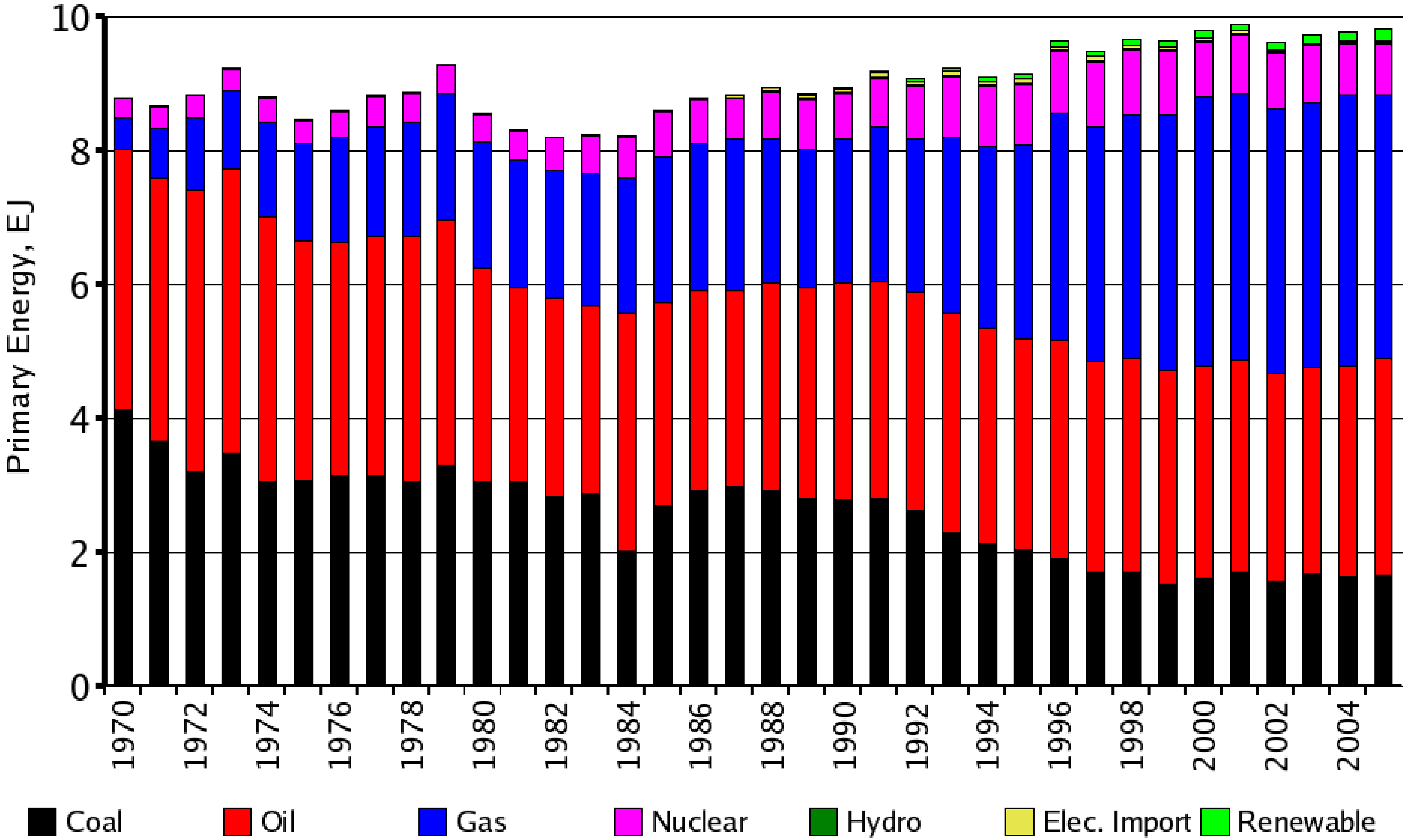
Less is a Four-Letter Word

Energy, Climate, and Economic Growth in a Finite World

Helston,
July 2008

UK Primary Energy Supply, 1970-2005



Source:

Digest of UK Energy Statistics 2006, DTI

MORE: The Earth is a "finite system"

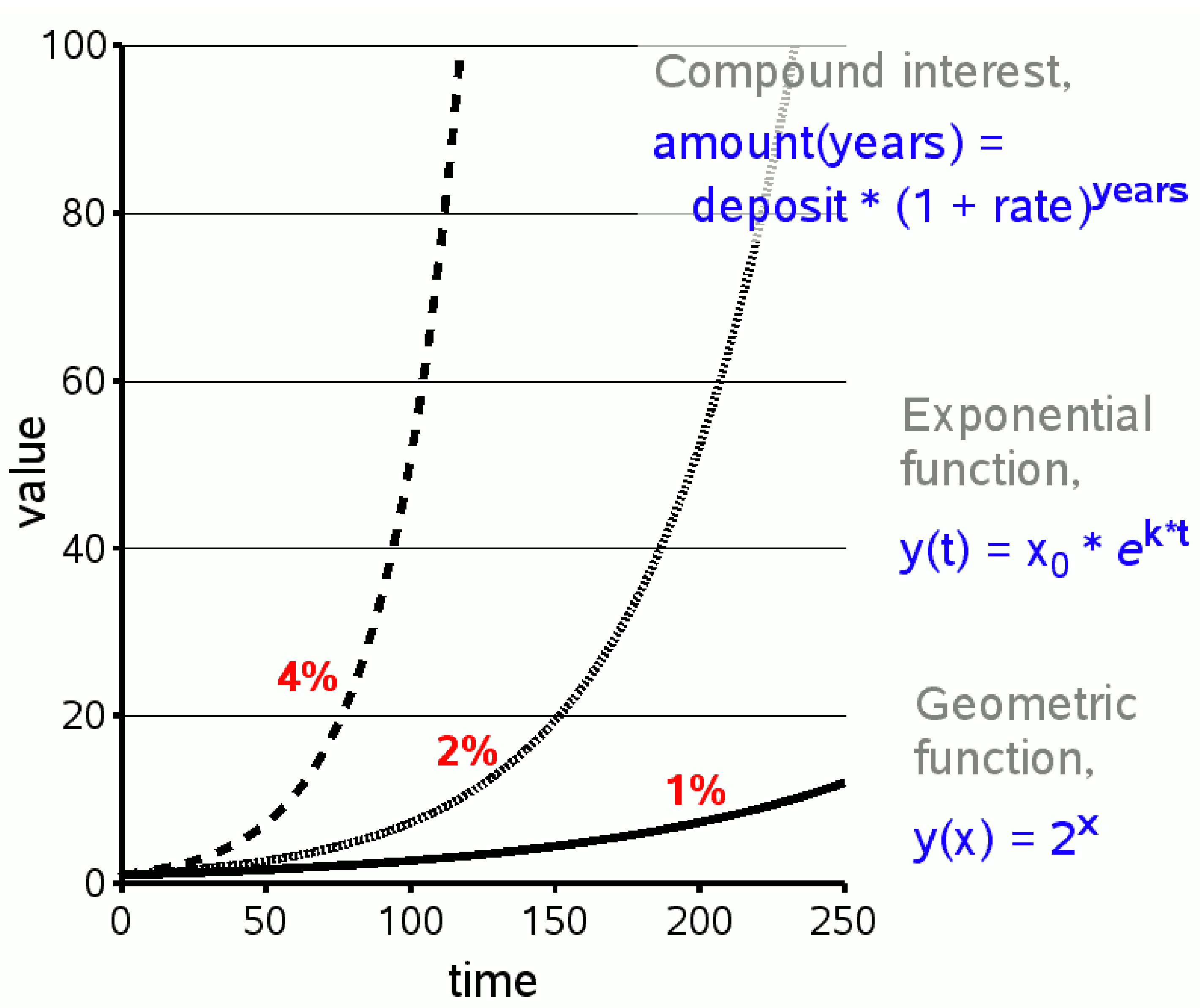
The resources available to humanity are constrained by the capacity of the planet to meet demand.

The First Law of Thermodynamics prohibits any other outcome!

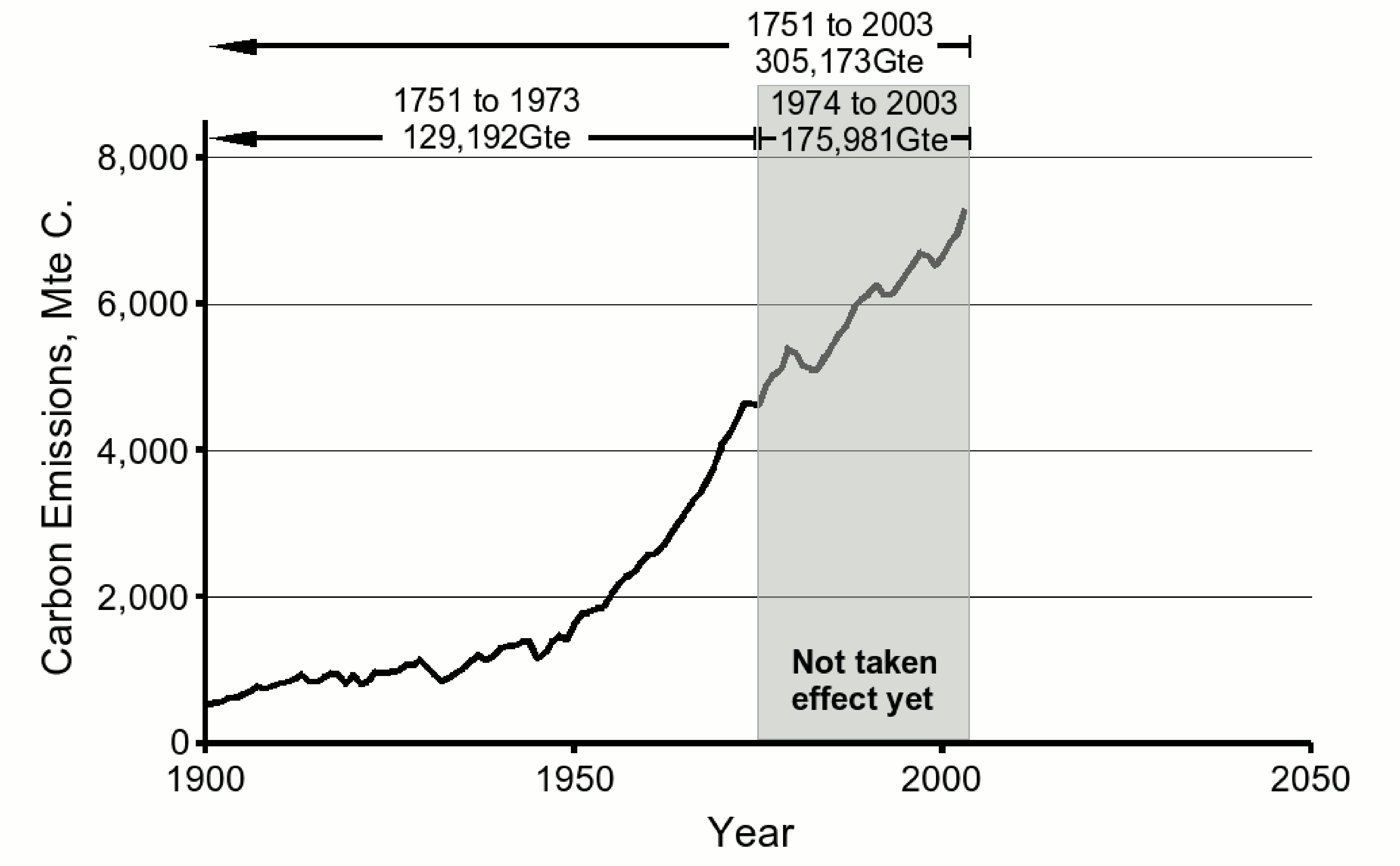
Exponential growth

Exponential (or geometric) growth occurs when the growth rate of a function is always proportional to the function's current size.

An everyday example is compound interest.



How Much Carbon?



