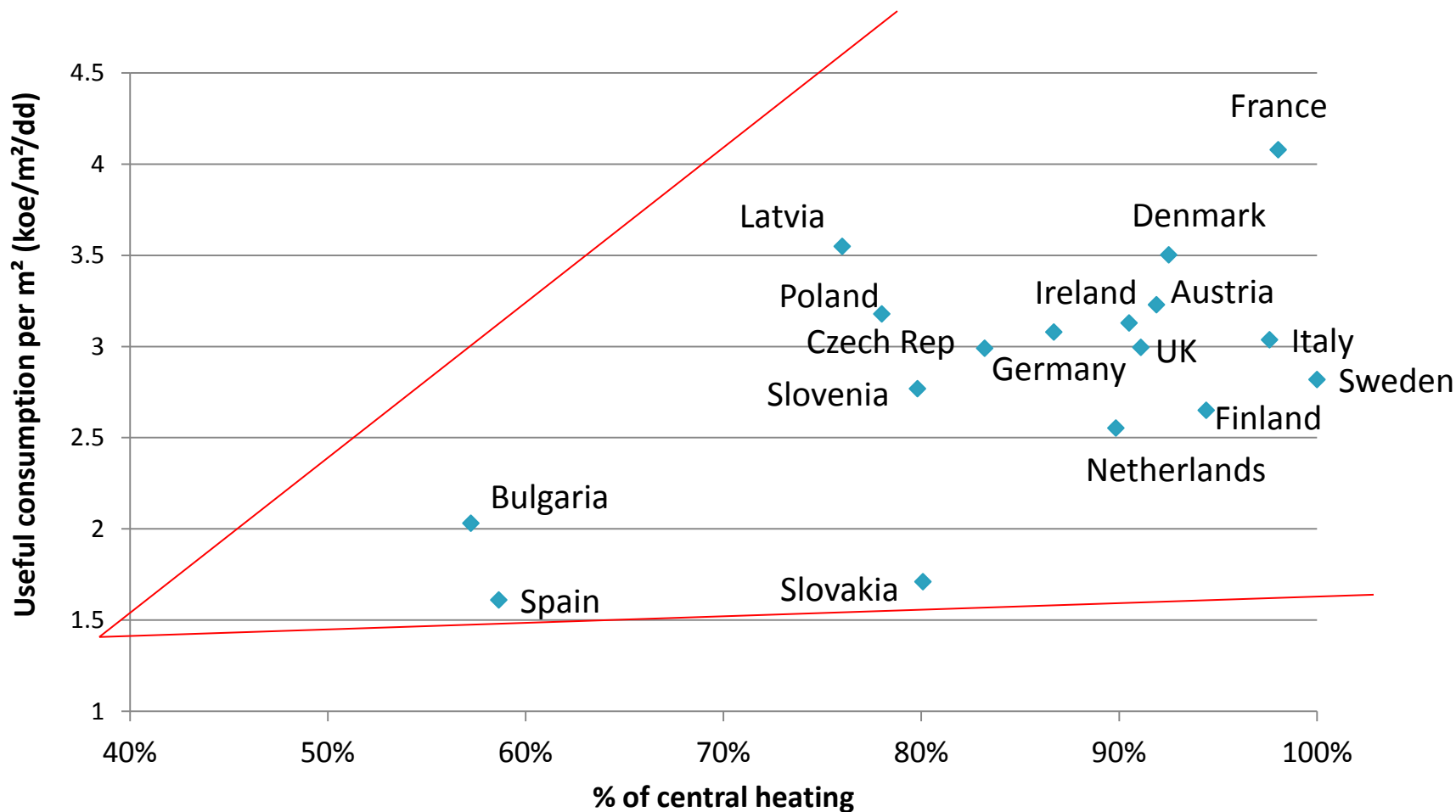
\*2008 for Spain, Romania and Slovenia

There is an energy efficiency progress for heating of 1.4%/year on average for the EU since 1997 (and 1.2%/year since 1990). Larger dwellings (+0.3%/year on average) and diffusion of central heating in the south of Europe (+0.1%/year on average) have offset the equivalent of 25% of energy efficiency gains at EU level. Heating behaviour had a significant impact at EU level on space heating consumption (-0.3%/year) since 1997.

### Drivers of the variation in heating consumption per dwelling (1997-2009)



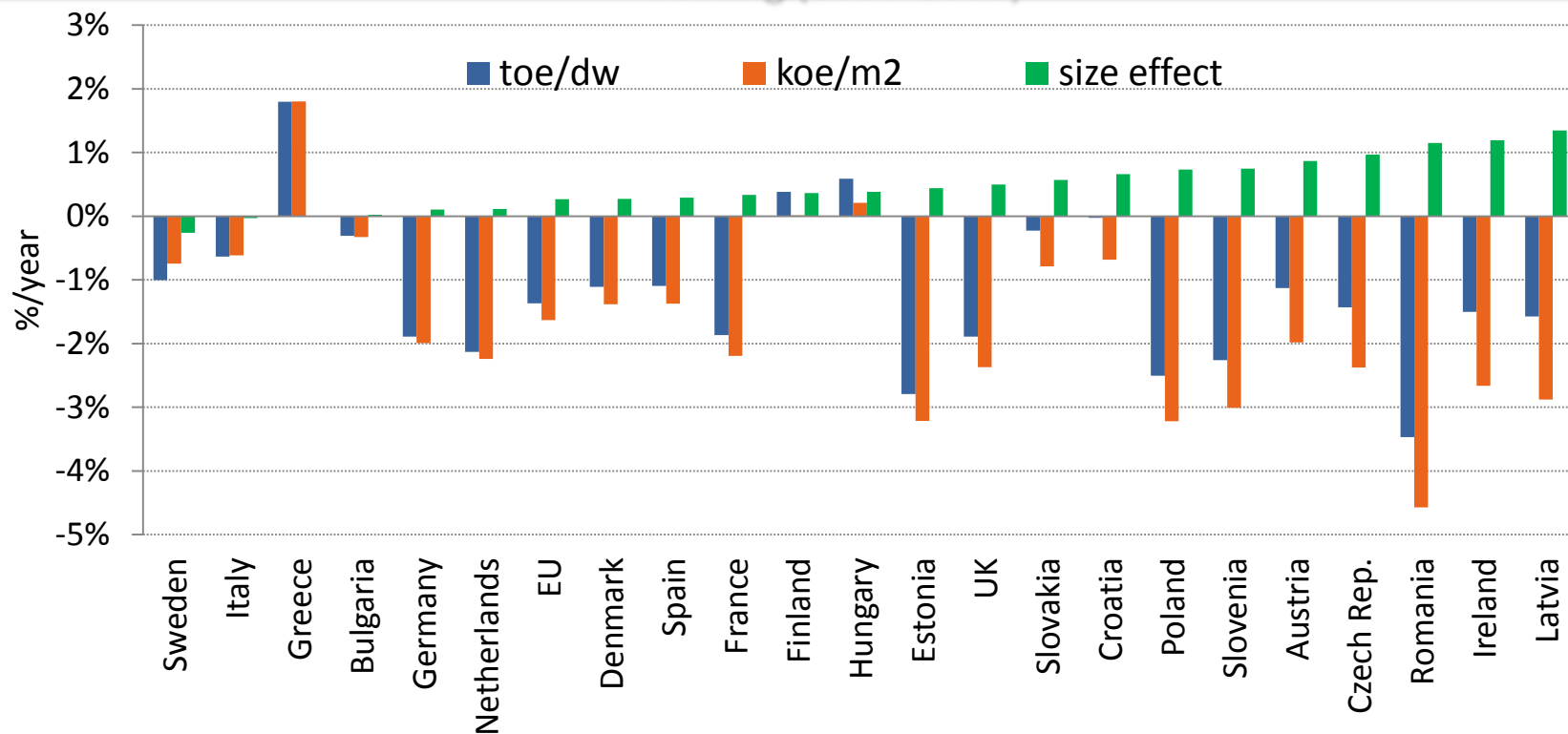
The recent penetration of central heating has contributed to increase the energy consumption in the household sector. The proportion of centrally heated dwellings at the EU level increased from 77 % in 1990 to 85 % in 2008



Central heating, which includes district heating, block heating, individual boiler heating and electric heating, implies that all the rooms are well heated, as opposed to room heating, where generally a stove provides heat to the main room only.

The average dwelling size increased (by 3.3% since 1997 at EU level), especially in Eastern European countries (about 10%). As a result, energy consumption per dwelling decreased slightly less (1.4%/year) than consumption per m<sup>2</sup> (1.6%/year) in the EU. This means that 20% of the energy efficiency progress for thermal uses has been offset, all things being equal, by the fact that dwellings are becoming larger.

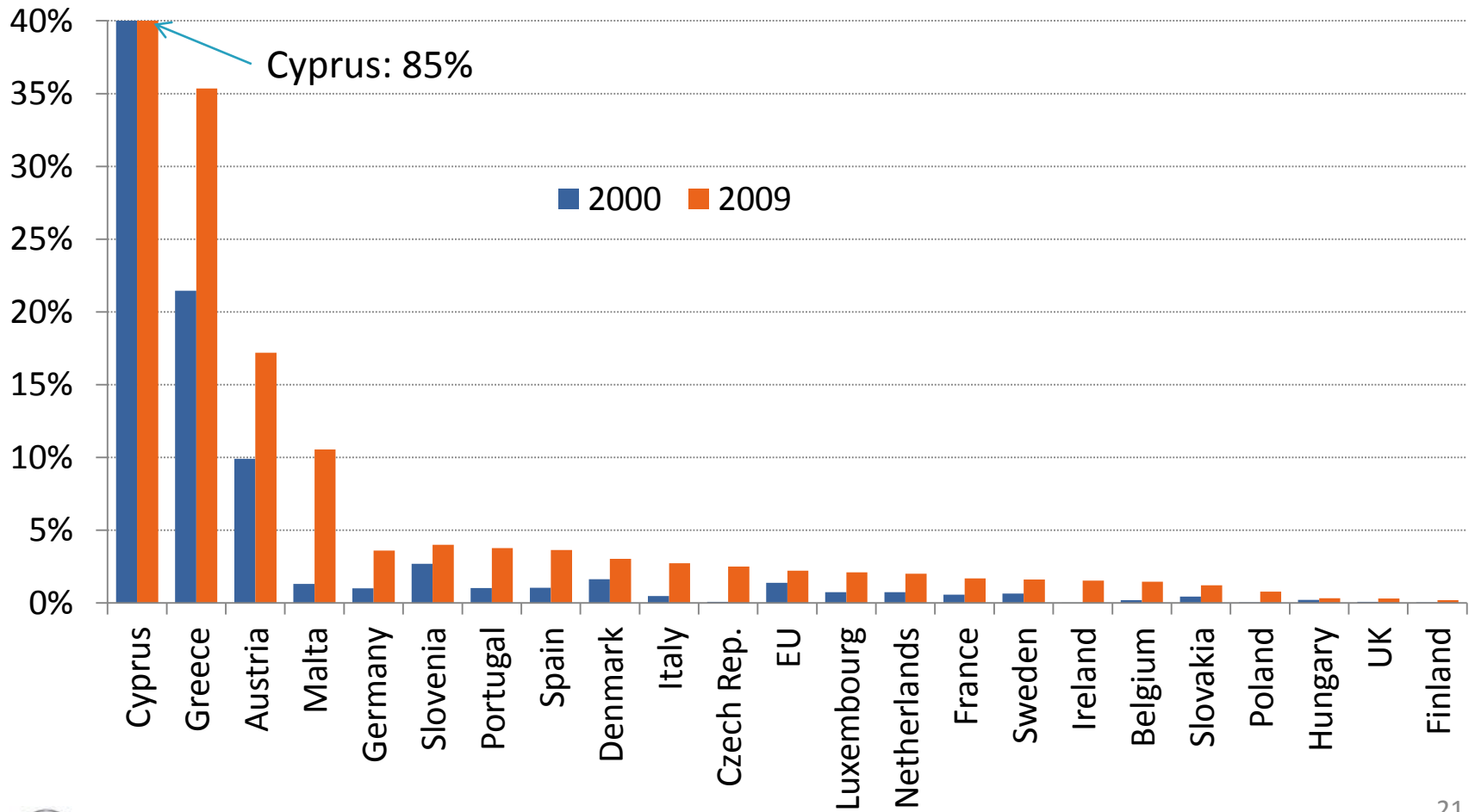
Average consumption per m<sup>2</sup> vs consumption per dwelling for household for space heating (1997-2009)



1. Overall energy consumption and drivers
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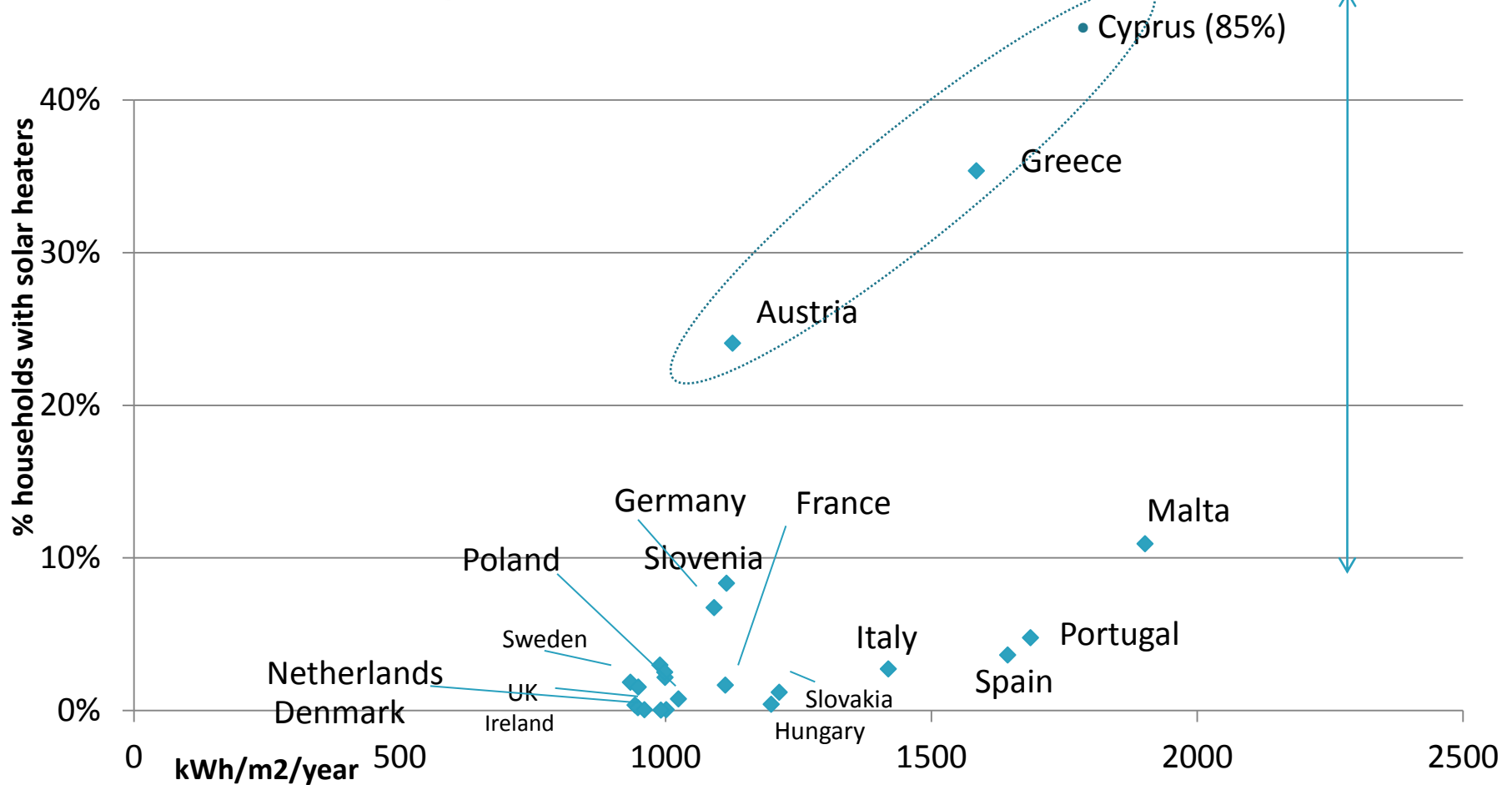
Large diffusion in southern countries and Austria: about 85% of dwellings with solar heaters in Cyprus, 35% in Greece, 17% in Austria, 11% in Malta; Larger progression in Greece (+ 15 points), followed by Malta and Austria (+9)

