

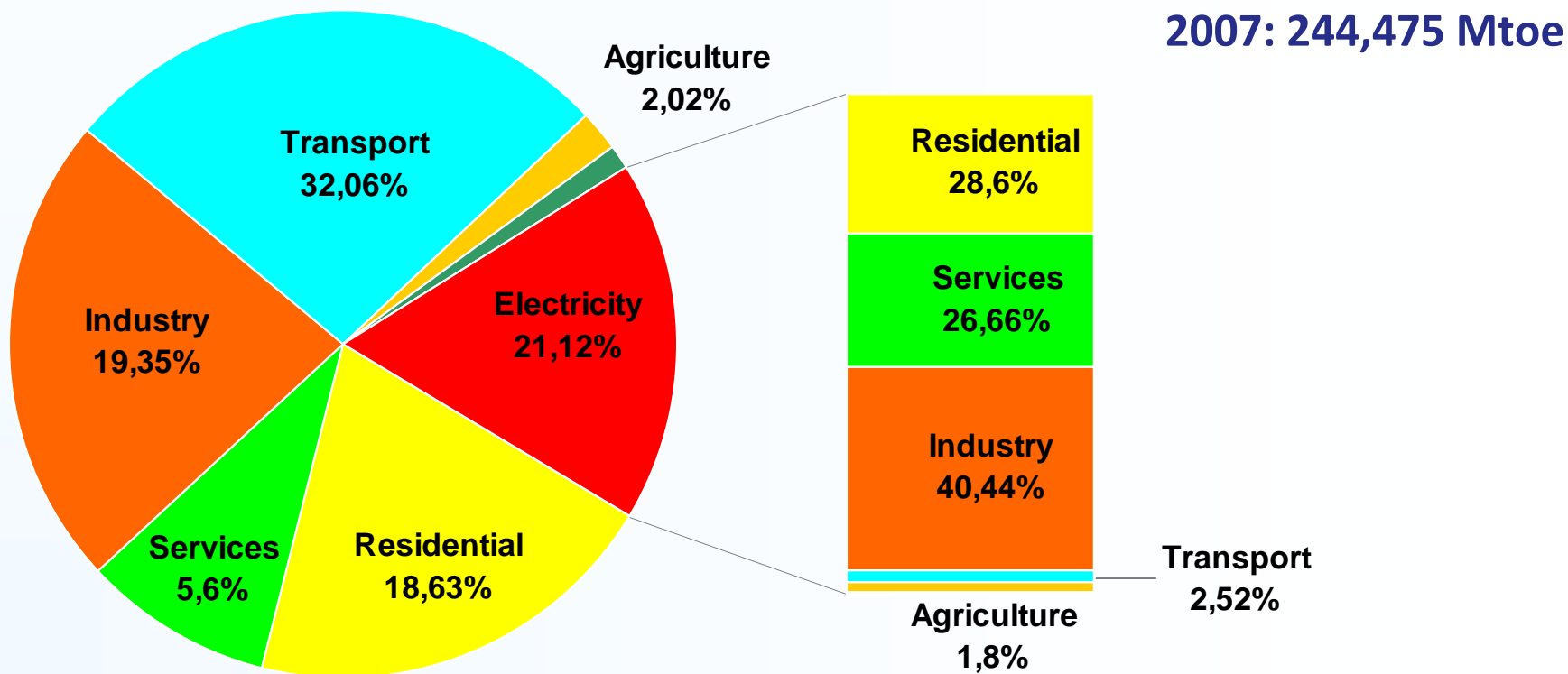
Analysis of the electricity end-use in EU-27 building sector

Paolo BERTOLDI

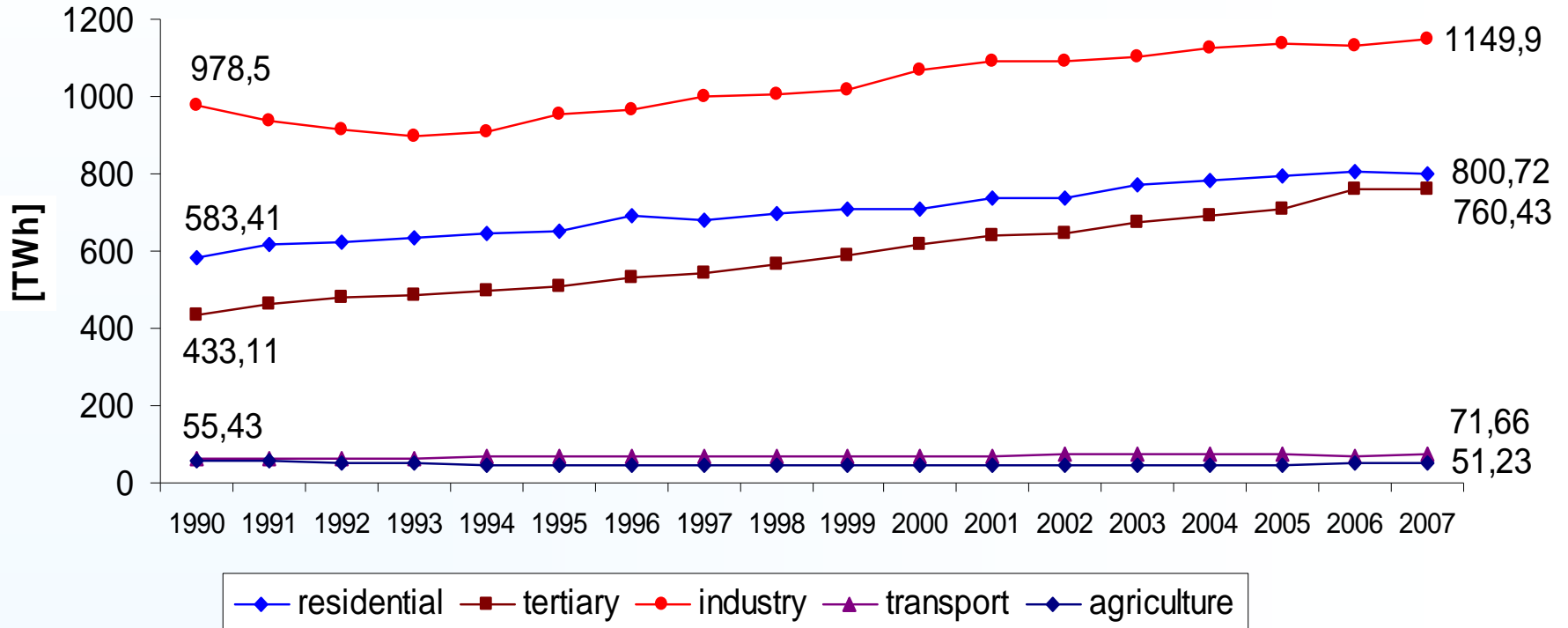
European Commission, Joint Research Centre, Institute for Energy

- This report summarises the outcome of the results of an in-depth survey of electricity consumption in buildings in the EU-27 conducted by the JRC, the main findings of the first preparatory studies for implementing the Eco-design Directive, as well as other recent analyses and studies on different aspects of the electricity final consumption in EU27.

- EU-27 final energy consumption grew by 8,4% between 1990-2007 and by 4,37% from 1999 to 2007. In 2007 the final energy consumption was 1,31% lower than it was in 2004.
- EU-27: The GDP growth was 20,5% from 1999 to 2007 (2000 exchange rates)