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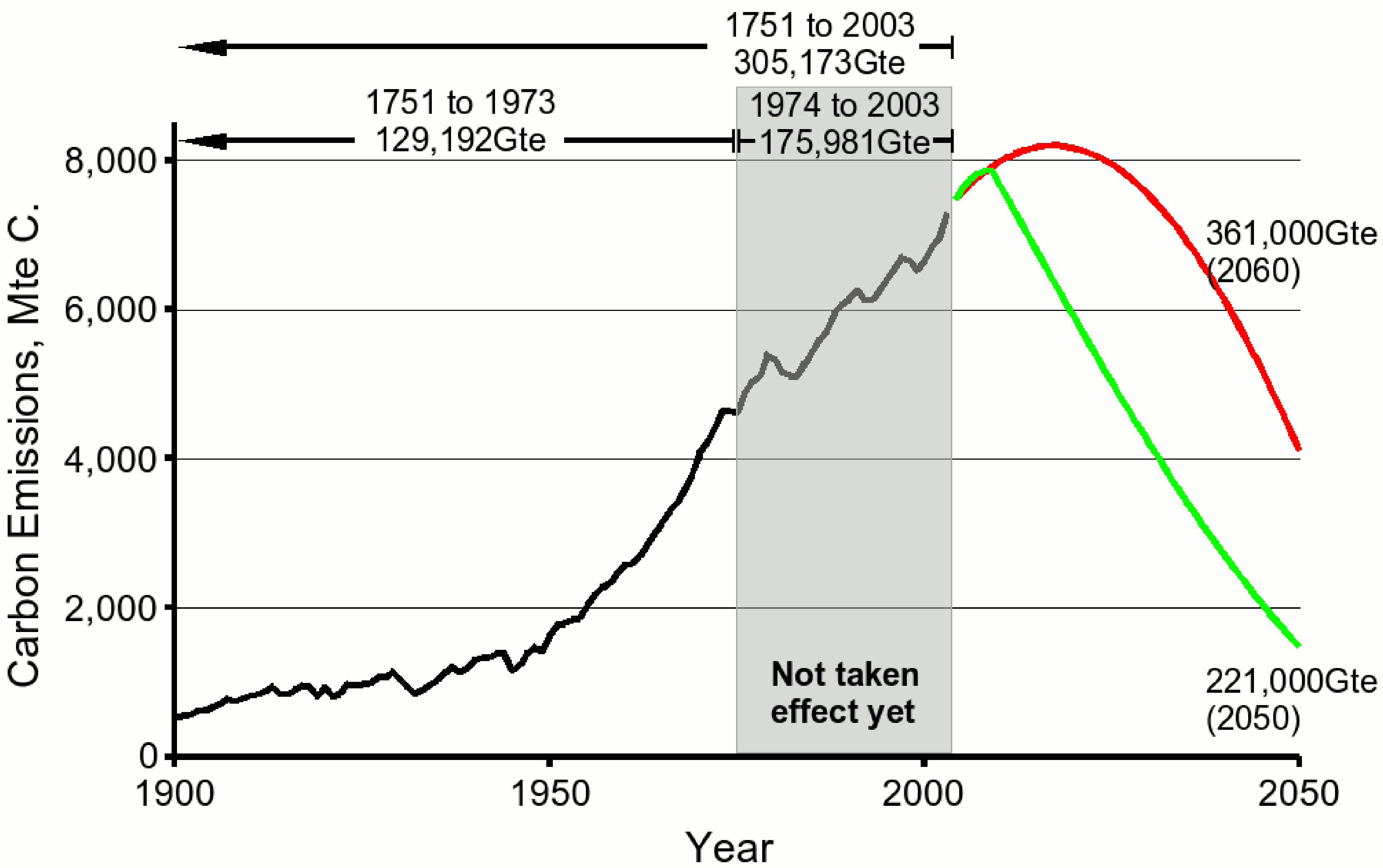

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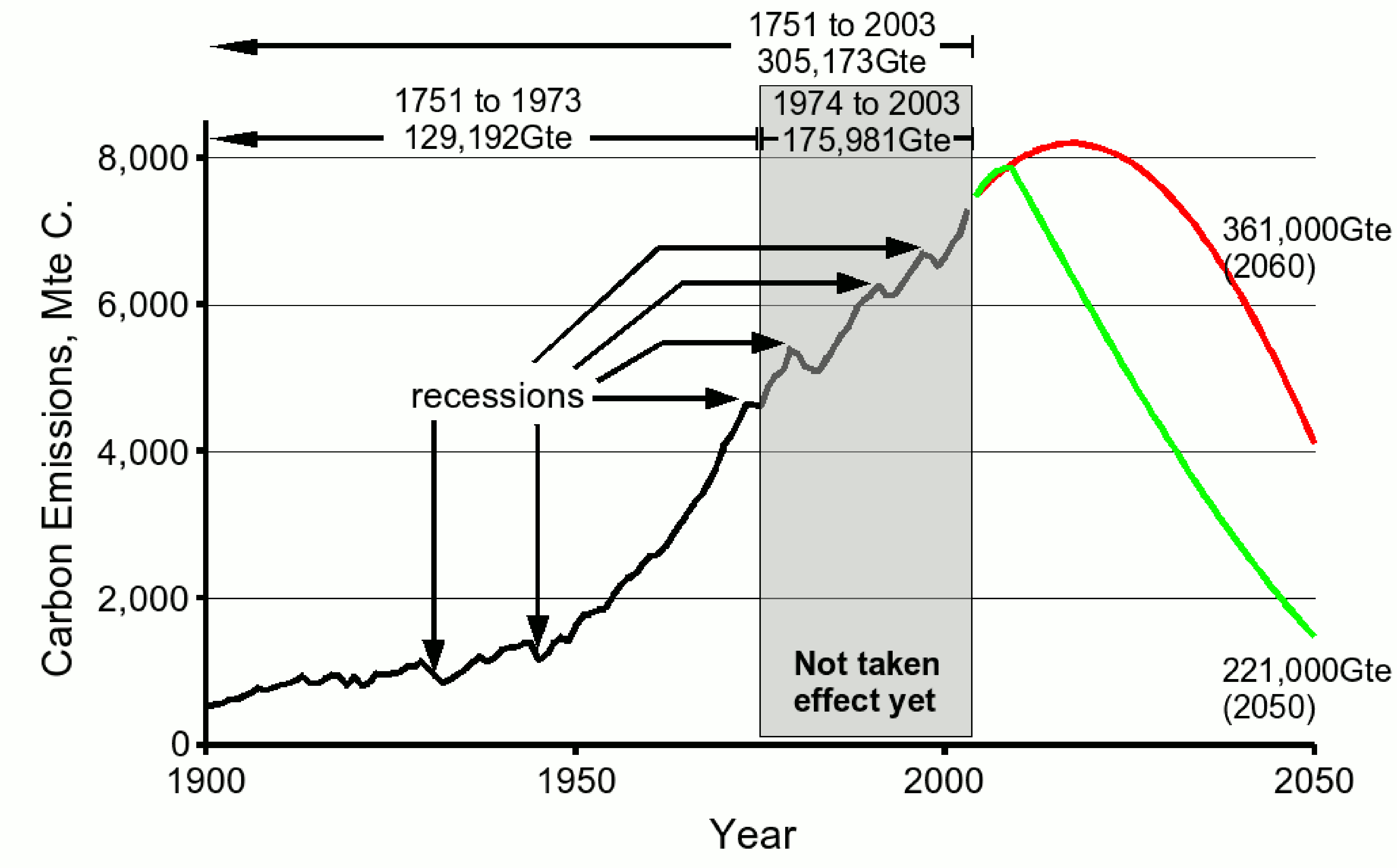
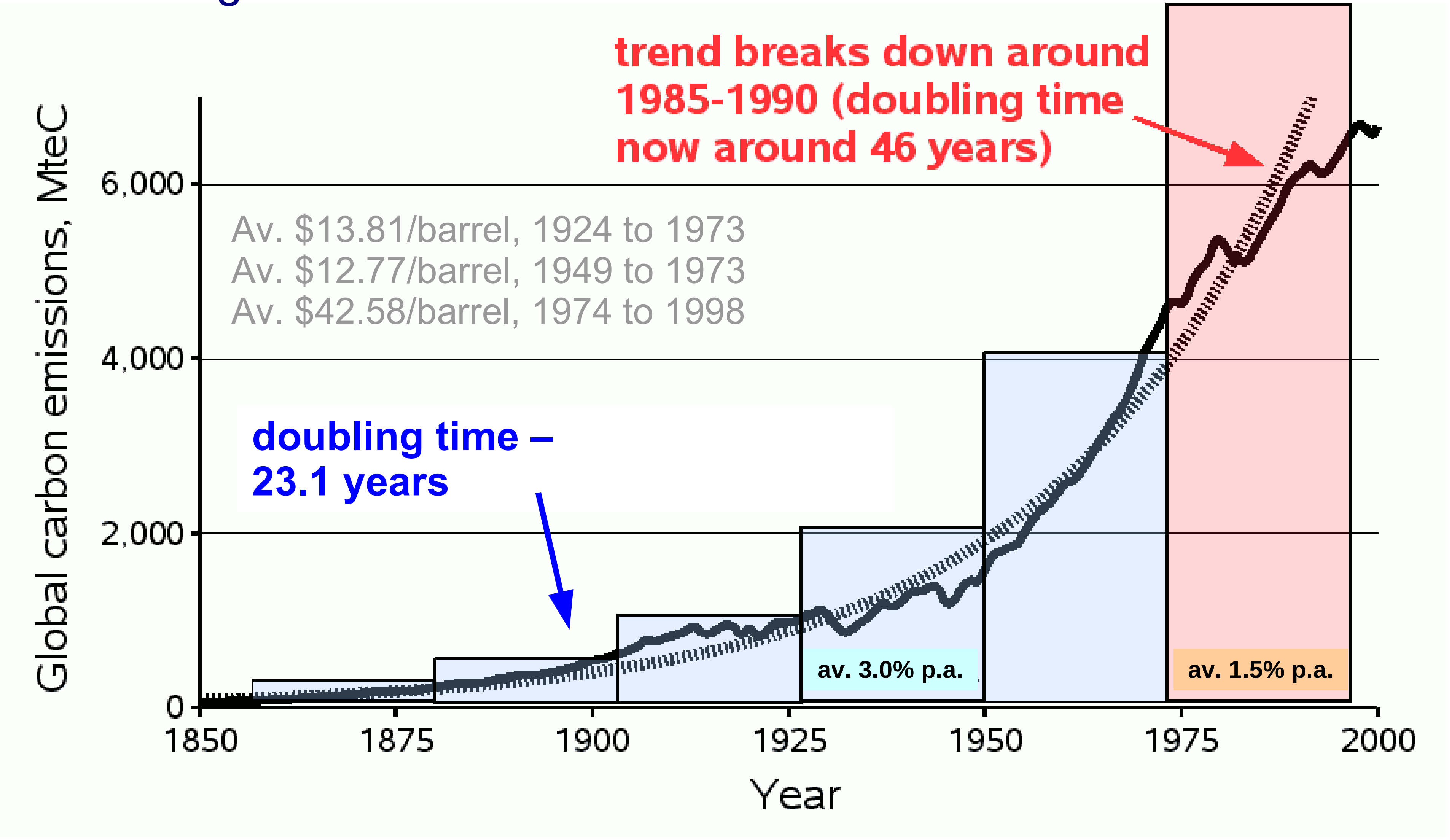
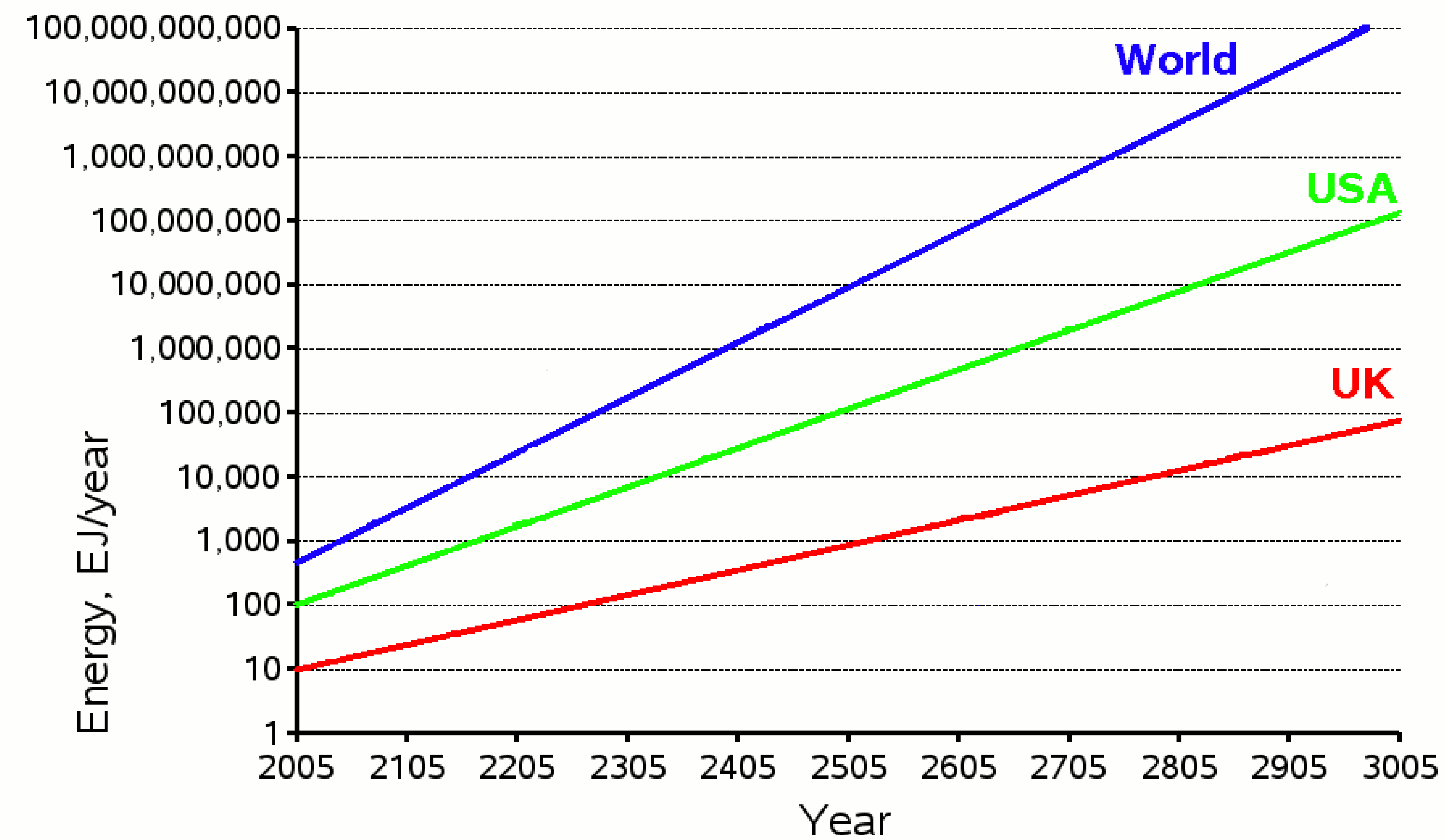


Doubling Time

Where growth is exponential, the value will double over a fixed period of time – the “doubling time”. This can be estimated by dividing 70 by the rate of growth.