### Diffusion of solar water heaters: % of dwellings of solar water heaters



Benchmarking of the penetration of solar water heaters should be related to the annual solar radiation: Austria is the benchmark for countries with medium solar radiation (from 3% in 1990 to 24% to 2009) and of course Cyprus for countries with good solar radiation

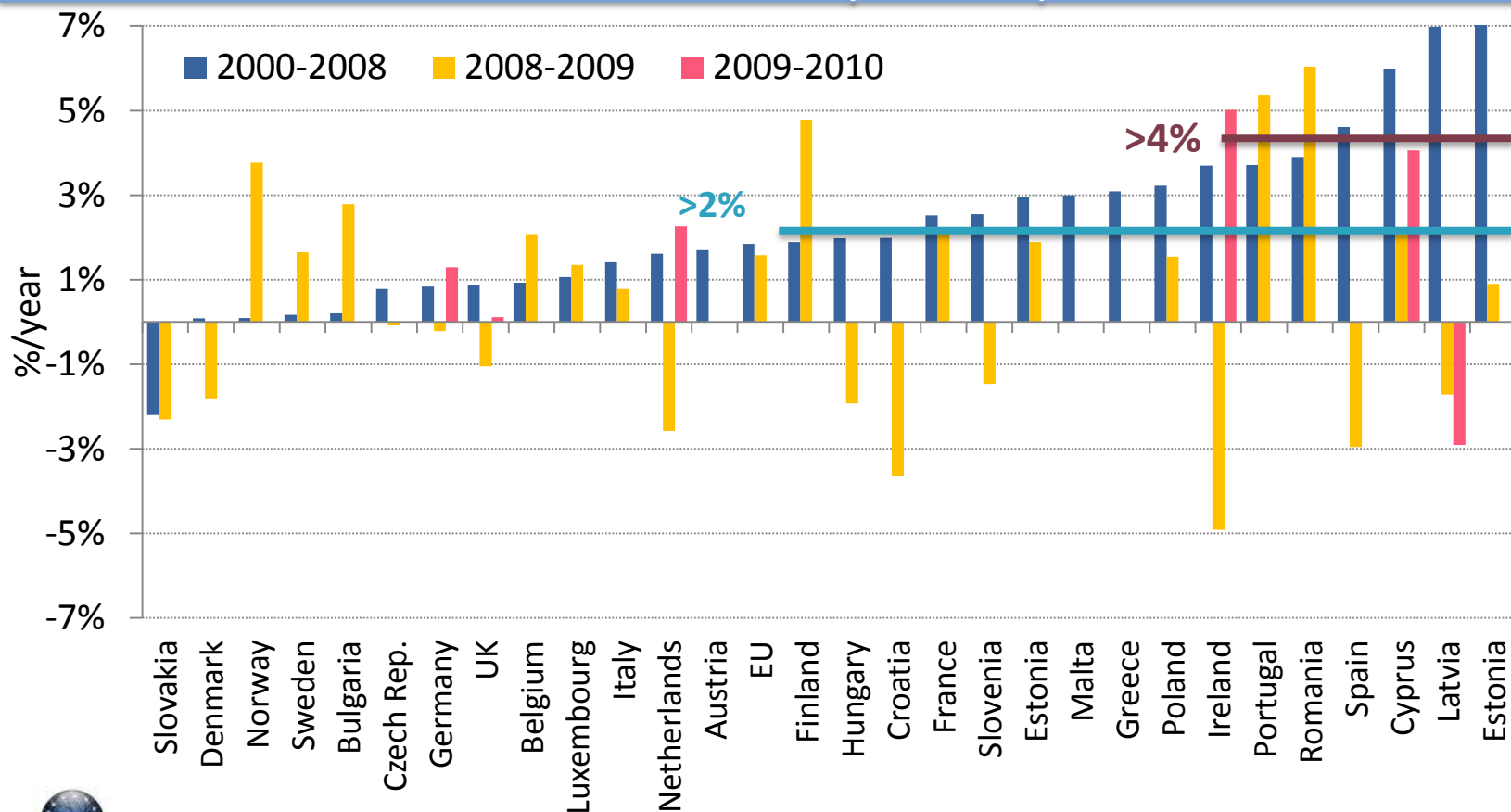
## % of dwellings with solar water heaters and solar radiation



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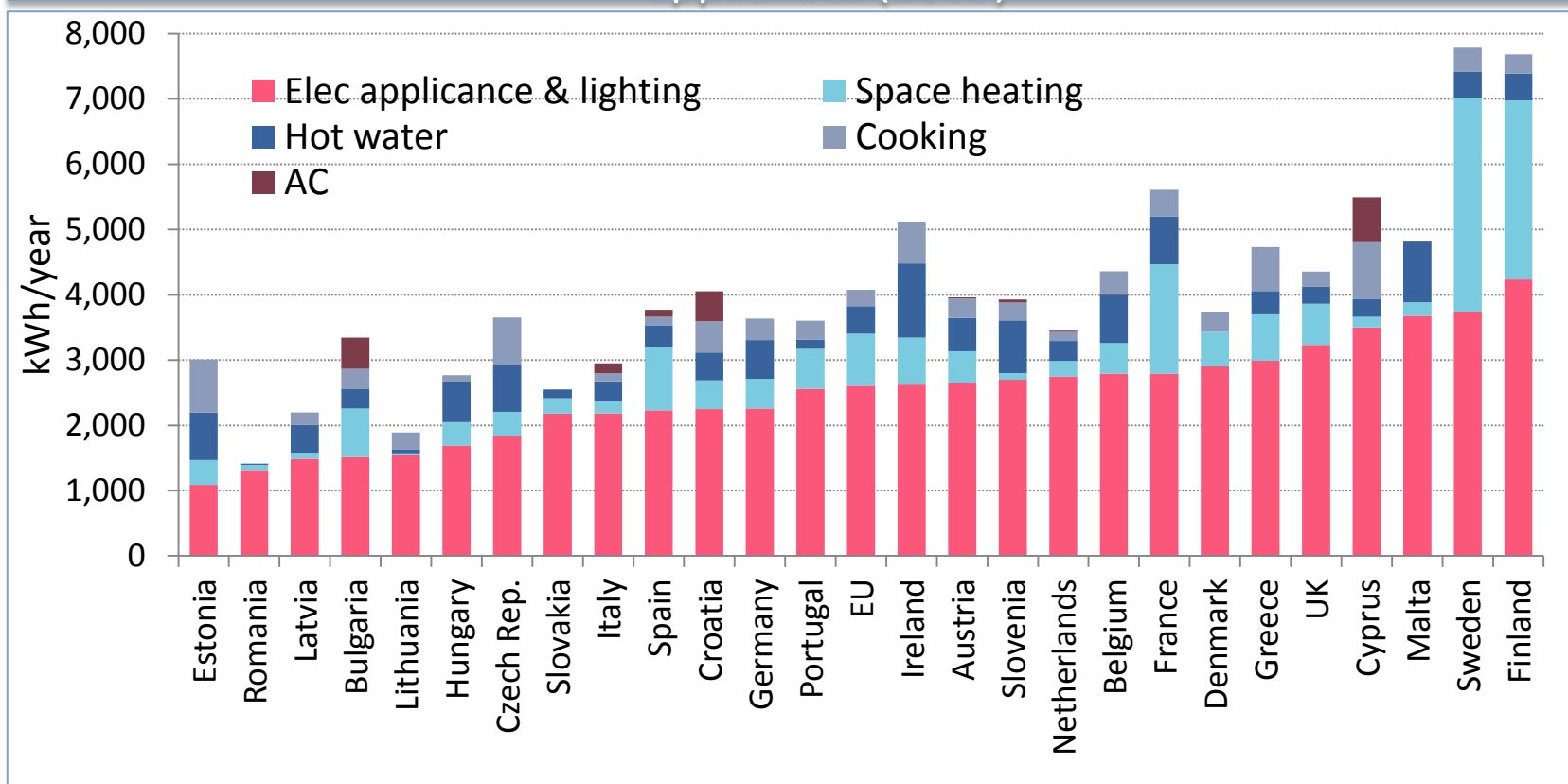
- Rapid increase in the electricity consumption between 2000 and 2008 in half of countries, with 6 countries > 4%/year and 10 countries around 2-4%/yr (1.7% for EU).
- Decrease in Slovakia or very low progression in Norway, Denmark, Sweden and Bulgaria, partly due to substitution of electricity for thermal uses
- Very rapid progression in south Europe due to AC and in Baltic countries.
- Strong impact of the 2009 crisis, except in France, Portugal & Croatia : net slow down in Estonia Italy, Poland & Cyprus; severe drop in UK, Spain, Ireland, Netherlands

### Trends in the electricity consumption



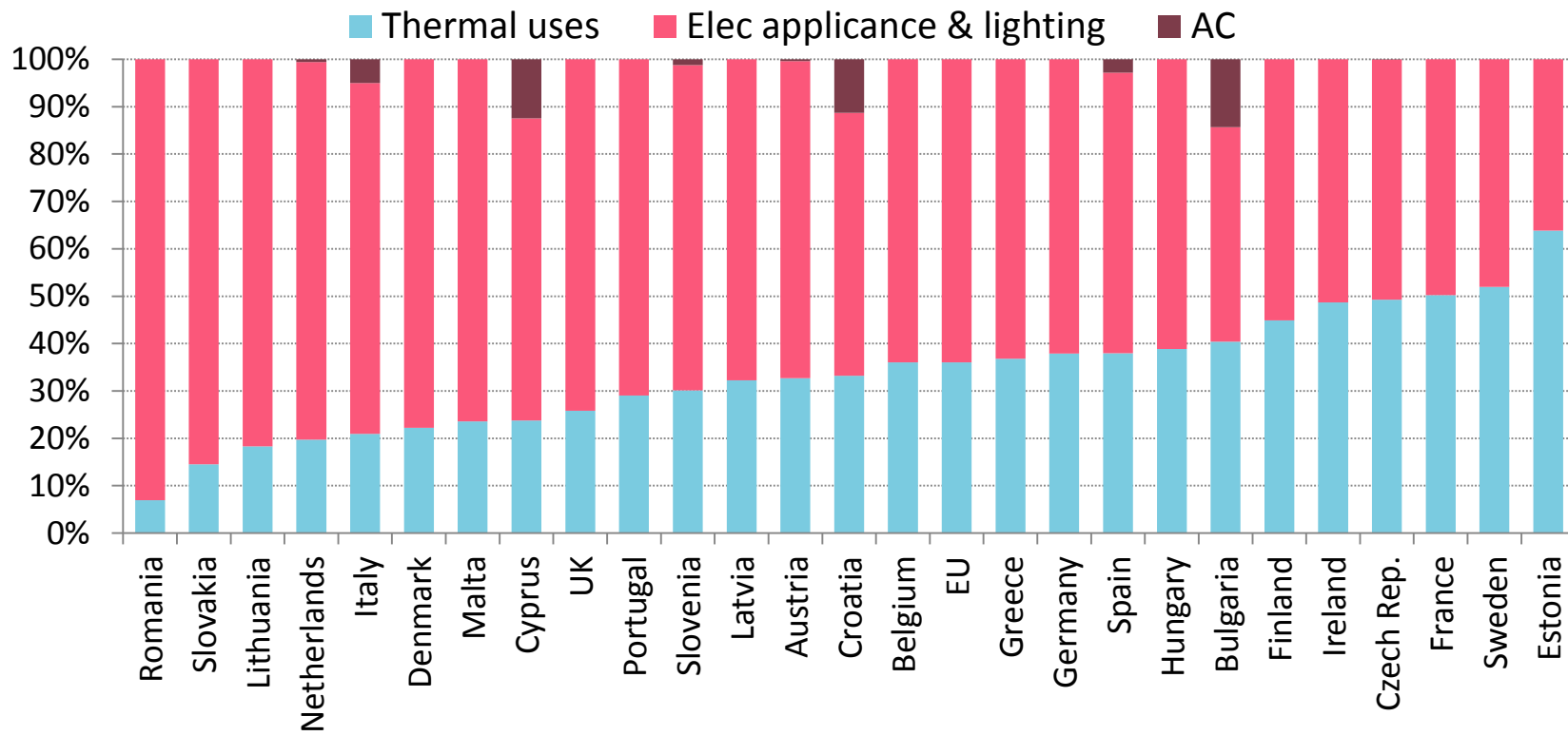
- Thermal uses of electricity important in Sweden, France, Ireland, Finland
- Consumption for electrical appliances and lighting (excl. thermal use) in a range of 1300 kWh/yr for Bulgaria, Romania to 3600 kWh for Cyprus, Malta and Sweden and > 4000 kWh in Finland
- Still low contribution of AC (Air Conditioning) in southern countries

