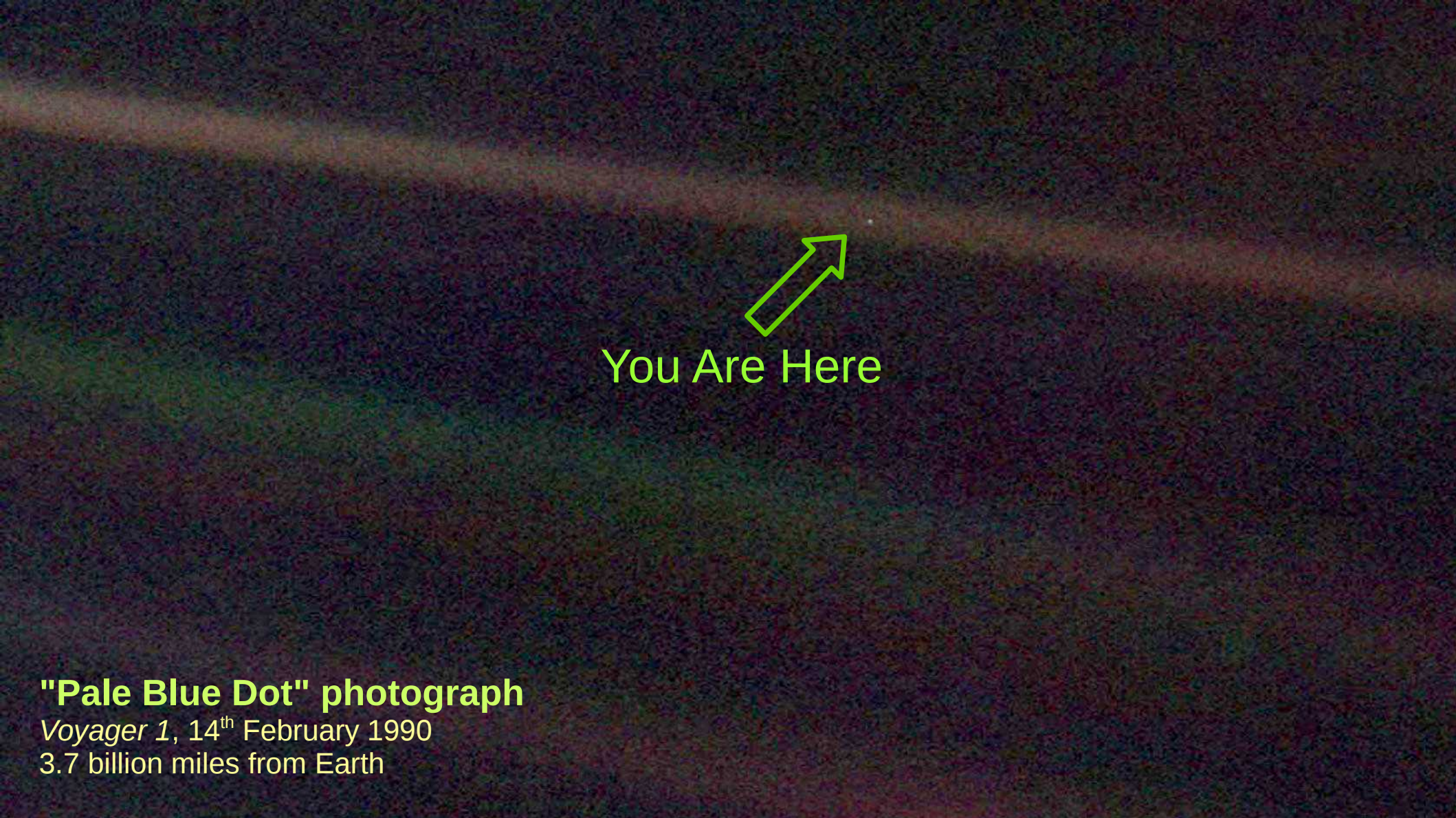
The all new, improved and reformulated...