The (Il)Logical Conclusion of Growth



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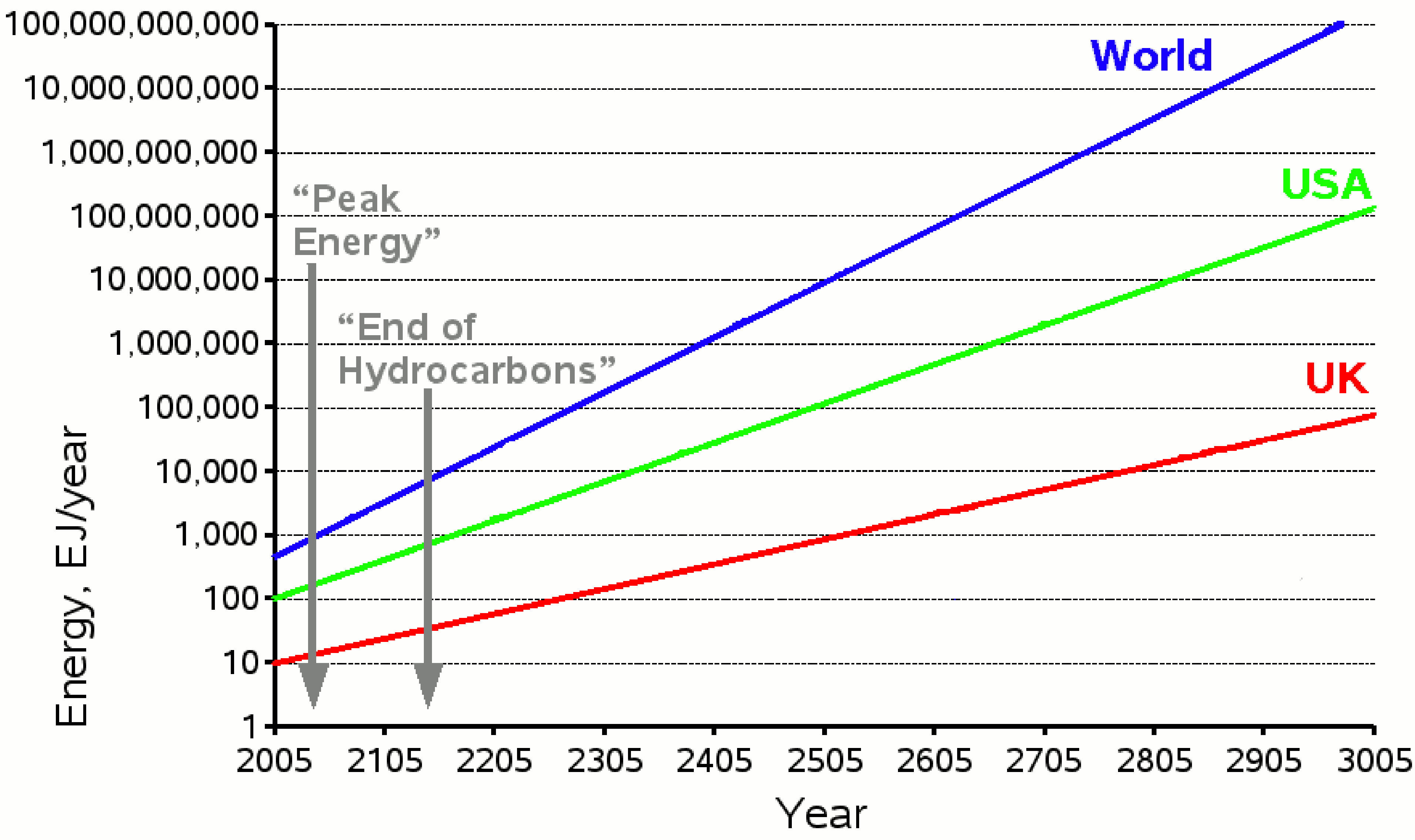

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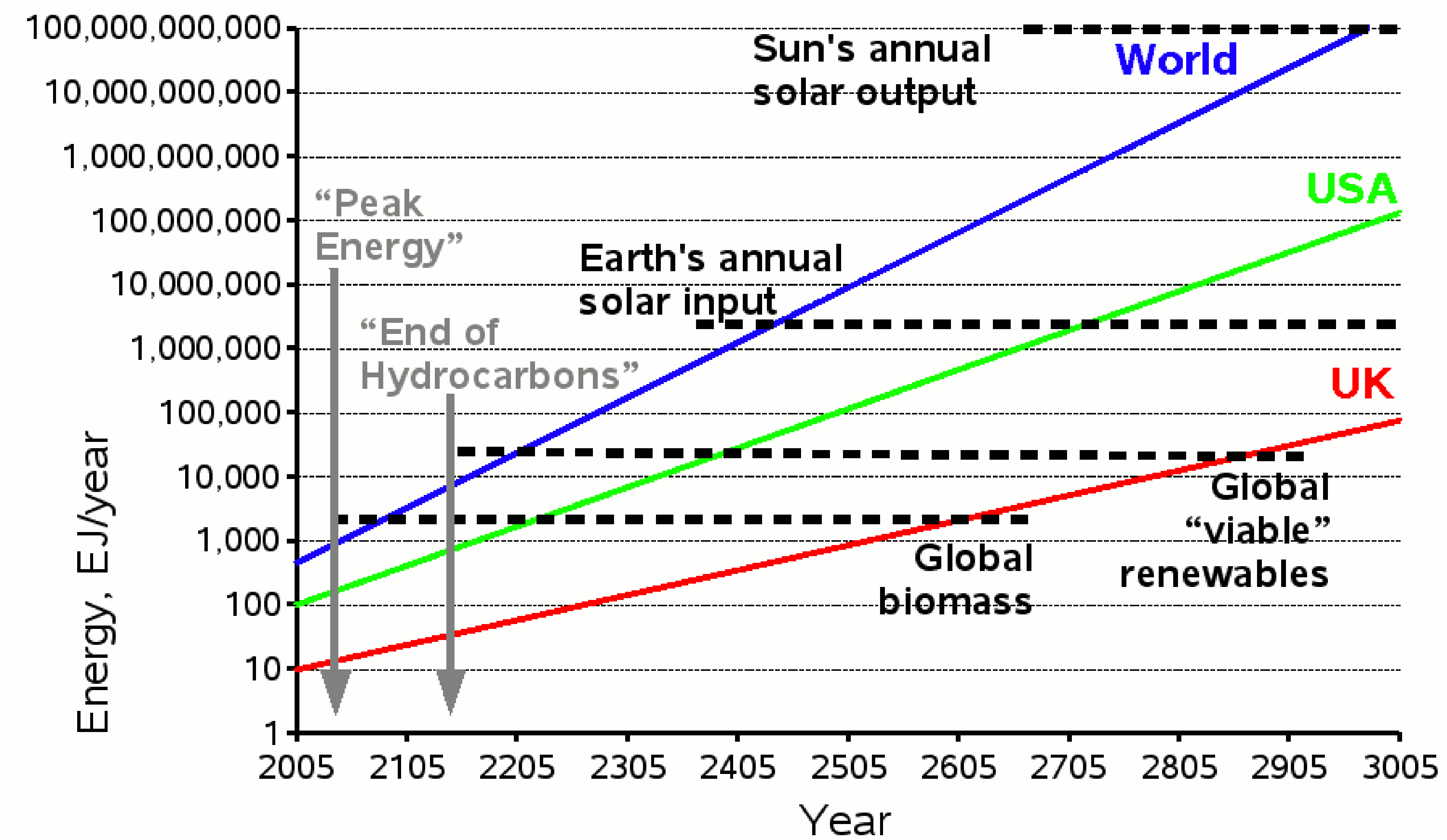
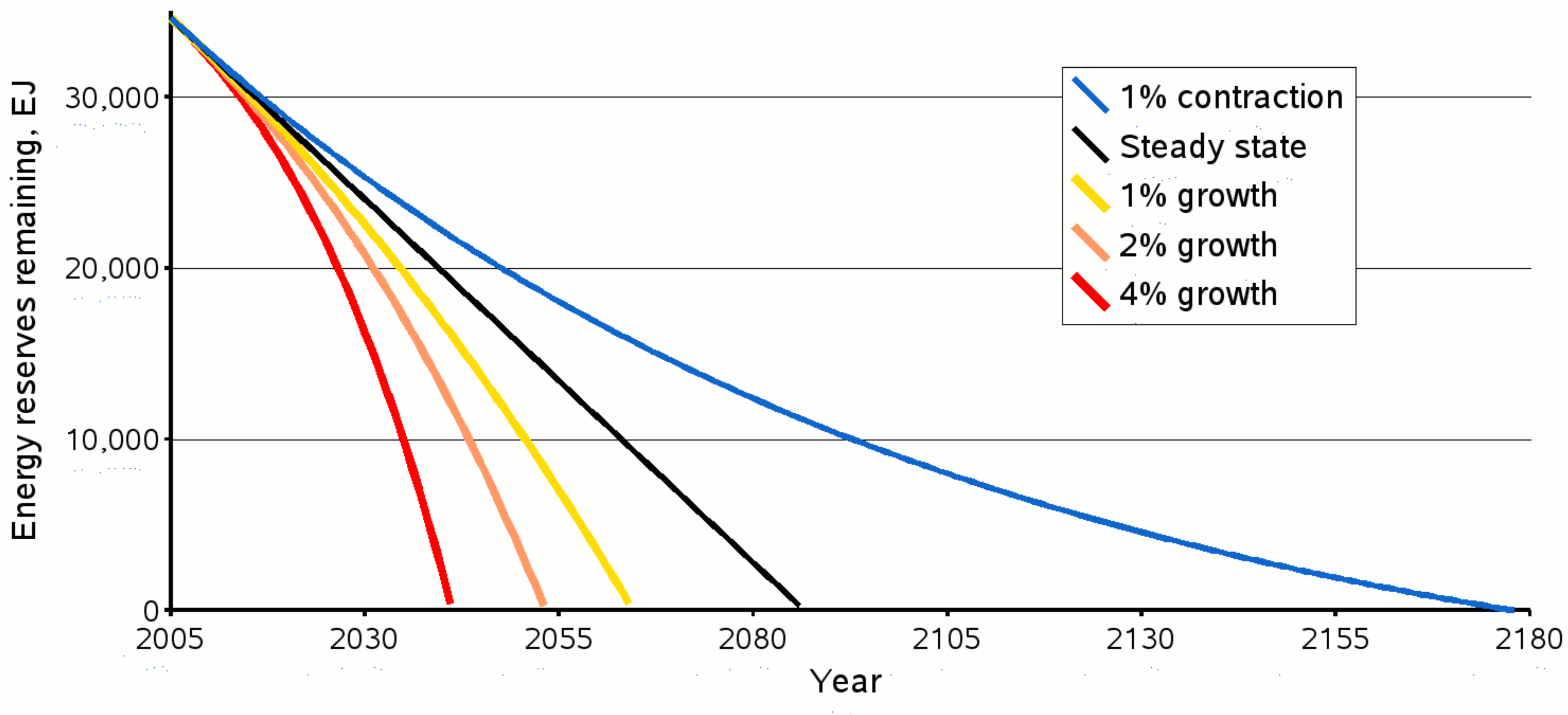


How Long Will It All Last

Source: BP/IEA

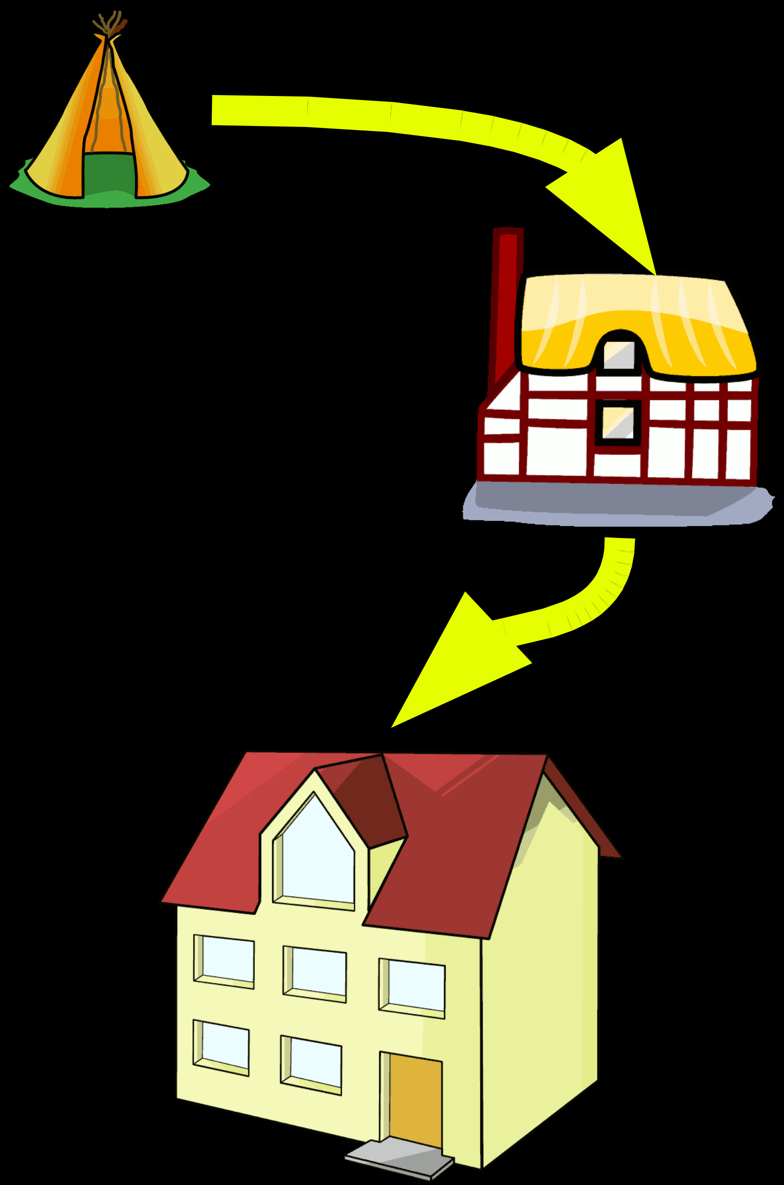
Resource	"Proven/ probable" resource	Annual consumption	Equivalent value of resource	Consumption EJ/year (2005)	R/P ratio, years
Oil (conventional)	1,201	30 billion barrels	6,856	172	40
Natural gas	179,850	2,750 billion cu. m.	6,777	104	65
Coal	909,100	5,853 million tonnes	19,370	123	158
Nuclear (uranium)	4,000	64 kilo-tonnes	1,632	26	63
Total (all resources)			34,634	424	82



RUSE: The value of "energy efficiency"

The standard solution to resource shortages is greater efficiency – more efficient use makes the remaining resource last longer.

