




# Households and service sector indicators and surveys

EPE-GIZ training on indicators

EPE, Rio de Janeiro , September 13-16 2011

Bruno Lapillonne, Vice President, Enerdata

Prepared with the support of GIZ

- 
- 1. Household indicators
  - 2. Service sector indicators
  - 3. Surveys



# Households indicators: definition and interpretation

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- ▶ 1. Overview of indicators
- 2. Data needed and definition
- 3. Climatic corrections
- 4. Specific energy consumption per dwelling:  
climatic adjustments
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- 6. Electrical appliances
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- 8. Air conditioning
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- 10. CO2 indicators
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## Basic indicators for households

Indicator	Comment
Energy consumption per household	Very aggregate ; includes change in equipment ownership
Electricity consumption per household	Very aggregate ; includes change in equipment ownership and electrification
Electricity consumption per electrified household	Very aggregate ; includes change in equipment ownership
Energy consumption of dwelling per unit of private consumption	Very aggregate ; measures the relative variation between energy use by household and their private consumption (a proxy for income)

## Advanced indicators by end-use in ODYSSEE: heating and water heating

Indicators	Type
Energy consumption per dwelling adjusted at same climate	SEC
Energy consumption for heating per dwelling	SEC
Energy consumption for heating per m2	SEC
Useful energy consumption for heating per dwelling or per m2	SEC
Energy consumption for heating per m2 or per dwelling for new dwellings	SEC
Penetration of efficient heating appliances (condensing boilers, heat pumps) solar water heaters (% of households equipped, annual sales)	Diffusion
Energy consumption for water heating per dwelling	SEC
Energy consumption for water heating per capita	SEC
Annual surface of solar water heaters installed per year	Diffusion
Penetration of solar water heaters (% of households equipped)	Diffusion

SEC: Specific Energy Consumption

## Advanced indicators by end-use in ODYSSEE: lighting and electrical appliances

<b>Indicators</b>	<b>Type</b>
Electricity consumption of appliance i (kWh/dwelling)	SEC
Penetration of efficient labels for appliance i	Diffusion
Electricity consumption for lighting (kWh/dwelling)	SEC
Penetration of efficient lamps (CFL)	Diffusion
Energy efficiency progress	ODEX
Energy savings by end-use	Savings
Decomposition of energy consumption variation by mode	Decomposition

SEC: Specific Energy Consumption

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## Household data

- There exists different statistics related to the **stock of dwellings**:
  - ✓ The most common ones relate to the total stock and to the stock of permanently occupied dwellings.
  - ✓ The difference between the two data corresponds to summer/week-end residences plus vacant dwellings.
  - ✓ For energy consumption analysis, the relevant data to handle is the stock of permanently occupied dwellings. Such statistics are usually available from the national statistical office.
  - ✓ Number of households closed to the number of occupied dwellings
  
- **Floor area** (average dwelling size) (m<sup>2</sup>) corresponds to the living area as usually defined in household survey and construction statistics.

## Household data: energy consumption for heating

- **Total energy consumption of households for space heating.**
- Not usually published by national statistical organization.
- It is estimated by specialised organisation on the basis of surveys and modelling and endorsed by national energy agencies or institutions.

## Household data: energy consumption for water heating

- The energy consumption for water heating is not available in usual energy statistics and is part of more detailed data or estimates.
- The consumption for water heating includes oil products, gas, coal and lignite, electricity, district heat, biomass and solar.
- In some cases, the use of solar water heaters is considered as a source of energy saving → the energy consumption of water heating should exclude solar energy for all calculations of energy savings and energy efficiency index.
- This is different of what is done in energy consumption statistics that accounts solar energy in the total consumption of households.
- Usually modeled from the stock of appliances by type of energy and an annual energy use by equipment

## Household data: electrical appliances

- Stock of appliance usually available from national statistics or can be estimated:
  - ✓ Either with a stock model from annual sales and an average lifetime.
  - ✓ Or from annual household survey on equipment ownership (i.e. % of households owning one or several appliances).
  
- Specific consumption for large appliances: calculated by dividing the total electricity consumption of each large appliance by the stock of appliances:
  
- Total consumption of the stock available from national estimates; it is usually estimated from calculation procedure that are specific to each appliance type:
  - ✓ for instance, for washing machines, dishwashers and cloth dryers, it is calculated as the electricity consumption per cycle multiplied by a number of cycles per year;
  - ✓ for TV it is calculated as the average power of the TV stock (in Watts) multiplied by an average number of hours of use per day and multiplied by 365 days.
  - ✓ For cold appliances, refrigerators and freezers, it is calculated as the specific electricity consumption per litre multiplied by the average size of the stock in litre and multiplied by 365 days.

## Household data: lighting

- The unit electricity consumption is calculated by dividing the electricity consumption for lighting by the number of occupied dwellings.
- The electricity consumption for lighting is for some countries available from national estimates; it is not covered by usual energy statistics. It is usually estimated from calculation procedures that take into account the number of lighting points, or the average lighting power and an average number of hours of lighting per year.
- A default value can be 1000 hours per year.

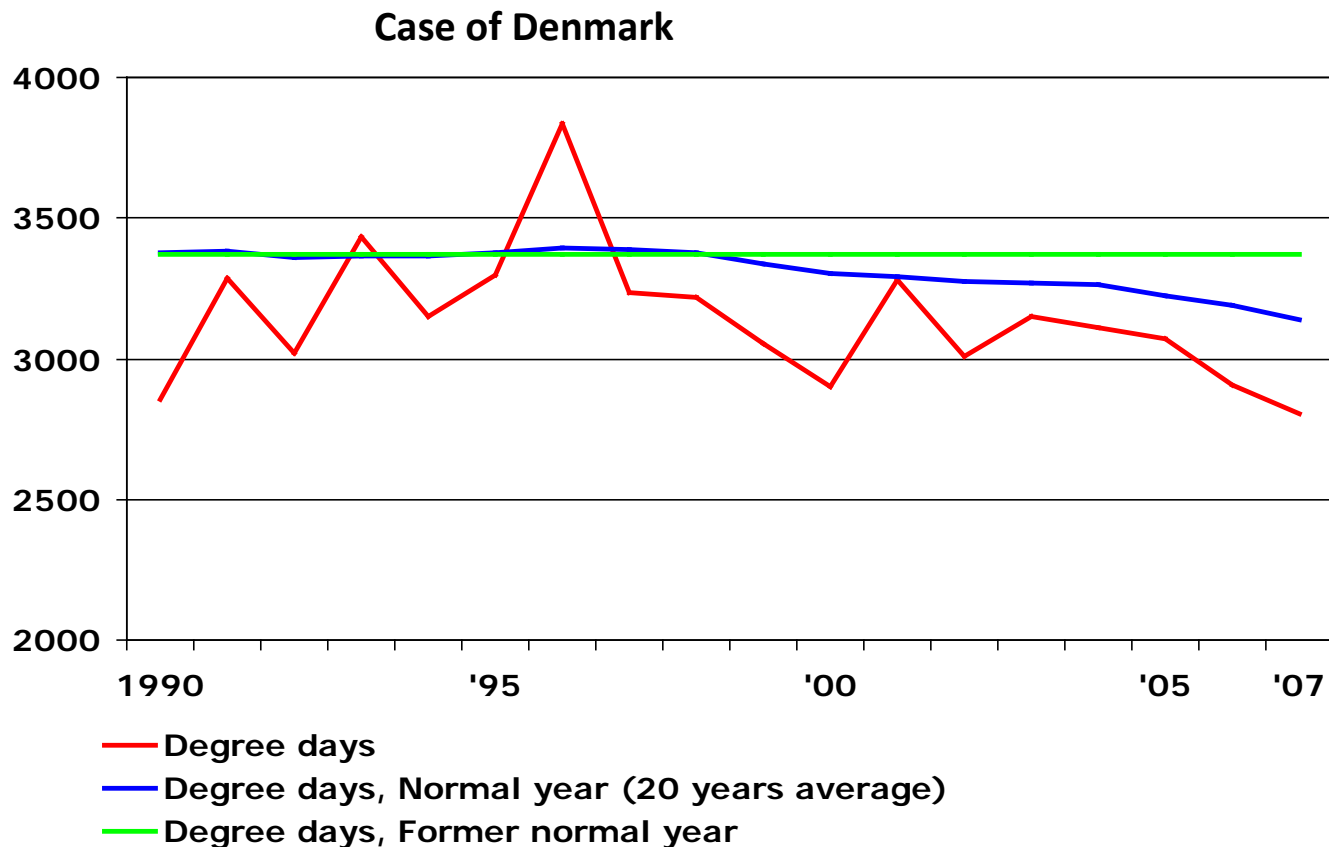
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## Household data: degree-days for heating

- Indicator of the winter severity, and thus of the heating requirement.
- Calculated as the sum over each day of the heating period (e.g. October to April) of the difference between a reference indoor temperature (usually 18°C) and the average daily temperature → If the average temperature of a day in winter is 5°C, the number of degree day of that day is 13 degree days (18-5).
- Number of degree-days in EU countries in a range from 700-800 degree-days for Cyprus and Malta to 4000-5000 degree-days in Nordic and Baltic countries (around 2800 degree-days for the EU-27 average).
- Daily outside temperature measured from various meteorological stations and averaged to get a national value:
  - arithmetic average or as a population weighted average.
  - The second approach should be used as it is more representative of the heating requirement in the country.

## Household data: long-term or mean heating degree-days

- Number of degree-days for a normal winter or an average winter; based on a long-term average of degree-days value . Eurostat uses a 25 years average (1980-2004);
- Some countries have however shortened the reference period (20 years) and are calculating the average since 1990 to account for the fact that winters have been warmer since 1990. Some countries are in addition changing the period (moving reference period), which means that the number of normal degree-days is not fix.





## Household data: cooling degree-days

- The **actual cooling degree days** is an indicator of the summer temperature, and thus of the cooling requirement. It is calculated as the sum over each day of the cooling period (e.g. May to September) of the difference between the average daily temperature and a reference indoor temperature (usually 20°C). For the moment there is no harmonised method to calculate cooling degree days in the EU and Eurostat does not provide such data.
- The **mean cooling degree days** represents the number of degree-days for a normal summer; it is based on a long-term average of degree-days value (e.g. 25 years).
- The calculation of cooling degree days is common in the US where they used 20°C as a reference, which is too low taking into account the present comfort habits and living style in Europe; a higher temperature would be more relevant (e.g. 26°C).

# Climatic corrections : methodology

- linear correction of the space heating consumption on the basis of the ratio normal degree days actual degree days
- for countries with yearly data: direct correction on space heating consumption
- for other countries , corrections on the space heating part of the consumption estimated from an exogenous and constant heating share (= method recommended by DIW to EUROSTAT)

# Climatic corrections : methodology

## → Countries with heating consumption data)

$$SH = SH_n \times (DD/DD_n) \text{ or } SH_n = SH \times (DD_n/DD) \quad (\text{by fuel})$$

## → Countries without annual space heating consumption data

$$\rightarrow E = E_n \times (1-K) + E_n \times K \times (DD/DD_n)$$

$$\text{or } E_n = E \times 1 / (1-K \times (1-DD/DD_n))$$

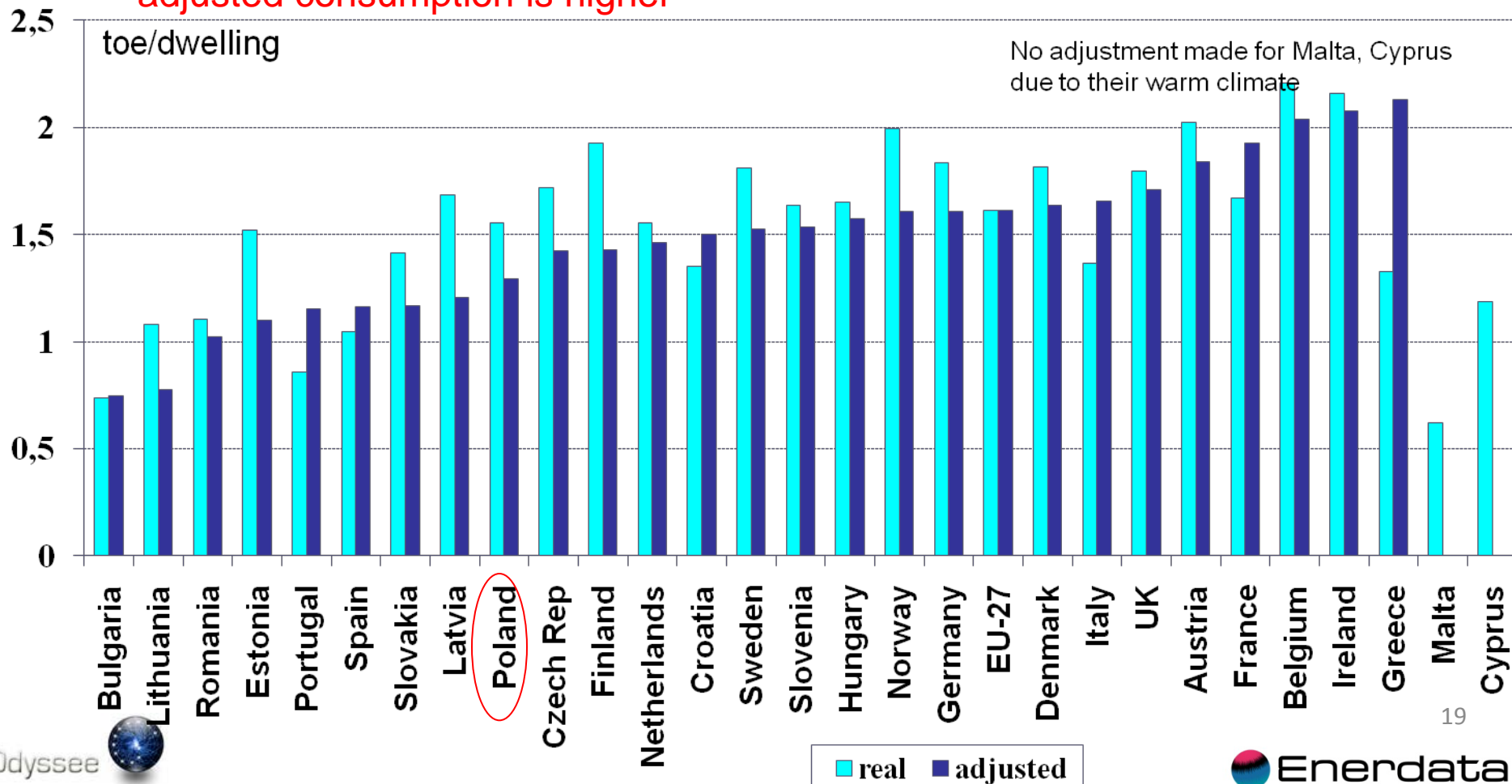
with  $K$  = heating share for normal year

or  $K = r \times a$  with  $r$  = heating share for normal year and  $a$  = share of heating dependant on degree days (eg 90%)

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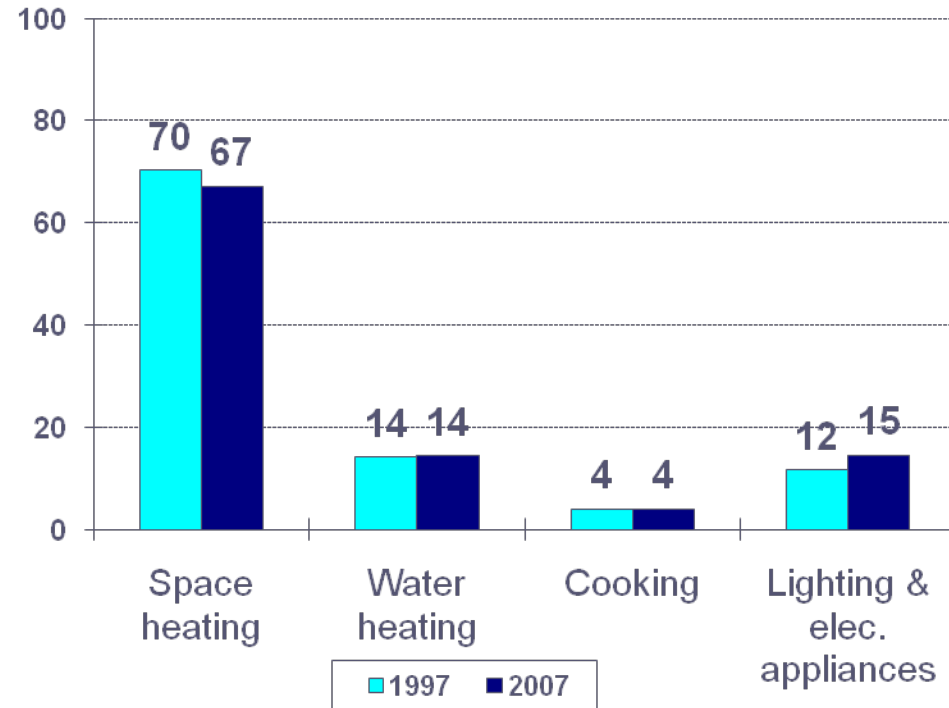
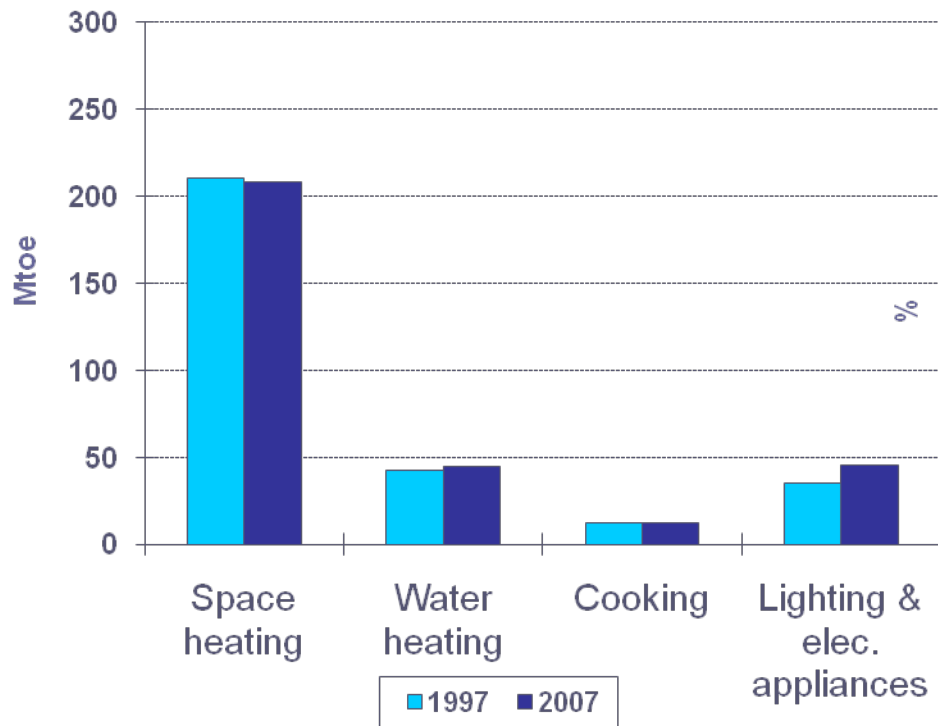
# Unit consumption per dwelling adjusted to EU average climate (2006)