"Less" (is a Four Letter Word)

– *Economics, Ecological Limits & Politics*

Paul Mobbs
Mobbs' Environmental Investigations
`http://www.fraw.org.uk/mei/`



"Pale Blue Dot" photograph
Voyager 1, 14th February 1990
3.7 billion miles from Earth

From this distant vantage point, the Earth might not seem of any particular interest. But for us, it's different. Consider again that dot. That's here. That's home. That's us. On it everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives. The aggregate of our joy and suffering, thousands of confident religions, ideologies, and economic doctrines, every hunter and forager, every hero and coward, every creator and destroyer of civilization, every king and peasant, every young couple in love, every mother and father, hopeful child, inventor and explorer, every teacher of morals, every corrupt politician, every "superstar," every "supreme leader," every saint and sinner in the history of our species lived there – on a mote of dust suspended in a sunbeam.

Carl Sagan - '*Pale Blue Dot: A Vision of the Human Future in Space*', 1994

"The Day the Earth Smiled"
Cassini, 19th July 2013
900 million miles from Earth

1972...
ecological consciousness

"The Blue Marble"
Apollo 17, 7th December 1972
28,000 miles from Earth

The Earth – *finite size*:

Radii – 6,378km eq./6,357km poles

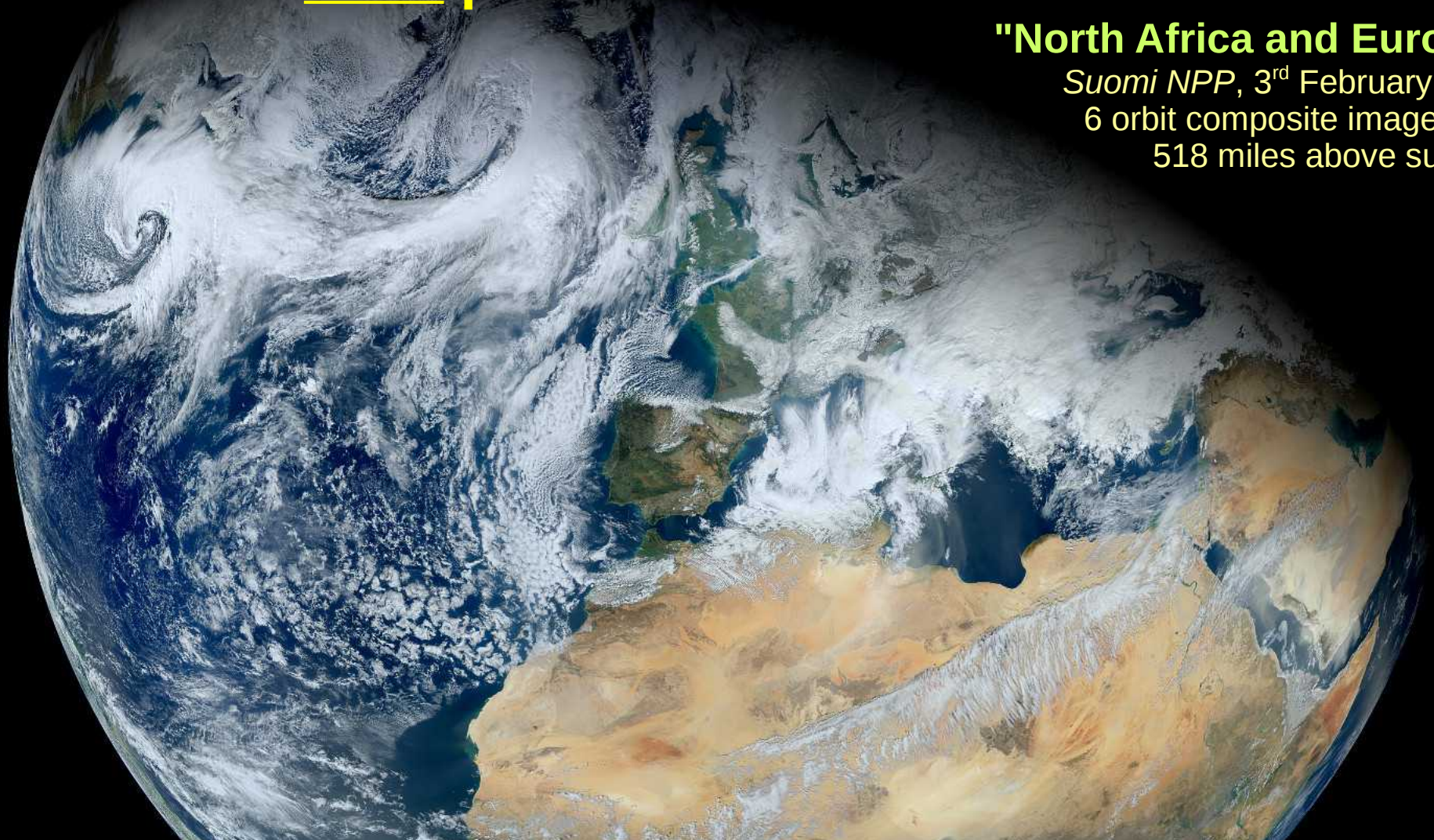
Earth volume – 1 trillion km^3

- Crustal depth, 50km (1.4% vol.)
- 'Extractable' depth, 5km (0.2% vol.)
- Stratosphere, 30km (2.4% vol.)
- Troposphere, 12km (0.6% vol.)

Humanity – *growing:*

	1972	2012
Population, bn.	3.85	7.06
Fossil C emissions, GteC	4.48	9.66
Primary energy, EJ	226	522
Copper production, Mte	6.54	16.9

We live on a finite planet...



"North Africa and Europe"
Suomi NPP, 3rd February 2012
6 orbit composite image from
518 miles above surface

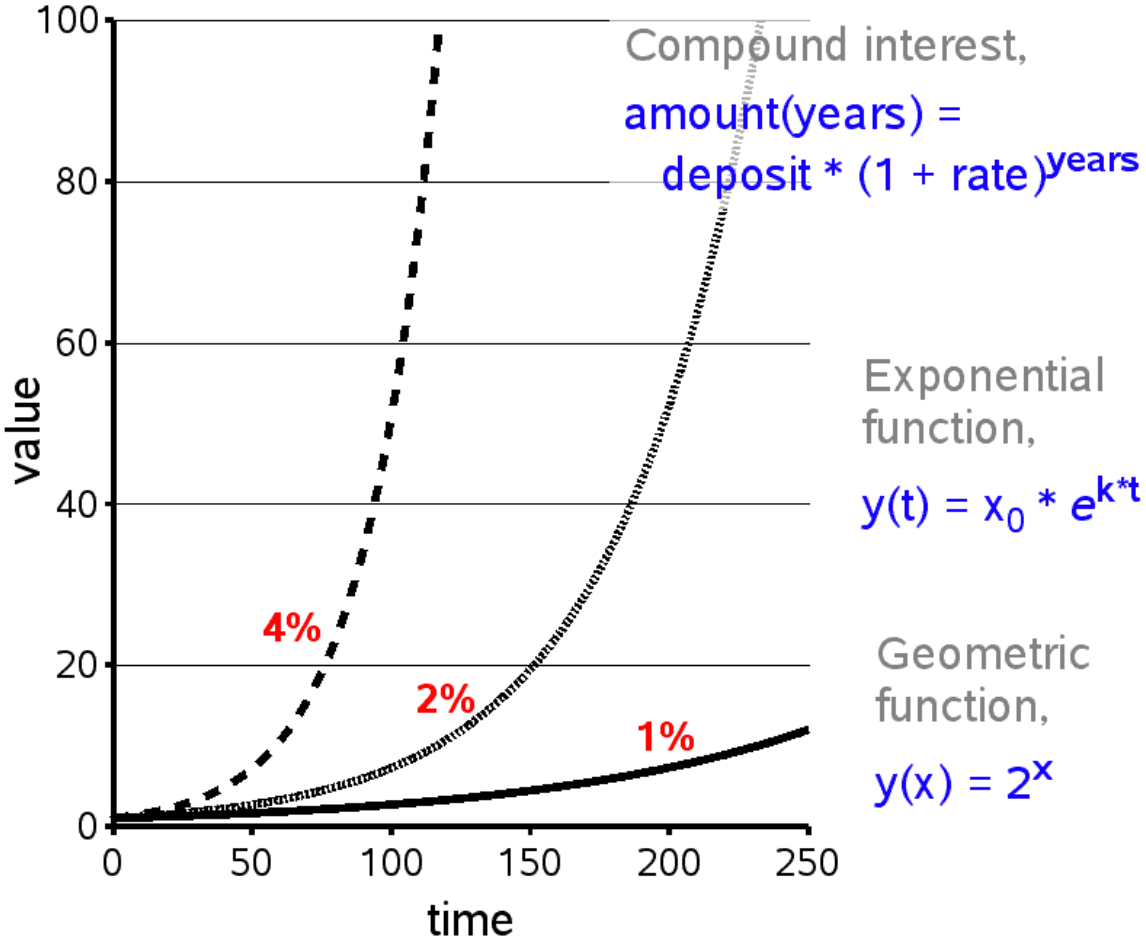
...but first we need to talk about growth

