



Third meeting of the project
“Monitoring of EU and national energy efficiency
targets” (ODYSSEE-MURE 2010)
Warsaw, October 6-7 2011

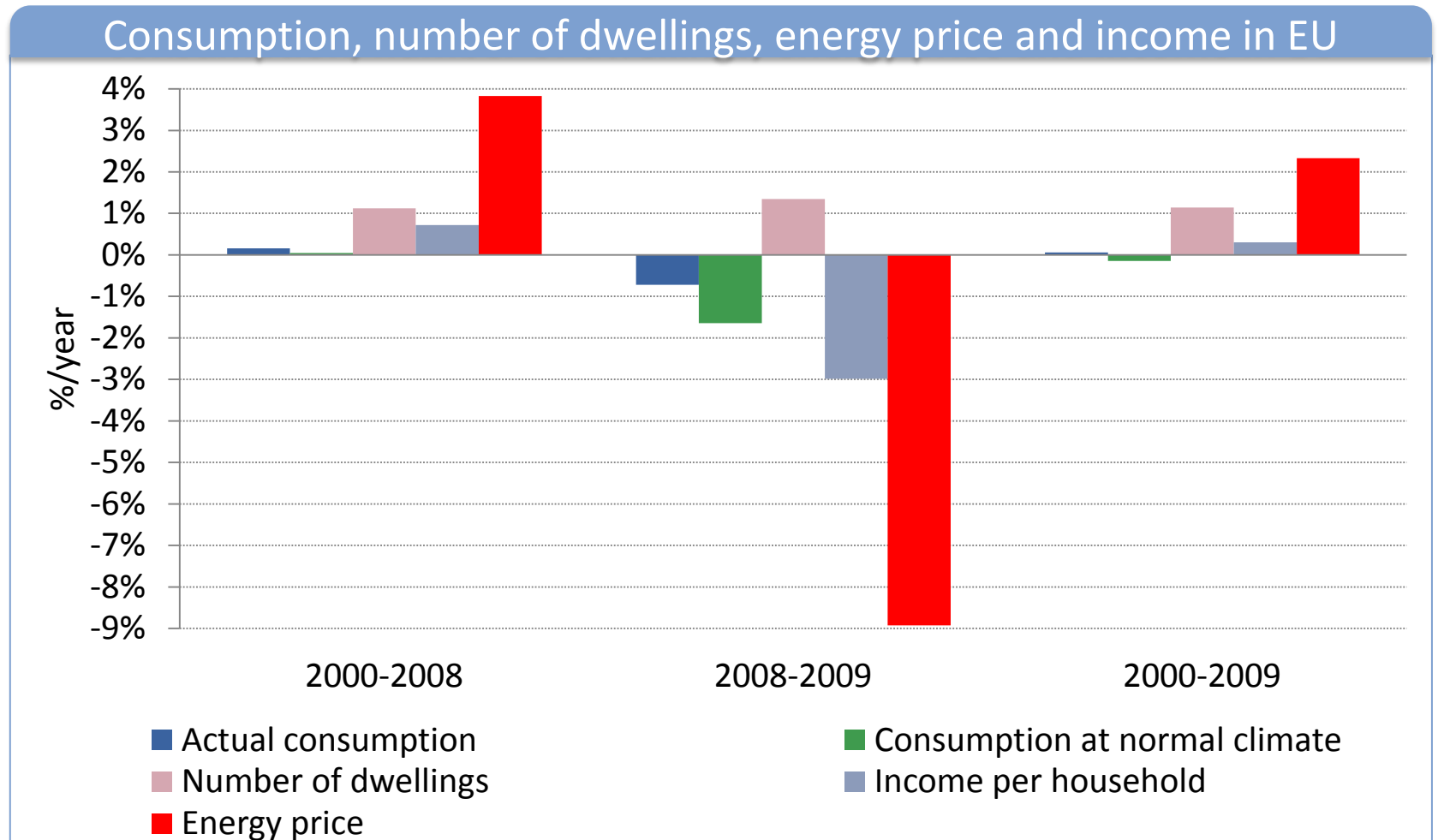
Energy efficiency in buildings in the EU

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Enerdata



- ▶ **1. Household energy consumption and drivers**
- 2. Heating trends
- 3. Comparison of heating performances
- 4. Water heating (solar)
- 5. Energy efficiency trends
- 6. Trends in service sector

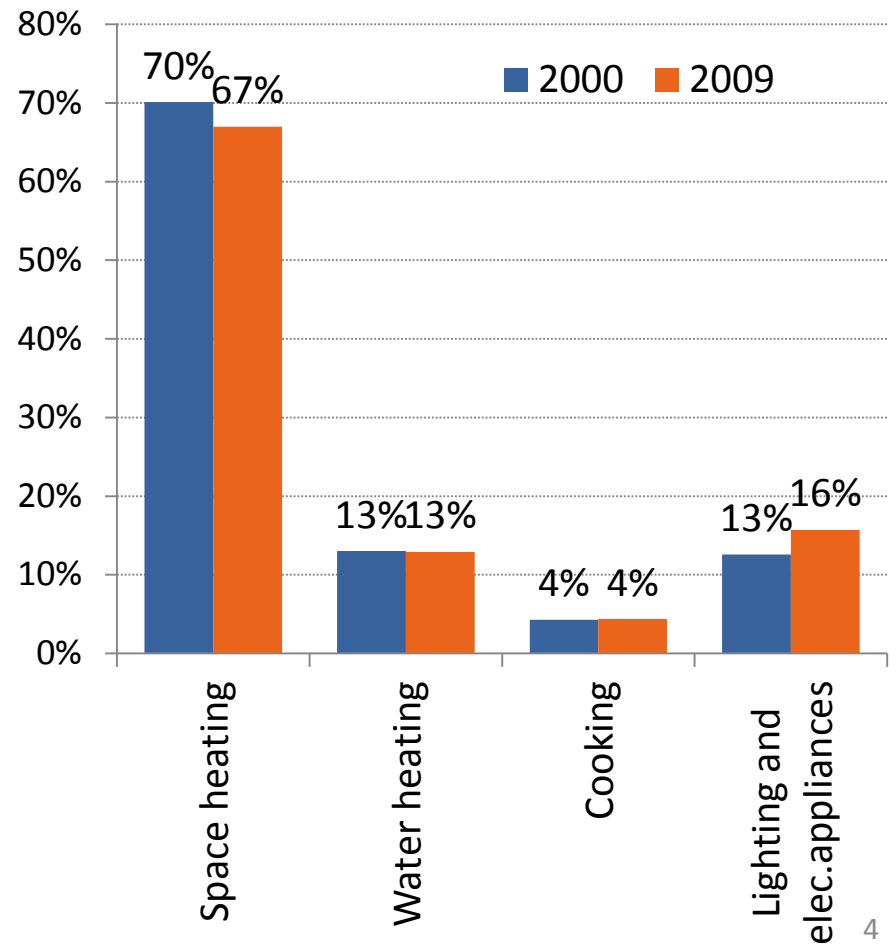
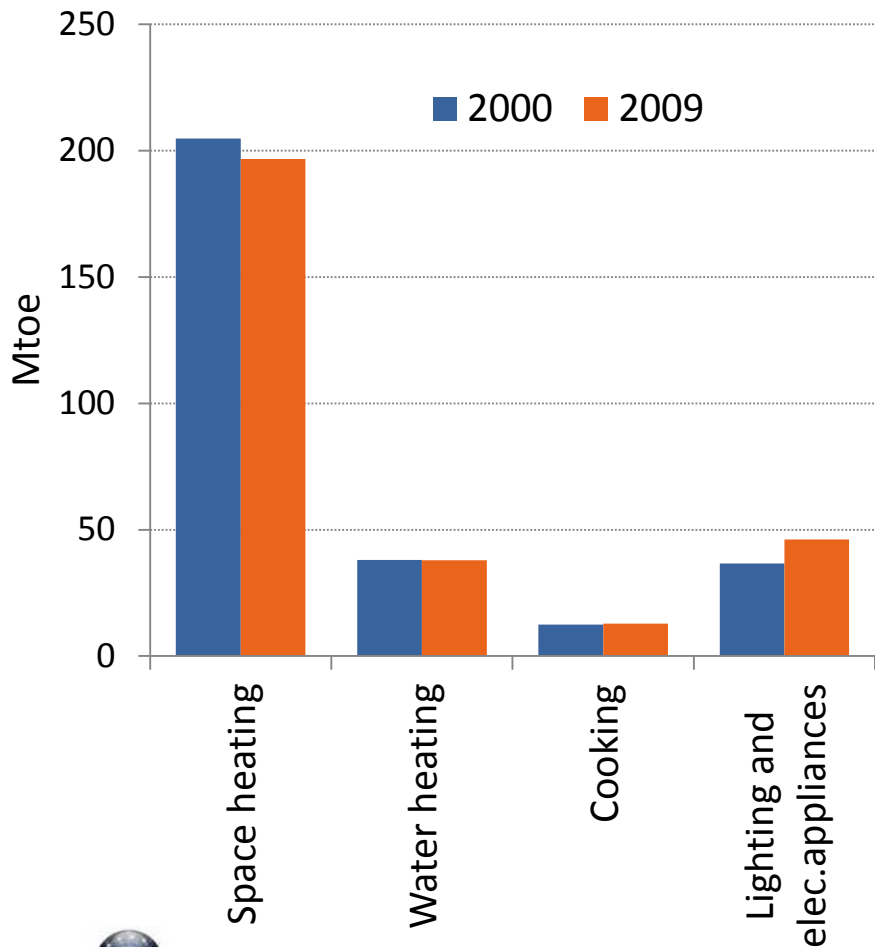
- Decrease of the energy consumption in 2009 by 0.7% (1.6% at normal climate) as a result of a decrease of income (-3%) and despite a drop in energy price (-9%)
- Consumption in 2009 (or 2008) closed to its 2000 level, despite a 1% growth in the number of dwellings and a slight progression of incomes



Energy price: weighted average

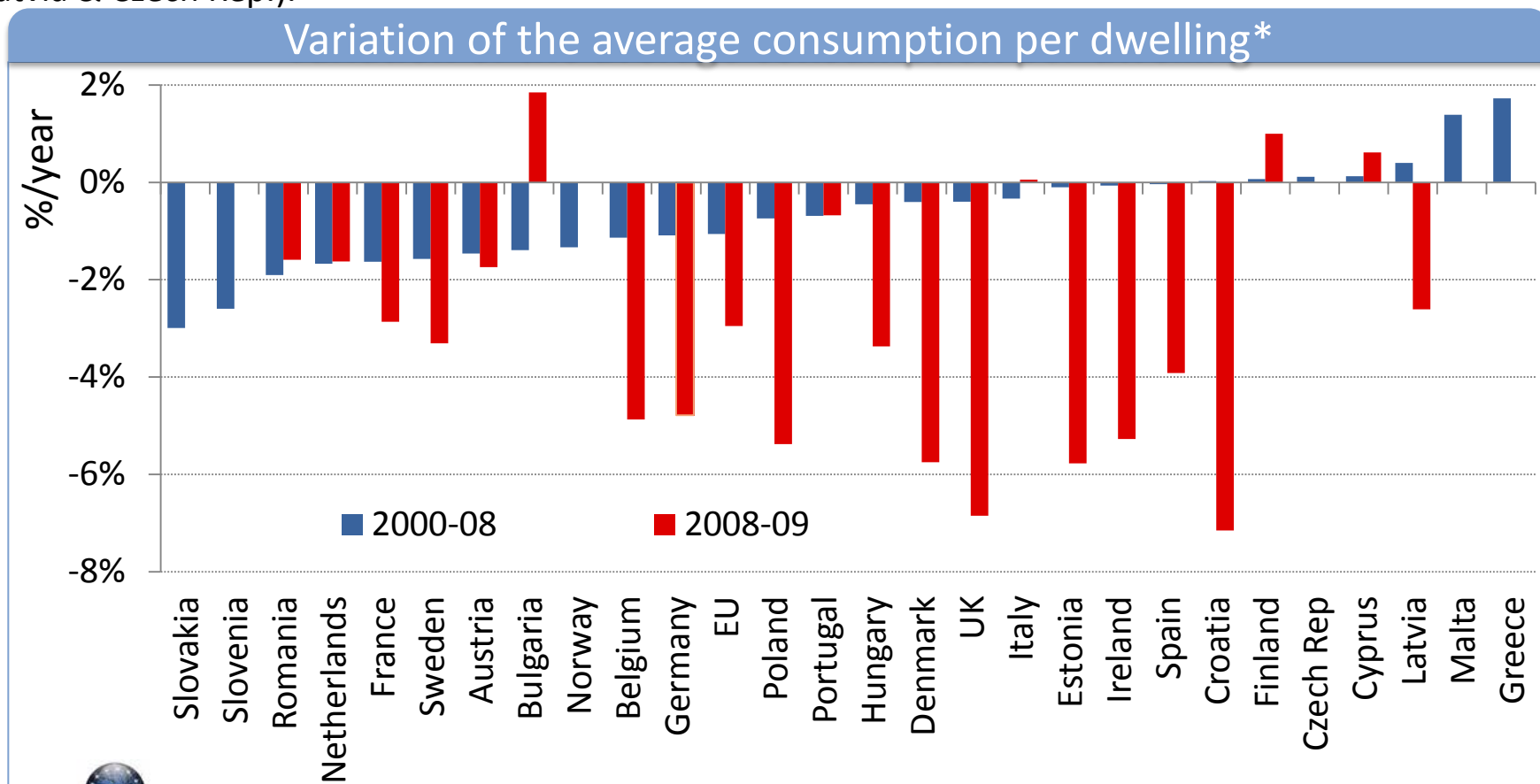
Declining share for space heating;
 Second end-use: water heating with a stable share (13%)
 increasing weight for electrical appliances and lighting

