

THE AECB SILVER AND GOLD ENERGY PERFORMANCE STANDARDS

Presented by

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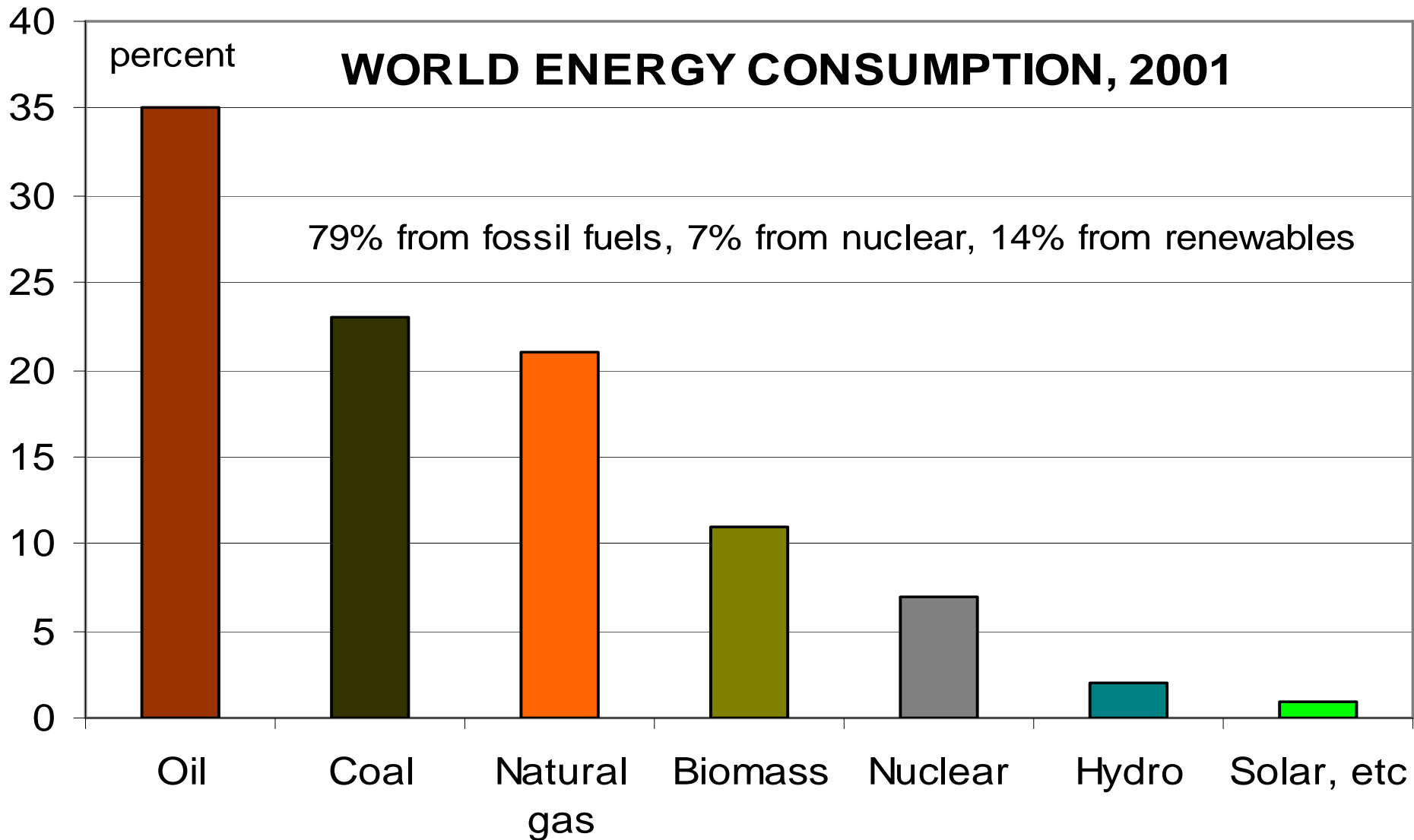
Web: www.energyadvisoryassociates.co.uk

What I plan to talk about

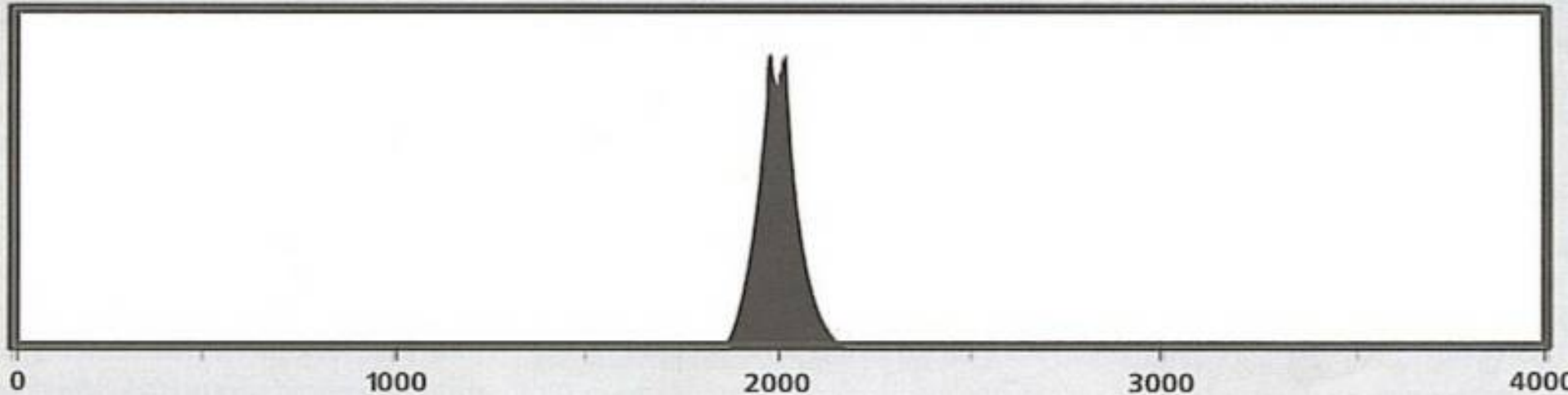
- Global imperatives
- The UK situation
- The AECB energy performance standards
- Some common misunderstandings
- What the standards exclude
- What the standards could achieve
- Case studies

Global Imperatives

Fossil Fuel Dependence



Peak Oil



Oil production & consumption in a historical context: actual profile 1870-2003 and predicted profile 2003-2130.

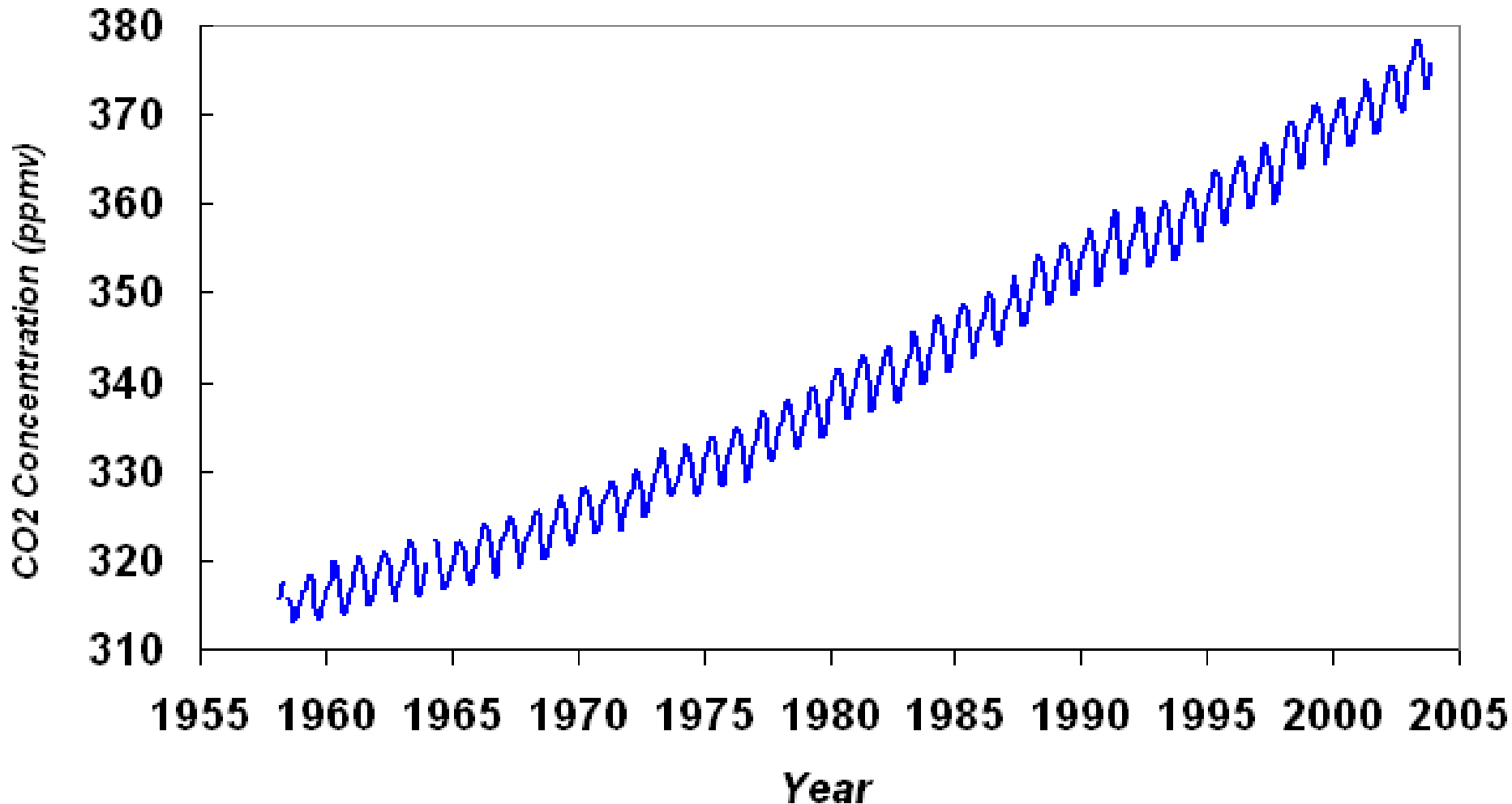
"The world has never faced a problem like this. Without massive mitigation more than a decade before the fact, the problem will be pervasive and will not be temporary. Previous energy transitions were gradual and evolutionary. Oil peaking will be abrupt and revolutionary."

US Dept. of Energy, March 2005 internal report.