However, *The Second Law of Thermodynamics* limits the extent to which efficiency can restrict consumption. In any case it is often it is the "form" of consumption that is the problem, not its "scale".



The paradox of efficiency

Technology leads to greater efficiency, but those savings can only be used once. Then growth takes over and increases consumption once more.

Very few efficiency advances have led to long-term reductions in consumption – all they tend to do is briefly halt the effects of growth.

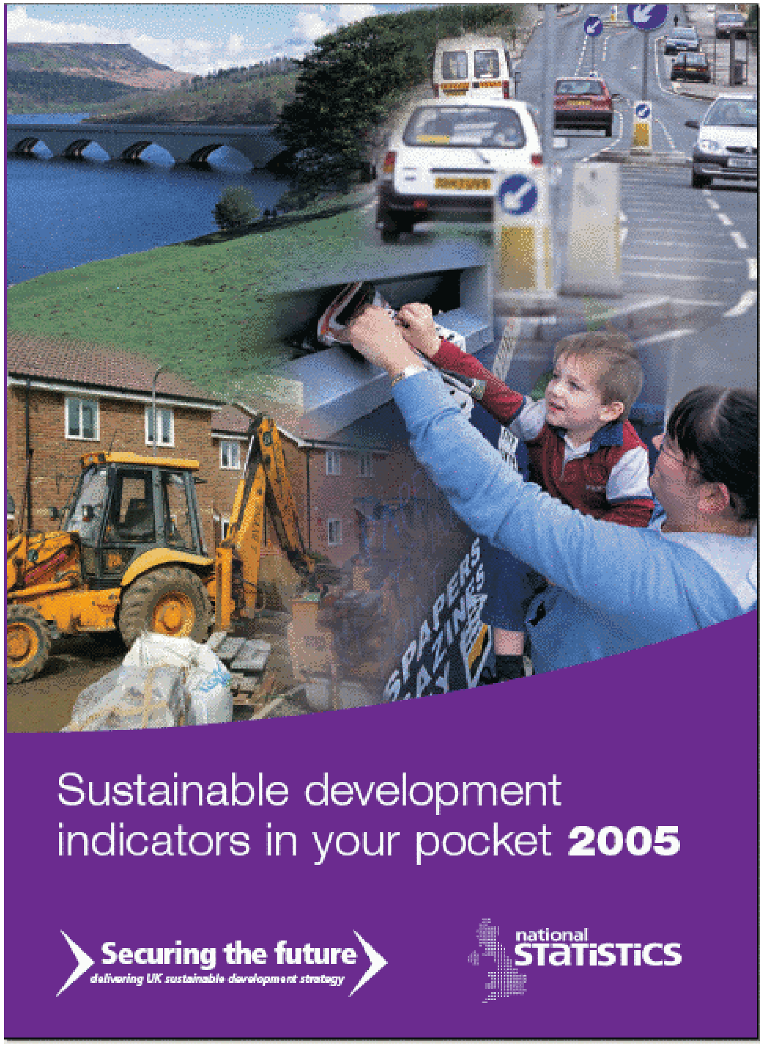
Jeavon's Paradox (1830s)
discovered that more efficient stream engines led to more coal being used in more engines

Rebound Effect (1960s)
discovery that efficiency savings are re-spent buying more "stuff", so re-consuming any savings

Khazzom-Brookes Postulate (1980s)
greater cost/technological efficiency, e.g. ICT, results in cheaper services and so greater use/consumption of services

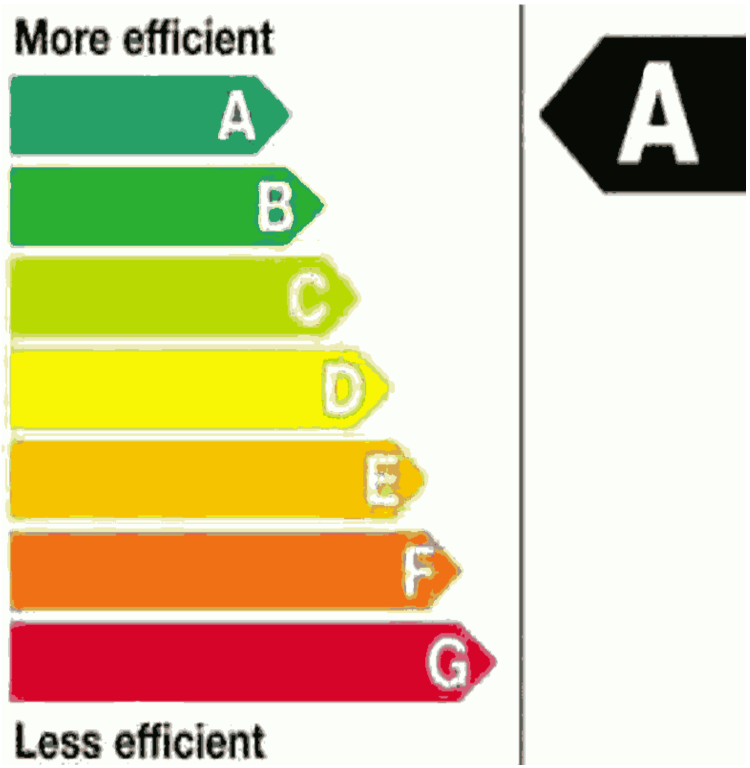
Efficiency vs. Growth

- The UK recycles more than twice the household waste it did 10 years ago (19% vs. 7%), but the amount of household waste going to landfill or incineration has increased over this period by 3%.
- In 2004 the UK emitted 31% less carbon/£ GDP than in 1990, but as the economy grew 39% over the same period the overall reduction in carbon emissions was just 4%.
- Over the past 30 years improvements in car engine efficiency have saved 400,000 tonnes of oil per year, but increased car usage has raised demand by 900,000 tonnes per year – a net increase of 500,000 t.p.a.



Efficient Appliances?

EU Eco-labelling scheme



Miele W3240

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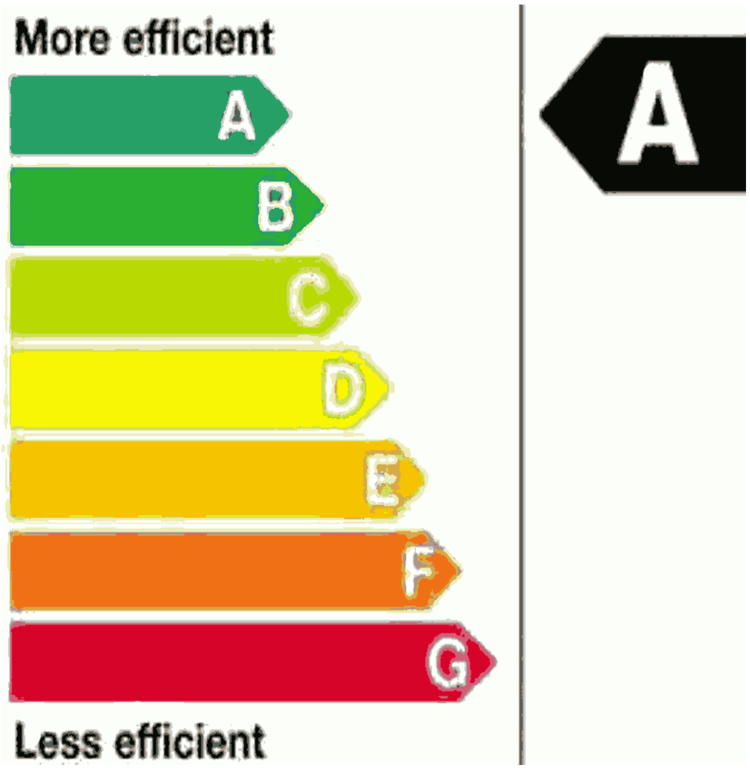
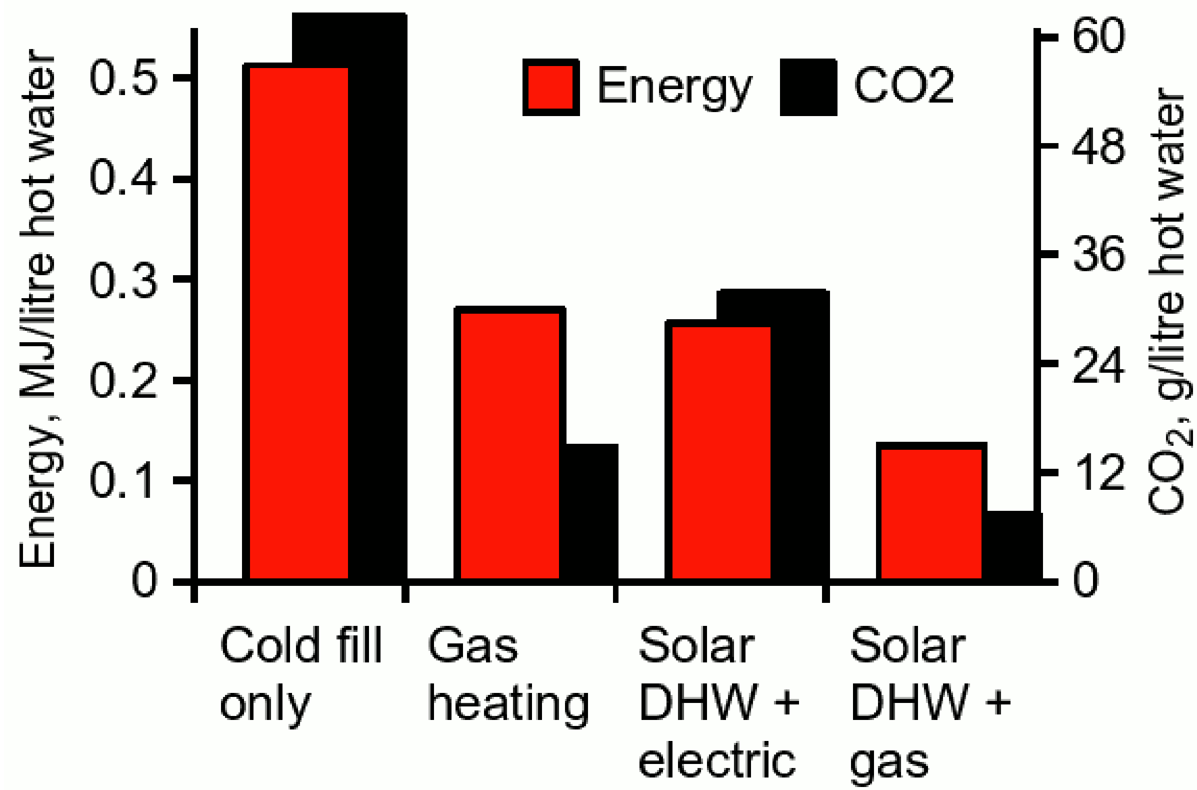


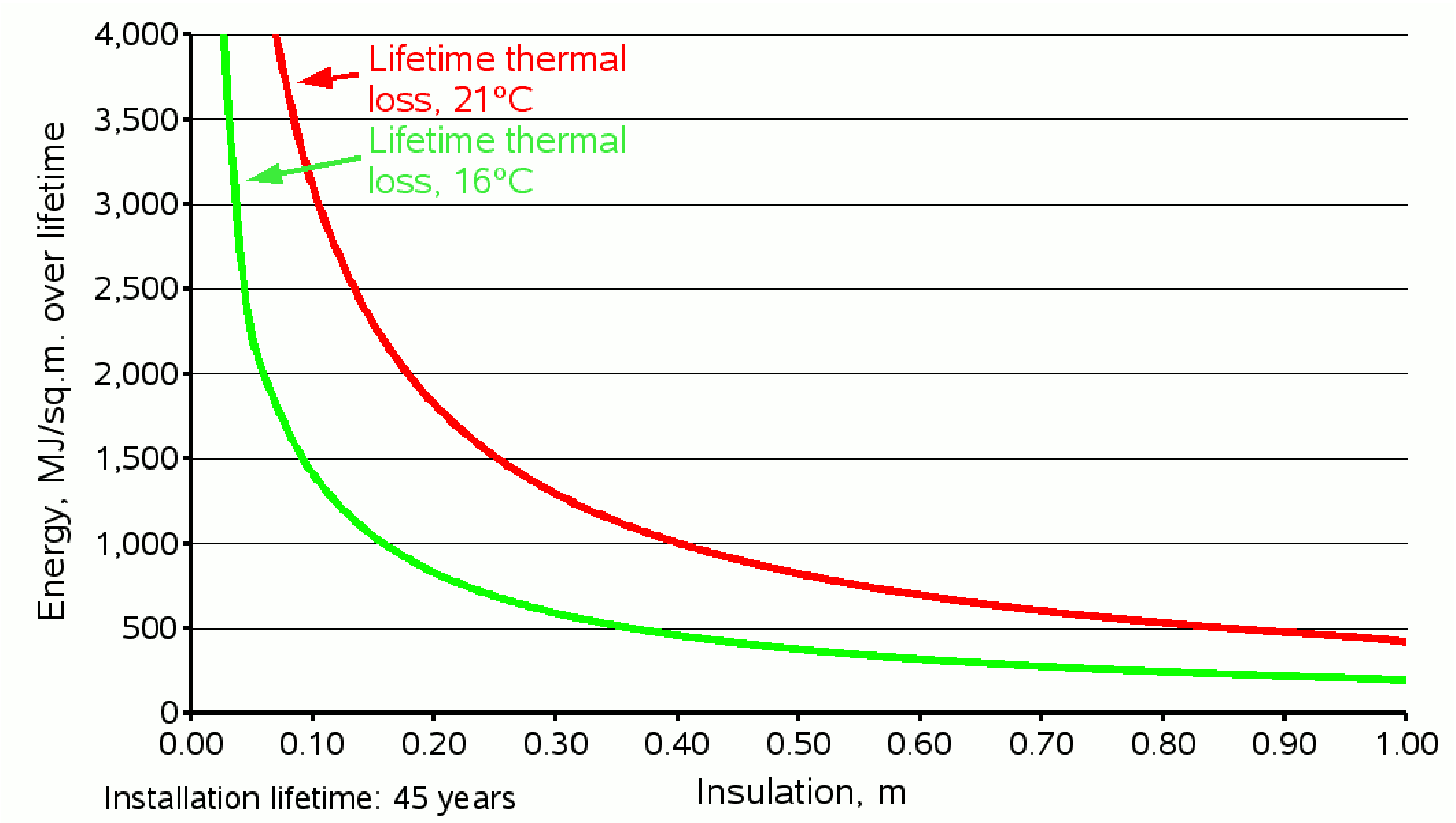
In terms of the “primary” energy consumed, a cold-fill machine uses twice the energy as a (gas-fired) hot fill machine, or four times as much if you have solar water heating*. It's also, respectively, a quarter or an eighth the level of carbon emissions.