## Electricity consumption per dwelling: thermal uses vs electrical appliances (2009)

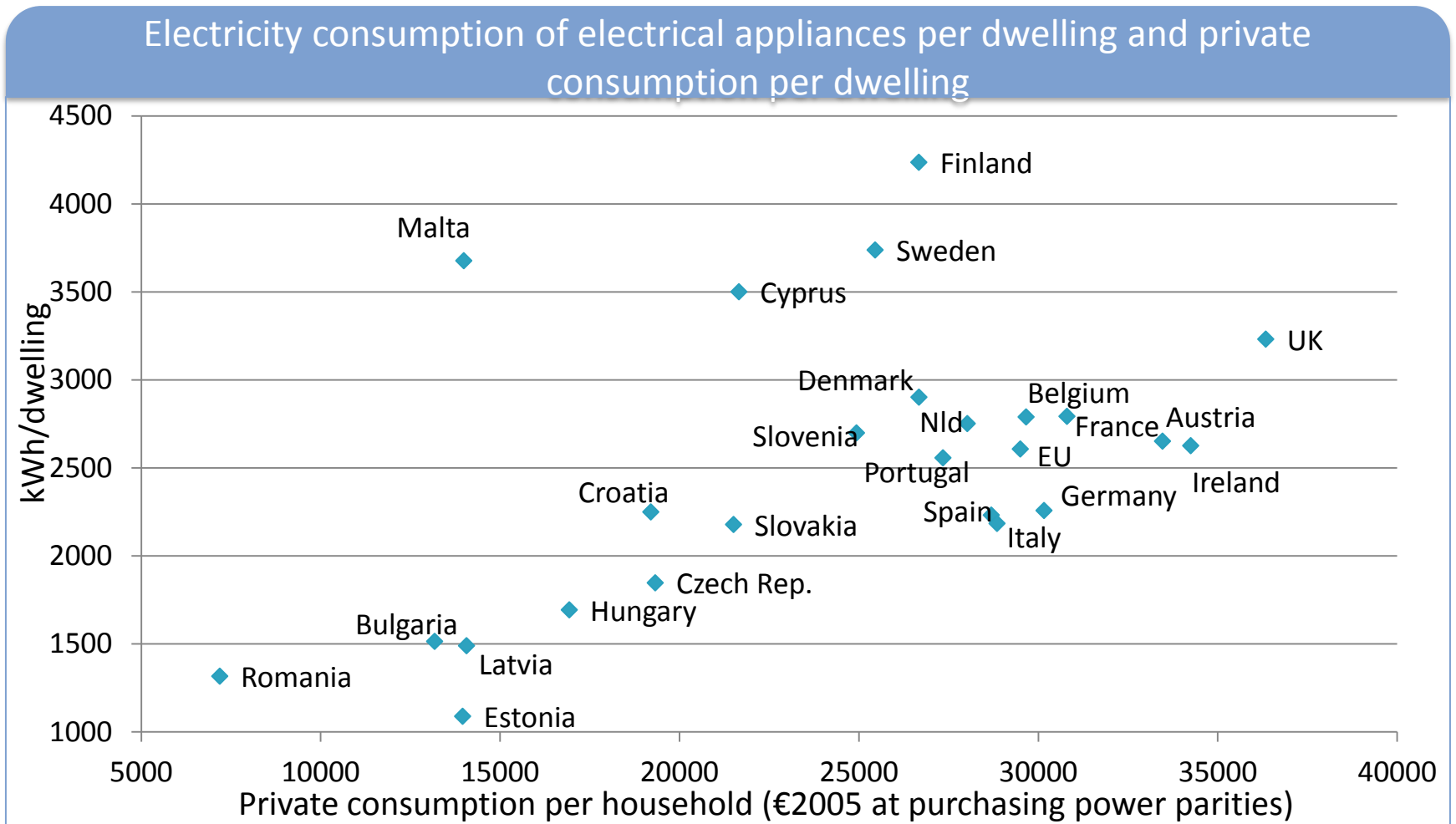


- Thermal uses of electricity important above 50% in Sweden, France and Czech Republic and above 40% in Ireland, Bulgaria, Germany and Finland
- Still low share of AC (Air Conditioning) in southern countries (10-15%) of total electricity consumption

Electricity consumption per dwelling: share of thermal uses (2009)

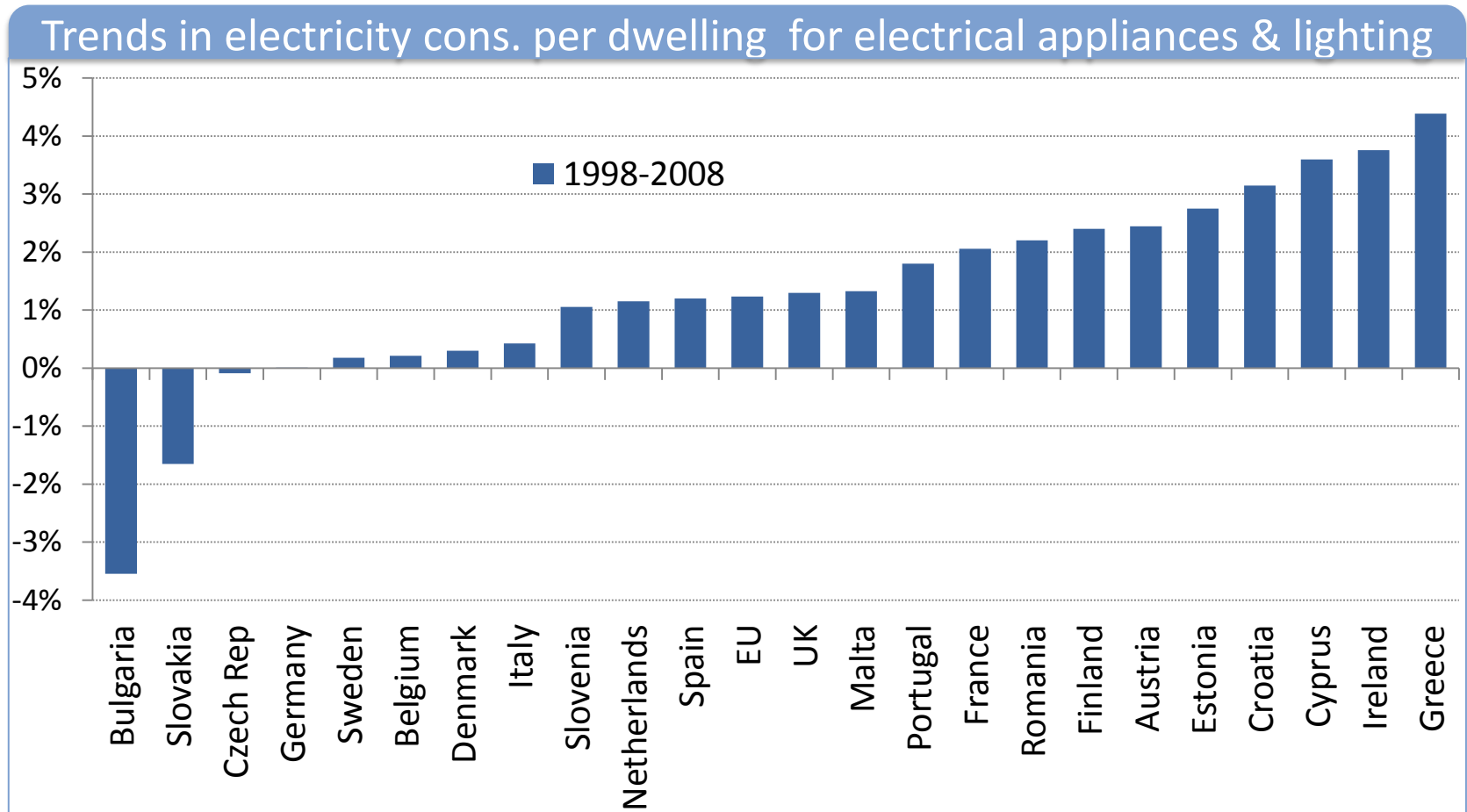


Electricity use for electrical appliances and lighting is correlated with the average income. However for a given level of income, there exist huge disparities reflecting differences in lifestyles and in equipment efficiency



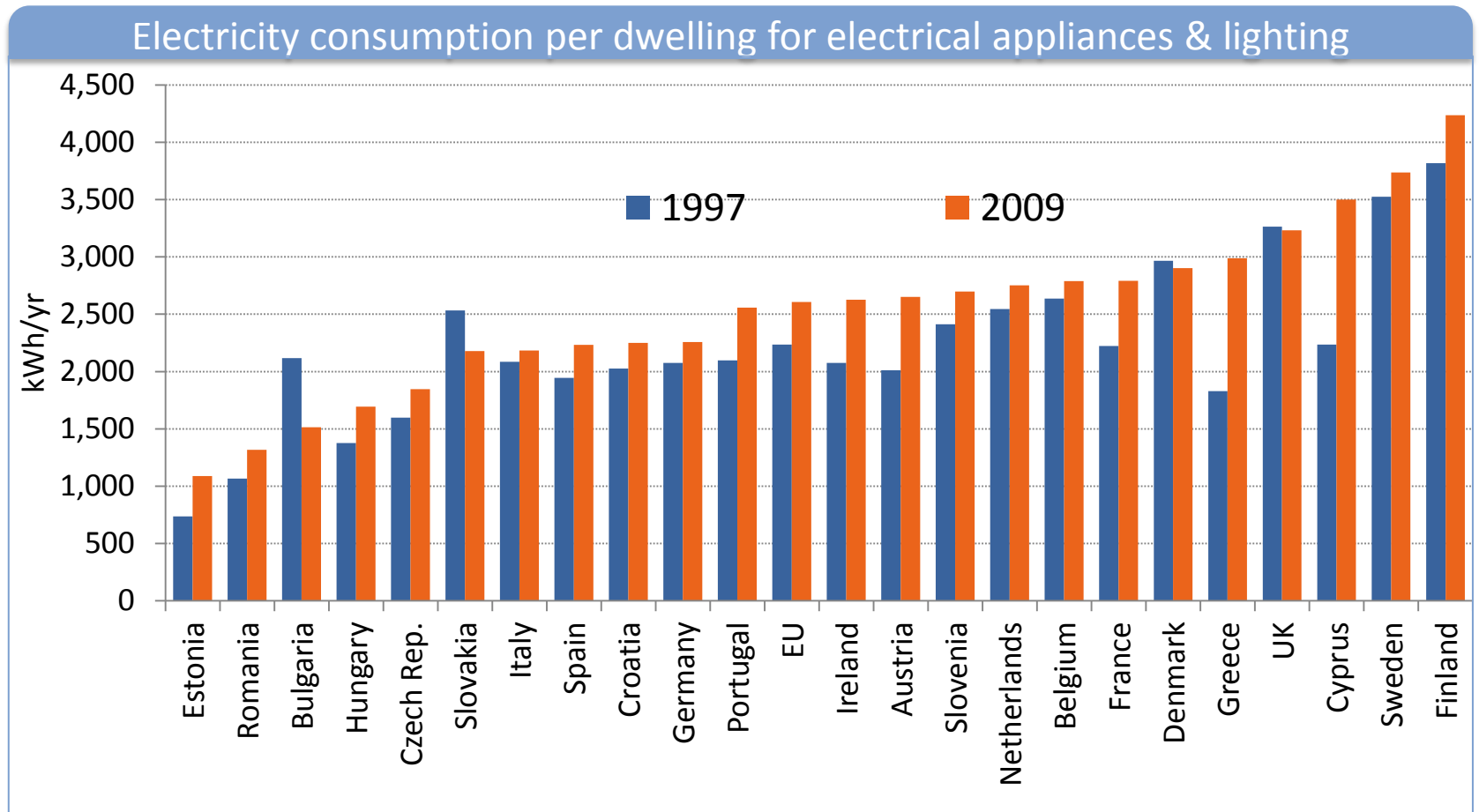
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- Very unequal progression across countries since 1998: decreasing trends in Bulgaria and Slovakia, low growth for Czech Rep., Sweden and Germany.
- Rapid growth in southern countries (Cyprus, Greece, Croatia)
- EU average 1,2%/yr



2000-2007 for Estonia; 2000-2008 for Malta, 1998-2007 Finland; Greece: AC included

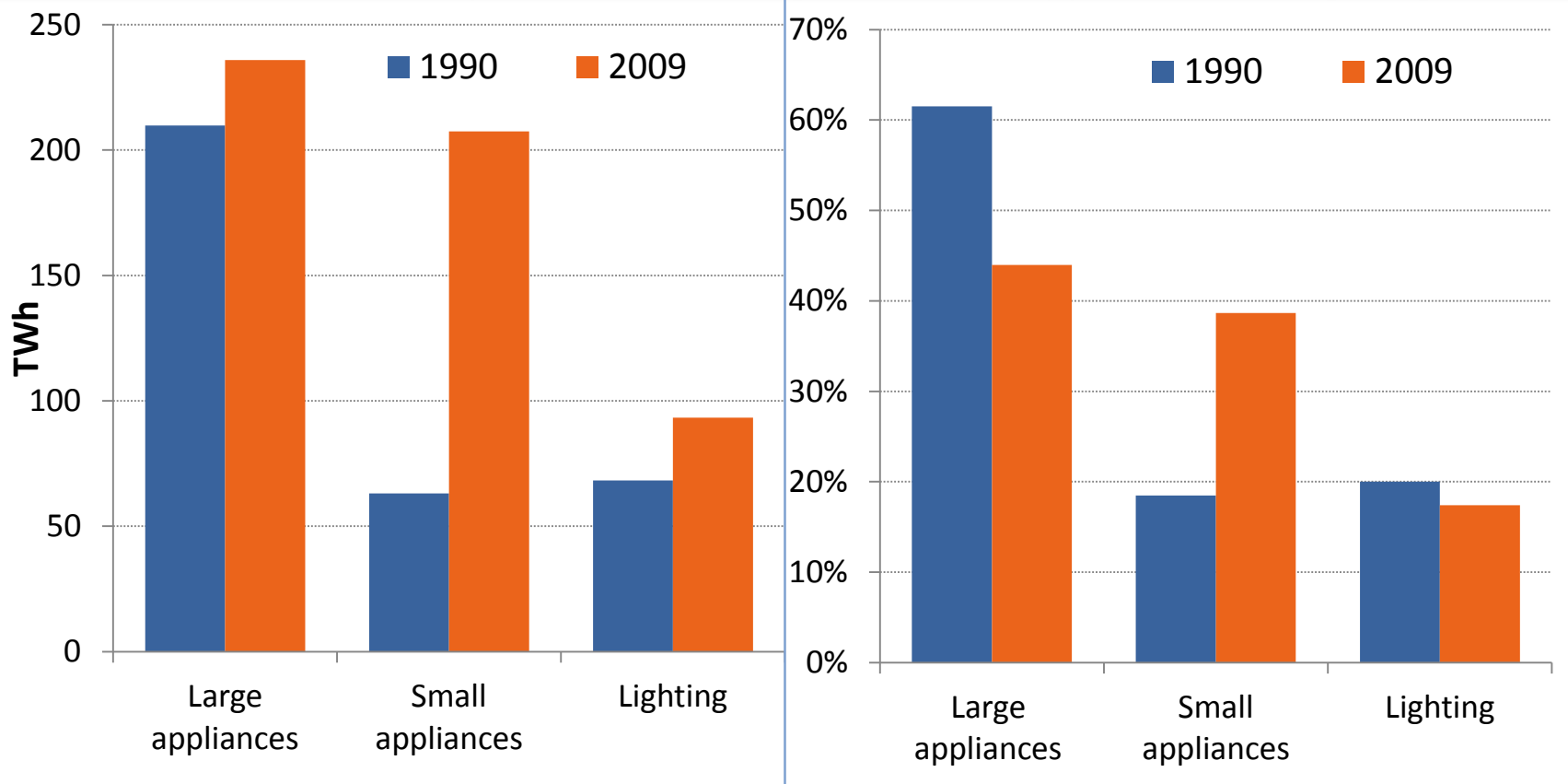
Among EU countries there are significant discrepancies in the electricity consumption for electrical appliances and lighting: in a range from 1000 kWh (Estonia, Romania) to 4000 kWh (Finland, Sweden)



2008 for Spain, Slovenia, and Romania; 2007 for Lithuania

- Strongest growth is recorded for the small appliances (6.5%/year): increase of their share of the total electricity consumption for appliances and lighting from 18% in 1990 to 39% in 2009 (+21%).
- The consumption of large appliances recorded a moderate growth and their share declined from 62% to 44%. With a share of approximately 20%, lighting is rather stable