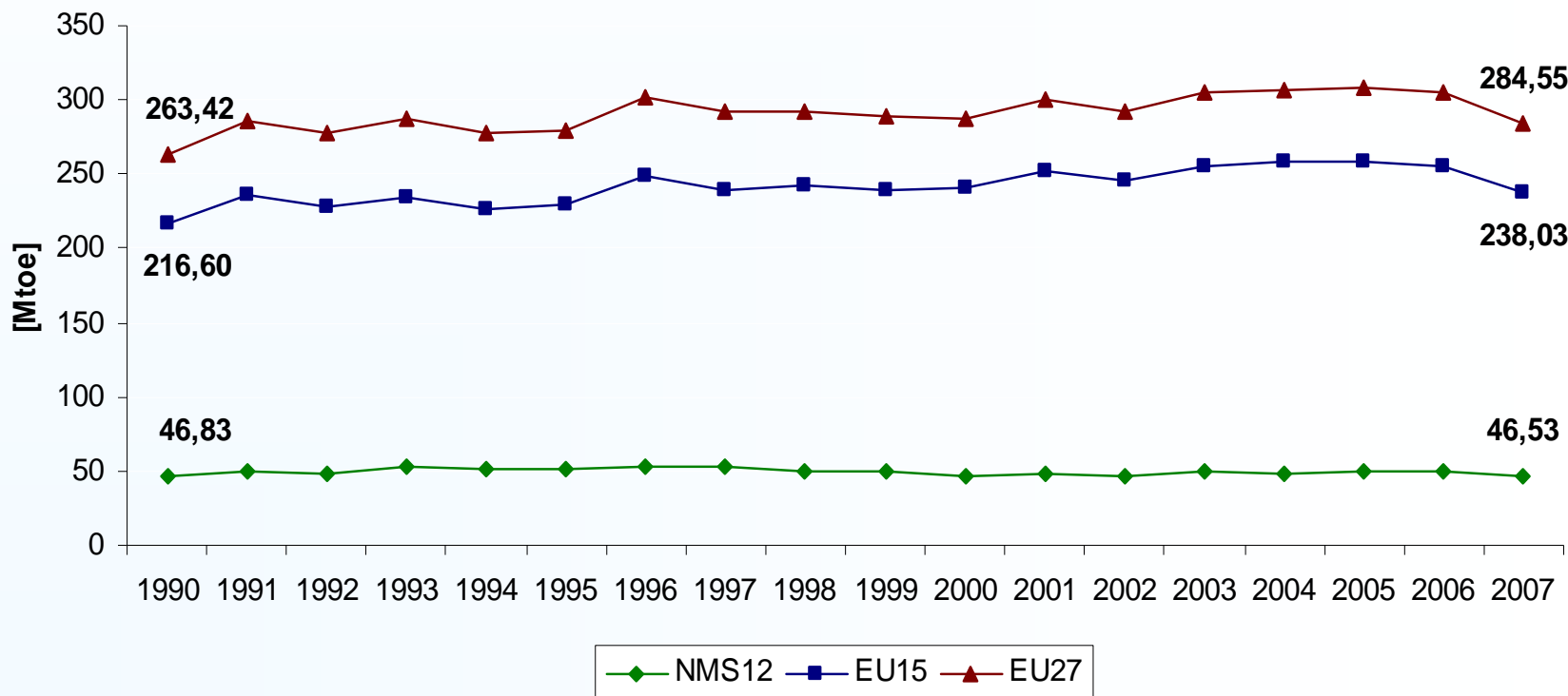


2007: 2843,24 TWh

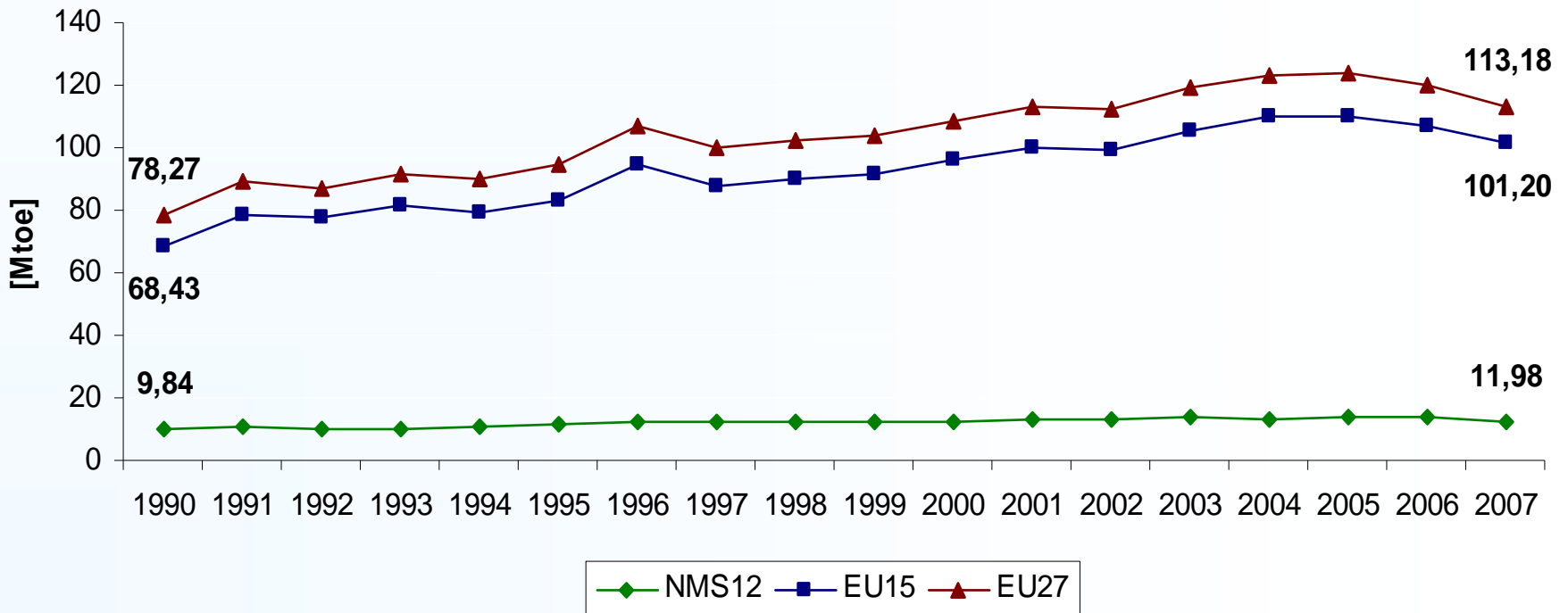


RESIDENTIAL SECTOR

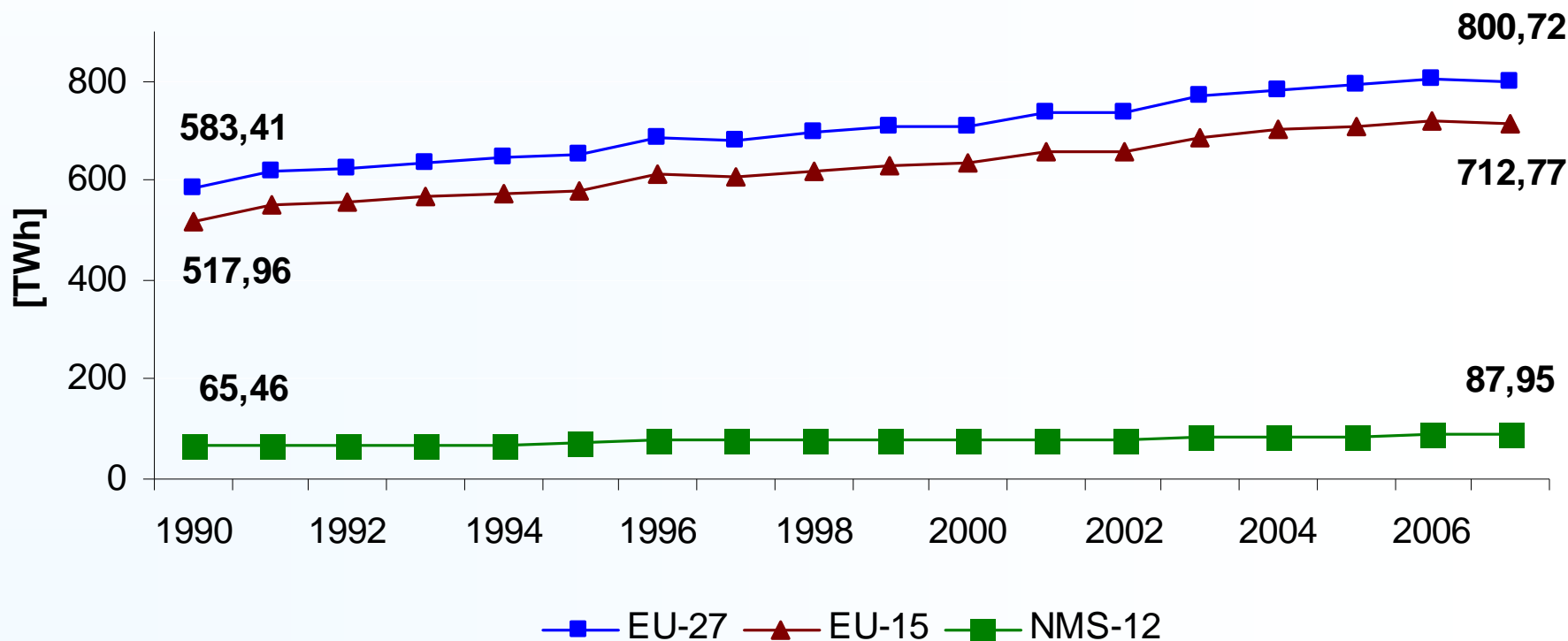
- Final energy consumption in the EU-27 residential sector started to decrease from 1999, going down by -1,55% in 2007 (-7,12% lower in 2007 than in 2004), but still 8% higher in 2007 than it was in 1990.



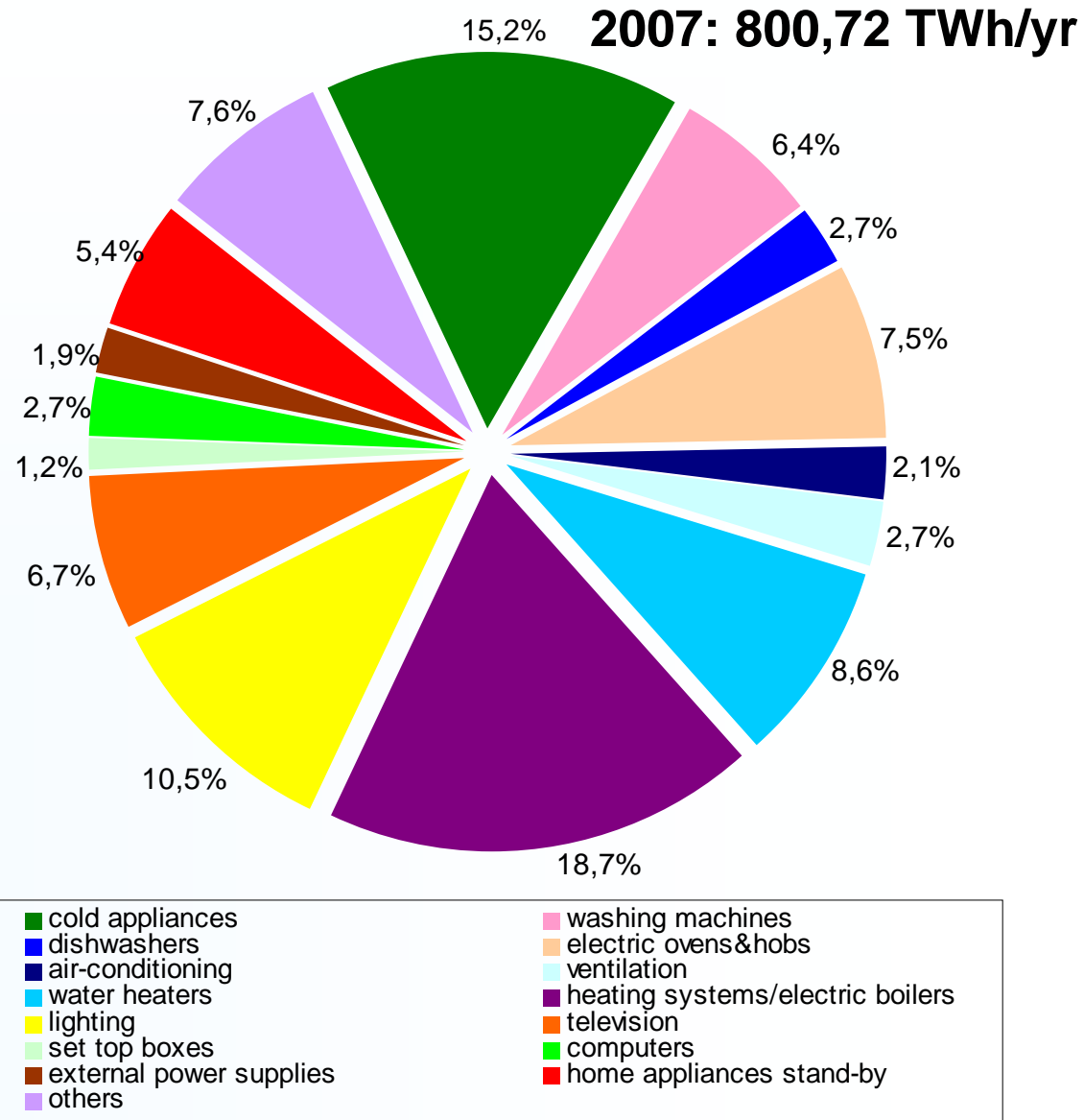
- The gas consumption of the residential sector has continued to grow in the period 1999 to 2007 in the EU-27 from 103,822 Mtoe to 113,176 Mtoe (9% growth), but the trend changed from 0,24% increase over the period 2004-2005 to -5,73% decrease over the period 2006-2007.