**(solar fraction 0.5)*



Insulation and Embodied Energy

Lifetime energy losses vs. embodied energy in a roof space, per square metre, using mineral wool insulation



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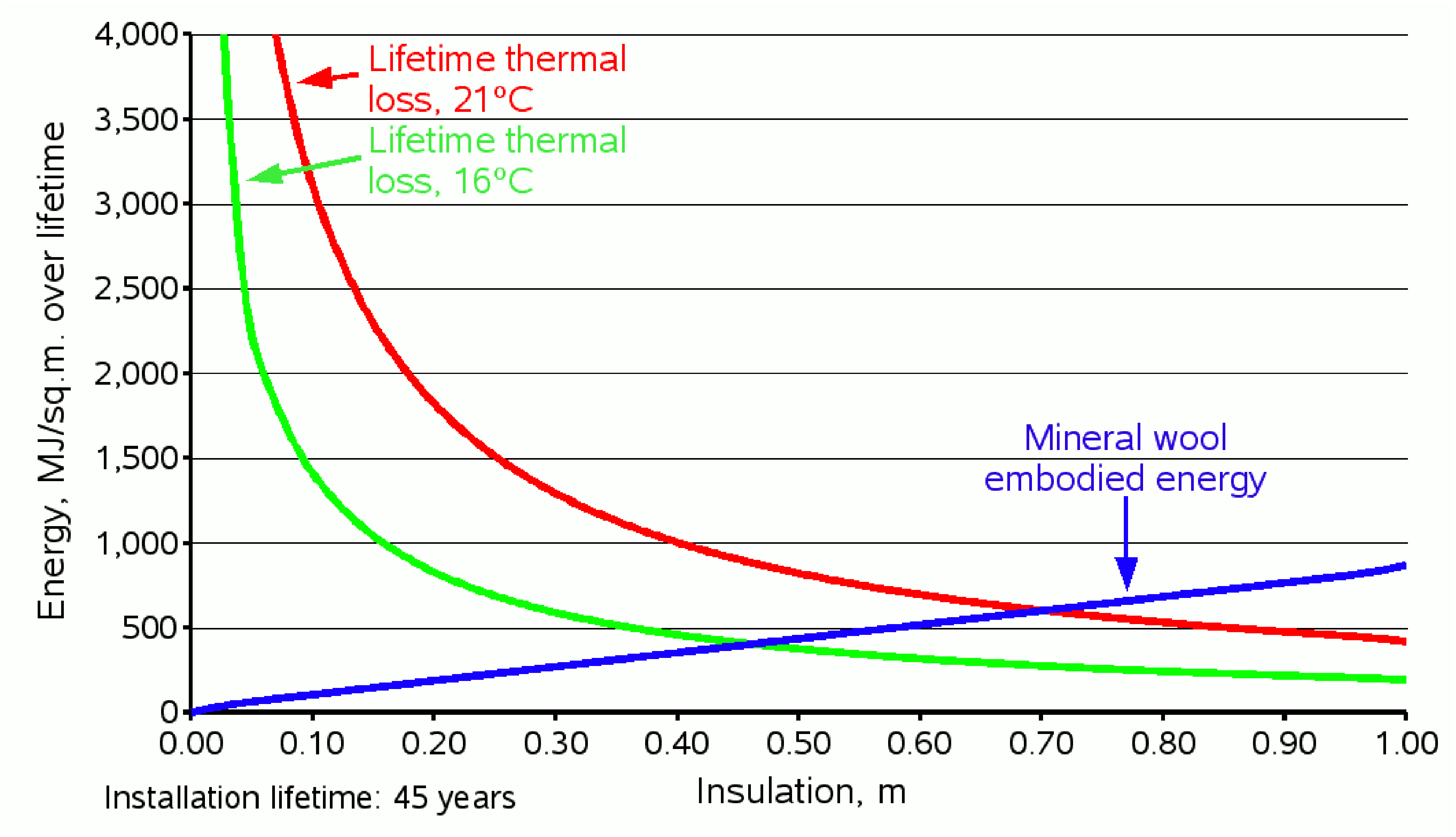

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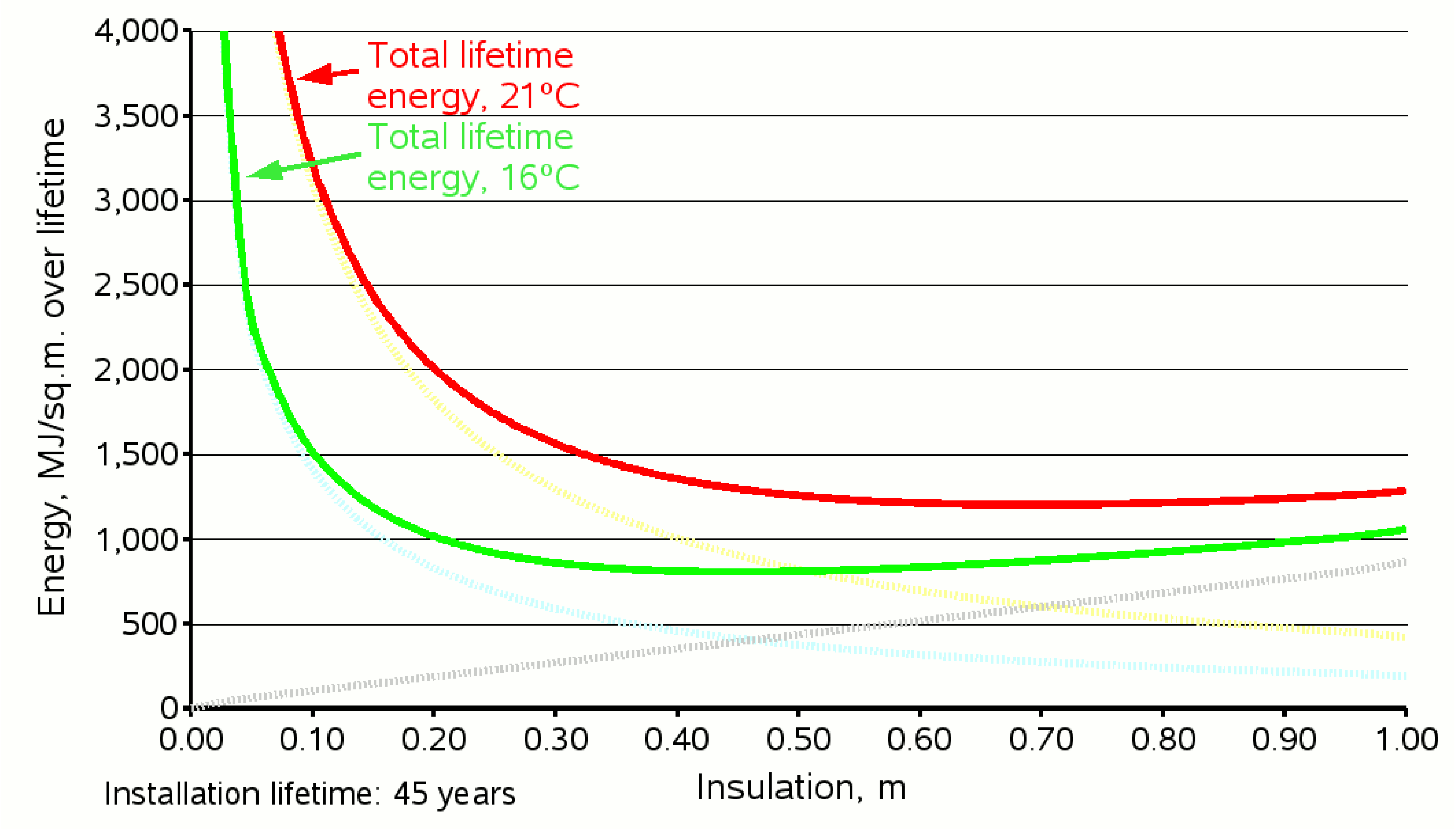

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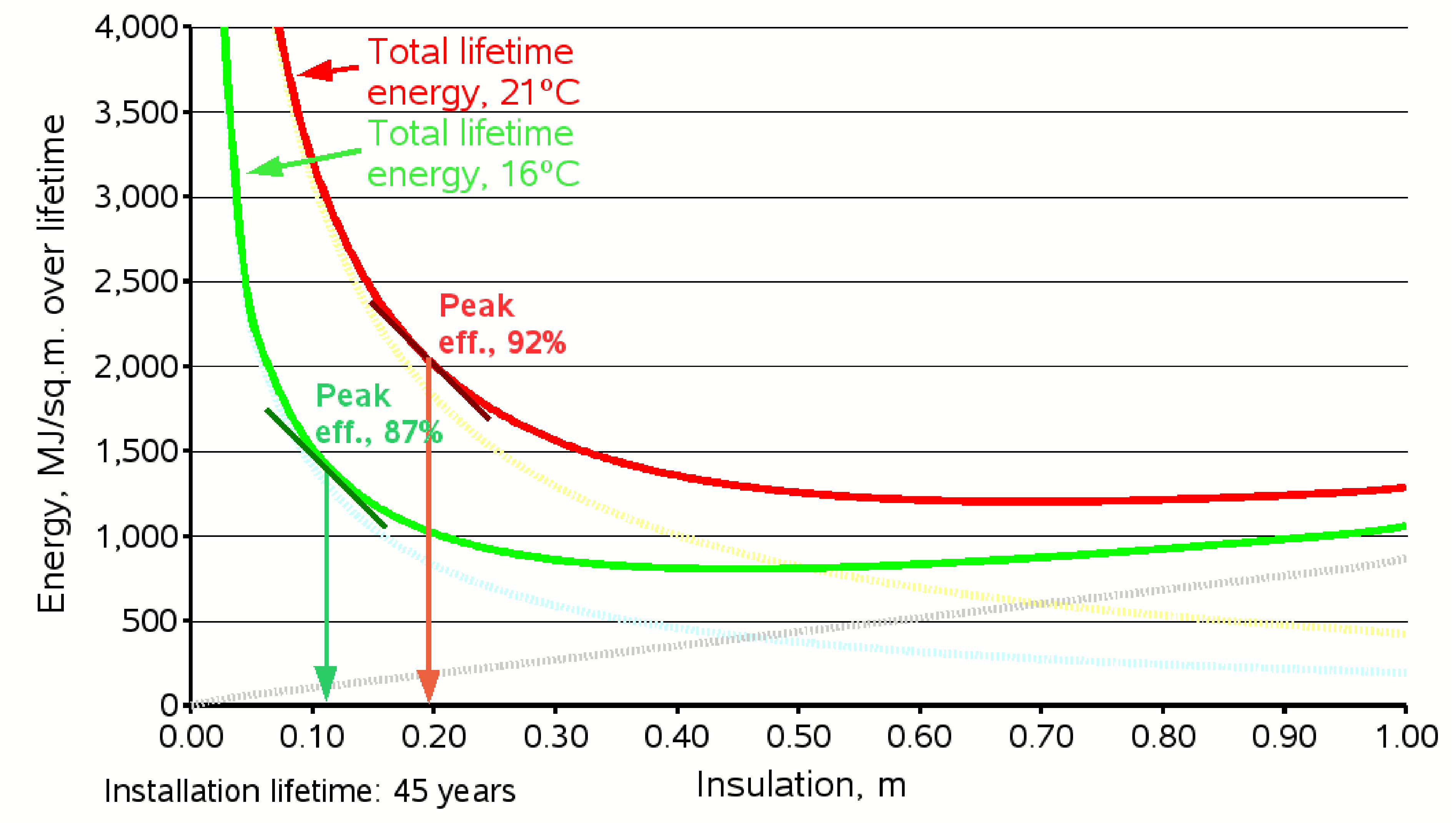