Household energy consumption in the EU



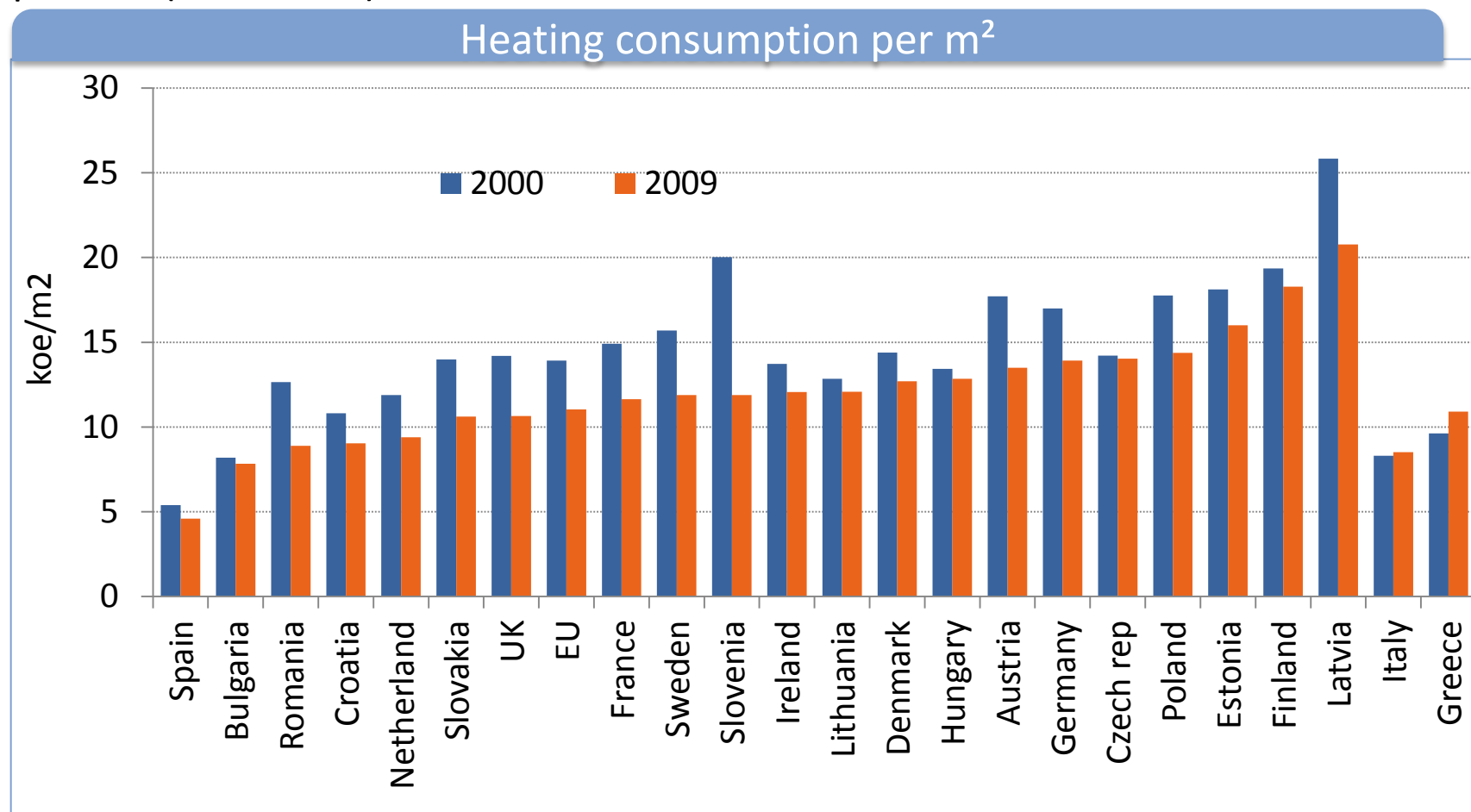
- Strong reduction of the average consumption per dwelling in **2009** in most countries: -3% at EU level compared to -1.1%/yr over 2000-2008; **large contraction** (closed to 5% or >5%) in 8 countries (Belgium, Germany, Poland, Denmark, UK, Estonia, Ireland & Croatia)

- 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.).

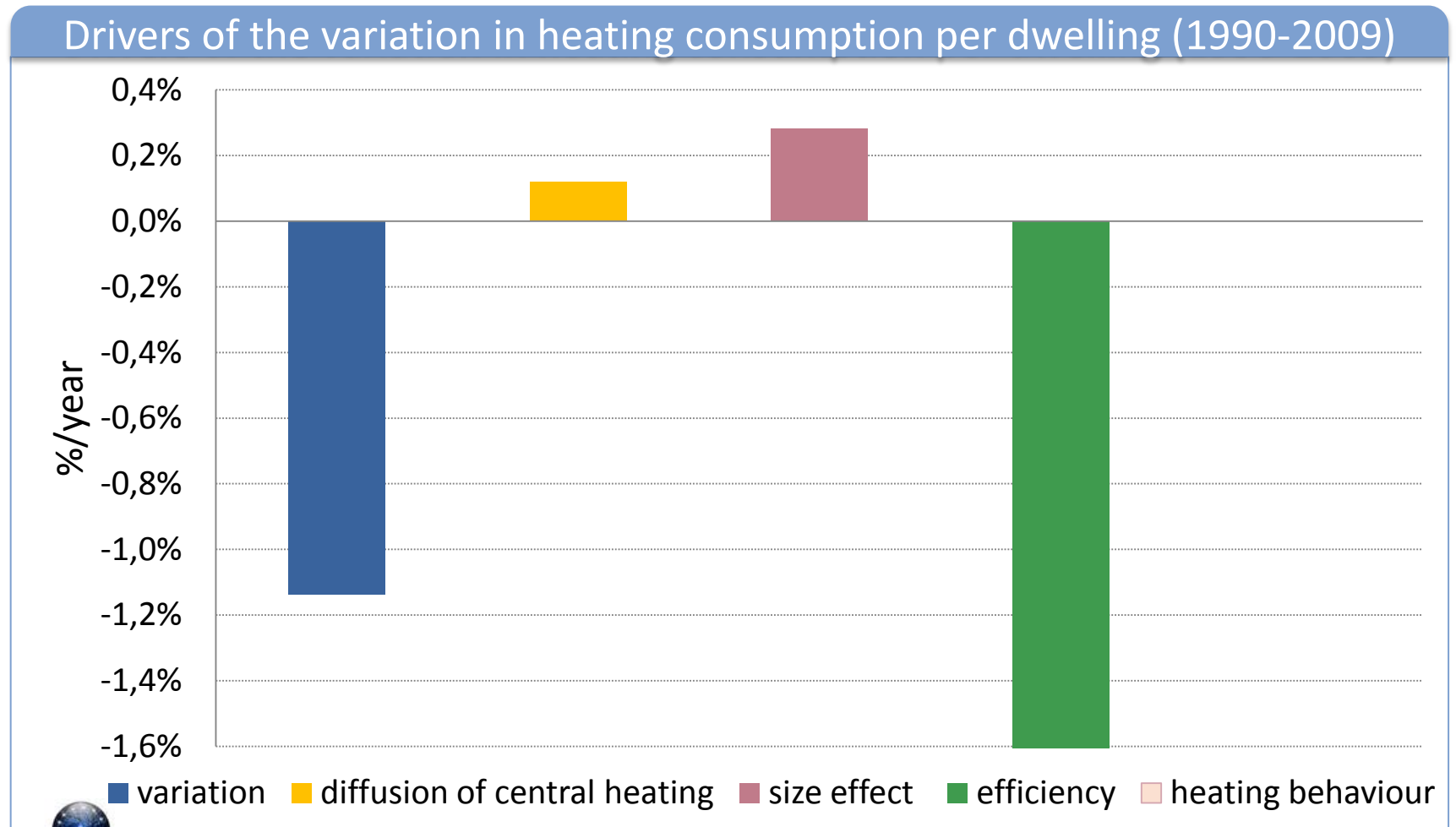


1. Overall energy consumption and drivers
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- Decrease in all countries, except Greece and Italy (maybe due to progress in comfort); significant reduction in some EU-15 countries (e.g. The Netherlands, Ireland and France) and in some new member countries (combined effect of higher price and efficiency improvements);
- Indicator used to assess energy efficiency trends for heating...not relevant for comparison (see below)



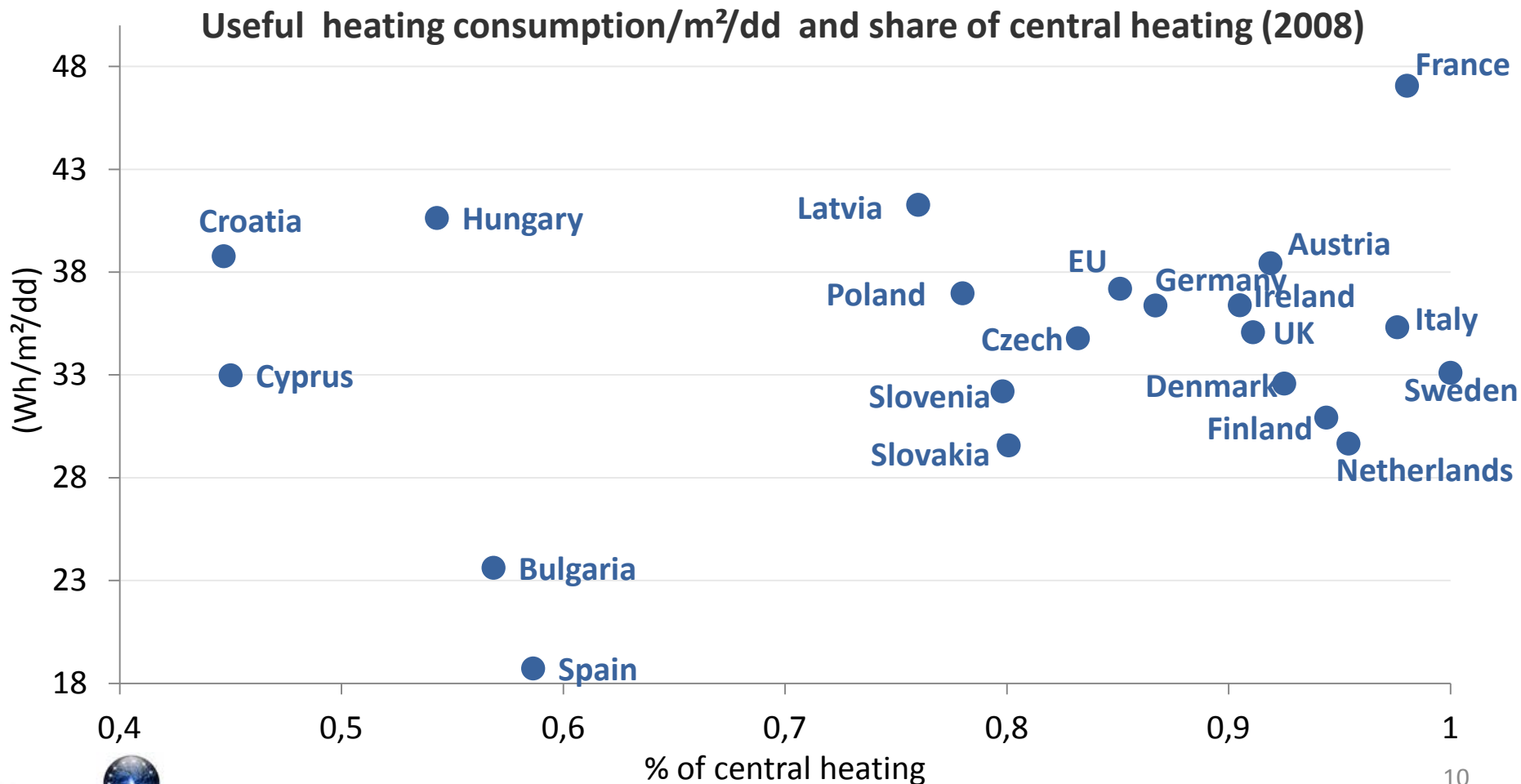
- Energy efficiency progress for heating of 1.6%/year on average for the EU since 1990
- Larger dwellings (+0.3%/y on average) and diffusion of central heating in the south of Europe have offset the equivalent of 25% of energy efficiency gains at EU level



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Cross-country comparisons of heating consumption

The indicator used to benchmark performance for heating in ODYSSEE is a **useful** energy consumption (to correct differences in the energy mix, thus in efficiency), **per m²** (to correct for differences in dwelling size) and **degree-day** (to correct for differences in climate)