The comparison 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



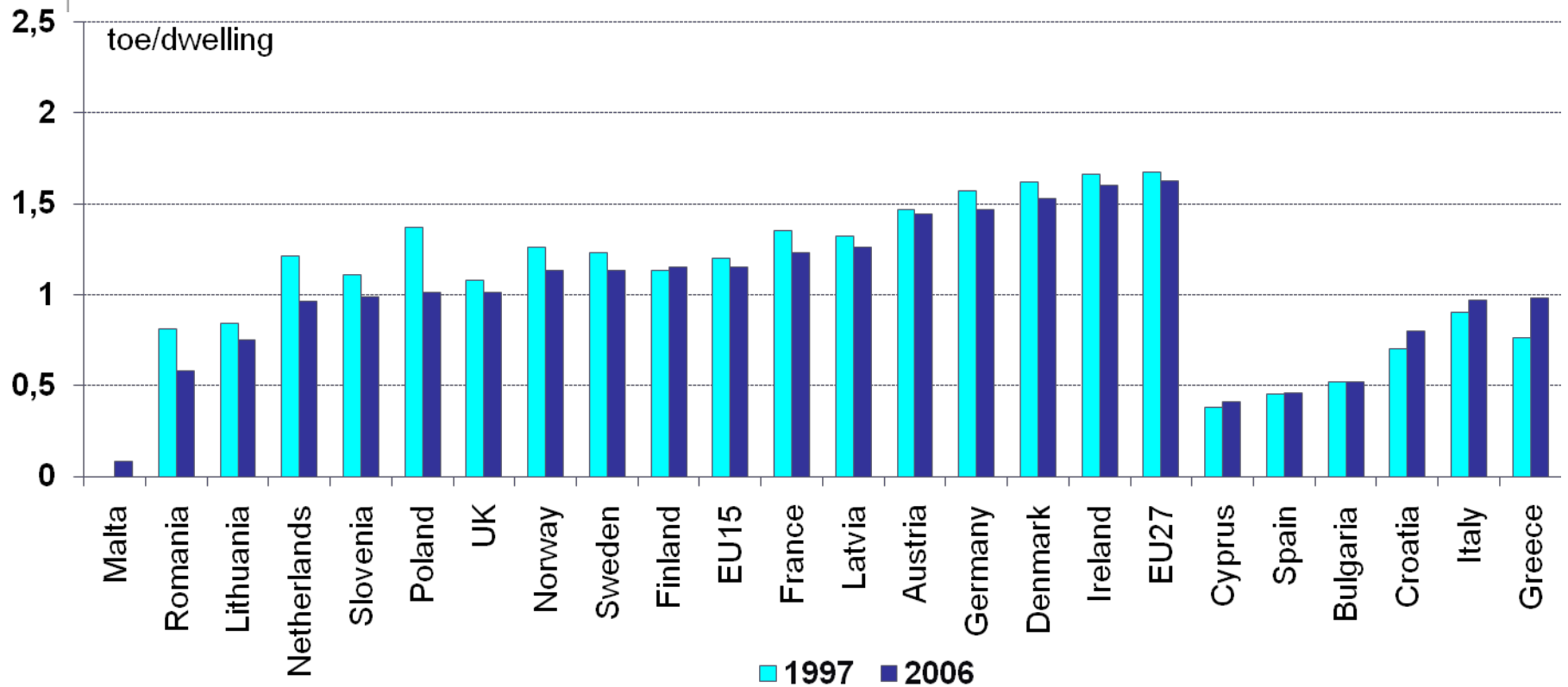
# Household energy consumption in the EU- 27

A slight progression of the household energy use in the EU-27 by 0.5 %/year since 1997, mainly due to a higher consumption for electrical appliances and lighting (+2.6 %/year) : declining share for space heating; increasing weight for electrical appliances and lighting



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# Heating consumption per dwelling in Europe

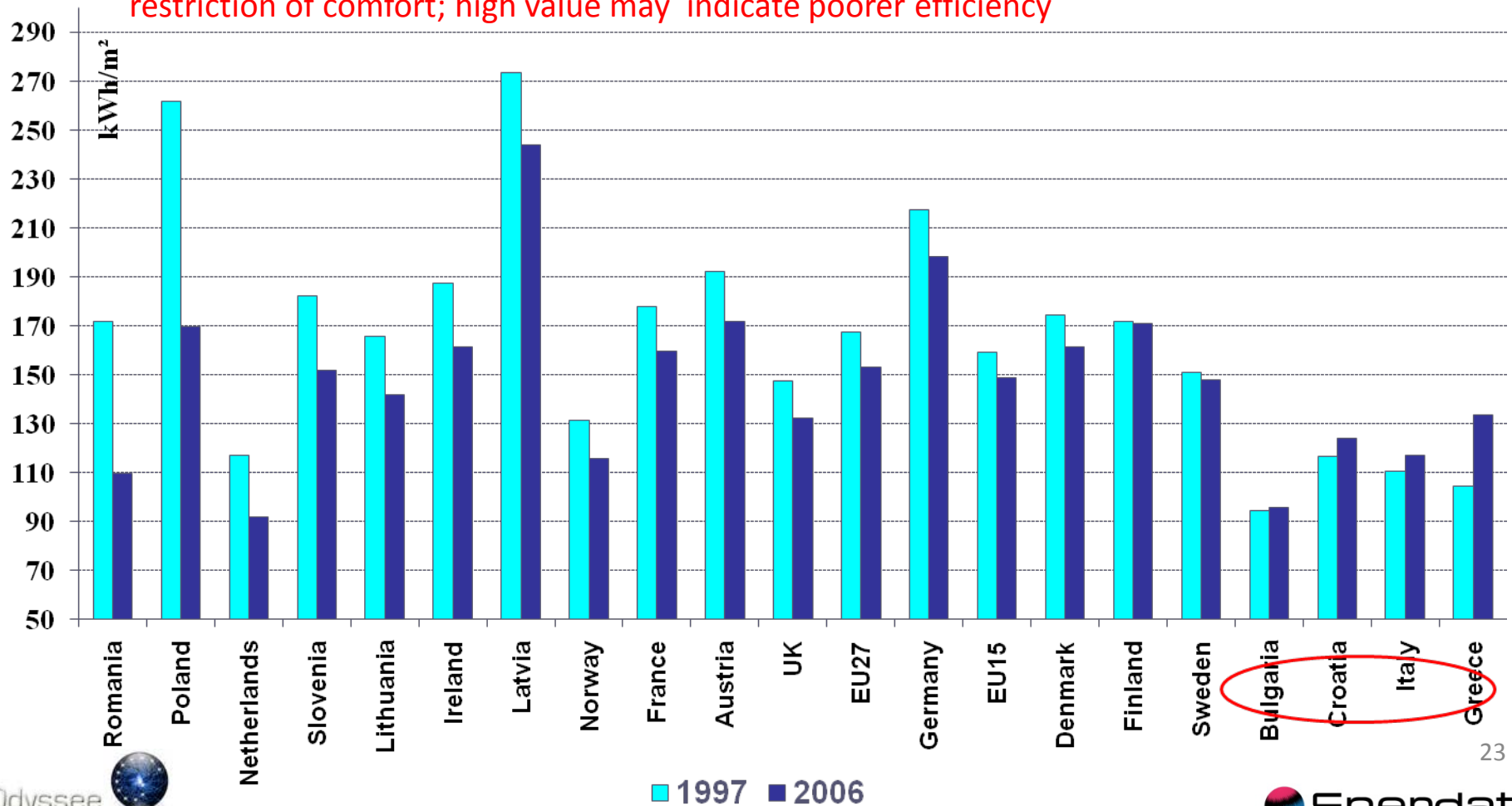




# Heating consumption per m2

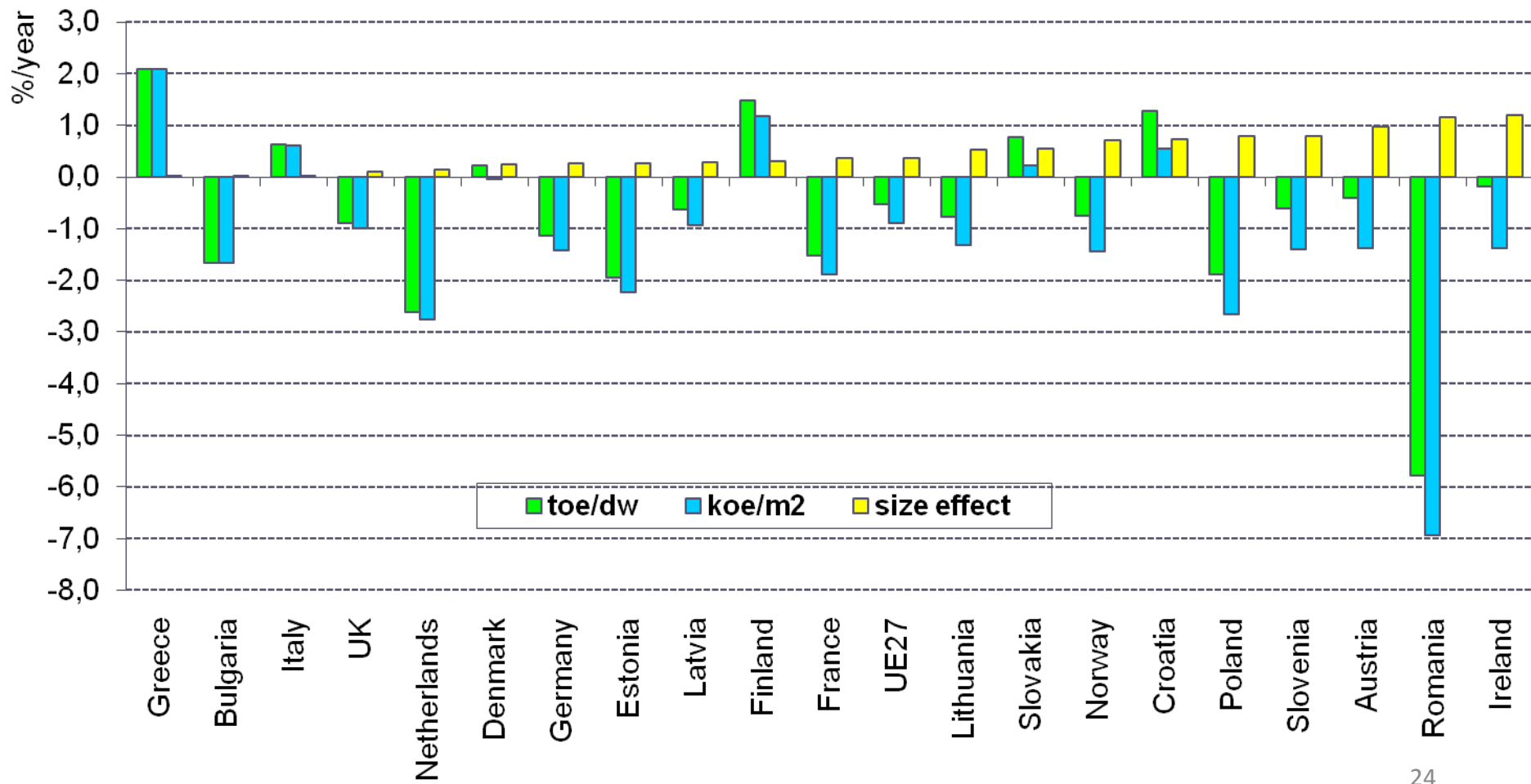
Decrease in all countries except Bulgaria, Italy, Croatia and Greece; for southern countries part of the increase due to progress in comfort; significant reduction in some EU-15 countries (e.g. The Netherlands, UK and France) and in some new member countries (combined effect of higher price and efficiency improvements)

Low value may not necessary reflect high energy efficiency, but the result of price increase and restriction of comfort; high value may indicate poorer efficiency

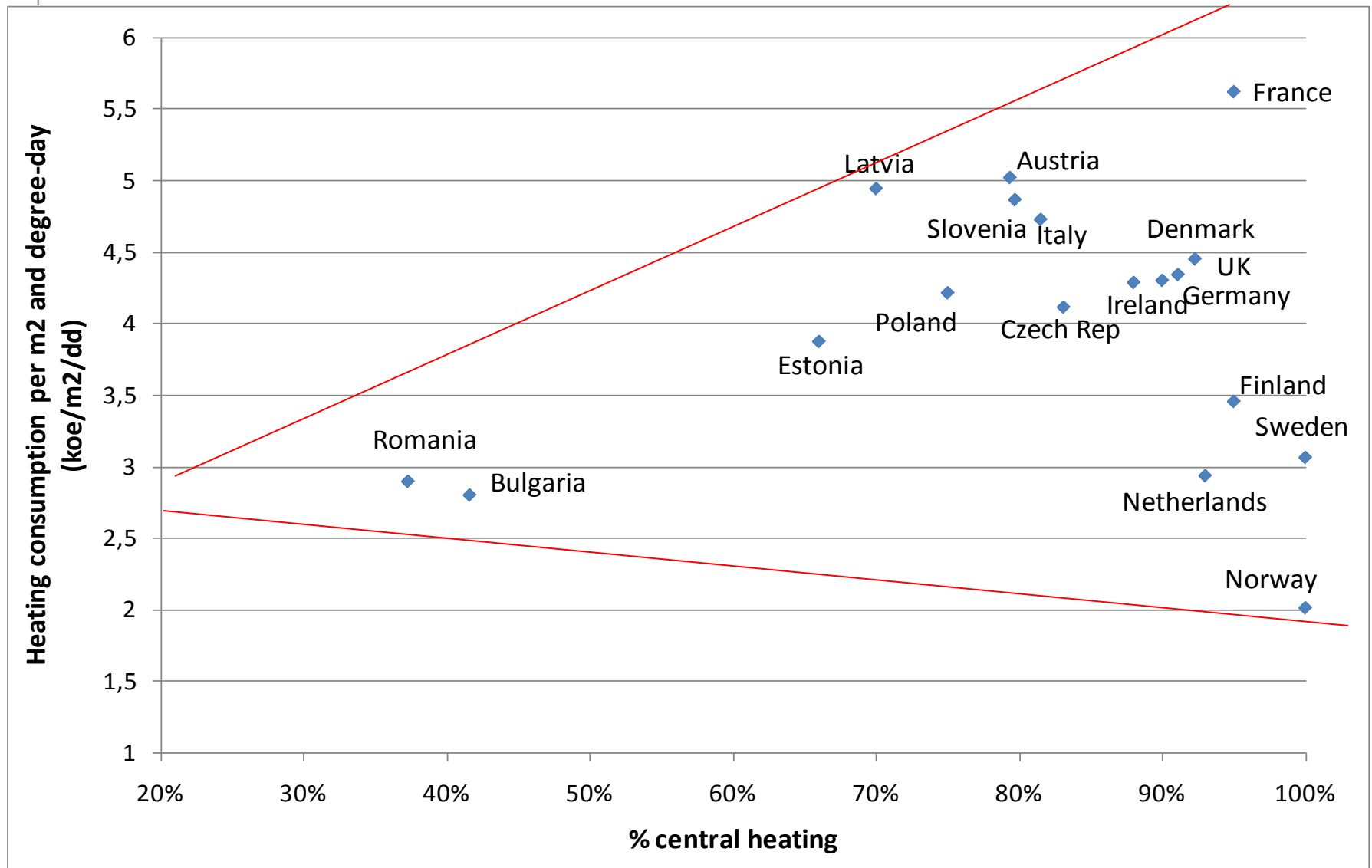


# Average consumption per m2 versus consumption per dwelling for households for space heating

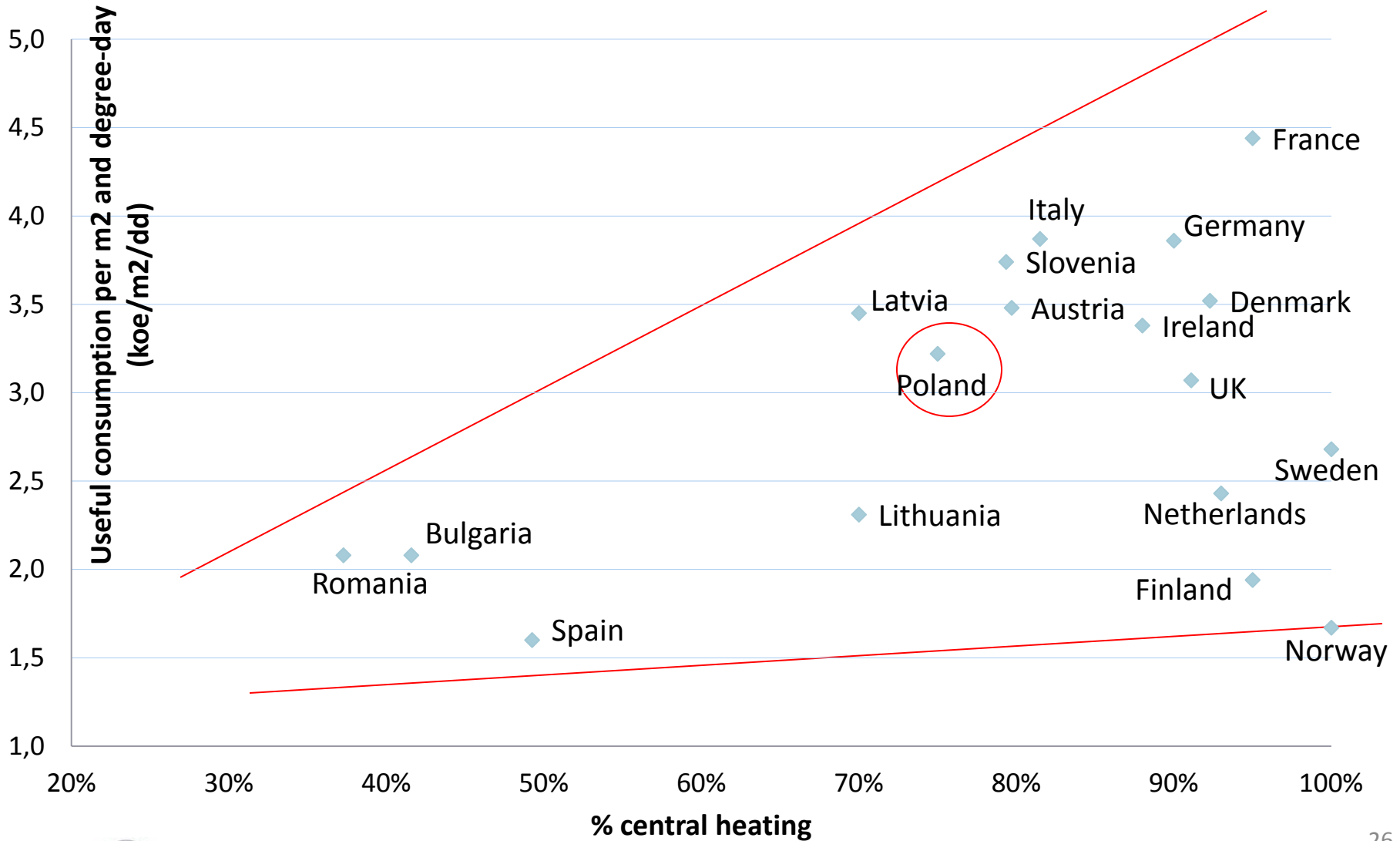
Increase in the size of dwellings offset part of reduction in the consumption between 1997 and 2006



# Household energy consumption for space heating per m2 and diffusion of central heating : final energy

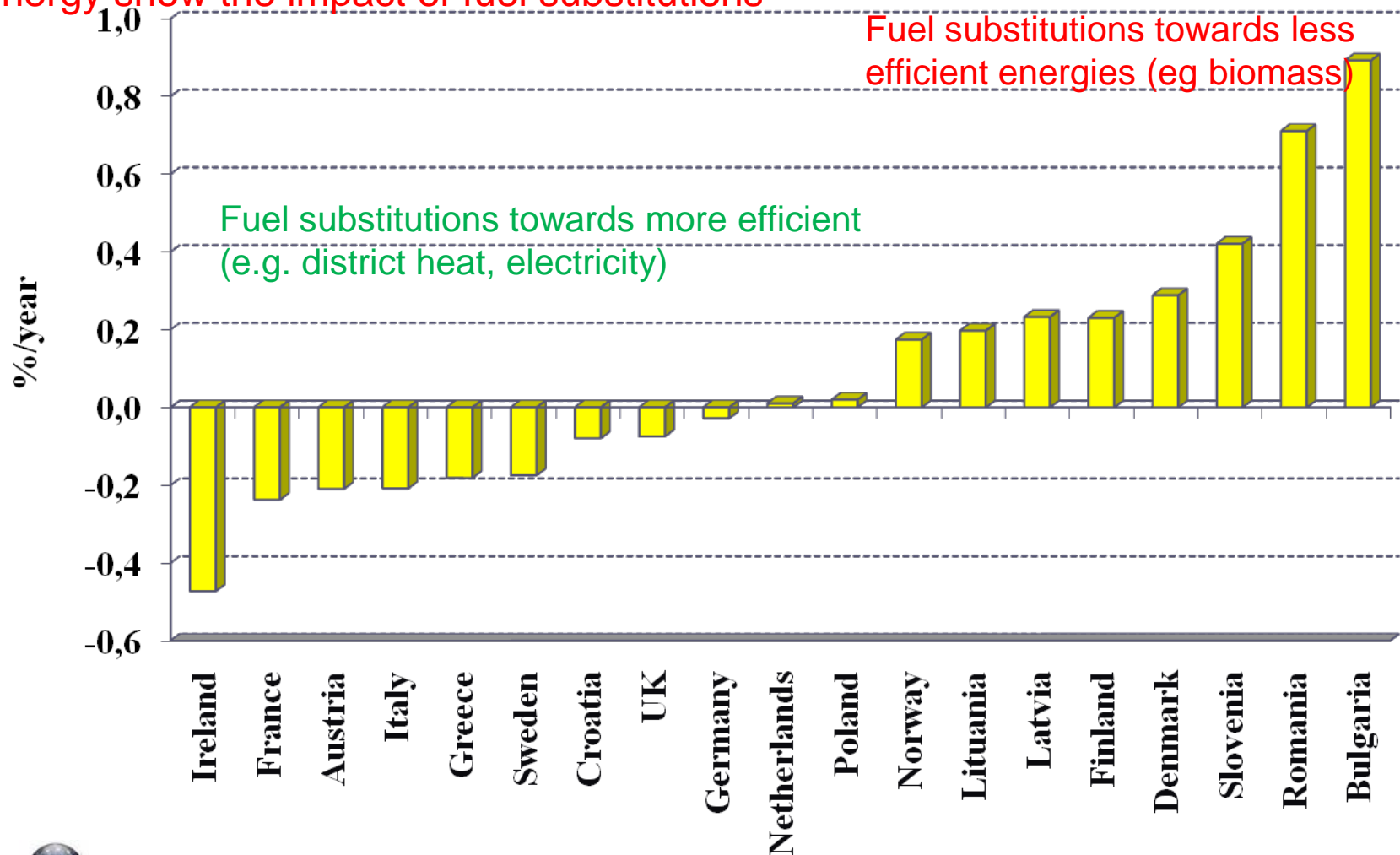


# Household energy consumption for space heating per m2 and diffusion of central heating: useful energy



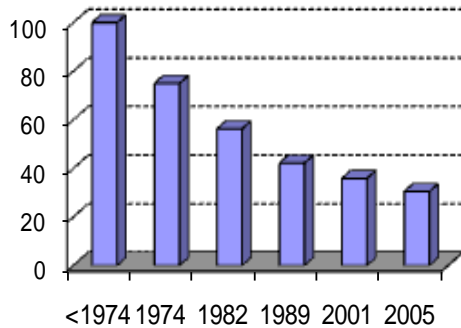
# Contribution of energy substitutions to the variation of the energy consumption per m2 for heating