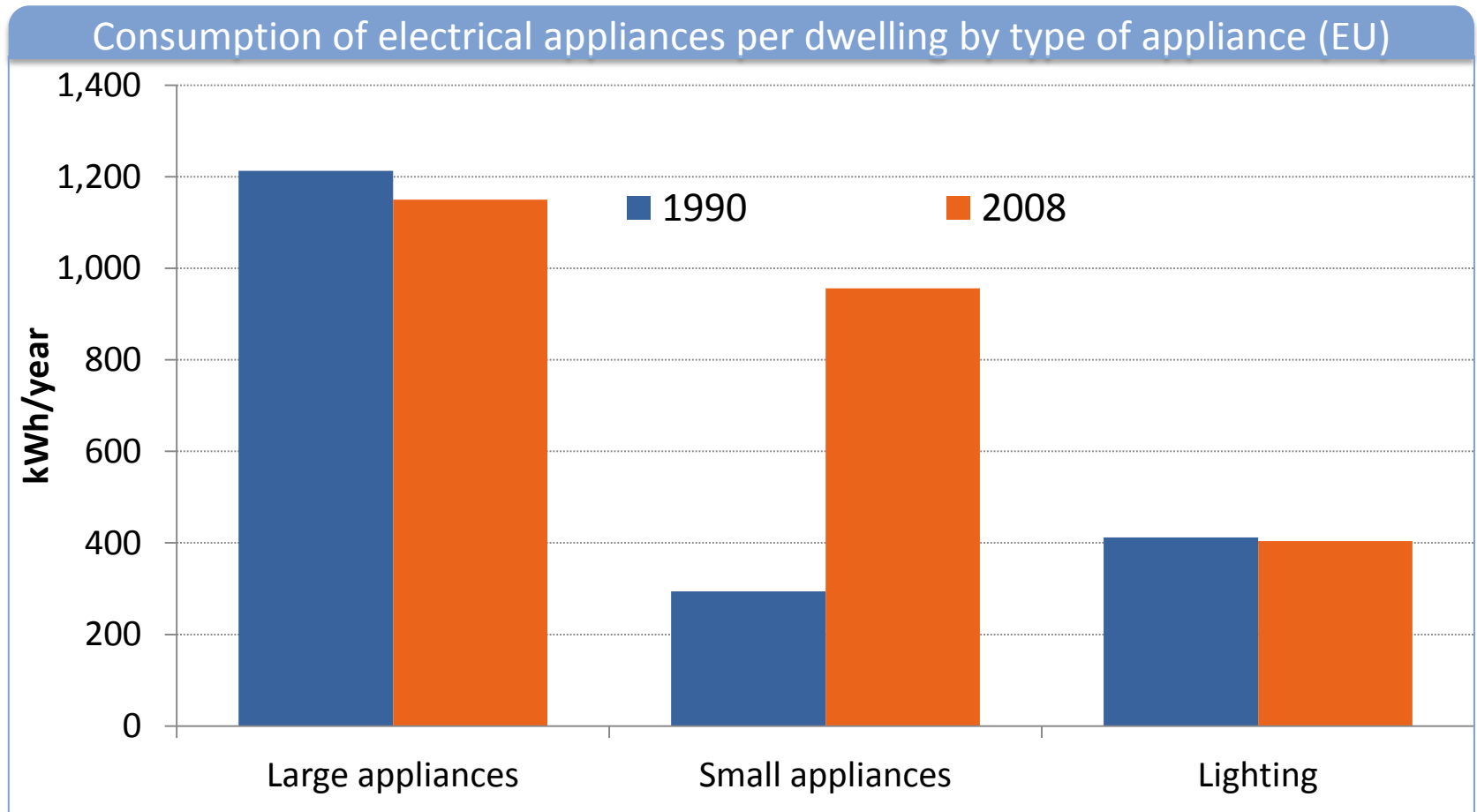
Breakdown of consumption between large and small appliances and lighting (EU)



Slight decrease of the annual consumption per dwelling for large appliances (50kWh per year).

Household consume three times more for small appliances in 2008 than in 1990 (from about 300 to 950 kWh/year);

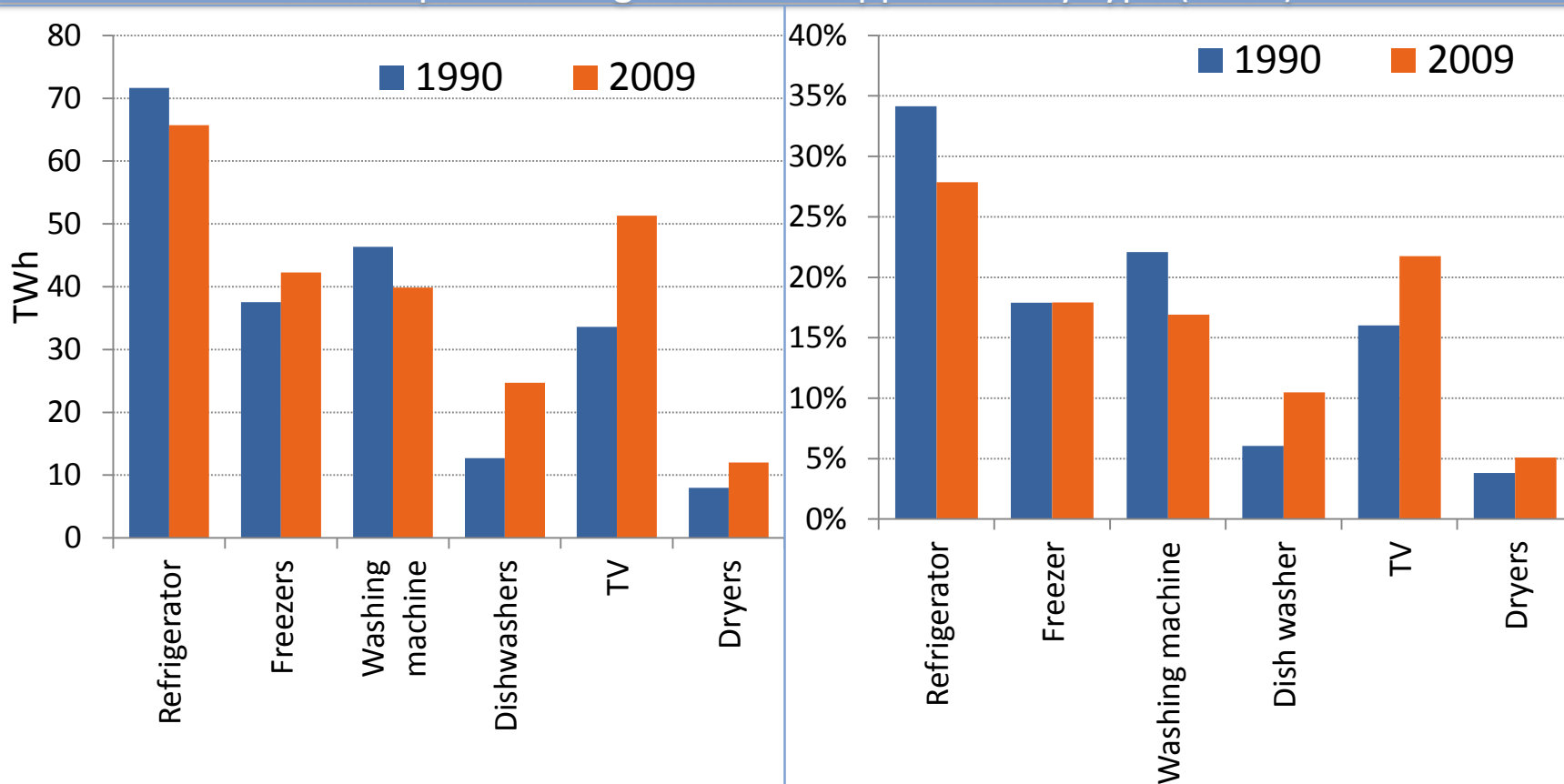
Slight increase for lighting



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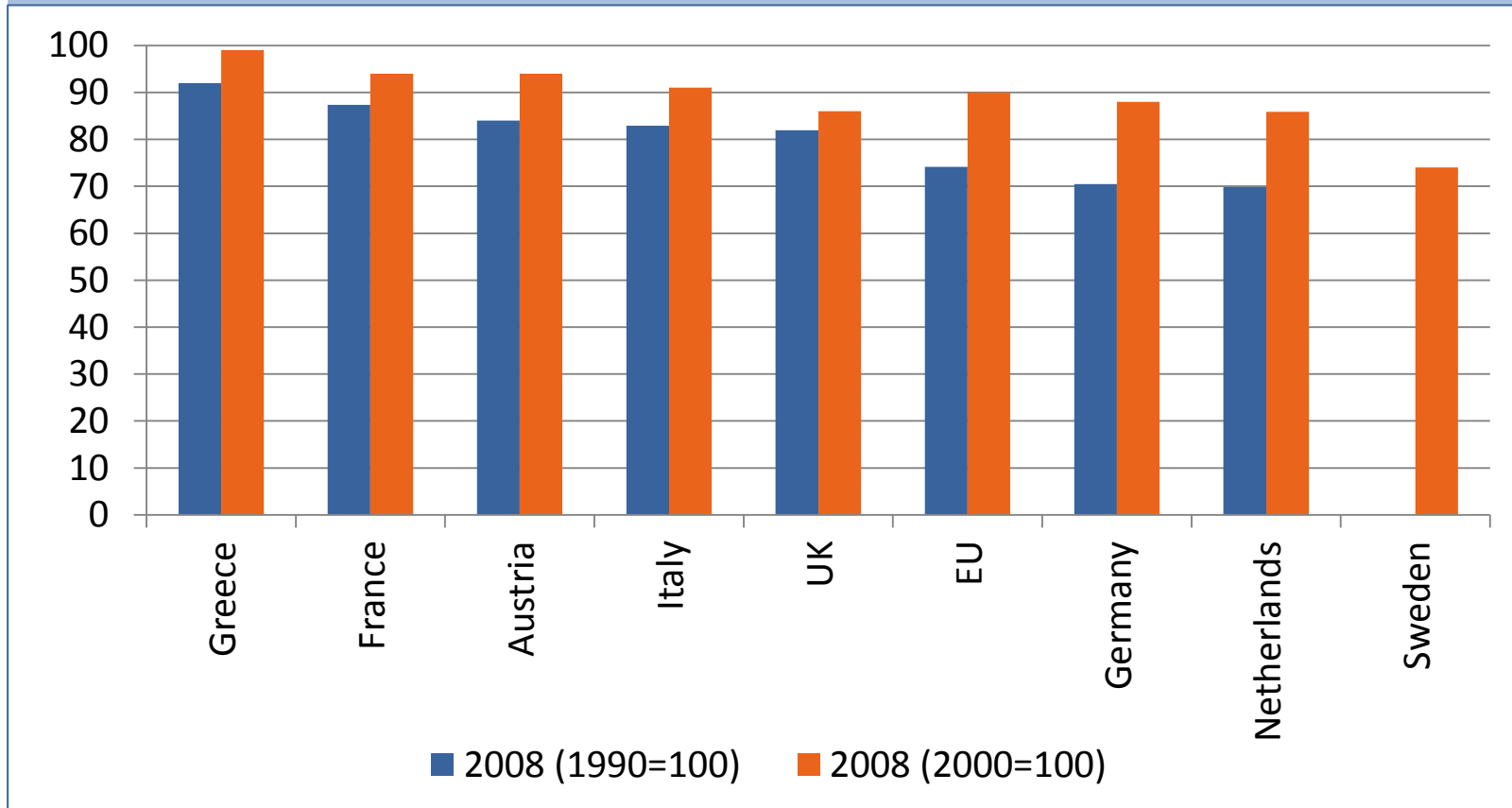
- Televisions, clothes dryers and dish washers increased their share over the period 1990-2009, due to higher penetration rates
- Refrigerators and washing machines registered a decline, mainly due to substantial electricity savings

Consumption of large electrical appliances by type (EU27)

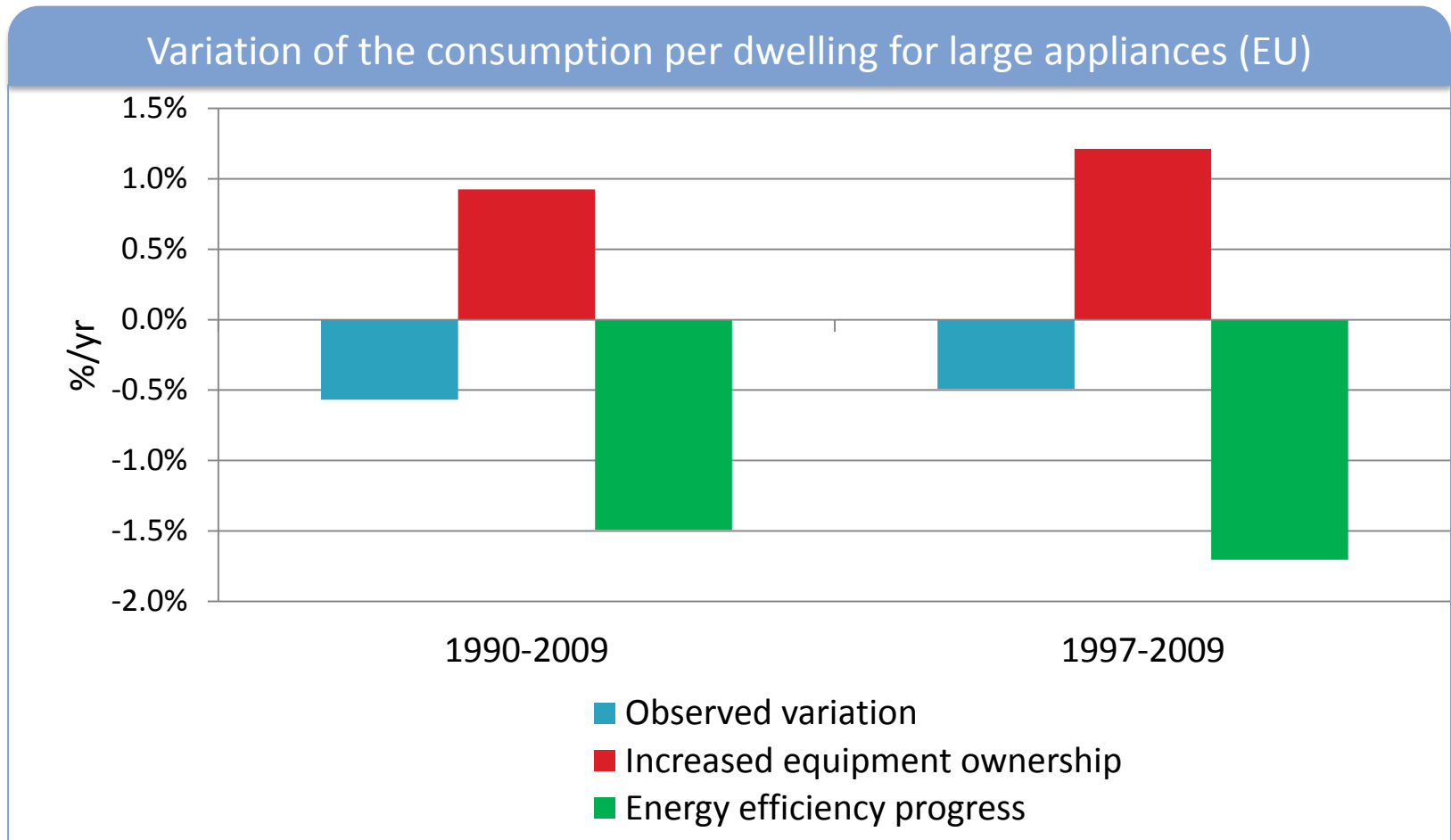


Large appliance are on average 25% more efficient than in 1990, with some countries registering very strong progress (Germany, Sweden, and Netherlands): ~2%/yr  
Slight reduction in the progress achieved since 2000 (1,6%/yr over 1990-2008 and 1,3%/yr since 2000 at EU level)

