energypact conference
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Let‘s plan for a five fold increase of energy productivity world wide

International Panel
for Sustainable
Resource Management

Prof. Ernst Ulrich von Weizsäcker
Co-Chair

What is the problem?

7 billion people want decent life styles

Today‘s lifestyles are energy intensive

Providing enough energy for 7 billion people is not sustainable at US lifestyles.

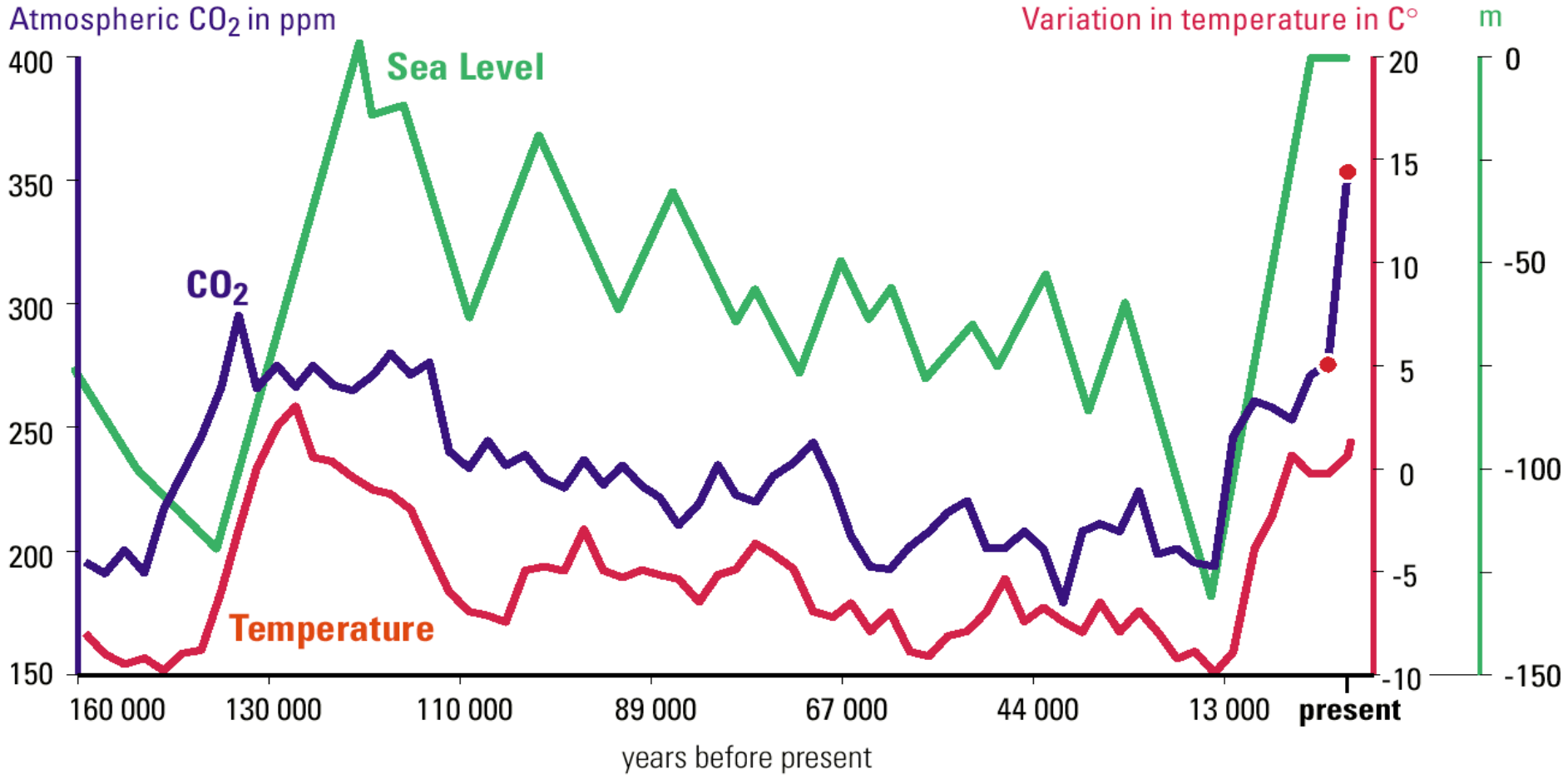
This leads to two big challenges:

(1) Increasing resource productivity fivefold (for climate also carbon-free energy counts)

(2) Developing a mechanism of fair distribution

Let us briefly look at the nature of the climate challenge

The most alarming feature of global warming is the potential sea level rise



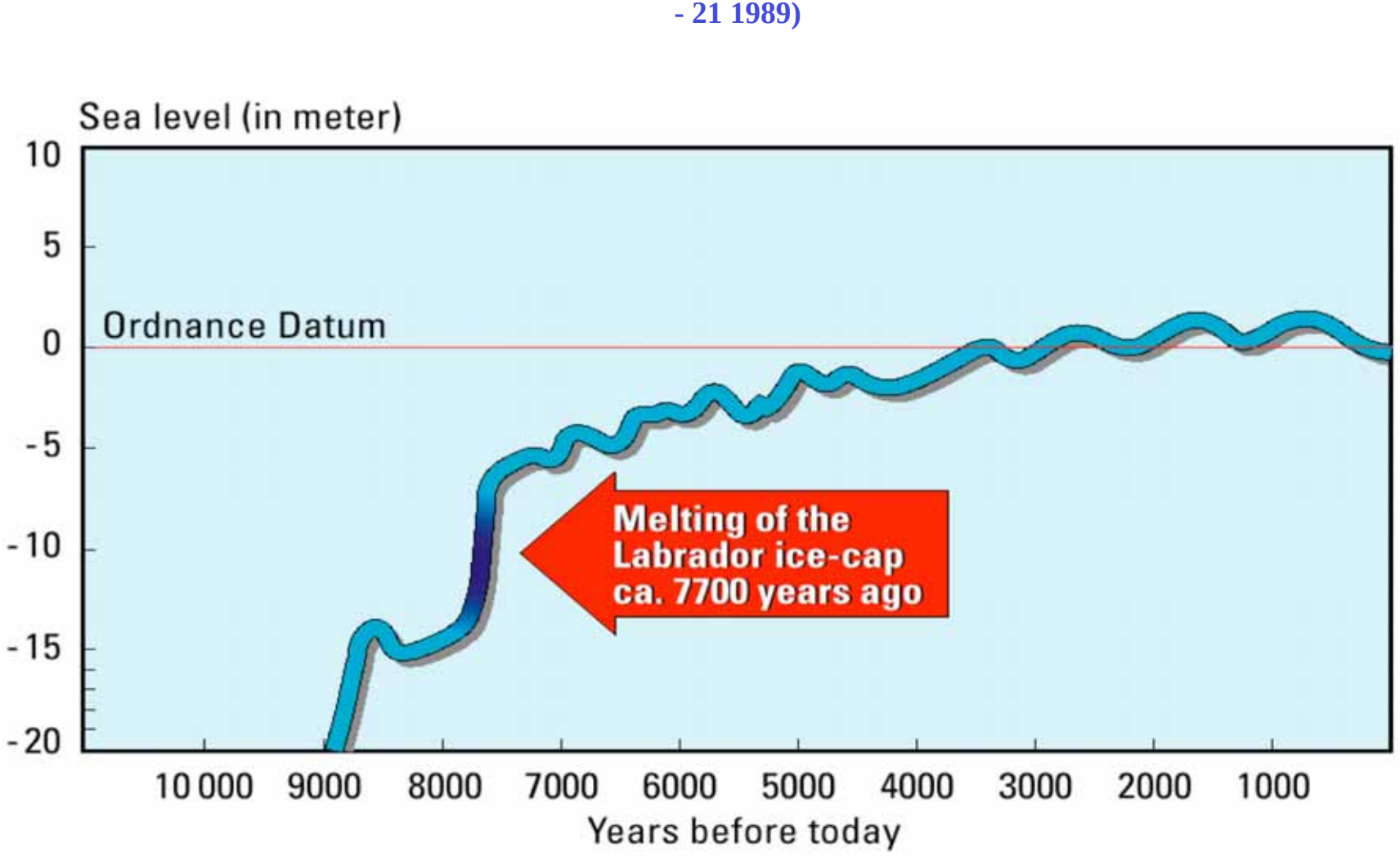
Italy during the last Ice Age (20 000 years ago)

.... and during the last Hot Age (2 million years ago)

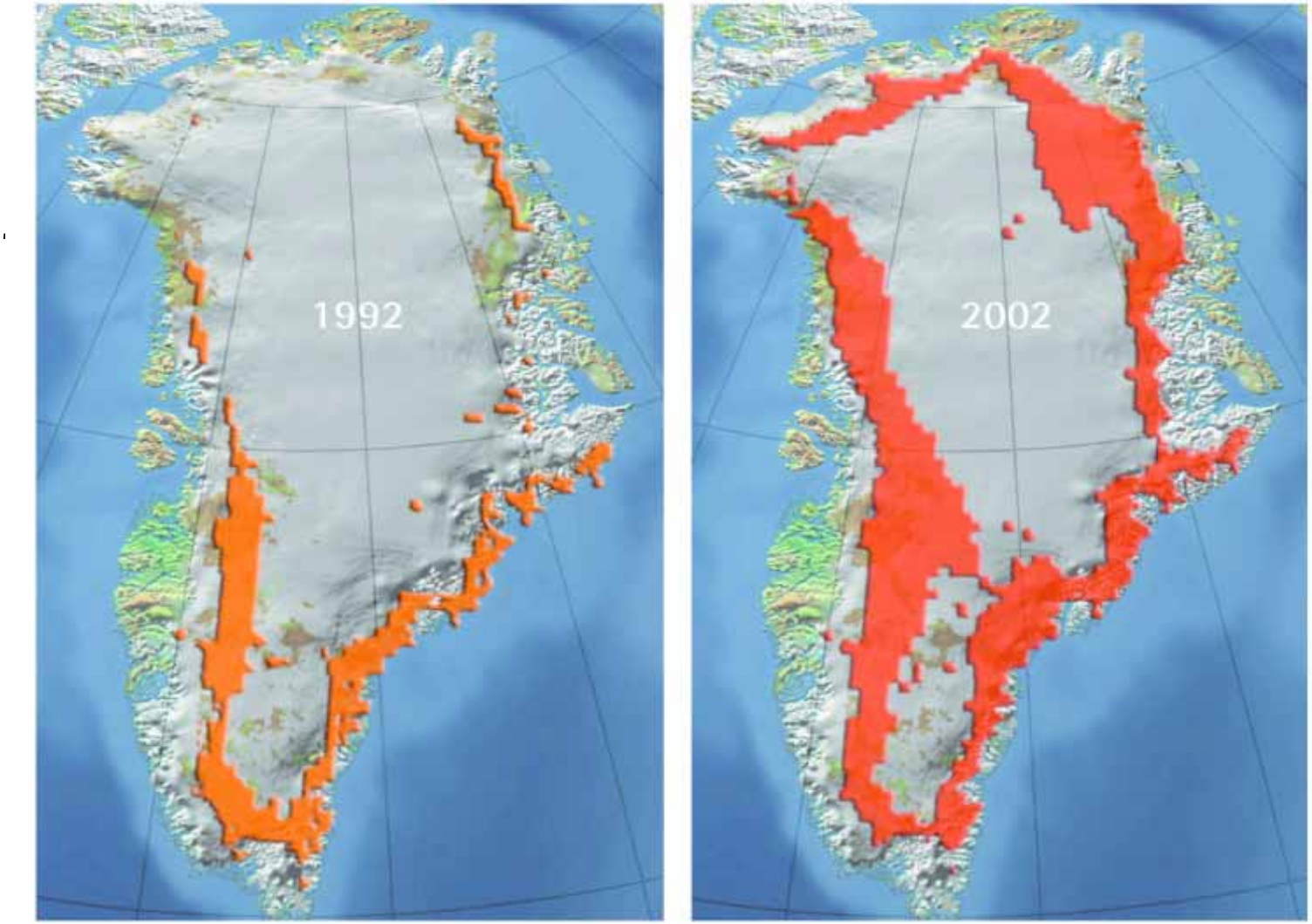
today's coast line

Sea level rise can take catastrophic speed!