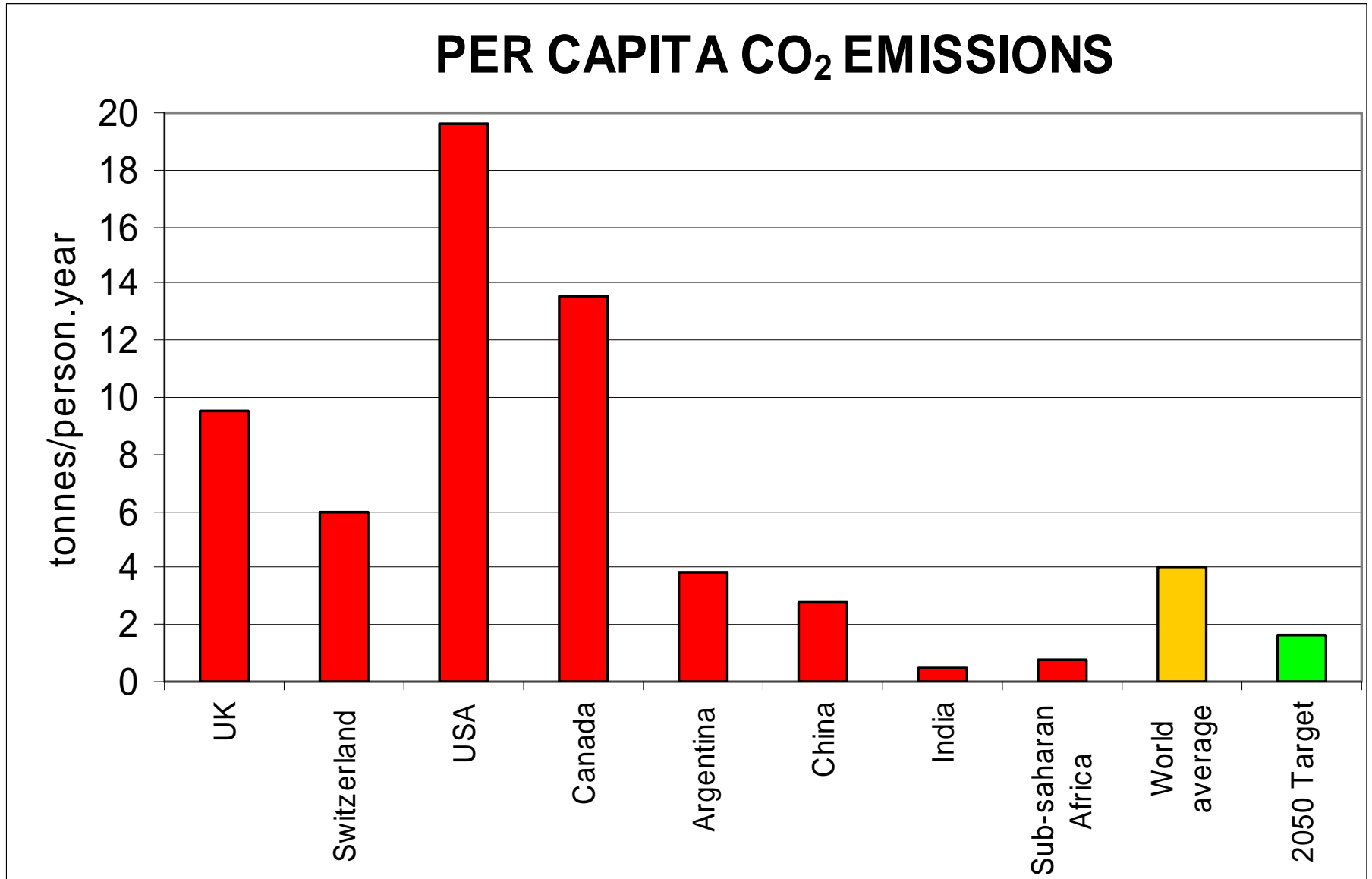
See also www.oilendgame.com

Rising Atmospheric CO₂

**Atmospheric CO₂ Concentration - Mauna Loa
Observatory 1958 - 2003**



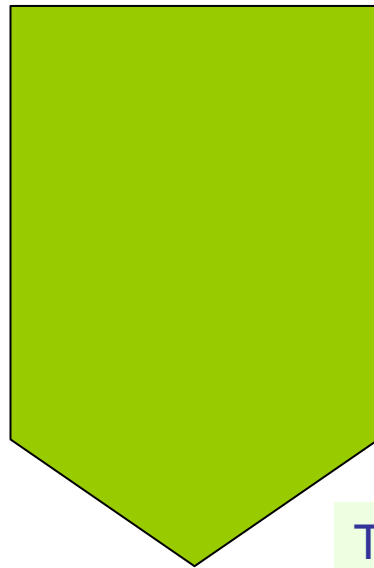
CO₂ Reduction Targets



CO₂ Reduction Targets

Developed Countries

- The prevailing view of experts now is that developed countries need to **cut their CO₂ emissions by at least 85% by 2050**
- This is an **average reduction of 4.5% per year for the next 44 years**



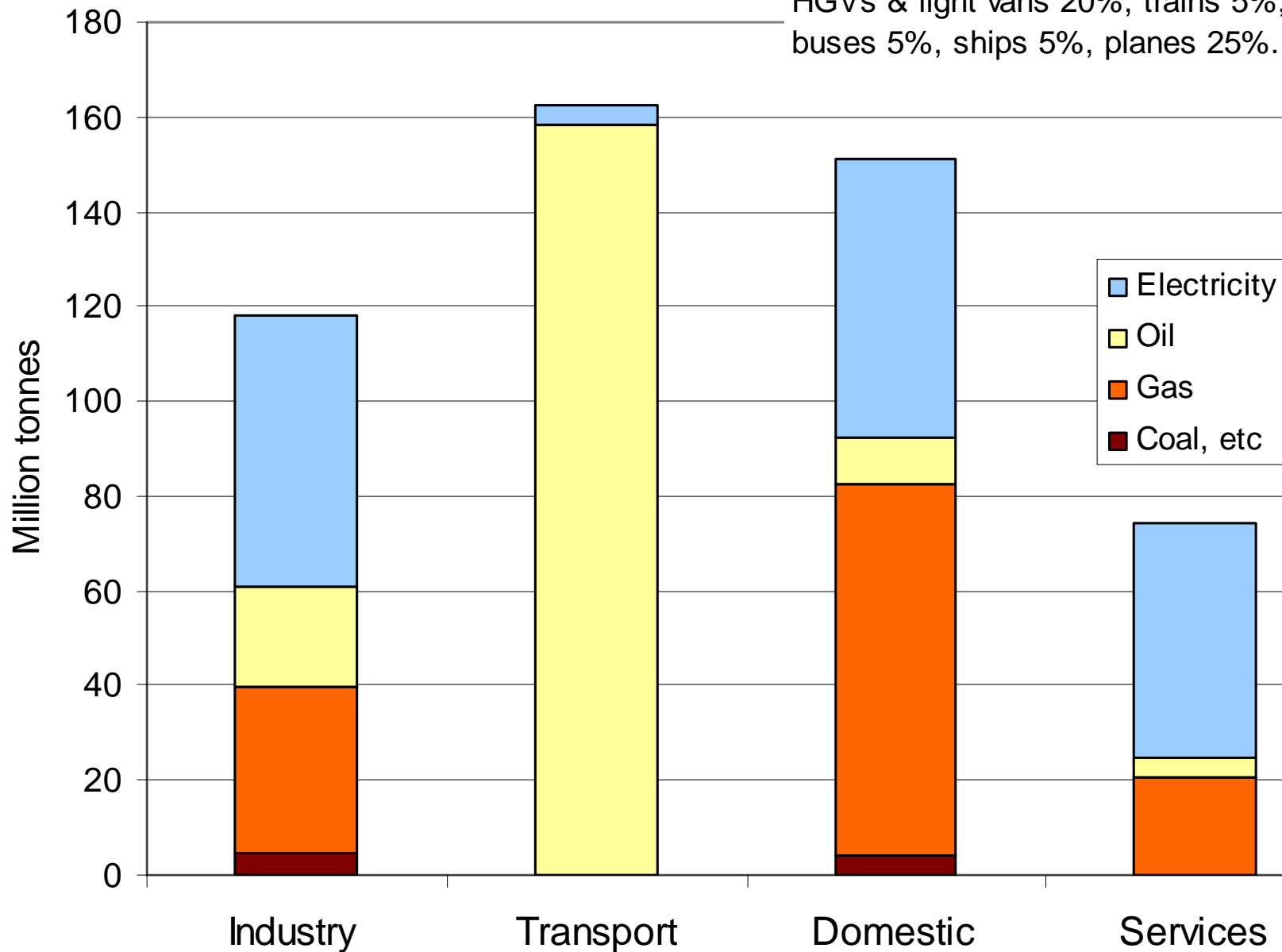
The AECB supports this view

The UK Situation

UK CO2 EMISSIONS, 2003

Total from energy uses = 506 M t.

NOTE: Transport sector breakdown is approx. as follows: Cars 40%, HGVs & light vans 20%, trains 5%, buses 5%, ships 5%, planes 25%.



