Energy and Climate

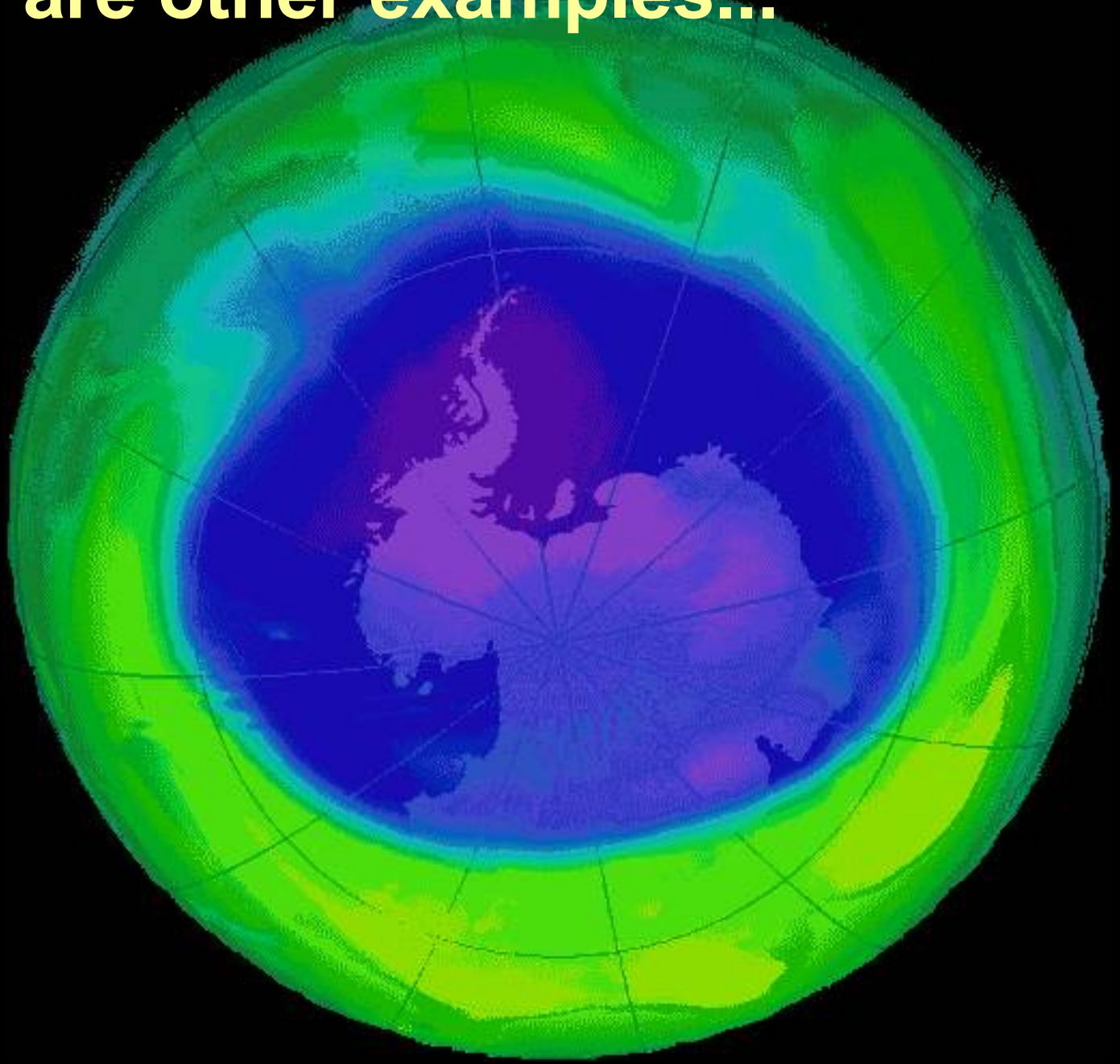
UK Peak Energy Tour
Spring 2007

http://www.fraw.org.uk/tour/

How can humans change the climate?

Source:
NASA

There are other examples...



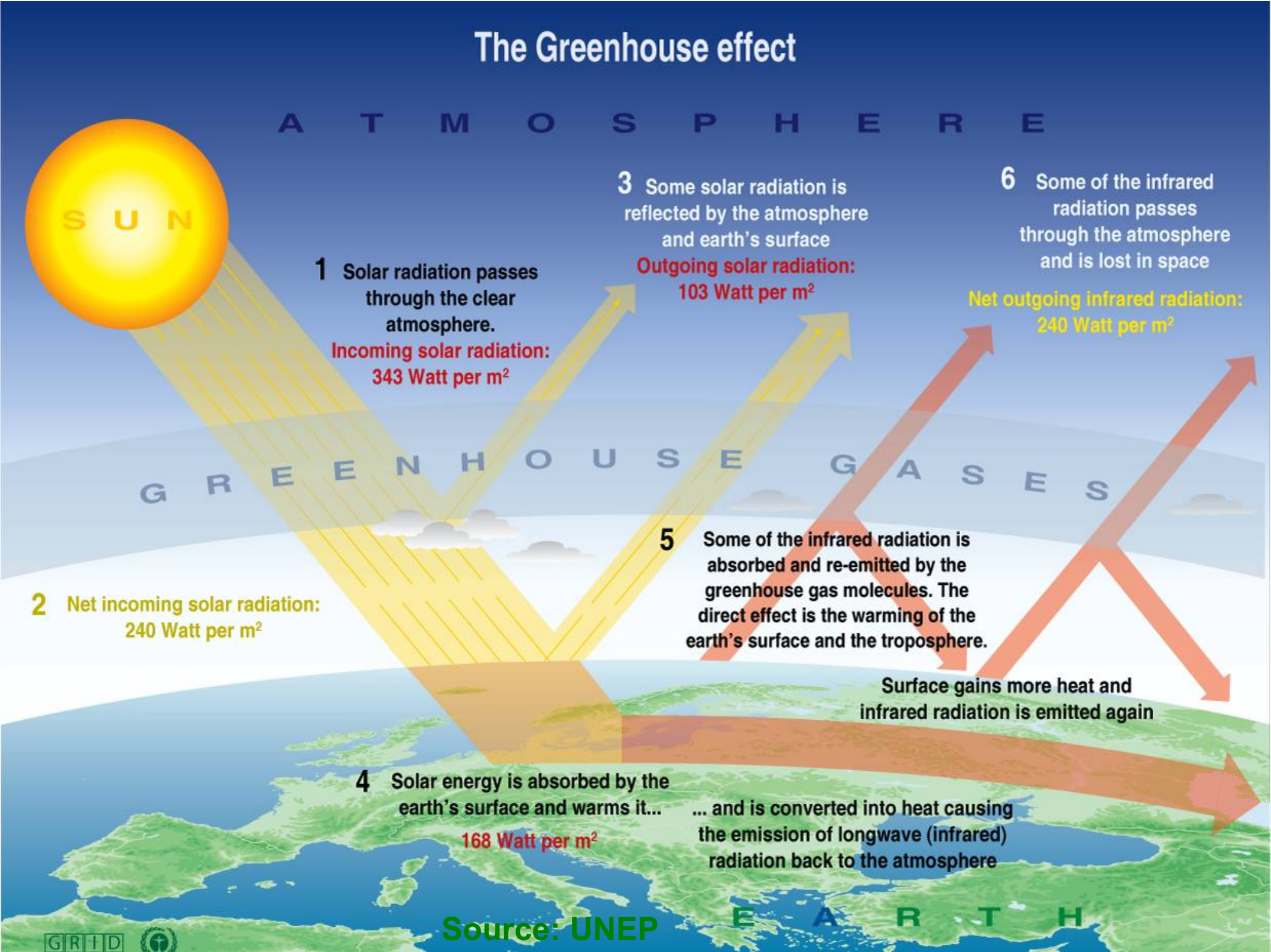
Source:
NASA

An illustration of the problem...

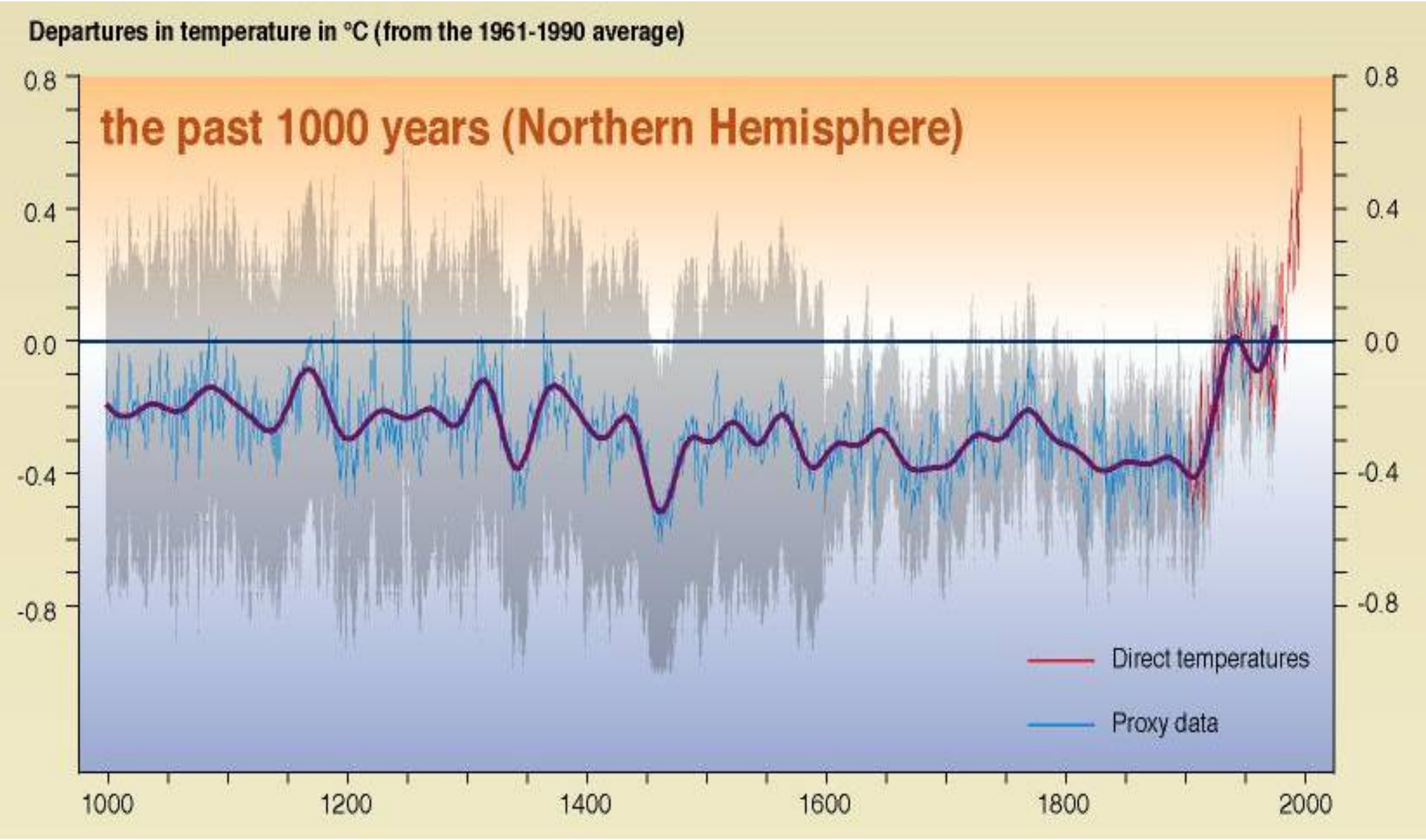
Source:
NASA

An illustration of the problem...