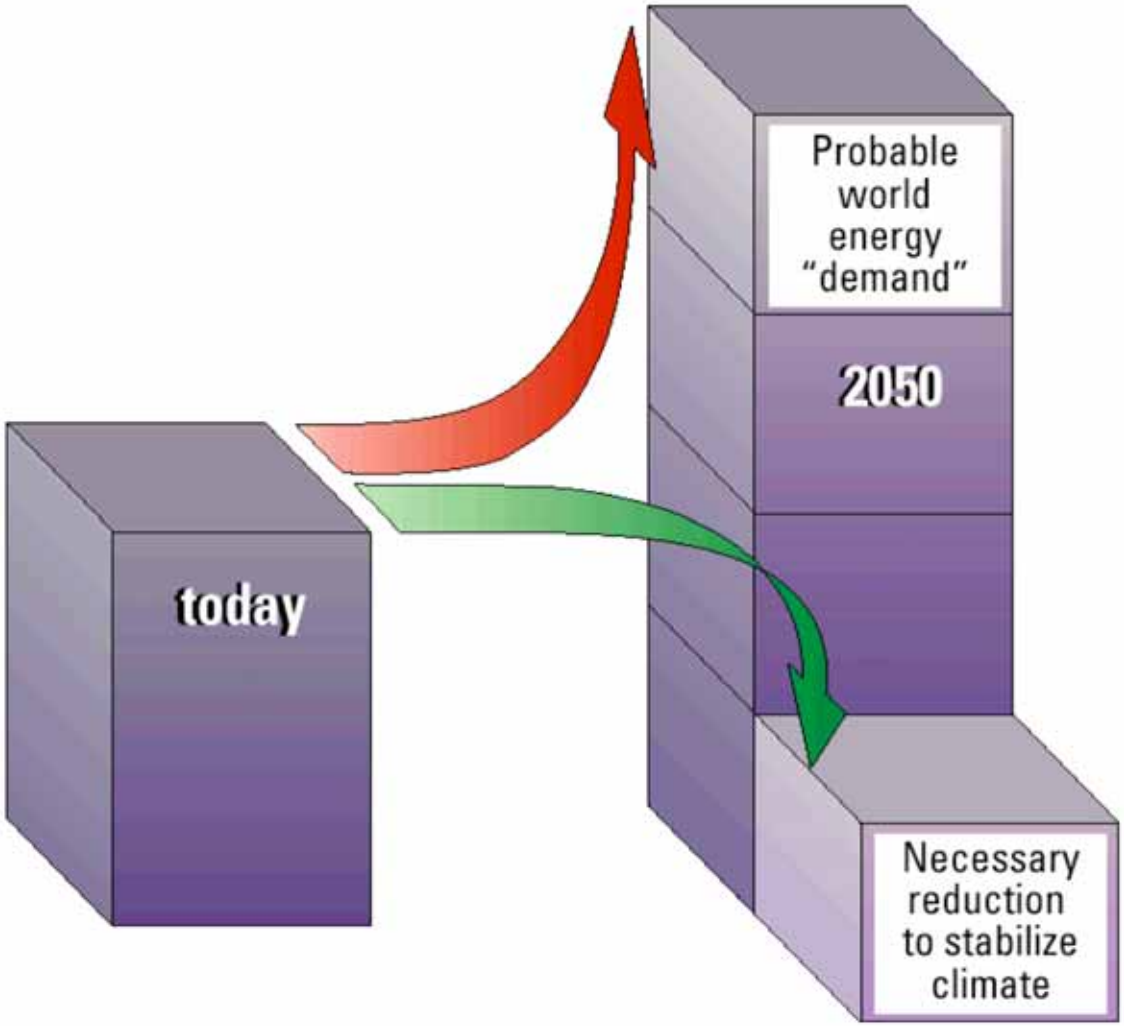
(after Michael Tooley. Global sea-levels: floodwaters mark sudden rise. Nature 342 (6245), p 20 - 21 1989)



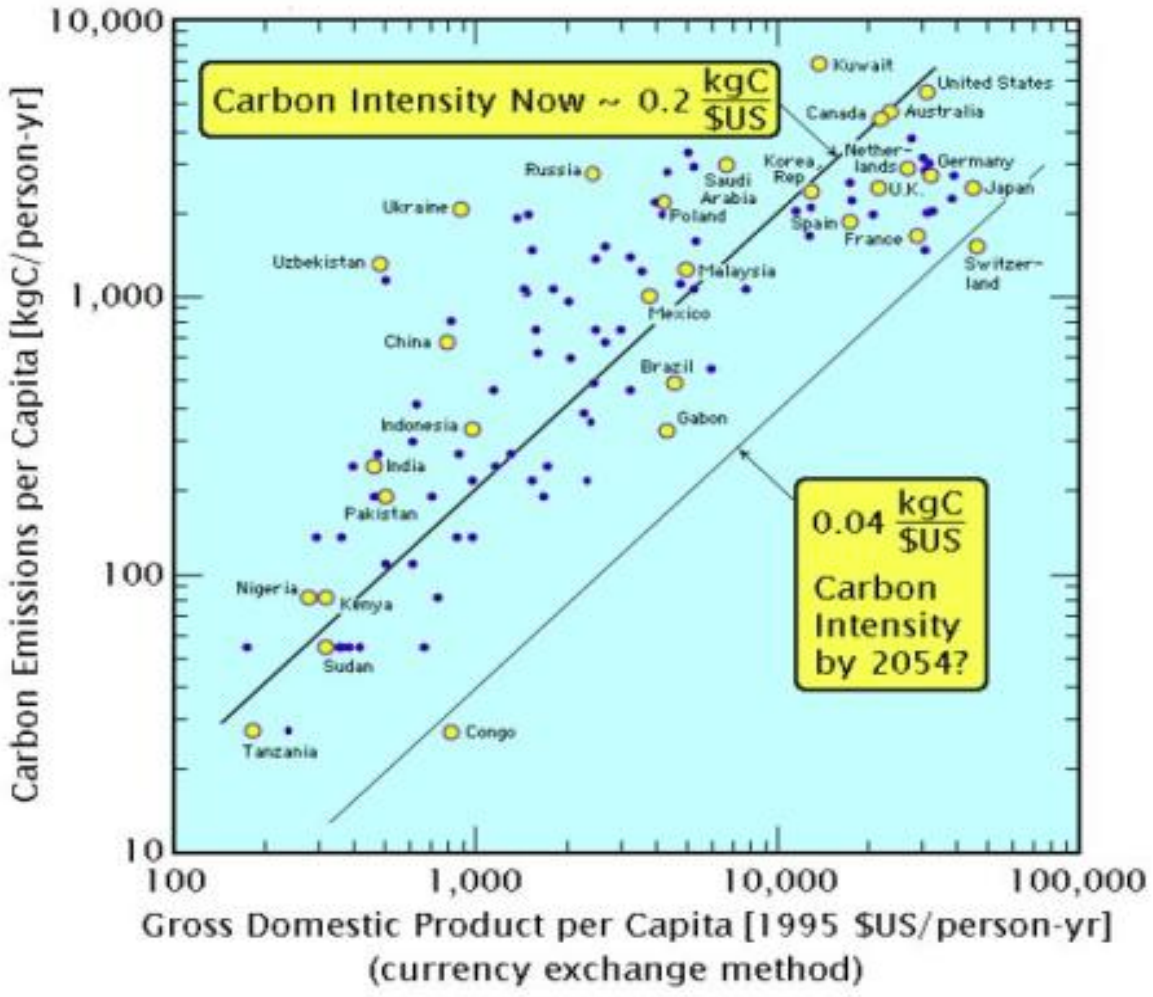
Freshwater cover over Greenland during Summers 1992 and 2002



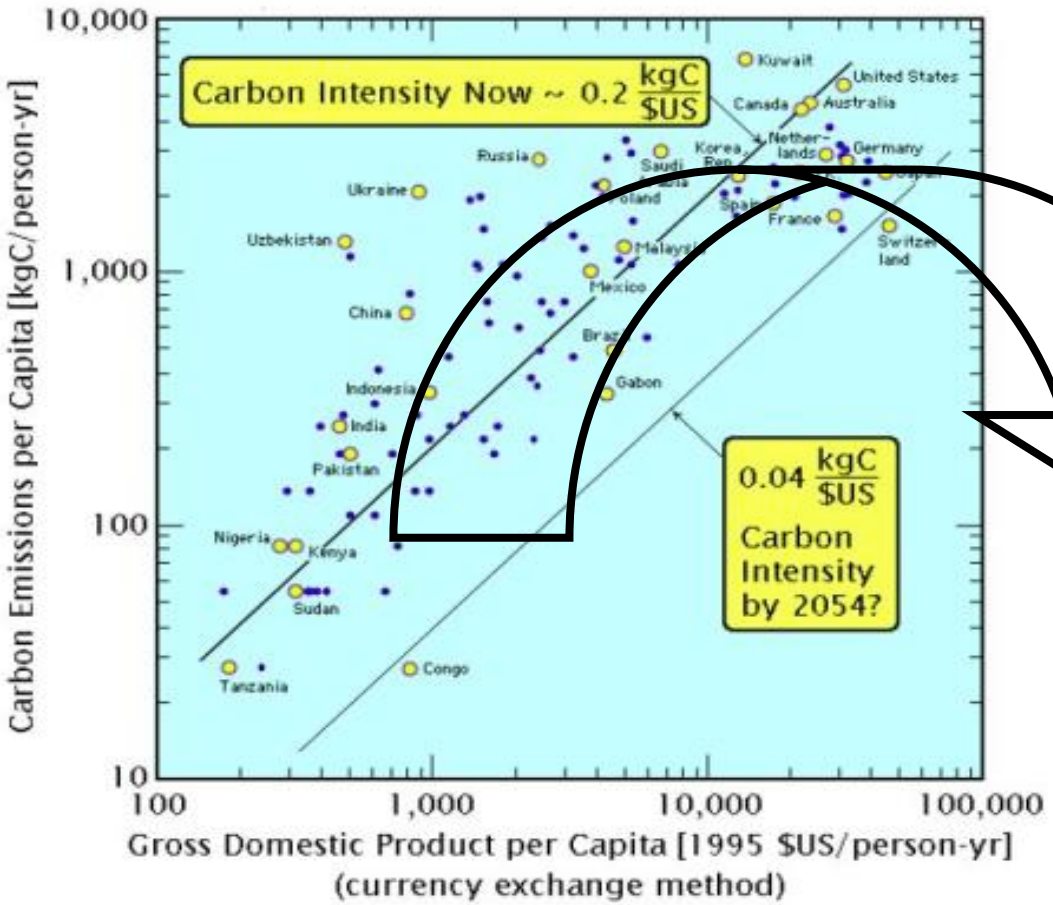
To stabilize greenhouse gas concentrations, emissons have to be cut in half, - but the world is heading for a doubling!