### Energy efficiency trends for large appliances (ODEX)

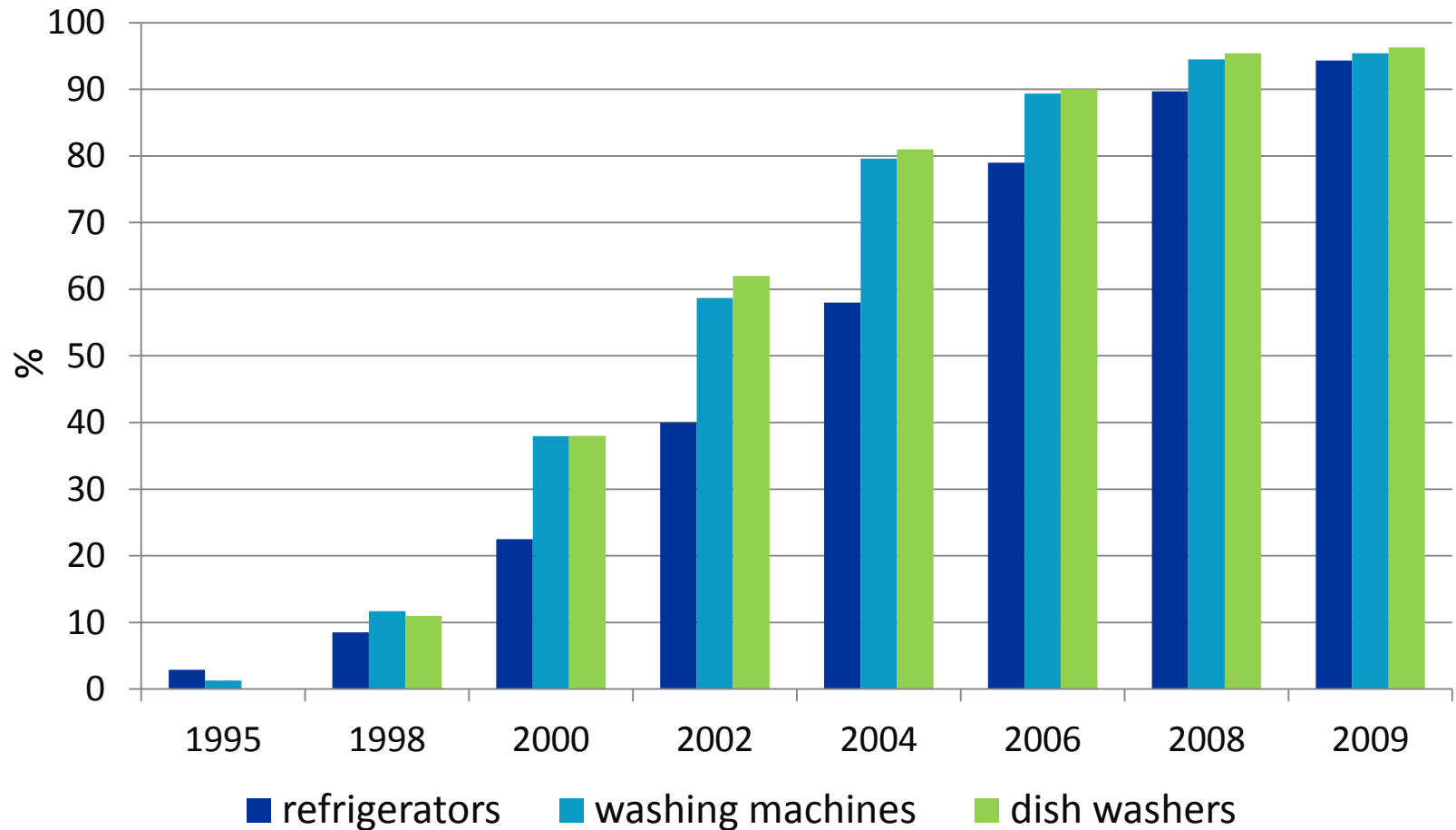


- Almost all energy efficiency gains over the last years have been offset by an increase in equipment ownership
- As a result, electricity consumption per household for large appliances is only slightly lower in 2009 than in 1997.

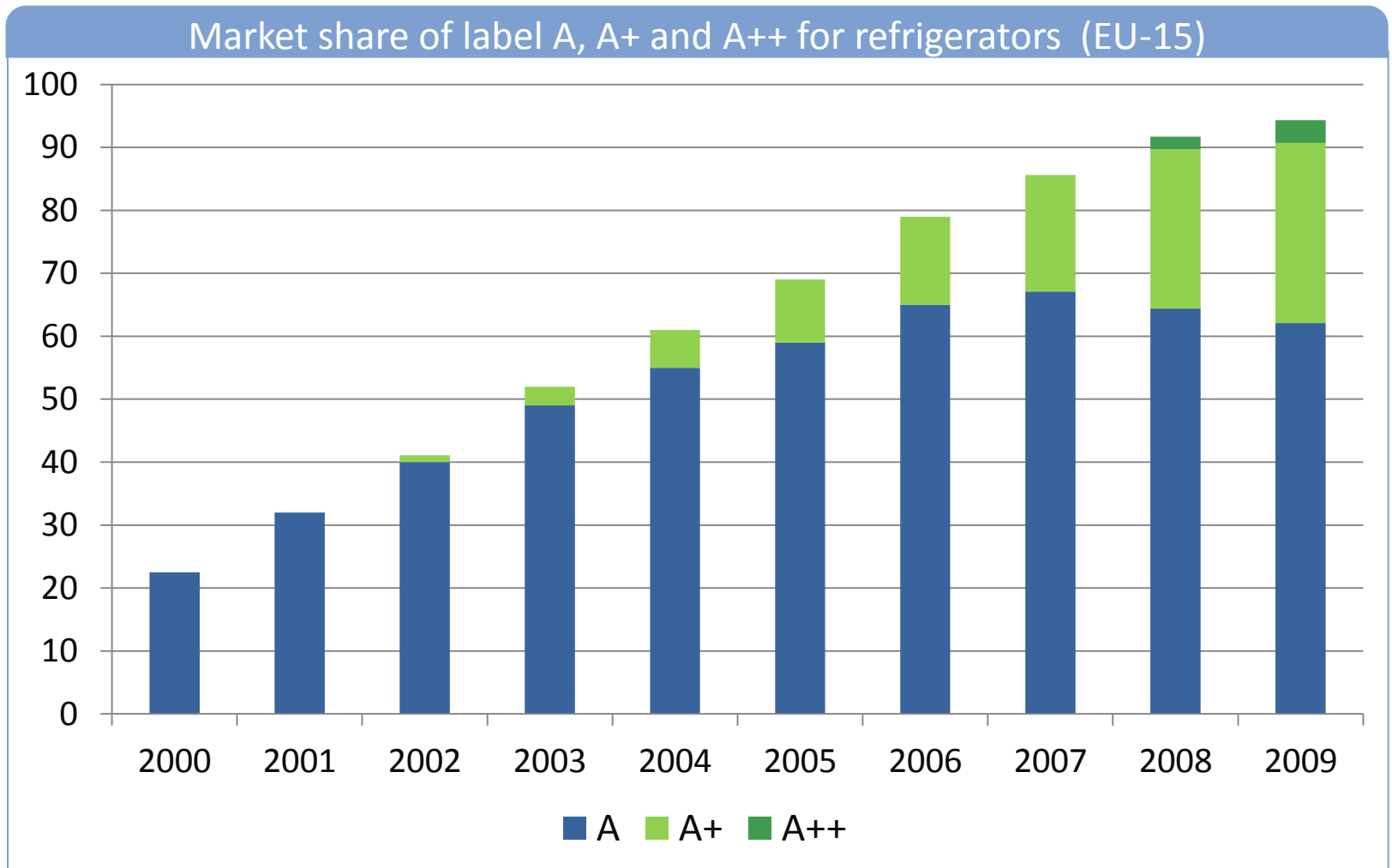


Almost 90% of refrigerators, washing machines and dishwashers with label equal or above A class

Market share of label A, A+ and A++ for cold and washing appliances (EU)

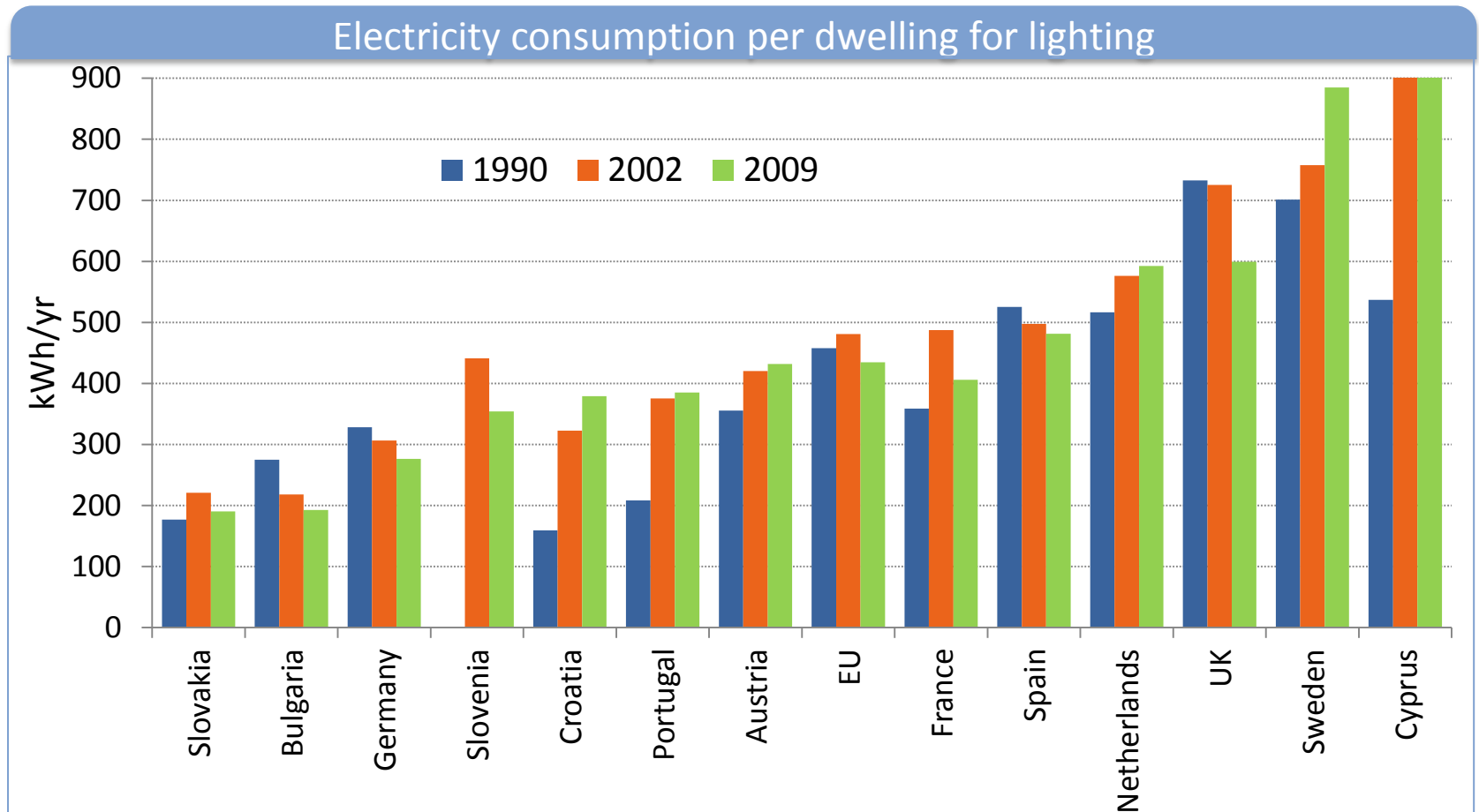


- About 30% of new refrigerators with labels A+ or A++ in the EU in 2009 up from less than 10% in 2005  
Around 40% in The Netherlands and 45% in Germany



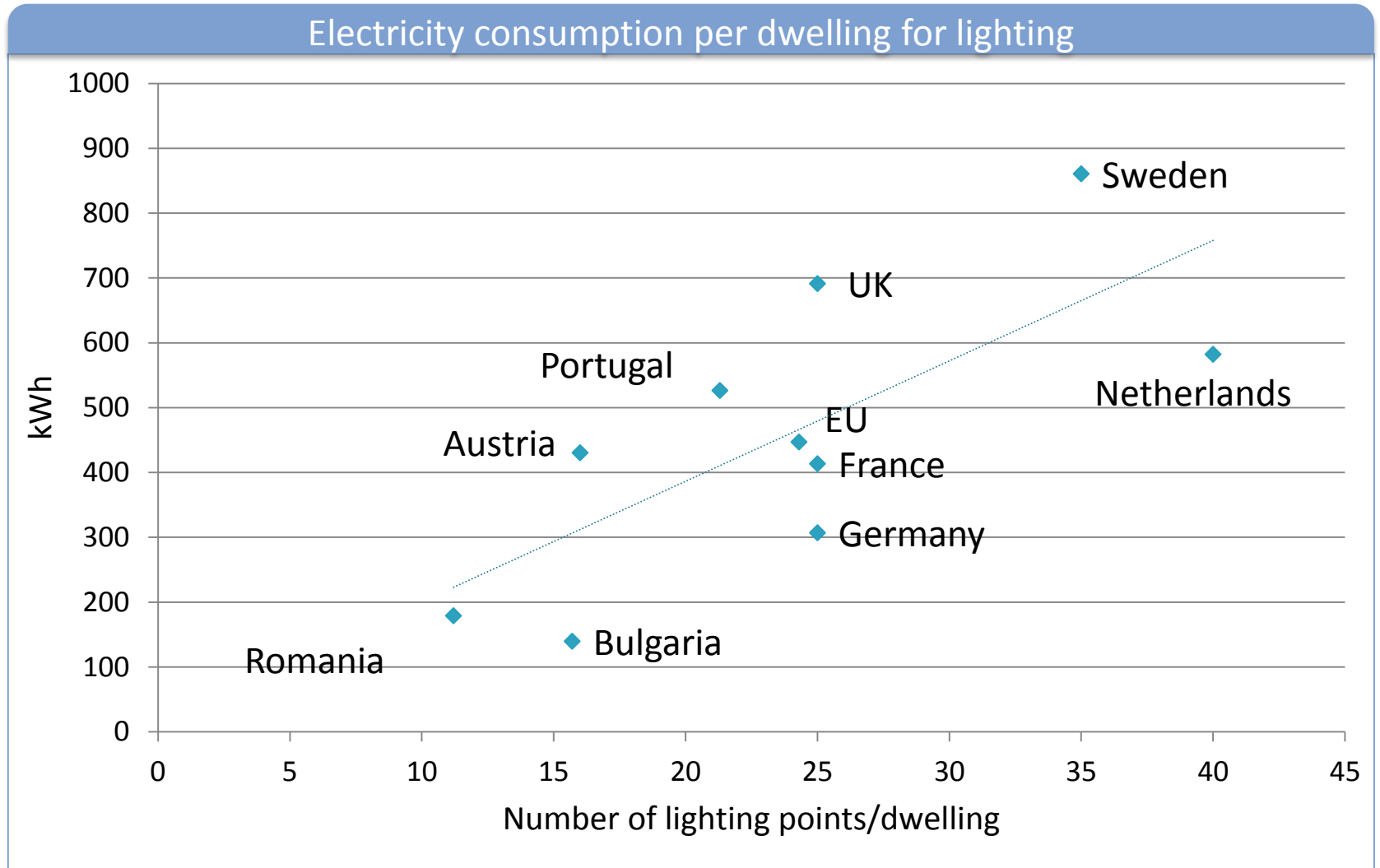
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- There is an unequal distribution of lighting consumption per dwelling among EU countries: from 200 kWh/year for Slovakia and Bulgaria up to 900 kWh/year for Sweden or Cyprus. In half of the sample of countries lighting consumption decreased thanks to the diffusion of CFL