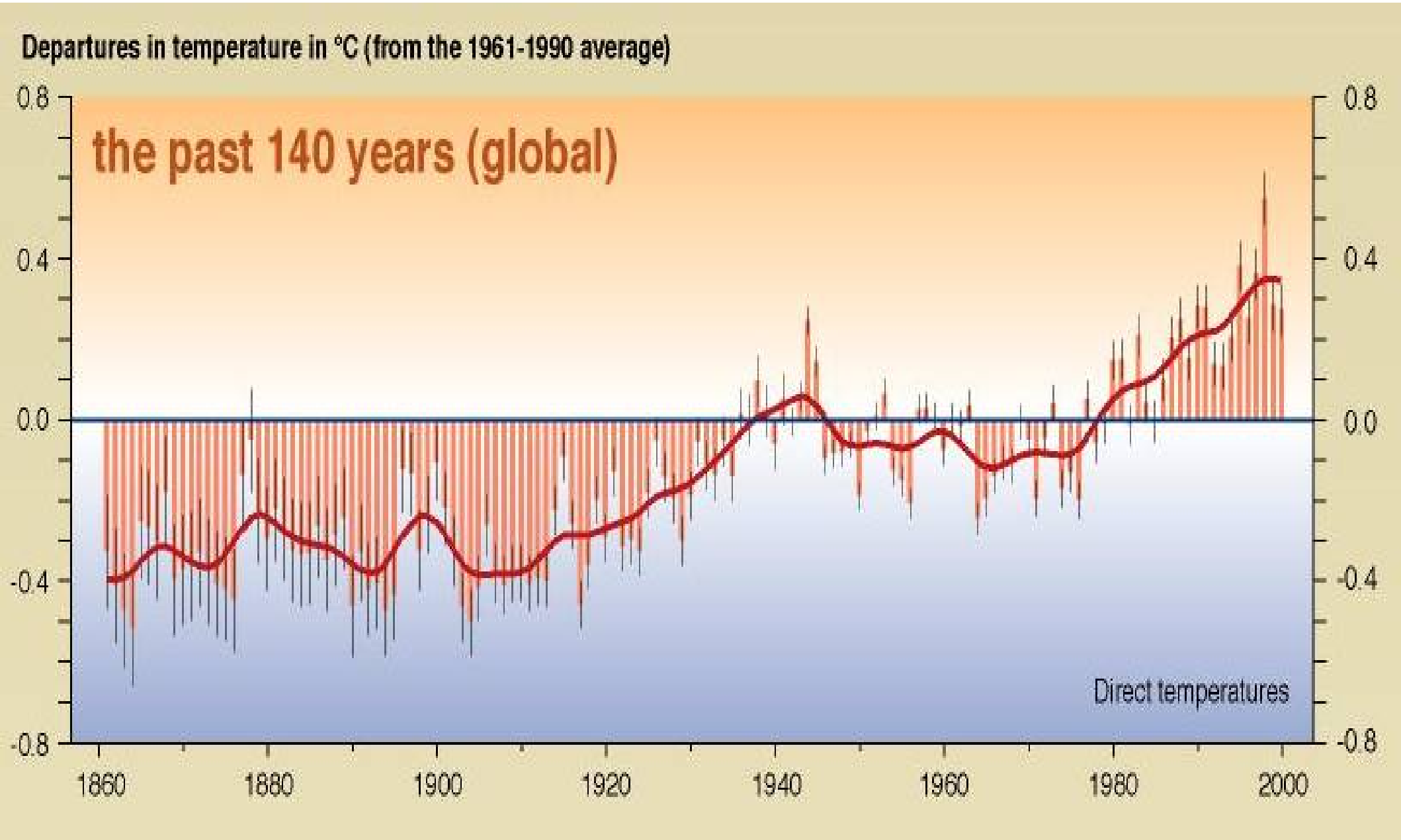
Source:
NASA


The Greenhouse effect
A T M O S P H E R E
S U N
1 Solar radiation passes through the clear atmosphere.
Incoming solar radiation:
343 Watt per m²
3 Some solar radiation is reflected by the atmosphere and earth's surface
Outgoing solar radiation:
103 Watt per m²
6 Some of the infrared radiation passes through the atmosphere and is lost in space
Net outgoing infrared radiation:
240 Watt per m²
G R E E N H O U S E G A S E S
5 Some of the infrared radiation is absorbed and re-emitted by the greenhouse gas molecules. The direct effect is the warming of the earth's surface and the troposphere.
2 Net incoming solar radiation:
240 Watt per m²
Surface gains more heat and infrared radiation is emitted again
4 Solar energy is absorbed by the earth's surface and warms it...
168 Watt per m²
... and is converted into heat causing the emission of longwave (infrared) radiation back to the atmosphere
E A R T H
GRID

Source: UNEP

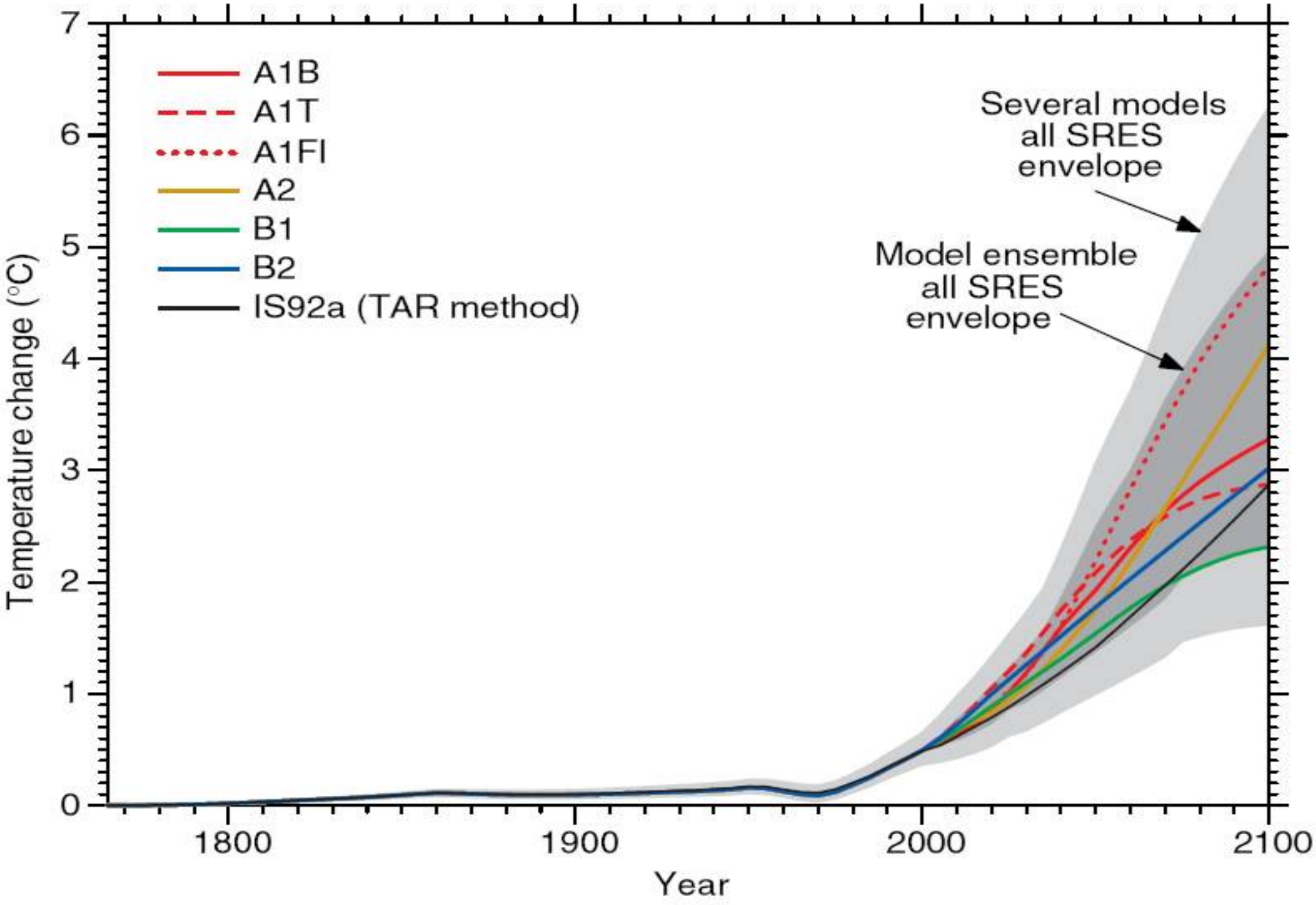

Departures in temperature in °C (from the 1961-1990 average)
the past 1000 years (Northern Hemisphere)
0.8
0.4
0.0
-0.4
-0.8
Direct temperatures
Proxy data
1000
1200
1400
1600
1800
2000