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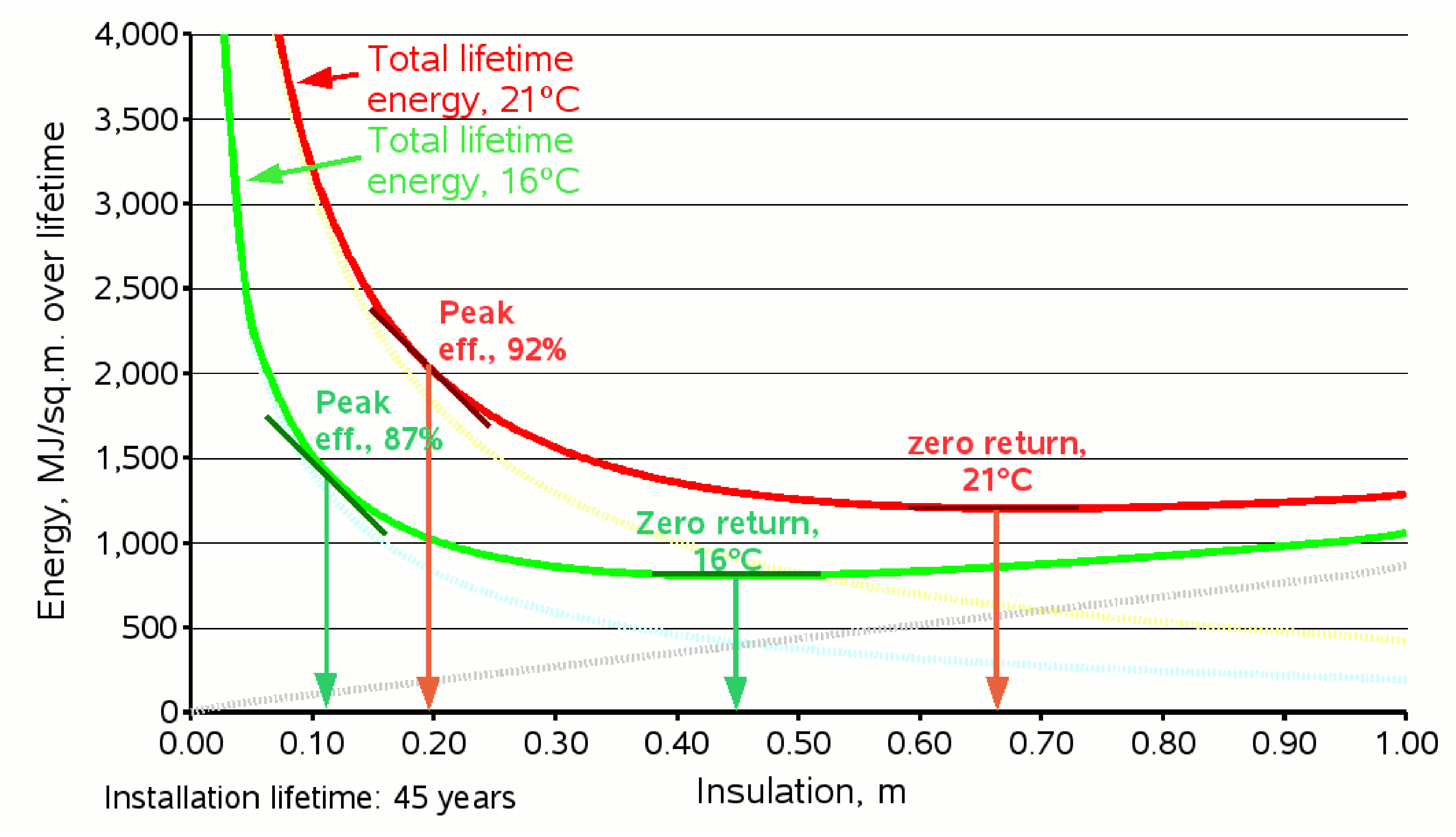
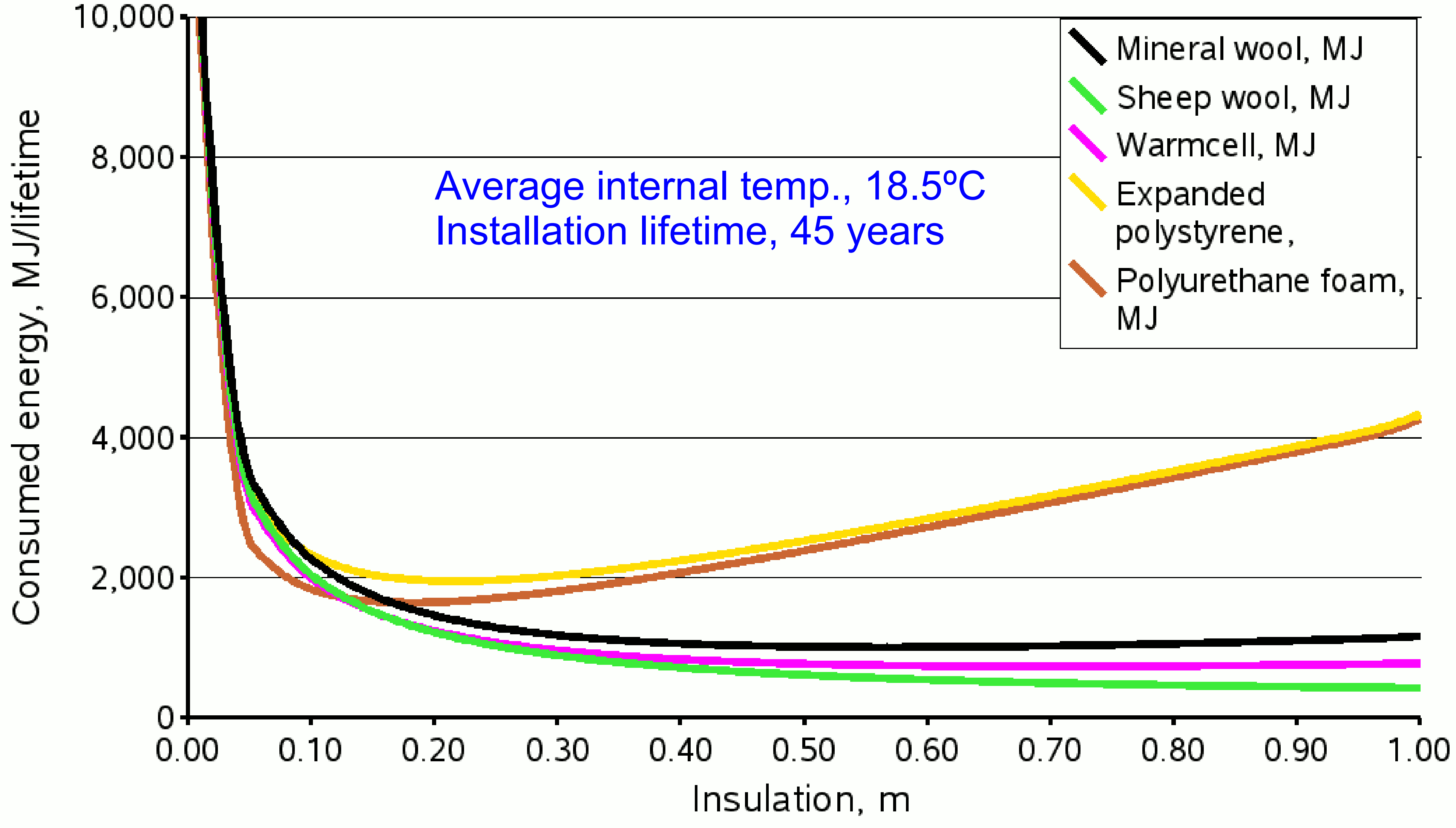


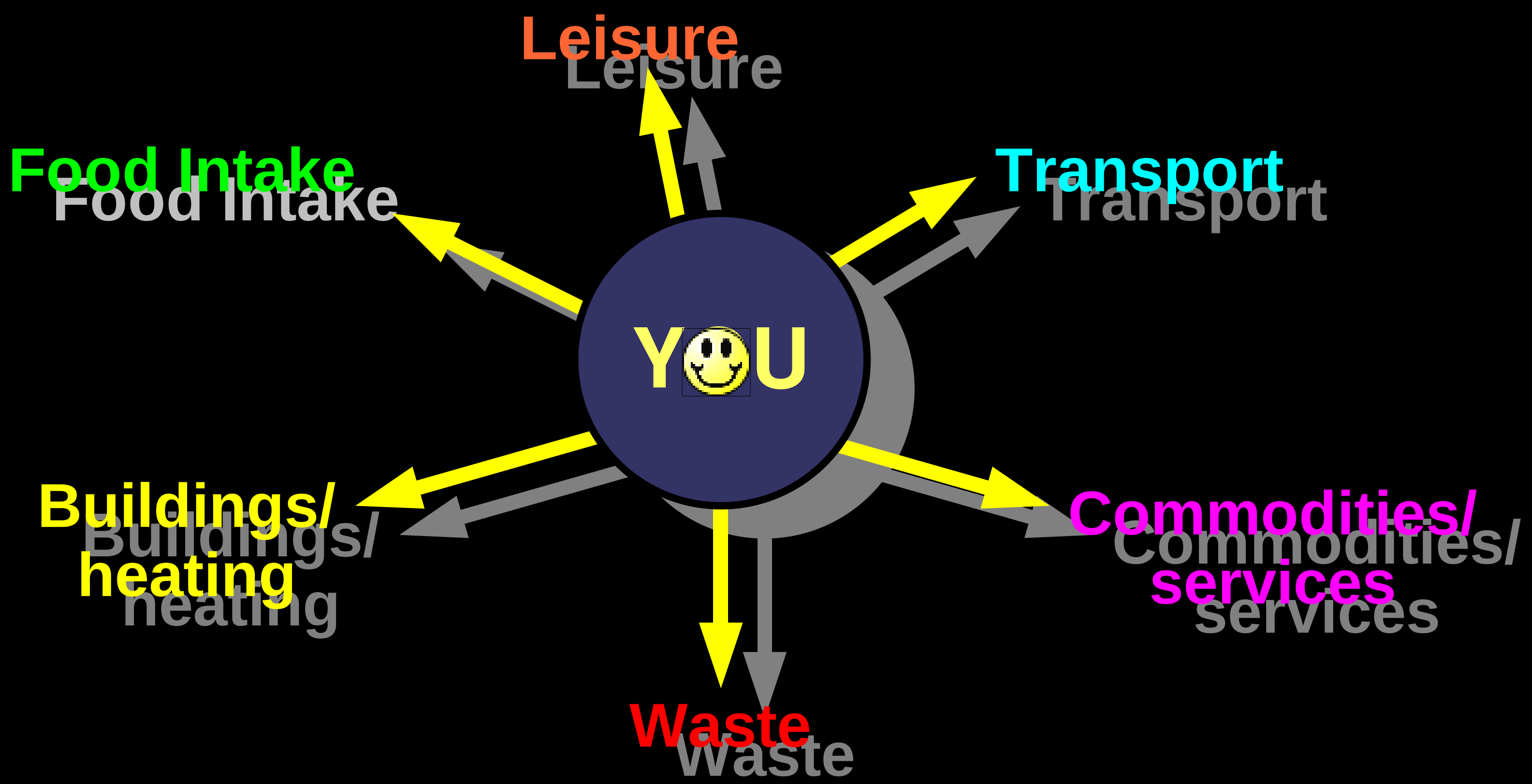
Insulation and Total Energy

Lifetime energy consumption (heat + embodied energy) in a roof space, per sq. m., using a variety of insulation materials



SELF: Energy in the Context of the Individual

Your existence is defined by very specific energy demands:



Each of these areas comprises a number of direct and indirect 'sinks' of energy and resources, and the emission of waste and pollutants (like CO2). Most importantly, much of this consumption takes place <u>indirectly</u>, not directly.

Embodied Energy: *The BigMac*

The BigMac, without including other inputs such as packaging and running the store, requires between 3.2 and 8.1 (av. 5.7) calories per calorie of food energy delivered.

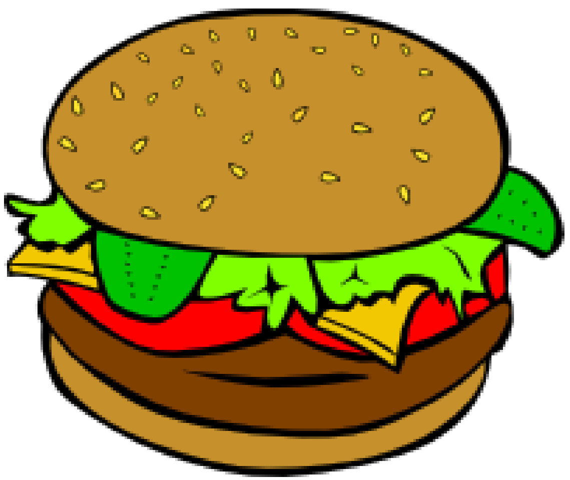
The BigMac – 210g serving (UK), 493kcal/2.1MJ
Average embodied energy, 11.8MJ (hi 16.7, lo 6.6)
Total inputs, 1941g (including process waste/animal feed)