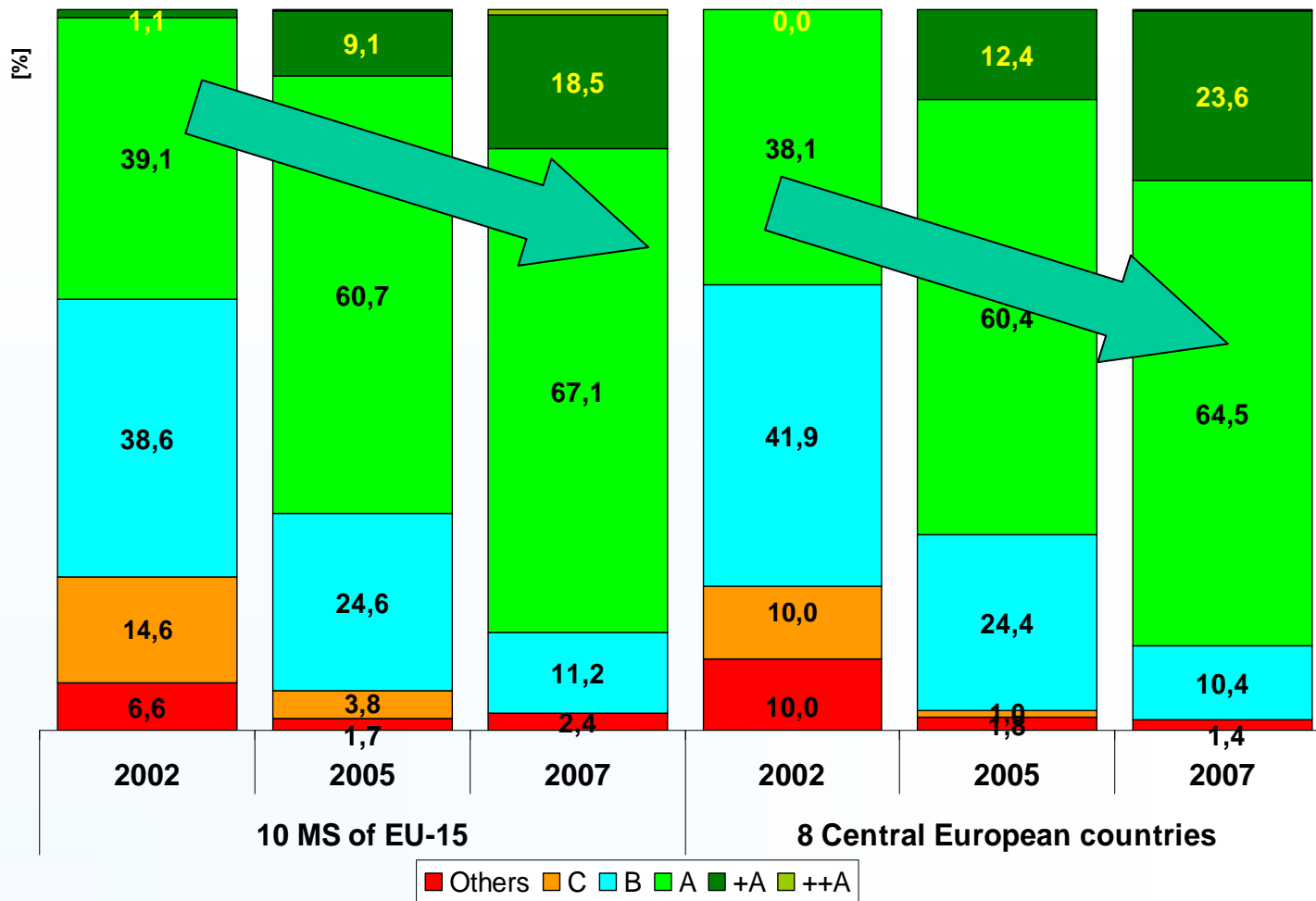
- EU-27: Residential electricity consumption rose by 13,17% on the period 1999-2007 and by 37,2% on 1990-2007, arriving to 800,72 TWh/yr, below the 2006 level by -0,72%.

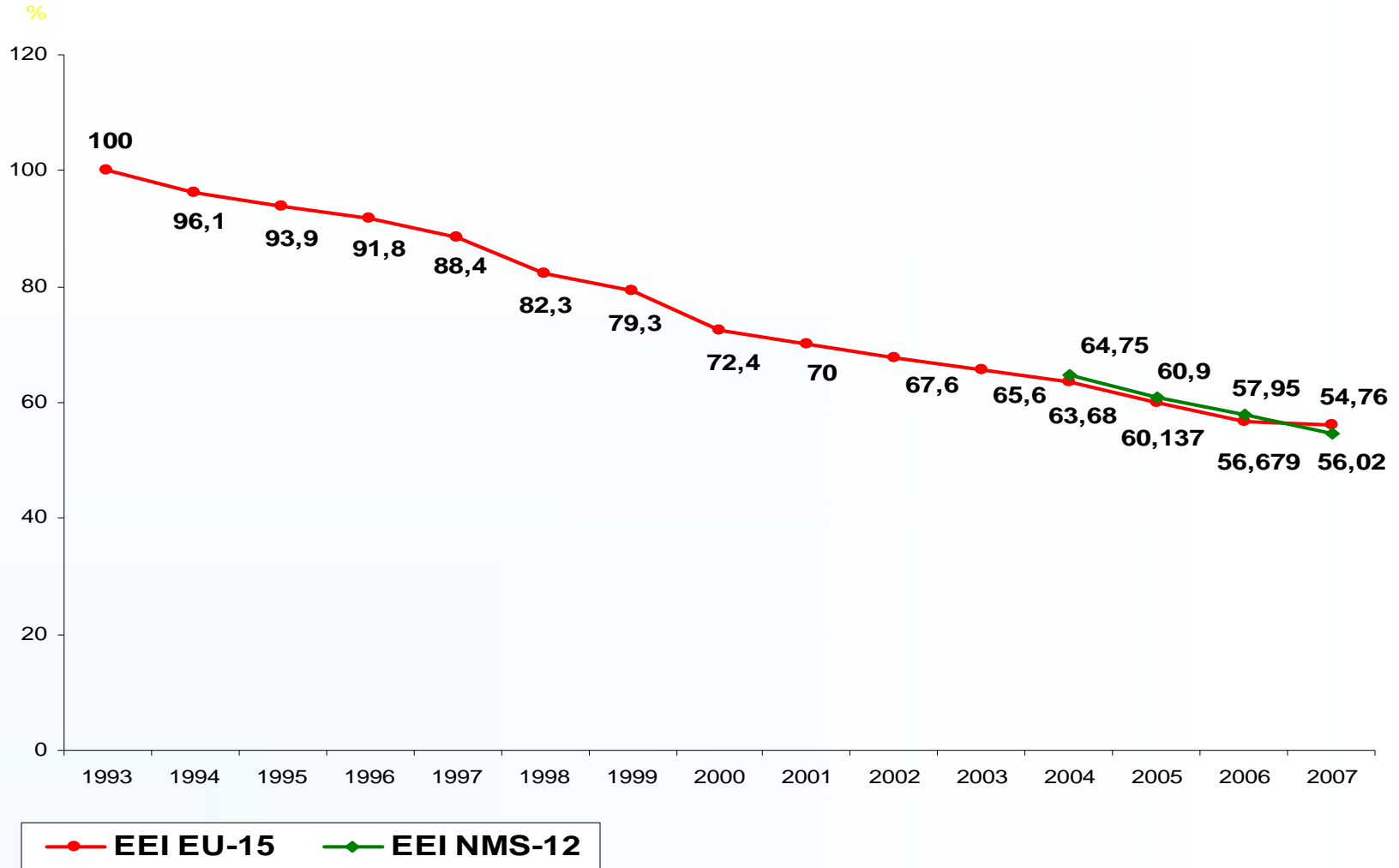


EU-27 residential electricity consumption	[TWh]
Cold appliances (refrigerators & freezers)	122,0
Washing machines	51,0
Dishwashers	21,5
Electric ovens & hobs	60,0
Air-conditioning	17,0
Ventilation	22,0
Water heaters	68,8
Heating systems/electric boilers	150,0
Lighting	84,0
Television	54,0
Set-top boxes	9,3
Computers	22,0
External power supplies	15,5
Home appliances stand-by	43,0
Others	60,6
Residential electricity consumption	800,7



- The refrigerators stock reached the saturation level, having penetration rates of around 100% in all the EU-27 countries.
- The freezer market registered a significant decrease tendency in the last years, due to the increase use of combined refrigerator/freezer appliances.
- In the year 2007, the combined refrigerator/freezer appliances (2 doors appliances) took the greatest share of the sales with 59,3% and 79% on both EU-15 and NMS-12 markets.
- The electricity consumption of cold appliances was around 122 TWh/yr.
- Regulated by energy labelling, voluntary agreements and minimum efficiency requirements since 1994 and 1996, domestic refrigerators and freezers are one of the success stories of Community energy efficiency policy.