Arithmetic growth is linear, e.g. 2 + 2 + 2...

The rate of change is constant.

Exponential growth is non-linear, e.g. 2 × 2 × 2...

The rate of change is proportional to the current value.



...but first we need to talk about growth

Arithmeti
e.g. 2 +

The rate
constant

Exponen
non-linea

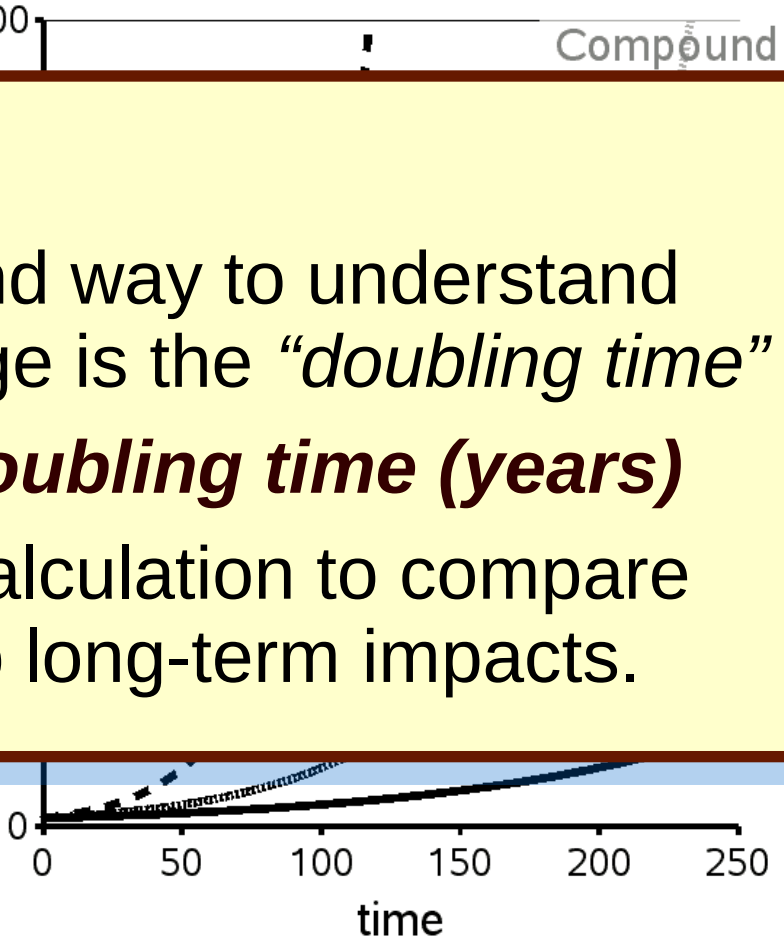
The rate
proportio
value.