Conventional wisdom: More wealth, more carbon intensity

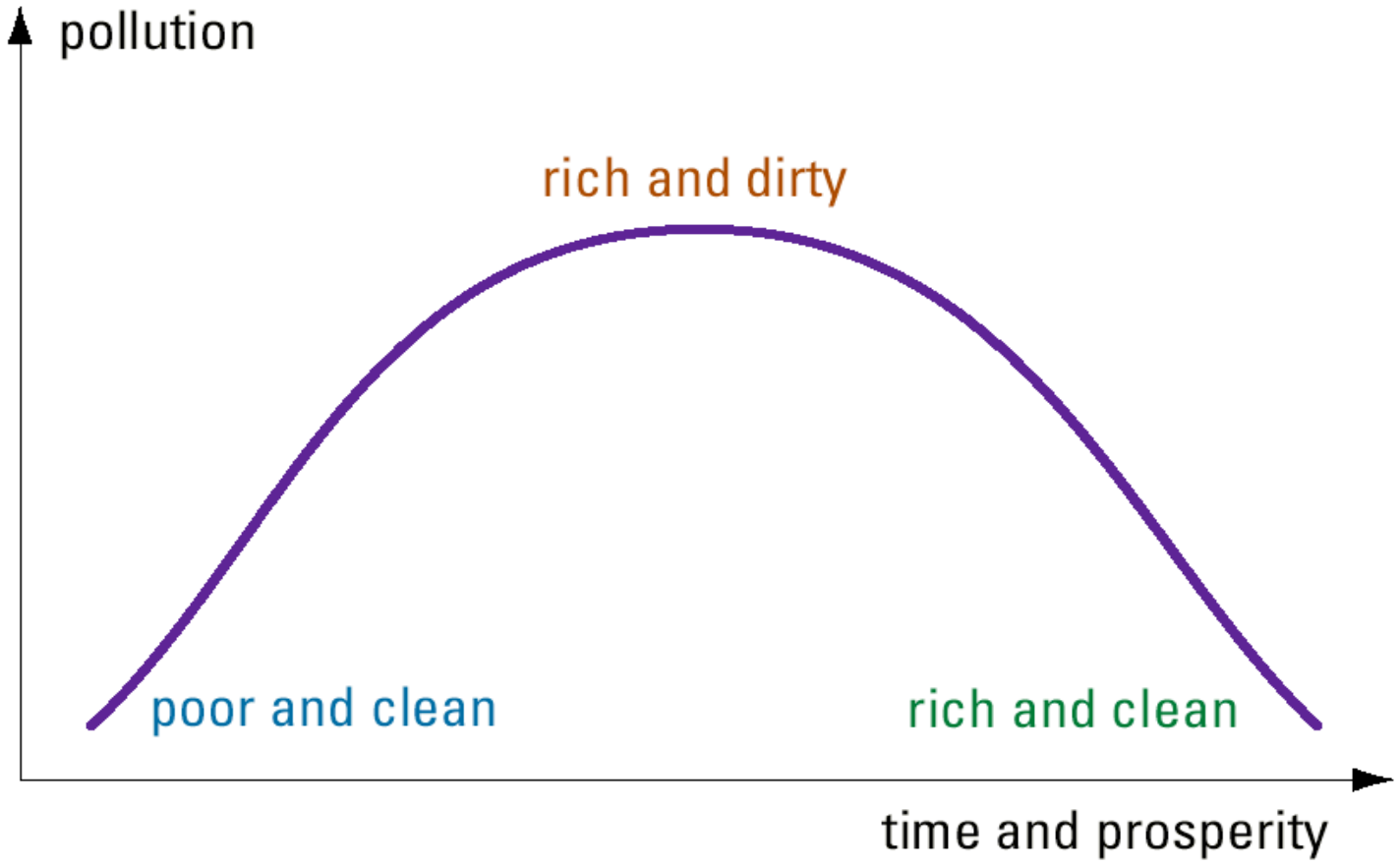


Escaping from this logic means we need a „Kuznets Curve“ of decarbonization!



„rich and carbon free“

The existing paradigm of a Kuznets curve of pollution



How do we get there?

Three options exist:

- **Reduce carbon intensity of energy**
- **Reduce energy intensity of wealth**
- **Reduce wealth**

I suggest this distribution:

- 30% Reduce carbon intensity of energy
- 65% Reduce energy intensity of wealth
- 5% Reduce wealth (such as weekend hopping to Teneriffa or Bahamas)

Conventional thinking suggests

- 70% Reduce carbon intensity of energy

  (solar, wind, nuclear, CCS)

- 15% Reduce energy intensity of wealth

- 15% Reduce wealth ("we all have to pay a painful price")

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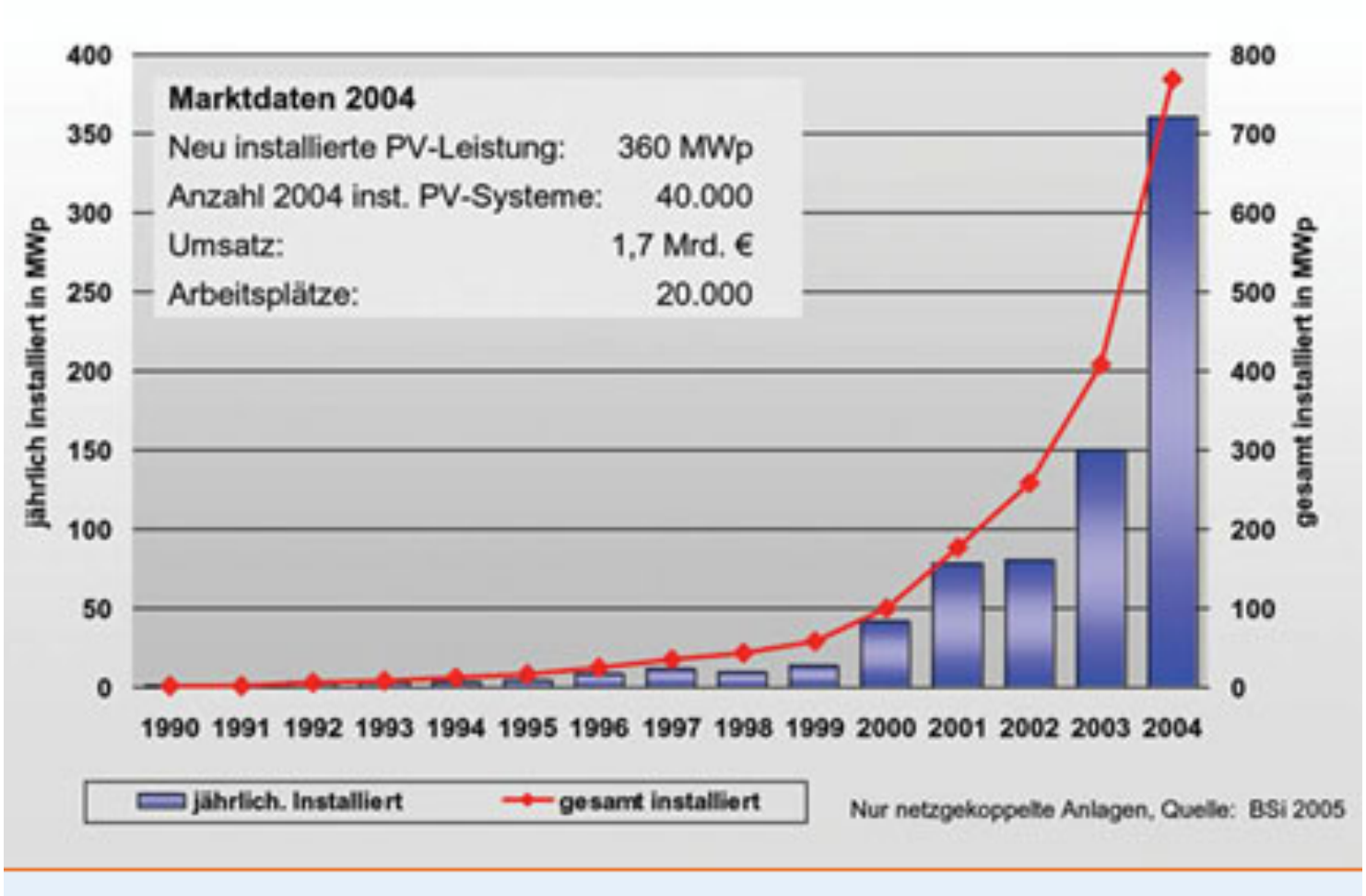
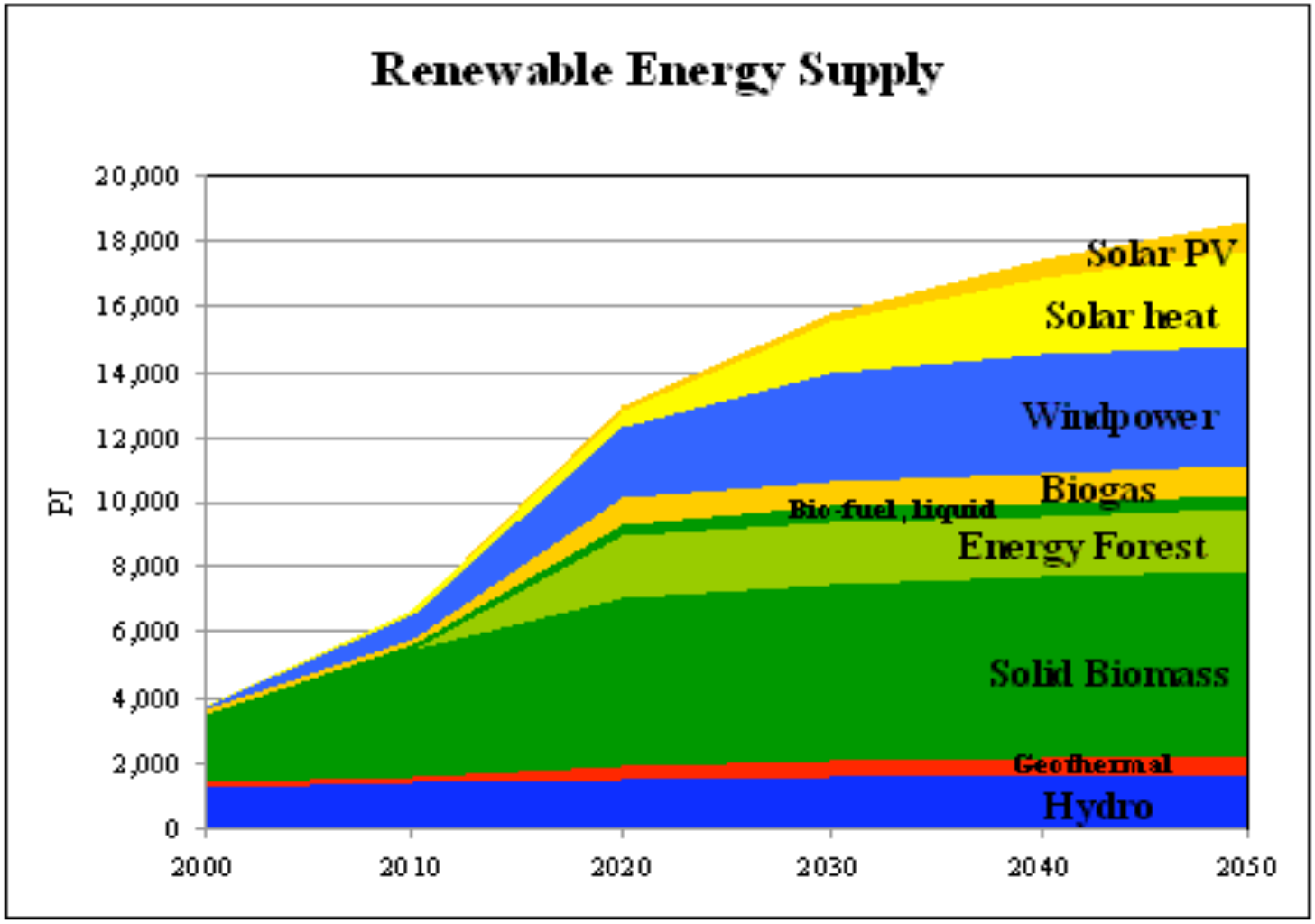
Renewables are on the rise, spurred by cost covering feed-in tariffs