Source: IPCC

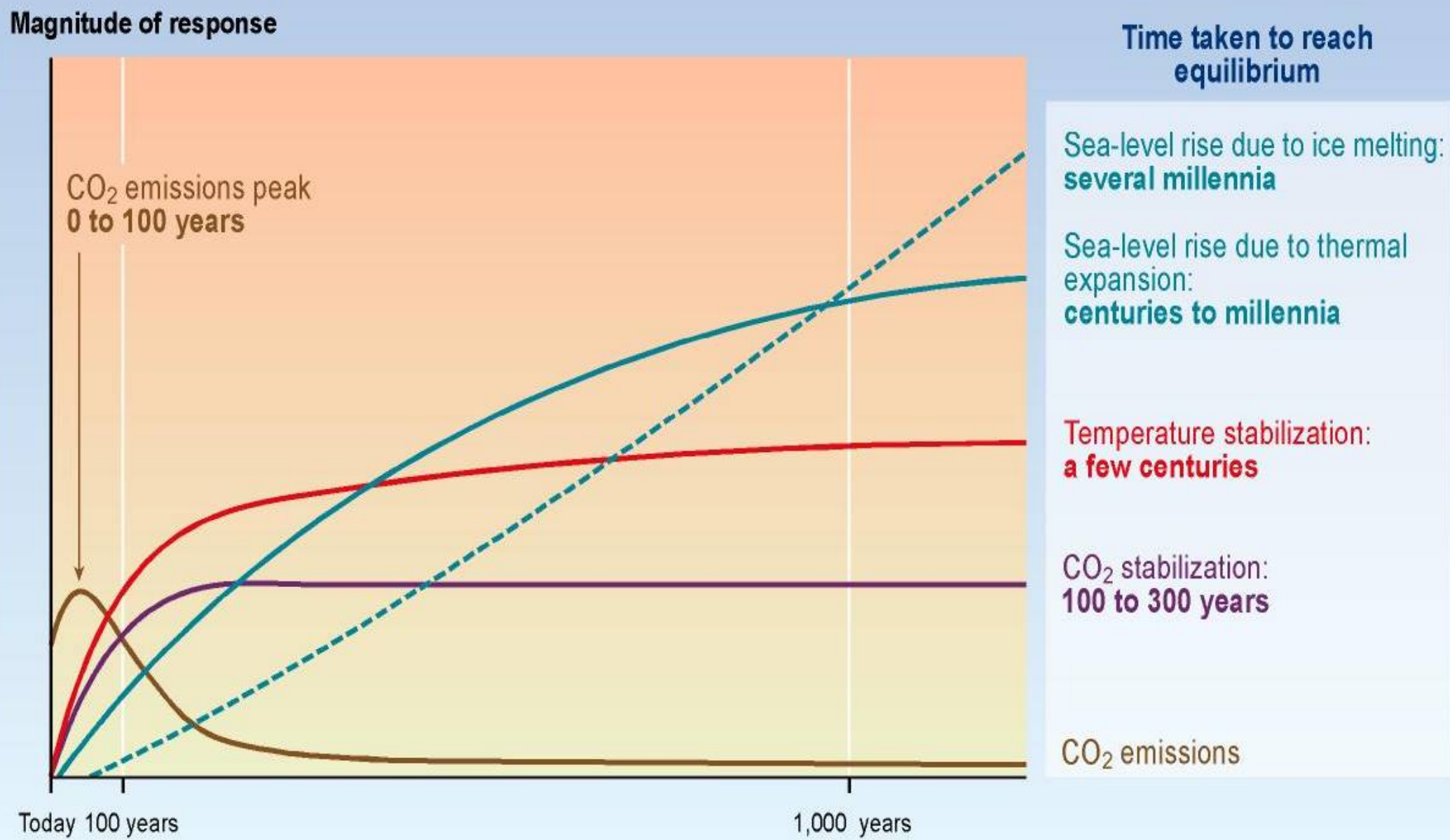

Departures in temperature in °C (from the 1961-1990 average)
the past 140 years (global)
0.8
0.4
0.0
-0.4
-0.8
Direct temperatures
1860
1880
1900
1920
1940
1960
1980
2000

Source: IPCC

Source: IPCC


A1B
A1T
A1FI
A2
B1
B2
IS92a (TAR method)
Several models all SRES envelope
Model ensemble all SRES envelope
Temperature change (°C)
Year
0
1
2
3
4
5
6
7
1800
1900
2000
2100

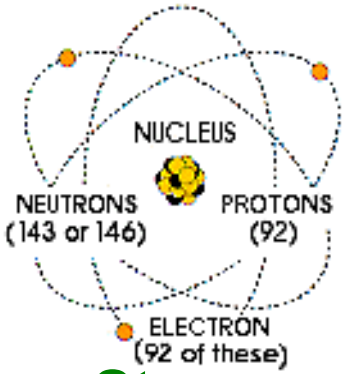
CO_2 concentration, temperature, and sea level continue to rise long after emissions are reduced



Source: IPCC

Fundamental Forces

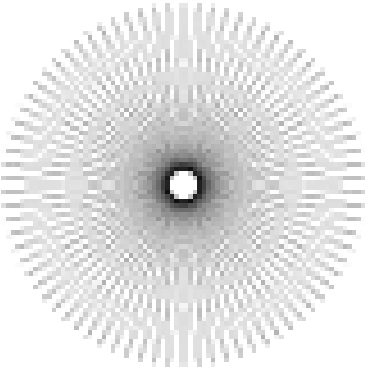
All forms of energy are based upon one of four “fundamental forces”



Strong nuclear

Weak nuclear

Electro-magnetic



Gravity

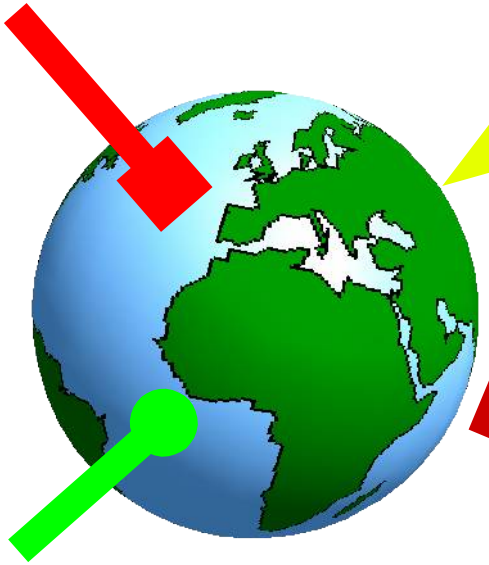
The rules:

- Energy and matter are constant (Law of Conservation)
- The activity within any system is proportional to the energy flowing through it (First Law of Thermodynamics)
- Energy only flows “downhill” – once utilised it takes more energy to restore its “quality” to its original state (Second Law of Th.)

Global Energy Inputs

Solar input,
5,400,000EJ
per year

Climate cycles
(wind/currents)
2,500,000EJ (46%)



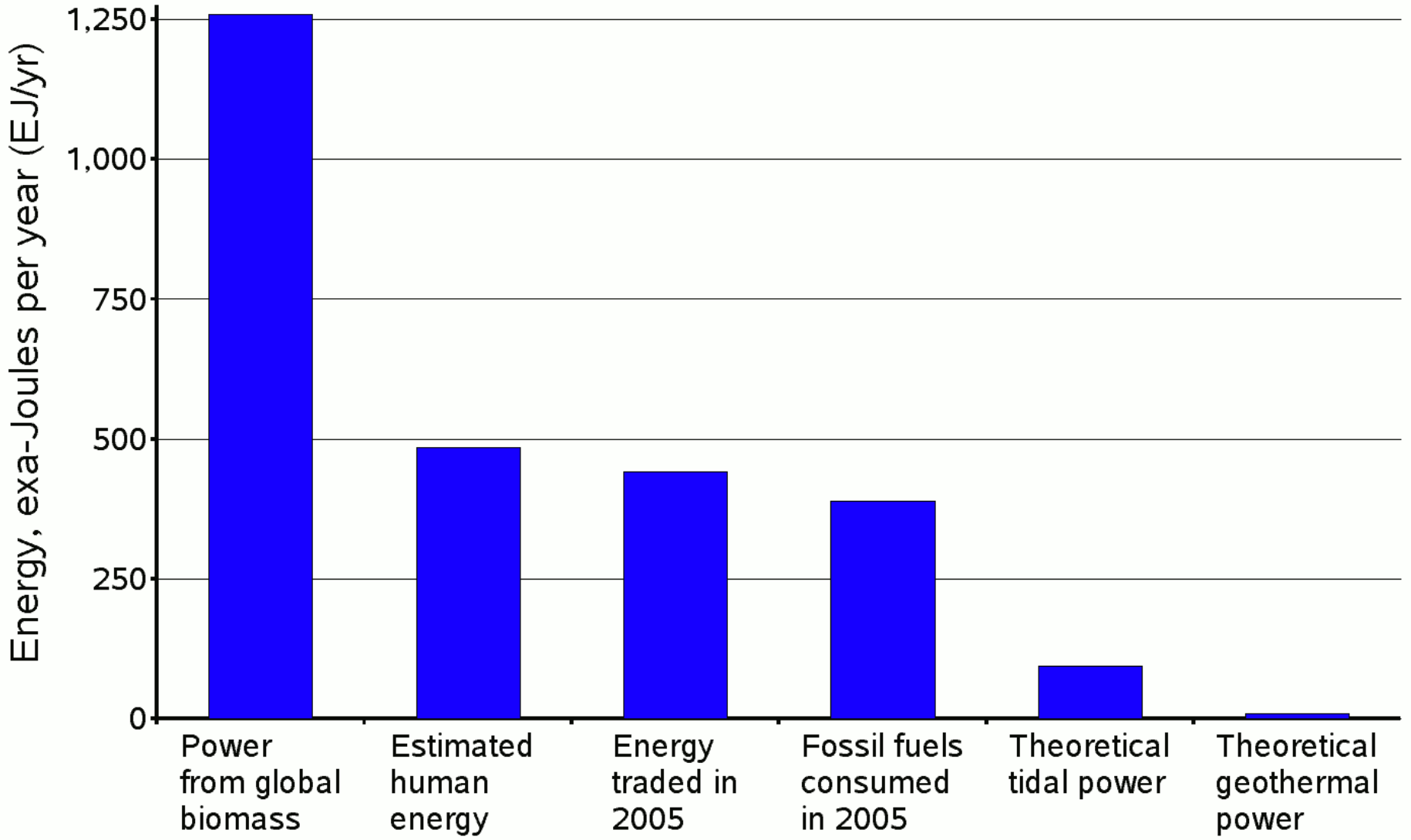
Moon's gravity
(creates tides)
94EJ per year

Reflected to space,
1,600,000EJ (30%)