Doubling time:

The best shorthand way to understand exponential change is the *"doubling time"*

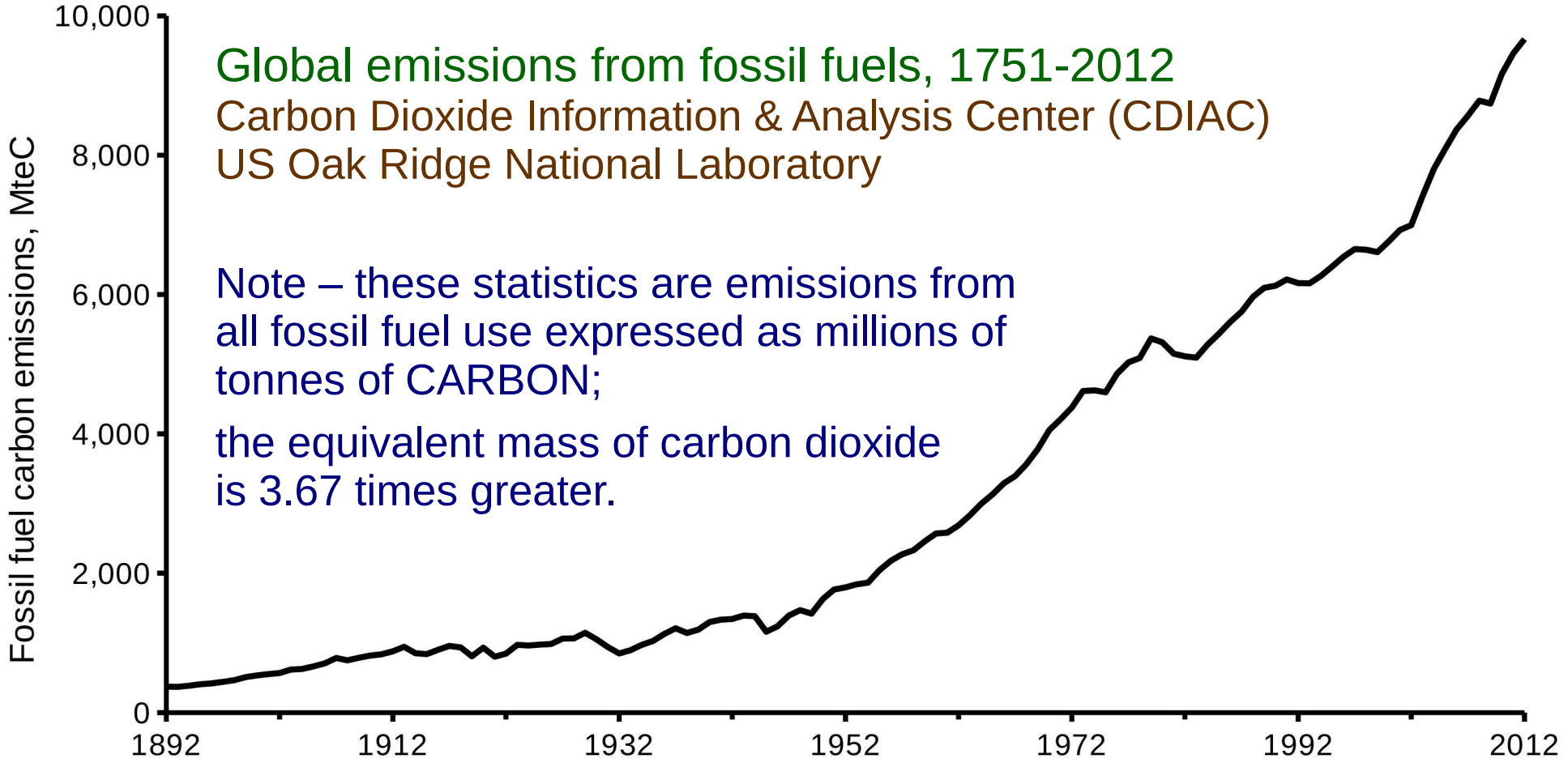
70 ÷ A.P.R = doubling time (years)

This is a simple calculation to compare rates of change to long-term impacts.