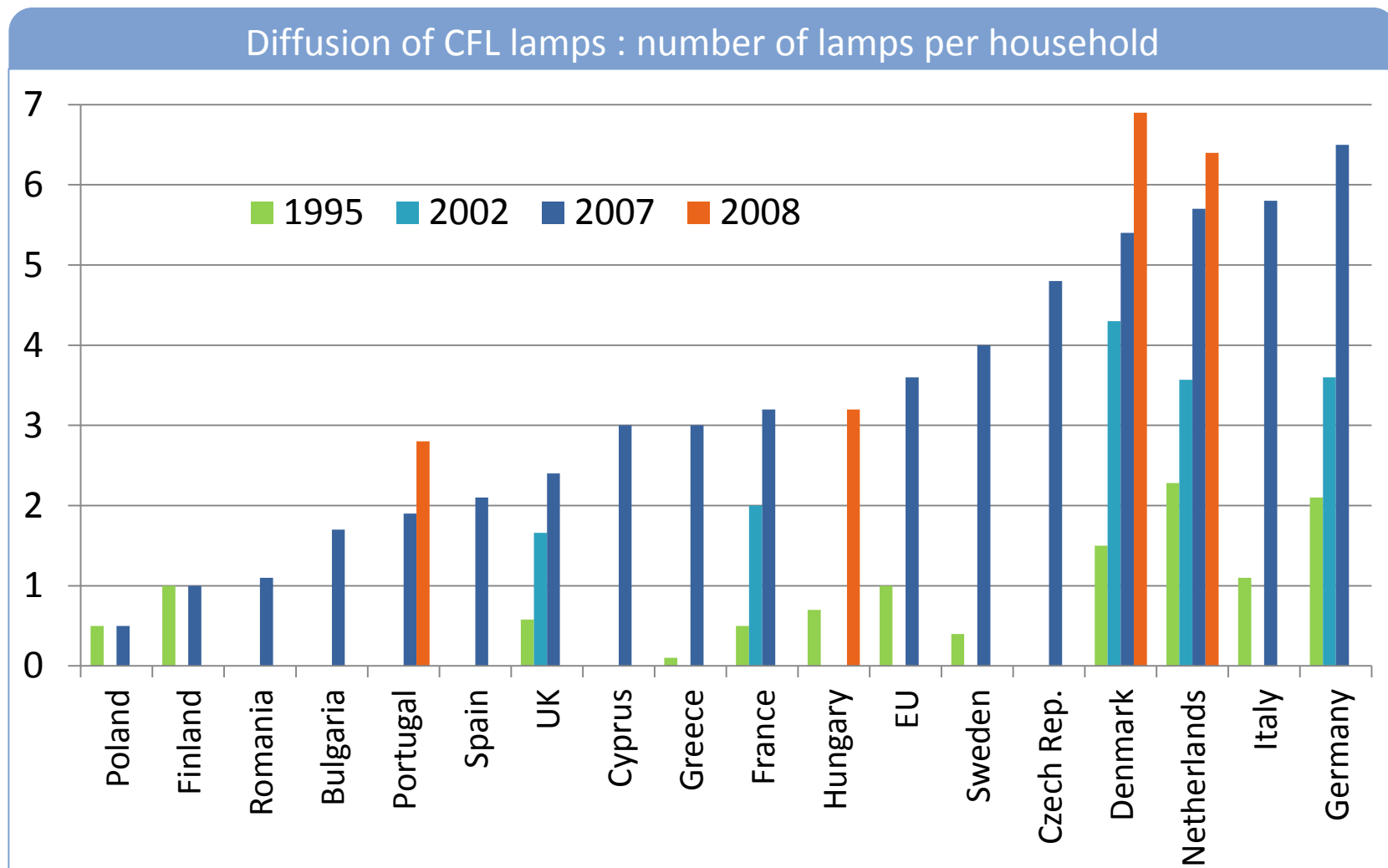
2007 for Portugal and UK; 2006 for Romania

The level of consumption depends on the efficiency of lamps, i.e. the penetration of CFL, but also on the number of lighting points ... and this number is increasing



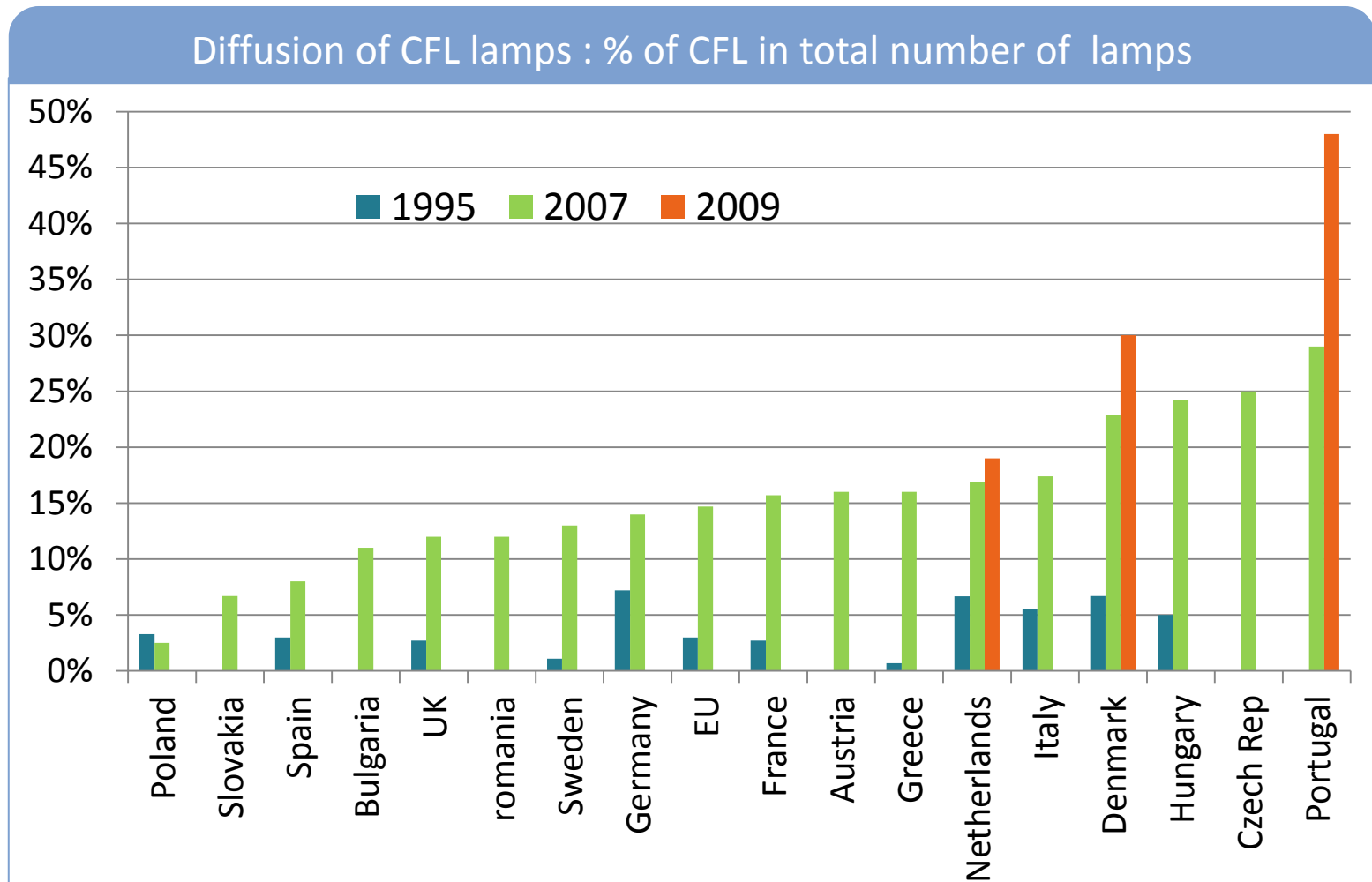
Number of lighting points: compiled by Enerdata from various sources, of which Remodece, JRC-Ispra

About 7 CFL per household in the countries with the largest diffusion of CFL



Compiled by Enerdata from various sources, of which Odyssee, Remodece, JRC-Ispra

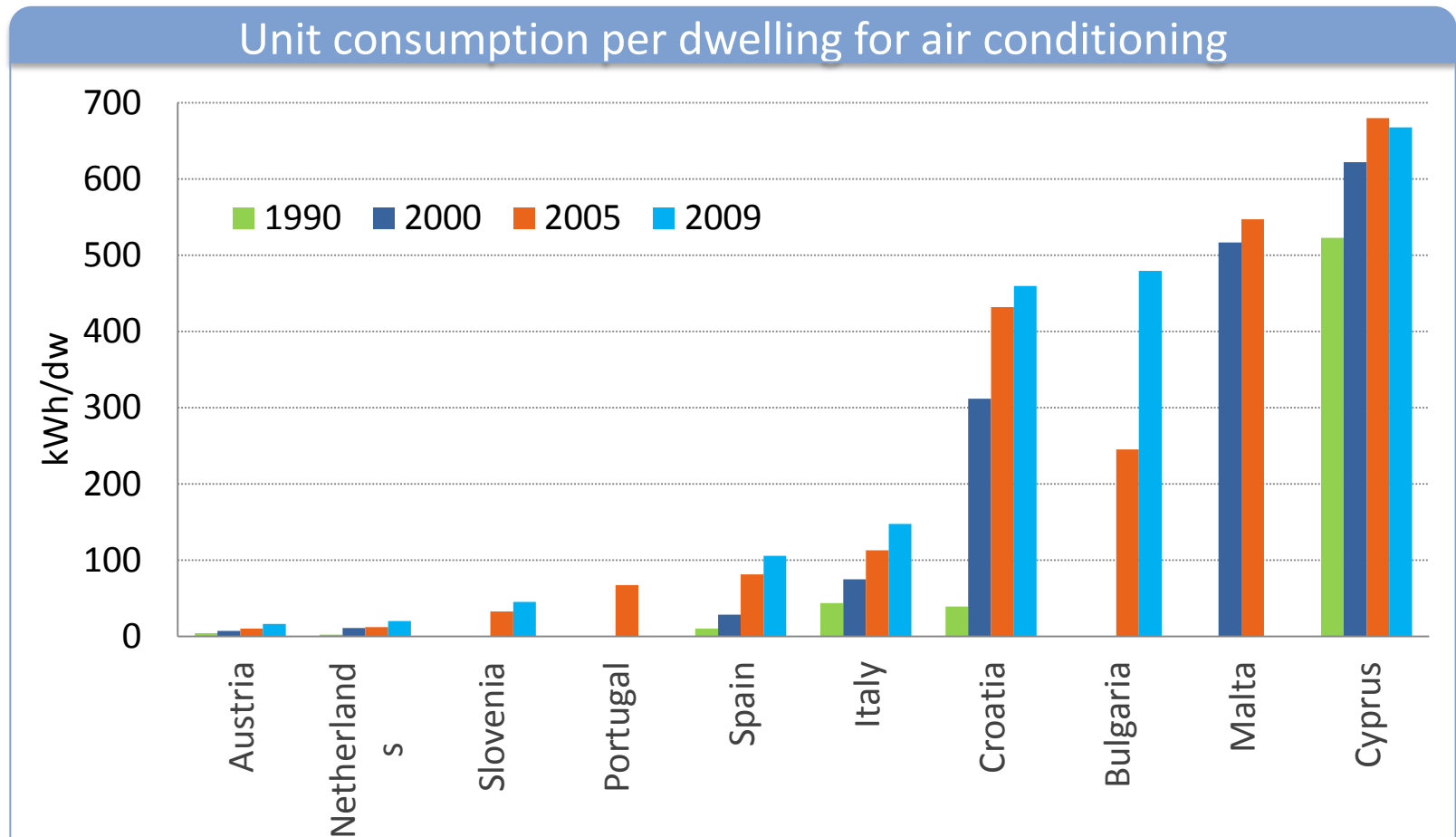
High penetration of CFL lamps in Portugal, Czech Republic and Hungary : the % of CFL in total number of lamps depend on the number of CFL per household and the total number of lighting points (above 30 in Sweden and Denmark, below 20 in new member countries)



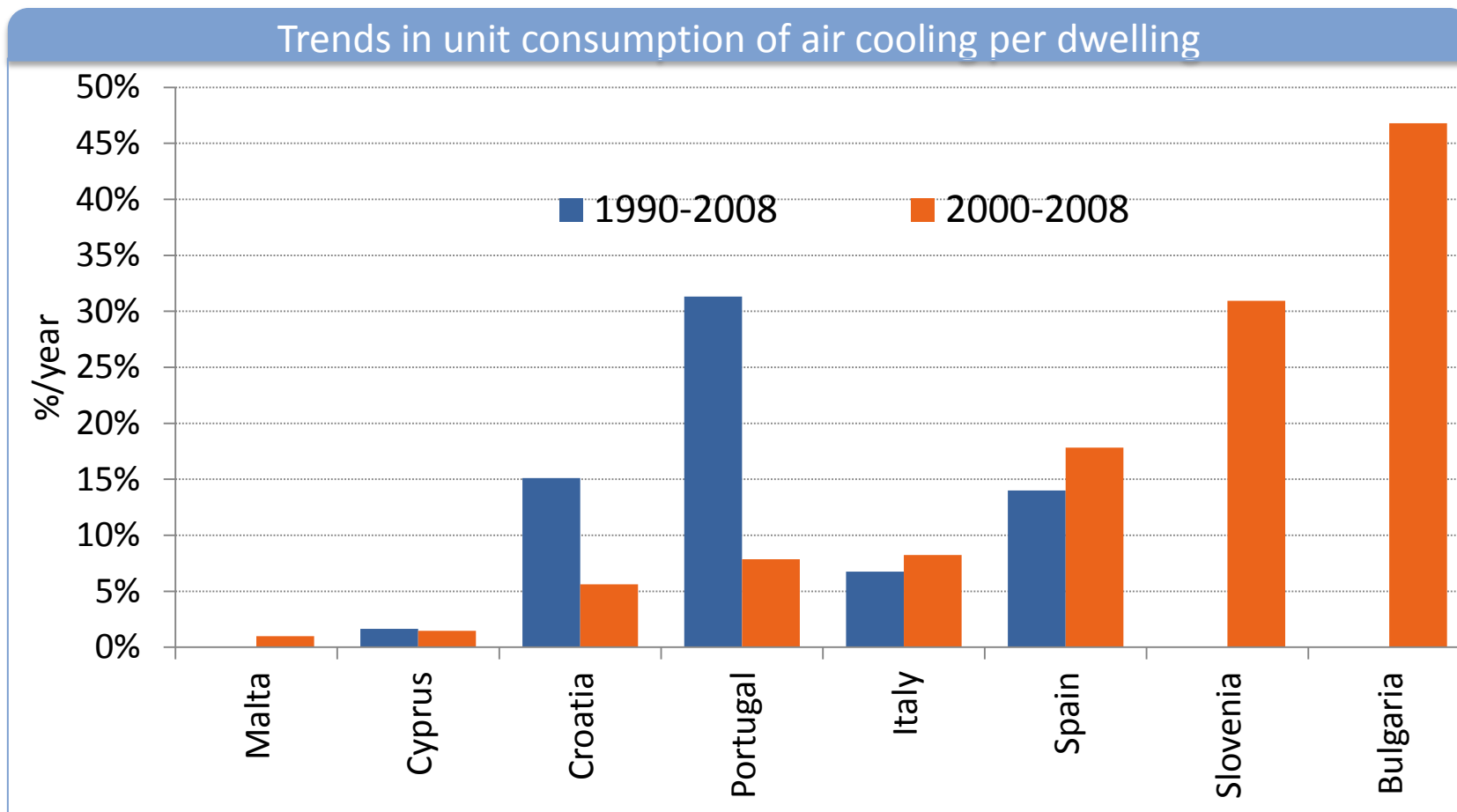
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Even if AC represents only 10% of total electricity consumption in the largest AC consumers (Cyprus, Malta and Bulgaria), the average consumption per dwelling for this end-use is increasing as the AC stock is increasing