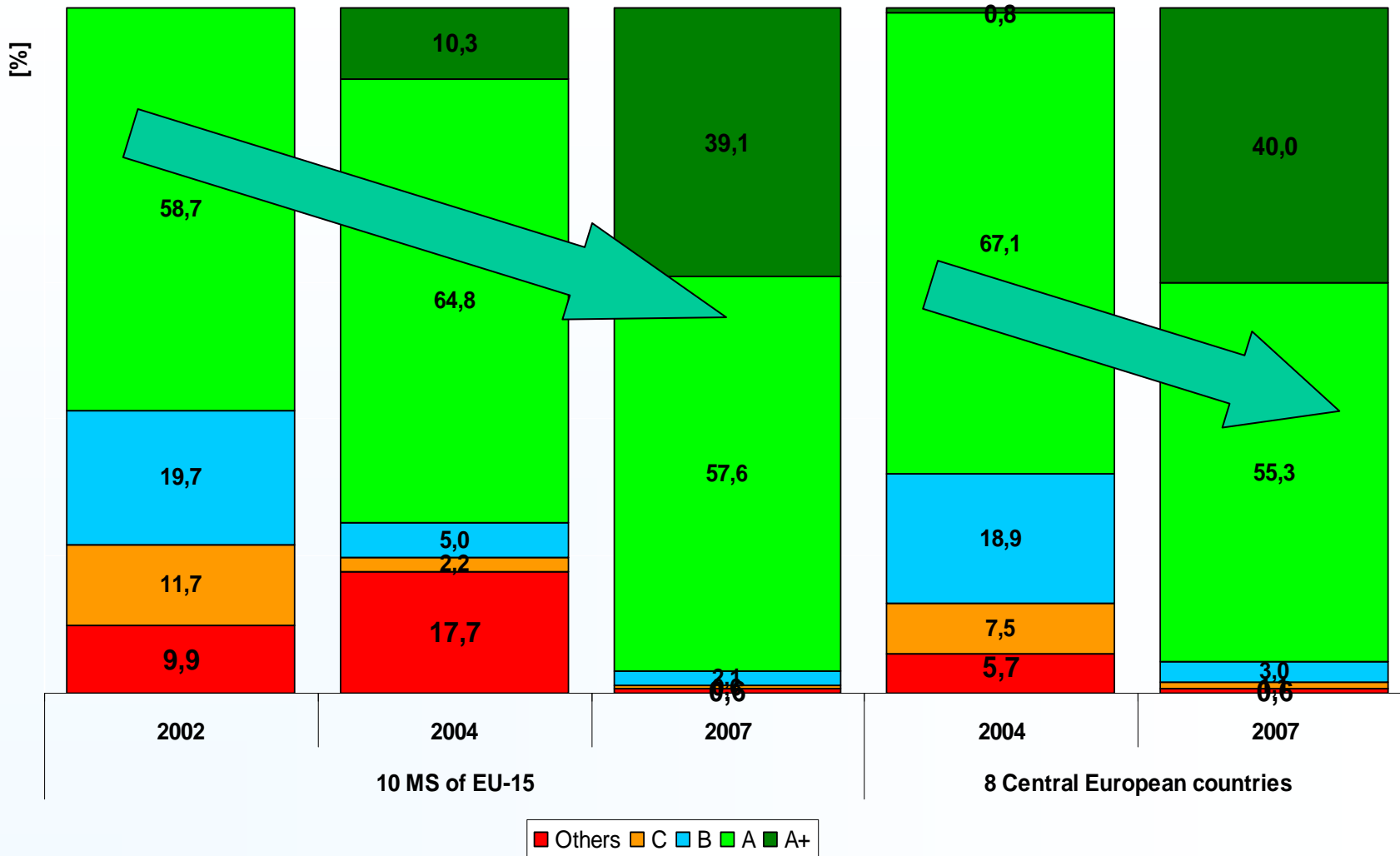


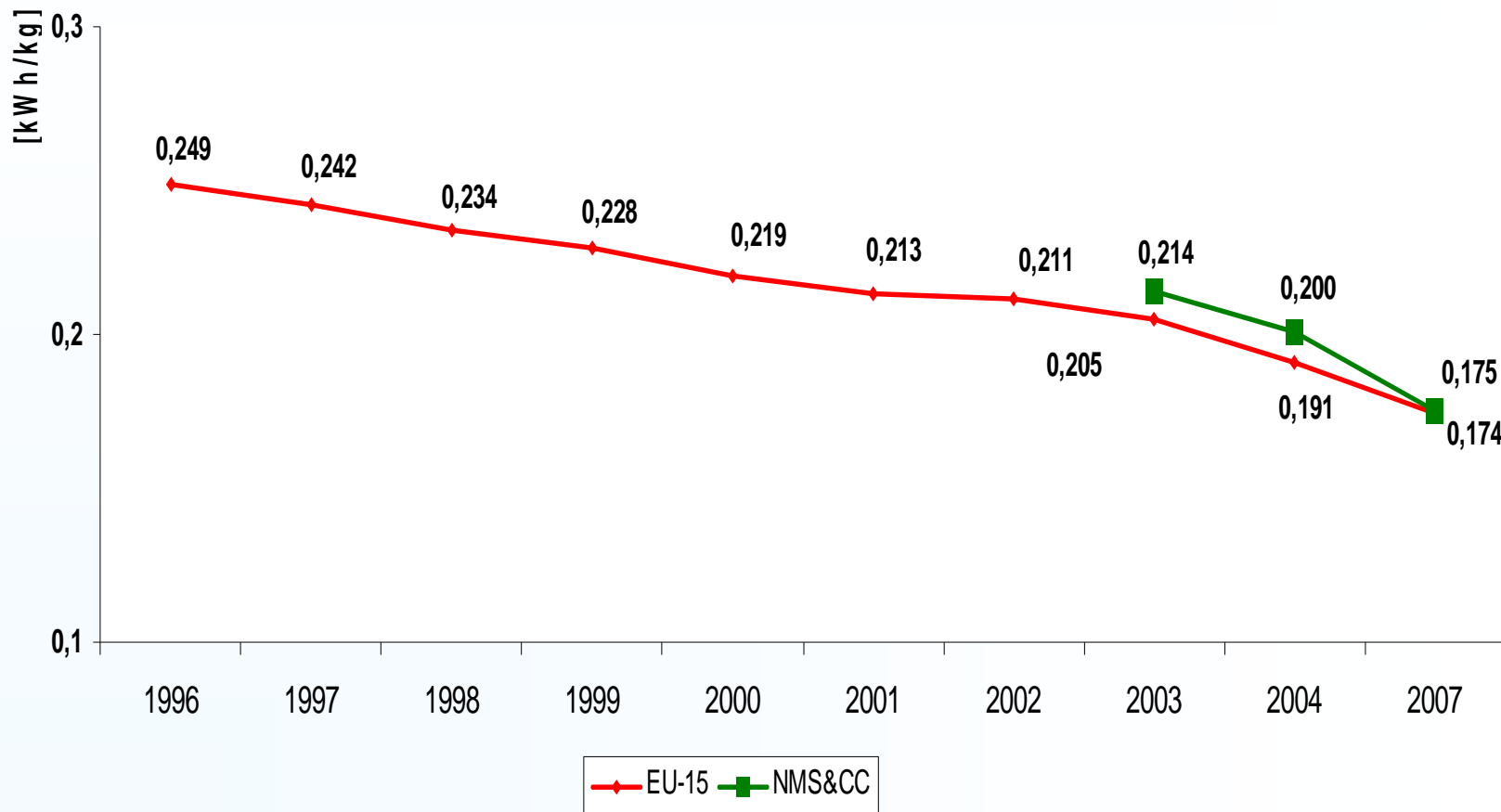


Additional requirements are coming from the EU Regulation (Eco-design Directive)-July 2009

- The mandatory requirements that will take effect in 2013 will include automatic switch-off of the "fast-freeze" function after 72 hours, electronic thermostats for optimising the switch to "winter setting" and automatic switch-off of small appliances with a volume of less than 10 litres.
- For compressor-type cold appliances (representing today 95% of the market), minimum energy requirements are foreseen according to the follow roadmap:
 - From July 2010: The current Class A becomes the new minimum energy performance requirement (EEI<55).
- For absorption-type and other type refrigerating appliances, minimum energy requirements are foreseen according to the follow roadmap:
 - From July 2010: The new minimum energy performance requirement will be EEI<150.
- **Estimated savings of 6 TWh/year within the EU-27 are expected by 2020, when the energy labelling and performance requirements for fridges and freezers reach their full impact**

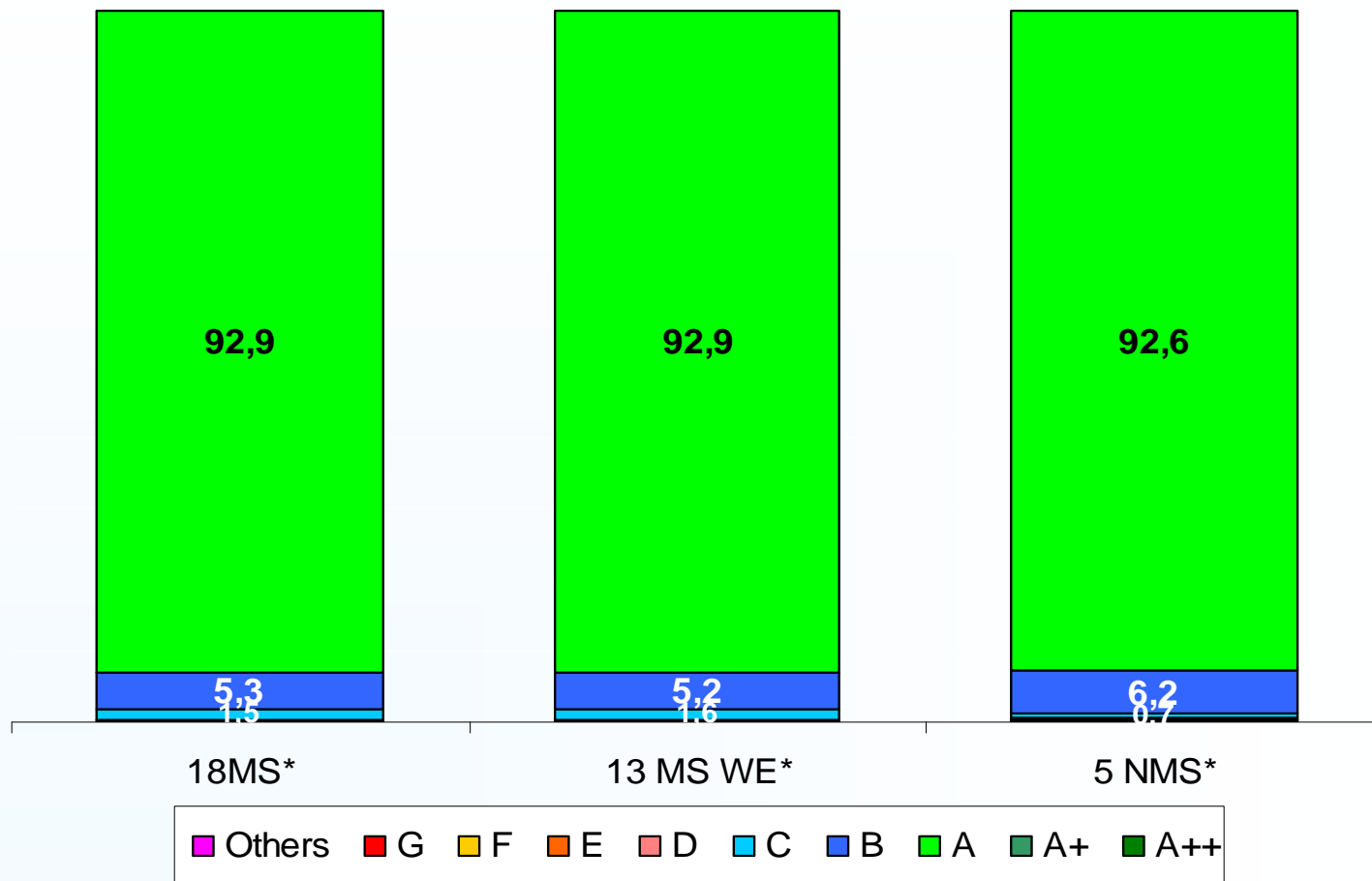
- The appliances stock of washing machines reached the saturation level, with penetration rate levels around 100% in all the EU-27 countries.
- 77,3% of the sales in 8 NMS from Central Europe were washing machines with spin speed more than 800 rpm, in 10 EU-15 countries being only 33,6%.
- The electricity consumption of washing machines in 2007 was estimated at around 51 TWh/yr.
- Regulated by energy labelling, voluntary agreements and minimum efficiency requirements from 1997, it is another successful story of the EU energy efficiency policy.





- In March 2009, the Regulatory Committee for the implementation of the Eco-design Directive agreed on minimum energy efficiency requirements for washing machines and an updated version of the Energy Labelling Directive for washing machines.
- For washing machines, minimum energy requirements according to the follow roadmap will be foreseen:
 - From 2010: Minimum requirement of current energy class A (EEI < 68) and limit on water consumption for the 60°C full-load programme.
 - From July 2015: Minimum requirement of the current energy class A+ (EEI < 59) for washing machines above 4 kg load.
- Energy labelling and minimum energy requirements for washing machines are expected to deliver savings of 2 TWh/year within the EU-27 by 2020, when these policy tools reach their full potential. On the other hand, behavioural measures, most importantly lowering the washing temperature, could still contribute with important savings.