Hydrological cycle
(evaporating water)
1,300,000EJ (24%)

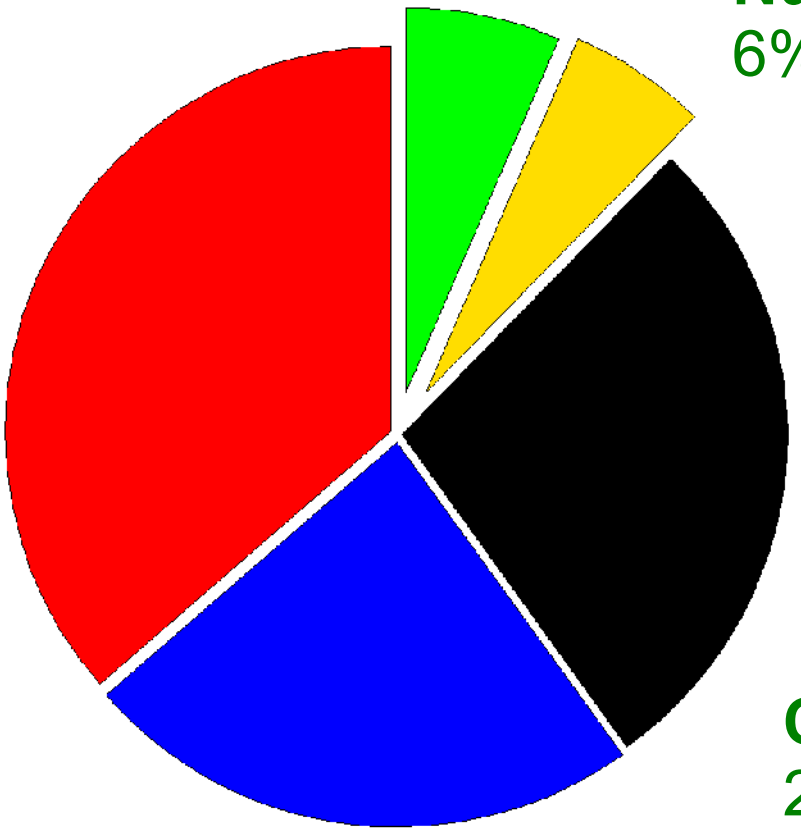
Source:
Open University

The Scale of Human Energy Use



Source:
BP/Open University

Globally Traded Energy, 2005

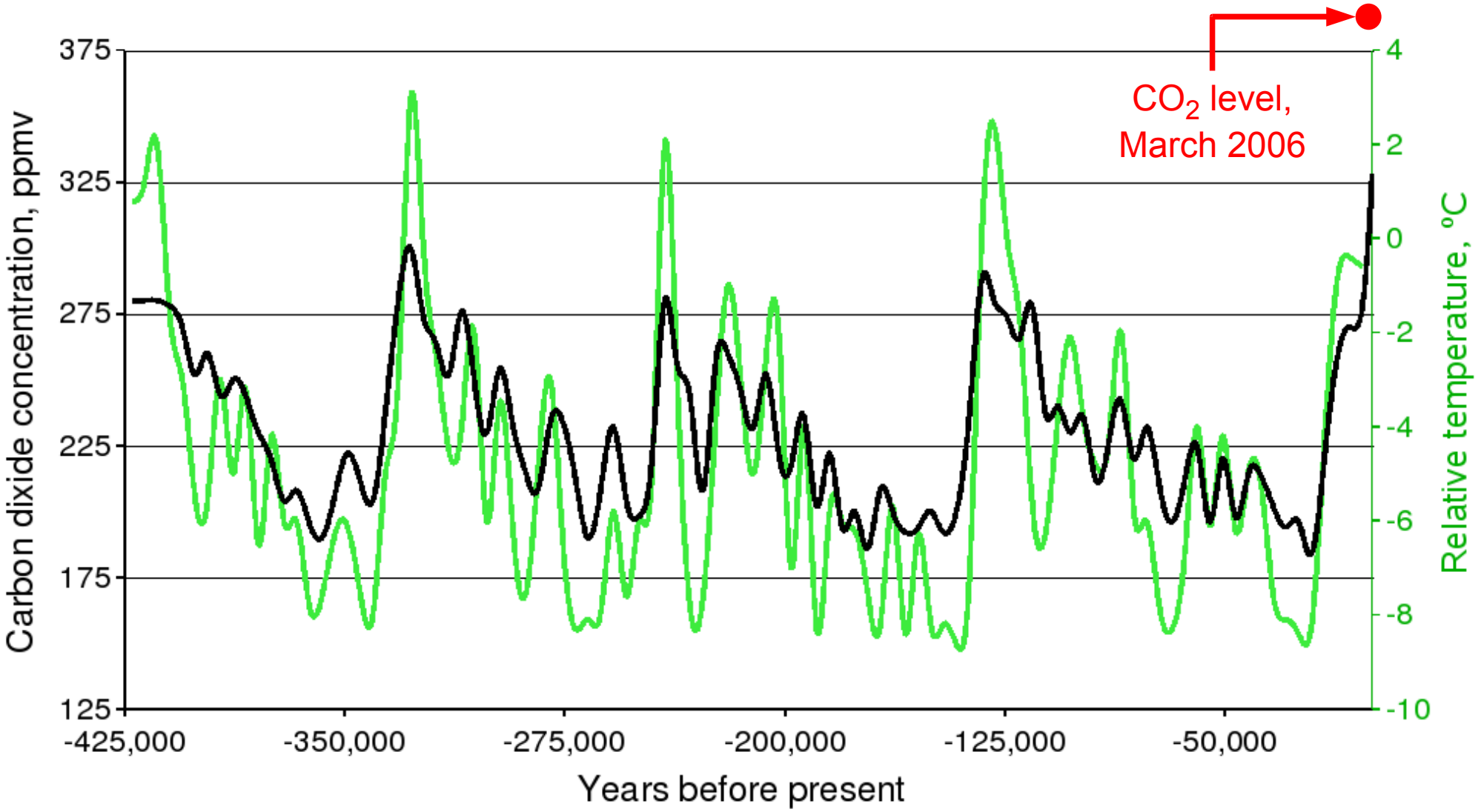


Consumption:	EJ
Oil	161
Natural Gas	104
Coal	123
Nuclear	26
Hydro	28
Total	**442**

88% fossil fuels!