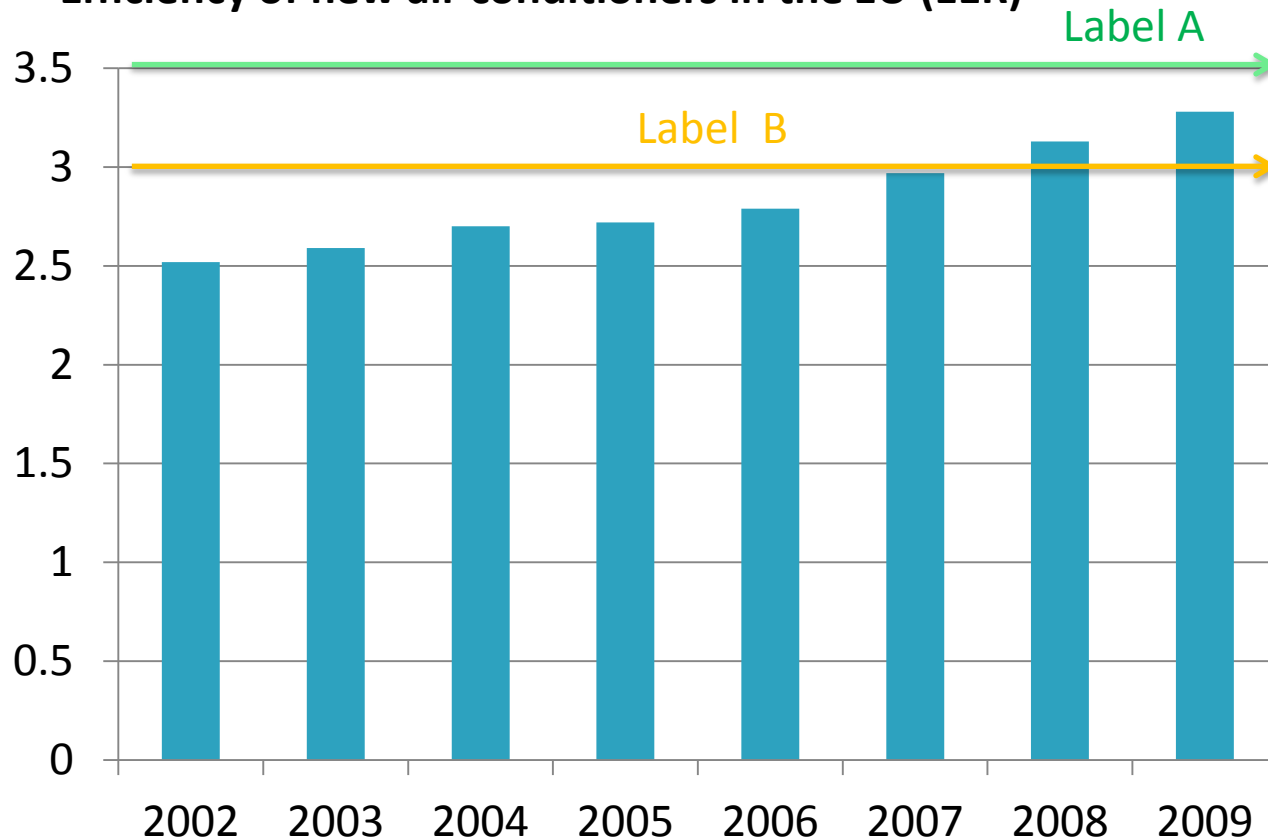


- Moderate growth for bigger air cooling consumers: Malta and Croatia and Cyprus
- Big accelerations in the trends for the new air cooling consumer: Bulgaria, Slovenia and Spain



# New air conditioners are 30% more efficient in 2009 than in 2002 in the EU

## Efficiency of new air conditioners in the EU (EER)

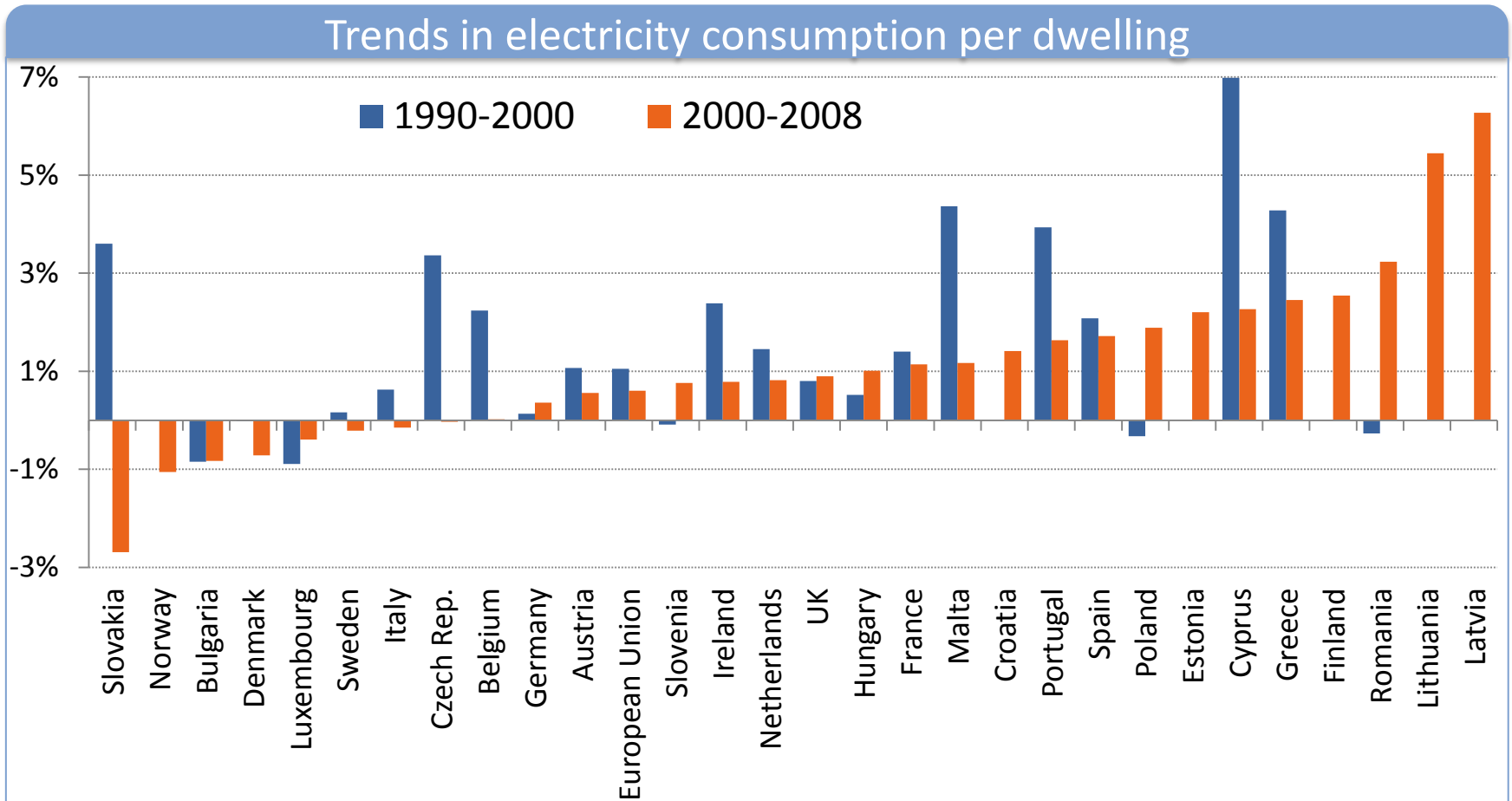


- Labelling since 2002
- % of units with variable speed drive increased from 4 % to 50%
- Almost 90 % of reverse cycles models (up from about 50% in 2002)
- Over half of sales in Italy (33%) and Spain (21%) (Greece 13% and France 7%)

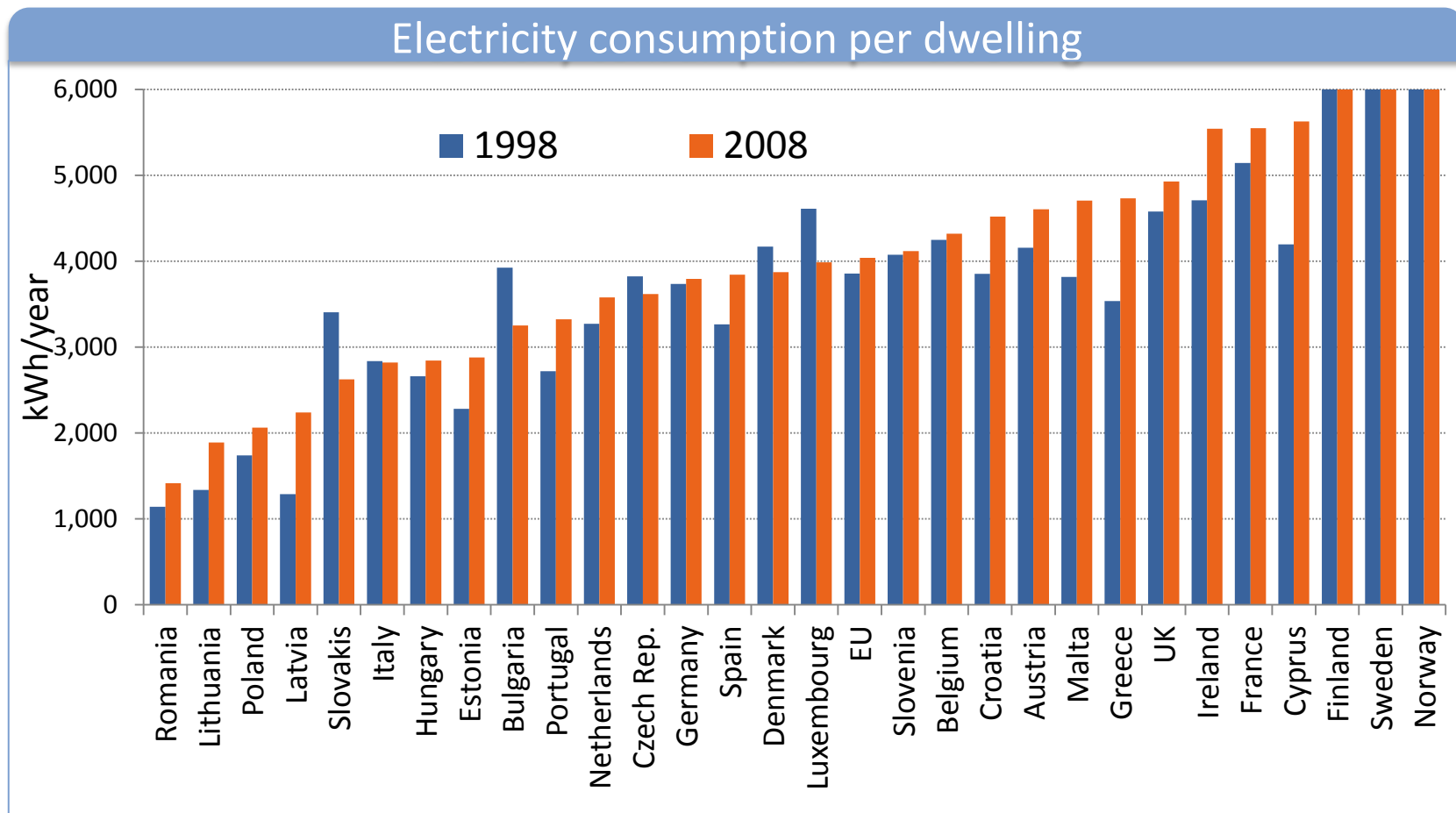
EER: kW per kW

Source: IEA, Mapping and Benchmarking, 2010; data from GFK; sales weighted; include split and multi-split (split about 95% of the market) ; products < 14kW

- Very different trends of electricity consumption per household
- Decrease in Slovakia, Bulgaria, Luxembourg, Norway, Denmark and Sweden, partly due to substitution of other fuels to electricity for thermal uses
- Very rapid progression in south Europe due to AC and in Baltic countries.



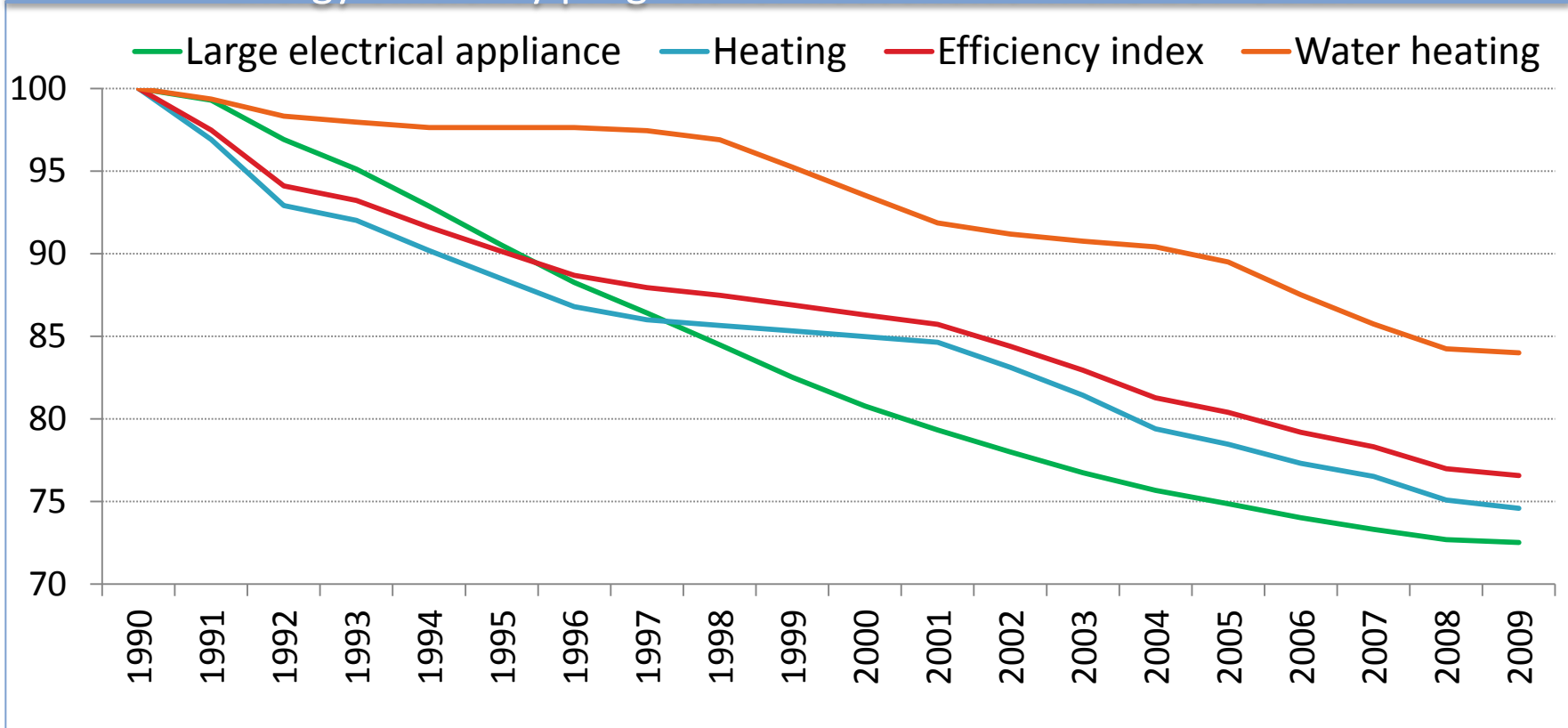
- Very unequal level of electricity consumption per household: very high level in Finland (~8000 kWh), Sweden (~9000 kWh) and Norway (>10 000 kWh); heterogeneity due to different use of electricity for thermal uses and different level of household electrical appliance ownership (especially for most new EU members)