A CO₂ Reduction Target for the UK

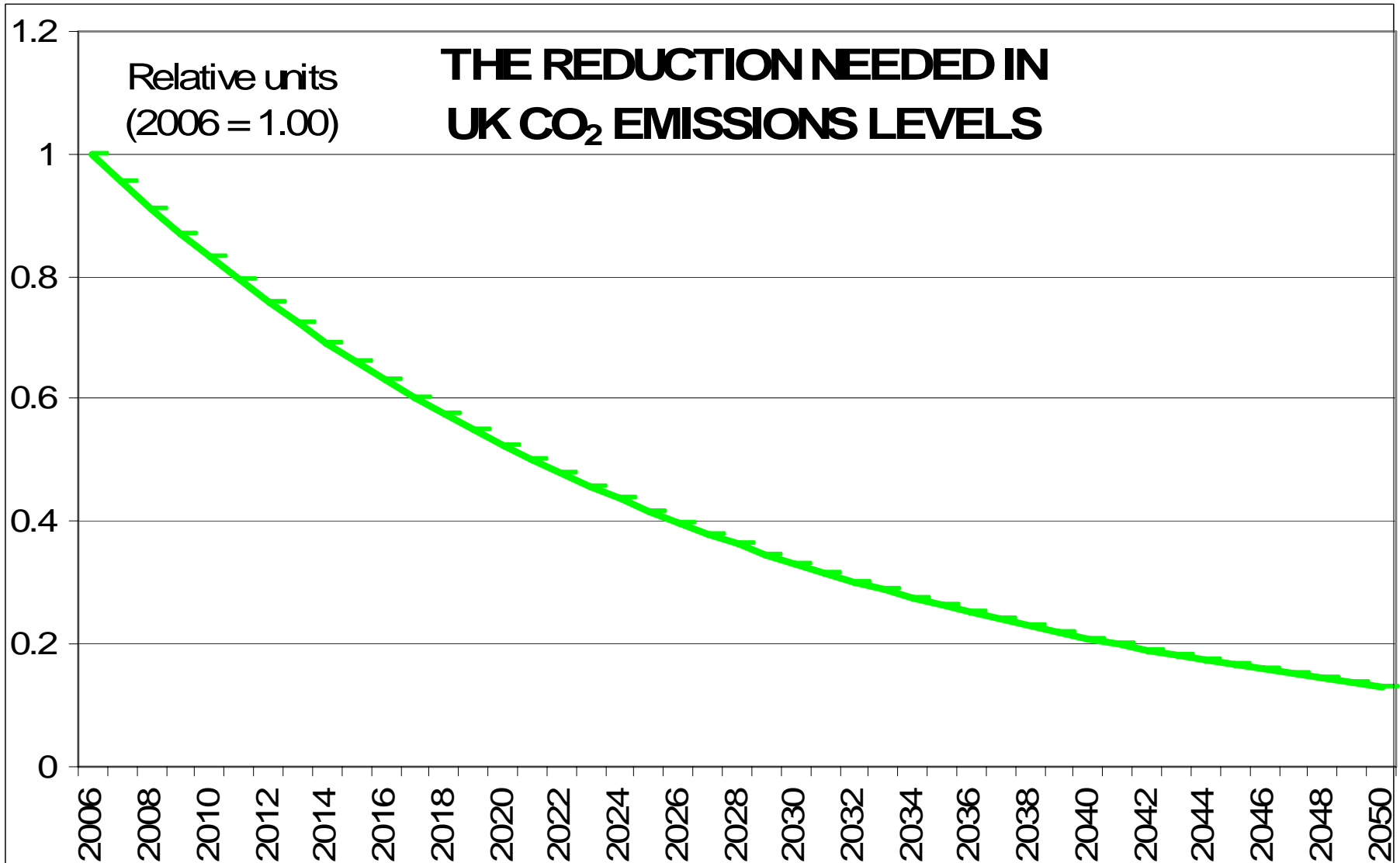
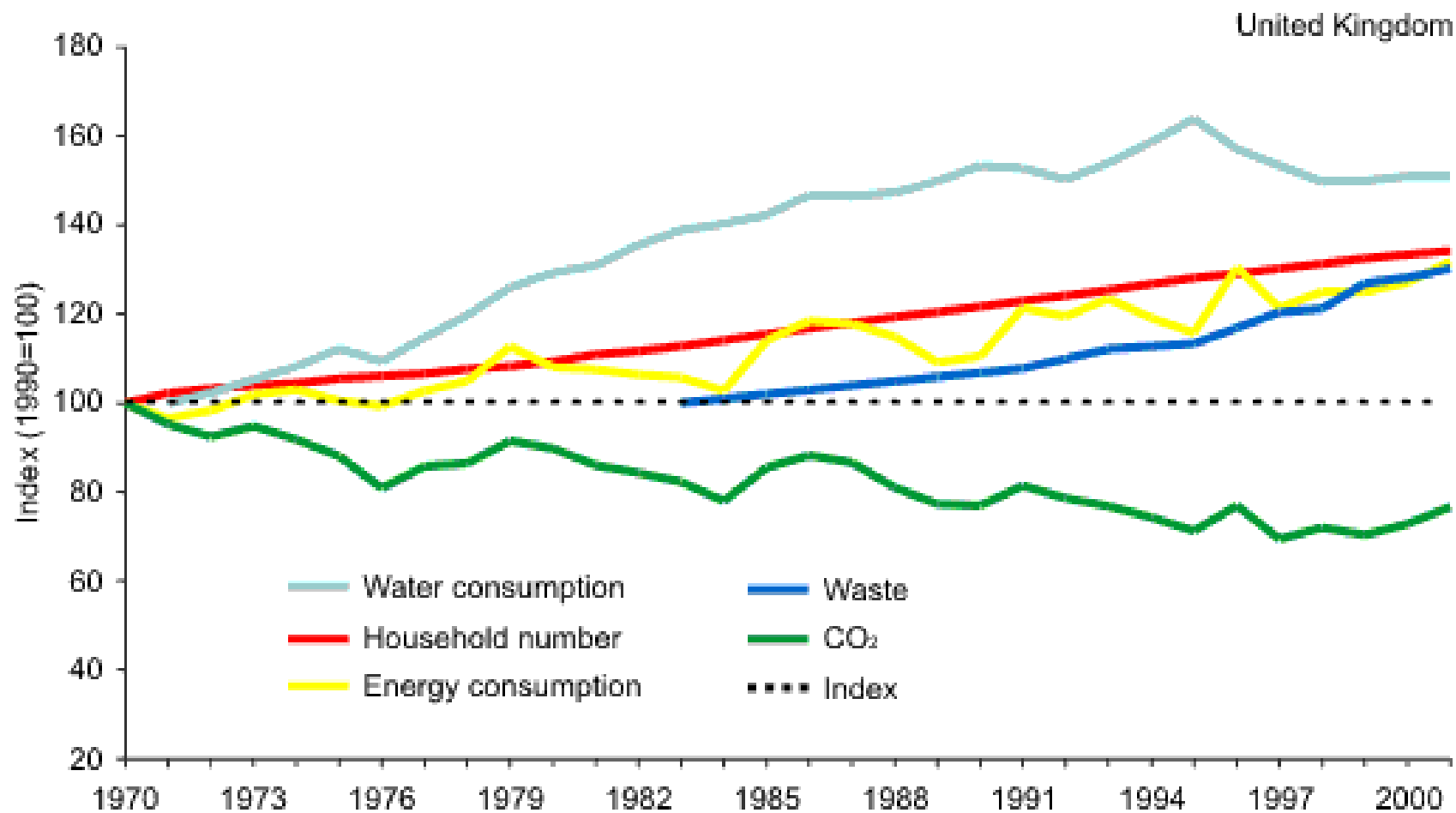
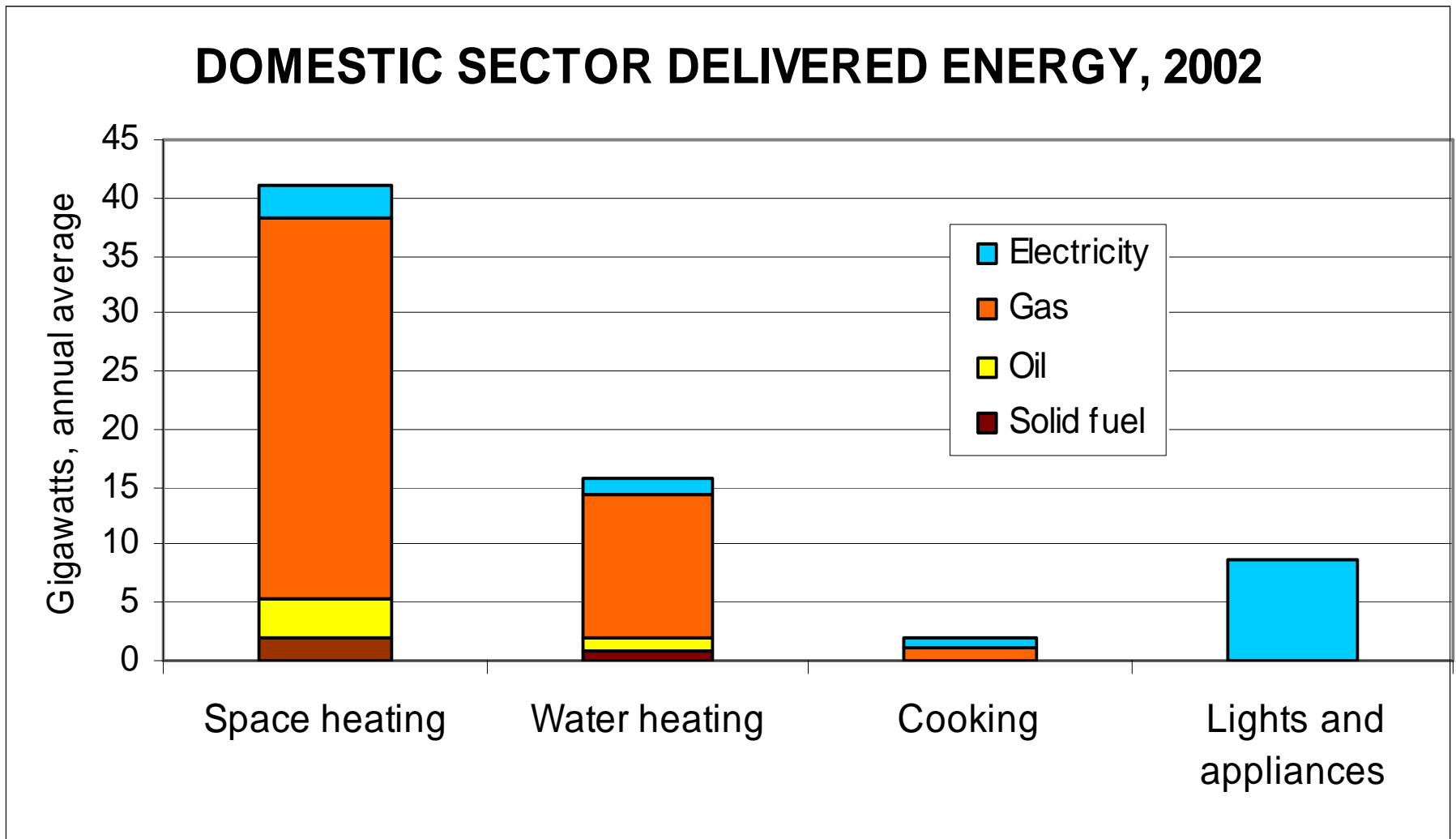