Difference of variation between unit energy consumption in useful and final energy show the impact of fuel substitutions

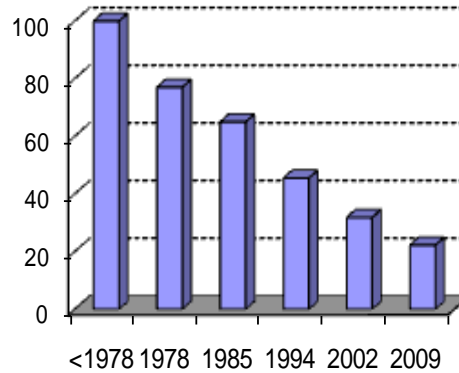


# Theoretical specific consumption of new dwellings according to building regulations in EU countries (first regulation= 100)

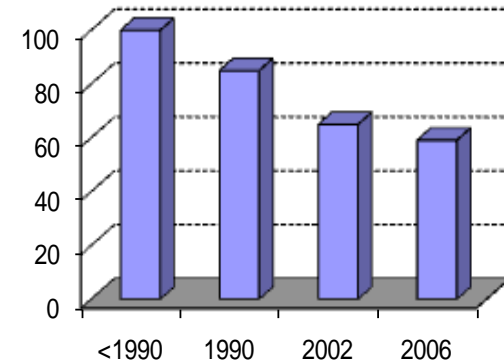
**France**



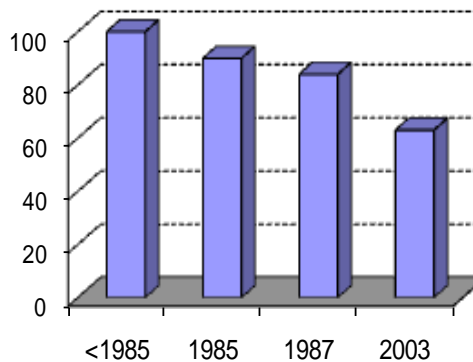
**Germany**



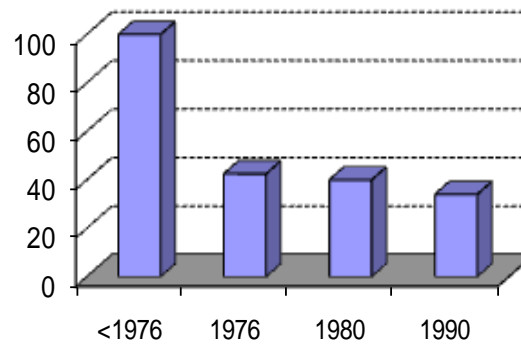
**UK**



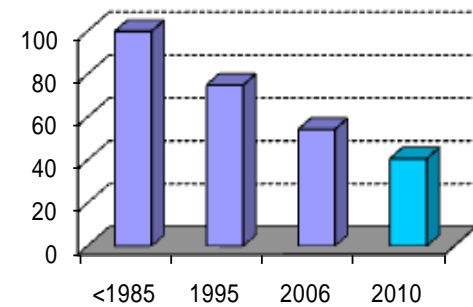
**Finland**



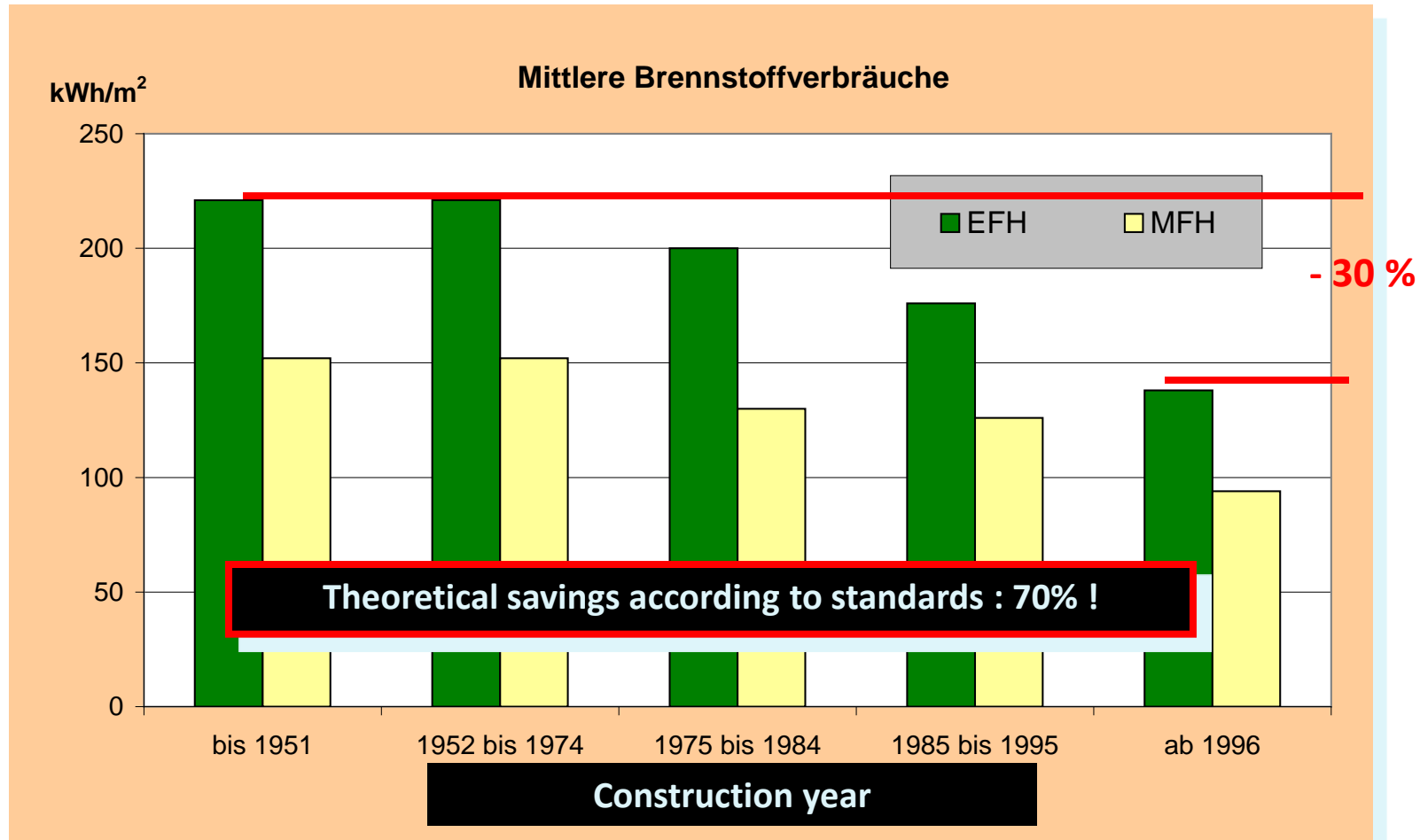
**Sweden**



**Denmark**



# Impact of new standards: problem of control and behaviours: Specific consumption of dwellings in Germany (2003)



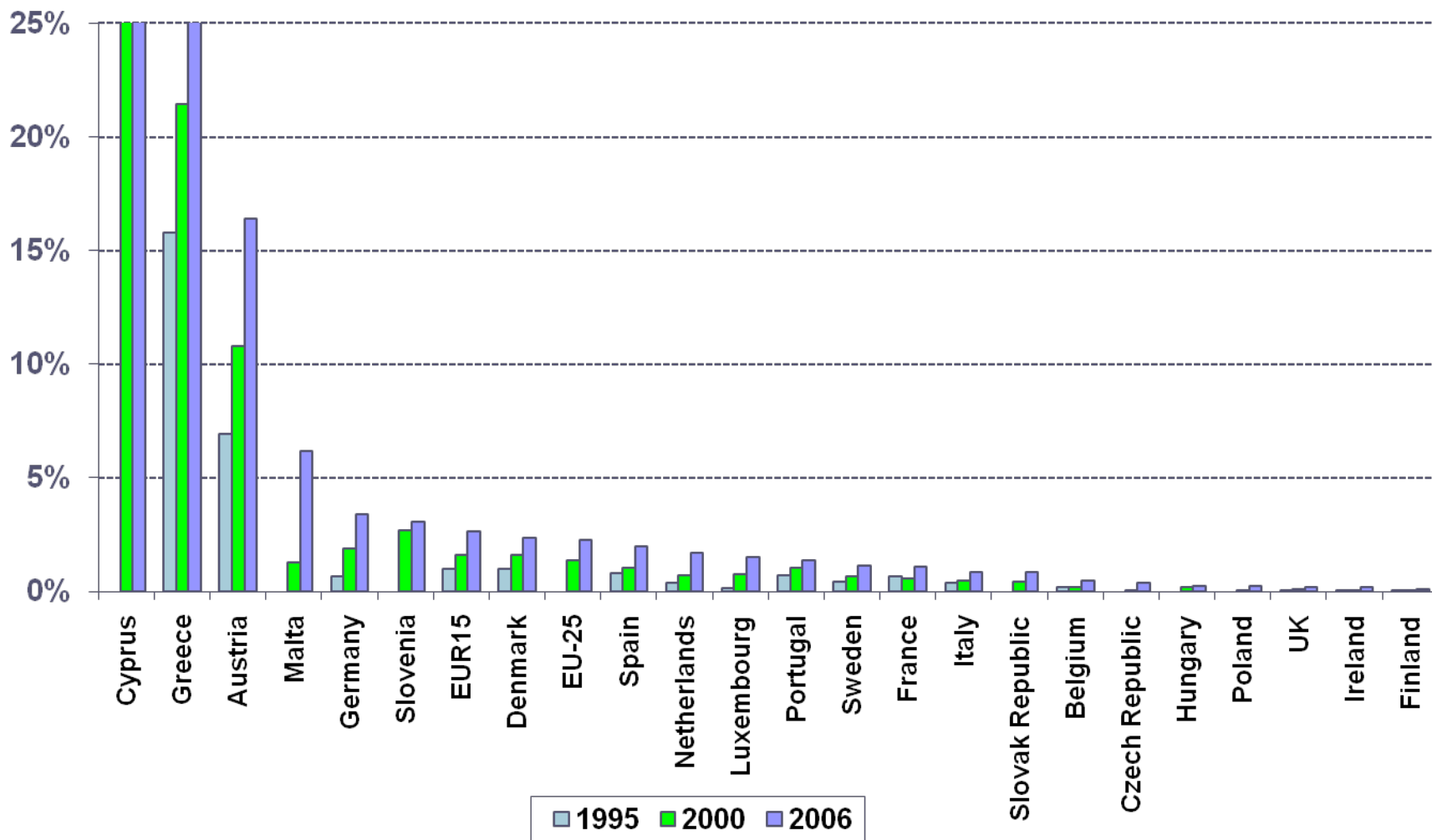
## Comparison of Odyssee indicators for heating

- Specific consumption per m<sup>2</sup> at normal climate (toe/m<sup>2</sup>)
- Specific consumption per dwelling at normal climate (toe/m<sup>2</sup>)
- Specific consumption per m<sup>2</sup> per dwelling equivalent with central heating (important for countries with a diffusion of central heating (Ireland, southern Europe))

	kWh/dwelling	kWh/m <sup>2</sup>	kWh/m <sup>2</sup> (per dwelling equiv with central heating)
<b>Pros</b>		<ul style="list-style-type: none"> <li>• Corrected for change in the average size of dwellings</li> </ul>	<ul style="list-style-type: none"> <li>• Corrected for the change in dwelling size and penetration of central heating</li> </ul>
<b>Cons</b>	<ul style="list-style-type: none"> <li>• Reduce the energy savings when dwelling size increases</li> </ul>		<ul style="list-style-type: none"> <li>• Implies an assumption on increased use with central heating compared to stove heating (+50%)</li> </ul>

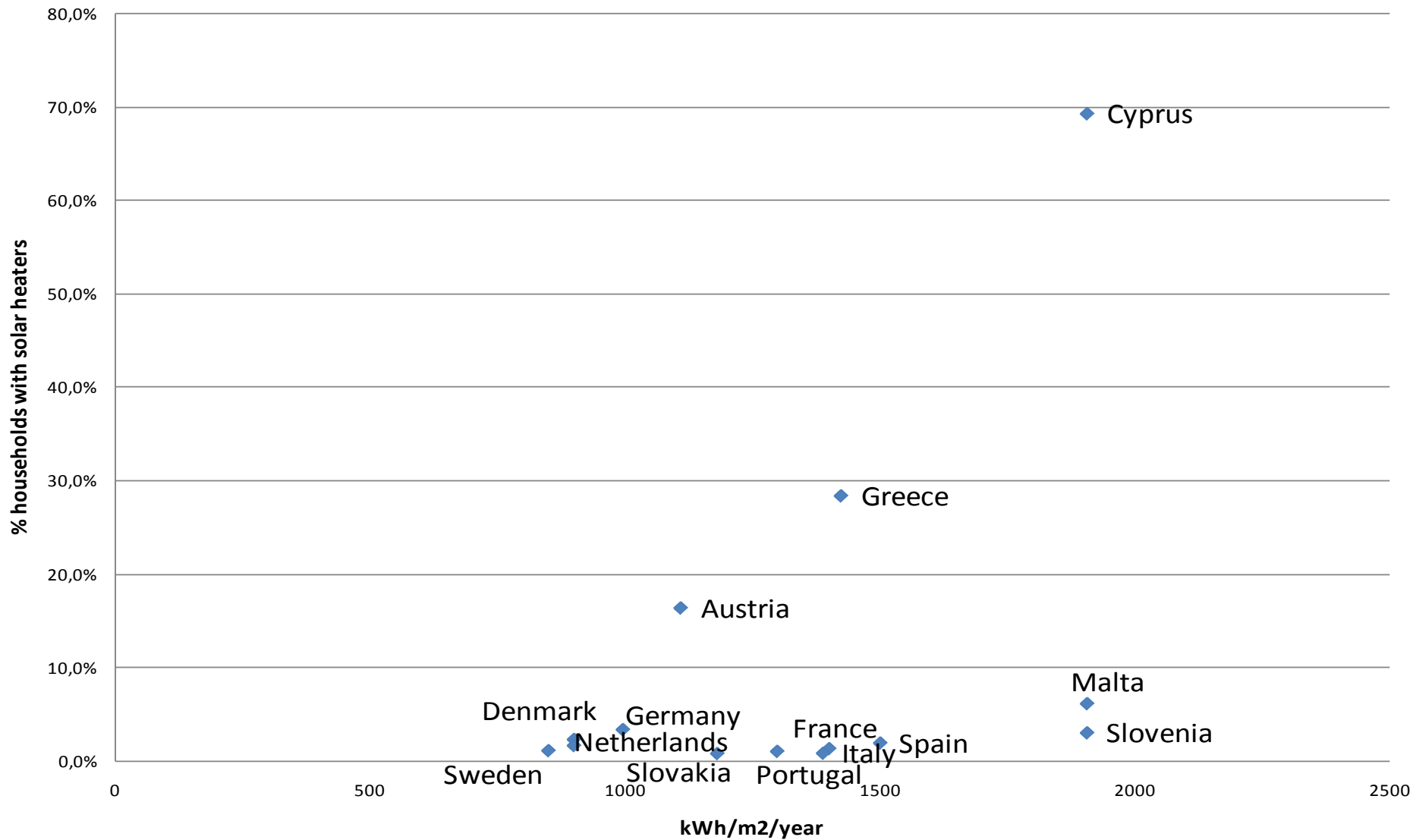


# Diffusion of solar water heaters: % of dwellings with solar water heaters



Source : Enerdata calculation from installed capacity in m2 from ObservER

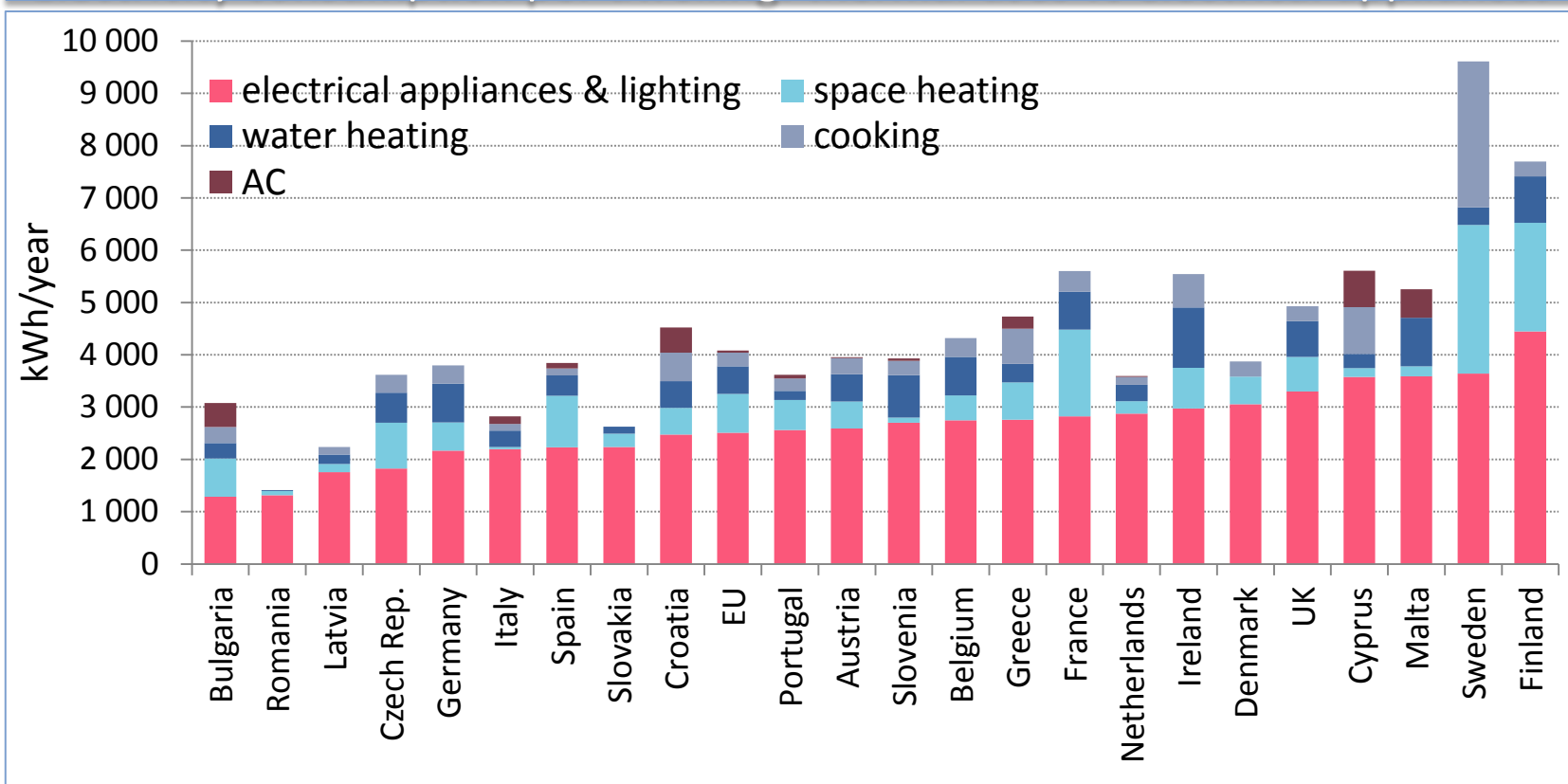
# Diffusion of solar water heaters: % of dwellings of solar water heaters and solar radiation