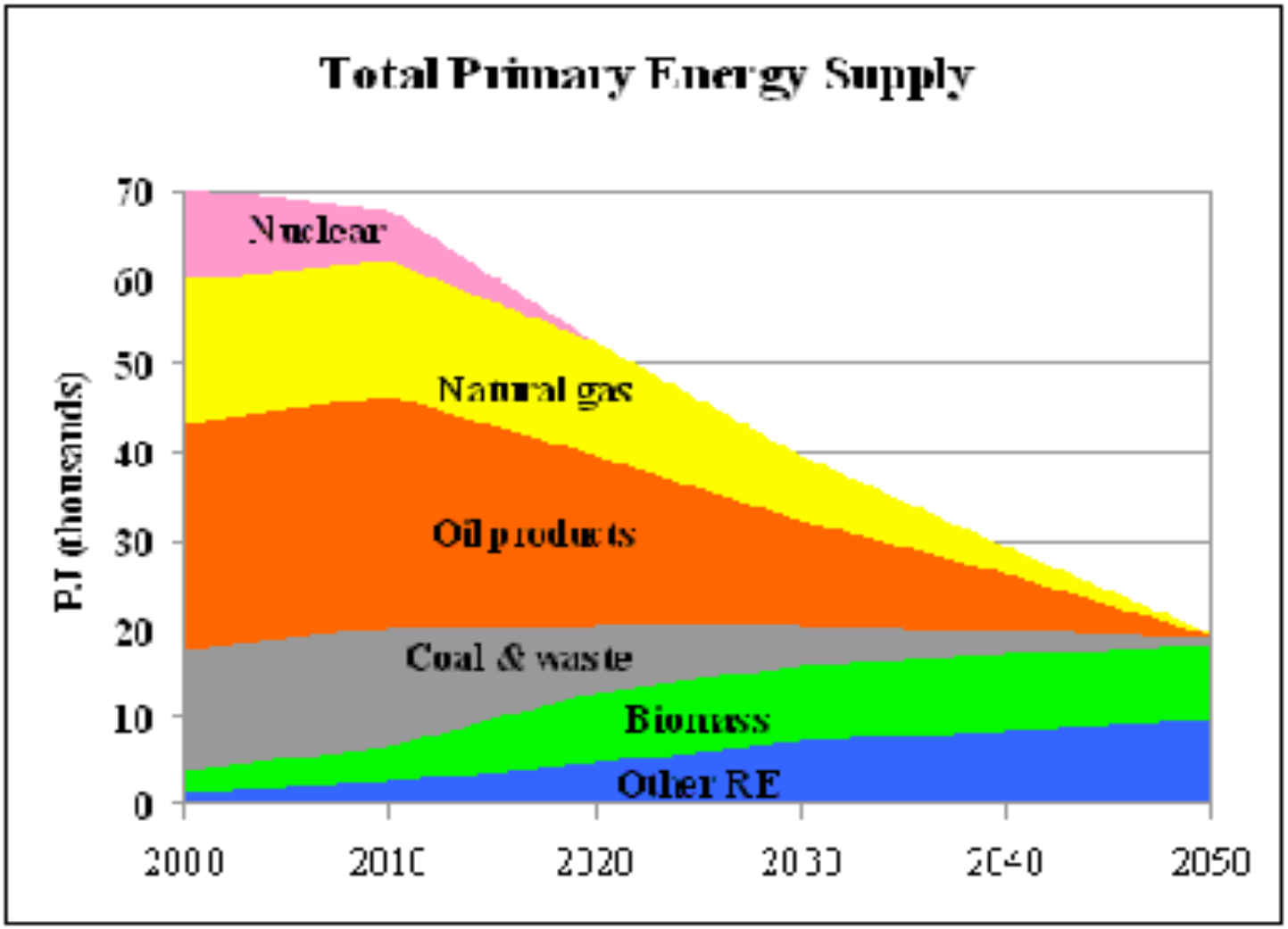
Source: BSi. 2005

Also the EU embraces renewables. But (realistically) they foresee flattening after 2020 (EU Vision 2050)



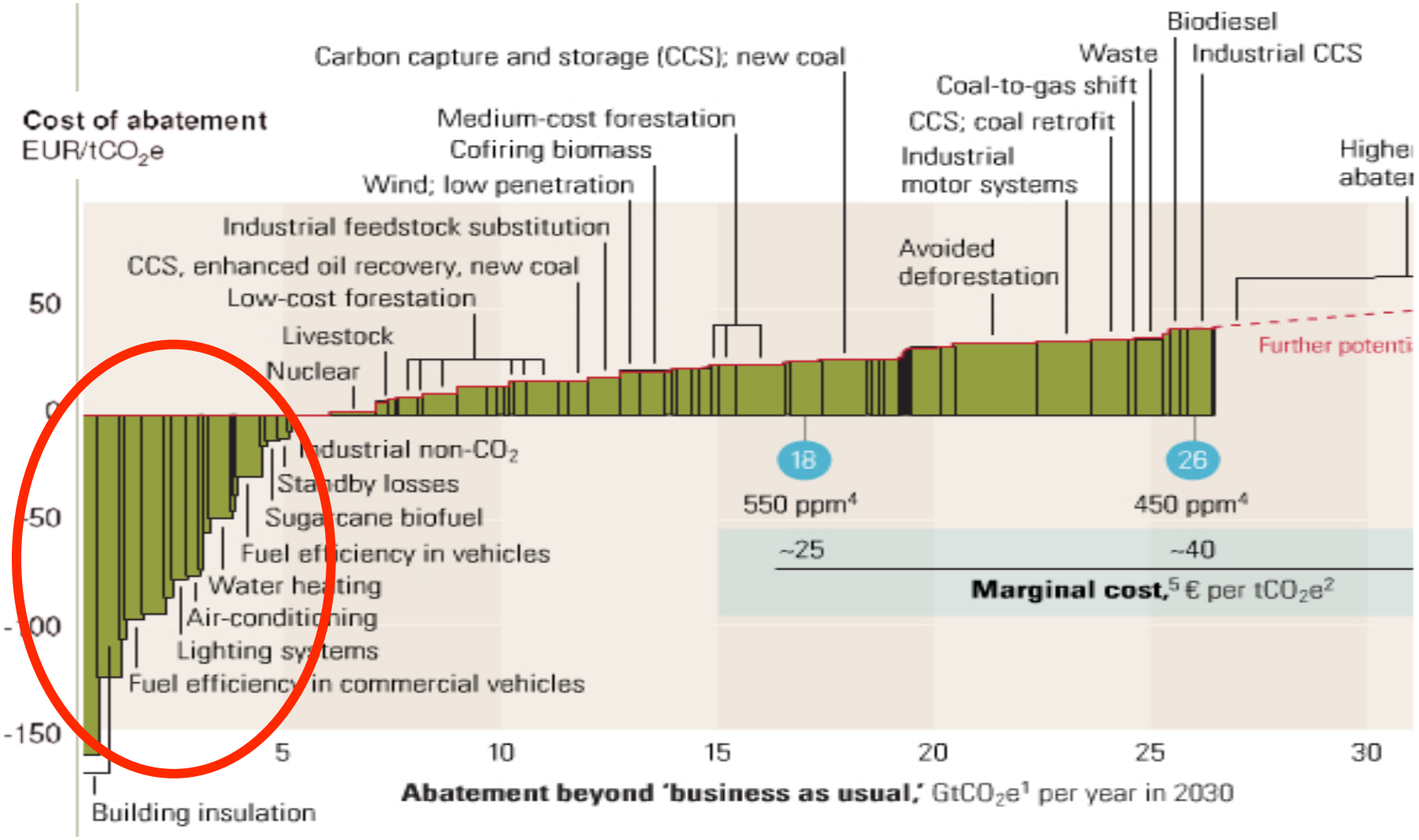
Source: EU-27 Renewable Energy Growth, Dec. 2007

The same EU Vision 2050 talks about a fourfold increase of energy productivity, allowing a phase-out of fossil & nuclear!



Source: Vision2050 for the EU 27, Brussels Dec. 2007

The win-win options relate to efficiency, not renewables



Source: MacKinsey & Vattenfall 2007

Let me now explain why I am so optimistic about energy efficiency - - which is the meaning of

“reduce energy intensity of wealth”.

Imagine a bucket of water weighing 10 kilograms.

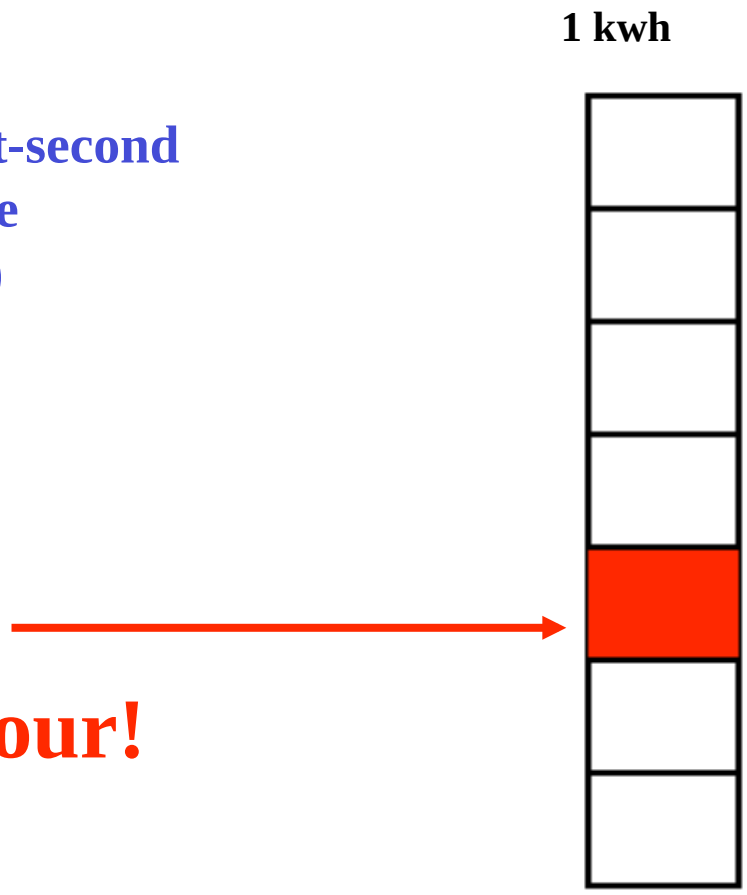
How many kilowatt-hours

would you need to lift that bucket from sea level up to the top of Mont Blanc?