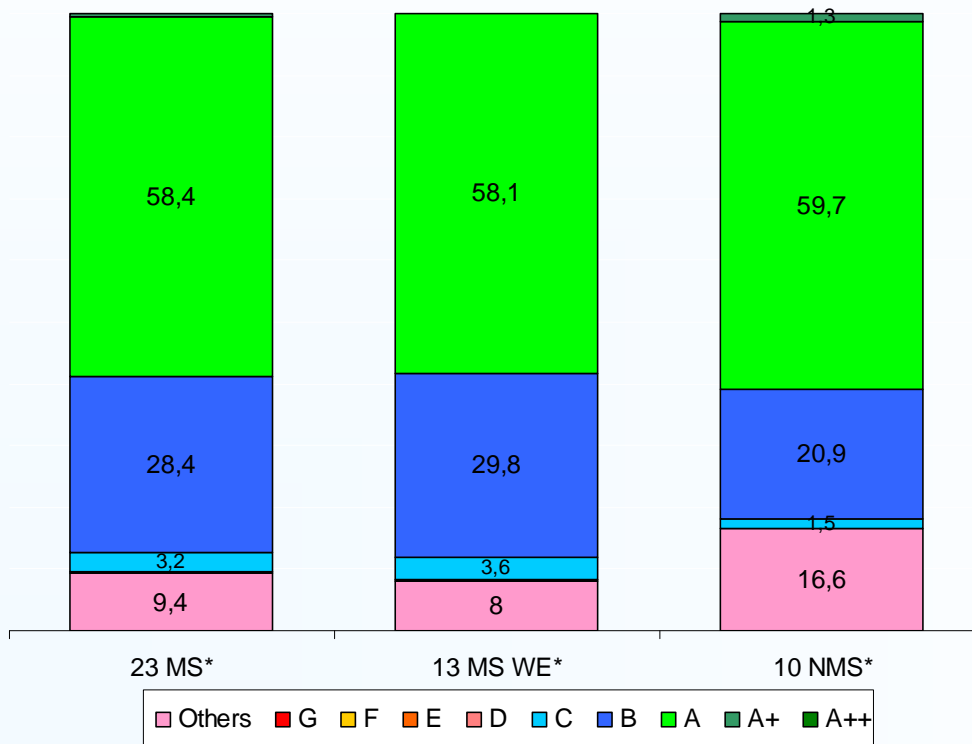
- In the EU-27 dishwashers have a lower saturation level than major appliances (refrigerators and washing machines). Penetration differs from country to country and is around 50-60% at maximum.
- The EU-27 dishwasher stock in the residential sector was estimated at around 69,307 million units. Our estimates show that the energy consumption of dishwashers in 2007 was around 21,5 TWh/yr.
- The current Directive 97/17/EC implementing Council Directive 92/75/EEC (energy labelling of household dishwashers) provides consumers a set of information related to energy consumption (kWh/cycle), cleaning performance, drying performance, water consumption and noise emission.



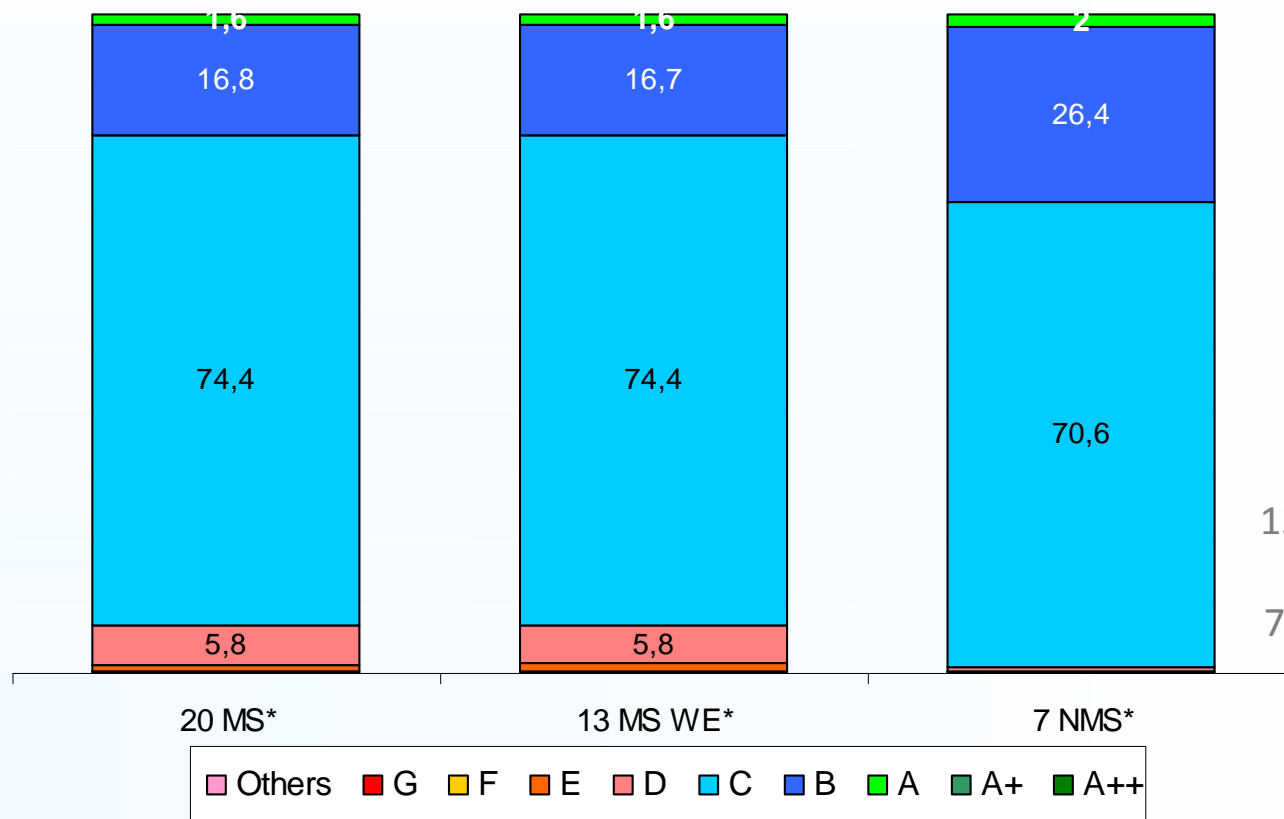
*Note: 13 MS WE=AT,BE,DE,DK,ES,FI,FR,GB,GR,IT,NL,PT,SE ; 5NMS=CZ,HU,PL,SI,SK

- The Eco-design Directive preparatory study (Lot 14) covers both dishwashers and washing machines, but the evaluation of the dishwashers proposals has been postponed. The main energy efficiency measures proposed for dishwashers include imposing as minimum requirement the current energy class B ($EEI < 71$) from 2010, and the current energy class A ($EEI < 63$) from 2015.
- By 2020, when the energy labelling and the minimum energy requirements for washing machines reach their full impact, savings of 2 TWh/year are estimated within the EU-27.

- The total electricity consumption for electric cooking is estimated to be of around 60 TWh (electric hobs and electric ovens together).
- There is a mandatory energy label only for electric ovens, which covers also the electric ovens in free-standing cookers. The impact of the energy labelling started to be visible on the market and the A class appliances represent more than 50% of the EU market



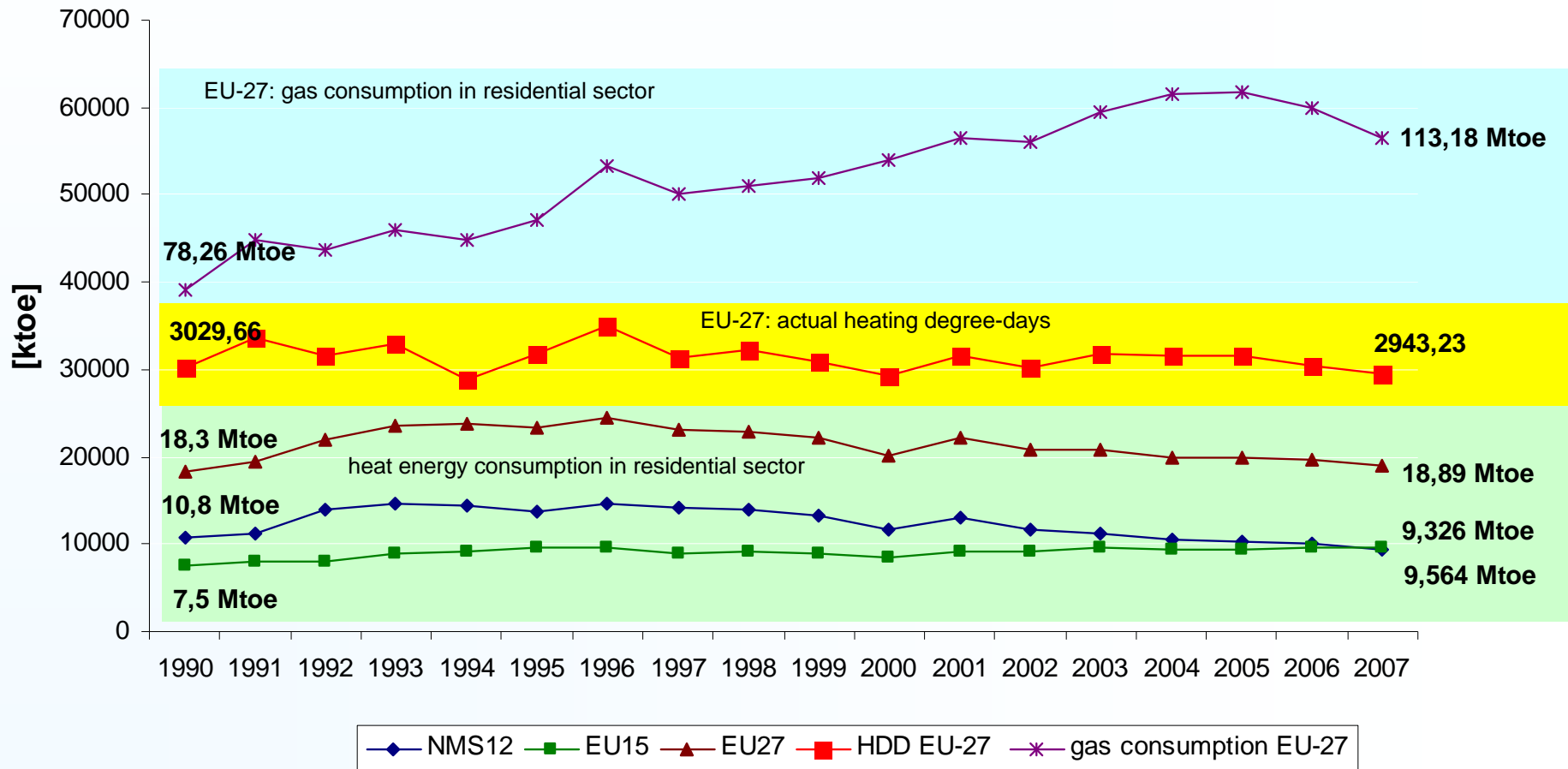
- Dryers are the appliance where little progresses in energy efficiency have been achieved with the mandatory energy label (Directive 95/13/EC) and transforming the dryer market to A-label equipments will save a lot of energy.