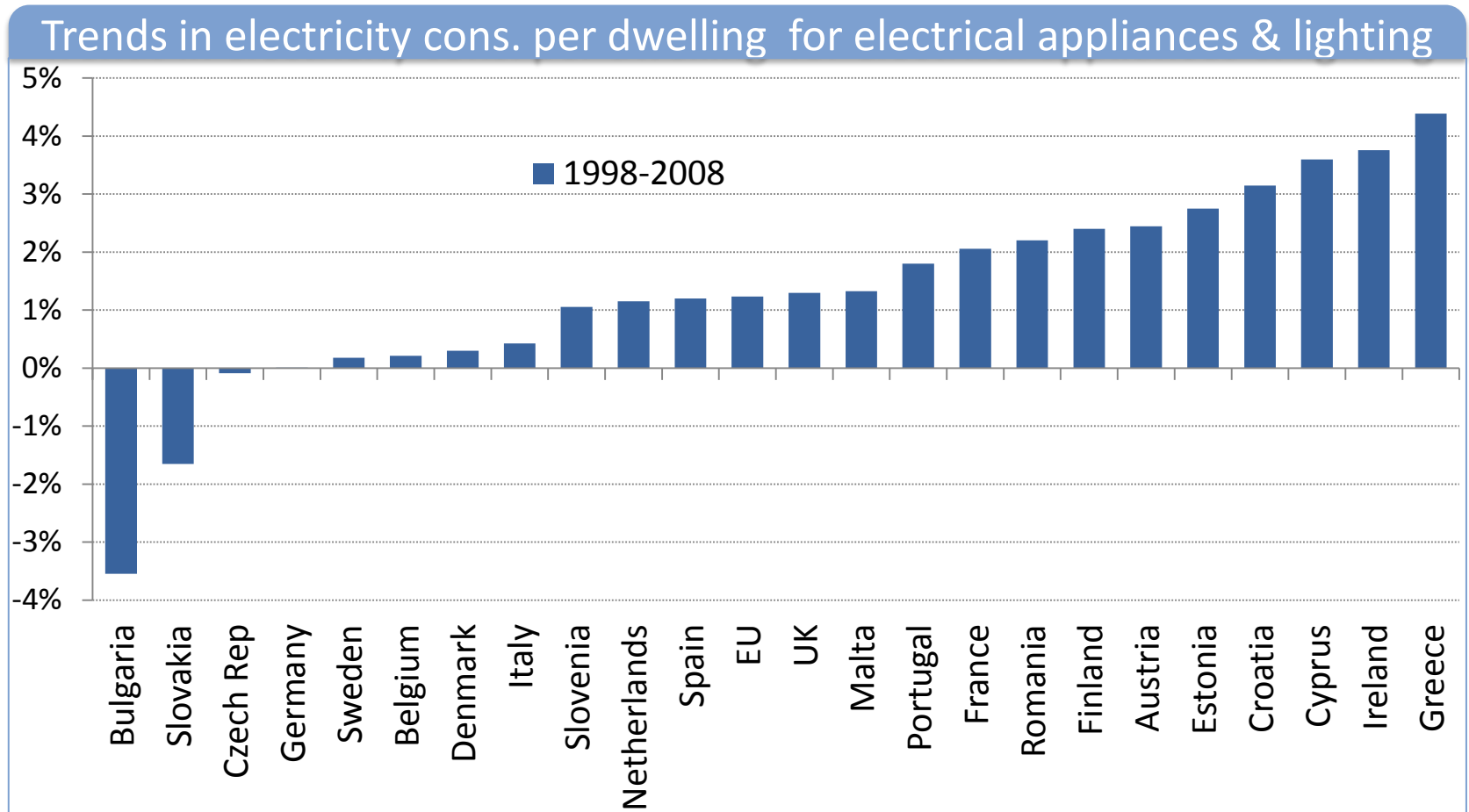
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- Thermal uses of electricity important in Sweden, France, Ireland, Finland
- Consumption for electrical appliances and lighting (excl. thermal use) in a range of 1300 kWh/yr for Bulgaria, Romania to 3600 kWh for Cyprus, Malta and Sweden and > 4000 kWh in Finland
- Still low contribution of AC (Air Conditioning) in southern countries
- 2500 kWh for the EU average

### Electricity consumption per dwelling: thermal uses vs electrical appliances

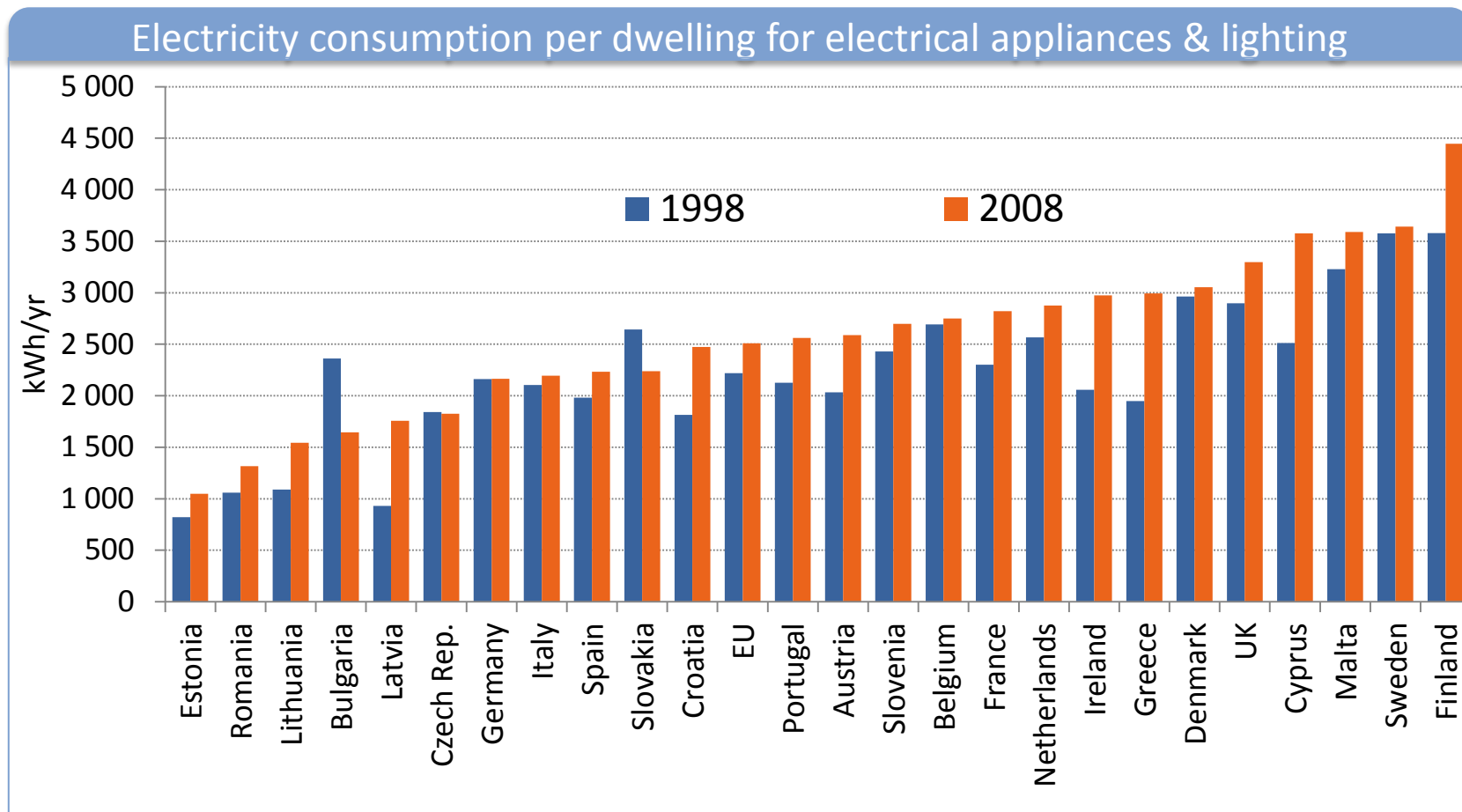


- Very unequal progression across countries since 1998: decreasing trends in Bulgaria and Slovakia, low growth for Czech Rep., Sweden and Germany.
- Rapid growth in southern countries (Cyprus, Greece, Croatia)
- EU average 1,2%/yr



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

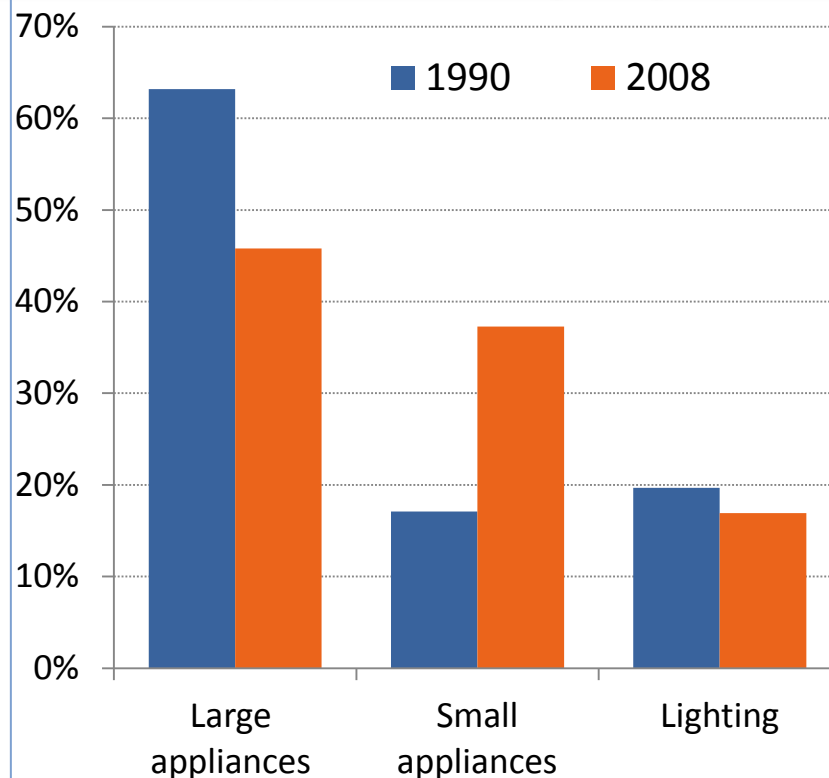
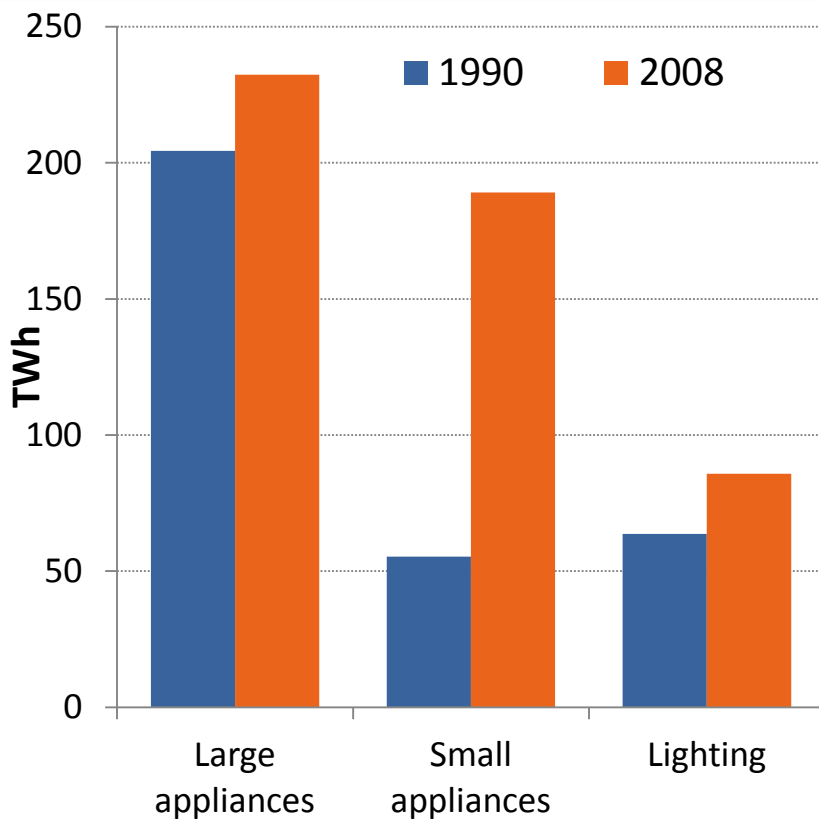
- Big difference of electricity consumption per dwelling for electrical appliances and lighting : range between 1000-6000 kWh
- Highest unit consumption in Finland and Sweden (above 3 500 kWh)



2007 for Estonia, Portugal, Finland and Lithuania; 2001 for Latvia and 2000 for Malta;  
Greece: AC included

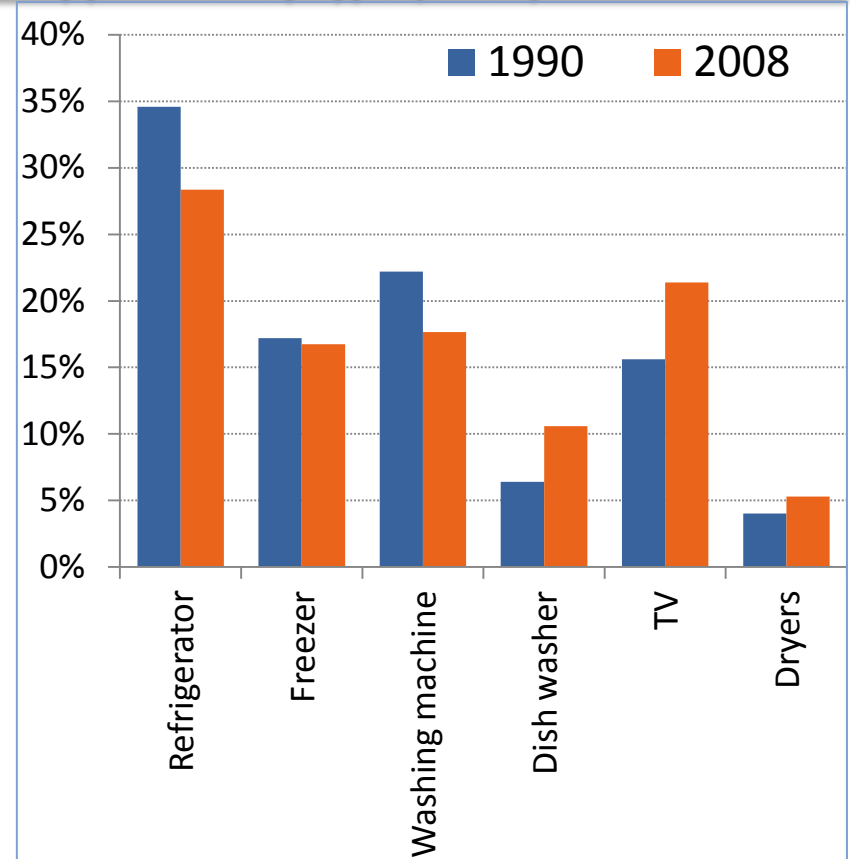
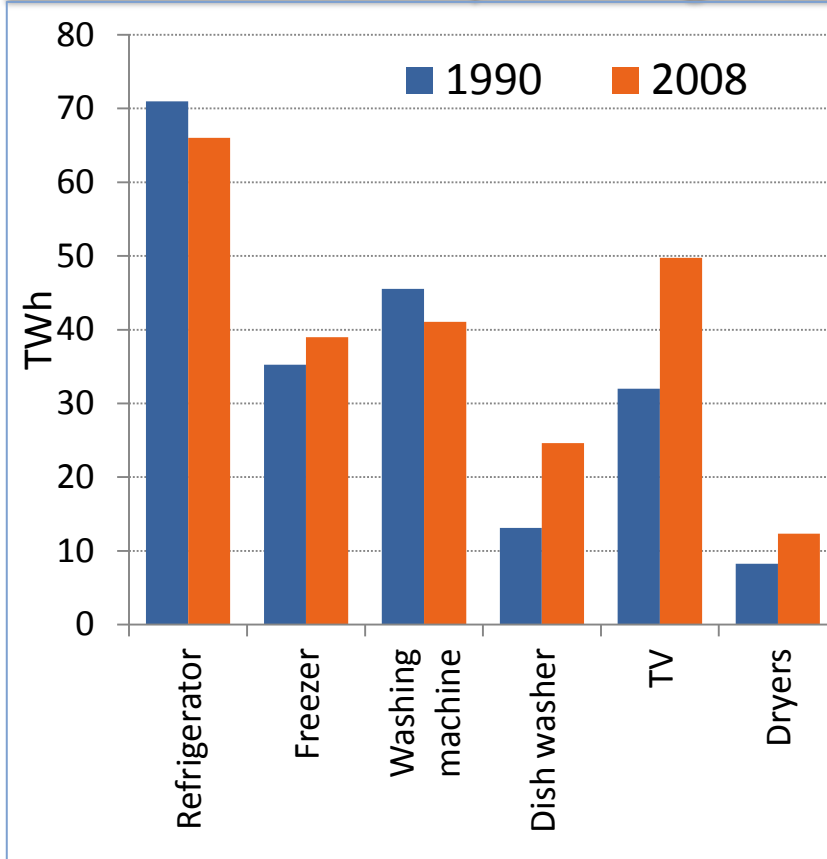
- Moderate increase of the consumption of large appliances and decreasing share in the consumption for electrical appliances & lighting (from 63 % in 1990 to 46 % in 2008).
- Rapid progression for small appliances : more than tripling of the consumption and share increasing from 17% to 37% (IT appliances about 15% of small appliances)
- Slightly decreasing share for lighting below 20%

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



- Decreasing consumption and share for refrigerators and washing machine
- Strong progression of consumption for dishwashers (+90%), dryers and TV (~+ 50%)