Figure 7: Environmental impacts of households: 1970-2001



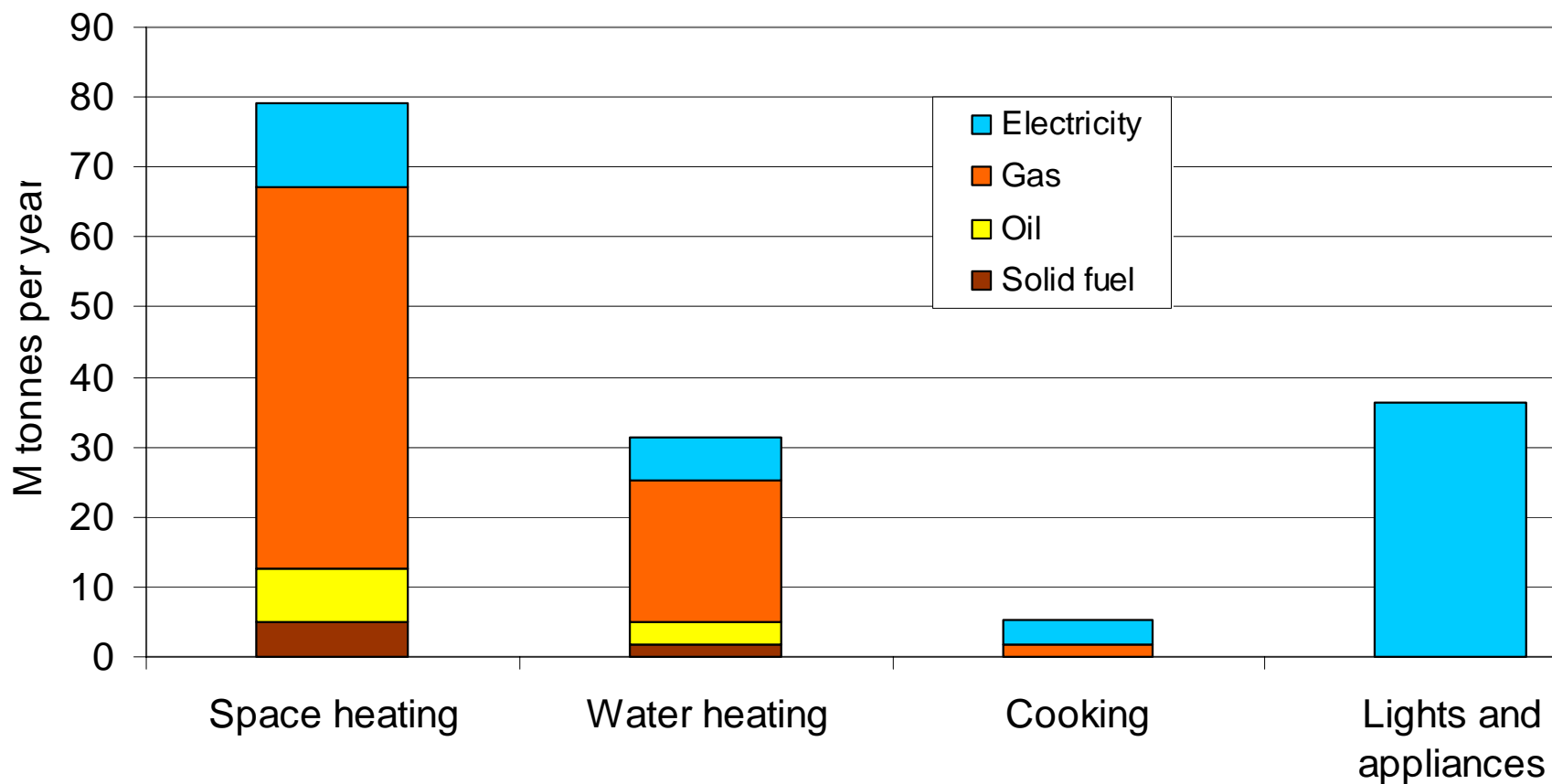
Source: Defra, DTI, ODPM, Ofwat, NETCEN

Energy Use in the Domestic Sector

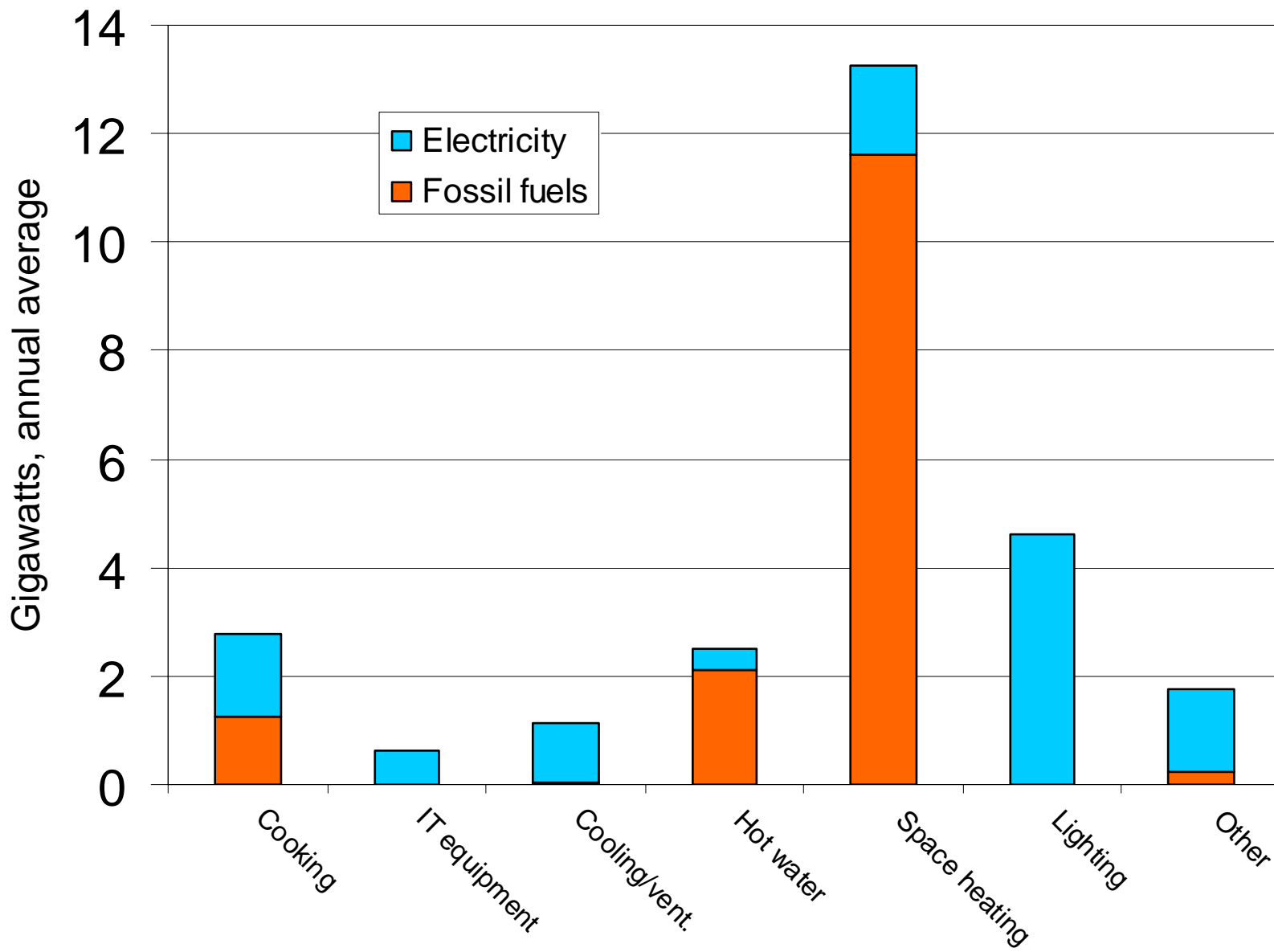


CO₂ Emissions From the Domestic Sector

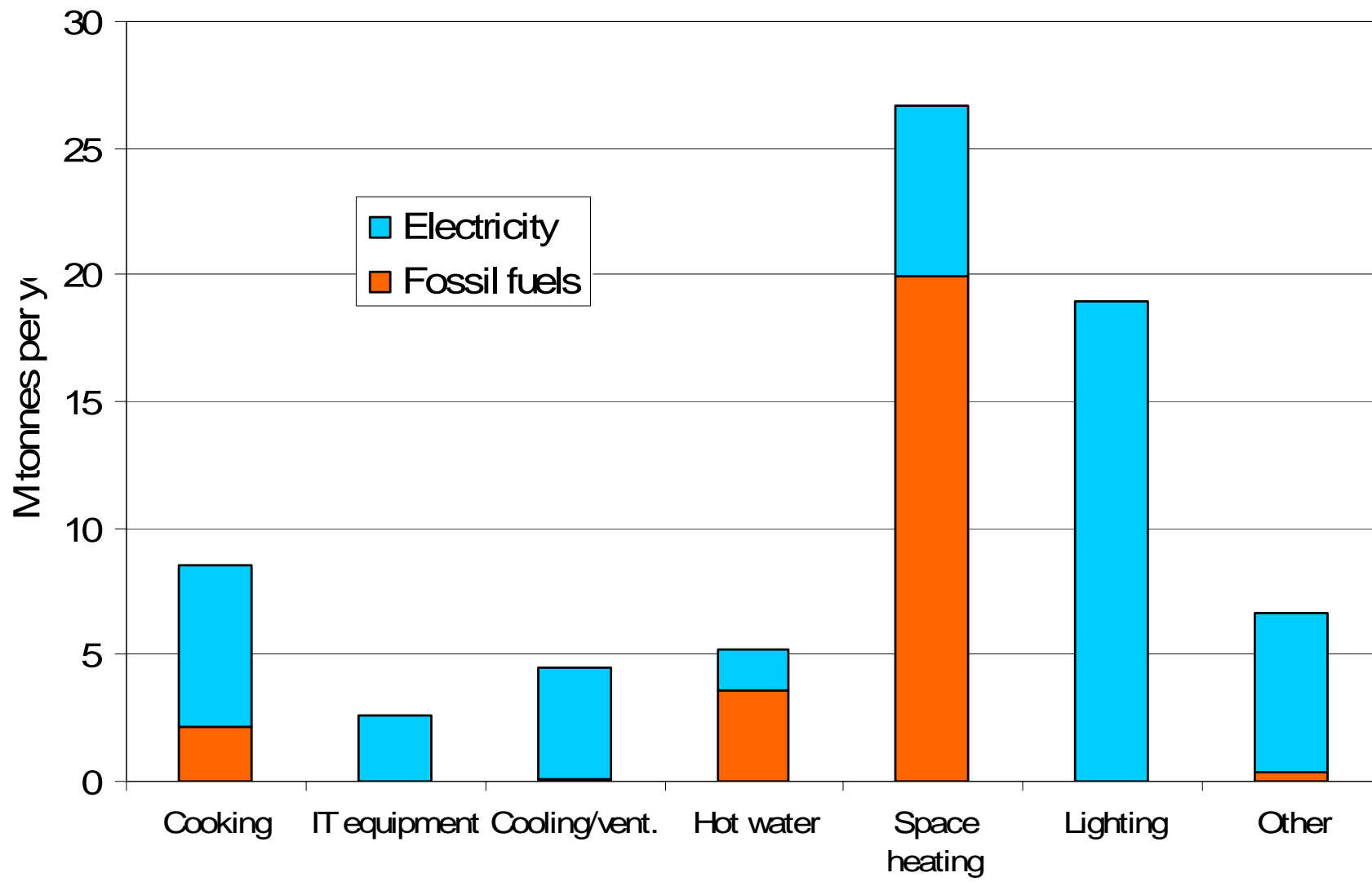
DOMESTIC SECTOR CO₂ EMISSIONS, 2002



SERVICES SECTOR DELIVERED ENERGY, 2002



SERVICES SECTOR CO₂ EMISSIONS, 2002



The AECB Energy Performance Standards

A Summary

PLATINUM

99-100% reduction in CO₂ emissions vs. an average UK building

GOLD

95% reduction in CO₂ emissions from the average

SILVER

70% reduction in CO₂ emissions from the average

BRONZE

45% reduction in CO₂ emissions from the average

The predicted energy use and CO₂ emissions are based on accurate reflections of reality in calculations, amended as the result of our research

These standards are spelt out in the paper “AECB Standards”
on the AECB website www.aecb.net.

Background - Voluntary Energy Standards in Other Countries

- 1 Germany - Passive House Standard www.passiv.de
 - Began 1990 with four pilot houses in Darmstadt;
 - Pioneered very high insulation and airtightness standards, first used in Sweden and Canada;
 - Used highly energy-efficient lighting, ventilation, electrical appliances and equipment;
 - 85% overall reduction in energy use and CO₂ emissions vs. the German dwelling stock.
- 2 Switzerland - MINERGIE standard www.minergie.ch;
- 3 USA - Energy Star, plus lots of programs at state, city or county level;
- 4 Canada - R-2000 Program, C-2000 Program, etc;
- 5 Norway - Low Energy Standards for houses and other buildings;

and so on.

Summary - AECB Bronze Standard

55% of Current CO₂ Emissions

- * Opaque real U-values <0.20 W/m²K in roof, <0.32 in external walls, <0.28 in ground floor.
- * Minimal thermal bridges, hence no changes in wall thicknesses, etc;
- * Glazing U-values <1.65 W/m²K.
- * Air permeability <5 m³/m²hr @ 50 Pa.
- * Vent. system as per current Part F;
- * More efficient lighting systems and electrical appliances than standard in new homes.
- * Draft downloadable from www.aecb.net.

Summary - AECB Silver Standard

30% of Current CO₂ Emissions

- * Opaque U-values <0.15 W/m²K roof, <0.25 walls, <0.20 ground floor;
 - * Glazing U-values <1.5 W/m²K, doors <1.0 W/m²K;
 - * Air permeability <3.0 m³/m²hr @ 50 Pa;
 - * Peak space heating load usually <30 W per m² floor area;
 - * Vent. system specific fanpower <1.5 W per l./s;
 - * Vent. system heat recovery >70% as seasonal average, excl. fan heat gains;
 - * Efficient lighting systems, electrical appliances & office equipment;
 - * Stresses energy efficiency *not* bolted-on gadgets;
- Draft downloadable from www.aecb.net.

Summary - AECB Gold Standard

5% of Current CO₂ Emissions

- * Opaque real U-values $<0.15 \text{ W/m}^2\text{K}$;
- * Glazing U-values $<0.8 \text{ W/m}^2\text{K}$;
- * Air permeability $<0.75 \text{ m}^3/\text{m}^2\text{hr}$ @ 50 Pa;
- * Peak space heating load always $<10 \text{ W}$ per m^2 floor area (requires lower U-values in most detached houses);
- * Vent. system specific fanpower $<0.8 \text{ W}$ per l./s ;
- * Vent. system heat recovery $>90\%$ as seasonal average, excl. fan heat gains;
- * The most efficient lighting systems, electrical appliances & office equipment on the market;
- * Enough electricity generation from on-site renewables; e.g PV, micro-hydro, to offset CO₂ emissions from elec. used for lights & appliances. Or CHP. Credit also for local tree planting.

Draft downloadable from www.aecb.net.

Summary - AECB Platinum Standard

<1% of Current CO₂ Emissions

- * Opaque real U-values $<0.15 \text{ W/m}^2\text{K}$;
- * Glazing U-values $<0.8 \text{ W/m}^2\text{K}$;
- * Air permeability $<0.75 \text{ m}^3/\text{m}^2\text{hr}$ @ 50 Pa;
- * Peak space heating load $<10 \text{ W/m}^2$;
- * Vent. system specific fanpower $<0.8 \text{ W}$ per l./s;
- * Electricity generation from on-site renewables; e.g PV, wind or micro-hydro.