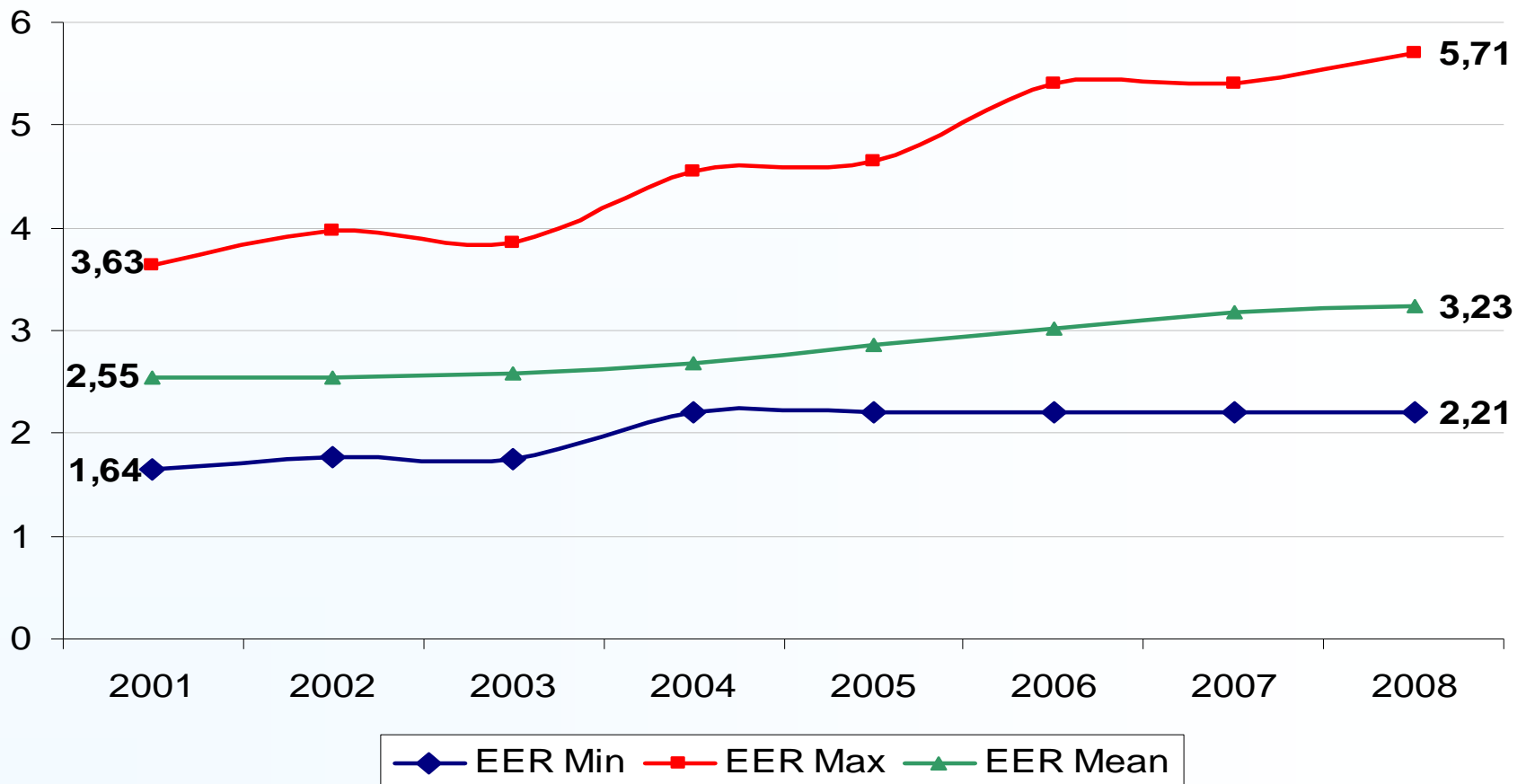
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- Space and water heating appliances together account for 29,8 % of the total electricity consumption in the residential sector.
- Space heating and cooling represent the largest single electricity end-use consumers in the residential sector, with 21,7% share, comprising the electricity consumption of air-conditioning, electric boilers, heat pumps, radiators and other electric heating appliances.
- The energy consumption for space heating and cooling is strongly dependent on the regional weather characteristics. The actual heating degree-days demonstrate that in almost all the countries the last years' tendency was negative, i.e. that temperatures were higher. This means that the heating needs decreased in 2007 in comparison to 2006 and this also explains the lower heating energy and electricity consumption in 2007 .

- There is a link between heating degree-days and heat energy consumption.



- Our estimates shown that around 2,6 million units were sold in 2007 on the EU-27 market, contributing with more than 10% to an existing stock of around 24 million air-conditioning systems, equivalent to a 100GW cooling capacity.
- In 2007 the overall electricity consumption of the EU-27 air-conditioning stock was around 17TWh.
- The biggest EU markets are Italy, Spain, Greece and southern-France. Spain represents 37% of the EU-27 market, followed by Italy with 20%, Greece with 15% and France with 11%, cumulating more than three quarters of the EU sales for residential use in 2005 (cooling capacity).



- For room air-conditioners (up to 12 kW output power), the Labelling Directive (2002/31/EC) has been adopted by the European Commission and was published in March 2002.
- Following the preparatory study for Lot 10 (Eco-design Directive), a new EC Regulation imposing minimum energy efficiency performance requirements and additional requirements on noise, energy use in standby, off-mode and other relevant modes is expected in the near future.

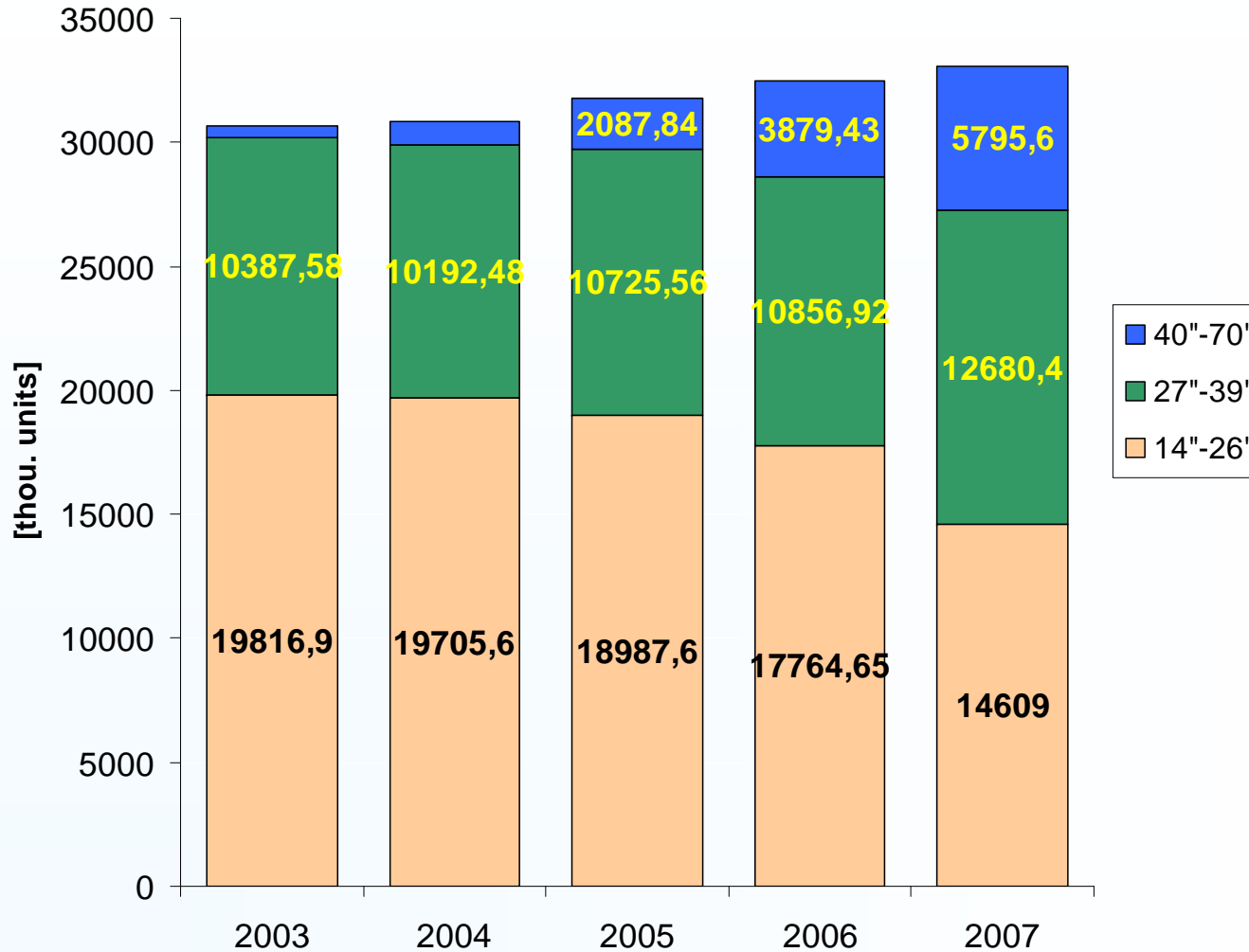
- Compact Fluorescent Lamps (CFLs) represent one of the most efficient solutions available today for improving energy efficiency in residential lighting. The recent drop in price, improvement in quality together with several information and promotion campaigns have had a positive impact on sales.
- The CFL penetration was strongly stimulated in many MSs due to some specific national policies and measures, like the white certificate schemes in the UK and Italy. There has been a 340% increase in the apparent consumption of CFL from 145 million in 2003 to 628 million in 2007.
- In 2007, the incandescent lamps (GLS) still had the dominant position on the market and also of the existing stock taking 54%. One third (33%) of the sold non-directional GLS lamps are 60W and 31,6% are 40W.
- Lighting represents 10,5 % of the residential electricity consumption in the EU-27, being the third main consumer after electricity for heating and cold appliances. From the estimates, residential lighting is responsible for around 84TWh/yr in 2007. The equivalent electricity consumption of the incandescent lamps represents around 50%, halogen lamps being responsible for around 30% of residential lighting consumption.
- The most promising emerging technology are LEDs which are not covered by the energy efficiency requirements and are A-class lamps.

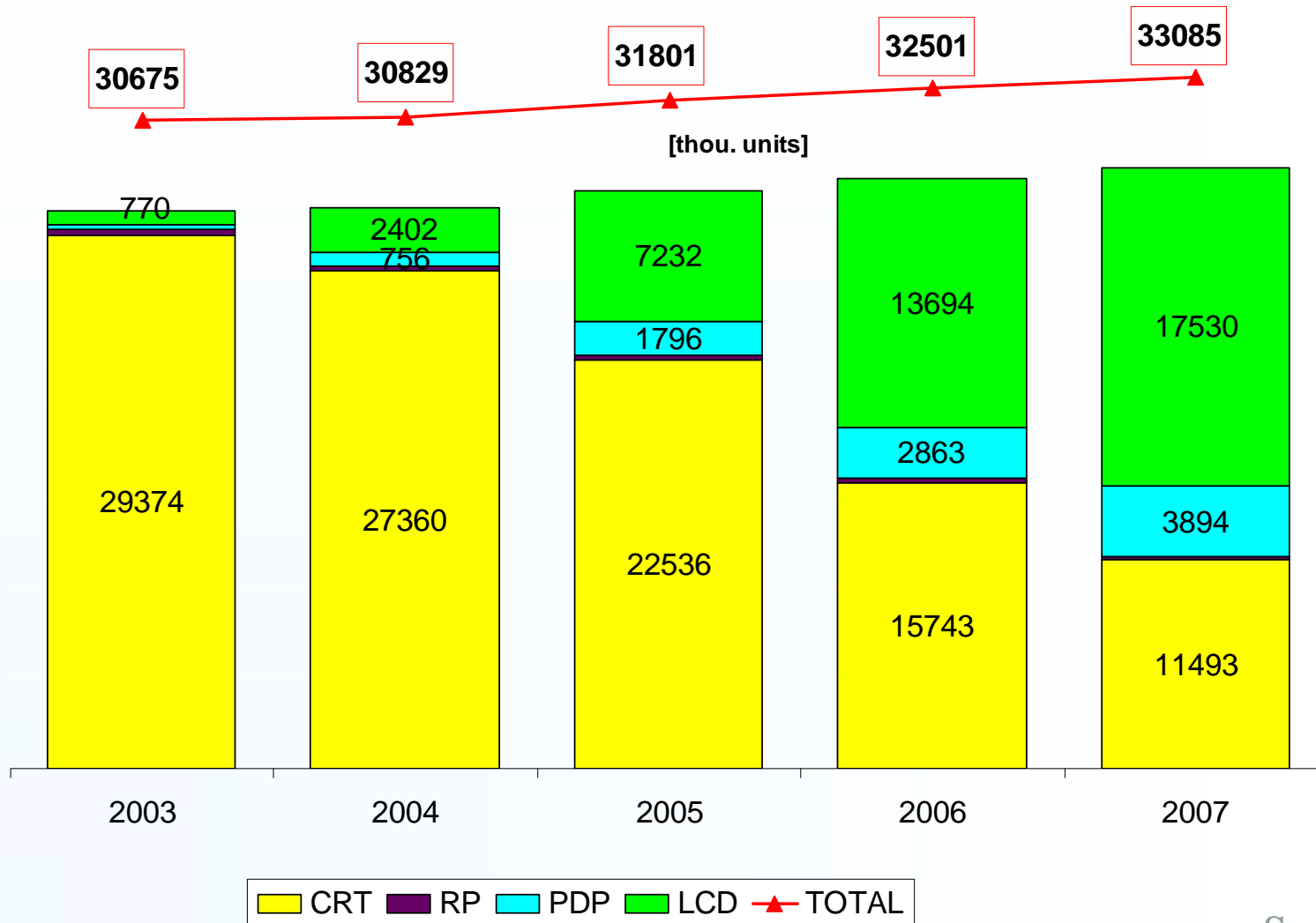
In March 2009 the European Commission adopted an eco-design regulation to improve the energy efficiency of household lamps, which envisages the progressive phase-out of incandescent bulbs starting in 2009 and finishing at the end of 2012.