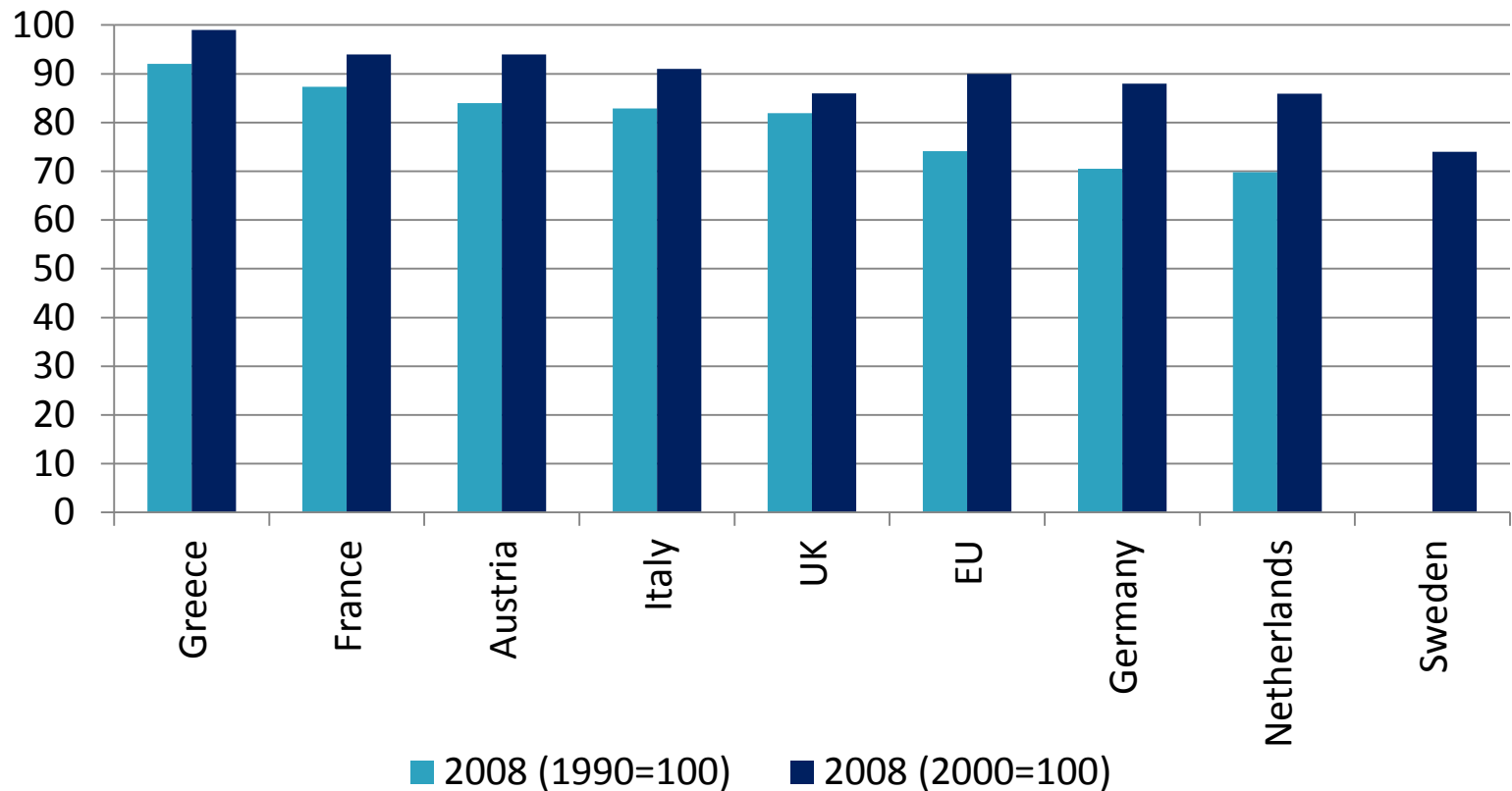
Consumption of large electrical appliances by type (EU27)





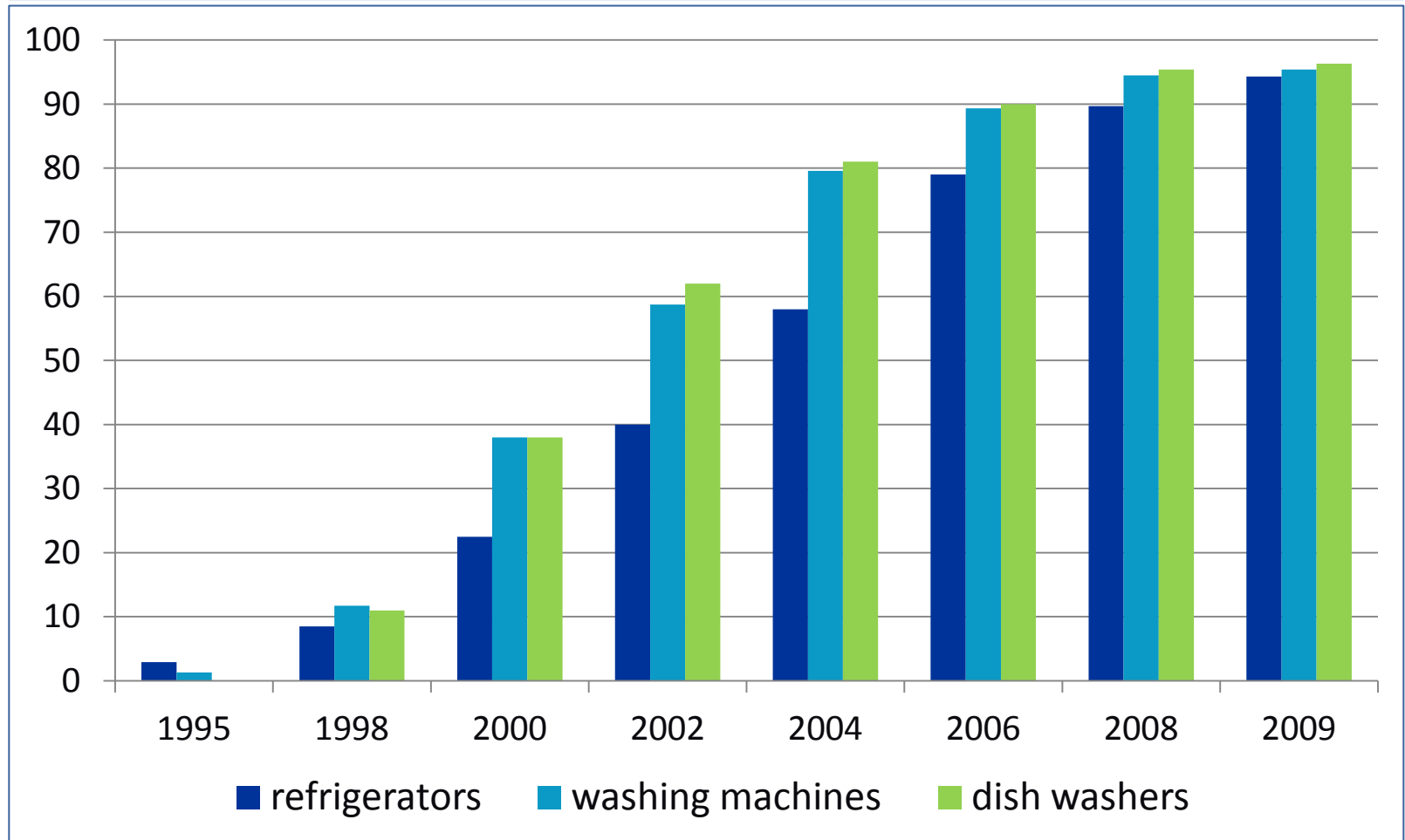
Large appliance are on average 25% more efficient than in 1990, with some countries registering very strong progress (Germany, Sweden, and Netherlands): ~2%/yr  
Slight reduction in the progress achieved since 2000 (1,6%/yr over 1990-2008 and 1,3%/yr since 2000 at EU level)

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



Almost 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)



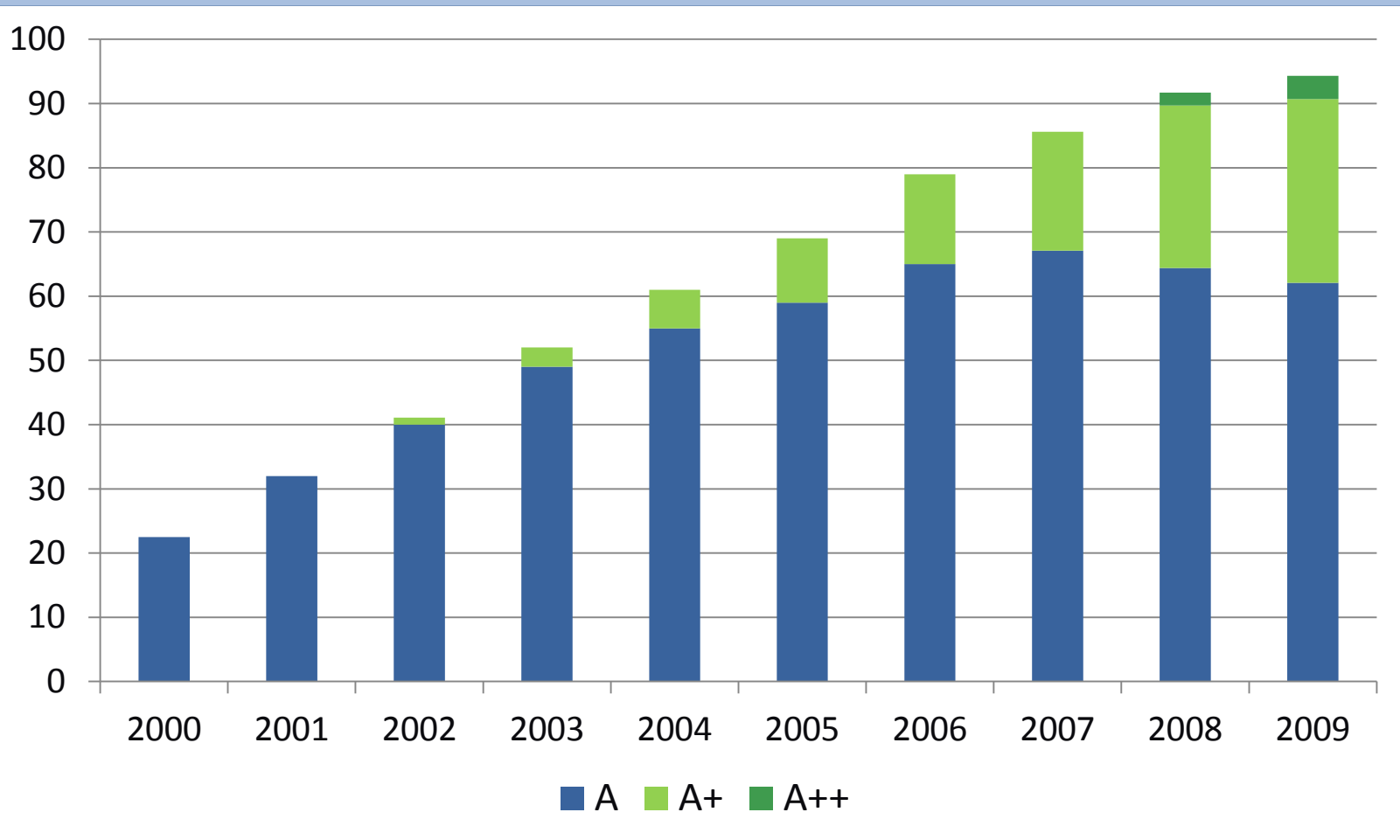
■ refrigerators ■ washing machines ■ dish washers

Source GFK, EEDAL

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

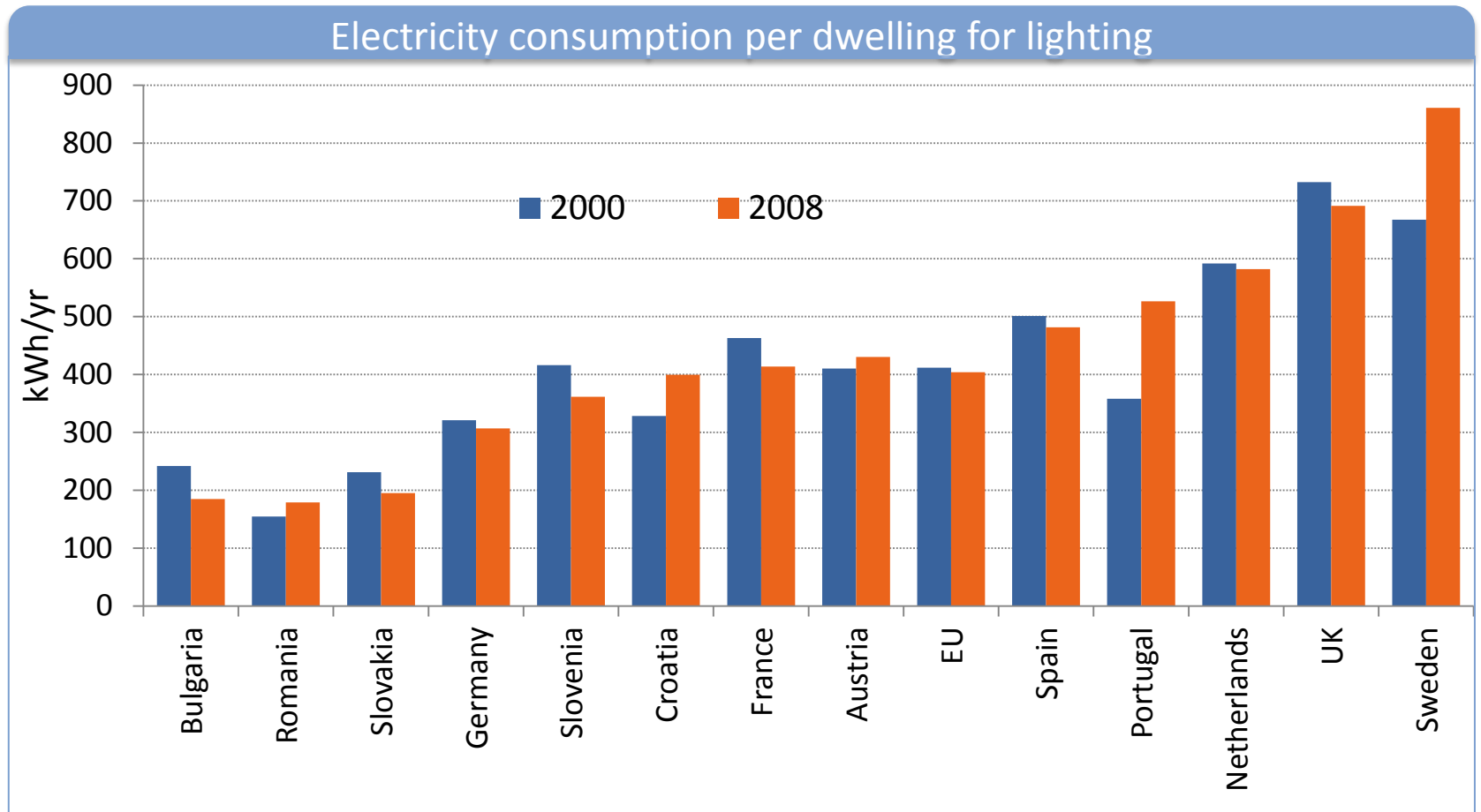
Market share of label A, A+ and A++ for refrigerators (EU-15)



Source GFK, EEDAL

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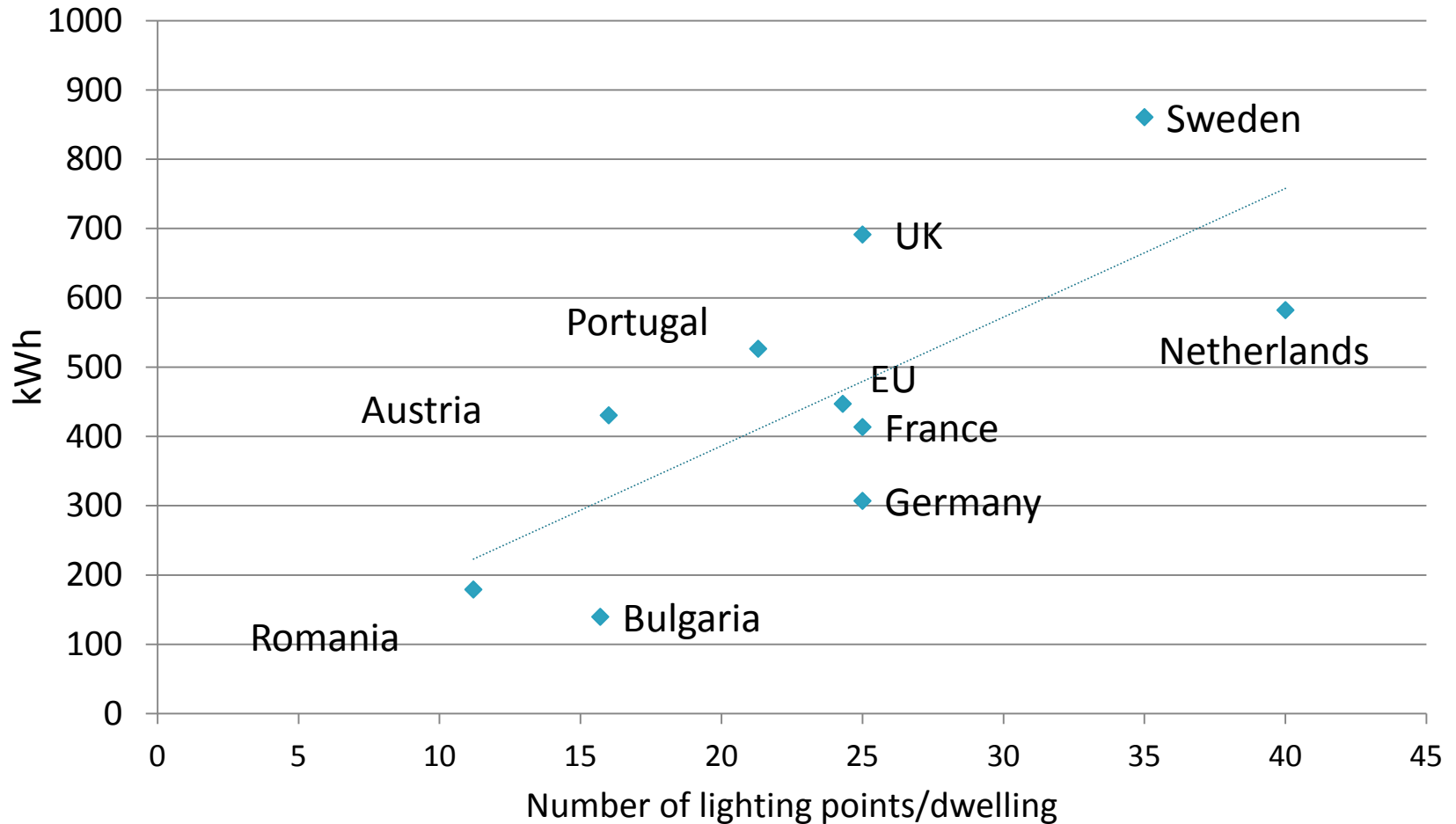
- Unequal electrical consumption per dwelling: range from 200 to 900 kWh/yr
- 400 kWh on average for the EU
- Decrease in several countries with the diffusion of CFL (in half of the sample)



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

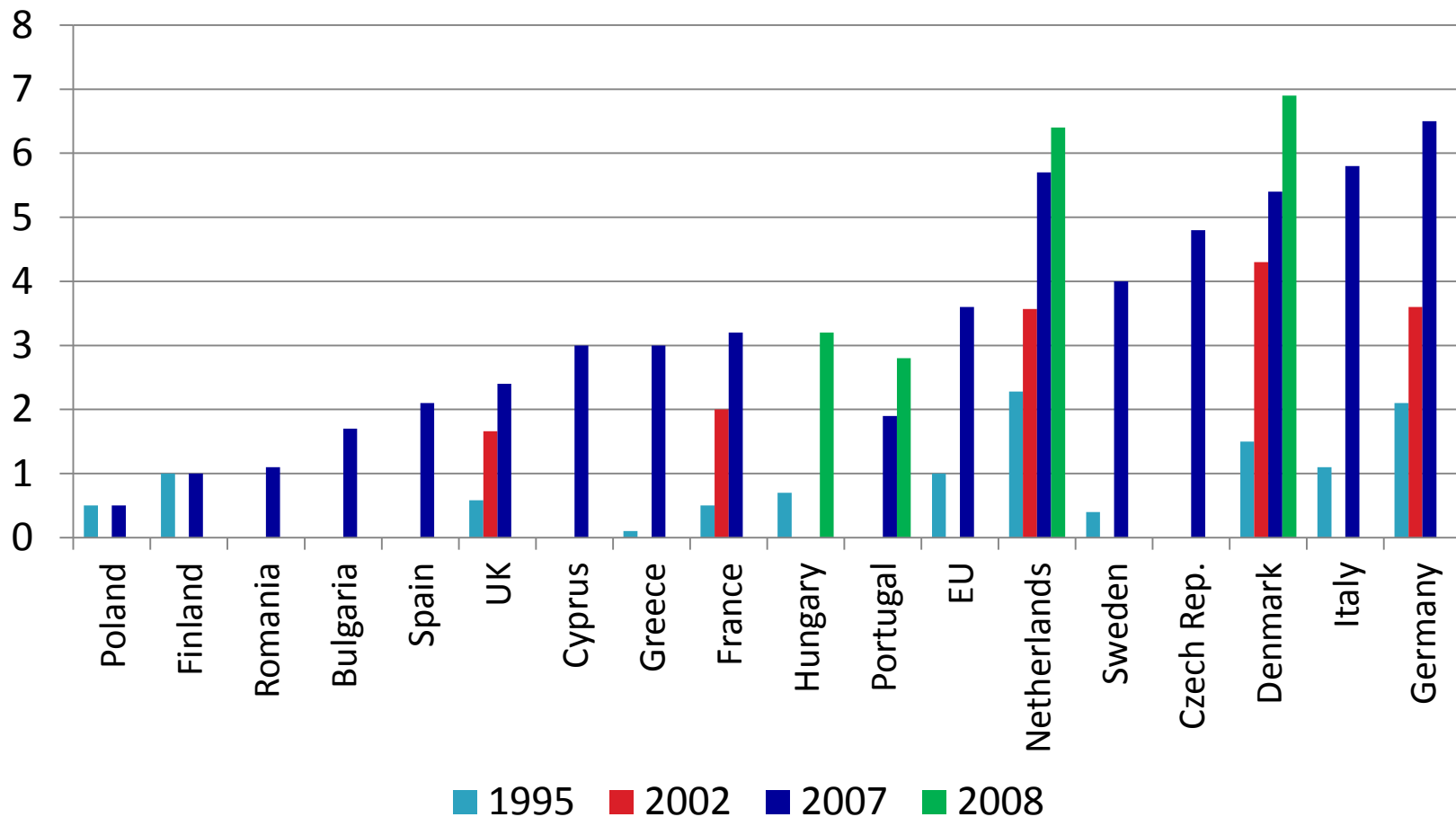
### Electricity consumption per dwelling for lighting