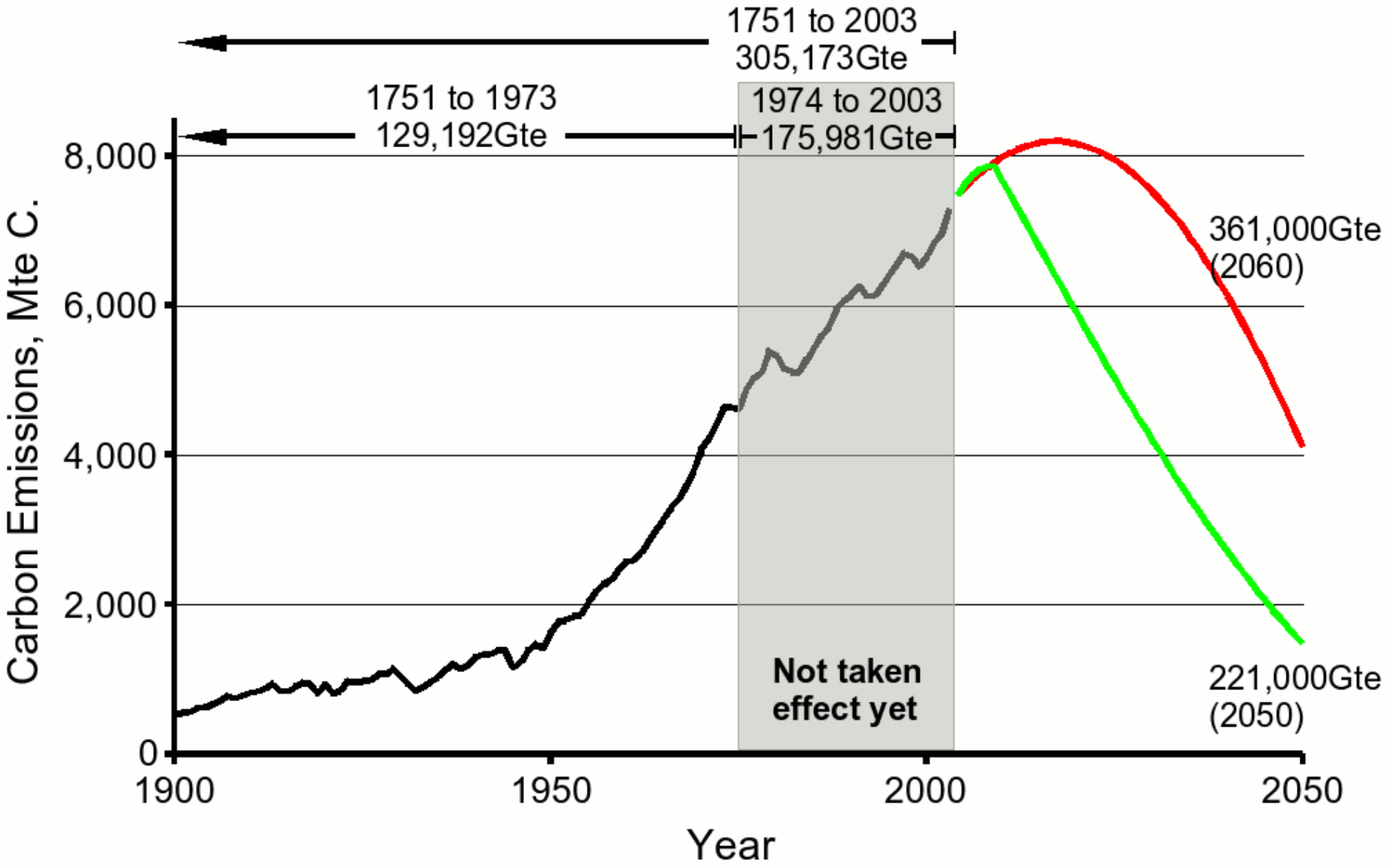
Source:
BP

Carbon and the Historical Climate

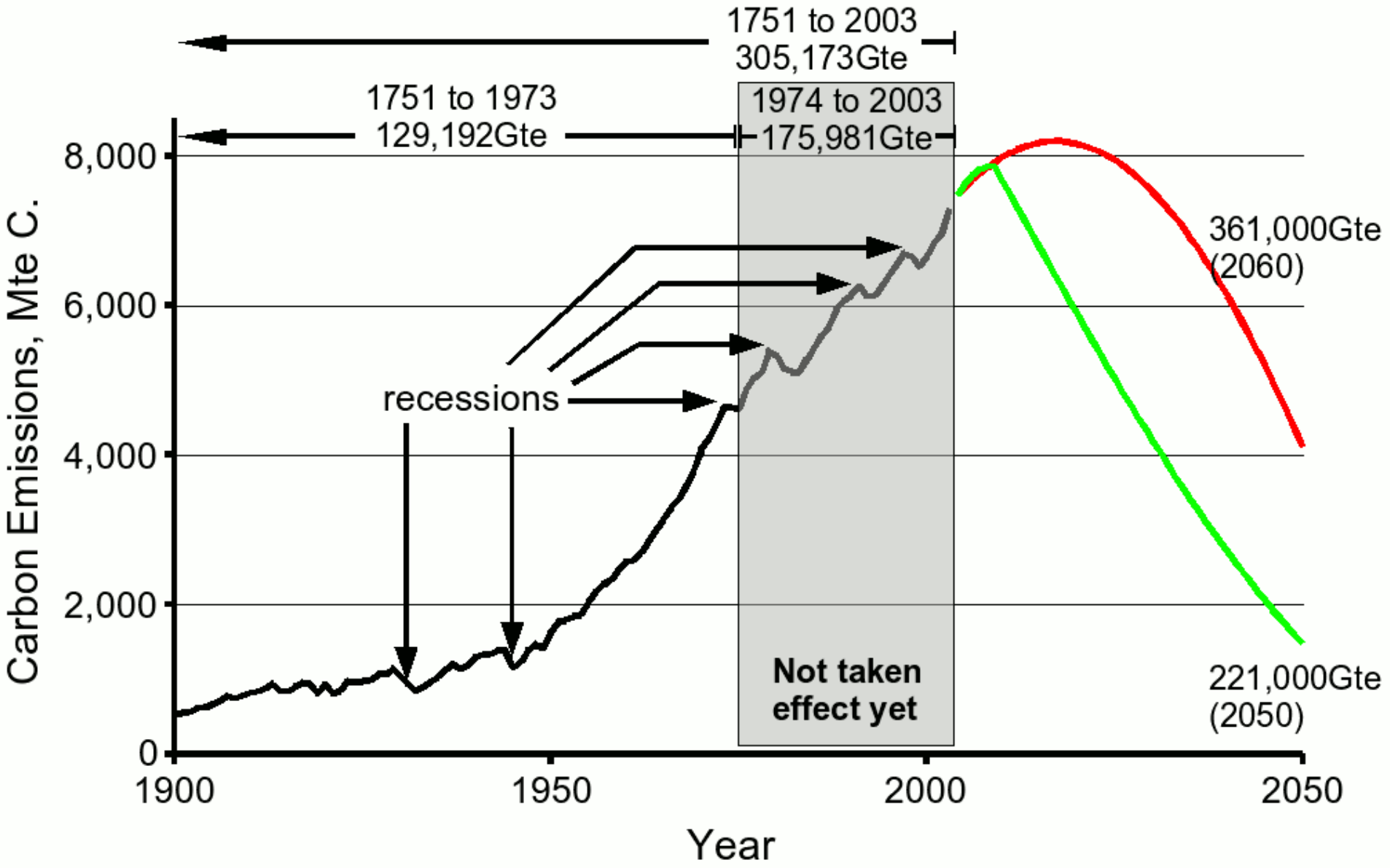


Source:
RCEP/Hadley Centre

How Much Carbon?

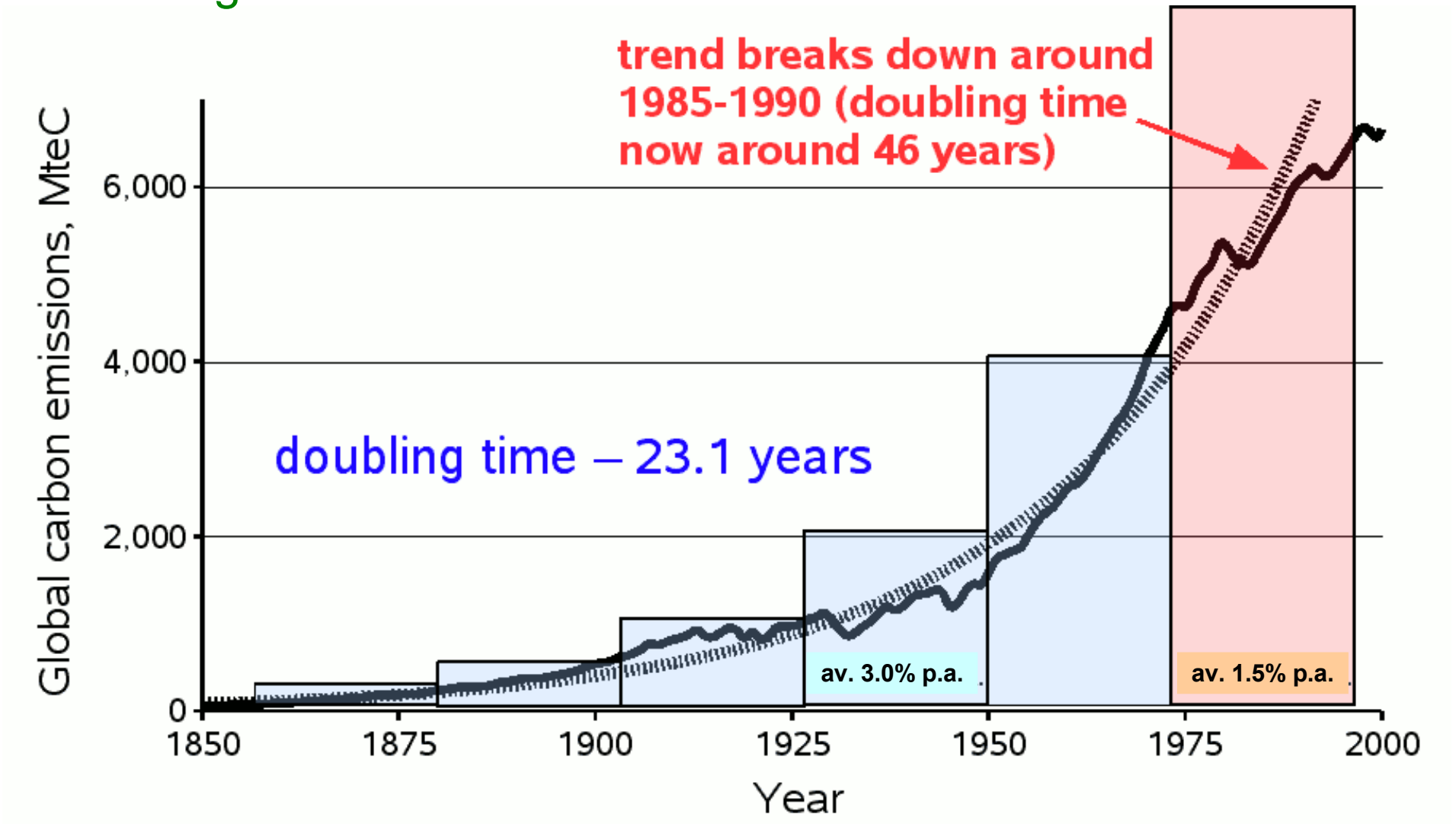


How Much Carbon?



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 Real Problem...

"In 2004, carbon dioxide emissions were 4 per cent below their 1990 level and latest projections show that carbon emissions will be 14 per cent below 1990 levels by 2010. Carbon emissions per unit of UK output fell 31 per cent between 1990 and 2004, but this improvement was largely offset by a 39 per cent increase in the size of the economy.

Energy – Its Impact on the Environment and Society 2005
Department of Trade and Industry 2005

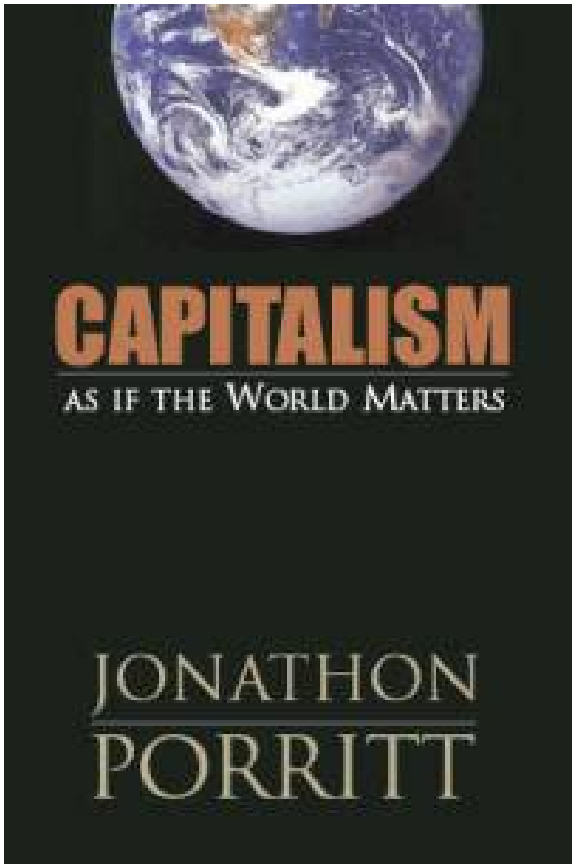
In short,
the problem is the growth in consumption, not carbon

Solutions...

"Incremental change is the name of the game, not transformation.