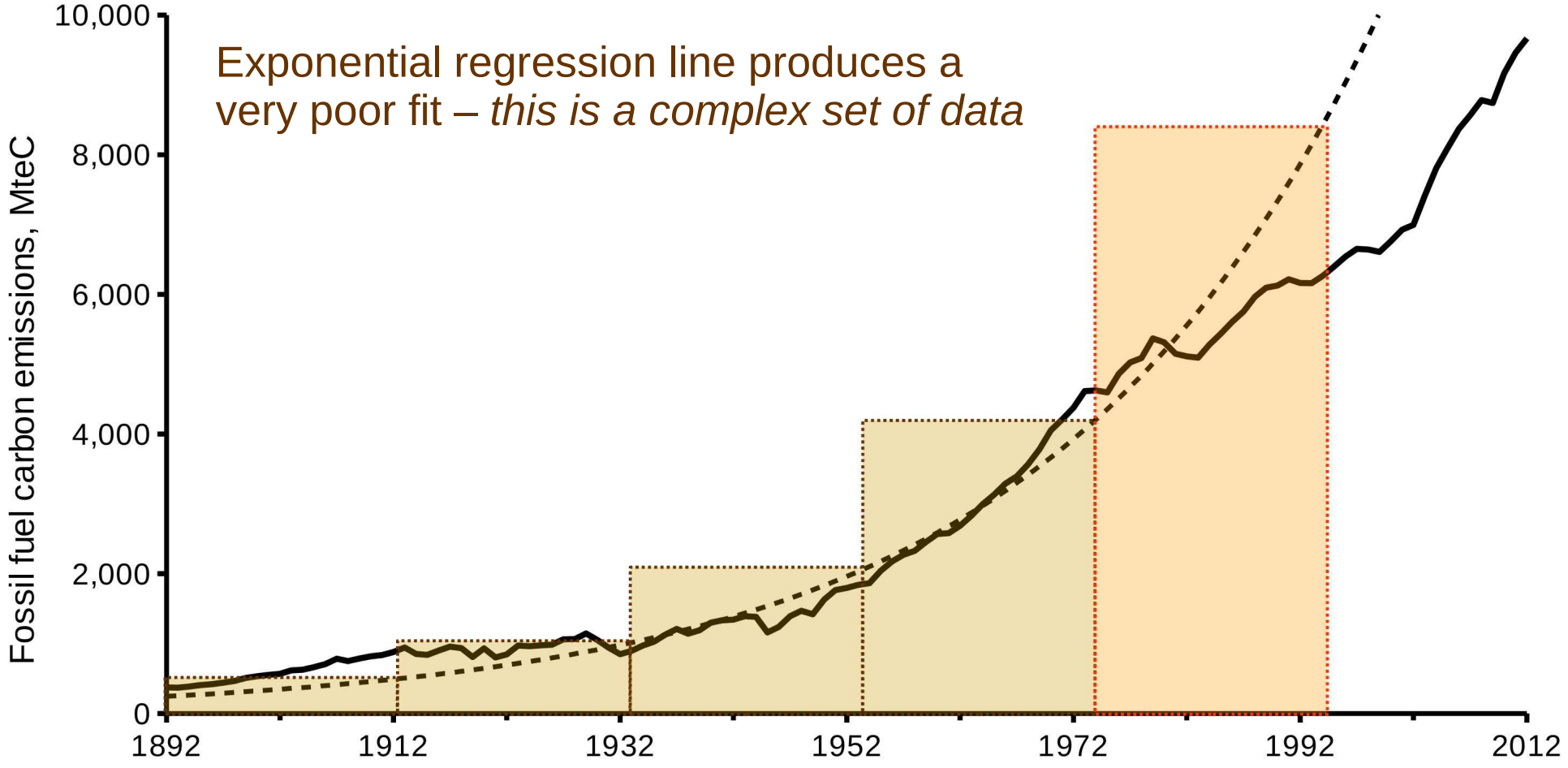


Compound interest,
) =
+ rate)^years
ponential
nction,
t) = x0 * e^k*t
eometric
nction,
y(x) = 2^x