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

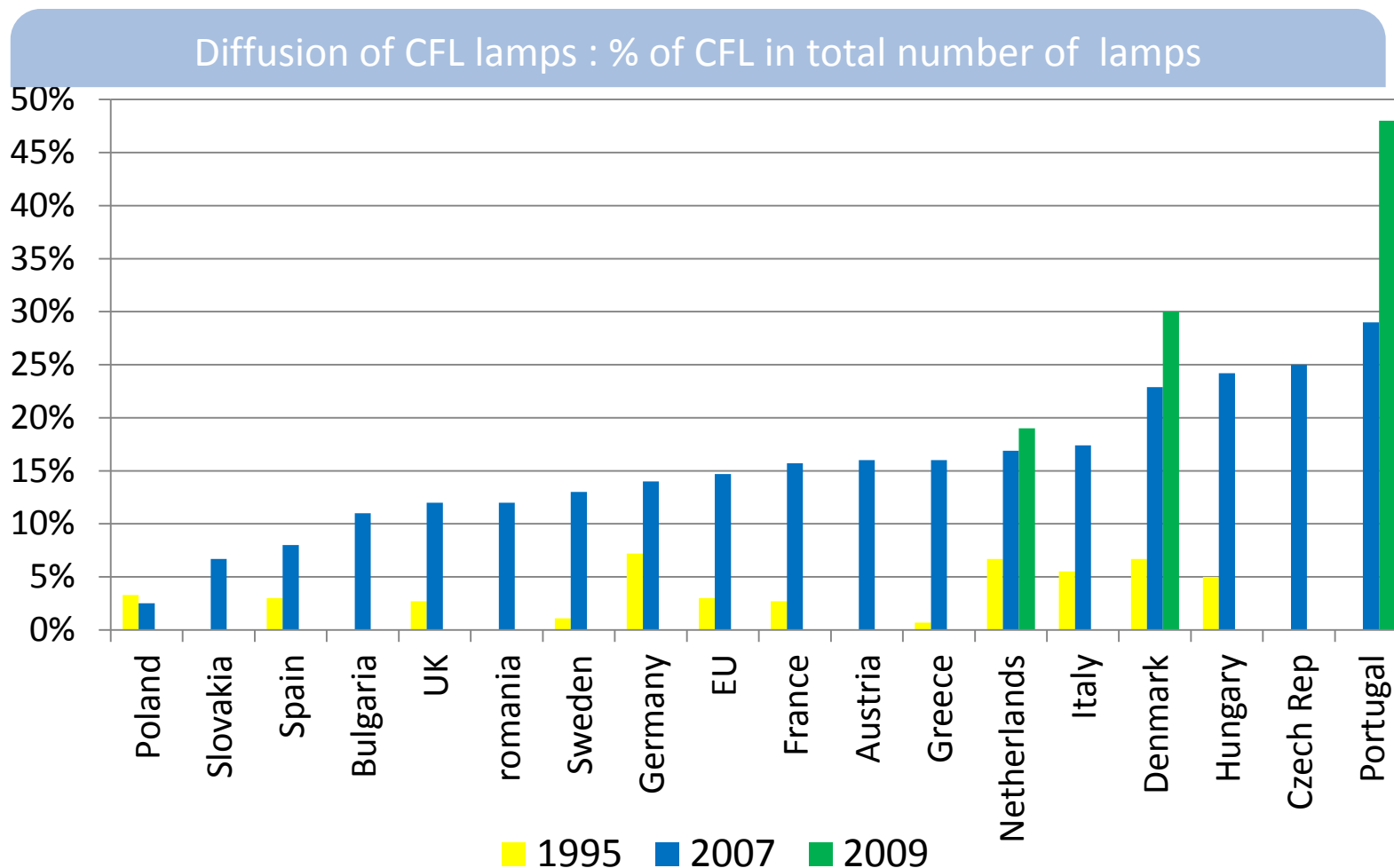
About 7 CFL per household in the countries with the largest diffusion of CFL

Diffusion of CFL lamps : number of lamps per household



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)

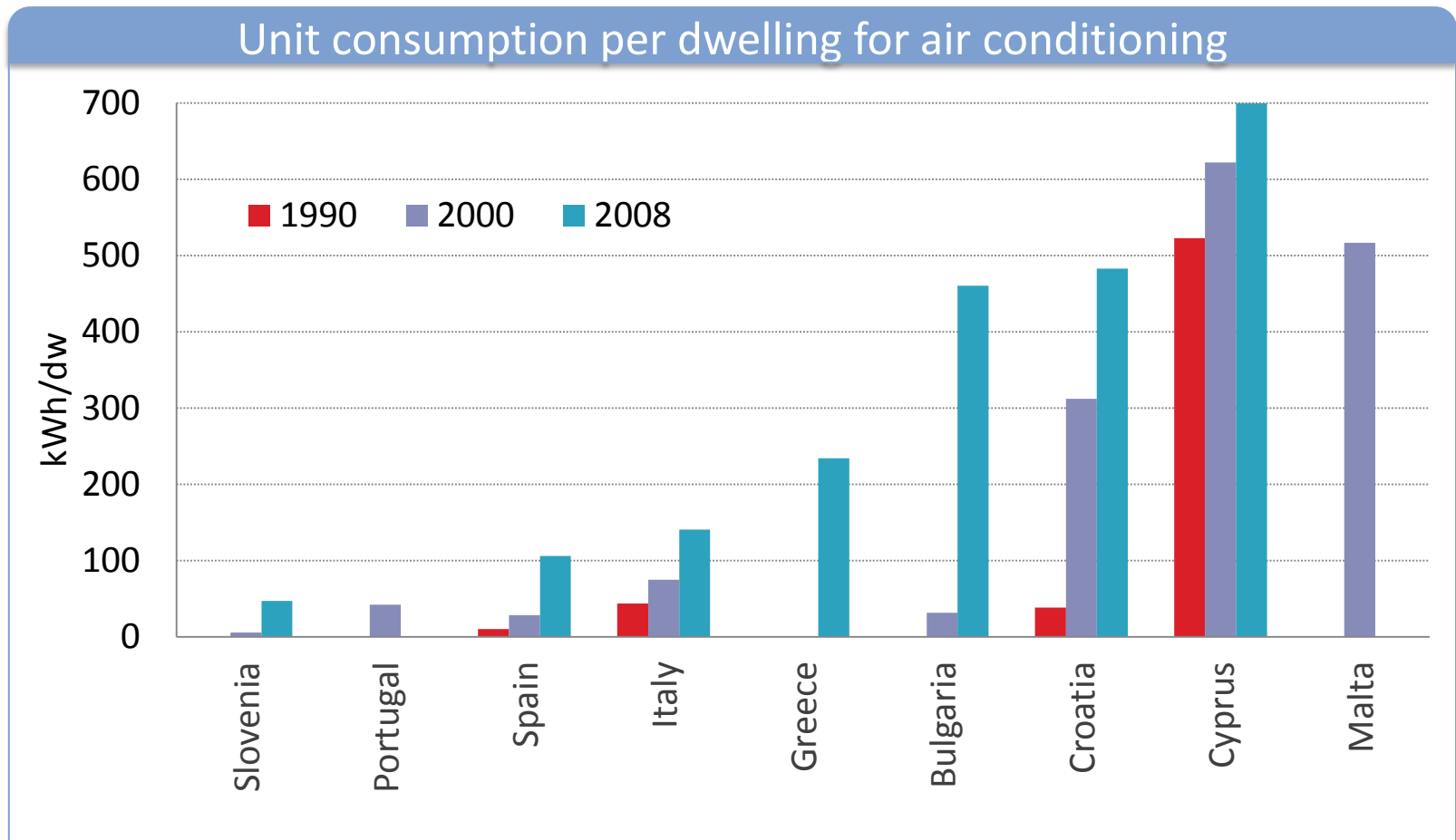


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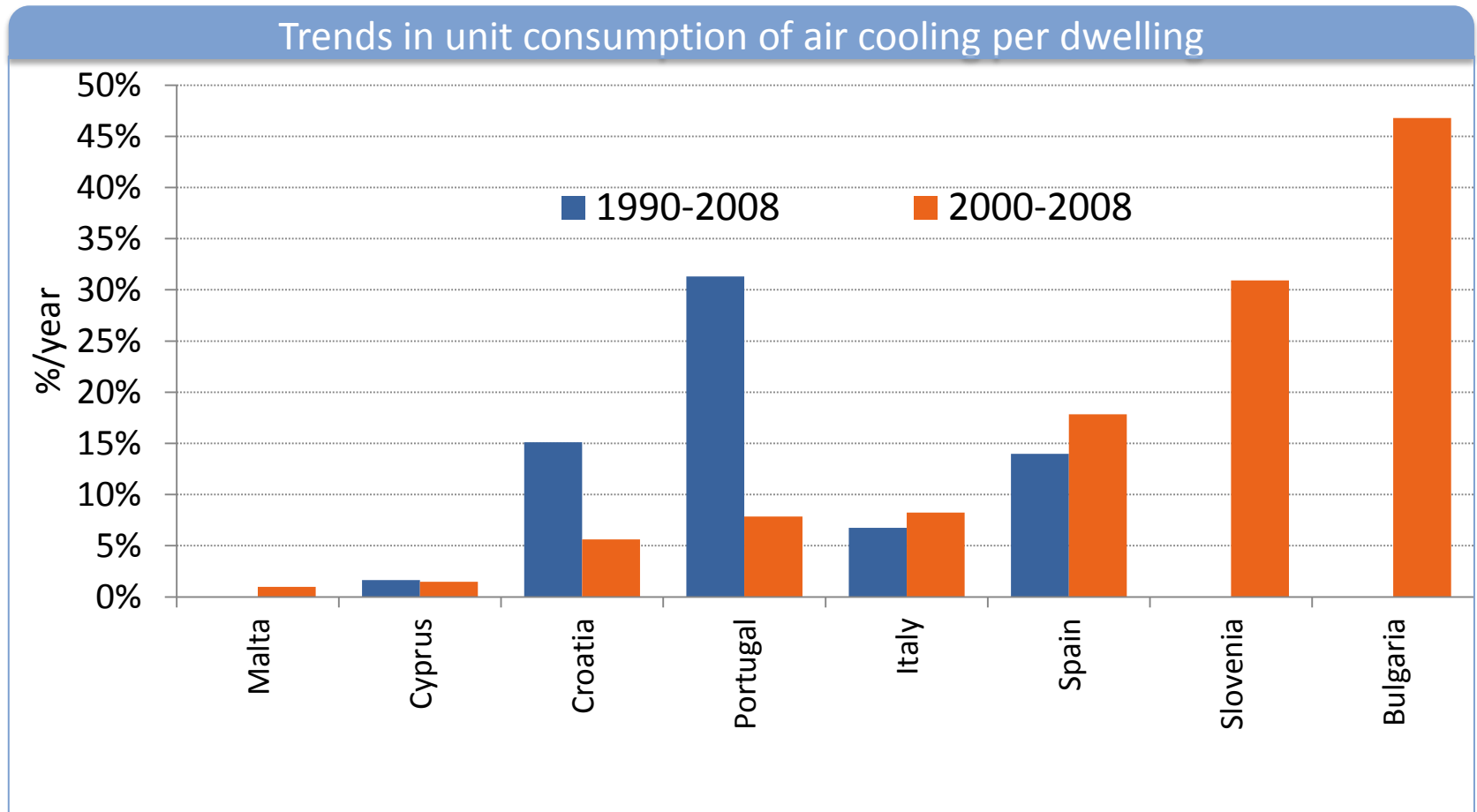


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- Cyprus, Malta, Croatia and Bulgaria are the largest consumers for air conditioning

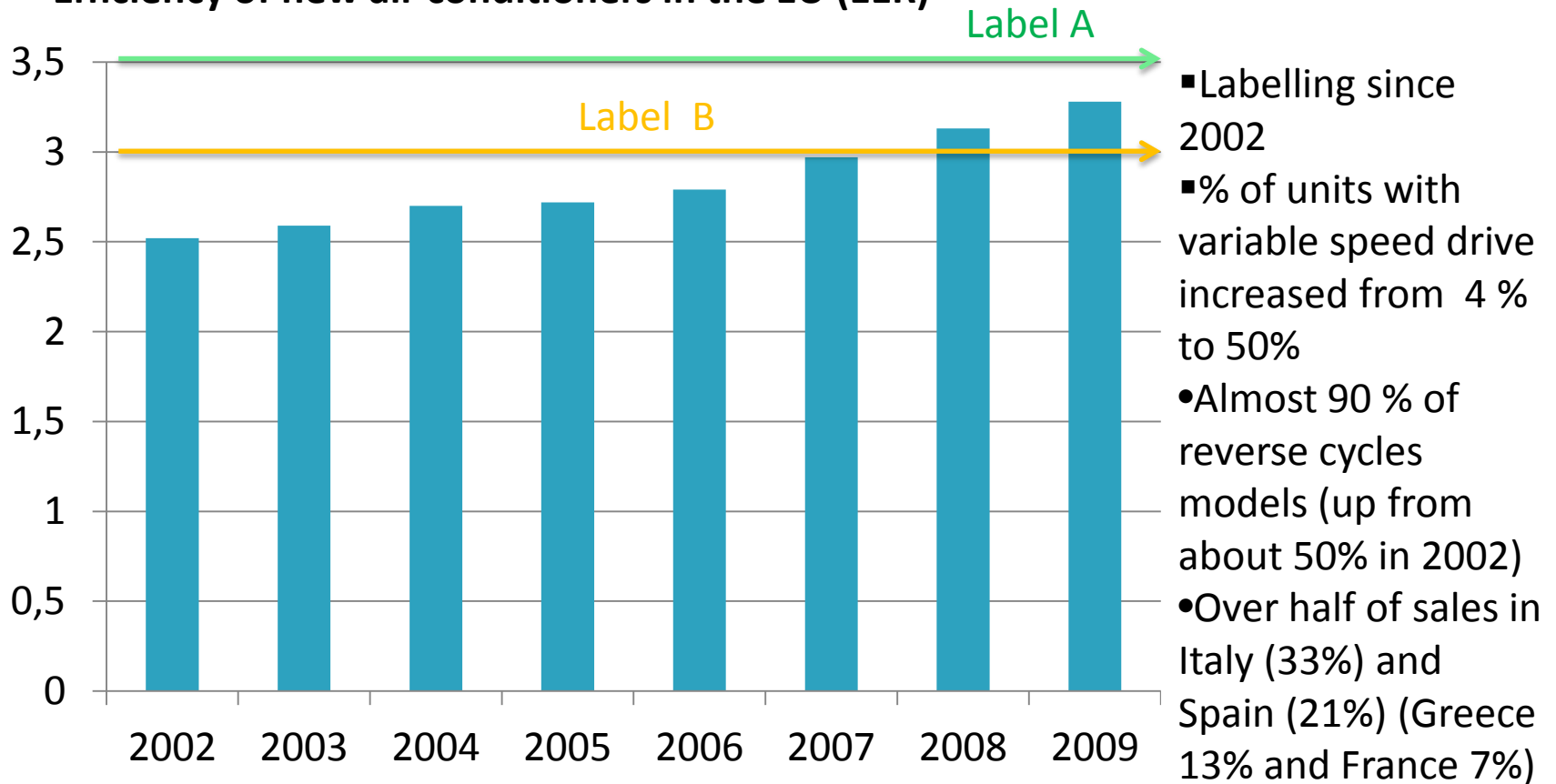


- Moderate growth for bigger air cooling consumers: Malta and Croatia and Cyprus
- Big accelerations in the trends for the new air cooling consumer: Bulgaria, Slovenia and Spain



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

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



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

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# Energy efficiency index for households

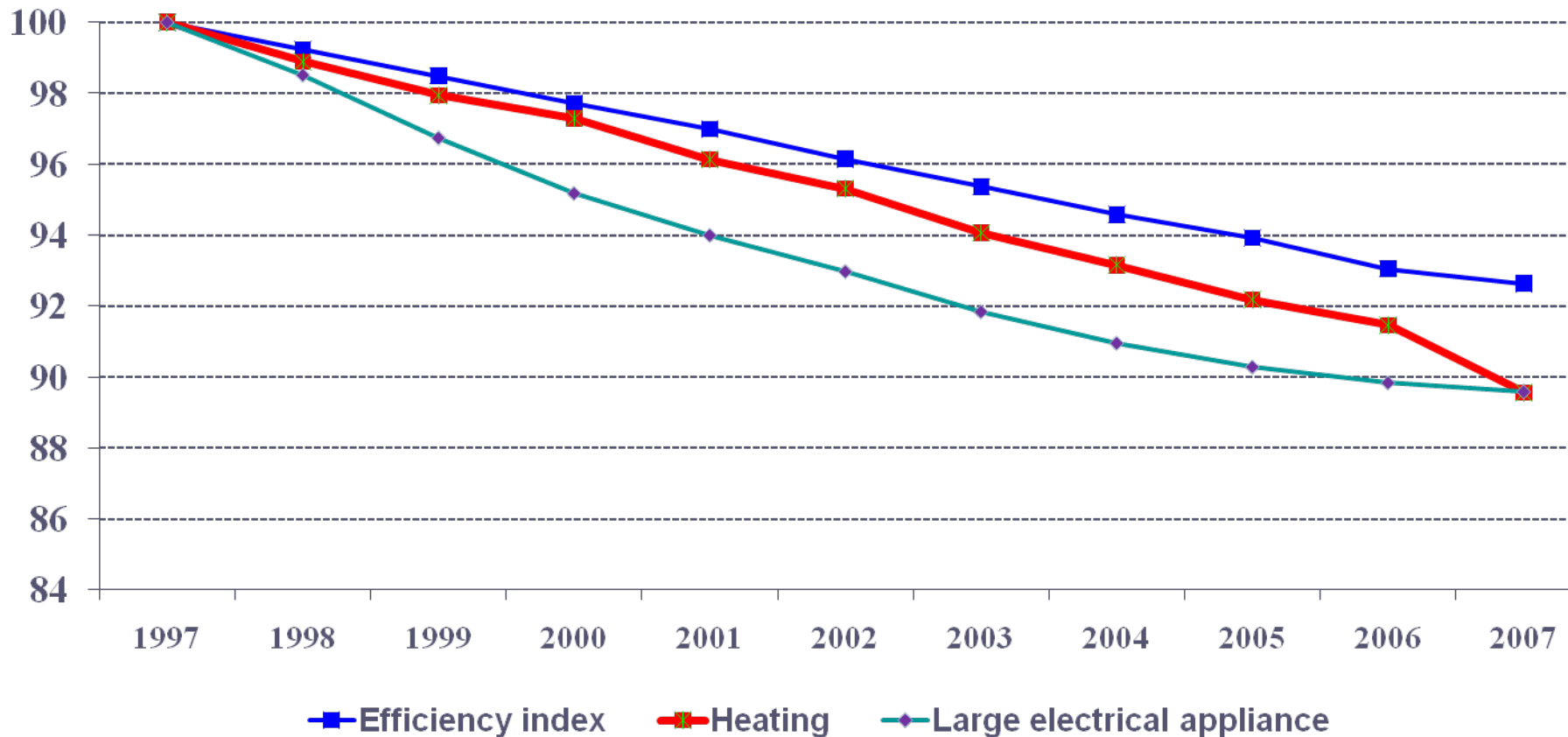
**Calculated on 8 end-uses/appliances** : heating, water heating, cooking, 5 large appliances (refrigerators, freezers, washing machine , dishwashers and TV)