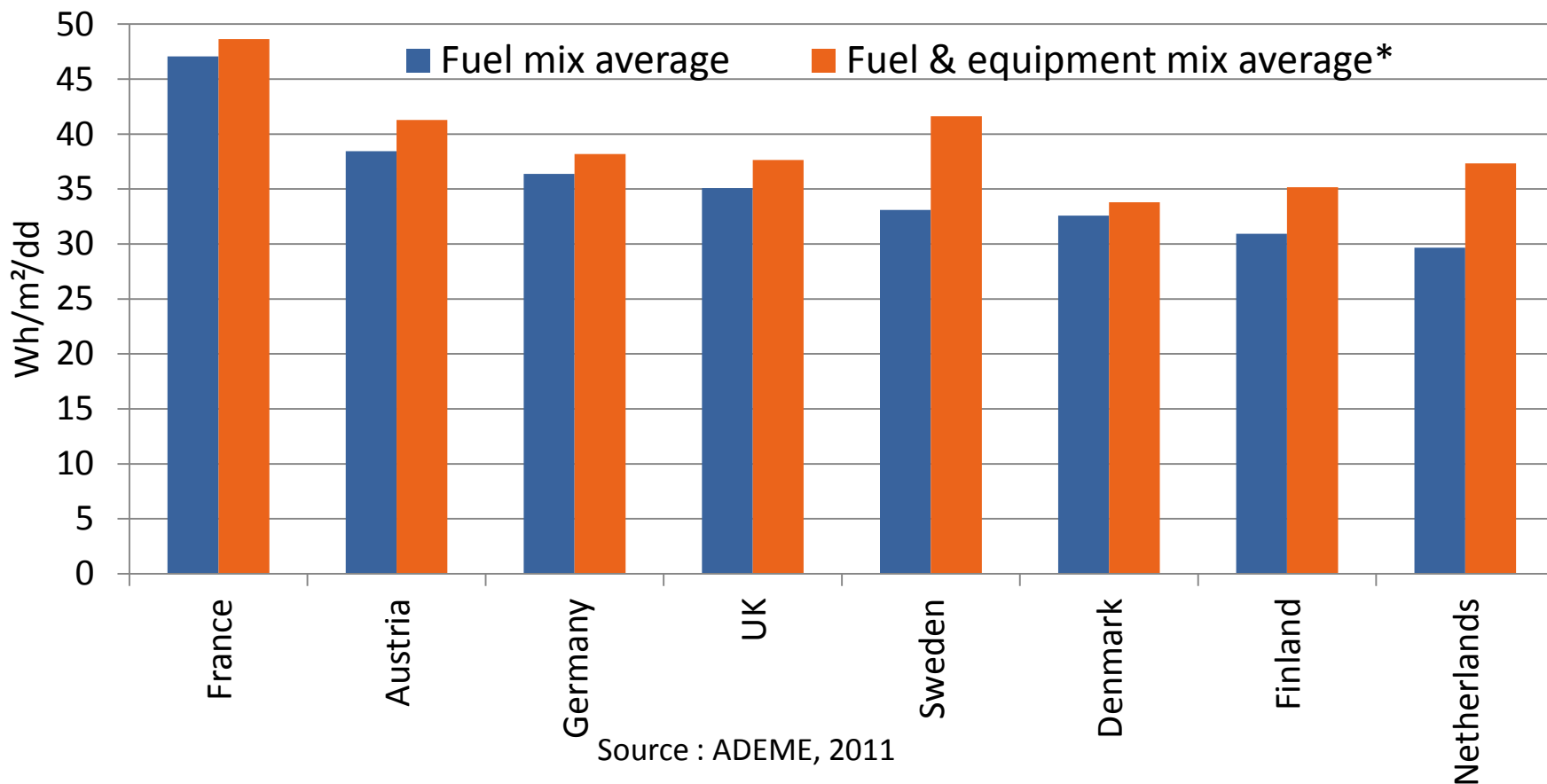
How to improve cross-country comparisons for heating?^(1/2)

- New indicators of benchmarking for heating have been developed by Enerdata for an ADEME study* aiming at understanding the lower energy efficiency performance of France for space heating compared to European benchmarks
- The first improvement relate to the **useful energy**:
 - **Presently the useful energy** is calculated on the basis on an average efficiency by energy, that is **identical for all countries**.
 - However, the diffusion of heat pumps and condensing boilers improve significantly the average efficiency of electricity and gas and this diffusion is not uniform among countries (e.g. high penetration of condensing boilers in The Netherlands and heat pumps in Sweden not seen in most other countries);
 - It was proposed to use in the comparison an **average efficiency** for gas and electricity that **takes into account the market shares of condensing boilers for gas, and heat pumps for electricity**

ADEME: *“Quantitative evaluation of explanatory factors of the lower energy efficiency performance of France for space heating compared to European benchmarks”*, 2011

With **new efficiencies** that take into account the market shares of condensing boilers and heats pumps, the useful heating specific consumption increases, especially for The Netherlands and Sweden (as efficiencies increased) and the differences among countries are reduced.

Useful heating consumption/m² /degree day: revised heating efficiencies (2008)



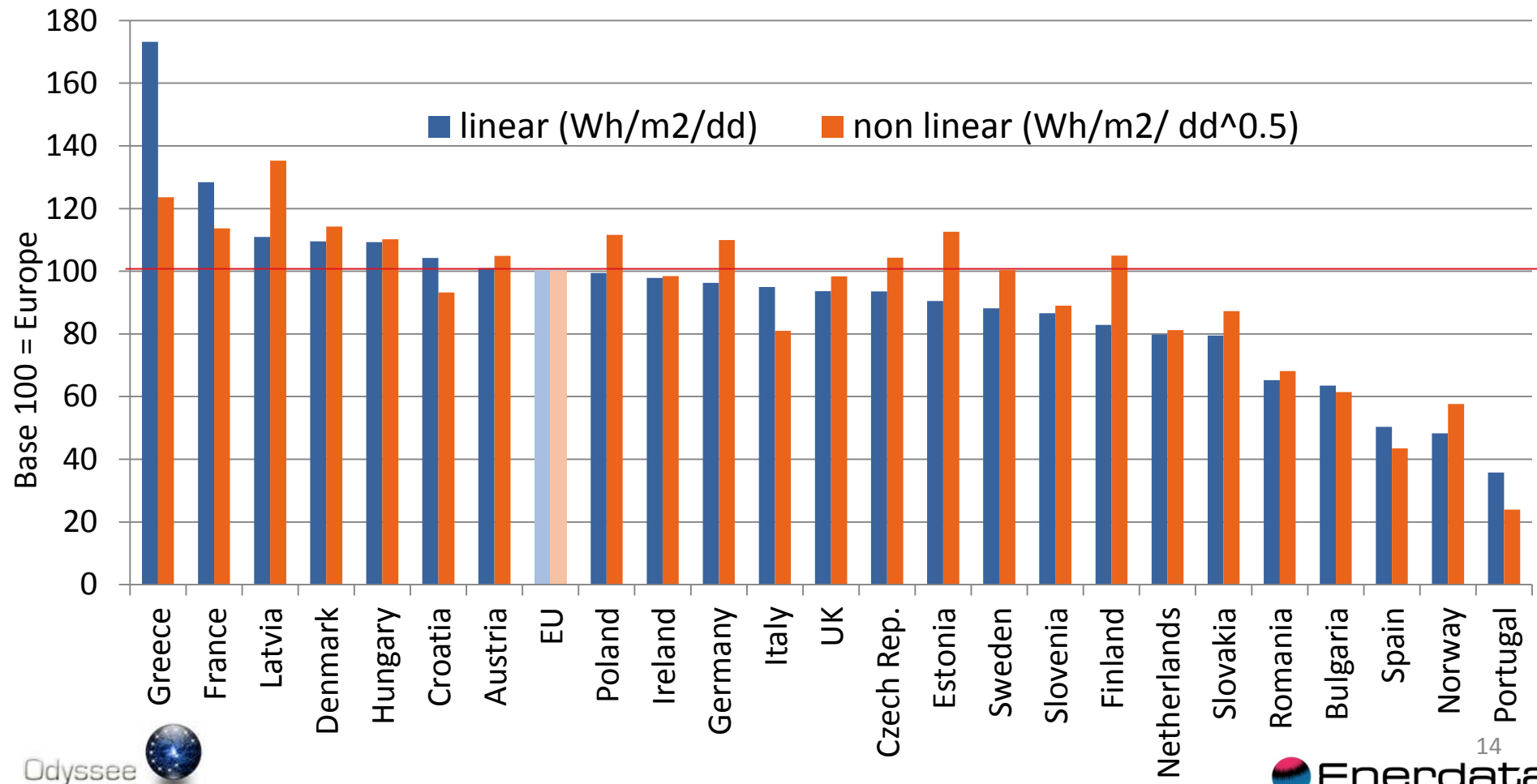
* Fuel & equipment mix average=weighted average for electricity and gas (accounting for the penetration of heat pumps for electricity and condensing boilers)

How to improve cross-country comparisons for heating?^(1/2)

- The second improvement related to the **climatic adjustment**
- Presently, the indicator is divided by the **number of degree days** to account for climatic difference among countries.
- However, According to Prof Swen Werner from Chalmers University, the optimal level of insulation is not linearly dependent on the climate. He proposed to use of a **non linear adjustment to the climate** and to divide the heating consumption by the **square root of the number of degree-days** (instead of the number of degree days)

The **non linear adjustment** increases the specific consumption of “northern countries”, and decrease the value of southern countries. It smoothes the climatic adjustment and seems more realistic

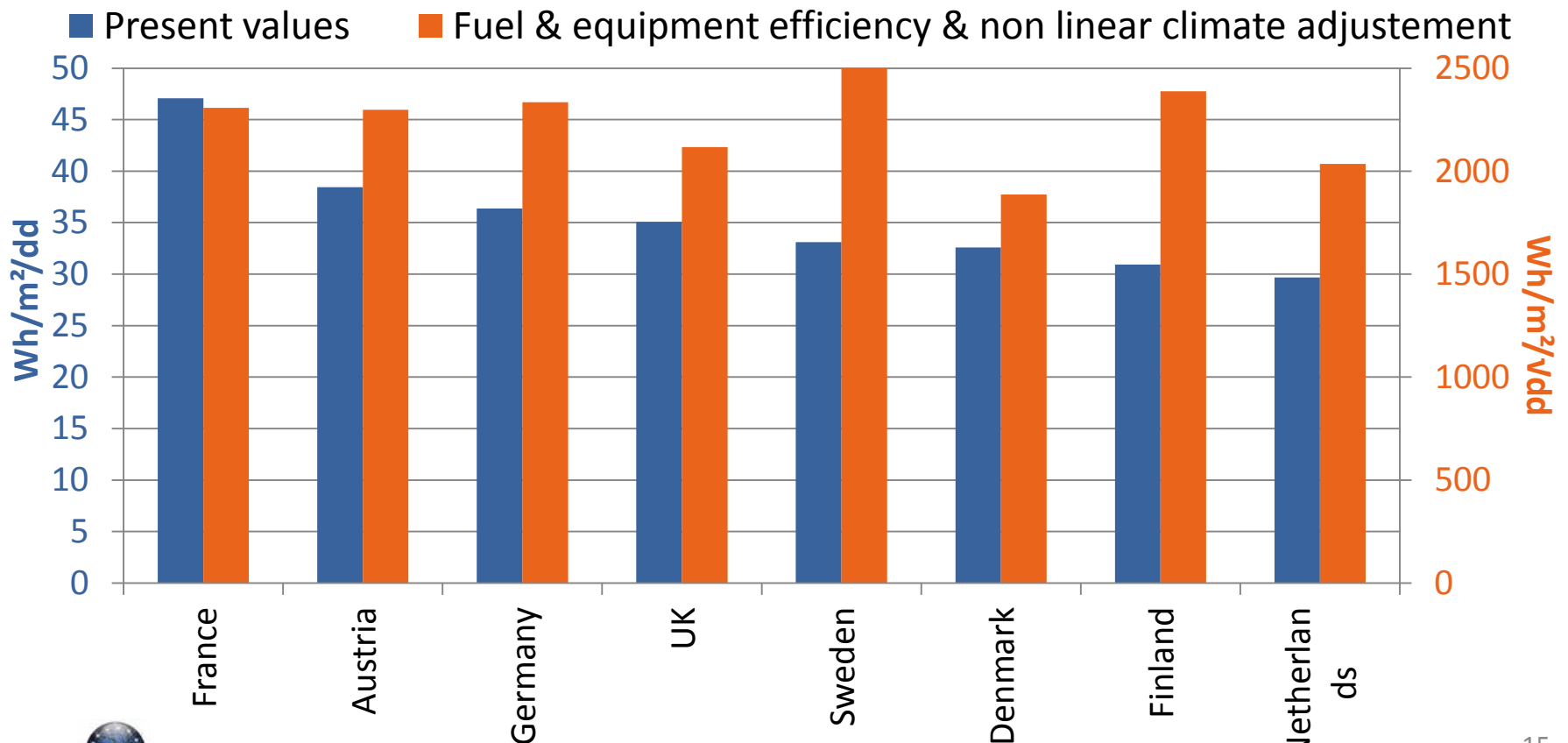
Useful energy consumption/m² /dd or / square root of degree day (2008)



Revised heating efficiencies and non linear climatic adjustment

The new method (orange histograms) change the ranking of countries (and differences among countries are reduced).