All above as per Gold Standard.

- * The fuel(s) normally used for heating and cooking is replaced by a *clean* renewable energy system; e.g., active solar or other heat sources with long-term/seasonal storage; geothermal; small CHP burning gaseous or liquid biofuels; large CHP burning solid biofuels (with full flue gas cleaning).

Draft downloadable from www.aecb.net.

AECB Gold and German Passive House Standards

Main Features

Passive House

- 1 Designed for exposure to passive solar heating in winter, passive cooling in summer and year-round daylight
- 2 Very high-quality building envelope;
- 3 Max. air leakage 0.6 air changes per hour @ 50 Pa;
- 4 No separate heating system needed;
- 5 Highly-insulated hot water system, majority of heat from solar;
- 6 Other heat from any source.

Gold draft

- 1 As for Passive House
- 2 As PH
- 3 Max air permeability 0.75 m³/m²hr @ 50 Pa
- 4 As PH
- 5 As PH
- 6 Other heat from gas, CHP plant, oil, LPG, elec. earth source heat pump (outside gas supply area) or a renewable heat source.

Passive House

- 7 Balanced mech. vent. & heat recovery (MVHR), max. elec. cons. 0.4 W per m³/hr of fresh air = 1.44 W per litre/sec.
- 8 “High-efficiency” lighting;
- 9 “High efficiency” domestic electrical appliances and office equipment;

Gold

- 7 MVHR, max. elec. cons. 0.8 W per litre/sec of fresh air;
- 8 “Cold” domestic appliances A++-rated;
- 9 “Wet” domestic appliances from the 10% best of the A class;
- 10 Lighting by high-efficiency CFLs, T5s, T8s or equiv and high-efficiency luminaires;
- 11 Standby <1 W for each appliance;

Passive House

- 10 Max. primary energy consumption 120 kWh/m²yr. Corresponds for instance *in Germany* to 14 kWh/m²yr mains gas plus 31 kWh/m²yr elec.
- 11 Maximum CO₂ emissions not specified.

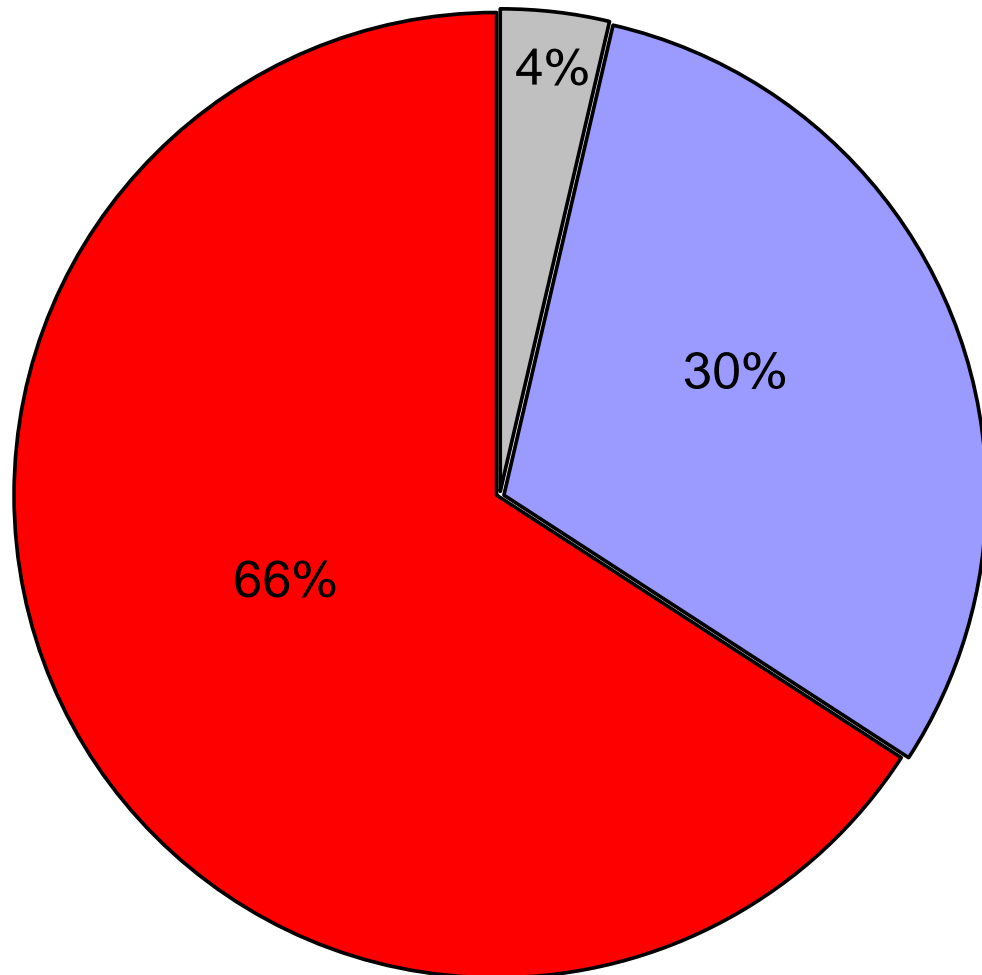
Gold

- 12 Office equipment chosen from the 10% most energy-efficient of that type of device; e.g., colour laser printers;
- 13 Office or school max. primary energy consumption 90 kWh/m²yr. Corresponds; e.g., to 14 kWh/m²yr mains gas and 27 kWh/m²yr purchased elec. *or* 15 kWh/m²yr heat and 30 kWh/m²yr elec., the latter coming partly from a gas-fired CHP plant;
- 14 Max. CO₂ emissions 4 kg/m²yr. Corresponds; e.g., to 15 kWh/m²yr mains gas plus 21 kWh/m²yr elec., of which the latter comes from dedicated renewables.

What The Standards Exclude

The standards do not regulate embodied energy.

LIFECYCLE ENERGY USE, NEW HOUSE

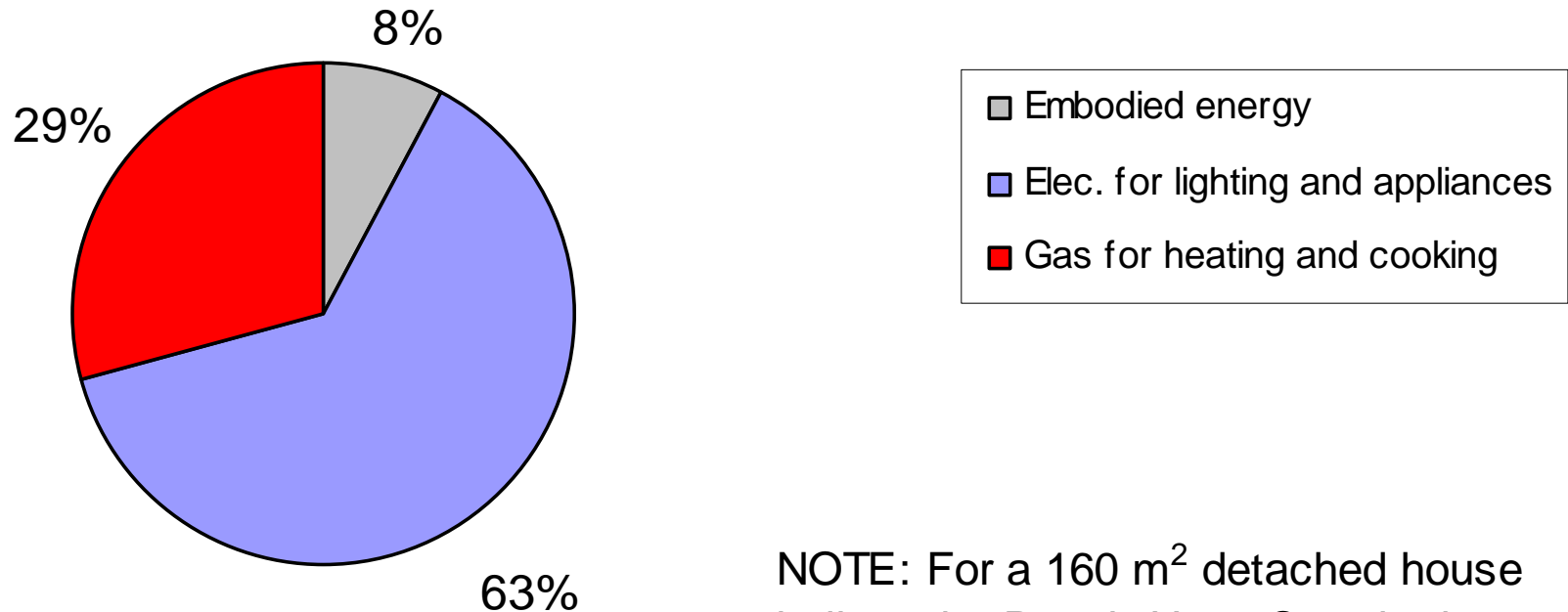


- Embodied energy
- Elec. for lighting and appliances
- Gas for heating and cooking

NOTE: For a 160m² detached house built to Part L of the 2002 Building Regulations and assuming that energy use for space heating matches the design predictions. Calculated over a lifecycle of 100 years.

Even after meeting best international practice on energy efficiency, embodied energy is a small proportion of a house or office's total energy use.

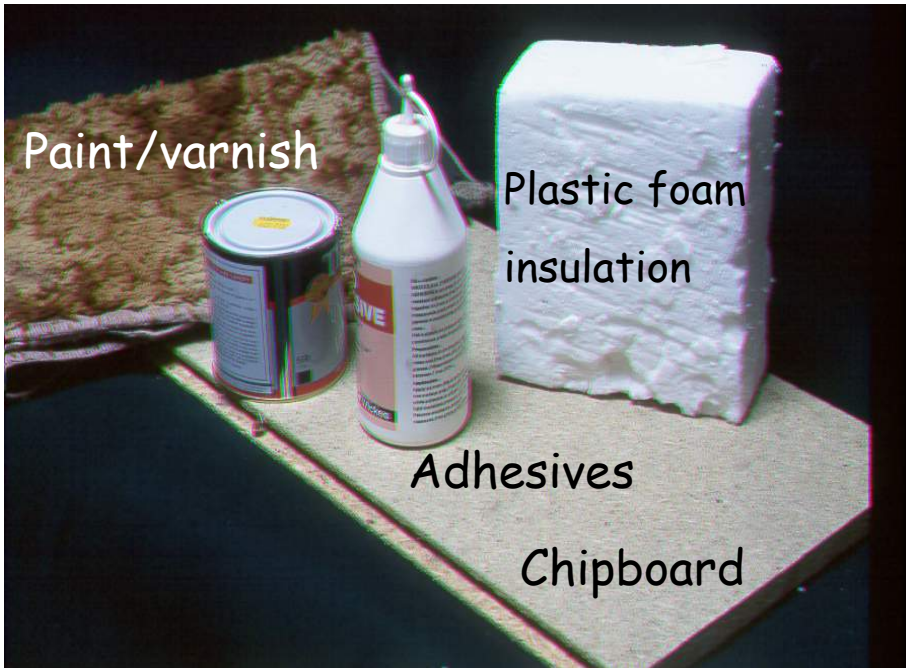
LIFECYCLE ENERGY USE, NEW HIGHLY ENERGY-EFFICIENT HOUSE



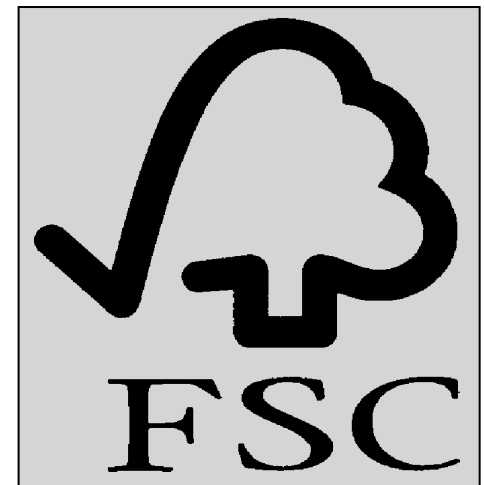
NOTE: For a 160 m² detached house built to the Passiv Haus Standard.