Lettuce
25g, 1.98MJ

Dried onion
1.5g, 0.08MJ

Pickles
6.6g, 0.04MJ

Dressing, 17.8g



Bread
66g, 2.95MJ

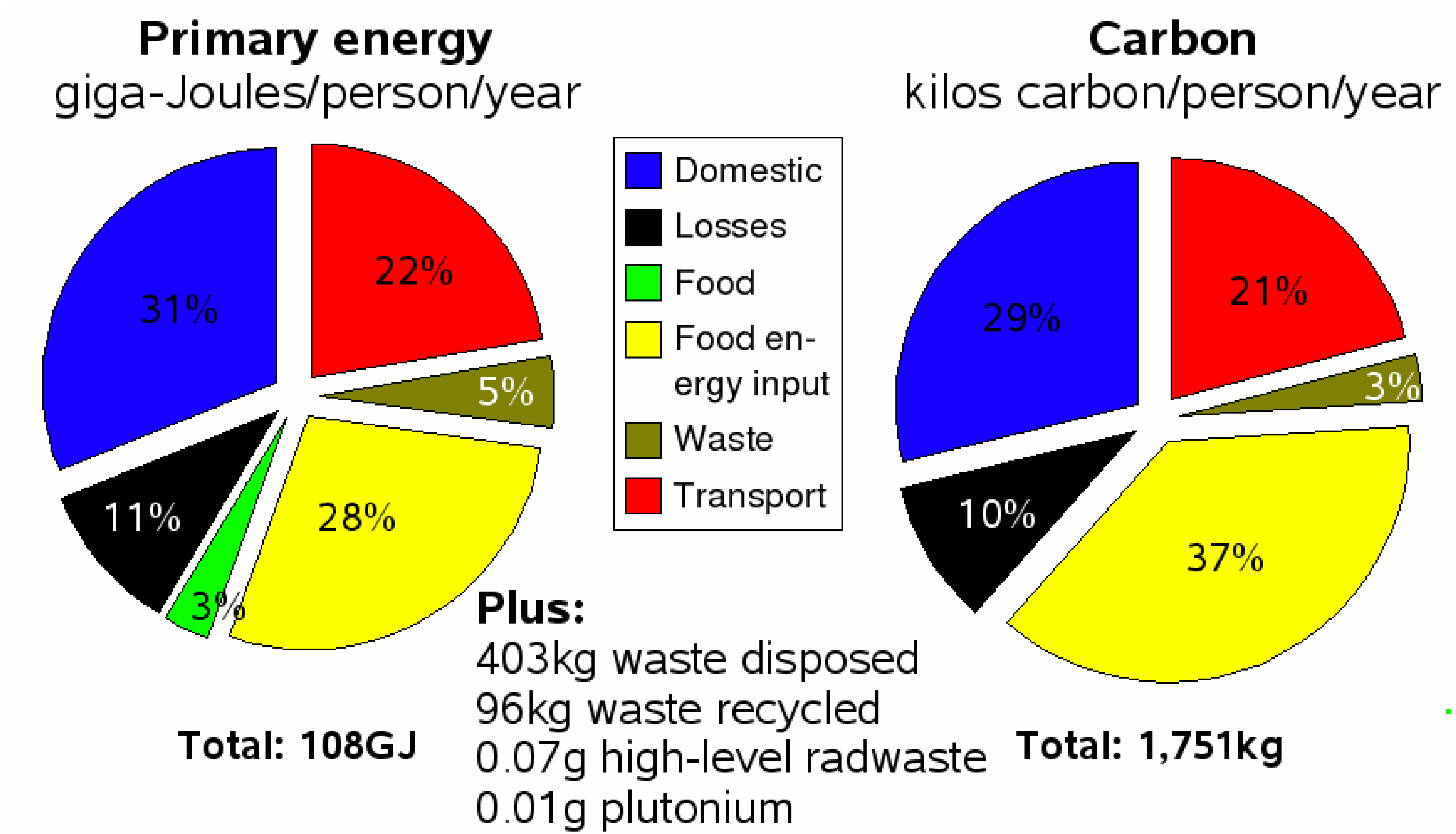
Meat
80g, 7.11MJ

Cheese
13.3g, 0.64MJ

Based upon: *Energy Use in the Food Sector: A data survey*, Annika Carlsson-Kanyama, Environmental Strategies Research Group, Stockholm University, 2001

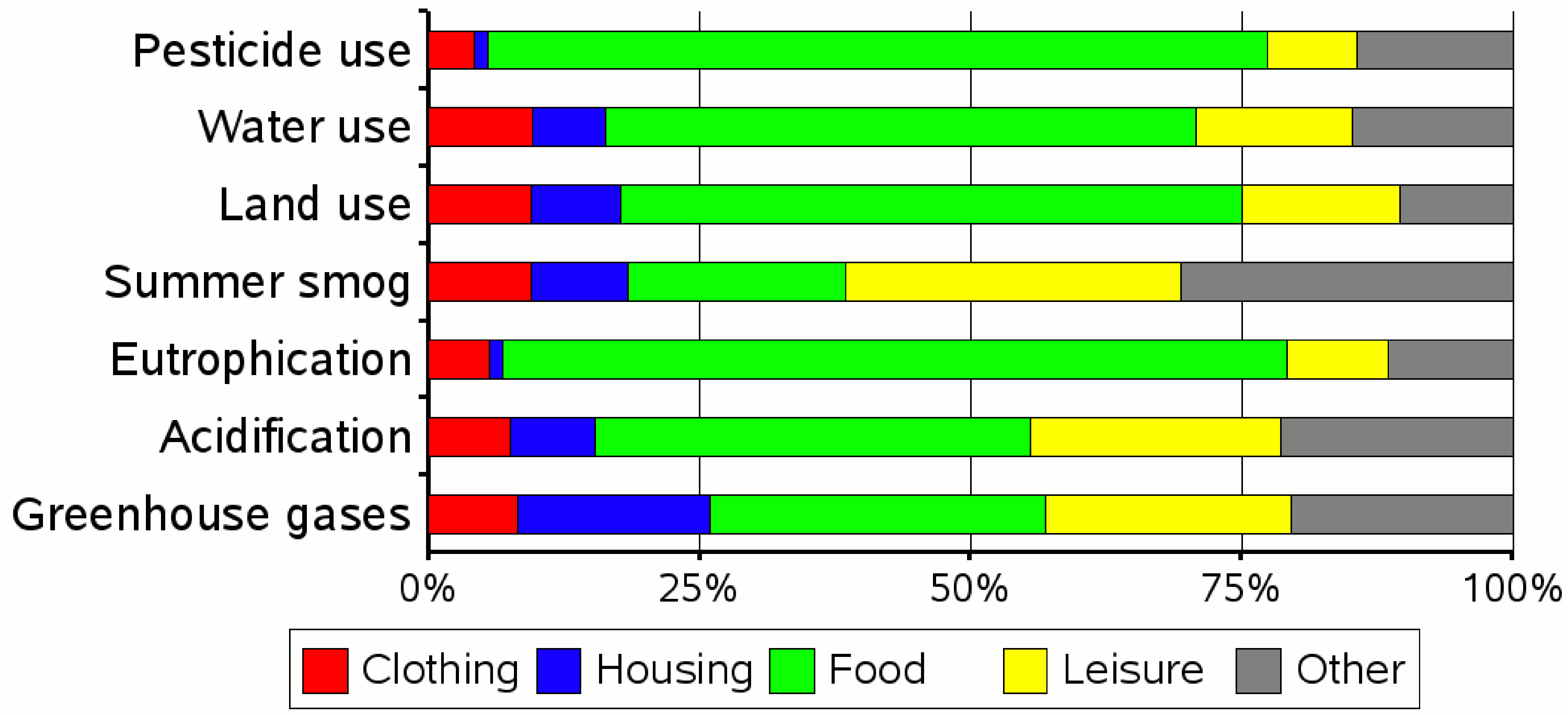
How Much do you Consume?

Energy and carbon levels recalculated for the “average” individual



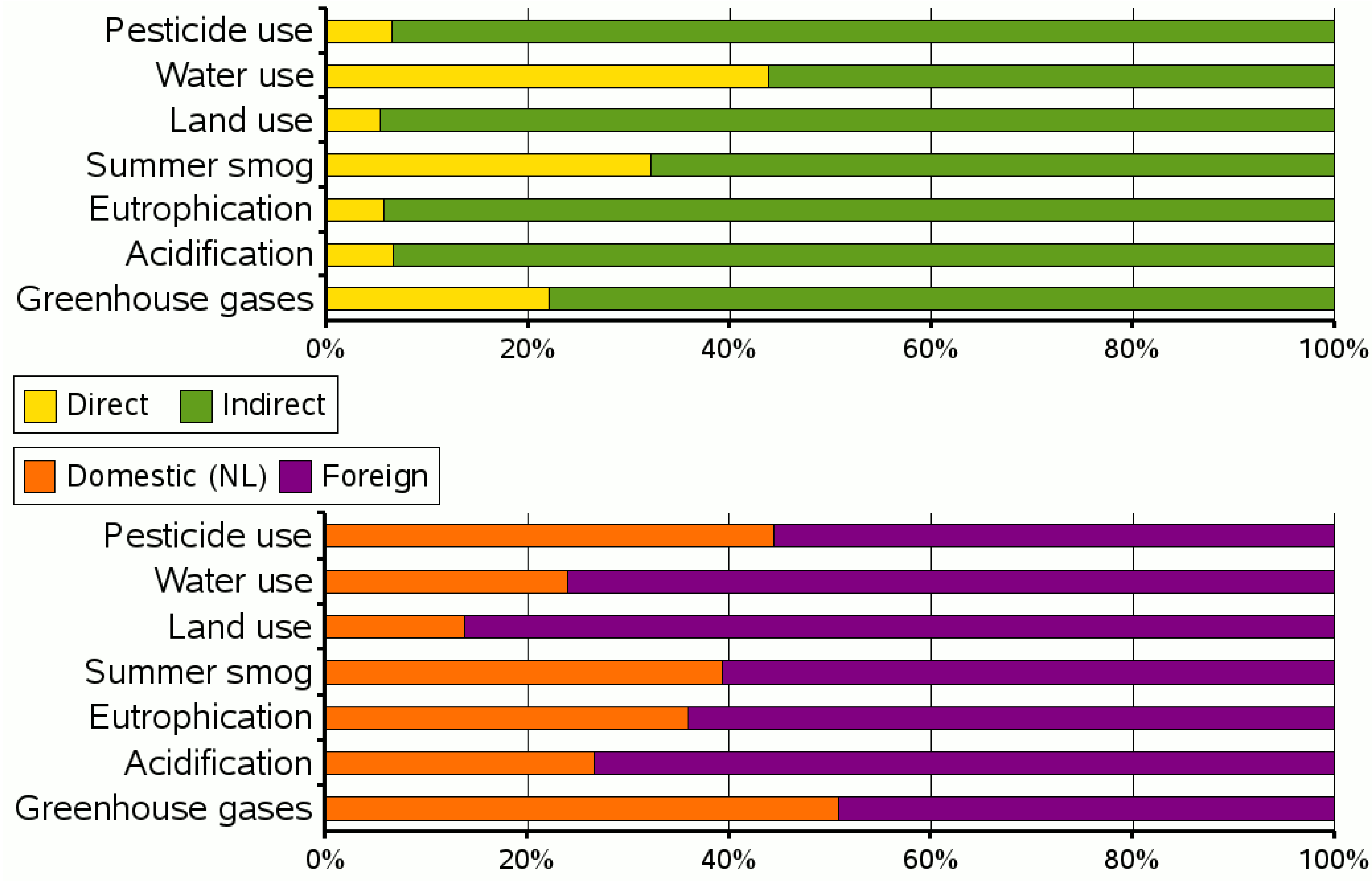
The Impacts of Consumption

Dutch consumption provides a good analogy for the UK:

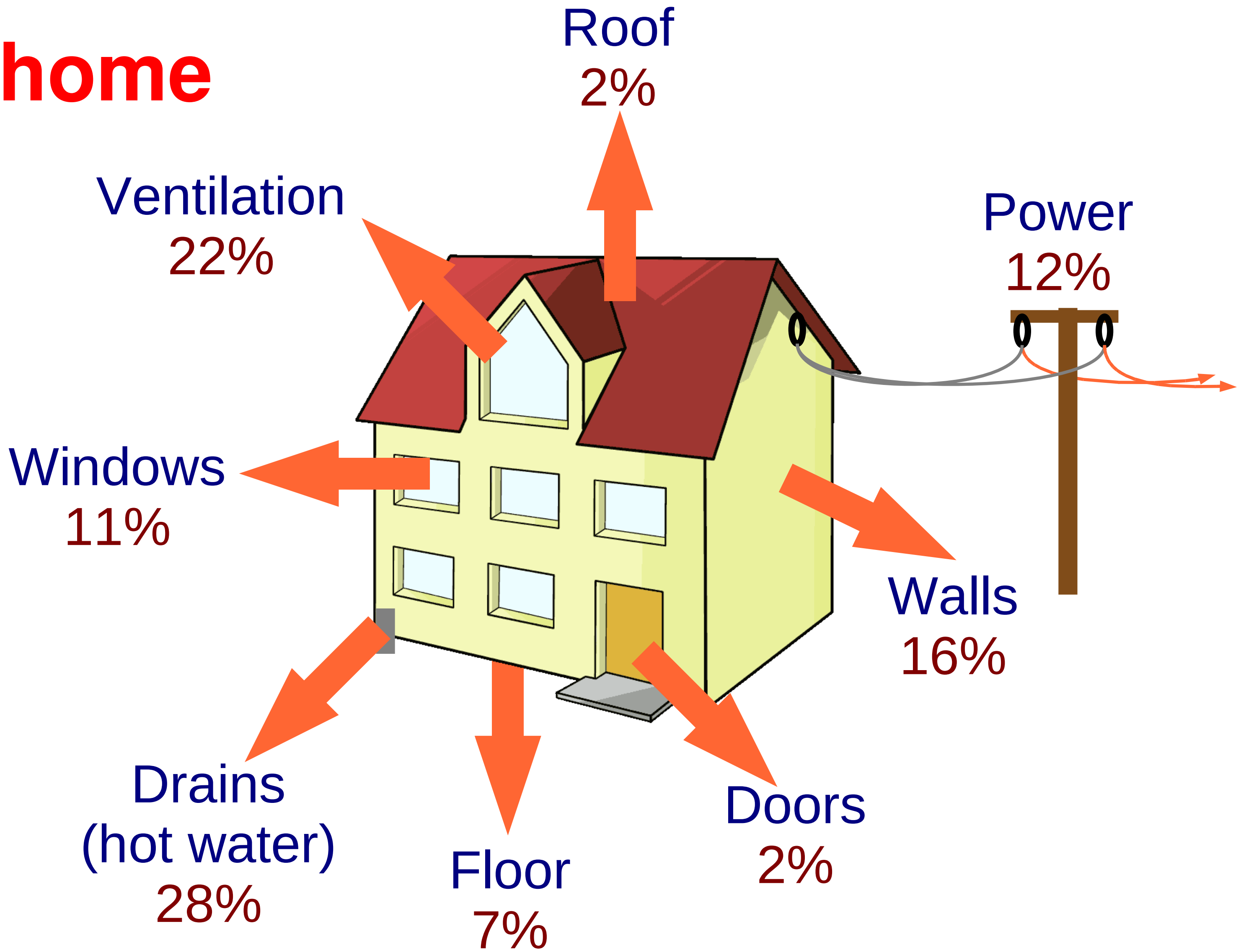


Source: Share of Consumption Environmental Load from Dutch Private Consumption, Nijdam et. al., Journal of Industrial Ecology 9(1-2), 2005