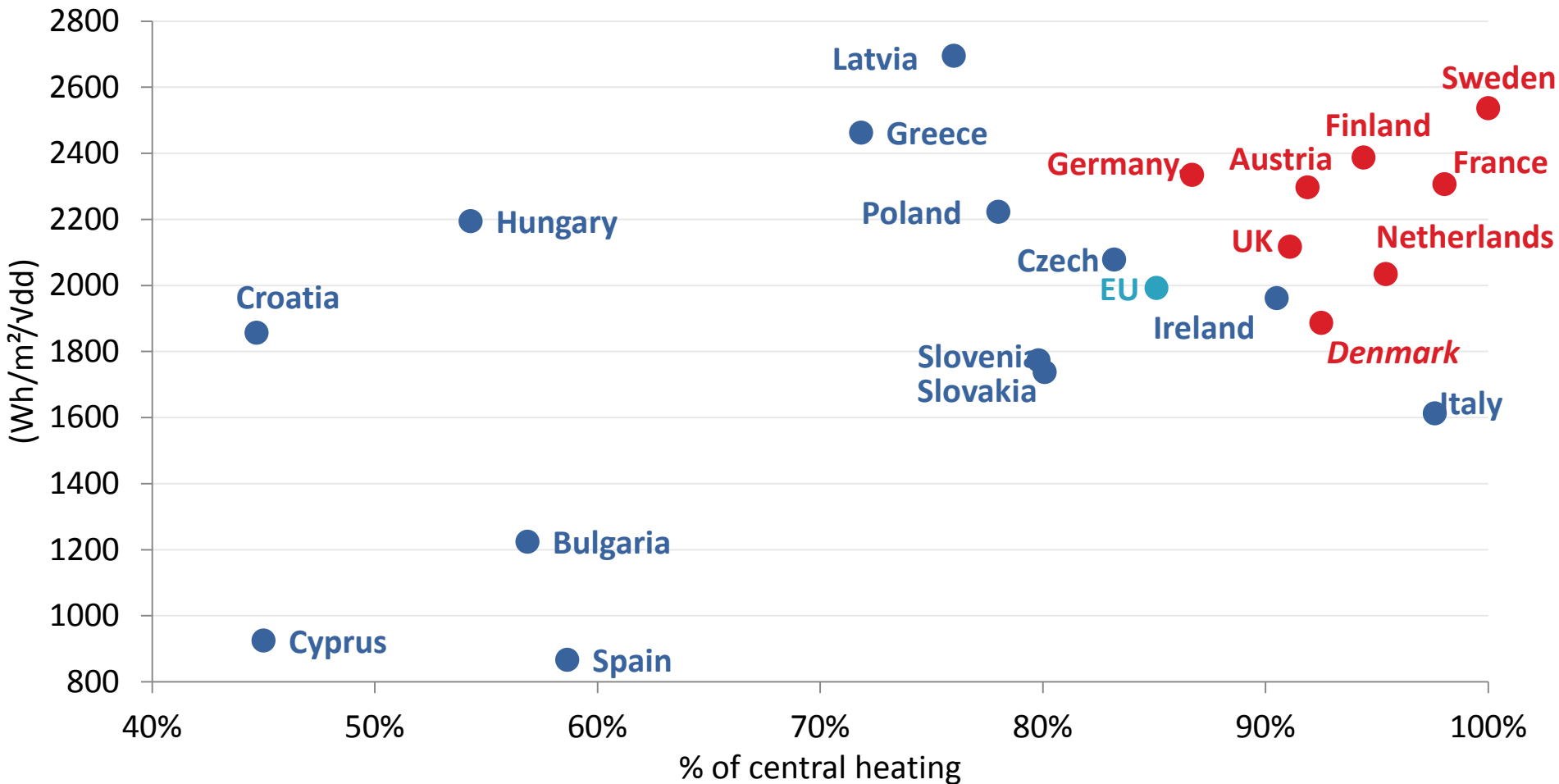
Useful heating consumption/m² /√degree-days: present vs revised indicator (2008)



Source : ADEME, 2011

Impact of the correction of efficiencies on the benchmarking graph for space heating with non linear adjustment

Useful heating consumption/ m^2/vdd and share of central heating (2008)

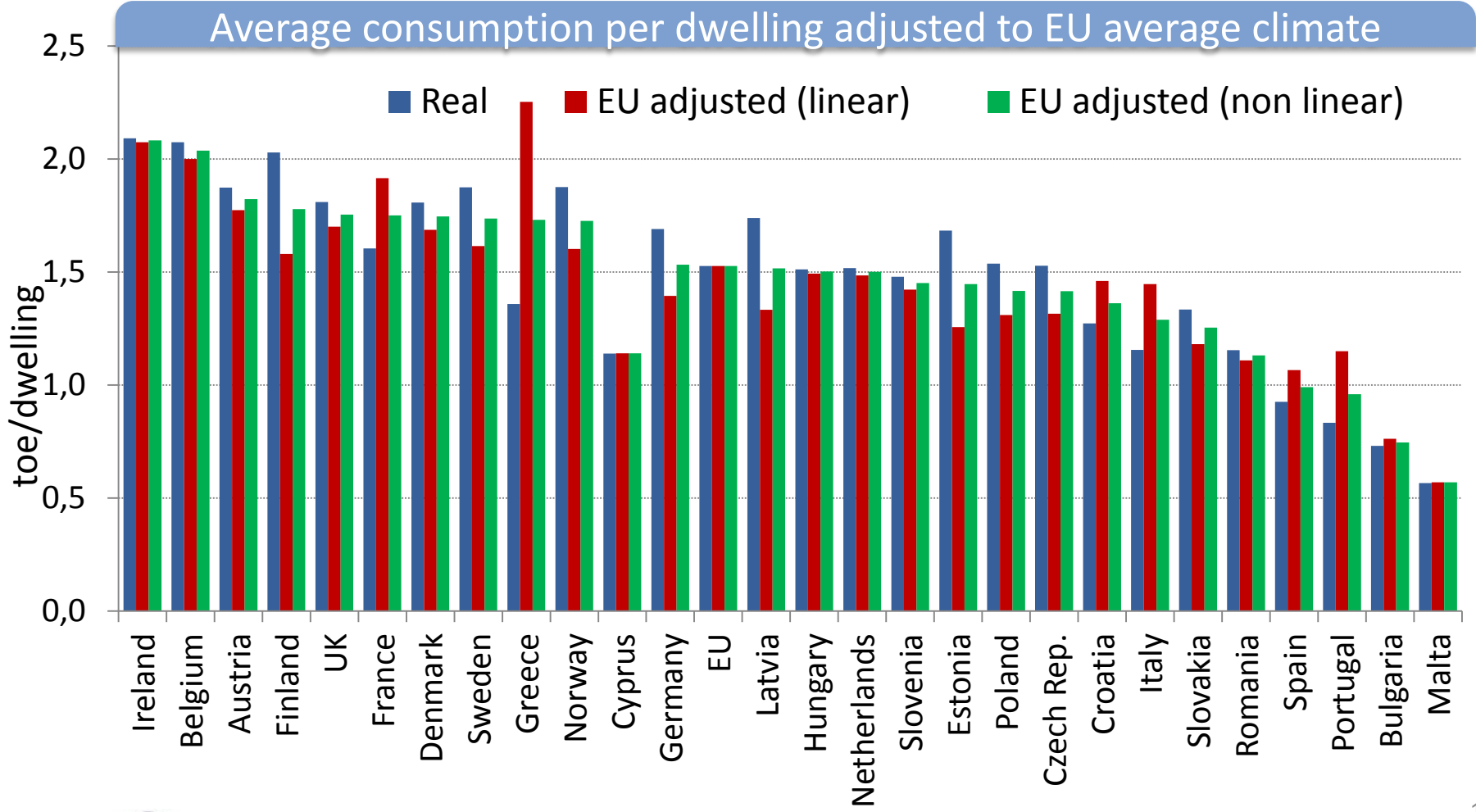


Source : ADEME, 2011

In red: revised values of efficiencies: fuel & equipment mix average

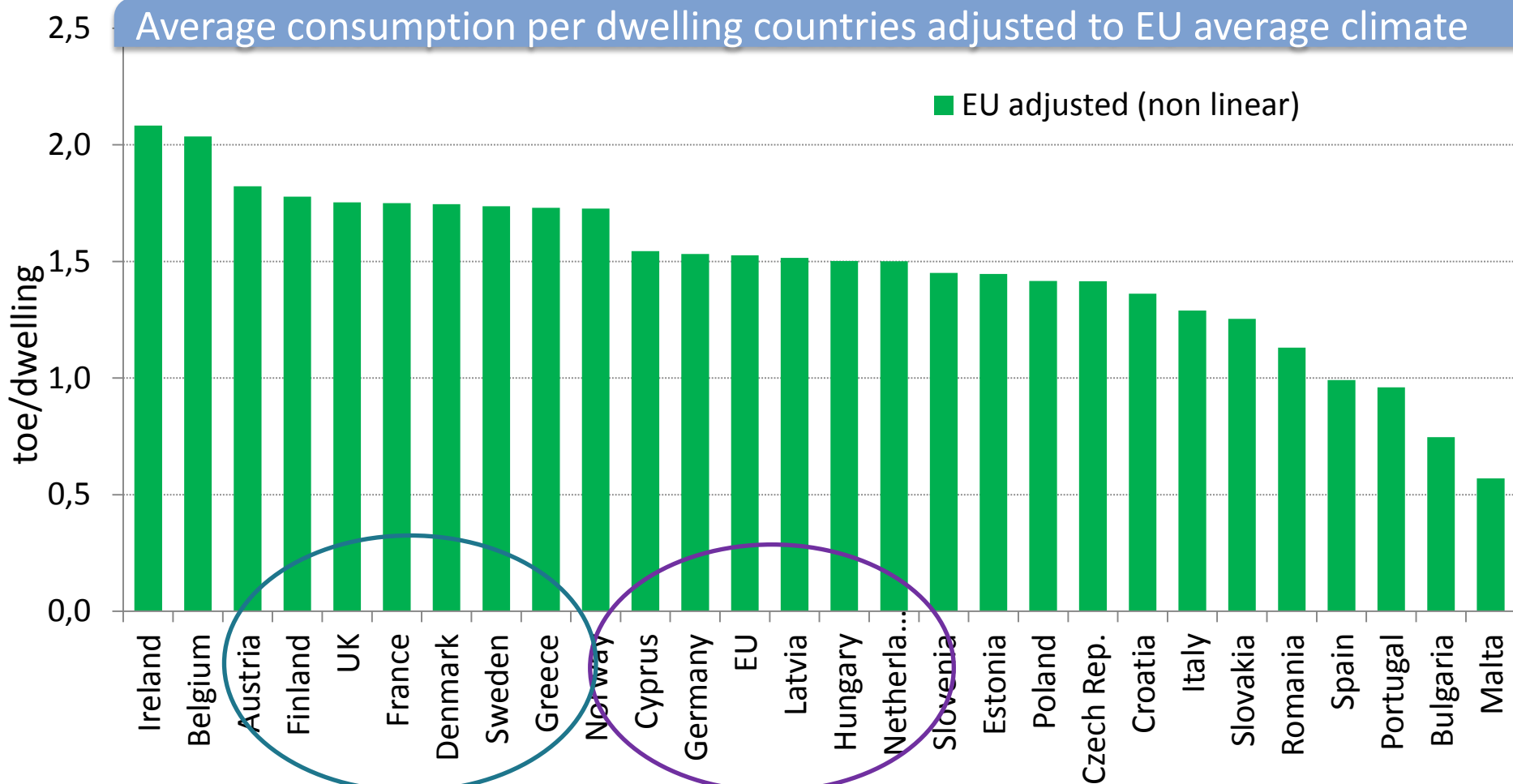
In blue: values not yet corrected (in general minor corrections)

Comparisons across countries of the consumption per dwelling should account for climate difference, by adjusting the heating part to the **same climate** (EU average). The climatic adjustment with a non linear method is more relevant as it avoids the over correction for warm countries (e.g. Greece, Italy, Portugal) or cold countries (Baltic, Scandinavia).



Revised consumption per dwelling adjusted to EU climate

New ranking of countries of average consumption per dwelling adjusted to the EU average climate (include all end-uses); apart from the extremes: countries are clustered in different groups with very similar consumption levels



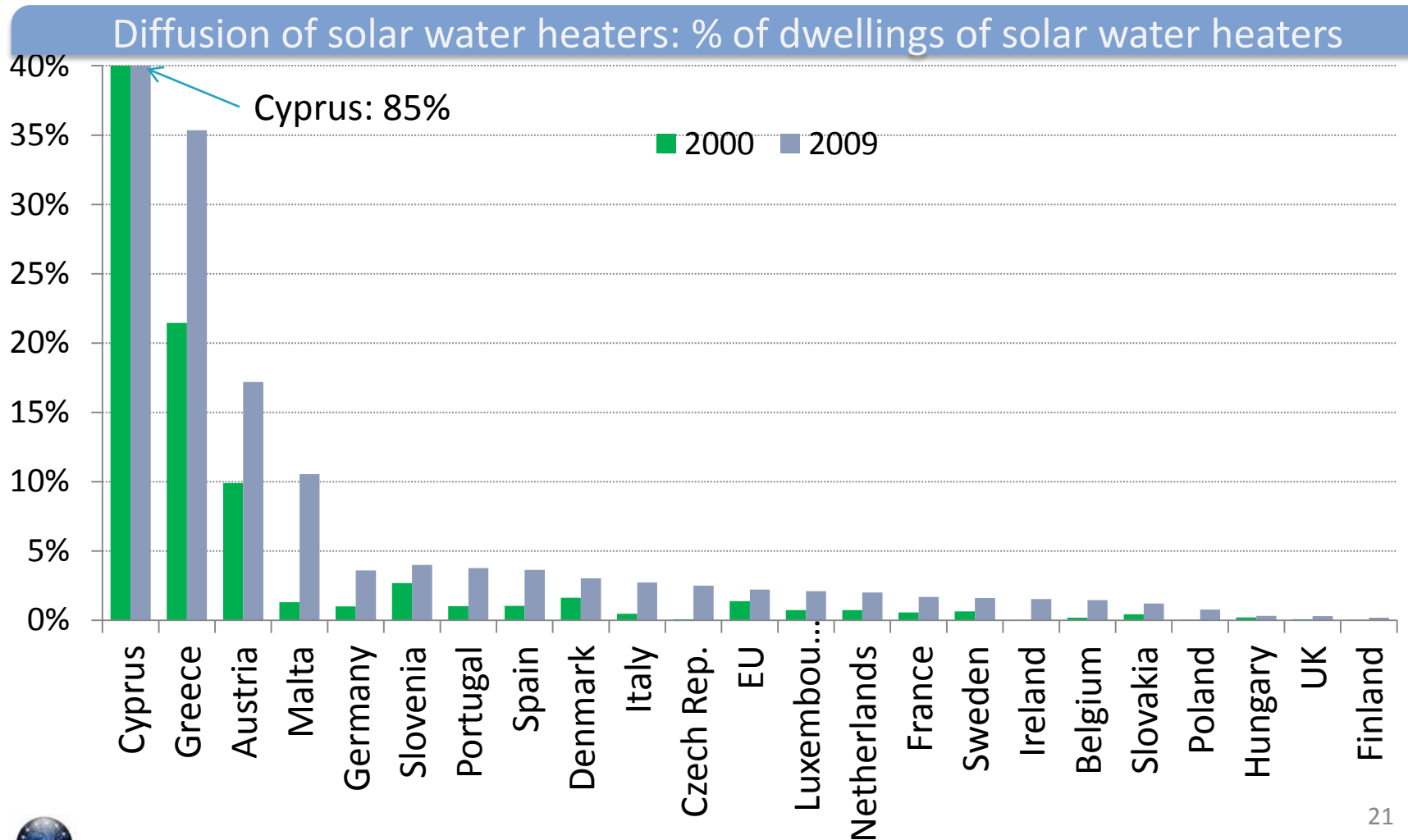
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Water heating: penetration of solar systems