The standards do not regulate materials use.

PVC pipes,
wiring and
windows



Sustainable forestry

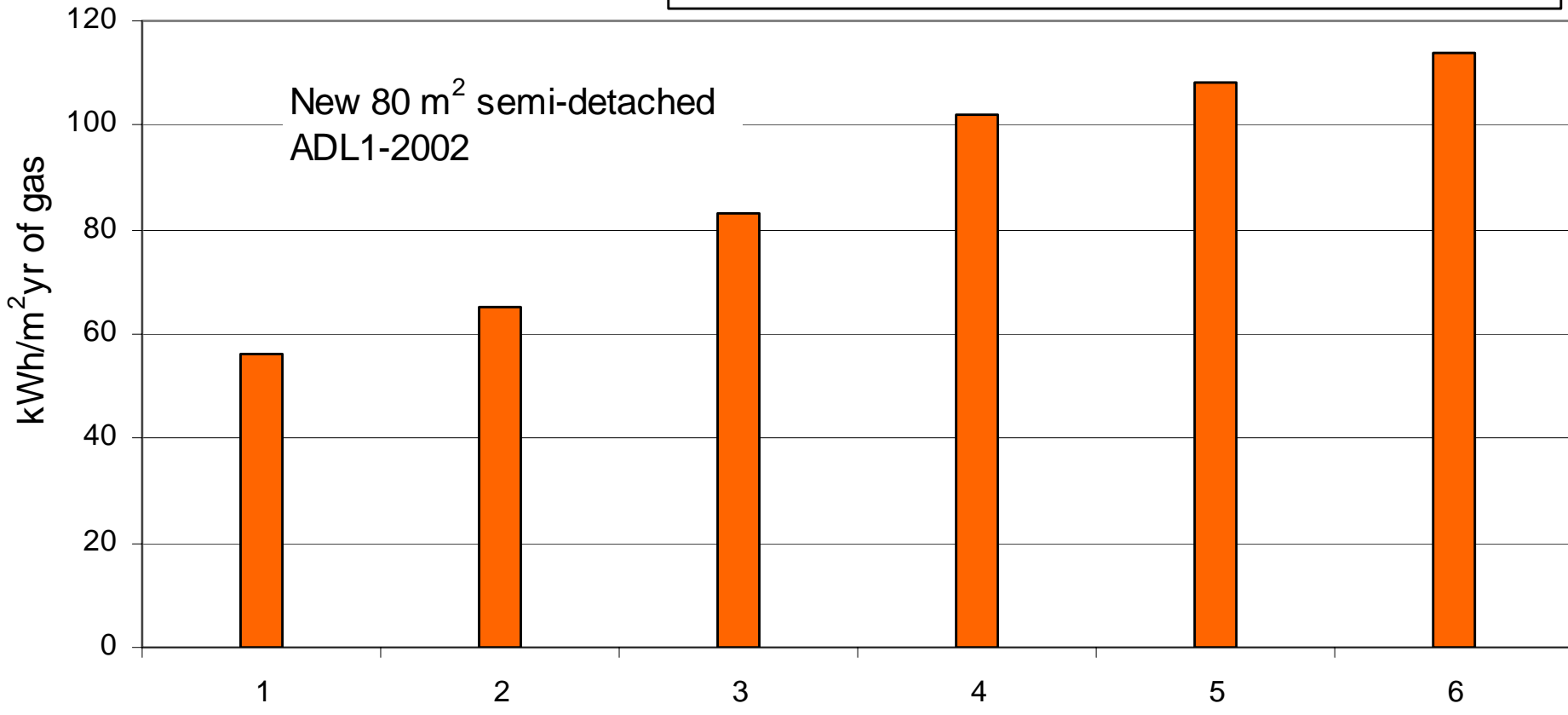


Some Common Misunderstandings

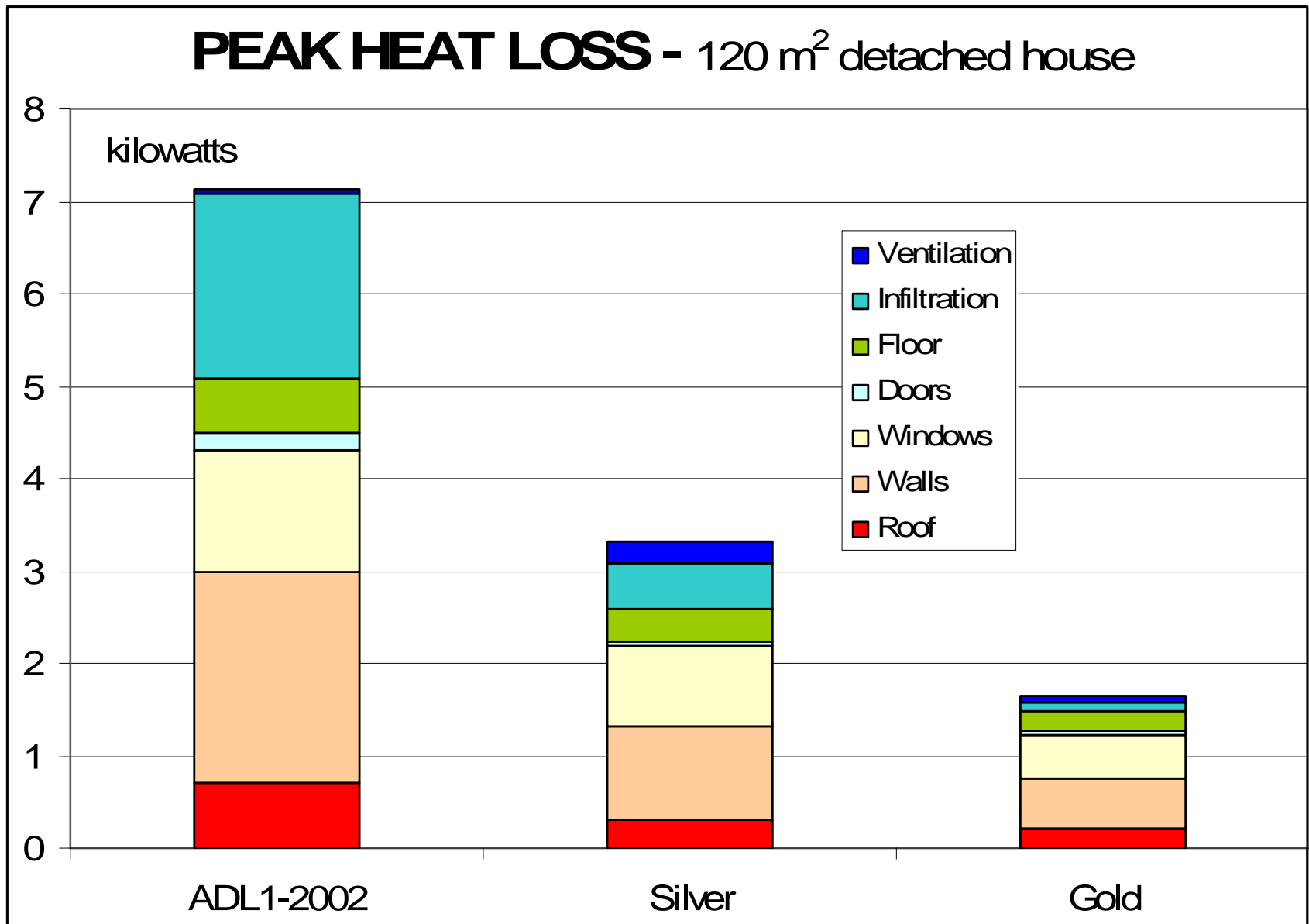
Over-optimistic procedures/methods have been used to calculate the energy consumption of new housing.

SPACE HEATING ENERGY CONSUMPTION

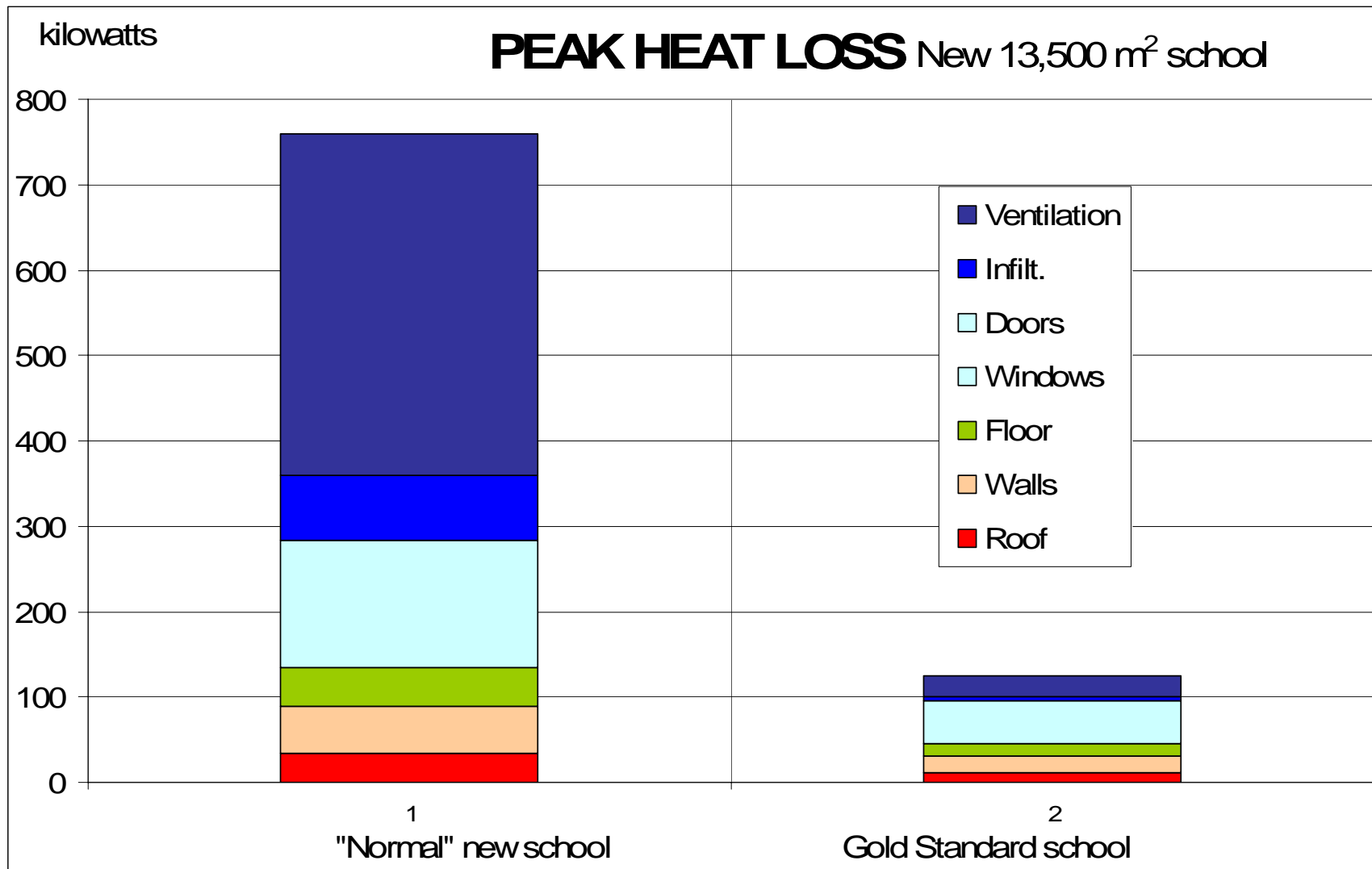
- 1 Design value for reference house ADL1-2002
- 2 Tradeoff smaller windows against higher opaque U-values
- 3 Internal temperature of 20 degC not c.18 degC
- 4 Include non-repeating and geometric thermal bridges
- 5 Include air movement within and around insulation
- 6 Allow for air permeability of 12 m/h not 10 m/h @ 50 Pa



This leads to erroneous claims that Part L1 (housing) of the UK Building Regulations has “reached a limit”.