Date	Non-clear lamps				Clear lamps						
	Requirement energy class	Incandescent	All halogen	CFLs	Requirement energy class	Conventional halogen				Halogen C	Halogen B
						≥100 W	≥75 W	≥60 W	<60 W		
Today	None				None						
Sep-09	A	phased-out			C for ≥100W, E for the rest ¹	phased-out					
Sep-10	A				C for ≥75W						
Sep-11	A				C for ≥60W						
Sep-12	A				C for all						
Sep-13	Second level of functionality requirements										
Review 2014	Review										
Sep-16	A	phased-out			B / C ²	phased-out					3

- 1 The requirement is raised for all clear lamps to class E, phasing out F and G class incandescent and halogen lamps in all wattages already in September 2009. After the first stage, only E-class incandescent lamps remain available in some wattages until they are also gradually phased out by September 2012.
- 2 Special cap halogen lamps will be required to be at least class C, all other clear lamps will have to be at least class B.
- 3 Only special cap halogen lamps are allowed to be C-class.

- The EU-27 electricity consumption in 2007 was around 60 TWh of which 54 TWh are in on-mode and 6 TWh are in standby/off-mode.
- On the TVs market dramatic changes in technology happened and will take place, driven by the technology change. Four main factors influence the market development:
 - Flat Panel displays (flat TVs)
 - Larger Screen Sizes
 - Digital television broadcasting
 - High resolution television (HDTV)



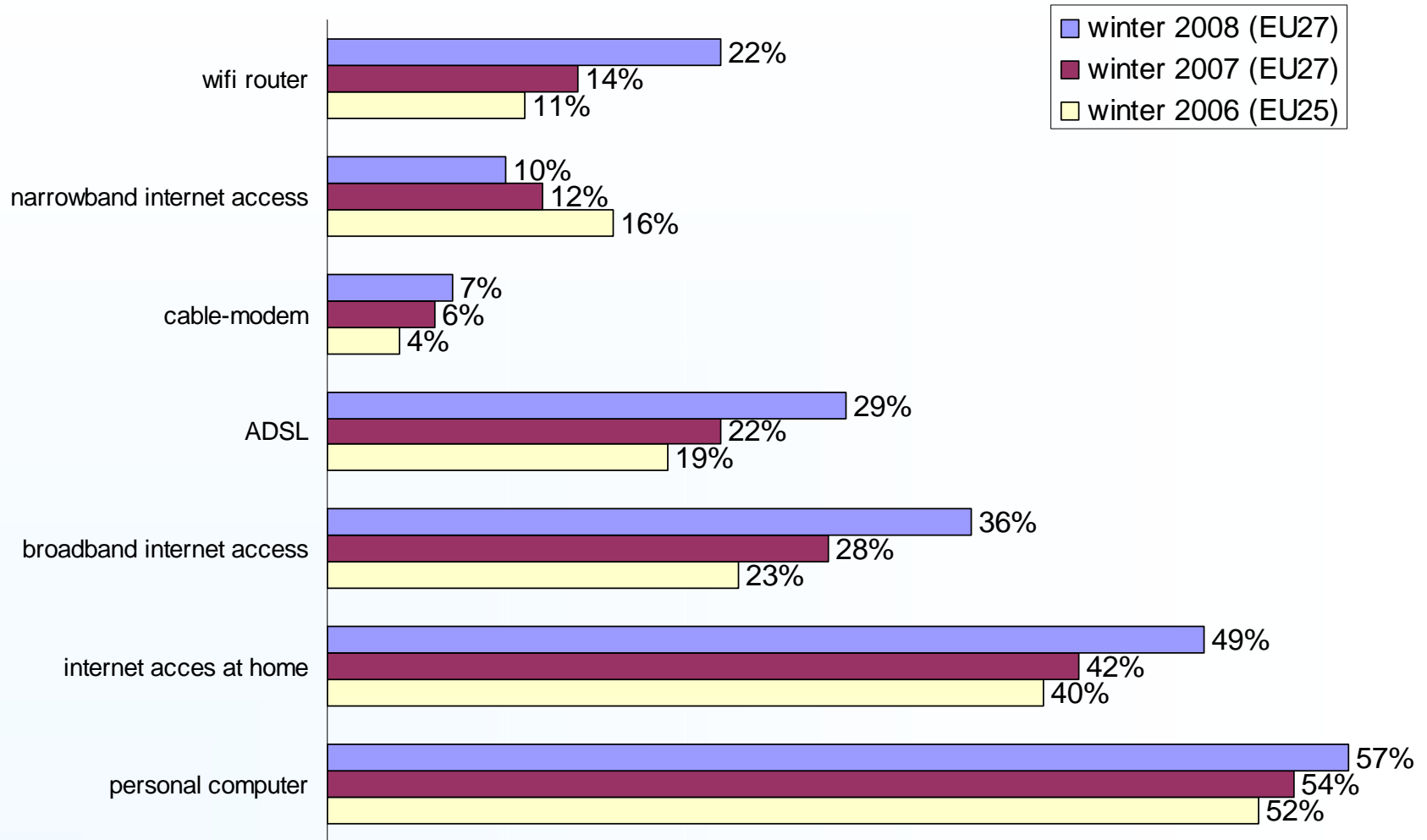


Broadband communications & equipment

- The penetration rate of broadband fix lines in EU-27 household reached 53,78% at mid-2008.
- In 2008, the EU penetration level for mobile broadband (data modems/cards/keys and other active 3G equivalent) was 6,9%. The figure must be significantly bigger, as time as France, the Netherlands and the UK did not report on.