- Main issue in terms of savings is the diffusion of solar water heaters;
- Only data available are the annual sales and stock estimates of m² of solar systems installed (usually based on cumulated sales) (source ObservER) → problem of systems replaced or not in use;
- To compare and benchmark the countries, ODYSSEE estimate the penetration of solar heaters, in terms of dwellings equipped on the basis of the average typical size of systems in each country (source: ODYSSEE for the key country and IEA for the others) → problem: the size changes with the technology and the use of solar systems (e.g. for both heating and water heating in Germany; water heating in most other countries)

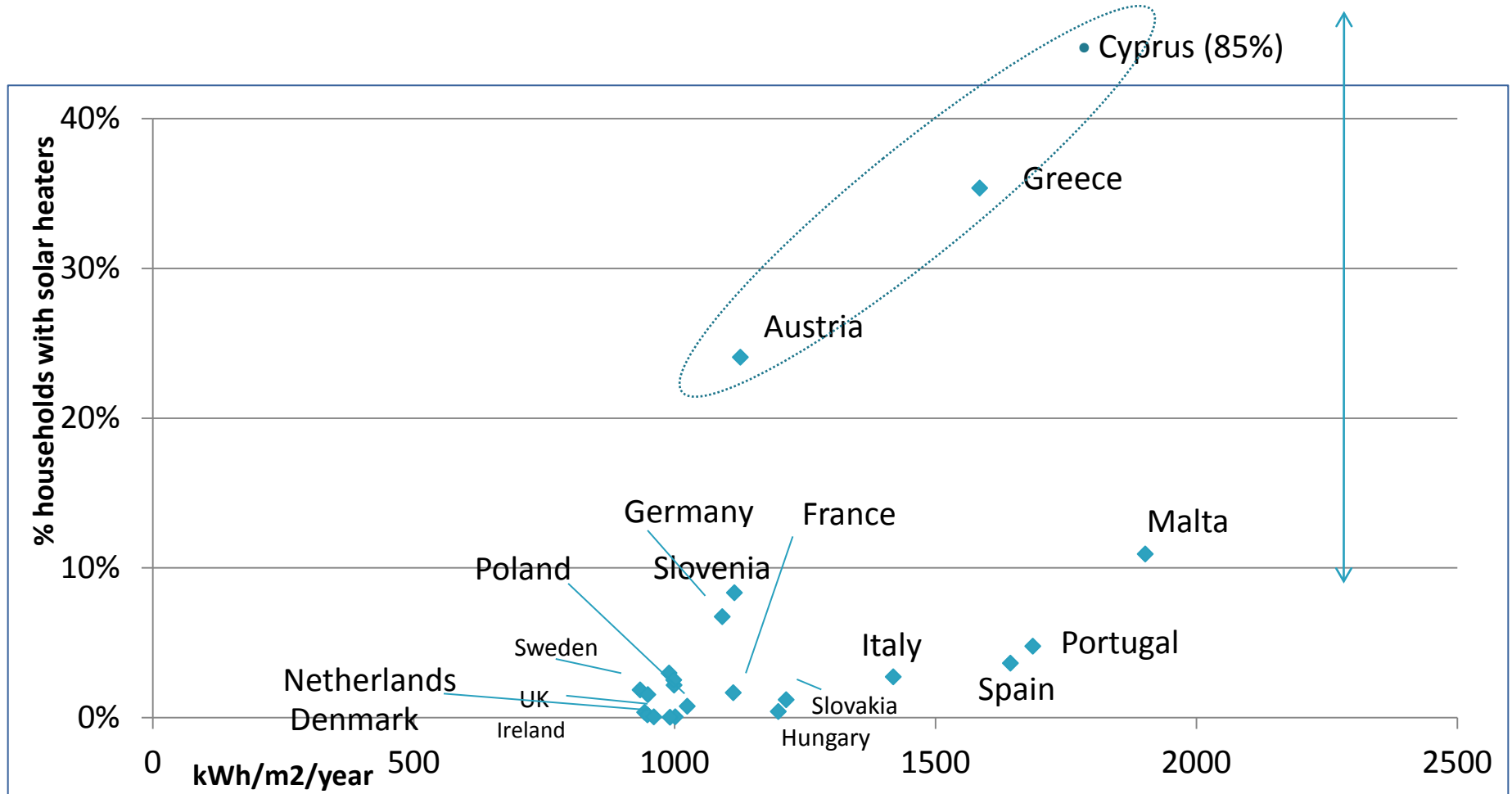
Diffusion of solar water heaters

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)



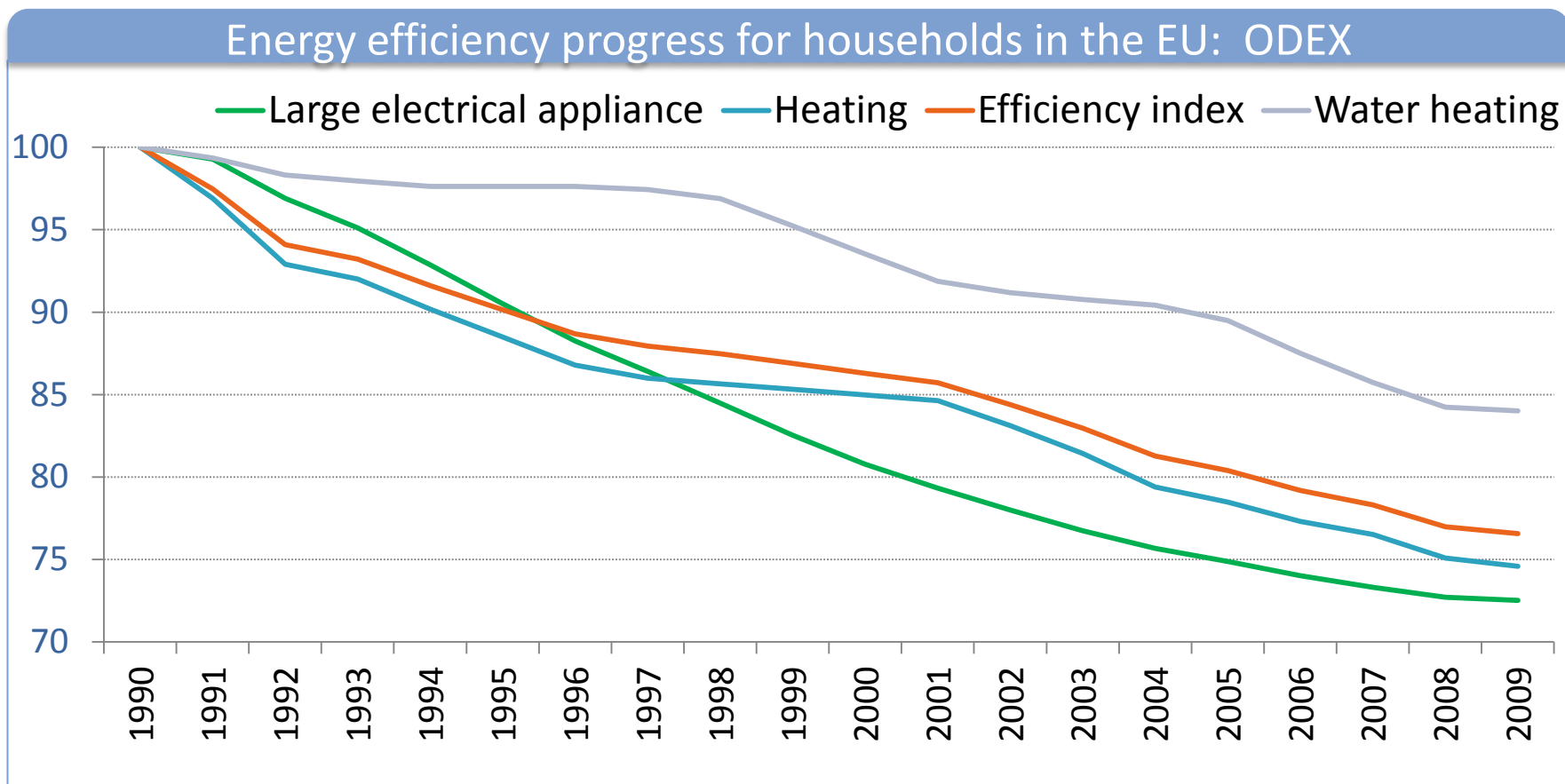
Benchmarking of the penetration of solar water heaters should be related to the annual solar radiation: Austria is the benchmark for countries with medium solar radiation (from 3% in 1990 to 24% to 2009) and of course Cyprus for countries with good solar radiation

% of dwellings with solar water heaters and solar radiation



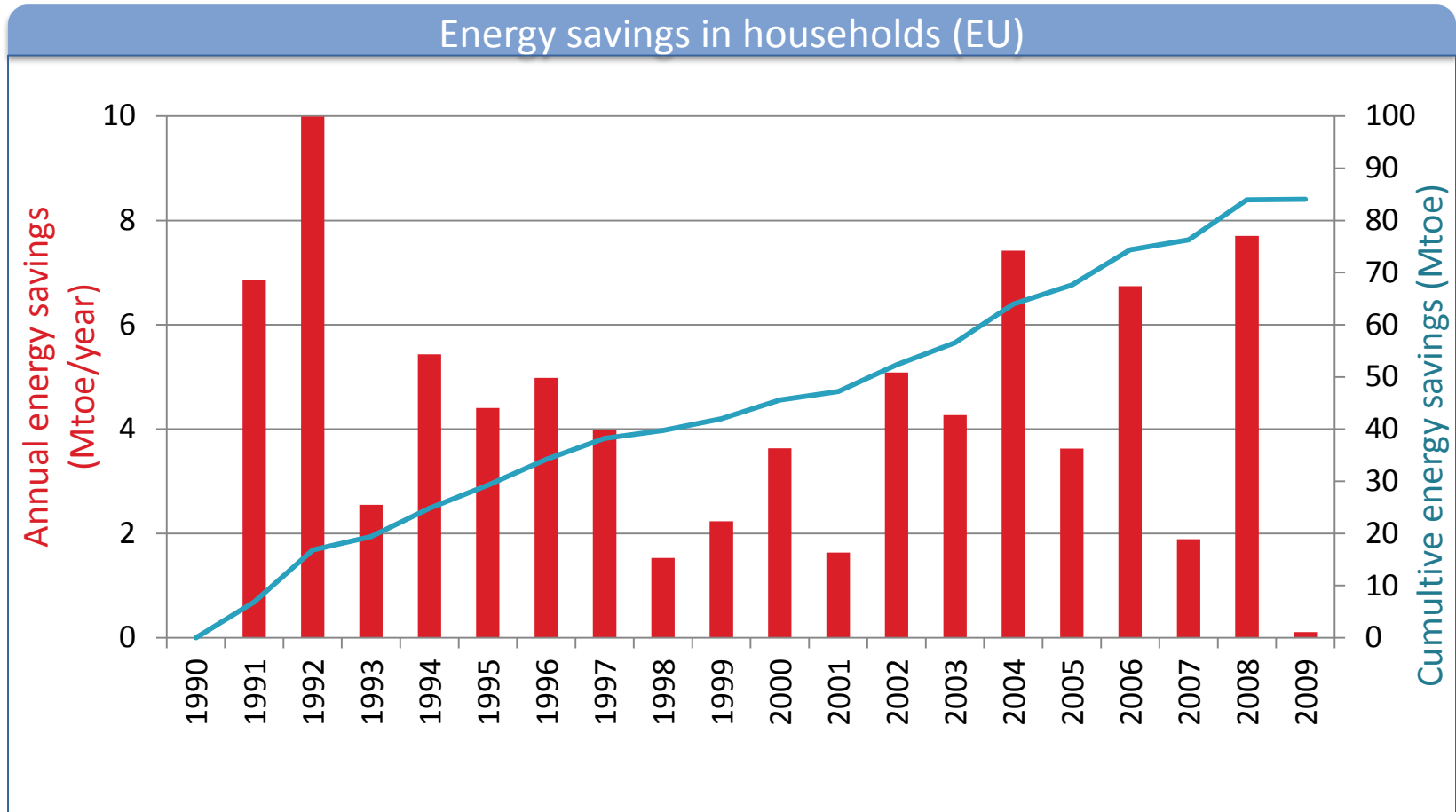
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23 % energy efficiency progress between 1990 and 2009 (1.4%/year) mainly due large electrical appliances (27% progress or 1.7%/y) and space heating (25% or 1.5%/y)