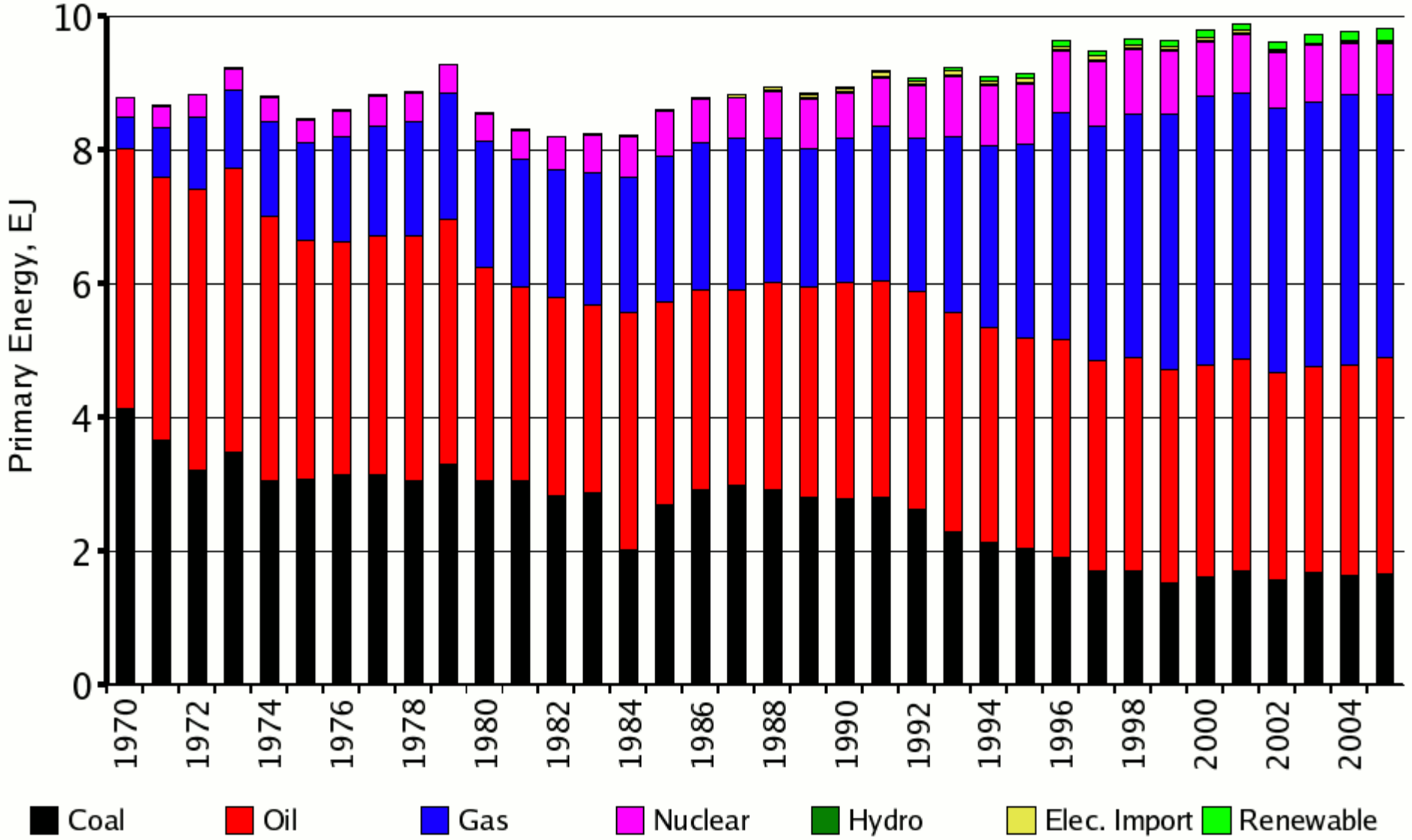
And that, of course, means that the emerging solutions have to be made to work within the embrace of capitalism. Like it or not, capitalism is now the only economic game in town....

For fear, perhaps, of arriving at a different conclusion, there is an unspoken (and largely untested) assumption that there need be no fundamental contradiction between sustainable development and capitalism."



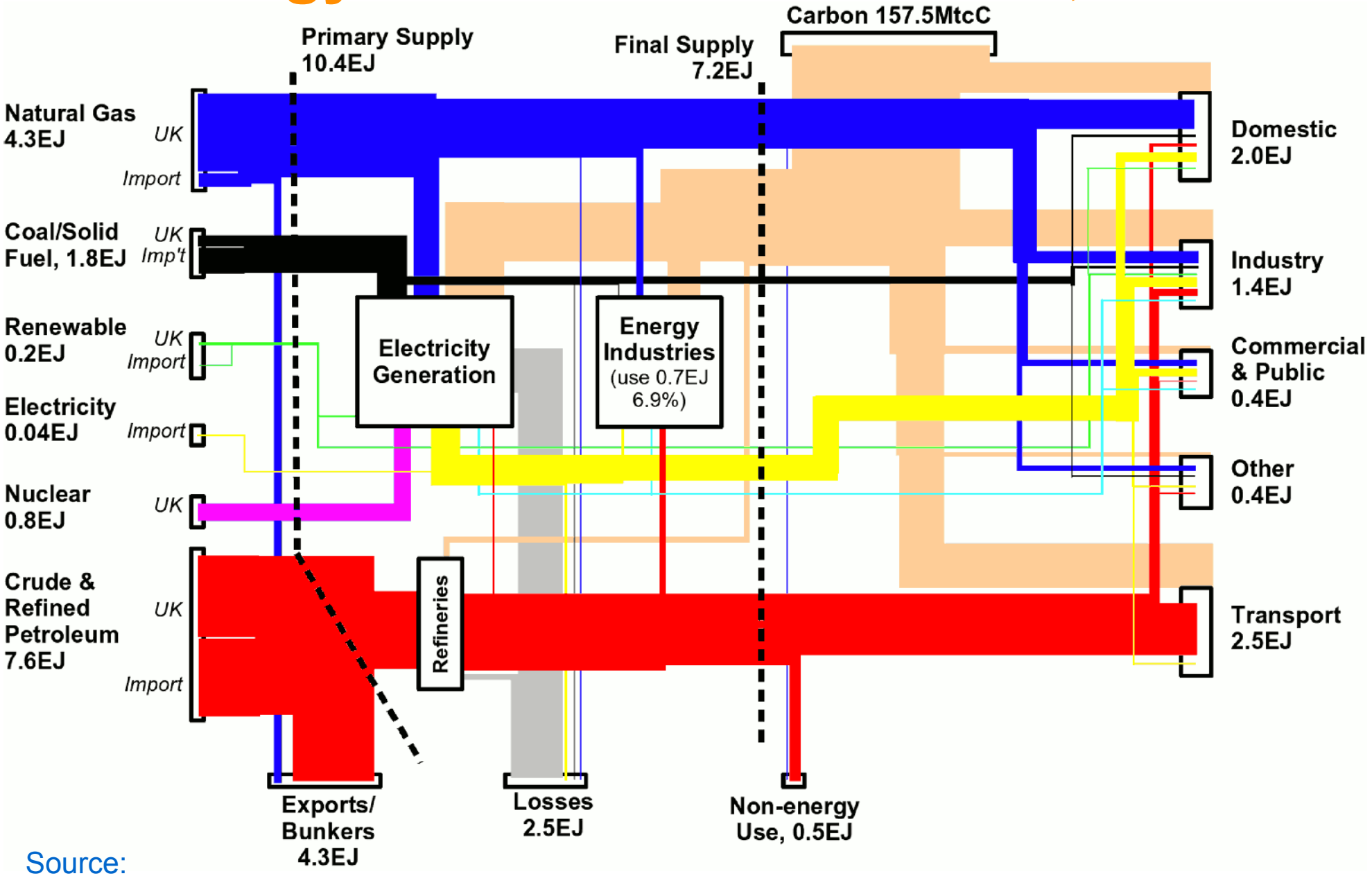
Source:
Page xiv, *Capitalism as if the World Matters*, Jonathon Porritt, 2005

UK Primary Energy Supply, 1970-2005



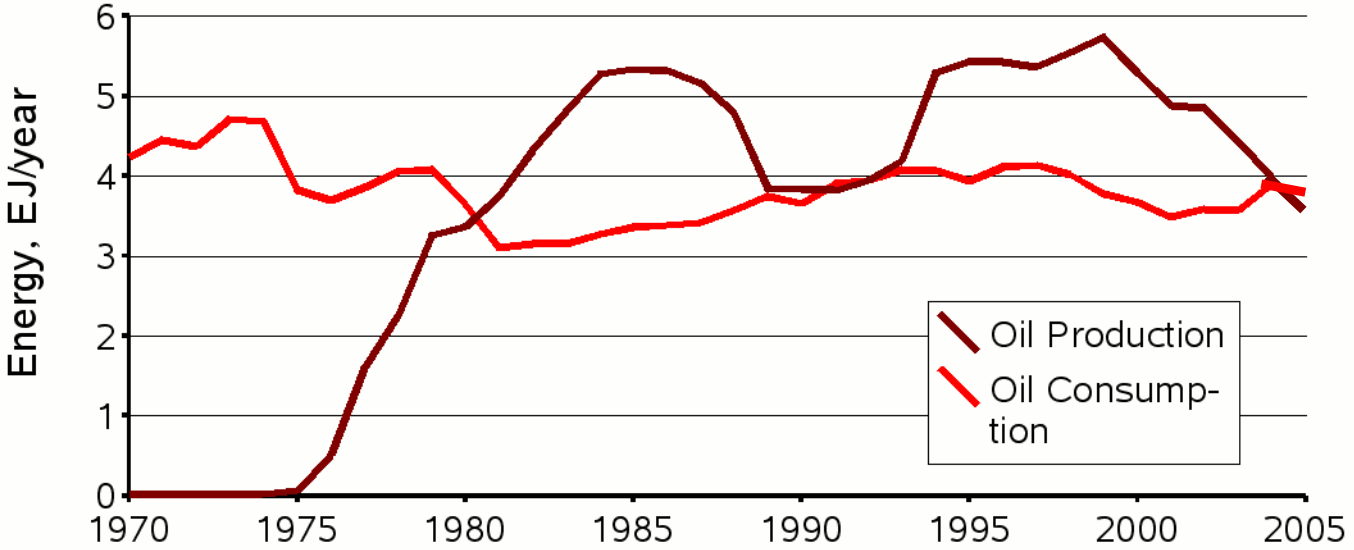
Source:
Digest of UK Energy Statistics 2006, DTI