## **Indicators used:**

- Heating: unit consumption per m<sup>2</sup> at normal climate (toe/m<sup>2</sup>) (per dwelling equivalent with central heating)
- Water heating: unit consumption per dwelling with water heating
- Cooking: unit consumption per dwelling
- Large elec. appliances: specific consumption per appliance (kWh/year)

# Energy efficiency progress for households in the EU-27: household ODEX

8 % energy efficiency progress between 1997 and 2007 (0.8%/year)

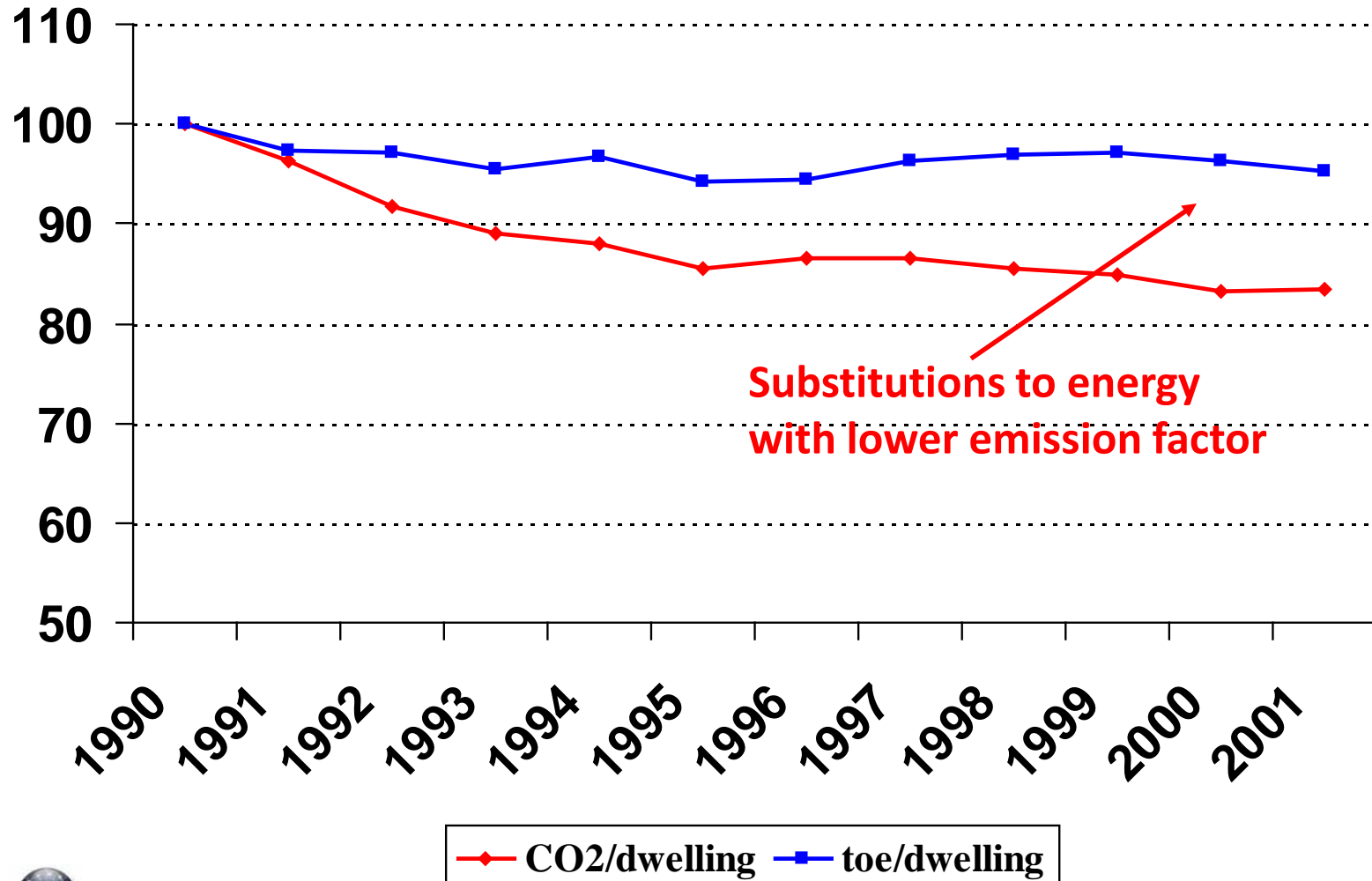


ODEX is an index weighting the energy efficiency progress gains of 8 end-uses/appliances : heating (toe/m<sup>2</sup>) water heating, cooking (toe/dwelling), refrigerators, freezers, washing machine, dishwashers and TV (kWh/year)

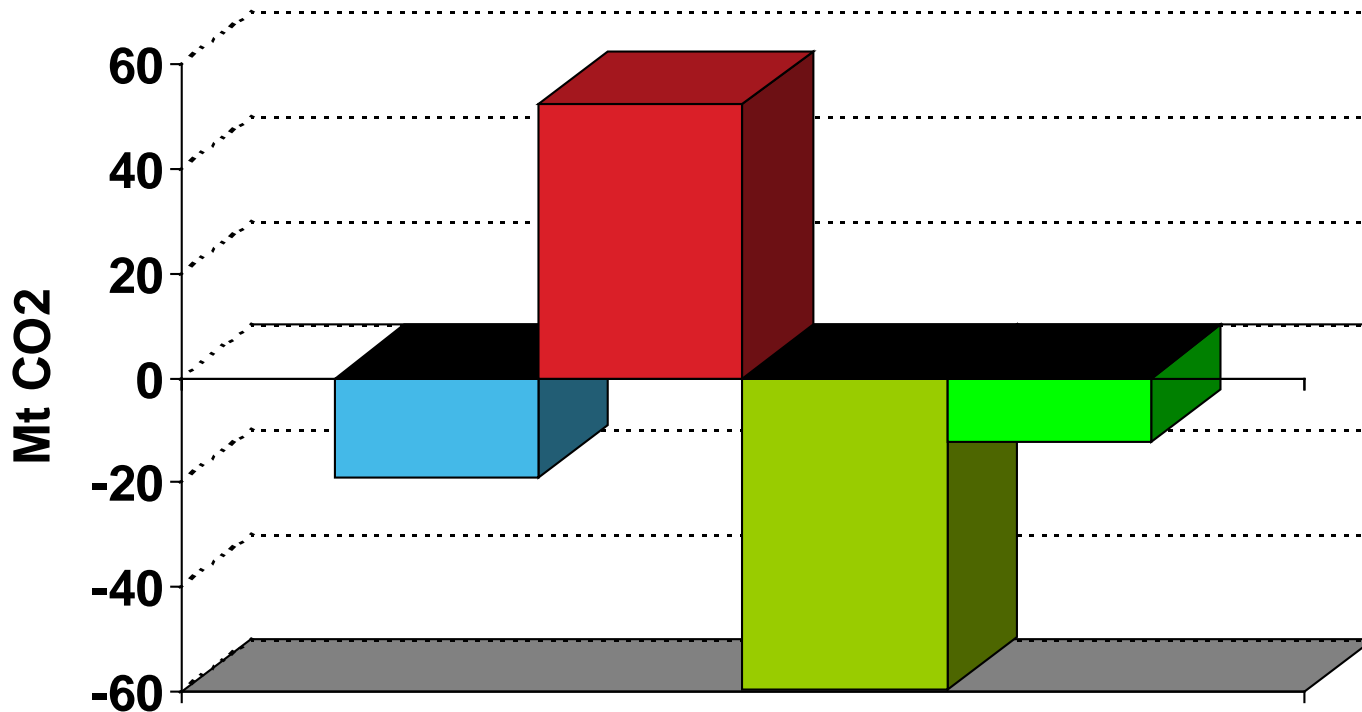
1. Overview of indicators
2. Data definition
3. Climatic corrections
4. Specific energy consumption per dwelling:  
climatic adjustments
5. Heating and water heating
6. Electrical appliances
7. Lighting
8. Air conditioning
9. Overall energy efficiency trends : ODEX
- ▶ 10. CO2 indicators
11. Understanding energy consumption variation



# Unit consumption per dwelling versus CO2 emissions per dwelling



# Interpretation of CO2 emissions variations for households in the EU15 (1990-2002)

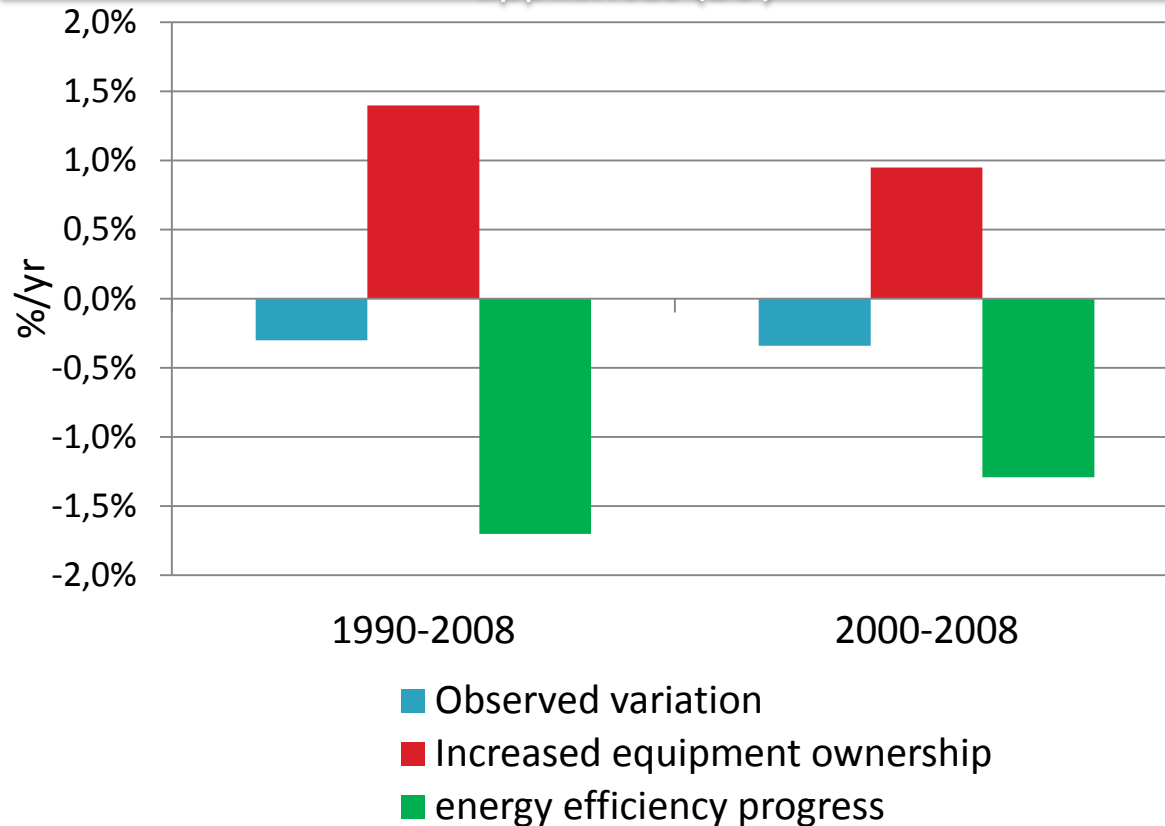


- total variations
- quantity effect (more dwellings)
- CO2 savings (energy substitutions)
- CO2 savings (energy savings)

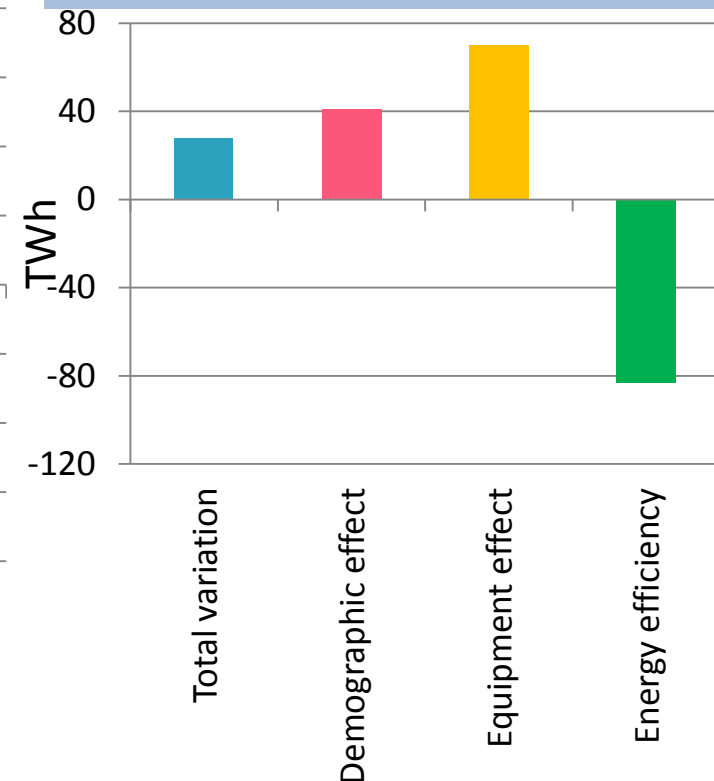
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- Almost all energy efficiency gains have been offset by an increase in equipment ownership: as a result the consumption per dwelling for large appliance is only slightly decreasing
- Energy savings reached 83 TWh in 2008 (30% of the consumption of large appliances) compared to 1990, limiting the consumption increase to 28 TWh

Variation of the consumption per dwelling for large appliances (EU)

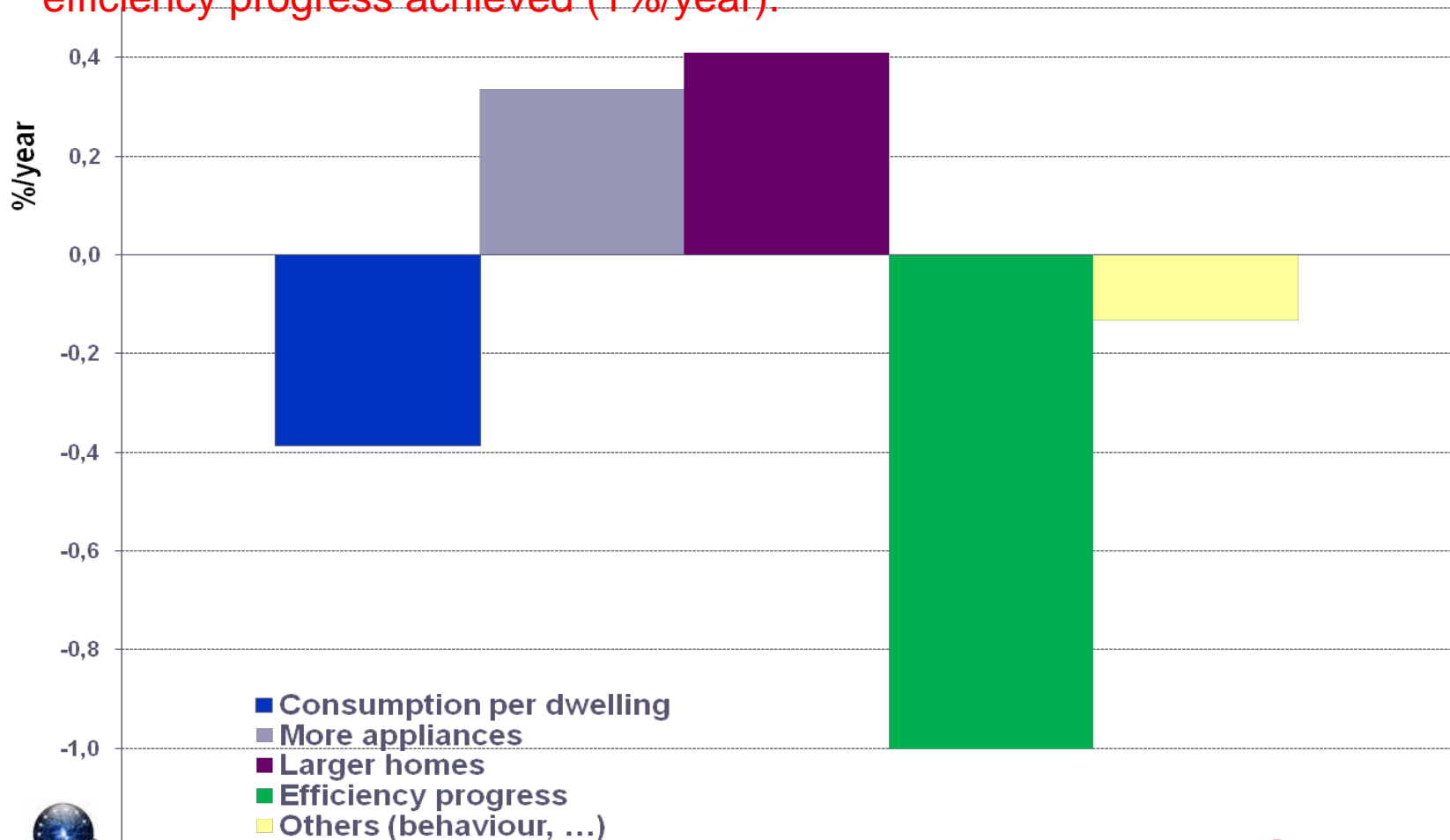


Variation of the consumption of large appliances (EU) (1990-2008)



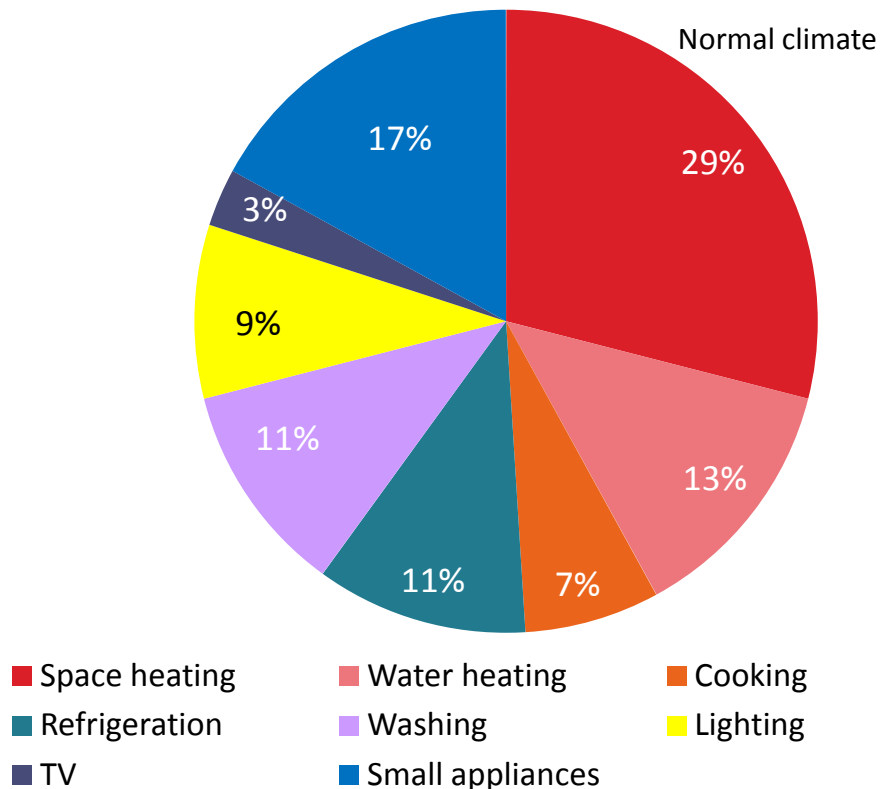
# Drivers of the energy consumption per dwelling in the EU-27 (1990-2007)

Change in life style (i.e. increase in the size of dwellings and in the number of large appliances and central heating) contributed to raising consumption per households by about 0.4%/year each and has offset 70% of the energy efficiency progress achieved (1%/year).