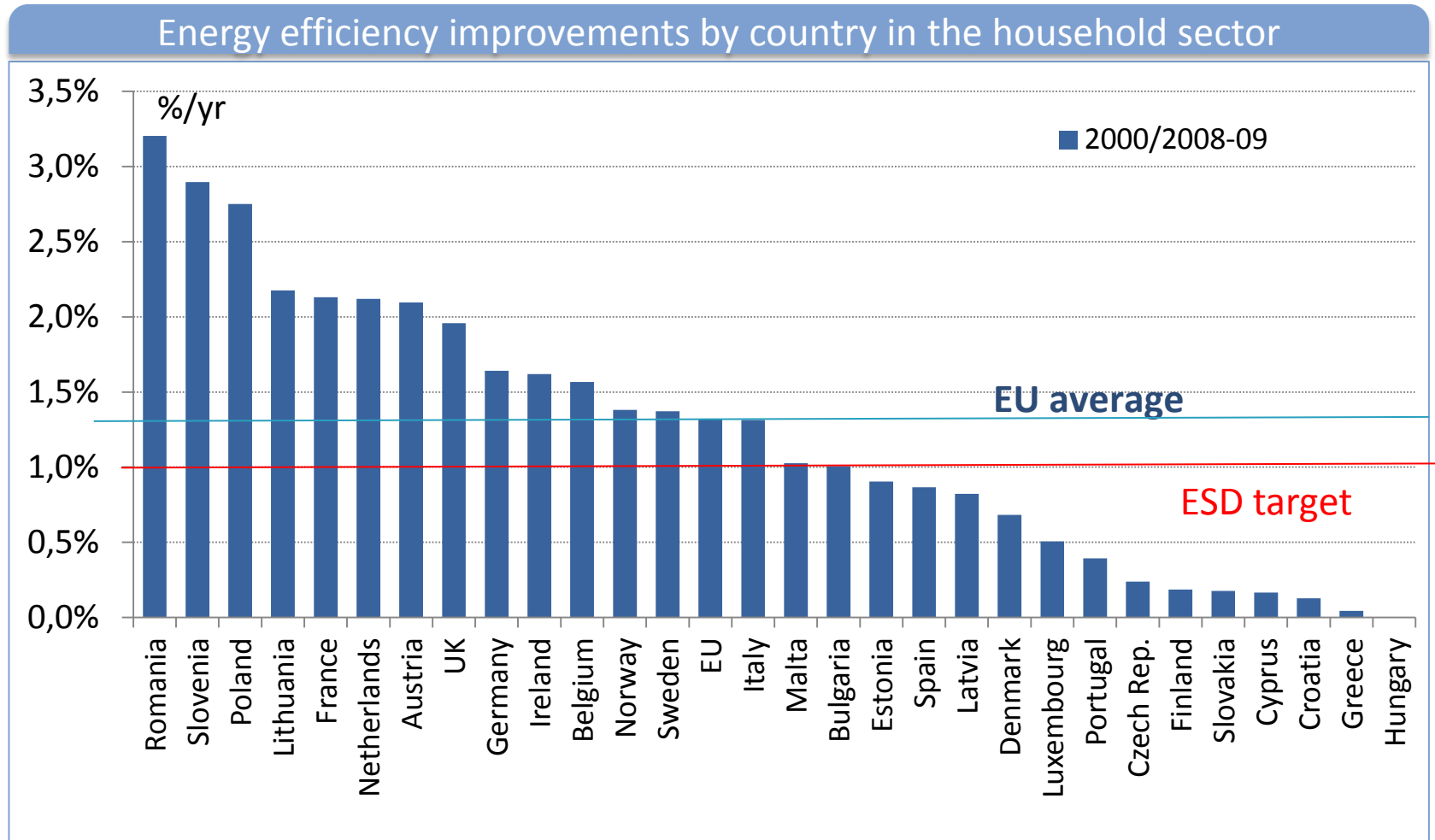
ODEX is an index weighting the energy efficiency progress gains of 8 end-uses/appliances : heating (toe/m²) water heating, cooking (toe/dwelling), refrigerators, freezers, washing machine, dishwashers and TV (kWh/year)

- 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



1.3%/year on average in EU between 2000 and 2009.

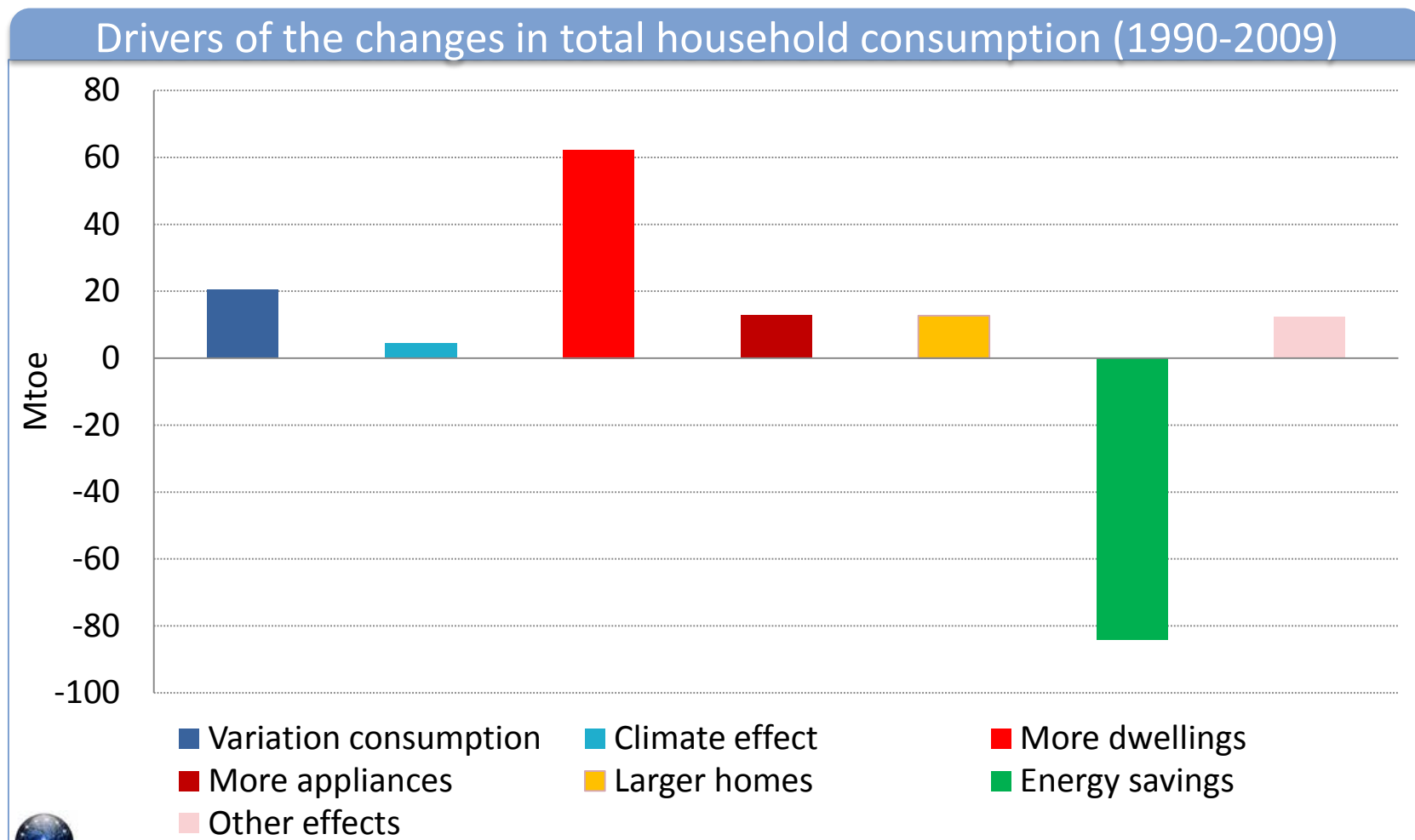
Large discrepancies among countries : from few improvements for Hungary, Greece to great improvements for new members such as Slovenia, Poland and Romania.



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

Between 1990 and 2009, the increase in the number of dwellings would have increased the household consumption by more than 60 Mtoe; larger dwellings and more appliances by about 13 Mtoe each

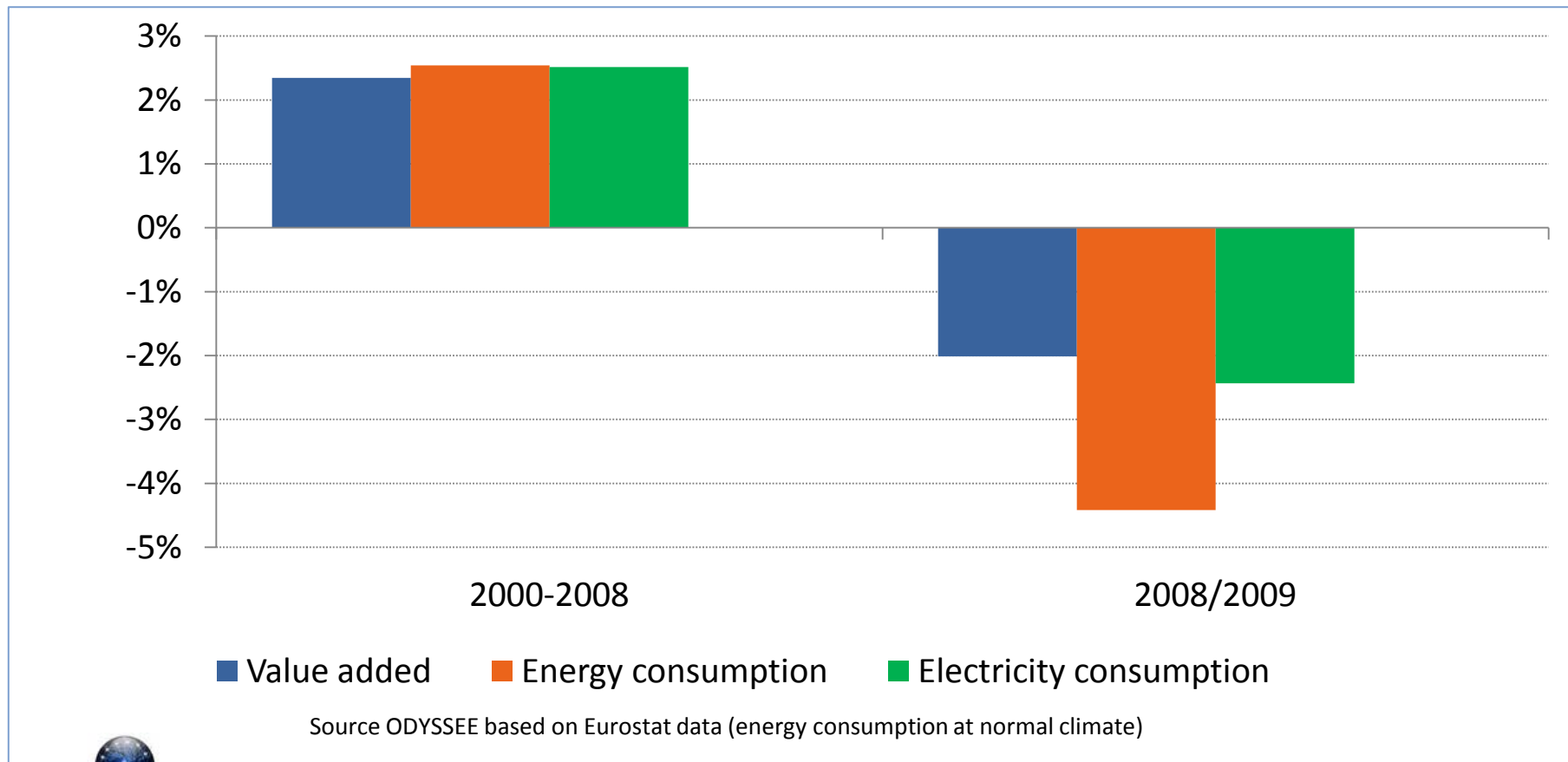
Energy savings offset most of the effect of these factors (> 80 Mtoe): as a result of these opposite trends, the total household consumption only increased by 20 Mtoe