The Location of Consumption Impacts



Your home

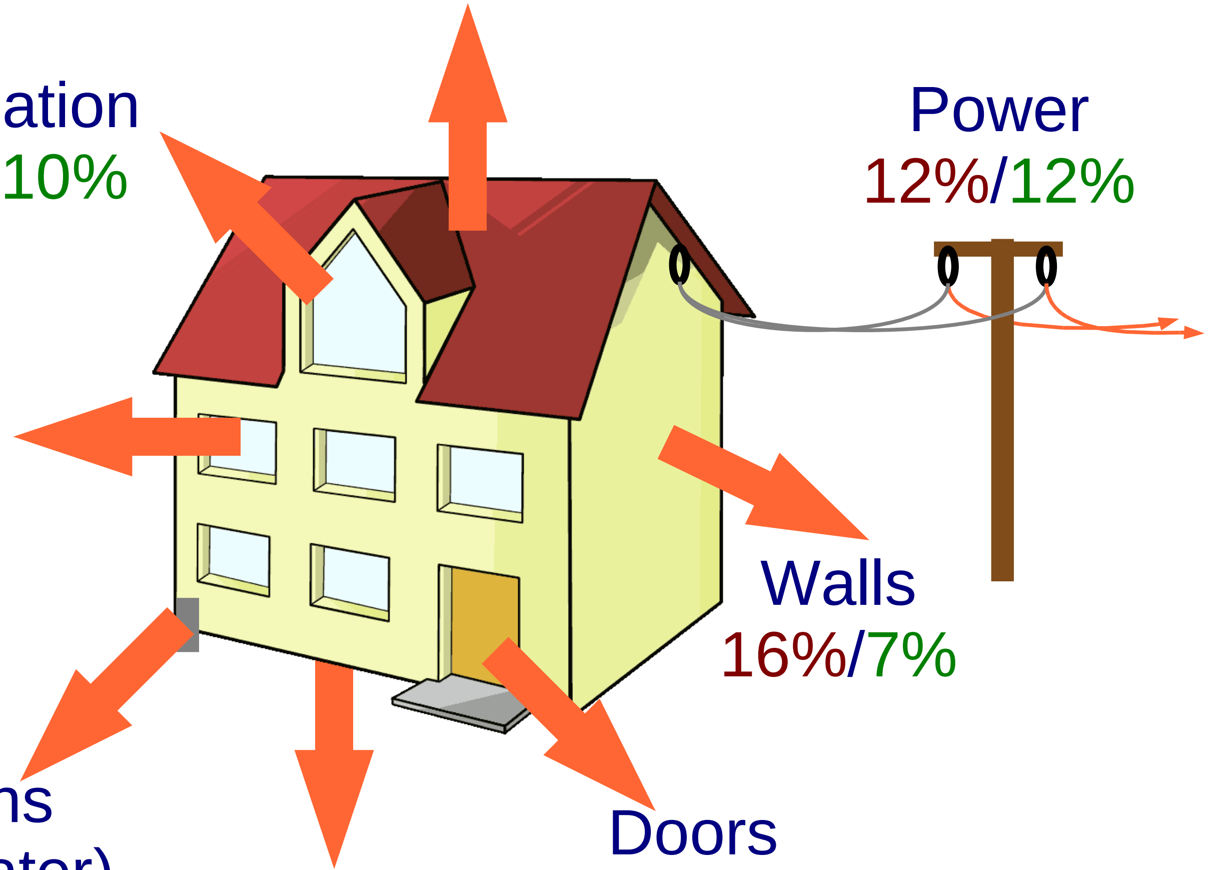


21ºC av. air temp., 70ºC av. water temp. – 125GJ/yr

Save more using less!

Reducing the average temp. by 1ºC saves about 10% of the heating load per year!

Note, in small houses the savings are proportionately less



Case 1: 21ºC av. air temp., 70ºC av. water temp. – 125GJ/yr

2: 16ºC av. air temp., 55ºC av. water temp. – 76GJ/yr (<40%)

[water <25%, heat <54%]

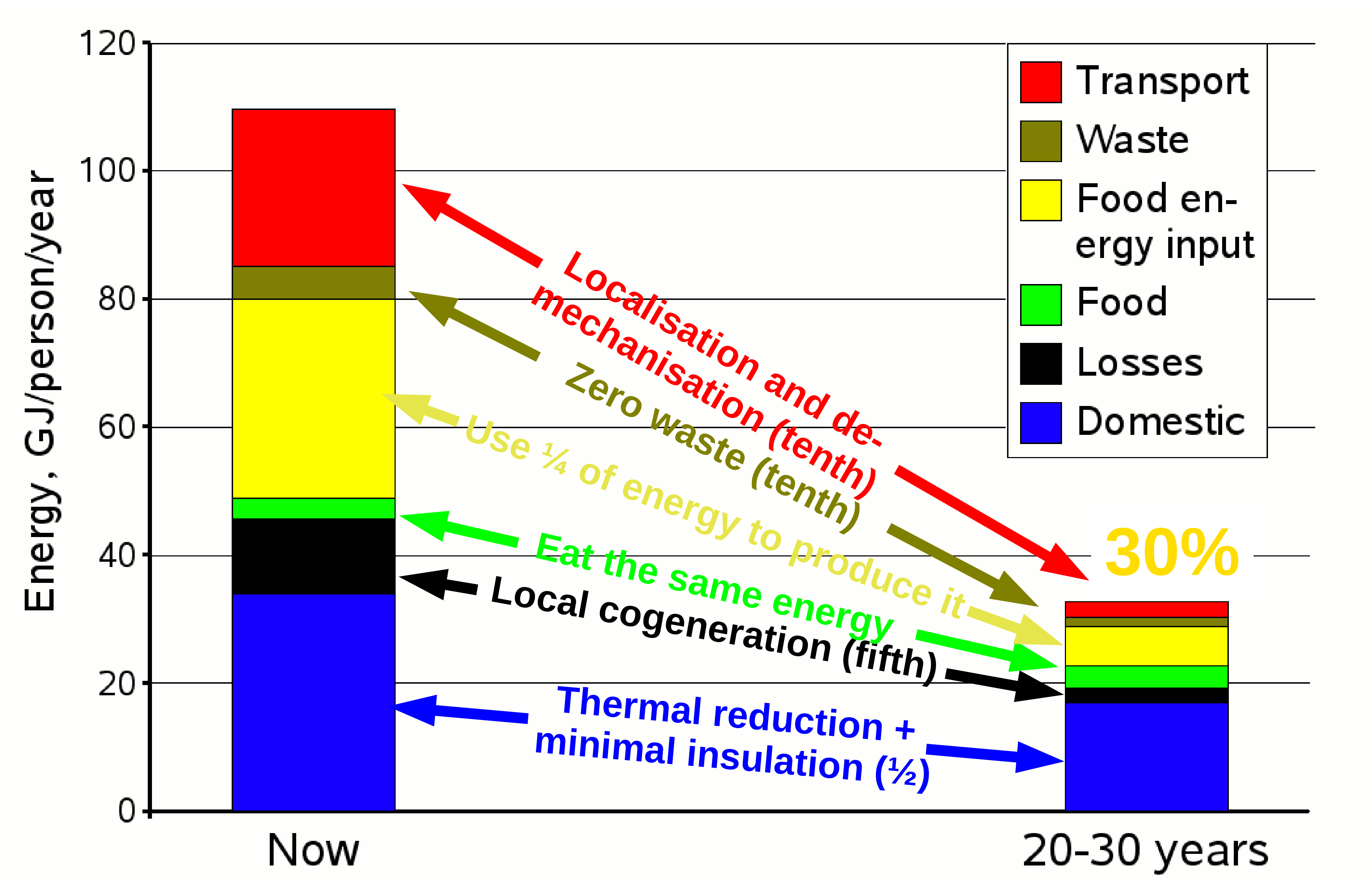
CODA: There is an Elegant Solution...

"Peak Energy", in terms
of our current market system,
is an unusual situation
since it precludes "business
as usual" solutions....

....therefore we should prepare
for "business as unusual!"

The solutions are not novel
or new – they do not need to
be invented... in fact, people have been
writing about them for the last 30 years...
it's just that they didn't fit into "the market"

Potential for Personal Reduction



The immediate priority: POWERDOWN

Network

You're going to need help! That begins by re-establishing social networks.

Skills

Reducing external energy means that you must put more in yourself – this requires that you re-learn the skills we've lost to the consumer society.

Consume less

If you wait to Powerdown is unavoidable you're going to be a unhappy person – don't wait, start today.

Acclimatise

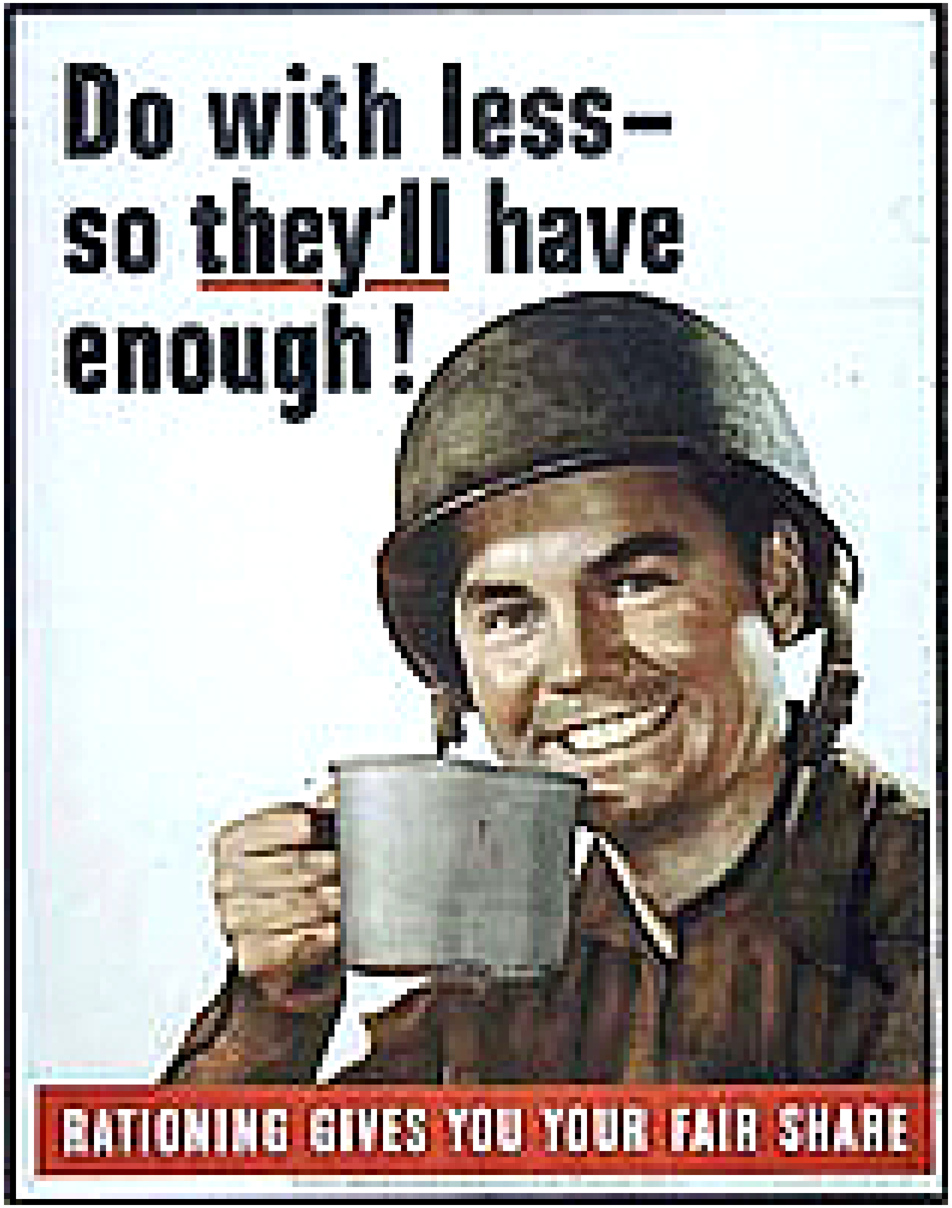
Turn your thermostats down now and put your jumpers on! (seriously, doing more yourself will make you physically fitter, but it takes time)

When is Peak Oil?

...when rationing starts!

In reality we're not talking about certain dates, times or processes. 2010, plus or minus 5 years, is the most likely.

The issue is not that Peak Oil will mean the end of oil, or the end of the motor car (immediately) – what it means is that the certainties of the market place we've known for 50 years will disappear.

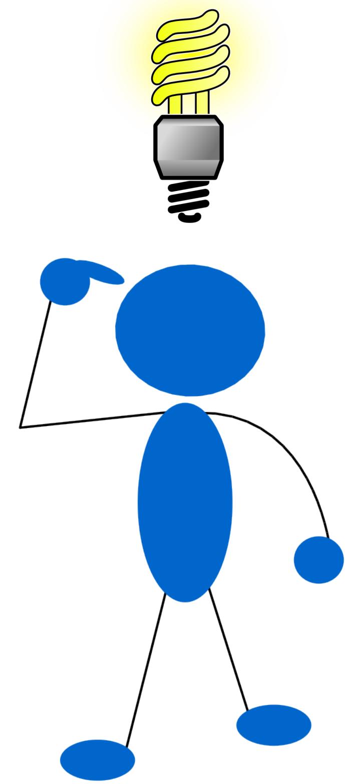


The Free Range “Energy Beyond Oil” Project

web: http://www.fraw.org.uk/ebo/

email: ebo@fraw.org.uk

...but,if you can think of a better idea, we'd like to hear it!



If you still don't have it, buy “Energy Beyond Oil”!

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