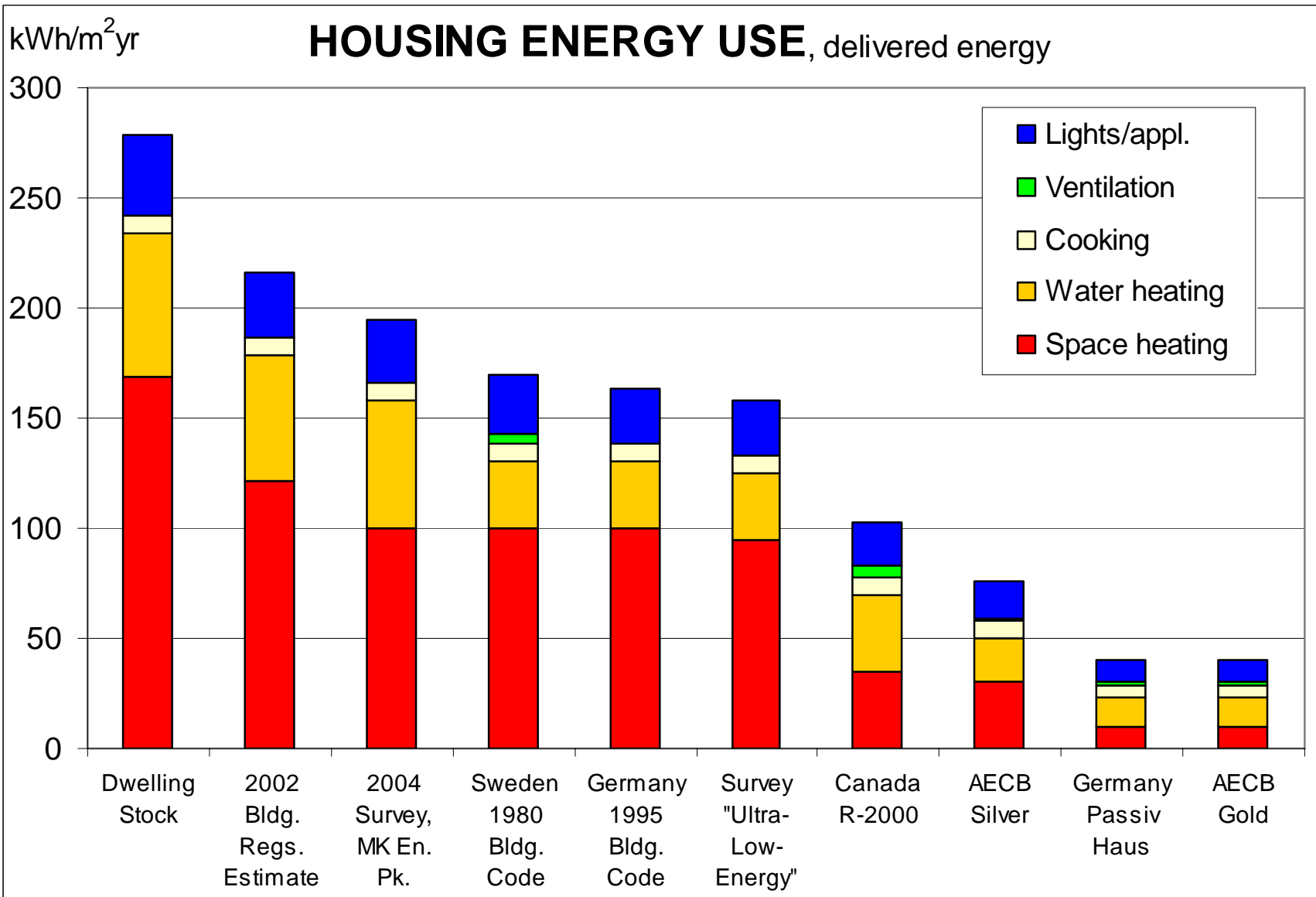


It leads to similar claims with respect to Part L2 (non-residential) of the UK Building Regulations.

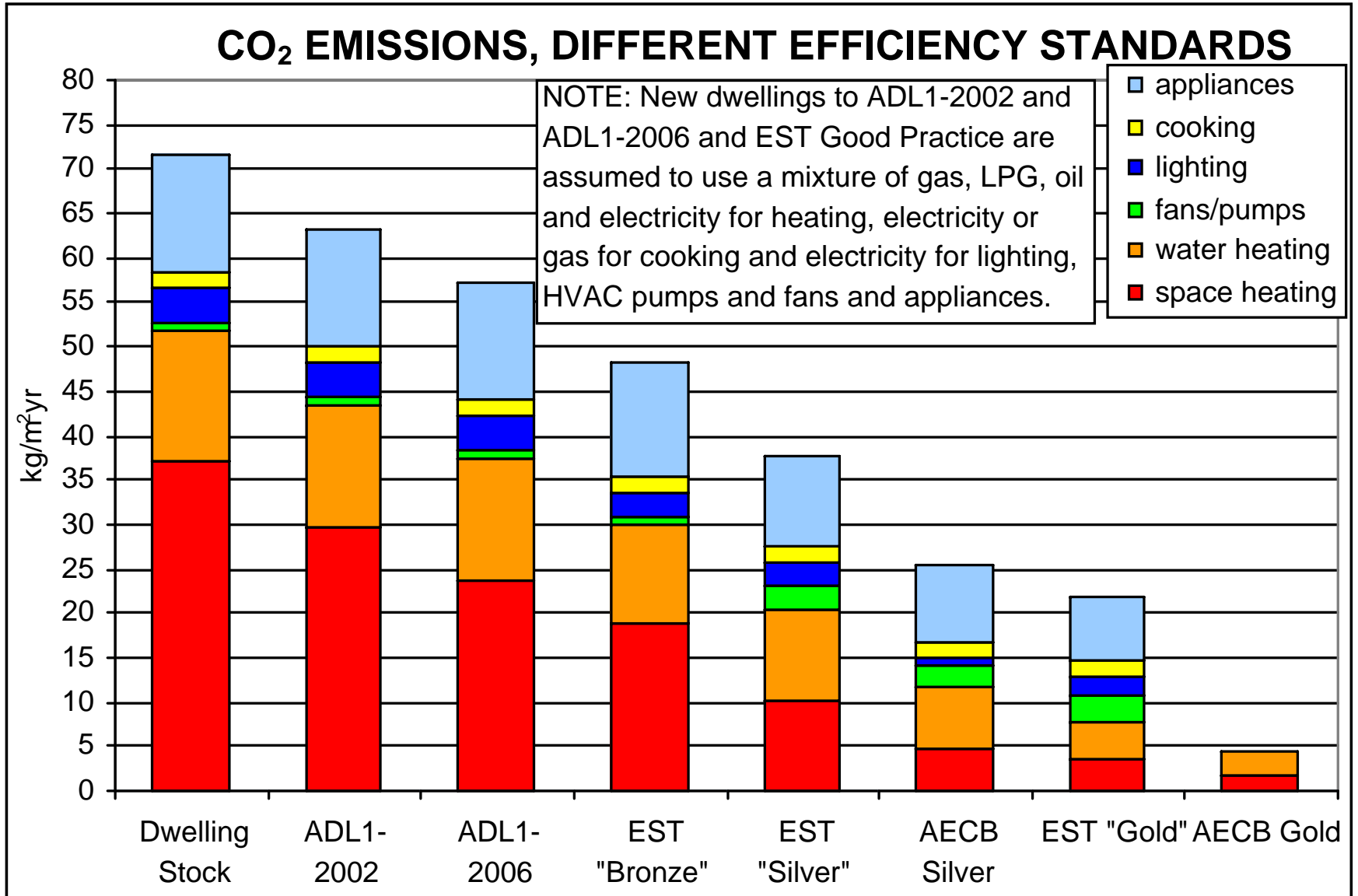


What The Standards Could Achieve

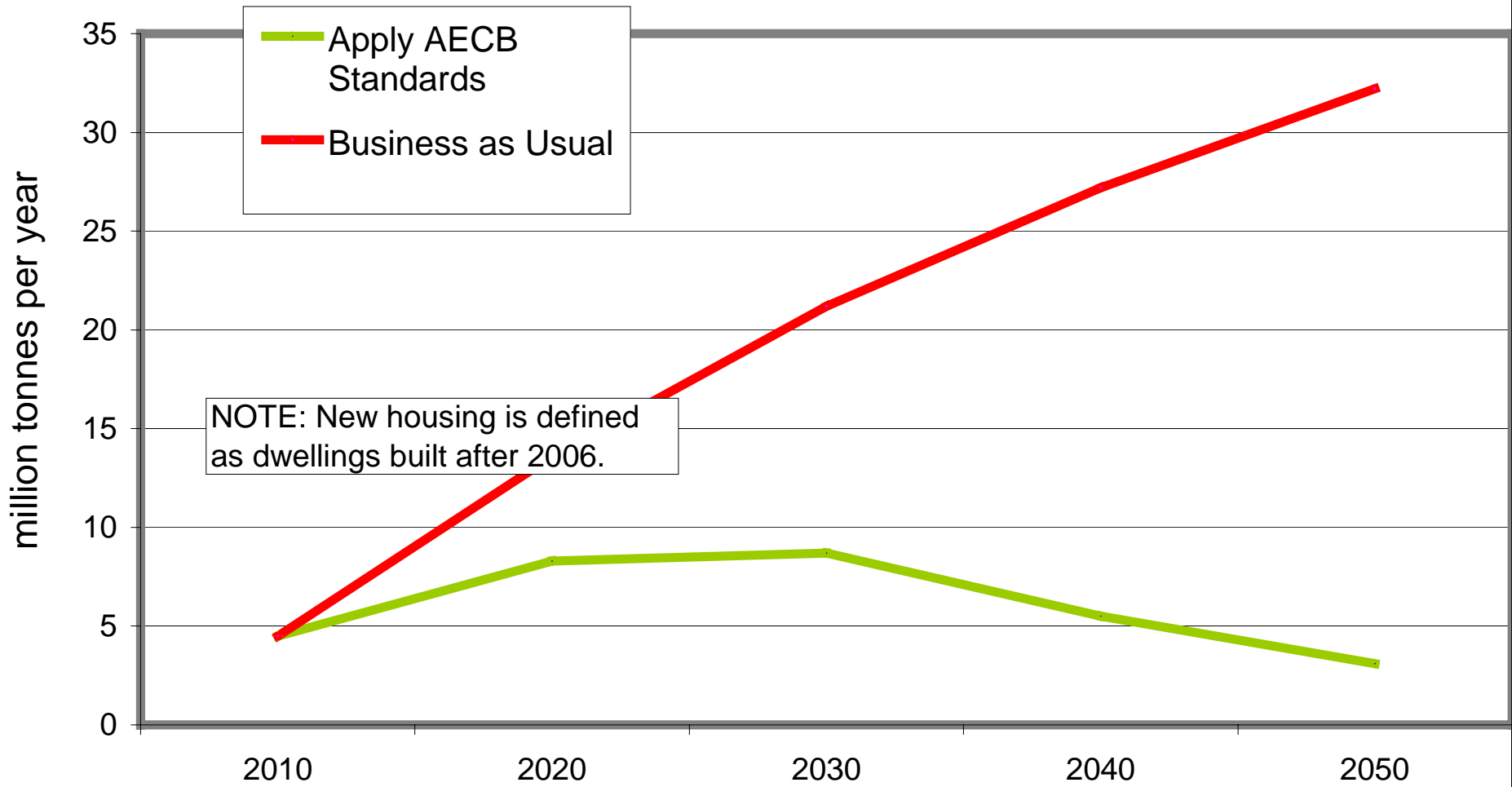
Impact of Effective Energy Performance Standards on Energy Consumption.