Assuming that one Watt-second (Ws) is equivalent to one Newton-meter, (1 Joule)

the answer is:

One seventh
of a kilowatt-hour!
(≈ 520.000 Ws)



“Factor Four” (1995) offered fifty examples of quadrupling resource productivity

Amory Lovins‘ Hypercar is up to seven times more fuel efficient than today‘s cars

Today‘s cars
6-10 l/100km

Hypercar
1 l/100km

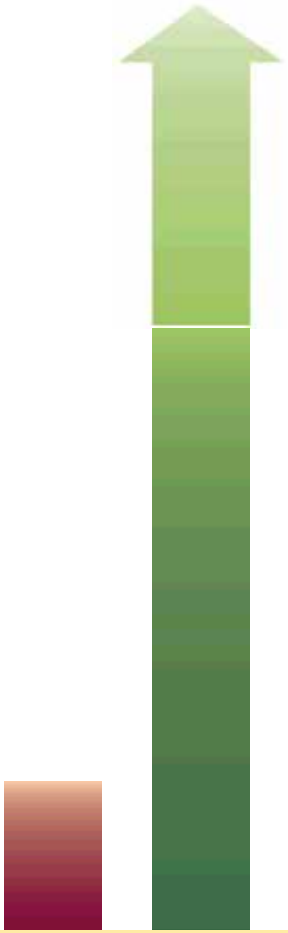
Energy efficiency

House in the Alps

Amory Lovins‘ Rocky Mountain Institute

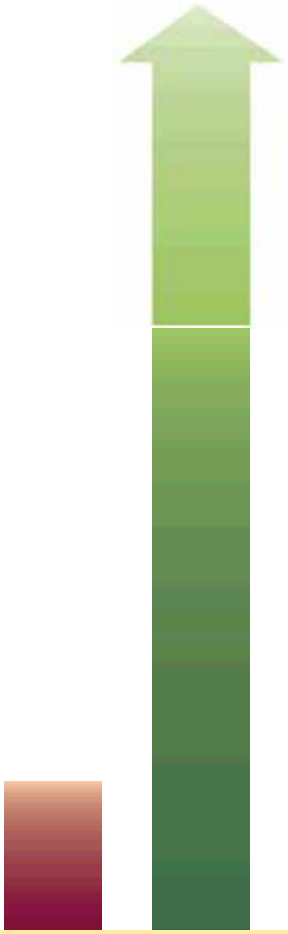
Heating efficiency

Solar „passive houses“ save 90% of heating costs



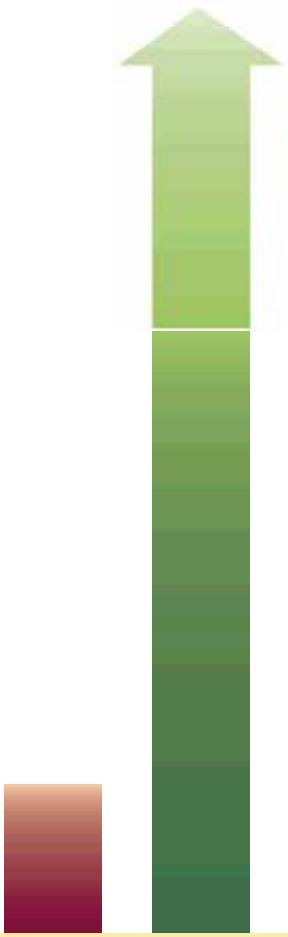
Energy and material efficiency

From incandescent to fluorescent lightbulbs



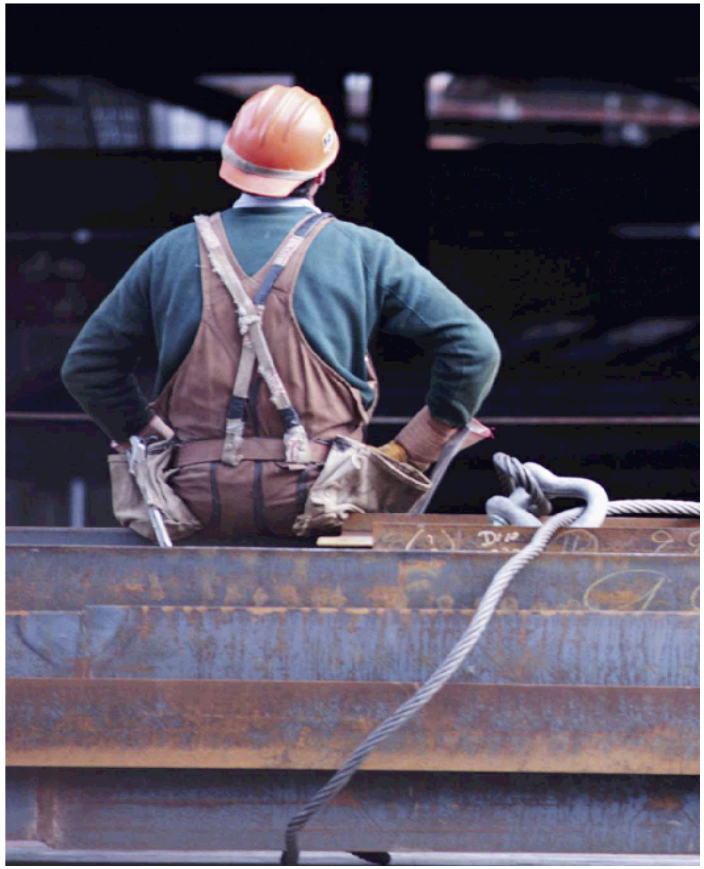
Energieeffizienz

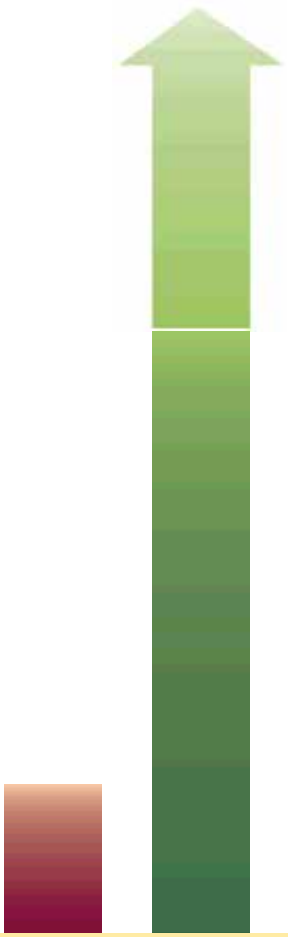
And from fluorescent light bulbs to solid state lighting



Energy efficiency

Modern Japanese steel can be 4 –10 times as resource efficient





Energy and material efficiency

Typically, however, a factor of four is unattainable if we look at efficiency of simple processes.
Bigger gains come in when optimizing complex systems. Here, we talk about productivity

(In Ashok Khosla‘s language: From Copy-Cat to Leap-Frog)

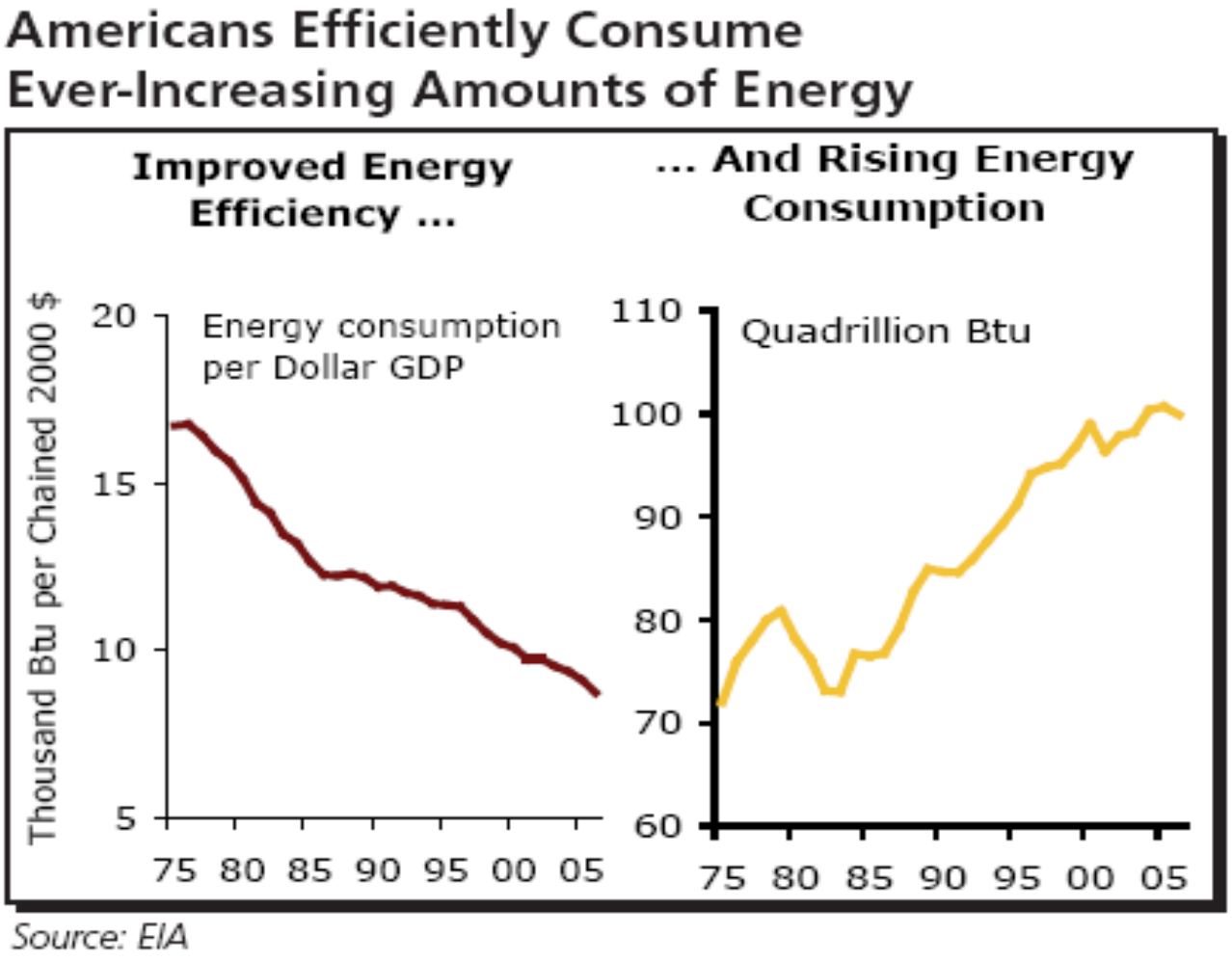
Moreover, efficiency gains are vulnerable to the rebound effect

The rebound effect was first described by William Stanley Jevon's in his 1865 book, The Coal Question, where he observed that England's consumption of coal soared after James Watt introduced his coal-fired steam engine, which greatly improved the efficiency over Thomas Newcomen's earlier steam pumps.

Since the 1980s, the rebound effect is often called the
Khazzoom-Brookes Postulate.
Daniel Khazzoom and Len Brookes observed that all the efficiency gains of the 1970s were overcompensated by additional consumption, notably after the oil prices came down again.