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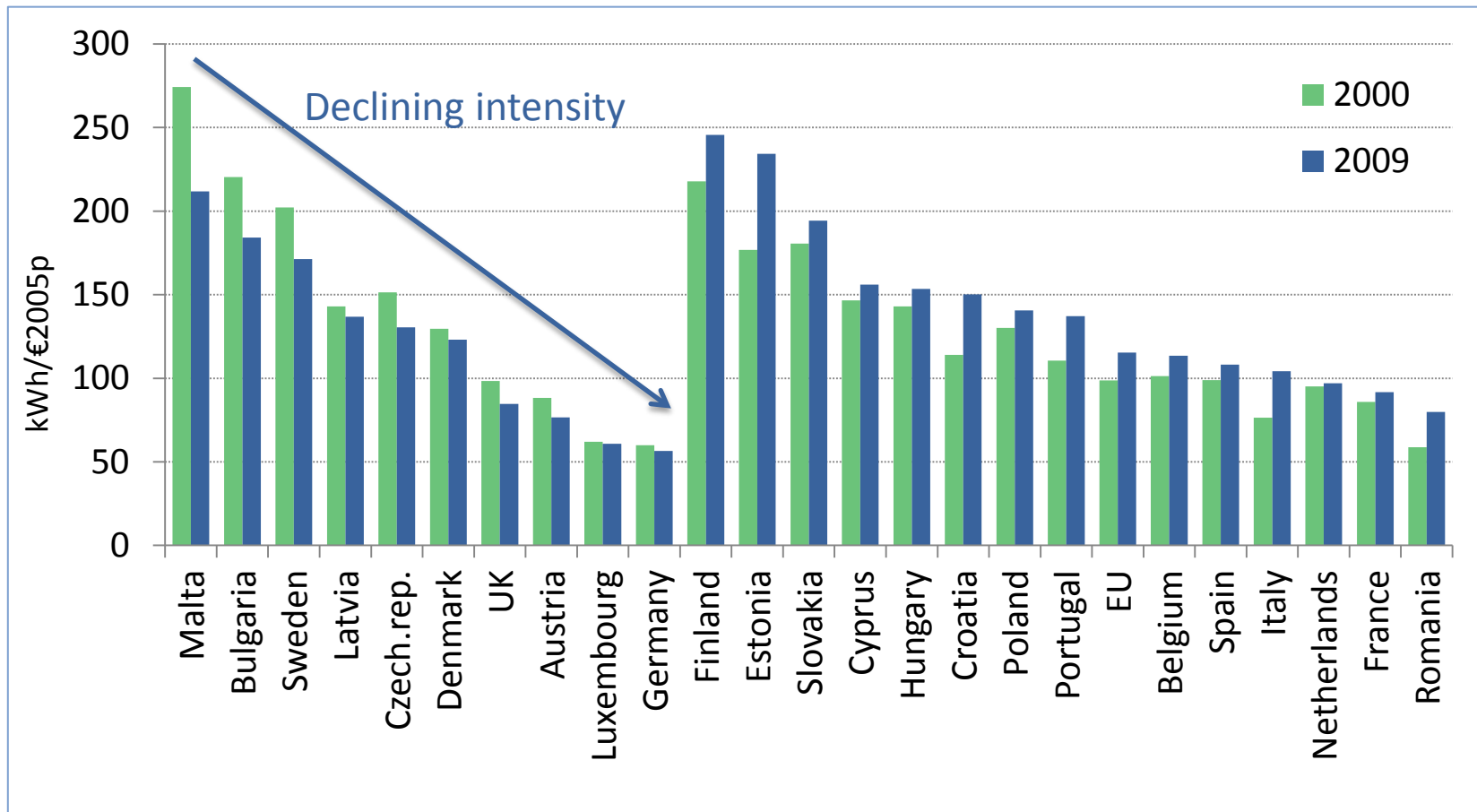
- Strong contraction of total energy consumption in 2009 (-4.4% for the total), more than twice higher than the value added (-2%)
- Since 2000, electricity consumption is growing at the same rate as the value added

Energy consumption and economic growth in services (EU)

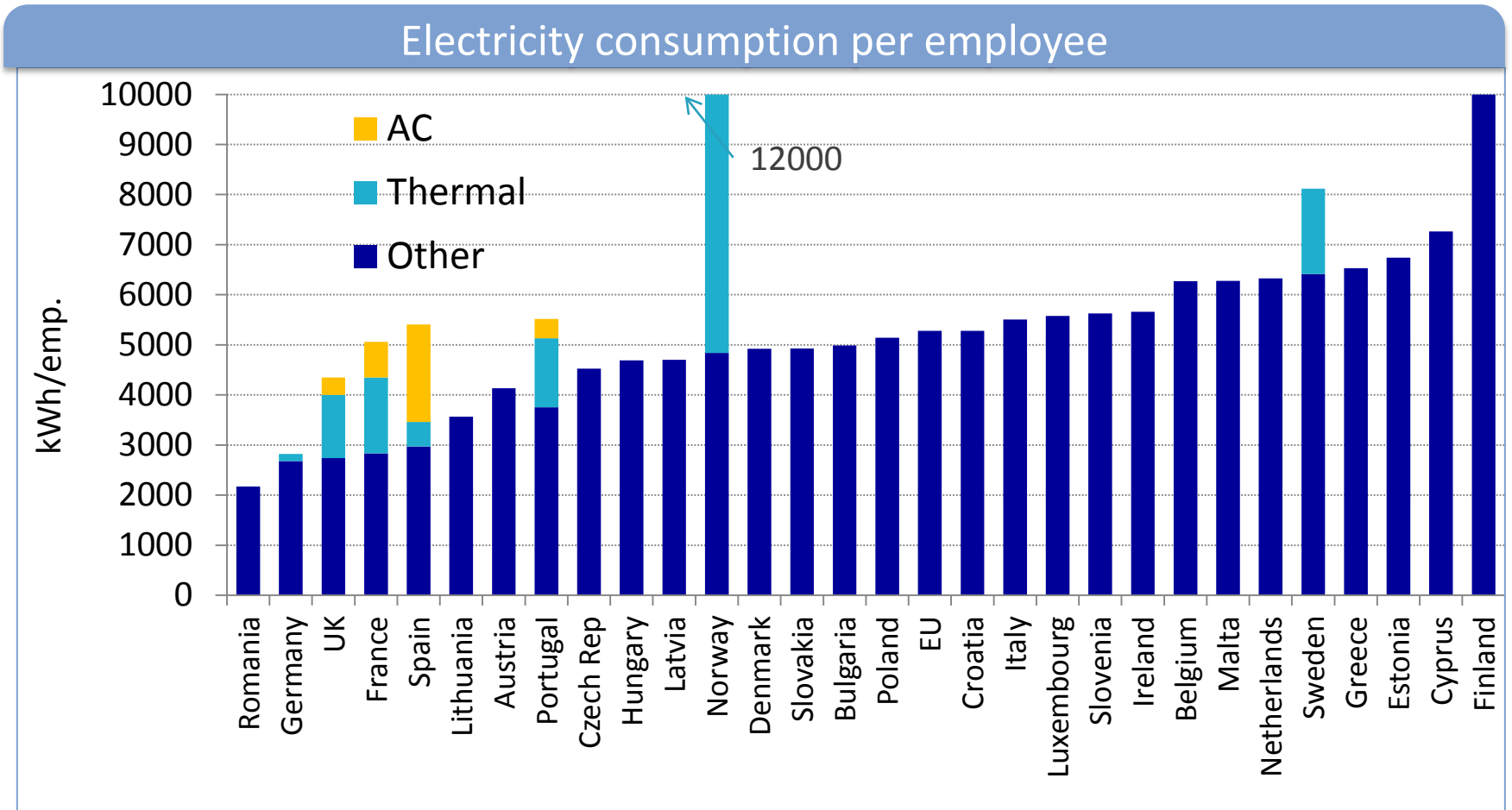


- Increasing electricity intensity in most countries : 1.7%/y at EU level
- Decreasing values in 10 countries: with very low value in Germany, Austria and UK

Electricity consumption per unit of value added in services

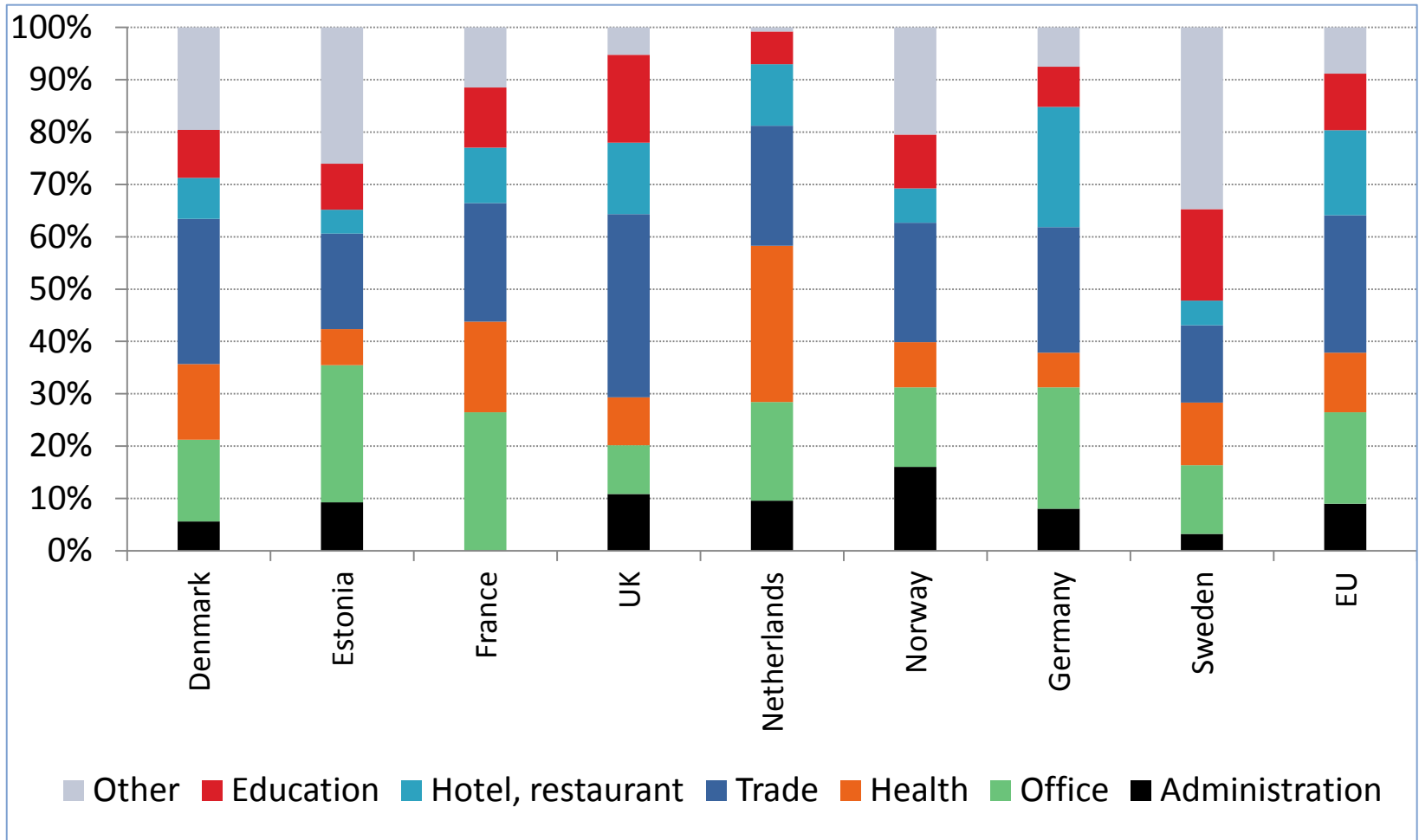


- Large discrepancies among countries: a factor 2 to 3 between Romania, Germany or UK and Nordic countries (Sweden, Finland)
- High values explained by large diffusion of air condition (e.g. Greece, Malta)



- The distribution of energy consumption according to service sub-sectors is quite heterogeneous; though the wholesale and retail trade sector is the most important with 25% of the total

Energy consumption by sub-sector in services

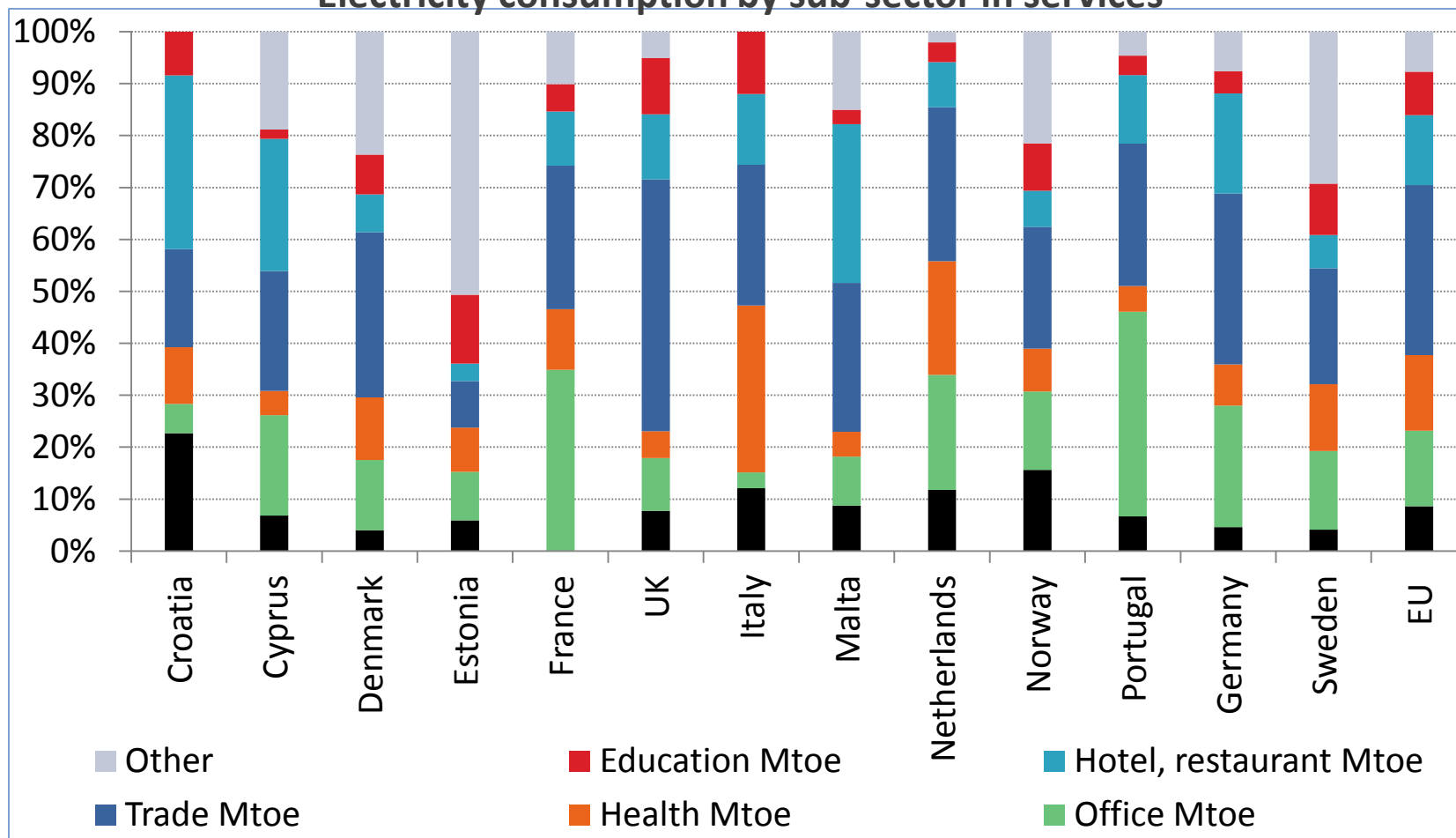


EU: Based on samples of 8 main EU countries (depending on sector);