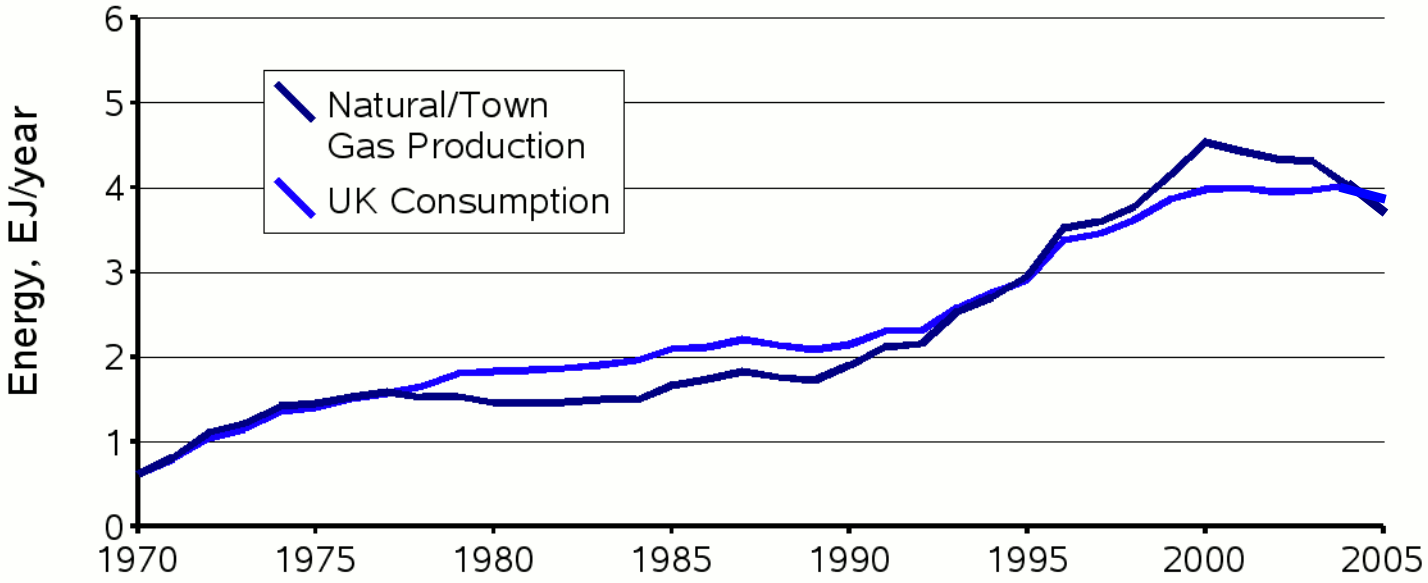
UK Energy and Carbon Flowchart, 2005



Source:
Compiled from Digest of UK Energy Statistics (2005) data

UK Oil and Gas Production



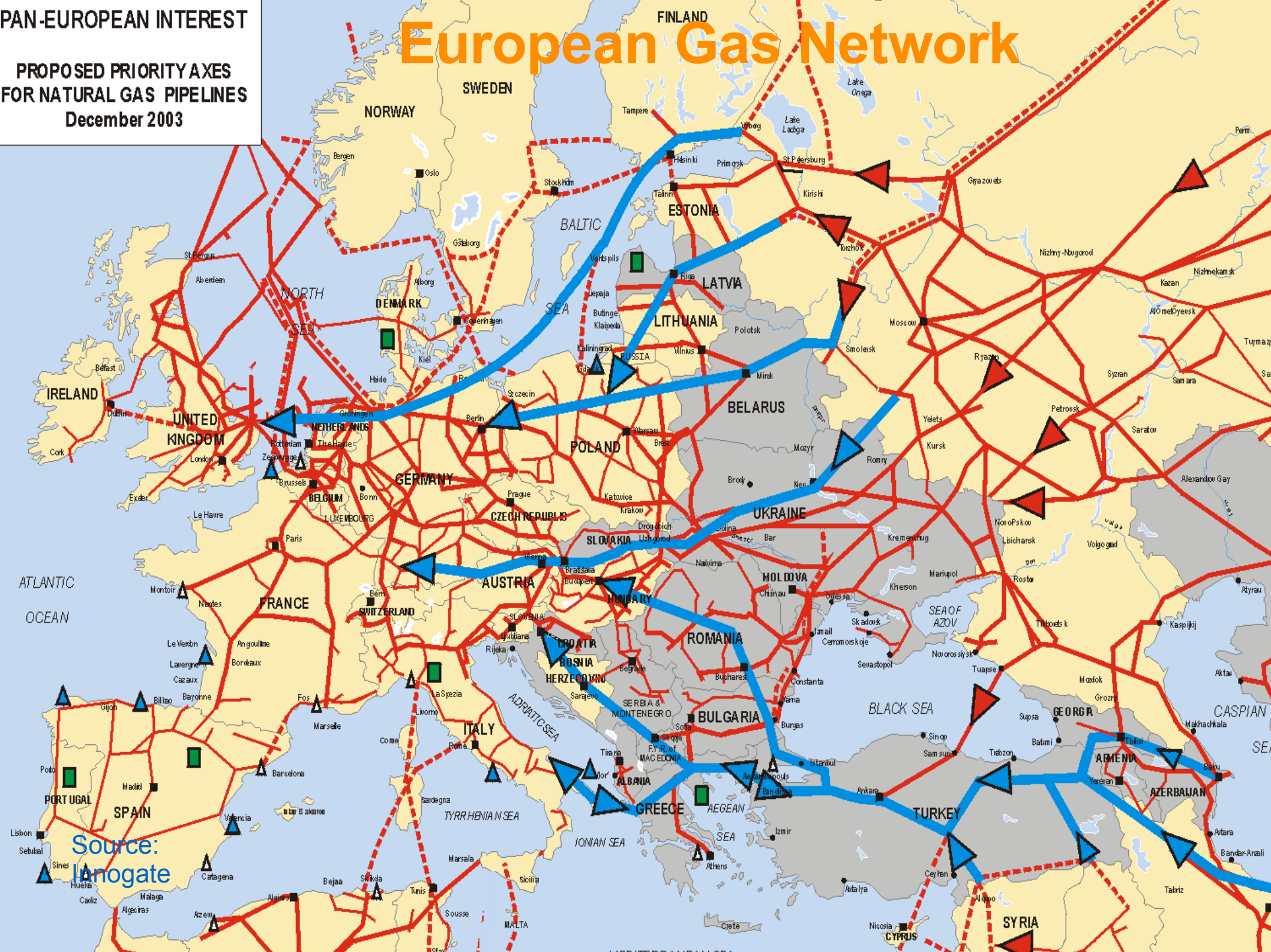


Source:
Digest of UK Energy Statistics 2005, DTI

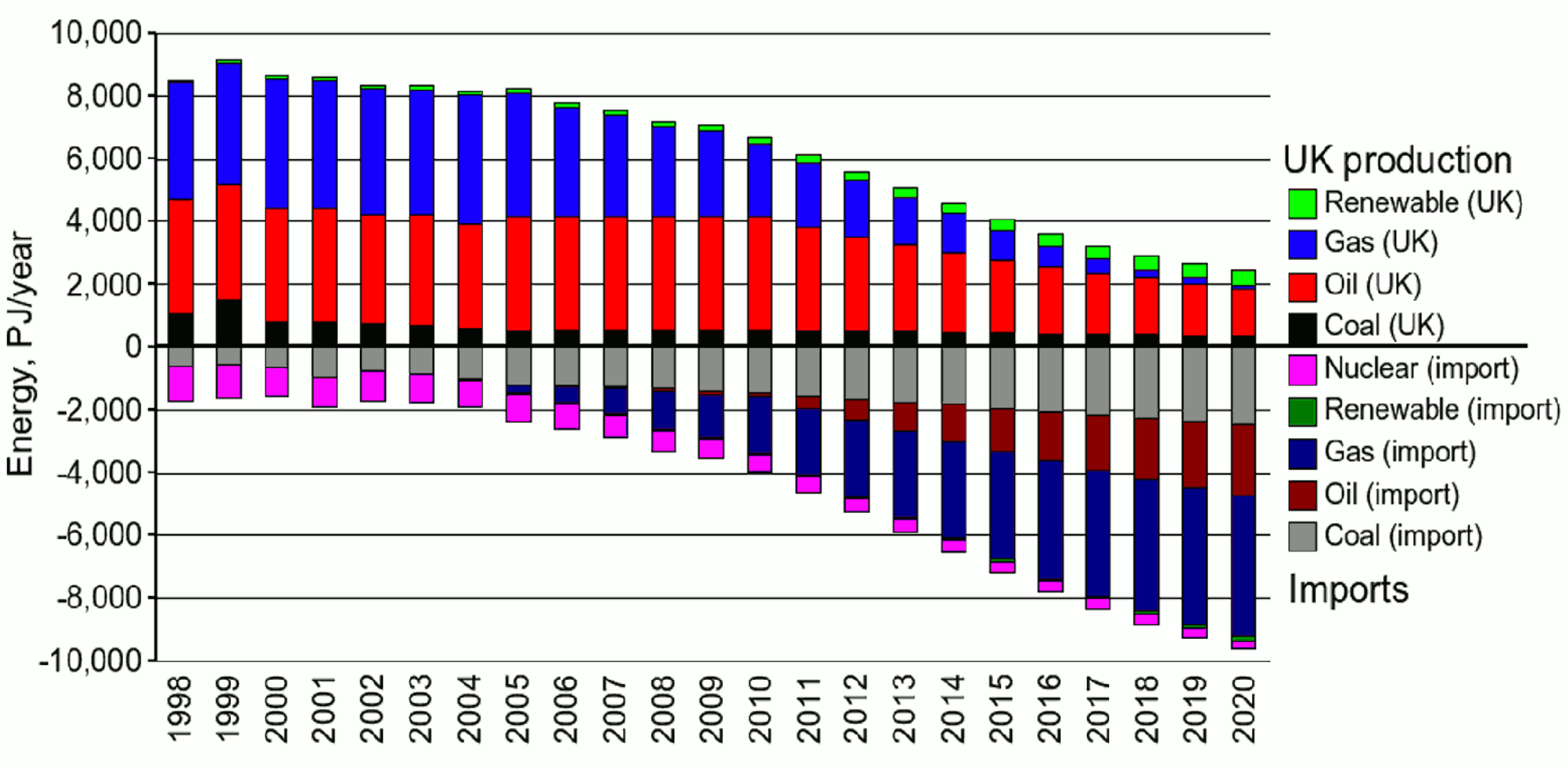
European Gas Network

PAN-EUROPEAN INTEREST

PROPOSED PRIORITY AXES
FOR NATURAL GAS PIPELINES
December 2003



Change in Imports



Source:
UK Joint Energy Security of Supply (JESS) Committee

What's Renewable?