# Drivers of the electricity consumption variation of households in France (1/4)

Electricity consumption of households (2008)



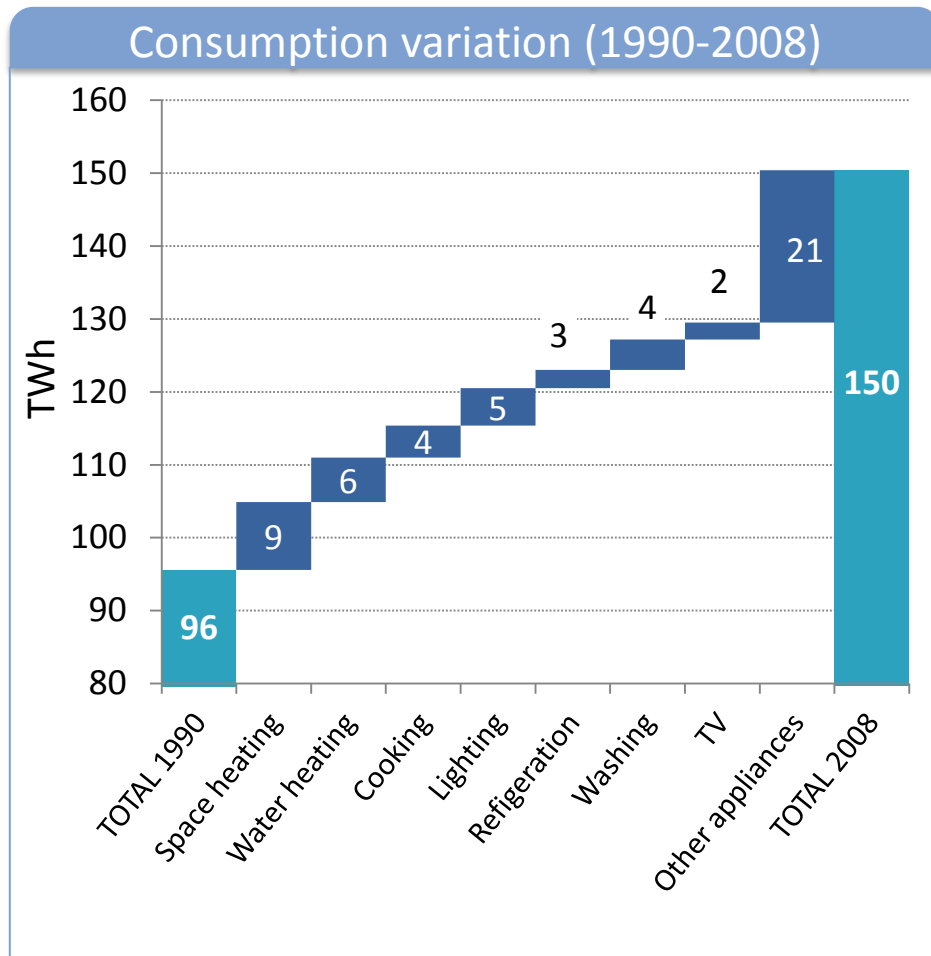
Source: Enerdata from Odyssee and own estimates

Washing : washing machine, dishwasher & dryer

Refrigeration: refrigerators & freezers

- Thermal uses of electricity represent about 50% of household electricity consumption, lighting 9% and appliances about 40% (up from 35% in 1990)
- Highest growth rate for appliances since 1990 (> 3.5%/yr)
- High share of space heating due to the large diffusion of electric heating (31% of households in 2008, up from 26% in 1990) but decreasing market share (36% in 1990)
- Small appliances represent 17% in 2008, of which around 3% for computers

# Drivers of the electricity consumption variation of households in France (2/4)



Source: Enerdata

- Electricity consumption increased by 55 TWh between 1990 and 2008
- Bulk of the additional volumes came from electrical appliances
- Driven by small appliances diffusion
- Decrease in electricity consumption of refrigeration and washing machine
- Space heating contributed to 15% of this increase (9 TWh)

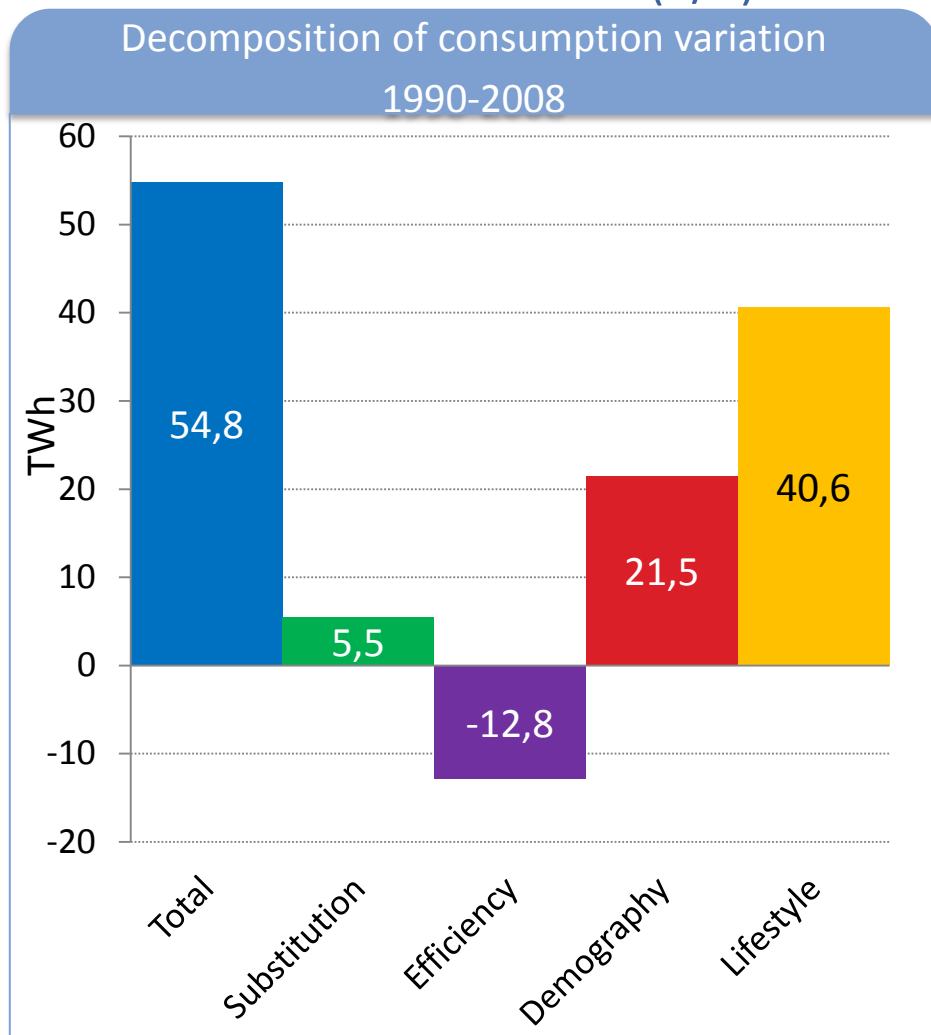
# Drivers of the electricity consumption variation of households (3/4)

Electricity consumption in households is changing under the influence of various factors

- Change in number of households
- Evolution of lifestyles:
  - Increase in average floor area of dwelling for space heating
  - Increase in equipment ownership for electrical appliances
  - More intensive use for water heating and lighting
- Change in the end-uses' specific electricity consumption, which is driven by two factors:
  - Substitution from fossil fuels to electricity for thermal uses, i.e. increase in the market share of electricity in end-uses
  - Energy efficiency improvements for end-use equipment, mainly as a result of the policies implemented (labeling and standards)



# Drivers of the electricity consumption variation of households in France (4/4)



Source: Enerdata

- Electricity consumption increased by about 55 TWh between 1990 and 2008
- Driven by :
  - Highest and new consumption induced by lifestyle (41 TWh)
  - Demography (21.5 TWh)
  - Increased penetration of electricity for thermal uses (5.5 TWh)
- Counterbalanced by efficiency (13 TWh)



***Monitoring of EU and National Energy Efficiency Targets  
(ODYSSEE-MURE 2010)  
Kick off meeting  
Madrid, 21/22 June 2010***

**Regular surveys on energy consumption in  
the residential and tertiary sector in Germany**

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# Background: Energy statistics in Germany

- Legislative foundation: Law on Energy Statistics from 2002
- Appropriate authority for energy statistics: Federal Ministry of Economics and Technology (BMWi)
- Federal Statistical Office: only responsible for industry; detailed consumption figures (4-digit level) based on a full survey in companies
- Energy Balances: provided by 3 institutions on behalf of BMWi; based on industrial data from Statistical office and sales figures by energy carrier for residential/tertiary
- End-use Balances: provided every year for 4 end-use sectors, energy carriers and 6 end-uses (space heating, hot water, other process heat, mechanical energy, lighting, ICTs)

# Surveys in the residential and tertiary sector

- Since 2001: regular surveys on energy consumption in the residential and tertiary sector carried out by independent research institutes in cooperation with a market research company (research projects based on open tenders)
- Residential survey: carried out by RWI and forsa; available years: (2001), 2003, 2005; 2008 in progress
- Tertiary survey: carried out by Fraunhofer ISI, TU Munich and GfK; available years: 2001, 2004, 2006; 2008 in progress
- Interpolation of interim years → complete time series

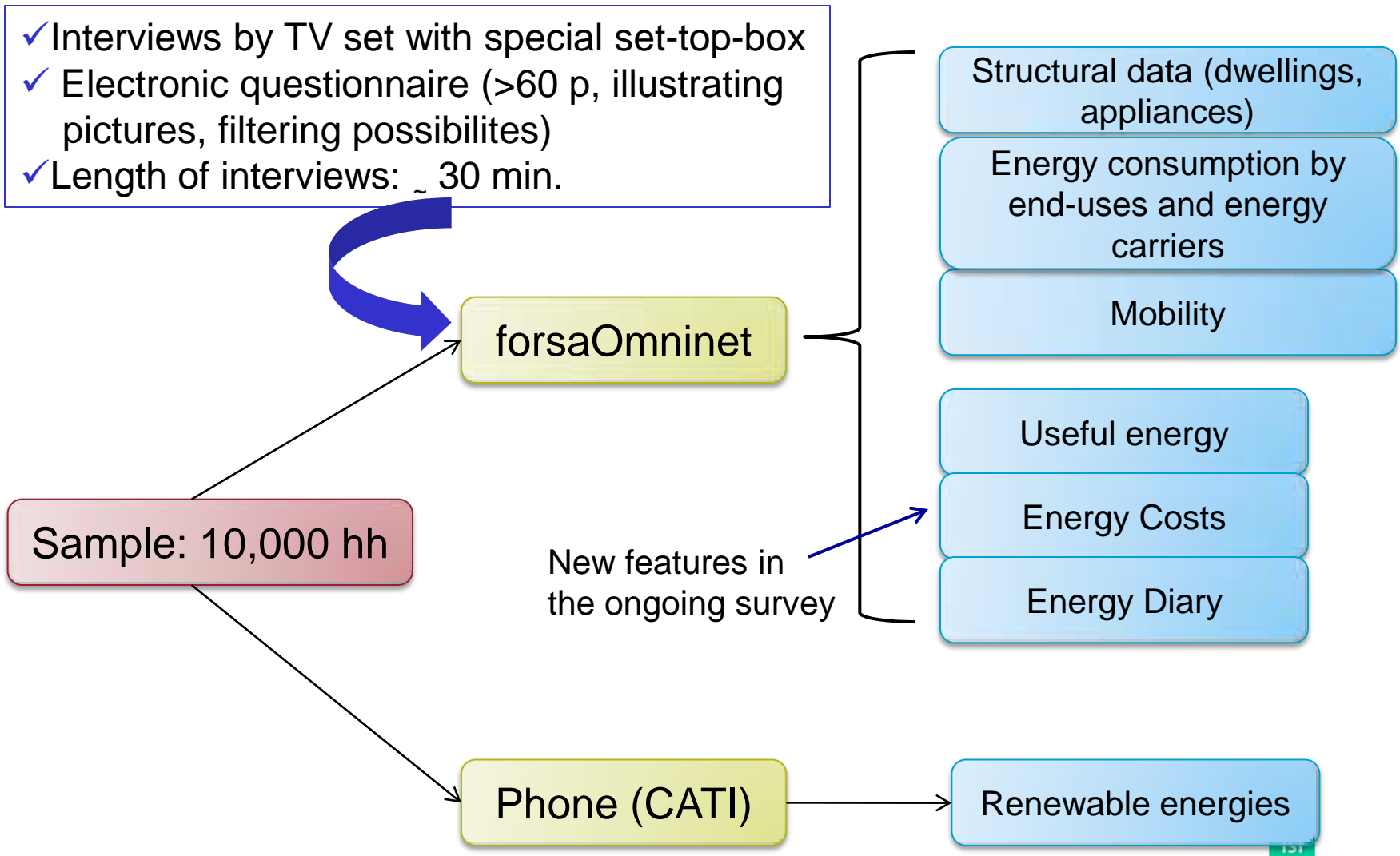
# Objectives of the regular surveys

- **Improvement of energy statistics** with regard to consumer groups, building types and end-uses
- More information on the use of renewable energies
- Establishment of a more detailed database for the national implementation and monitoring of European Directives (ESD, EPBD) and the monitoring of national programmes
- Complete time-series on energy consumption by combination of surveys (every 2-3 years) and interpolation; new: short-term extrapolation
- Specific information on energy consumption structures, energy-related features and energy management for the design of additional national policies (e.g. energy audits, financial and information programmes)

# Survey in the residential sector

# Survey Design

- ✓ Interviews by TV set with special set-top-box
- ✓ Electronic questionnaire (>60 p, illustrating pictures, filtering possibilities)
- ✓ Length of interviews: ~ 30 min.



New features in the ongoing survey

# Survey in the tertiary sector



# Survey Design

Size of sample	Approx. 2,000 workplaces
Selection of sample	Quotas (stratified sample)
Survey modules	<p>(1) Broad survey: face-to-face interviews in 2000 companies</p> <p>(2) Inspection of 100 workplaces by engineers (new module in the ongoing survey)</p> <p>(3) Specific survey on renewable energies by short phone interviews in 10,000 workplaces and detailed interviews in 300 workplaces (+some checks in the company)</p>
Questionnaire	<p>Several stages:</p> <ul style="list-style-type: none"> <li>▪ General questions about company structure, energy consumption and level of equipment with relevant energy technologies</li> <li>▪ Sector-specific questions</li> <li>▪ Questions about energy management</li> </ul>
Data checks, margins	Specific energy consumption; exclusion of max. 20%
Activities for extrapolation	<p>For most subsectors: employees</p> <p>For some sub-sectors: sector-specific activities (number of students/pupils, number of hospital beds, water volume for baths, traffic units for airports)</p>
Stratification	12 groups, 29 splits, sub-splits
Secondary statistics	Agriculture, airports

# Extrapolation method

## For survey years:

- ✓ Calculation of a specific fuel and electricity consumption (per employee or sector-specific activity) by sub-sector from the 2000 workplaces included in the survey.
- ✓ Extrapolation to the country by multiplying the specific consumption value from the survey by the actual number of employees (or sector-specific activity) in Germany.

## For years not covered by the survey:

- ✓ Interpolation (or extrapolation) of the specific fuel and electricity consumption (incl. temp.-adj.) from the survey multiplied by the actual activity of the respective year.

# Main results

- Energy consumption by energy carriers and 12 (new survey: 14) sub-sectors. Data available for the survey years and the years between by interpolation → complete time series 2001 – 2006 (2007/2008 in progress)
- New feature of the ongoing survey: short-term extrapolation to the following year (2009)
- Energy consumption by end-uses (electricity and heat) and sub-sectors.
- Detailed information on energy consumption structures, energy features and energy management in the sub-sectors of the very heterogeneous tertiary sector

# Electricity consumption by sub-sectors

# Energy consumption by end-uses (2006)

2006			Consumption		Shares											
Grp. No.	Split	Definition	Elec.	Fuels & district heat	Electricity						Fuels and district heat					
			absolute	absolute	Lighting	Power	Process heat	Process cold	AC	Commu- nications	Space heating	Power	Process heat	Process cold	AC	Space heating
			[TWh]	[TWh]	[%]						[%]					
1		Construction *	3.7	13.5	46.0	15.5	4.9	0.5	0.2	13.5	19.3	27.4	8.2	0.0	0.0	64.4
2		Office-like companies	25.6	72.6	44.9	3.1	4.1	0.9	2.0	41.8	3.1	0.0	3.6	0.0	0.2	96.2
3		Manufacturing enterprises	4.0	6.4	44.0	29.2	2.2	0.3	1.0	8.6	14.7	0.5	23.3	0.0	0.0	76.1
4		Retail trade	29.2	41.9	55.5	7.6	3.1	14.6	1.5	8.0	9.8	0.0	4.3	0.3	0.1	95.2
5	21	Hospitals	7.0	12.6	22.0	30.6	31.5	0.9	4.5	10.6	0.0	0.0	22.6	0.0	2.5	74.9
5	22	Schools	3.8	19.3	66.9	9.6	2.0	1.8	1.5	11.5	6.6	0.0	5.4	0.0	0.1	94.5
5	23	Public baths	4.9	12.4	14.5	71.5	13.5	0.0	0.1	0.4	0.0	0.0	98.8	0.0	0.0	1.2
6		Hotels, restaurants, homes	16.5	48.9	24.2	36.1	12.7	17.4	0.3	2.8	6.6	0.0	32.5	0.0	0.0	67.5
7	5	Bakers	0.6	1.3	7.5	16.8	57.3	16.6	0.1	1.6	0.2	0.0	73.2	0.0	0.0	26.8
7	6	Butchers	0.6	0.5	15.0	14.6	18.2	45.7	0.9	3.4	2.3	0.0	36.5	0.0	0.0	63.5
7	7	Other food	0.1	0.2	20.3	3.0	2.6	0.2	4.5	3.5	65.9	0.0	50.0	0.0	0.0	50.0
8		Laundries	0.3	0.4	22.3	20.3	49.1	0.1	1.7	0.9	5.6	0.0	87.8	0.0	0.0	12.2
9		Agriculture	5.2	36.3	20.8	46.9	15.6	10.4	2.1	3.1	1.0	56.8	13.0	0.0	0.0	30.3
10		Horticulture	0.3	3.9	52.3	17.4	11.6	1.2	2.3	11.6	3.5	0.0	86.9	0.0	0.0	13.1
11		Airports	1.4	2.0	35.4	30.3	8.1	2.0	10.1	9.6	4.5	24.9	4.0	0.0	11.9	59.3
12		Textiles, clothing, forwarders	0.7	2.0	77.0	1.1	5.0	0.6	0.0	13.2	3.1	0.0	18.6	0.0	0.0	81.4
<b>Sum Groups 1 - 12</b>			<b>104.1</b>	<b>274.2</b>	<b>40.8</b>	<b>19.2</b>	<b>8.6</b>	<b>8.2</b>	<b>1.6</b>	<b>15.4</b>	<b>6.3</b>	<b>9.1</b>	<b>18.0</b>	<b>0.1</b>	<b>0.3</b>	<b>72.7</b>
13		Rest	1.4	0.3	44.0	29.2	2.2	0.3	1.0	8.6	14.7	0.0	30.0	0.0	0.0	70.0
<b>Extrapolation result</b>			<b>105.5</b>	<b>274.5</b>	<b>40.9</b>	<b>19.3</b>	<b>8.5</b>	<b>8.0</b>	<b>1.6</b>	<b>15.3</b>	<b>6.4</b>	<b>9.9</b>	<b>17.7</b>	<b>0.1</b>	<b>0.3</b>	<b>72.1</b>
		Street lighting	3.4		98.0	0.0	0.0	0.0	0.0	2.0	0.0					
		Share installations MFH	1.3		29.0	70.0	0.0	0.0	0.0	1.0	0.0					
		Military	1.2	7.3	44.9	3.1	4.1	0.9	2.0	41.8	3.1	41.1	6.8	0.0	0.0	52.1
		Others	6.3		10.9	75.6	4.8	0.8	0.9	6.8	0.1					
		Undocumented	12.2	7.3	40.5	46.8	2.9	0.5	0.7	8.3	0.4	41.1	6.8	0.0	0.0	52.1
<b>Calculations tertiary</b>			<b>117.7</b>	<b>281.8</b>	<b>40.8</b>	<b>22.2</b>	<b>7.9</b>	<b>7.3</b>	<b>1.5</b>	<b>14.5</b>	<b>5.8</b>	<b>9.9</b>	<b>17.7</b>	<b>0.1</b>	<b>0.3</b>	<b>72.1</b>

# Conclusion and Outlook

- Since 2001, improvement of energy statistics in the residential and tertiary sector in Germany by regular surveys
- Second push for energy statistics by ESD and other international and national reporting and monitoring obligations: new features have been added to the surveys
- Further improvement is expected from the planned re-organisation of the national end-use balances; direct link to the surveys in the residential and tertiary sector and additional efforts for industry
- Still open: integration of the survey results in the national energy balances and further disaggregation of the residential and tertiary sector