France : offices also include administrations

- Trade sector consumes 30% of the total electricity at the EU level. For almost all countries, trade sector represents the largest share of electricity consumption, up to 44% in UK

Electricity consumption by sub-sector in services

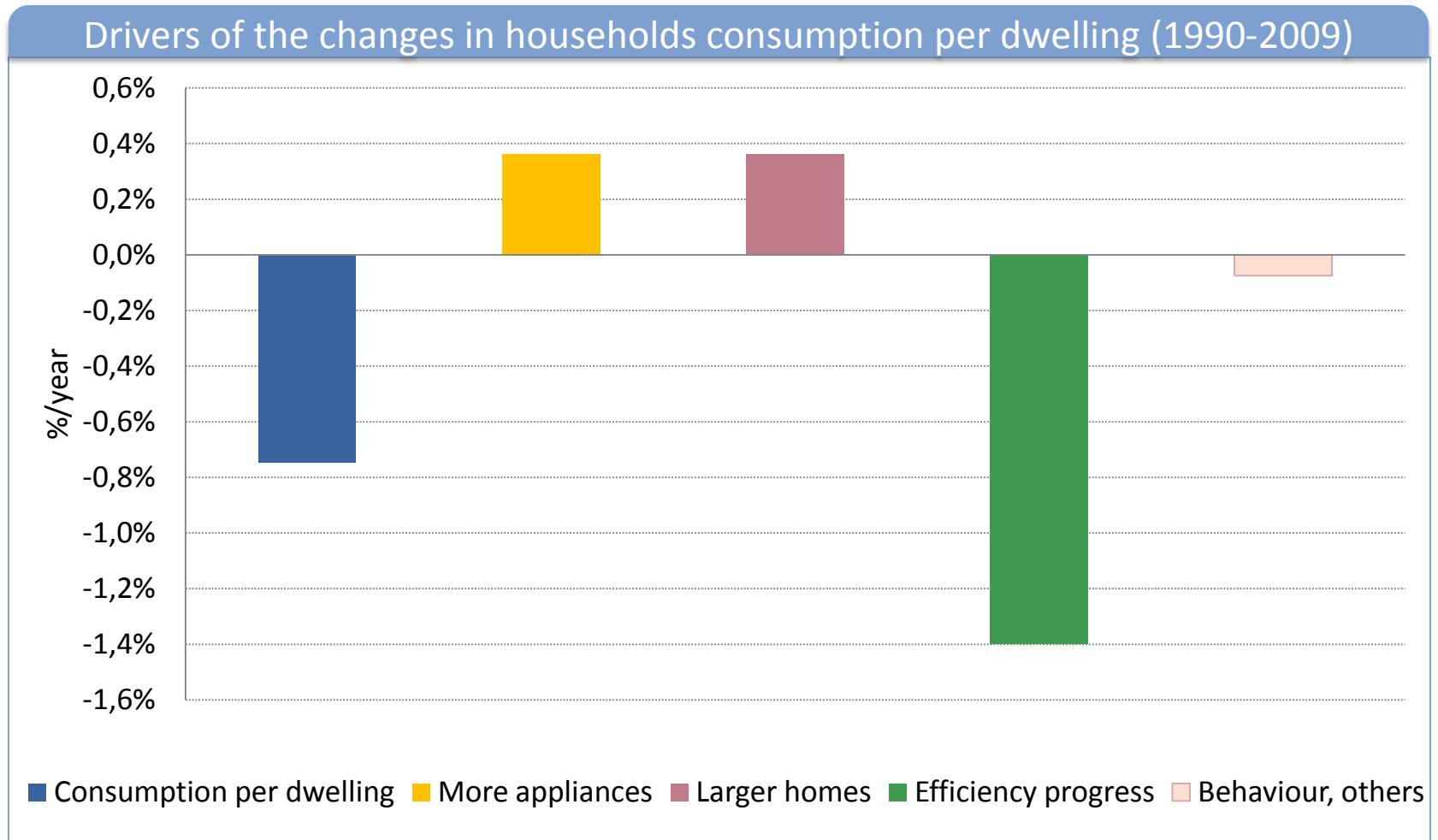


EU: based on samples of 9 main EU countries (depending on sector); France : administration included in offices; Italy : education included with health

Conclusions

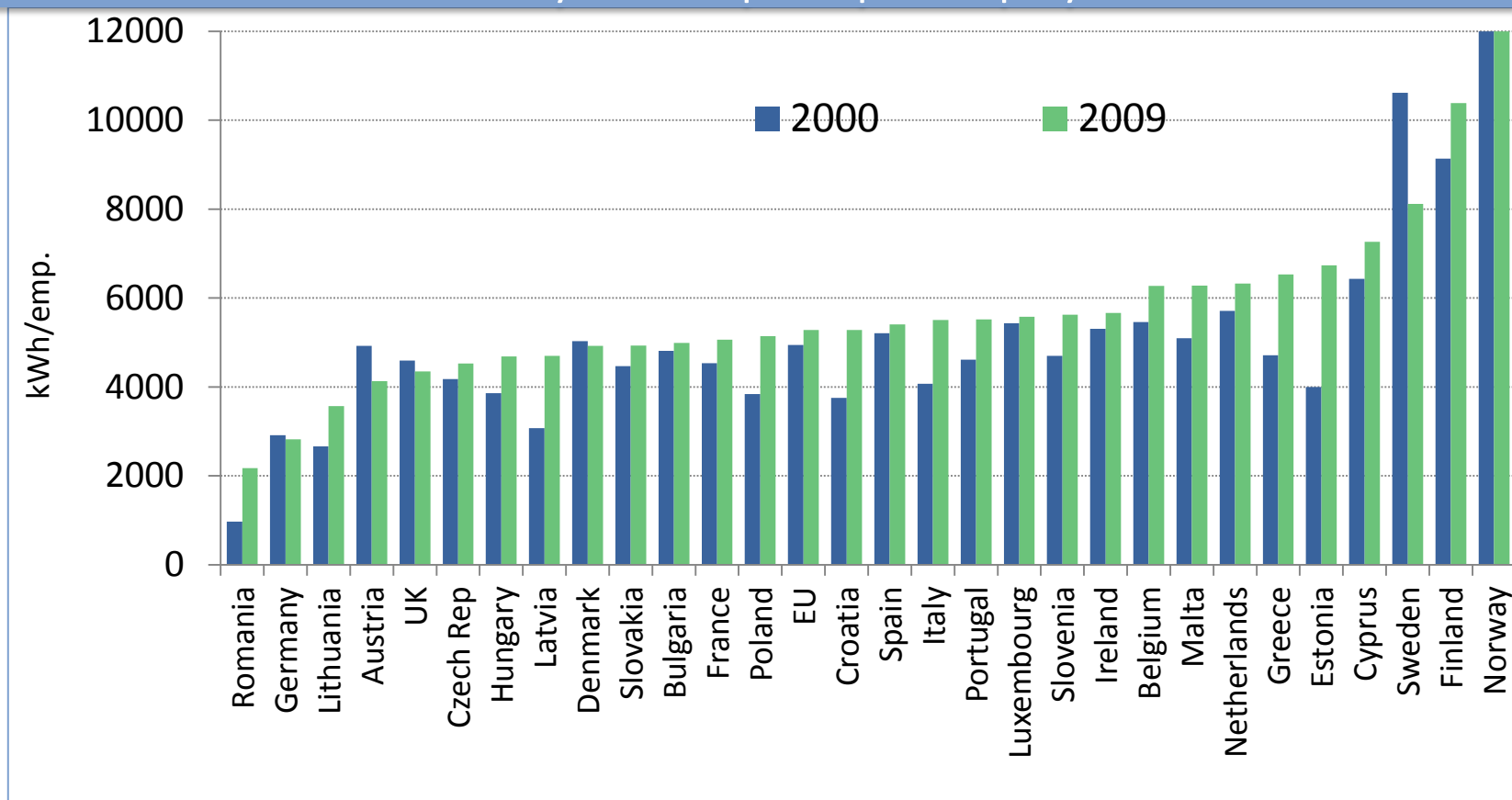
- Strong reduction of the average consumption per dwelling **in 2009** in most countries.
- Energy consumption per dwelling **below 2000 level** in almost 2/3 of countries in 2009.
- Austria and Cyprus are benchmark countries for solar water heating
- The comparison of heating performance can be improved by calculating useful energy on the basis of the actual average efficiency of heating systems → this implies to collect data on the stock of heat pumps and condensing boilers
- The comparison in final energy can also be improved by a non linear climatic adjustment on the basis of the square root of the degree days

Larger dwellings (+0.4%/y on average) and more appliances (+0.4%/y) have offset the equivalent of 60% of the energy efficiency gains



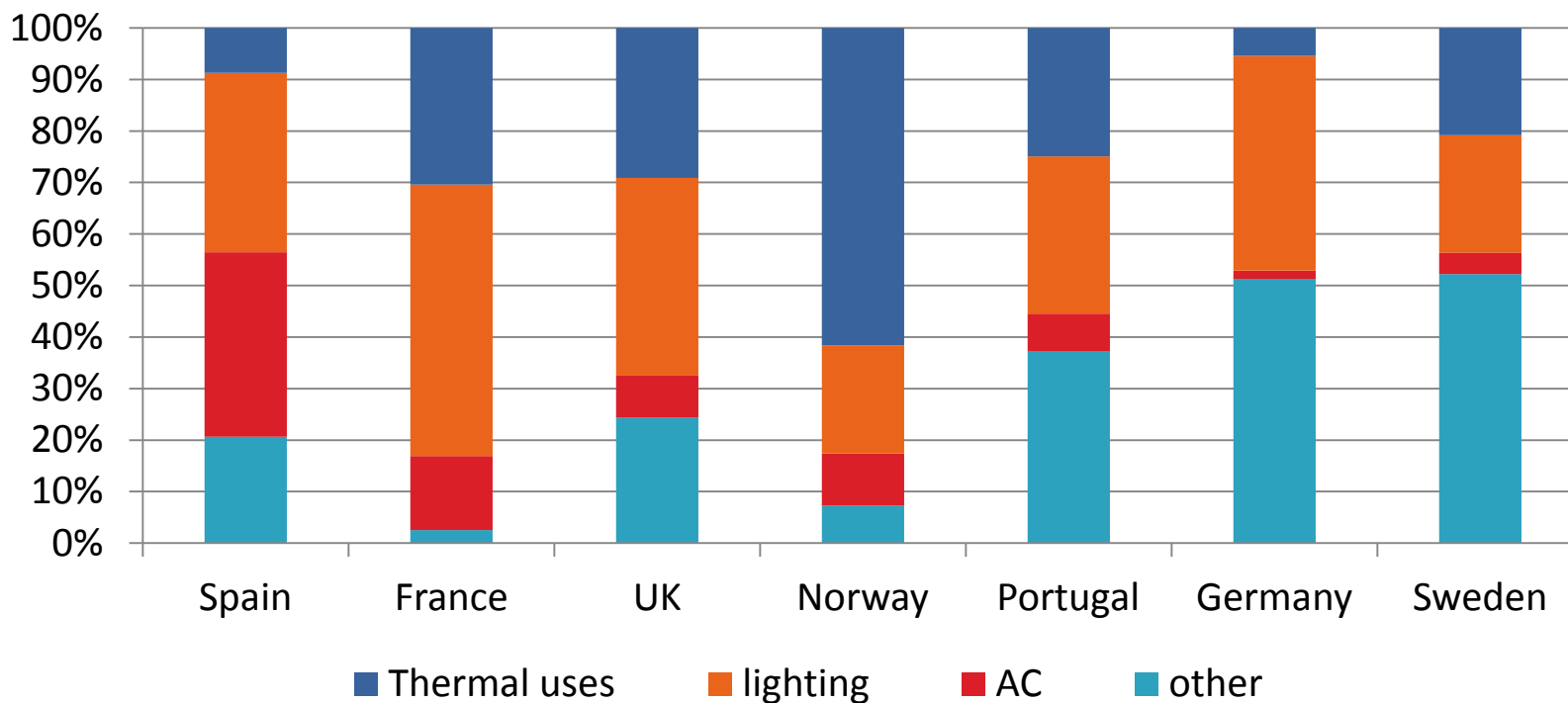
- Large discrepancies among countries: a factor 3 between new members countries, such as Romania and Lithuania and Nordic countries (Sweden, Finland and Norway)
- Increasing electricity consumption per employee except for 6 countries (Germany, Austria, UK, Denmark, Norway and Sweden).
- Nordic countries are in the contrary the less performing countries. Nevertheless, Sweden is improving its consumption (-2.9%/year between 2000 and 2009)

Electricity consumption per employee



- Thermal uses of electricity are important in France, UK (30%) and Norway (62%)
- Increasing share for air conditioning and specific electricity due to the diffusion of office equipment

Electricity consumption by end uses (2008)



Thermal uses: space heating, water heating and cooking