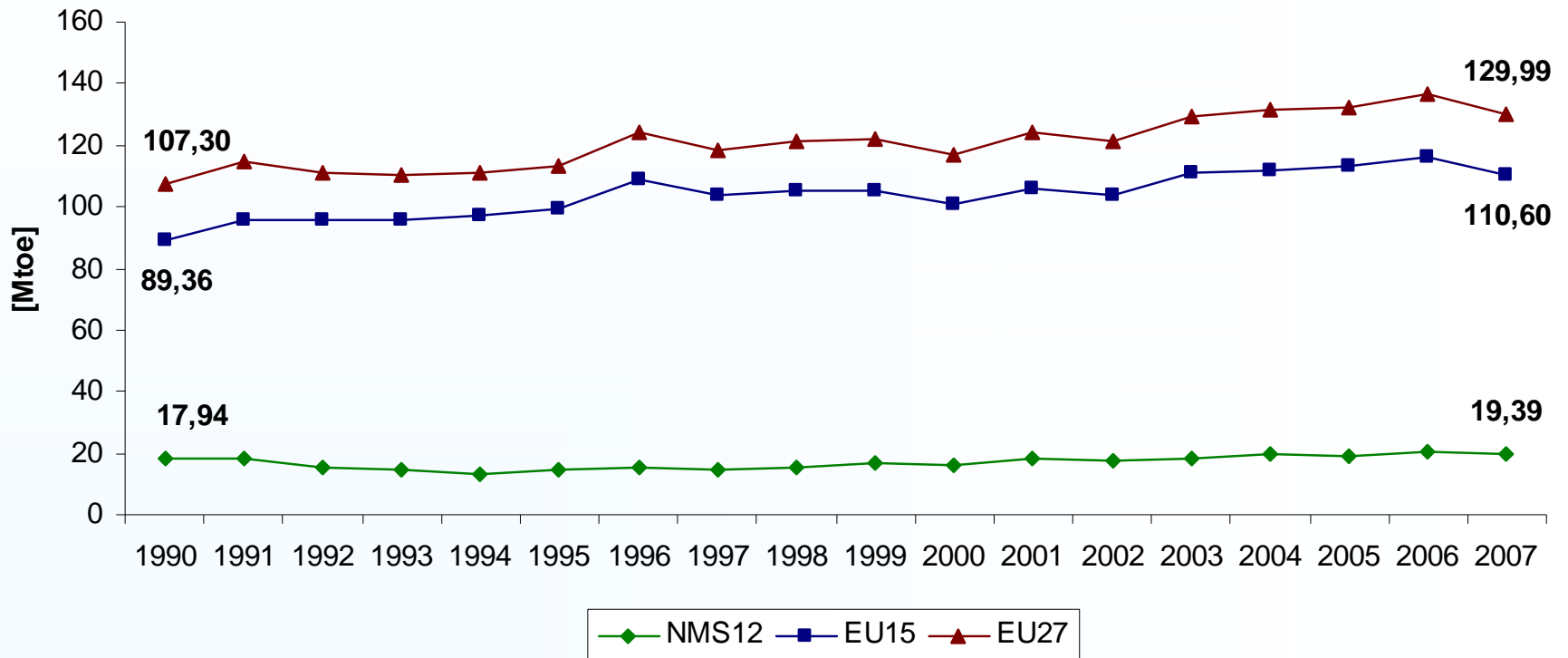
Information technologies

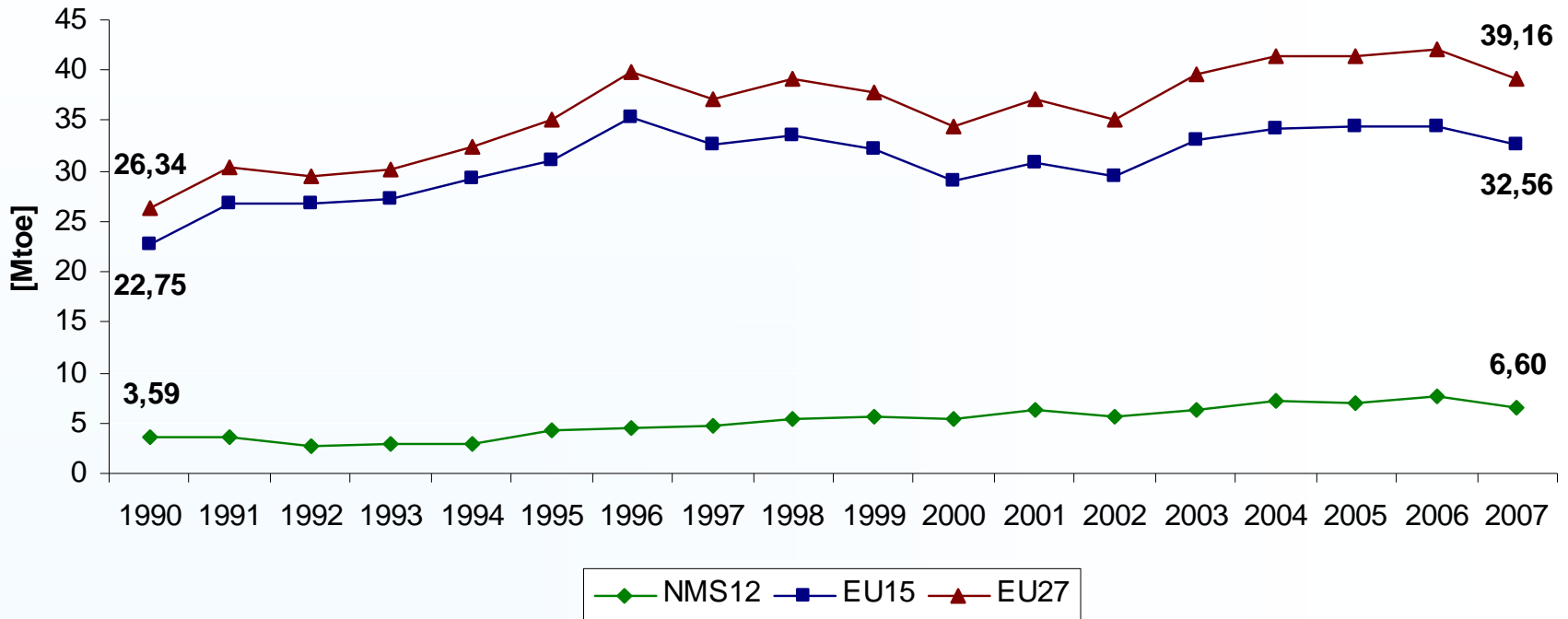
- The majority of European households (57%) had a computer and nearly half of the household population now has access to the Internet (49%)
- There has been a significant increase in Internet penetration rates across Europe since 2007 (+7 percentage points). However, the Internet access remains considerably higher in the EU15 (52%) than in the NMS12 (33%).
- This trend is most pronounced in Slovenia, and Cyprus (+14 percentage points) and the penetration rates remain the Czech Republic the highest in the Netherlands (86%), Denmark (80%) and Sweden (78%).
- Meanwhile, less than a quarter of households in Bulgaria (22%, 57% annual growth), Greece (22%, 15,7% annual growth) and Romania (24%, 100% annual growth) have Internet access.

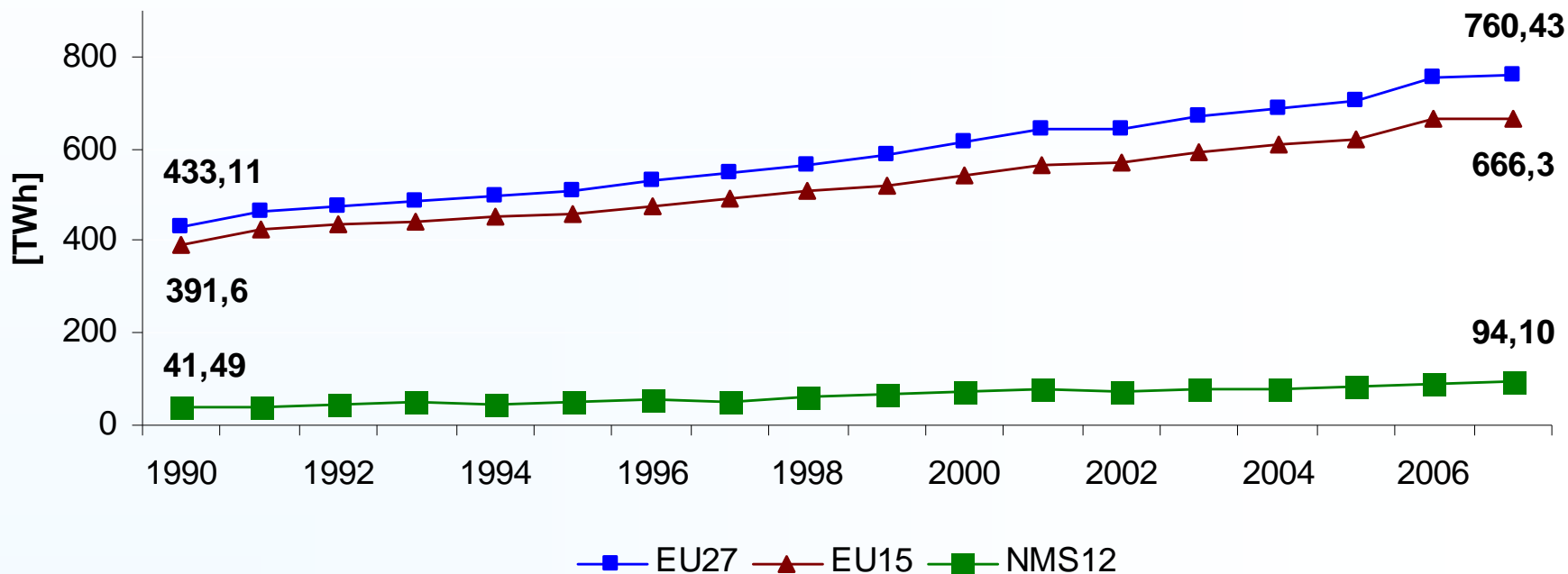


Source: Eurobarometer

Tertiary sector



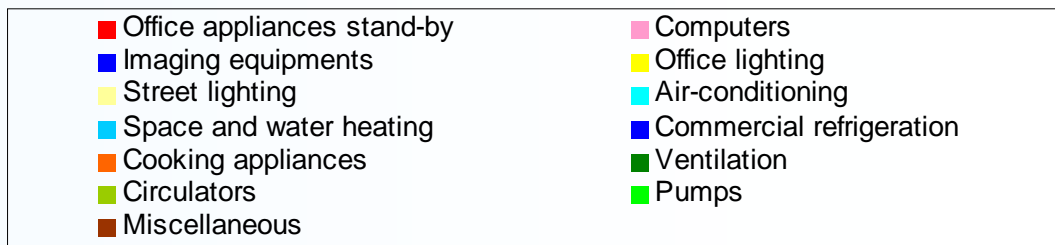
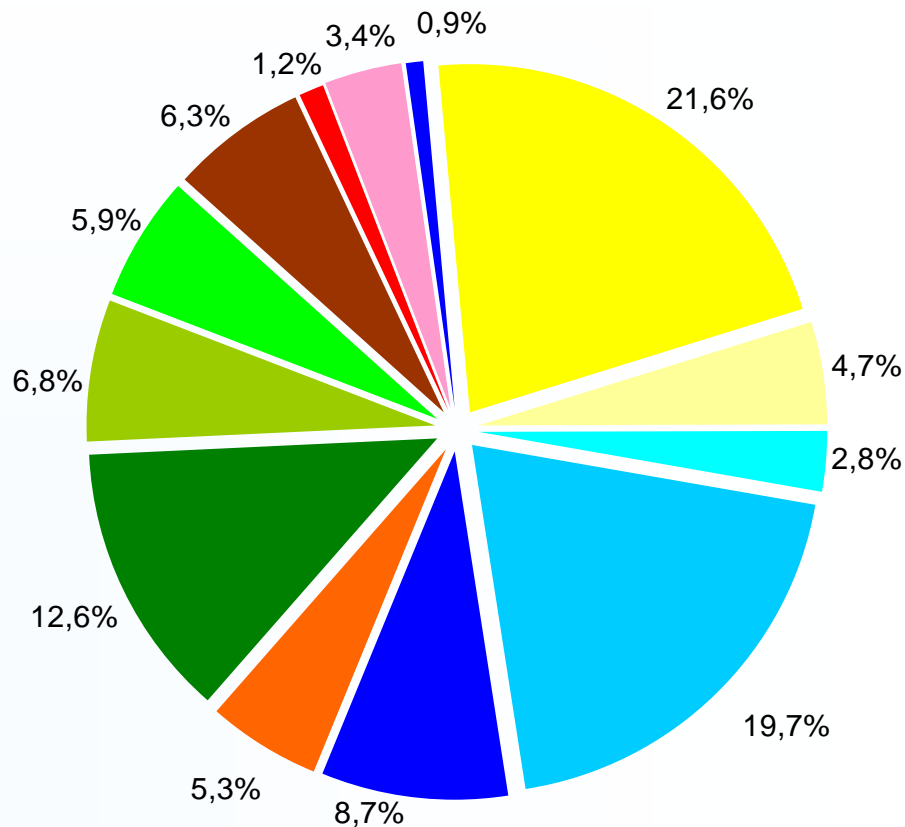




- The largest electricity consumers in the EU-27 tertiary sector are indoor lighting in commercial buildings (21,6% and 26,3%, together with street lighting), electric space and water heating systems (19,7%), ventilation (12,7%) and commercial refrigeration (8,7%).
- In March 2009: EU Regulation concerning the Eco-design requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and of the Council. The estimated savings by implementing this Regulation are at about 38 TWh/year by 2020.
- In 2007, the electricity consumption of air-conditioners in non-residential buildings was estimated at about 21,6 TWh, the fans for ventilation systems (including fans) at about 96 TWh and the commercial refrigeration at around 66 TWh. All of them have an important potential for energy savings and energy efficiency Regulations should follow the correspondent Eco-design preparatory studies.

2007: 760,43 TWh/yr

EU-27 tertiary electricity in 2007	[TWh]
Office appliances stand-by	9,43
Computers	26
Imaging equipments	7
Office lighting	164
Street lighting	36
Air-conditioning	21,6
Space and water heating	150
Commercial refrigeration	65,83
Cooking appliances	40
Ventilation	96
Circulators (and other similar)	52
Pumps	45
Miscellaneous	47,57
Total final consumption	760,43



Measure	Estimated savings (annual by 2020) [TWh]	Measure adoption
Stand-by (ecodesign)	35	Dec-08
Simple set-top boxes (ecodesign)	6	Jan-09
Street & office lighting (ecodesign)	38	Feb-09
External power supplies (ecodesign)	9	Mar-09
Domestic lighting (ecodesign)	39	Jul-09
Televisions (ecodesign & labelling)	43	Jul-09
Freezers & refrigerators (ecodesign & labelling)	6	Jul-09
Washing machines (ecodesign & labelling)	2	-
Dishwashers (ecodesign & labelling)	2	-
Electric motors (ecodesign)	140	Jul-09
Circulators (ecodesign)	27	Jul-09
Total savings (annual by 2020)	347 TWh/yr.	



Electricity Consumption and Efficiency Trends in European Union

- Status Report 2009 -

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THANK YOU!