Rebound effect in the USA:

Energy intensity goes down, total energy consum-ption goes up.

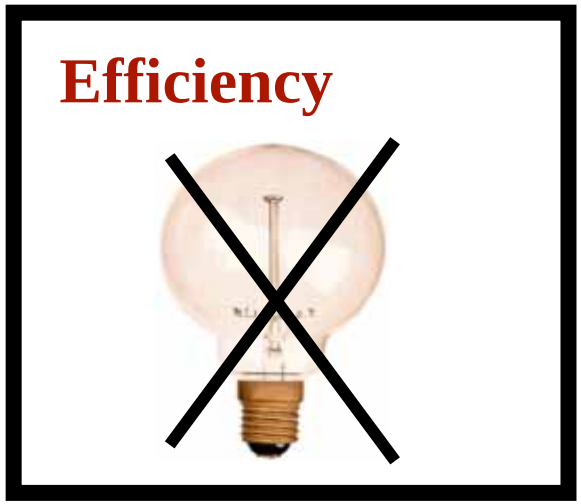


Overcoming the rebound effect with economic instruments

Regulation, e.g

banning old light bulbs

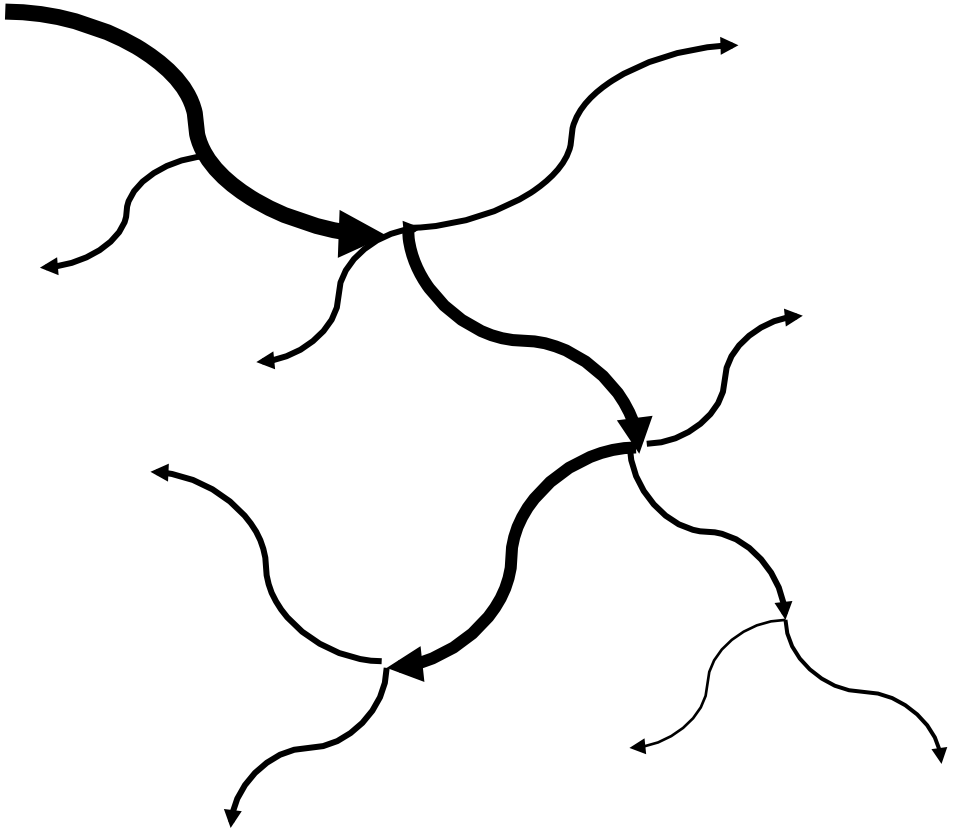
mostly inside the box



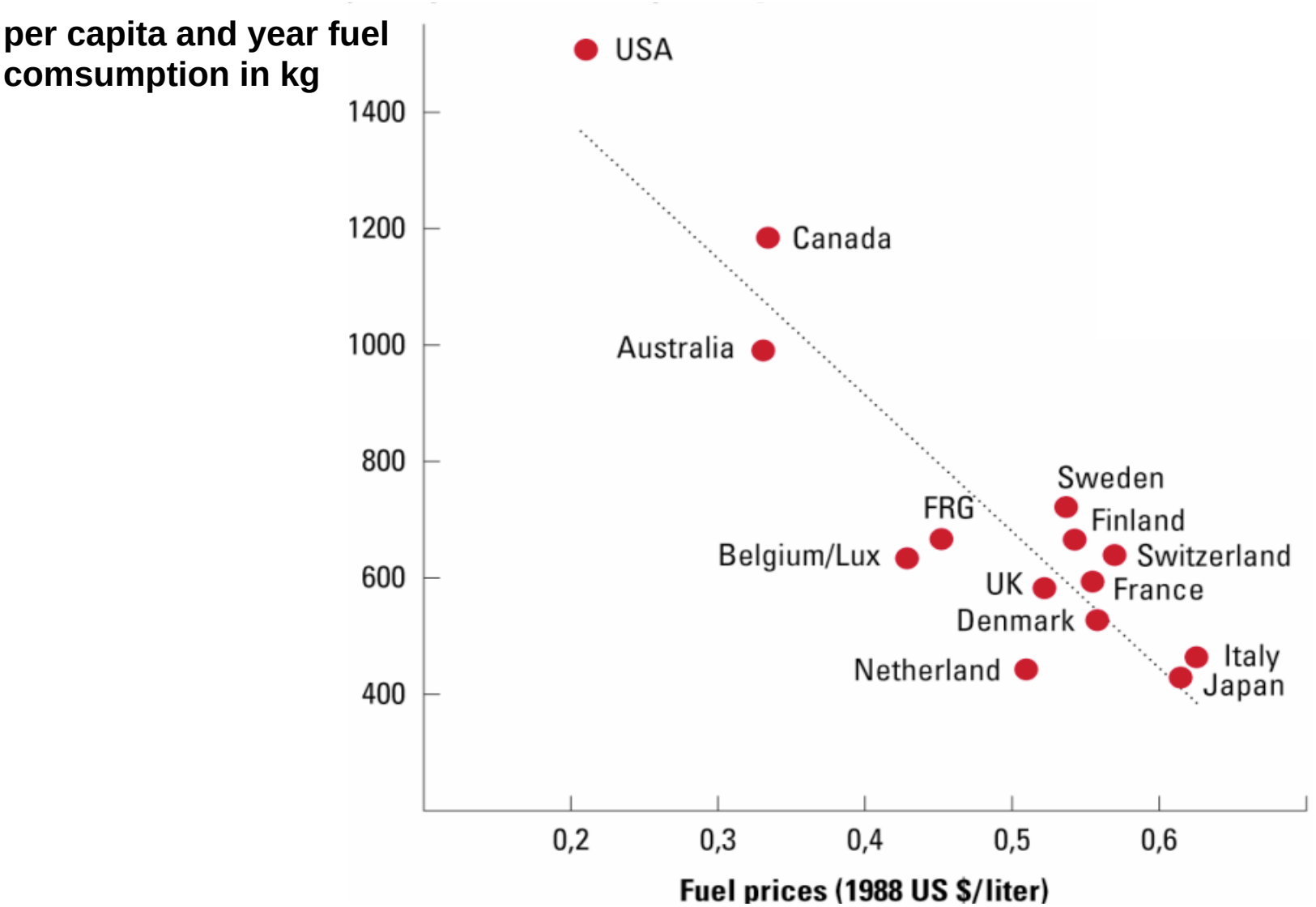
Economic Instruments

Adding a price tag on consumption:

networks and cascades get leaner

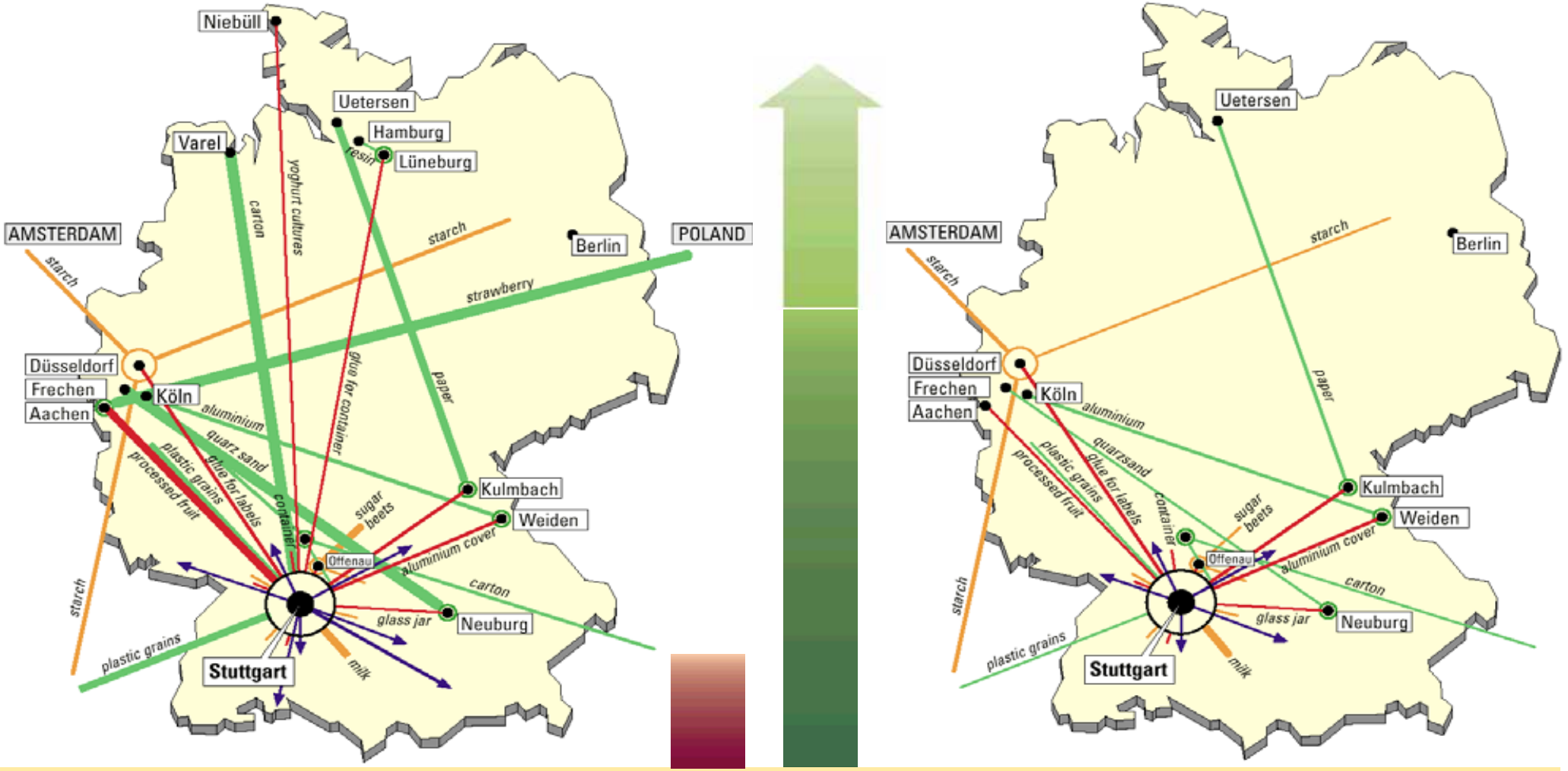


Japan in the 1980s was four times more fuel efficient than the USA and had four times higher fuel prices