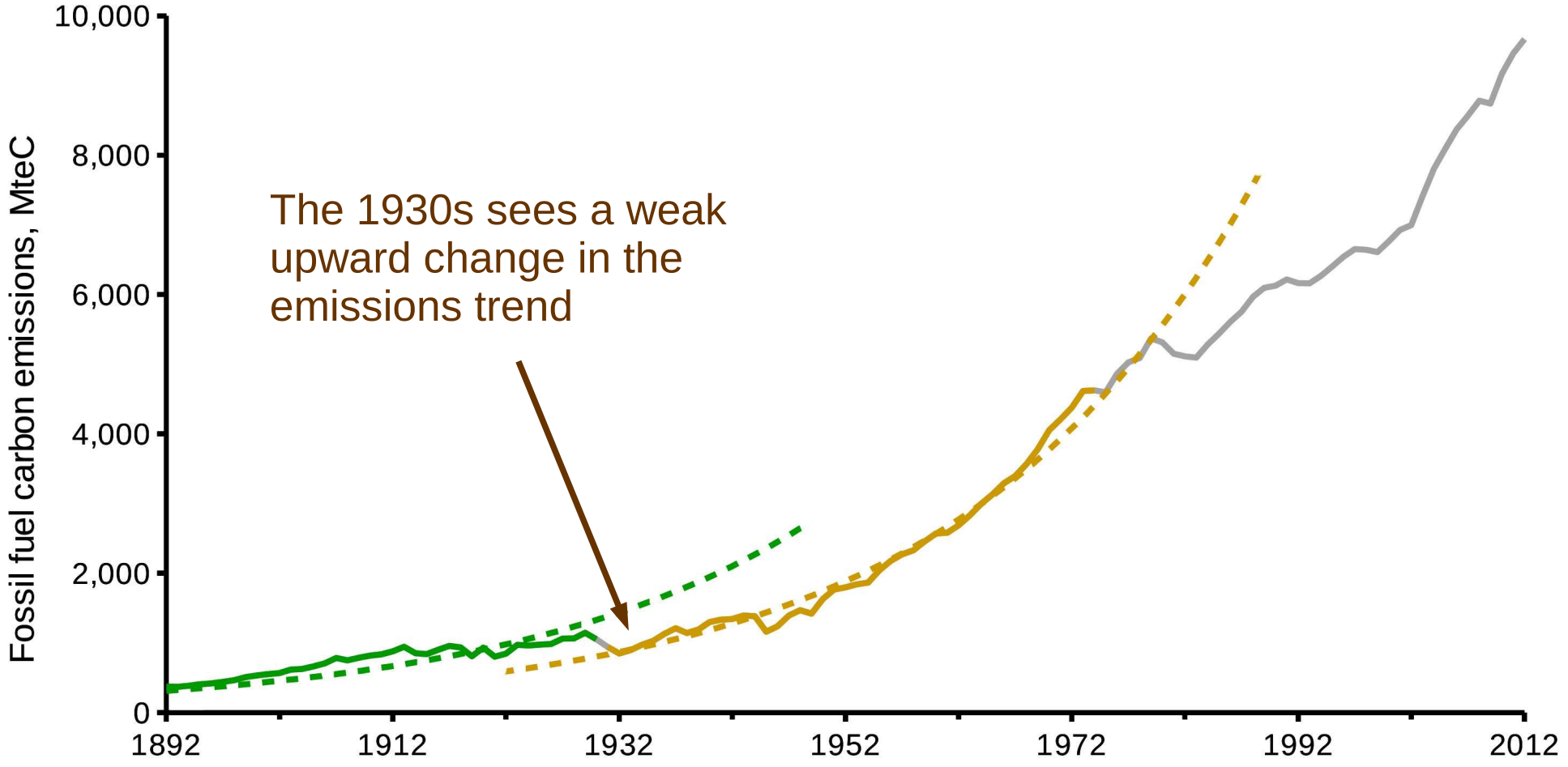
Carbon & growth