Wave

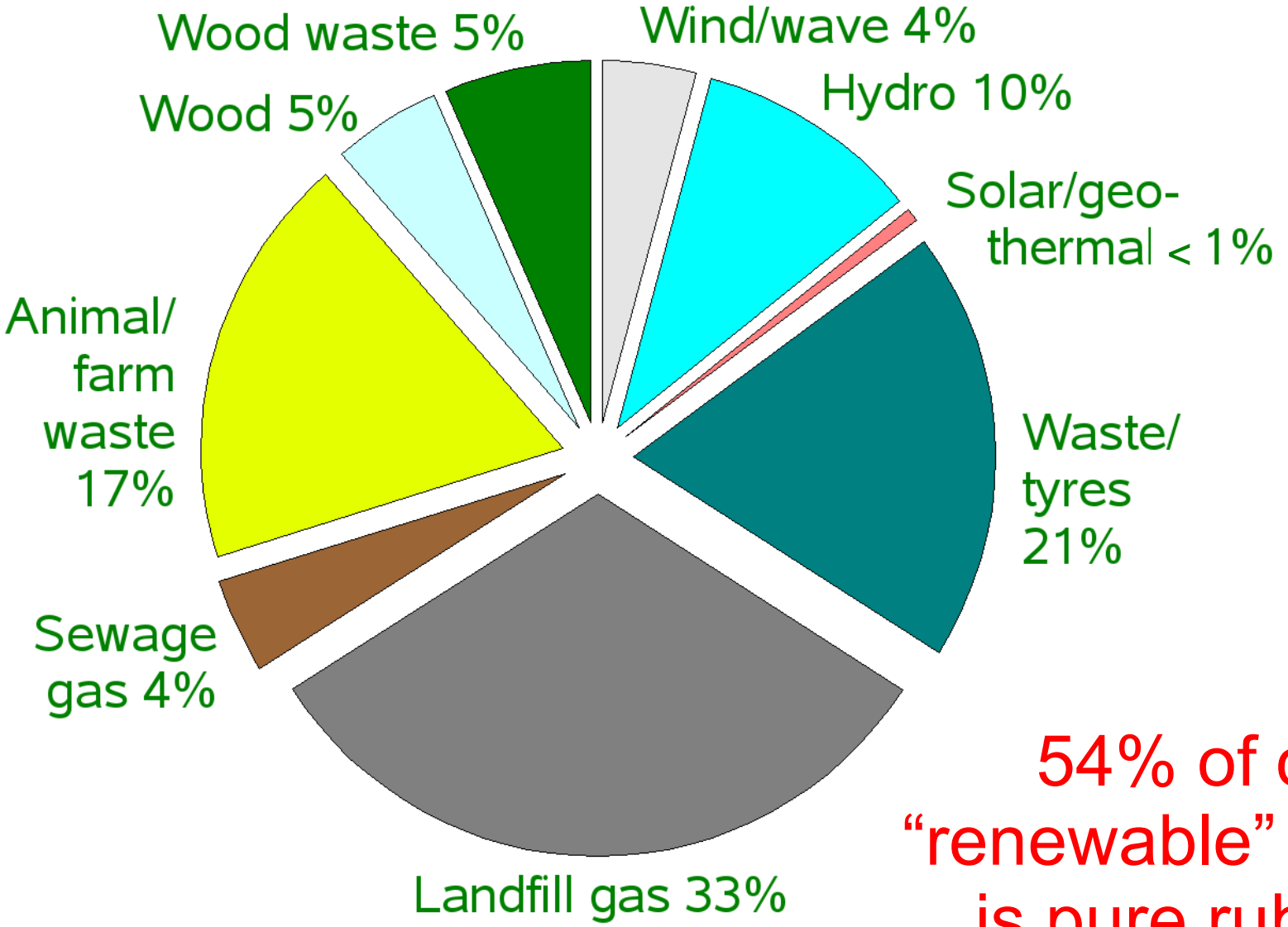
Wind

Hydro

Solar PV

Thermal solar

UK “Renewable” Energy, 2005

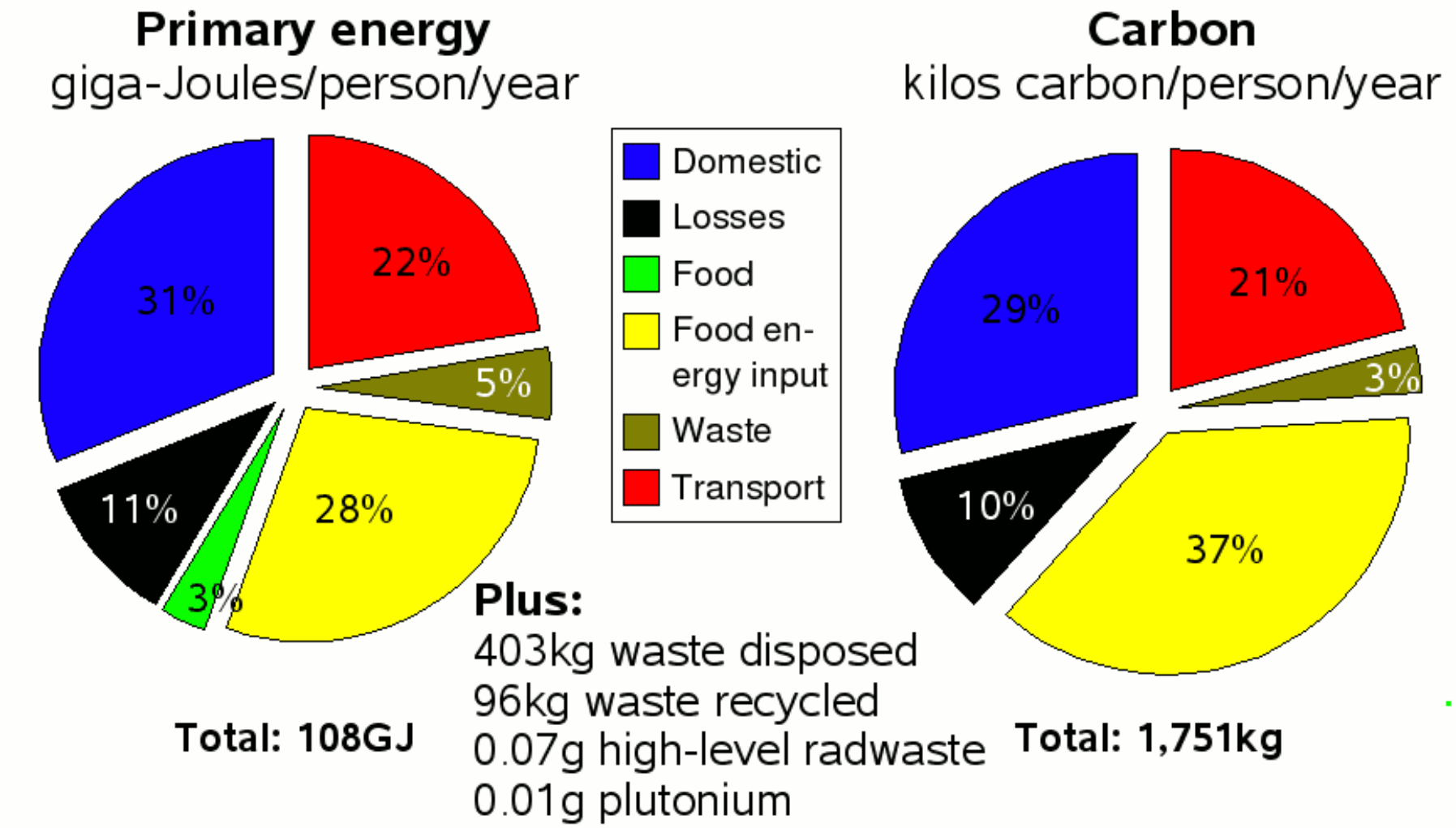


54% of our “renewable” energy is pure rubbish!

Source:
Digest of UK Energy Statistics 2006, DTI

Domestic Energy Use

Energy and carbon levels recalculated for the “average” individual

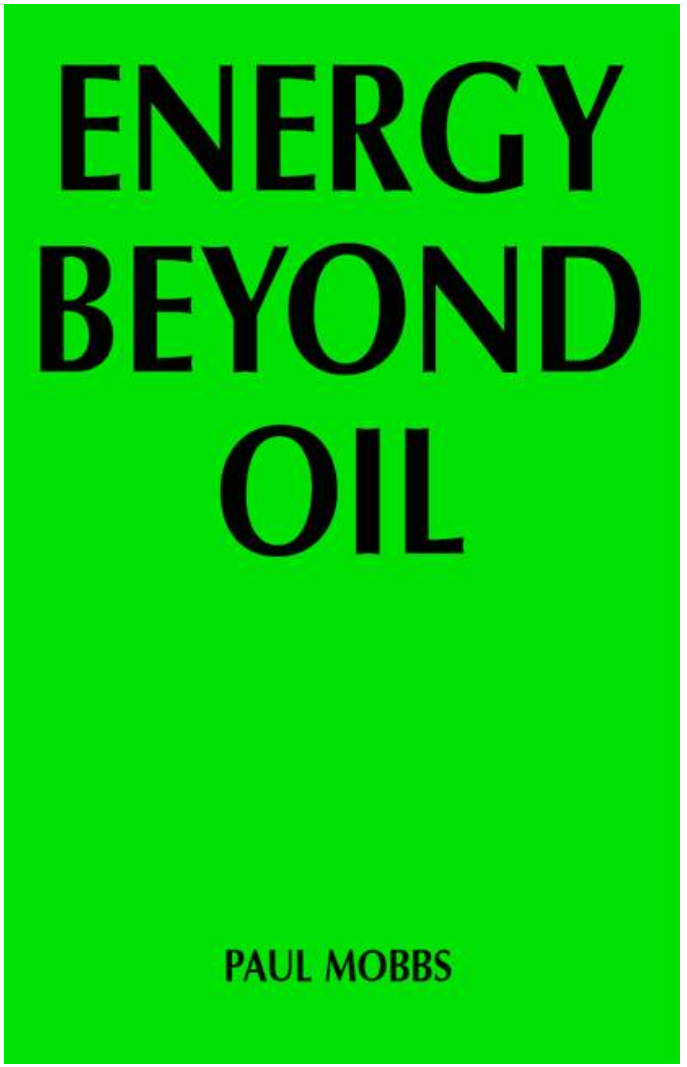


The Simple Solution...

Why not just

HAVE LESS?

Finally, read the book!



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