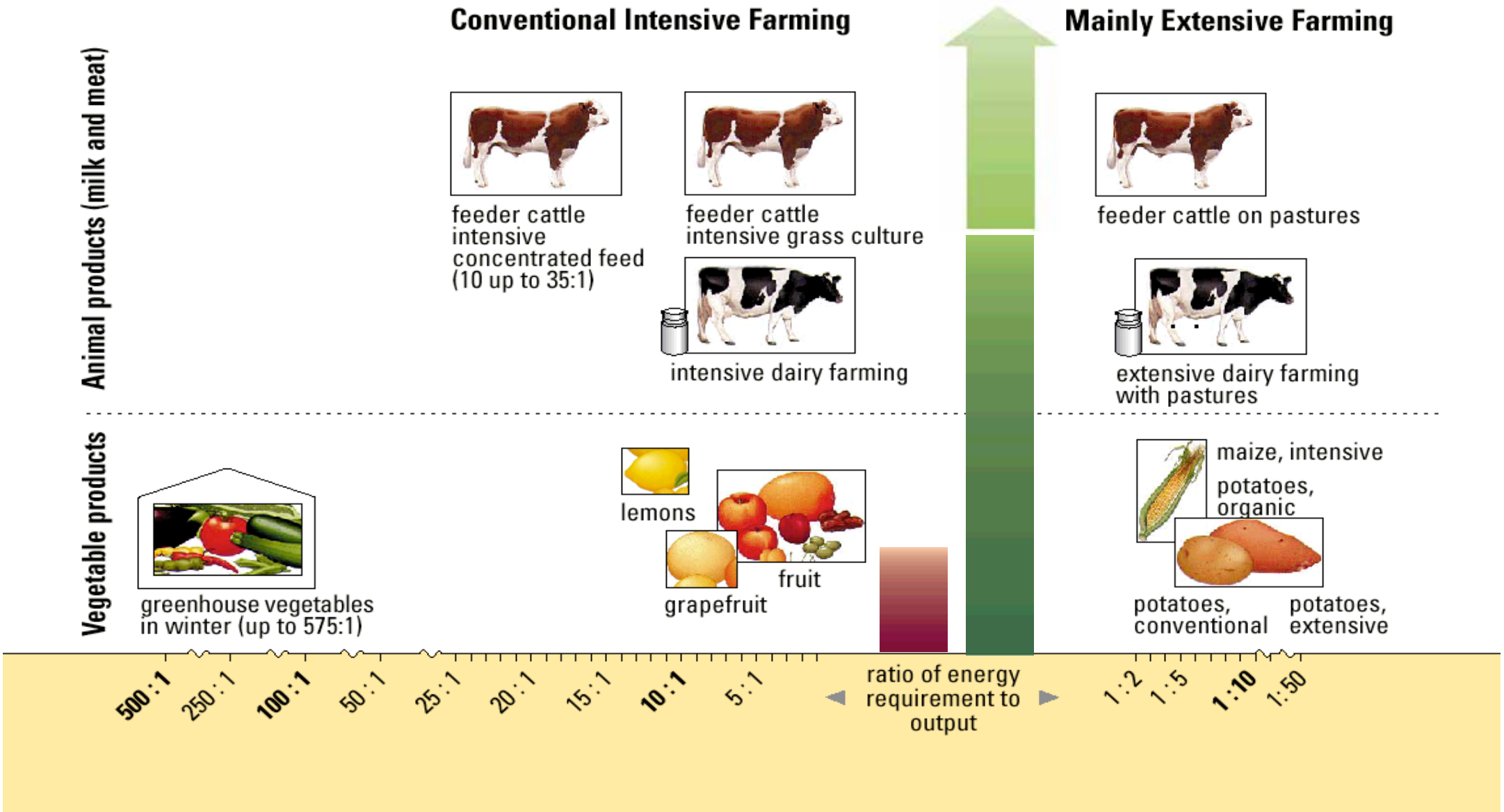


Let us now look at some examples of increasing *systems* productivity

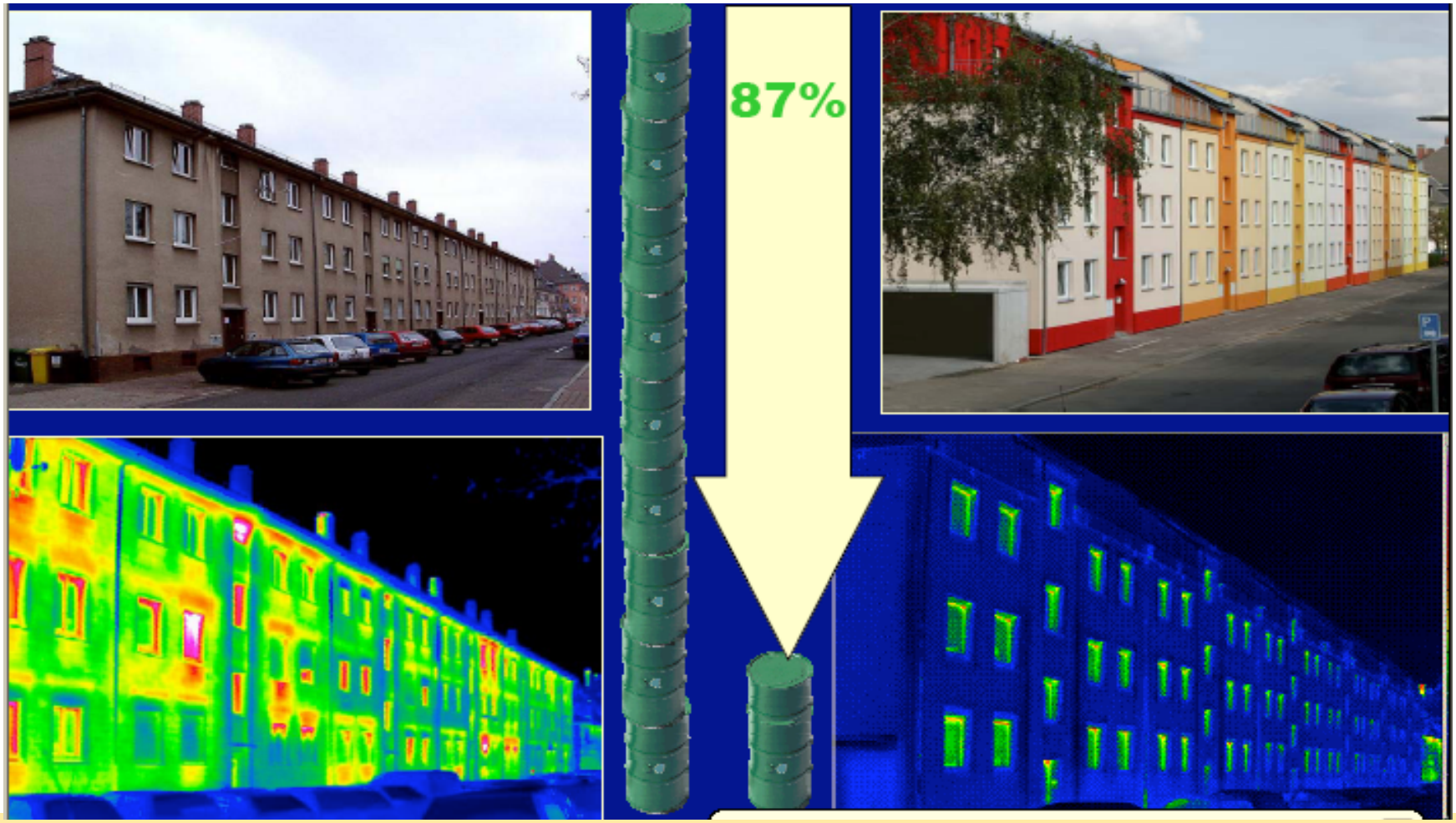
Strawberry yoghurt logistics: 1500 instead of 8000 kilometres (logistics is extremely price-sensitive!)



Seasonal diets, organic farming, a little less meat (stop all subsidies for high-input farming!)

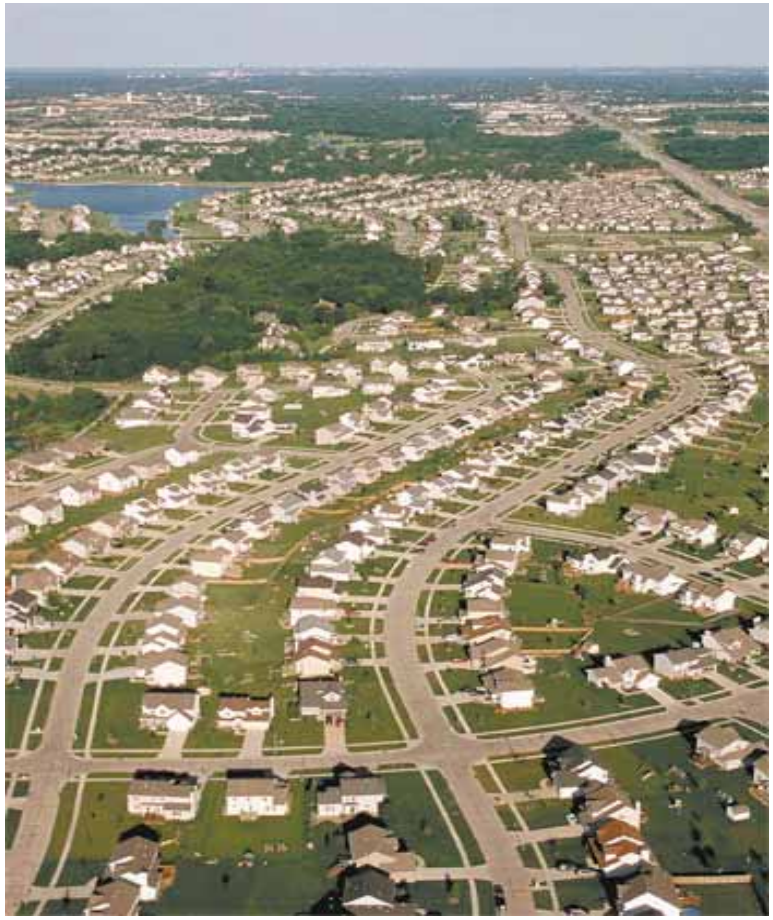


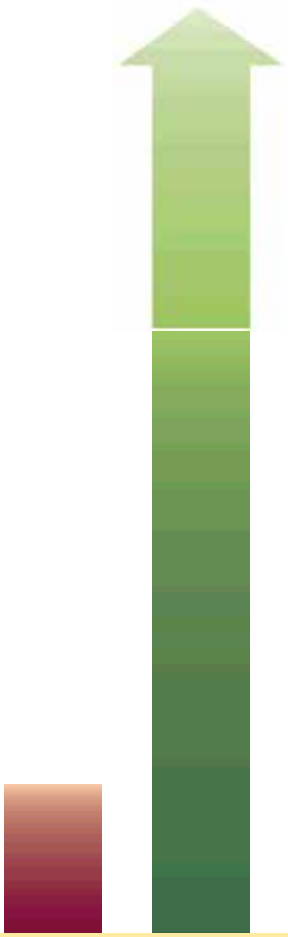
Refurbishing existing buildings can also yield up to 90% improvements but won‘t be done at low energy prices