2007 for Estonia and Lithuania; 2006 for Portugal

- Improvement of almost 10% for the period 2000-2009 (or about 1.3%/year) and 24% since 1990 (or about 1.4%/year, Figure 18). The efficiency improvement for heating, hot water and large appliances reaches about 10% since 2000.
- But since 1990 heating and large appliances efficiency improvement reached 25% when hot water ones reached only 15% during the same period

## Energy efficiency progress for households in the EU: ODEX

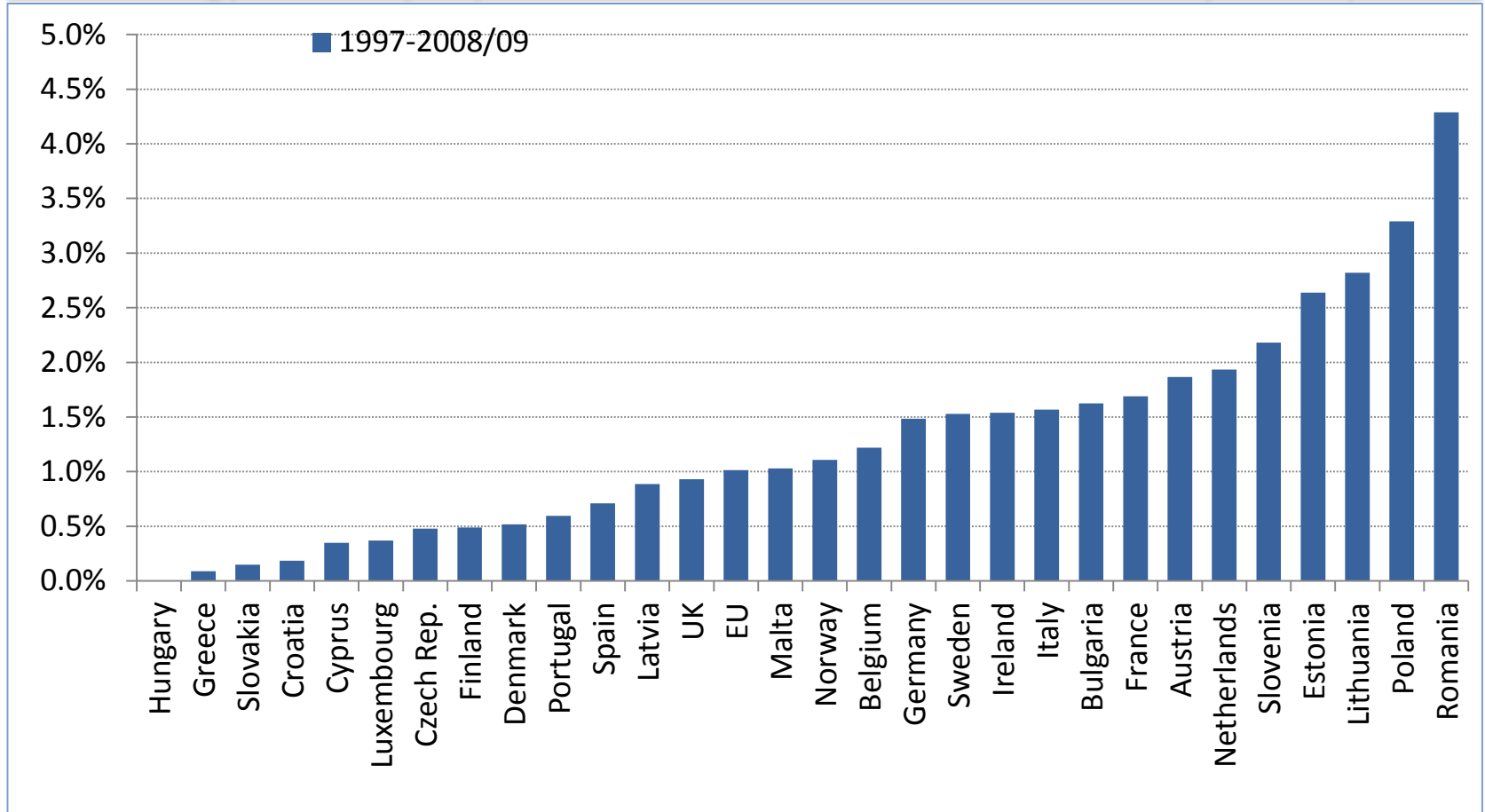


ODEX is an index weighting the energy efficiency progress gains of 8 end-uses/appliances : heating (toe/m<sup>2</sup>) water heating, cooking (toe/dwelling), refrigerators, freezers, washing machine, dishwashers and TV (kWh/year)

1%/year on average in EU between 1997 and 2008.

Large discrepancies among countries : from few improvements for Hungary, Greece to great improvements for new members such Estonia, Poland and Romania.

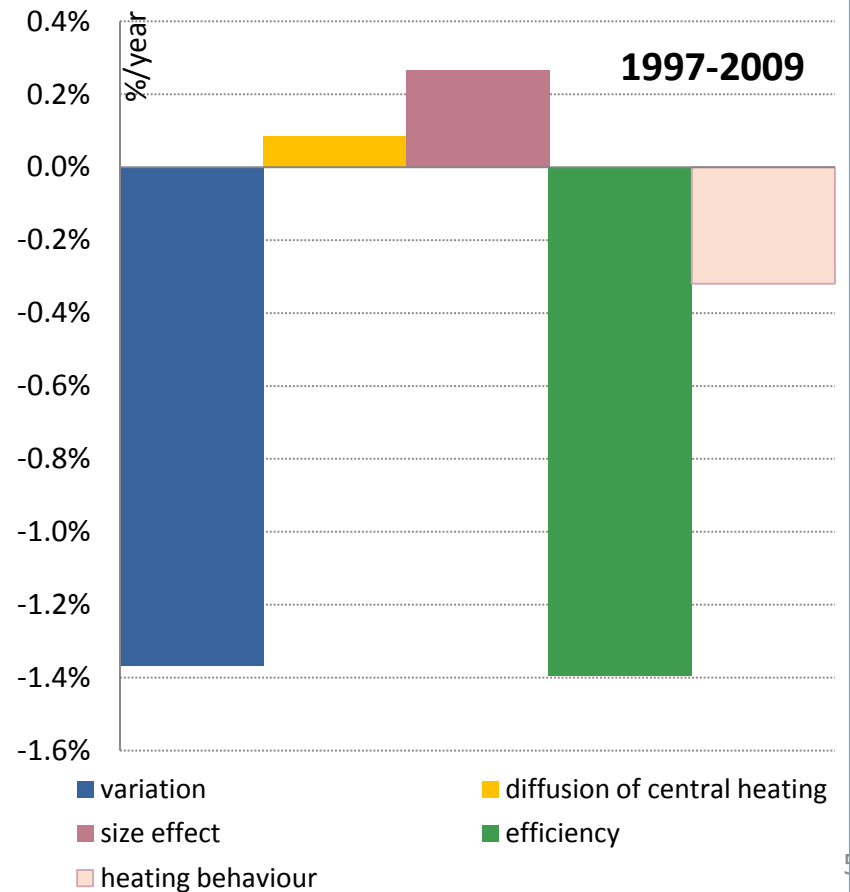
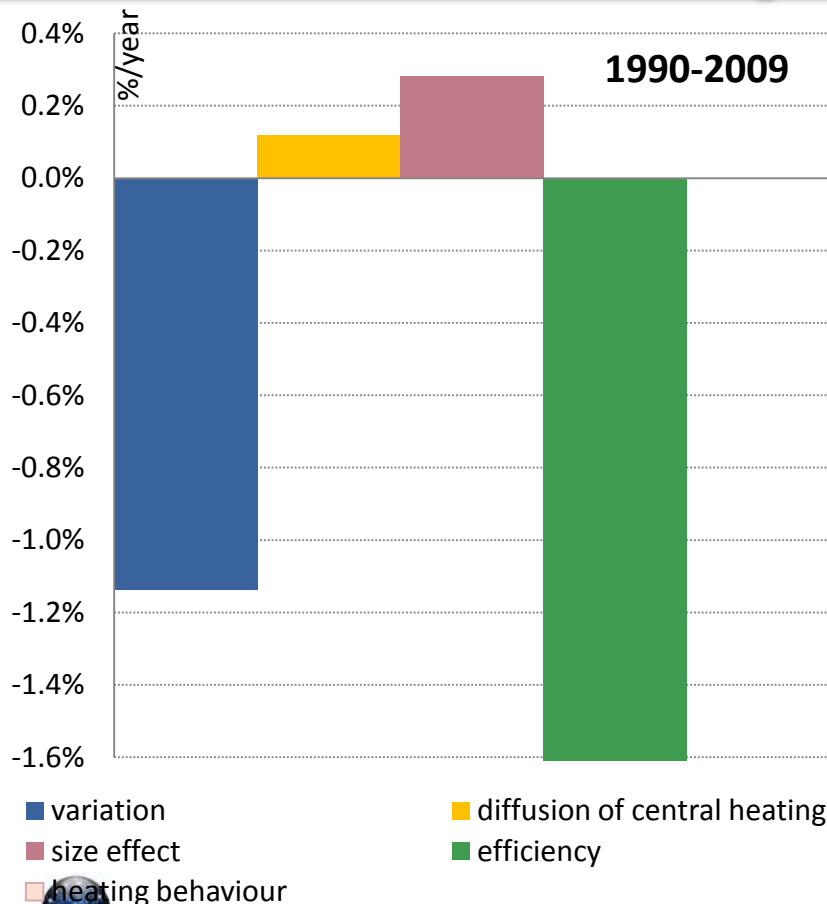
### Energy efficiency improvements in the household sector: EU by country



Period of analysis 2000-2008 for Cyprus, Malta, Sweden, Latvia  
1997-2009 for Croatia, Belgium, Germany, Austria, Netherlands, Poland

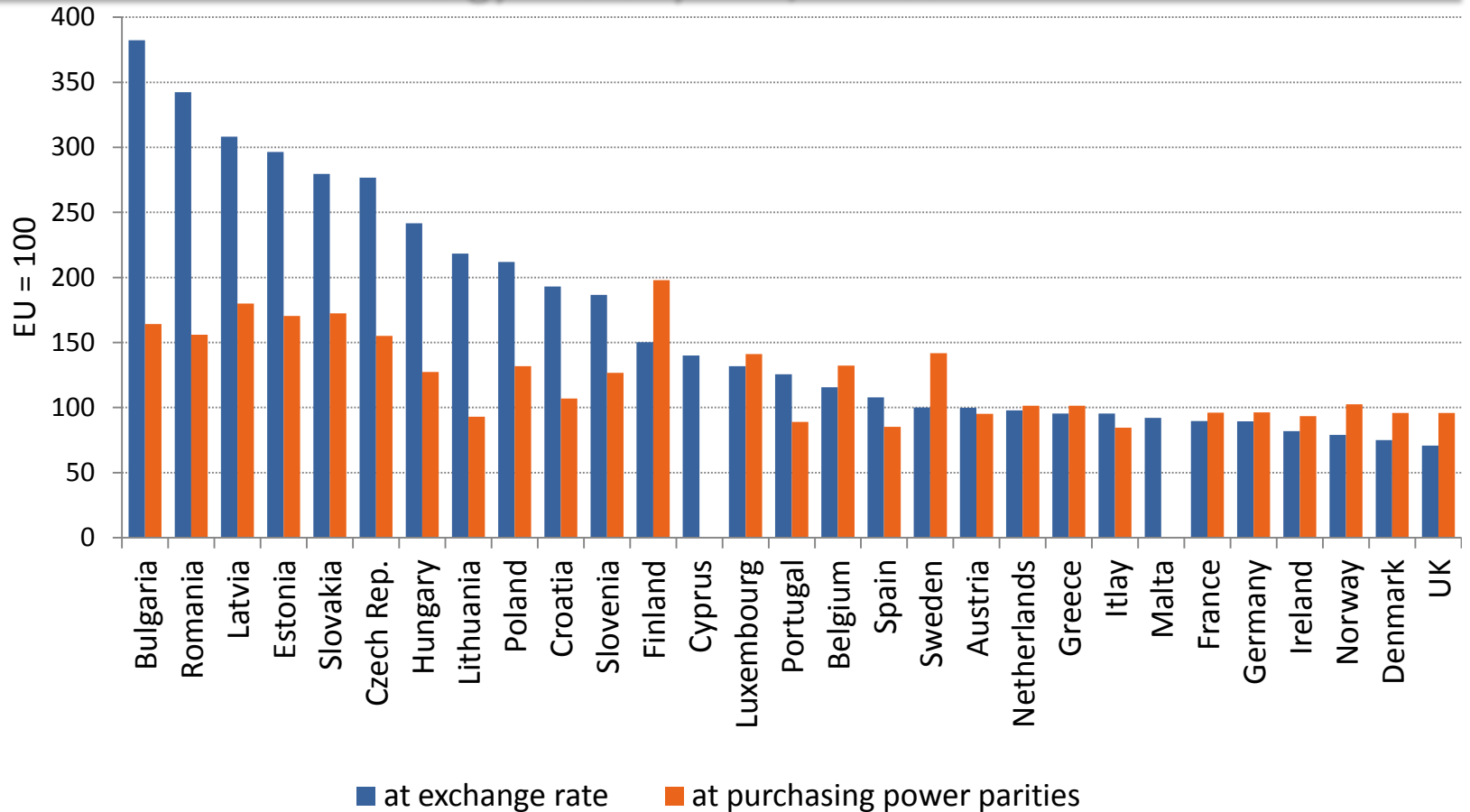
There is an energy efficiency progress for heating of 1.4%/year on average for the EU since 1997 (and 1.2%/year since 1990). Larger dwellings (+0.3%/year on average) and diffusion of central heating in the south of Europe (+0.1%/year on average) have offset the equivalent of 25% of energy efficiency gains at EU level. Heating behaviour had a significant impact at EU level on space heating consumption (-0.3%/year) since 1997.

### Drivers of the variation in heating consumption per dwelling (1997-2009)



## Additional graphs

## Energy intensity with/without PPP



No adjustment for Malta and Cyprus