Impact of Effective Energy Performance Standards on CO₂ Emissions.

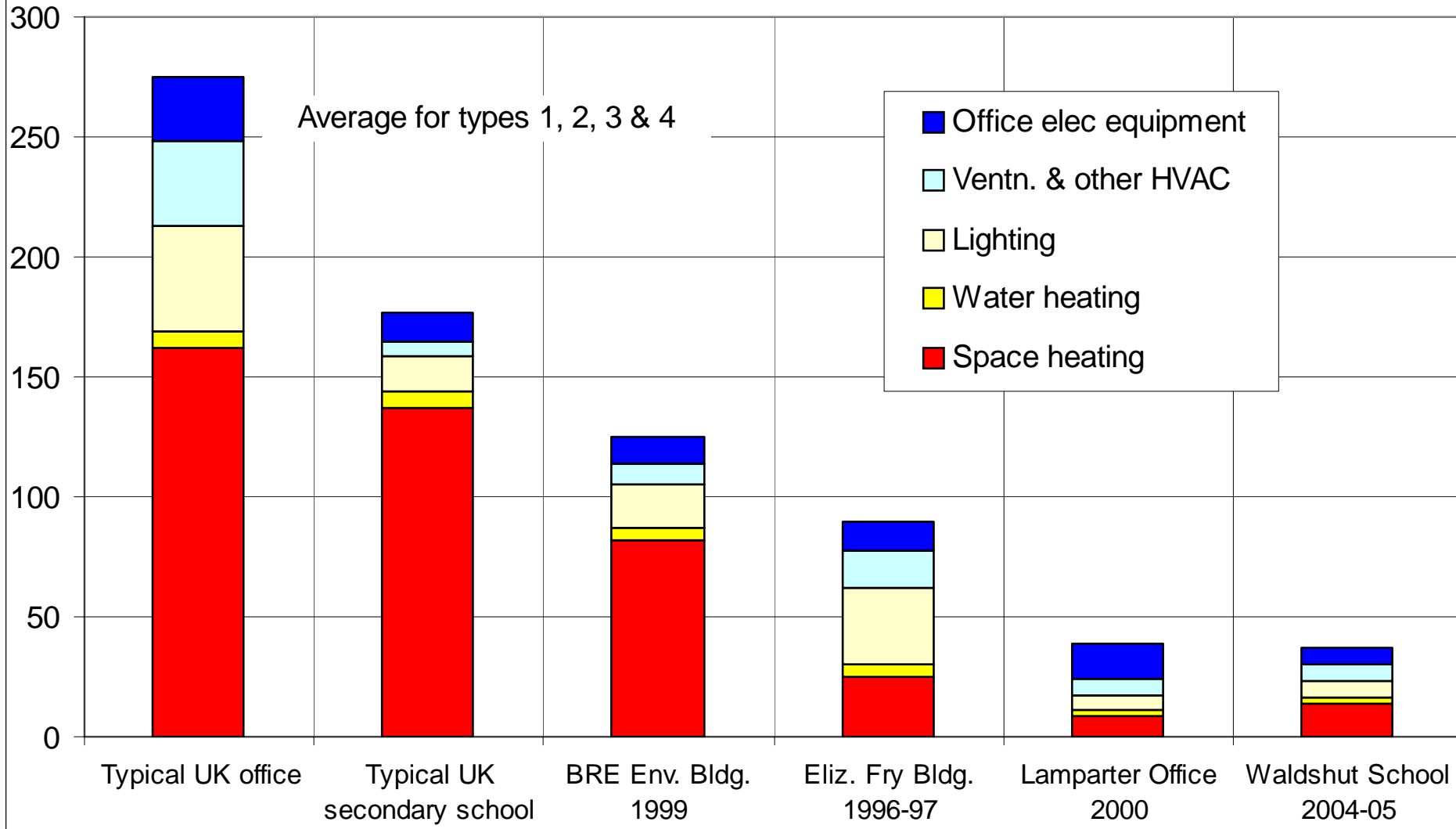


CO₂ EMISSIONS FROM NEW HOUSING



Figures for Non-Domestic Building Energy Use

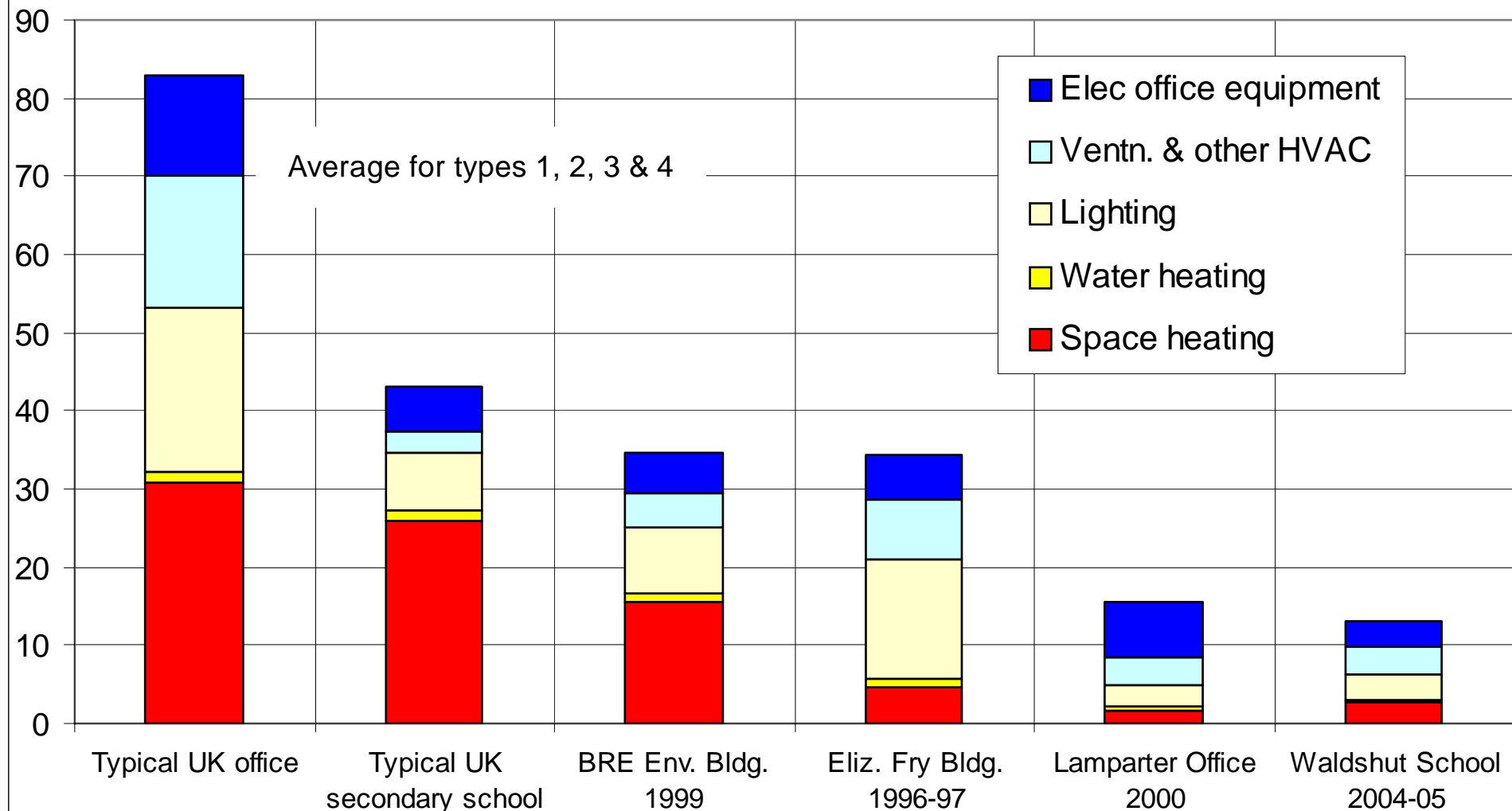
RELATIVE ENERGY CONSUMPTION Delivered energy in units of kWh/m²yr



Figures for Non-Domestic Building CO₂ Emissions

RELATIVE CO₂ EMISSIONS

In units of kg/m²yr



Why Silver and Gold Particularly Matter

Silver – takes us to 30% of current CO₂ emissions.

Straightforward, off-the-shelf energy efficiency technologies which are available in the UK. No renewables needed. A stepping stone to ...

Gold – Down from 30% to 5% of current emissions.

“International best practice” energy efficiency technologies, which can be obtained in the UK if designers know where to go, plus modest investment in renewables. Sidesteps requirements which at present lead to technical controversy; e.g. use of wood, “green electricity”.

Overall – It is important to get emissions down to 5-10% of current levels. The earth has sufficient carbon sinks to cope with *very low* emissions for a longer time.

When Do We Need to Introduce The Standards?

As soon as possible - ideally we would have 10,000 Silver Standard dwellings by 2010 from which to learn

Standard	Voluntary Adoption by Industry	Becomes Regulation	Successful Uptake Leads to CO2 Reductions vs Emissions of Average Building 2003	Ideal Standards Vehicle
Silver	2006	2015	c70%	Code for Sustainable Building 2006 Or Ecohomes Silver
Gold	2006+	2020	c95%	Code for Sustainable Building 2010/11 Or Ecohomes Gold
Carbon Neutral / Platinum	2006++	2025	c99%	Code for Sustainable Building 2020 Or Ecohomes Platinum
2050				OUTCOME 12 million affordable, relatively sustainable homes [and other buildings] built since 2006

Case Studies

A Detached House to the AECB Silver Standard in Charlbury, Oxon (1993).



Lower Watts House

*Measured Energy Use
from 1993-2005:*
Gas 50 kWh/m²yr.
Electricity 12 kWh/m²yr.
Total 62 kWh/m²yr.

A Detached House to the Passiv Haus Standard in Hohen Neudorf, Brandenburg, Germany (2004).



A School to the Passiv Haus Standard in Waldshut, Germany (2003).



A Block of Flats to the Passiv Haus Standard in Frankfurt, Germany (2004).



Silver and Gold Standard Projects, England/Wales

Self-Build Houses, Small Non-Domestic Buildings

Gold

Headquarters building for a small charity, Essex.

New visitor centre for St. Margaret's Bay Trust, east Kent (finished).

New houses in Caerphilly, Carmarthen, Machynlleth, Anglesey, Herefordshire, west Oxfordshire.

Silver

Lifestyle 2000 House, Milton Keynes (1986).

Lower Watts House, Charlbury, Oxon. (1992).

New house, south Suffolk (1994).

New house, Twyford, Berks. (1995).

Two new houses, north Essex (1997-98).

New house, south Oxfordshire (2006).

Plus many more not listed.

Multi-House Developments, Large Offices and Schools

Two Mile Ash, Milton Keynes (1985).

Elizabeth Fry Building, UEA, Norwich (1994), two later UEA buildings*.

Cambridge City Council, proposed 48 homes to Gold or Silver Standard.

Possible Gold standard school, Dorset.

Flats at Stamford Brook, Cheshire **.

Good Homes Alliance.

* These met Silver with respect to gas use (i.e., the building's thermal design) but not electricity use (i.e., its ventilation, lighting and office electrical equipment).

** Reportedly these complied with most requirements of Silver but this is unverified due to lack of resources.