Above: photos
Below: thermograms

From urban sprawl to high density cities
(this is essentially USA vs Japan)





Space and energy efficiency

Video conferences can replace a lot of business travel (one of the few examples that is not too price sensitive)

Energy efficiency

The sequel to Factor Four will be published in 2009 and will be called

Factor 5

The Promise of Resource Productivity

Authors: Ernst Ulrich von Weizsäcker, Charlie Hargroves and Michael Smith (Brisbane)

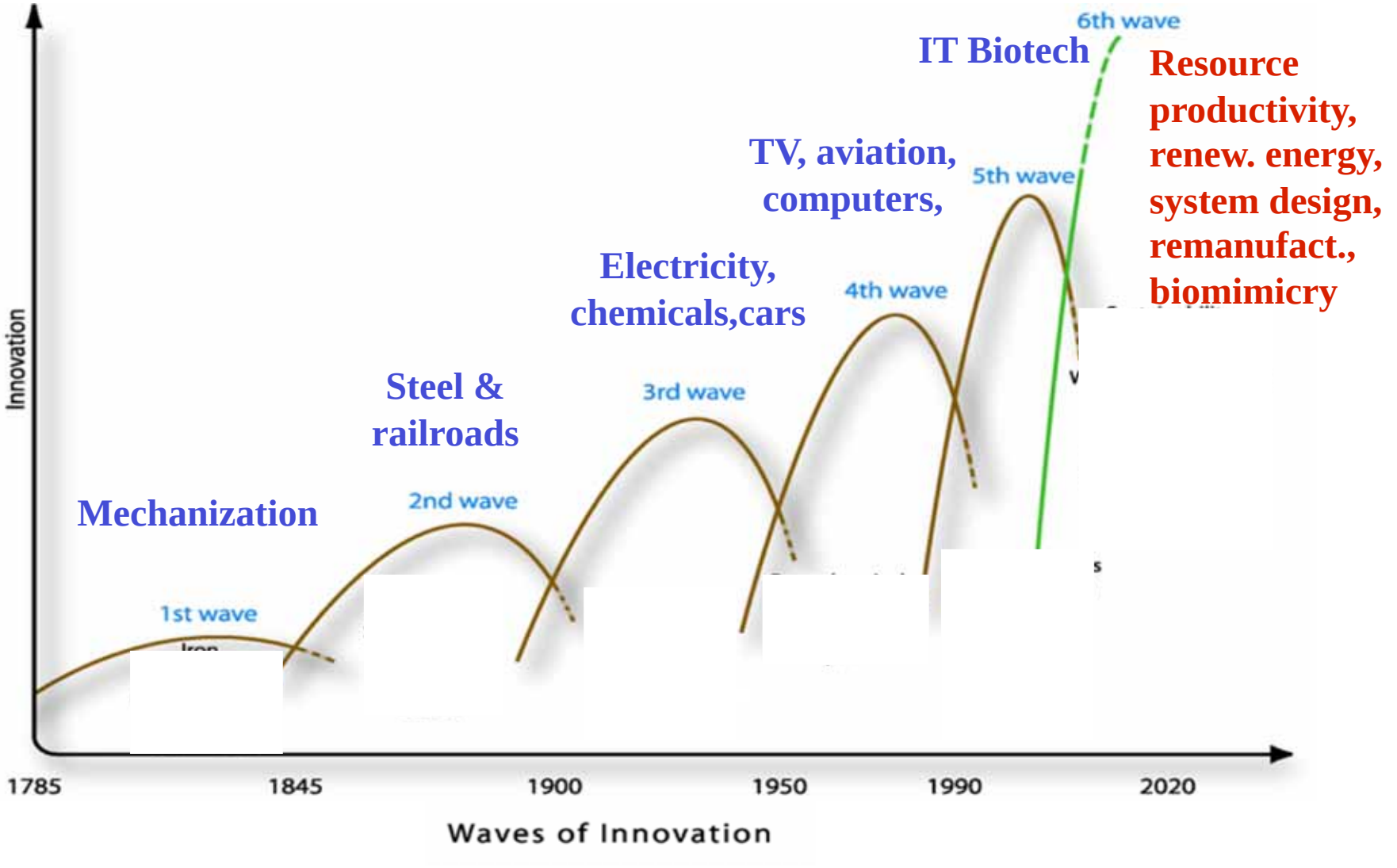
Factor Five escapes from the pure technology (copy cat) paradigm and talks about systemic efficiency improvements.

It arrives at the vision of a

new Kondratiev cycle

The sixth Kondratiev: Resource productivity

(after Charlie Hargroves, Brisbane, Australia)



Changing technological paradigms

Old:

Increasing labour productivity

New:

Increasing resource productivity

If labour productivity has increased twentyfold since 1850, it is not utopian to think of resource productivity increasing tenfold in 100 years and fivefold in 50 years!

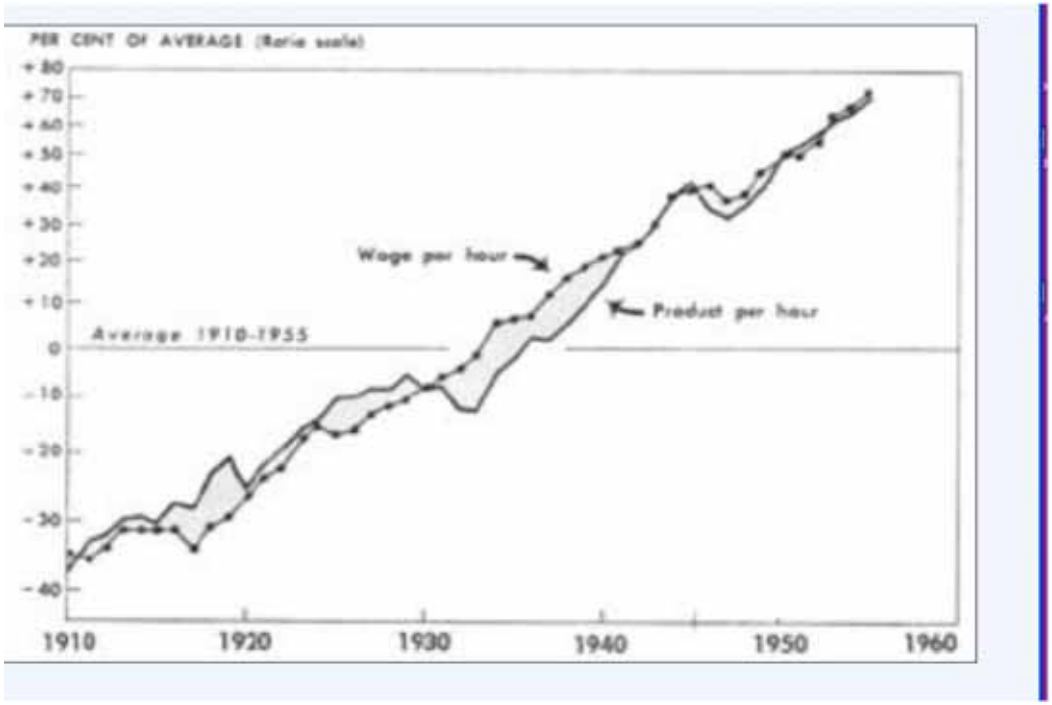
What was the main driving force for the steady increase of labour productivity?

Economists would say it was labour cost.

And what was the main driving force for the twenty-fold increase of wages?

Economists would say it was labour productivity

Labour productivity rose in parallel with labour costs



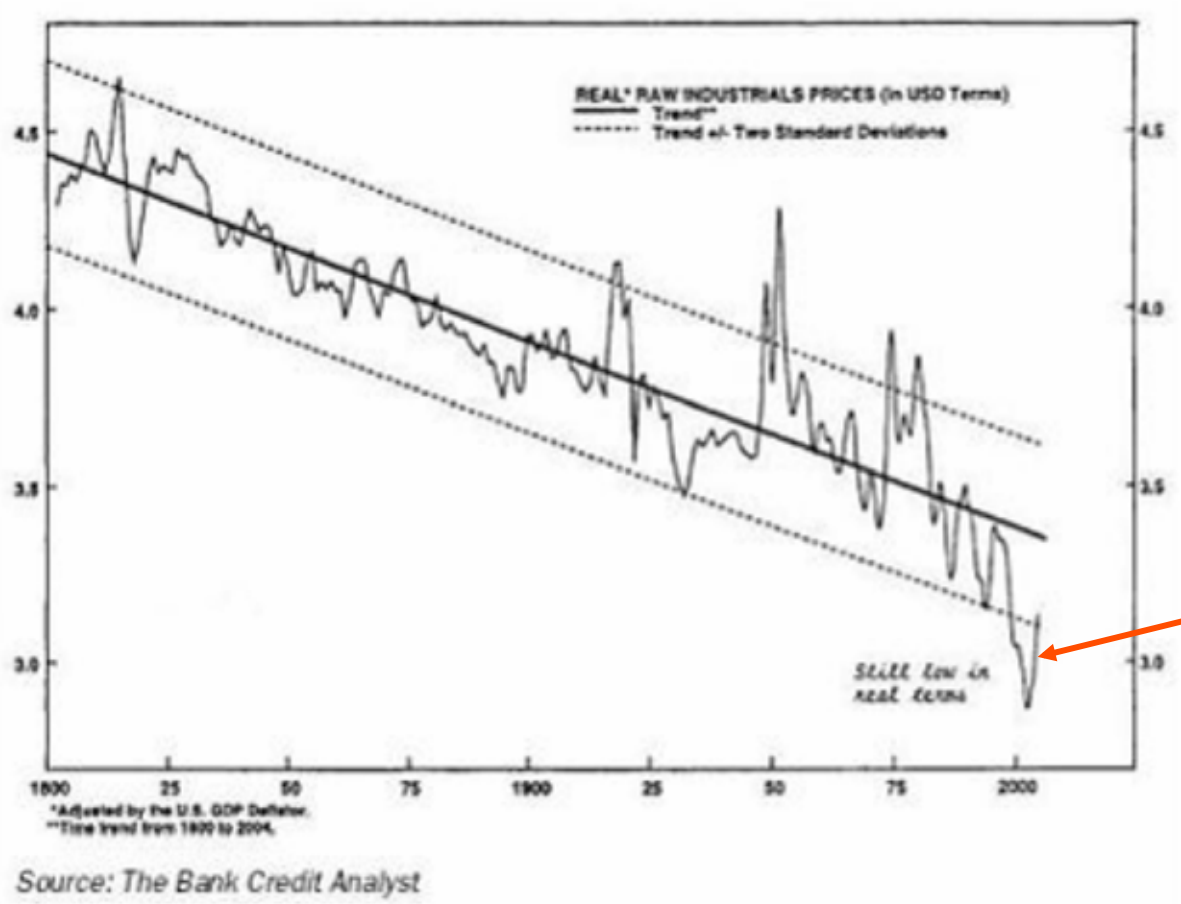
Labour poductivity rose in parallel with labour costs

This suggests a strategy of actively elevating energy prices in parallel with energy productivity increases

Predictability is the strongest signal to investors. They know labour cost will always go up, while resource prices fluctuate up and down (mostly down).

For 200 years resource prices were falling. Recent price hikes just brought us back into the lower confidence interval! And after the Wallstreet crash, prices are back to lowest levels.

Prices of industrial commodities & energy, in constant dollars



Source: The Bank Credit Analyst

The last 5 years

Thomas Friedman: A green revolution and green taxes needed