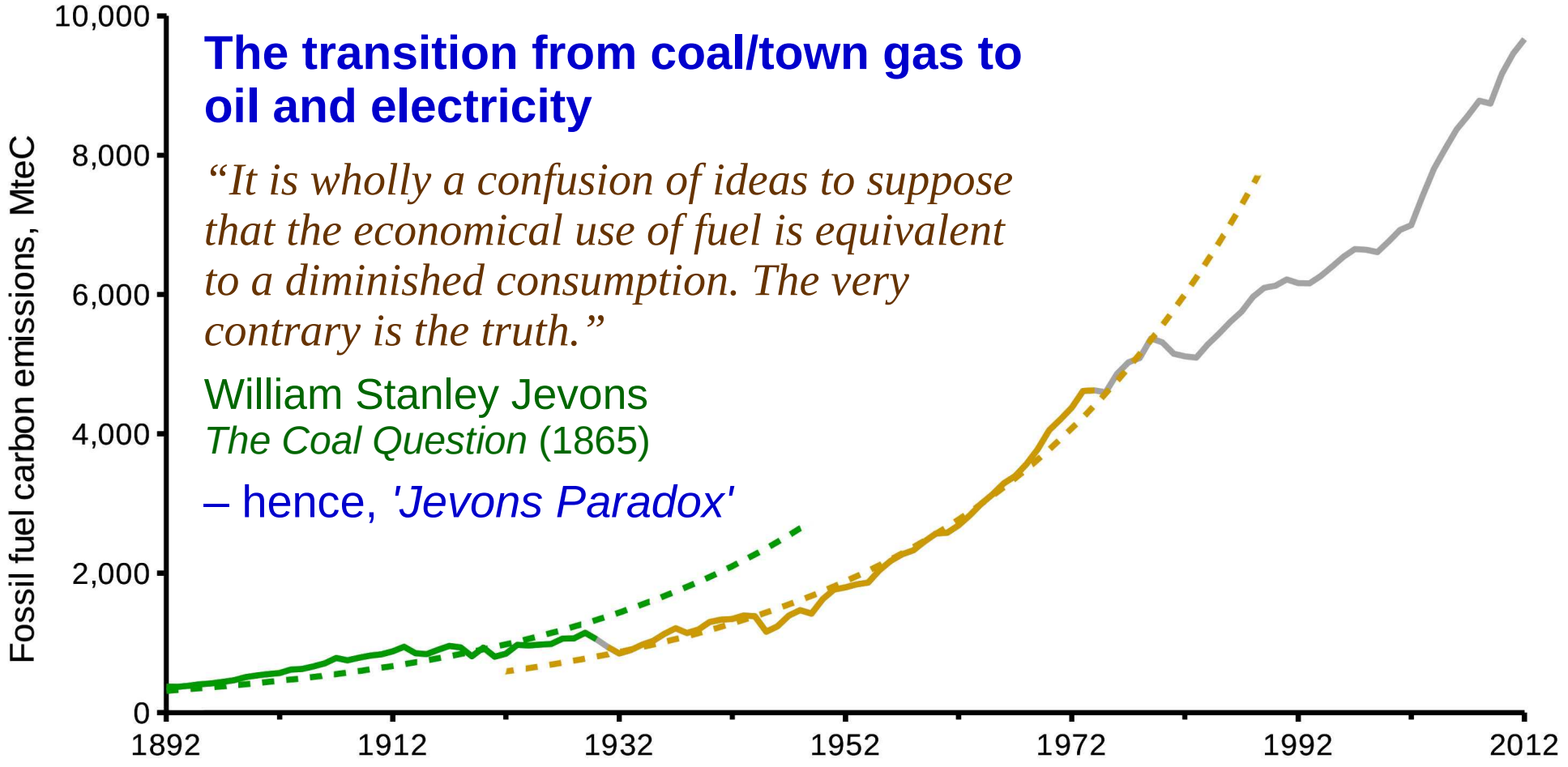
Carbon & growth



Carbon & growth



Carbon & growth



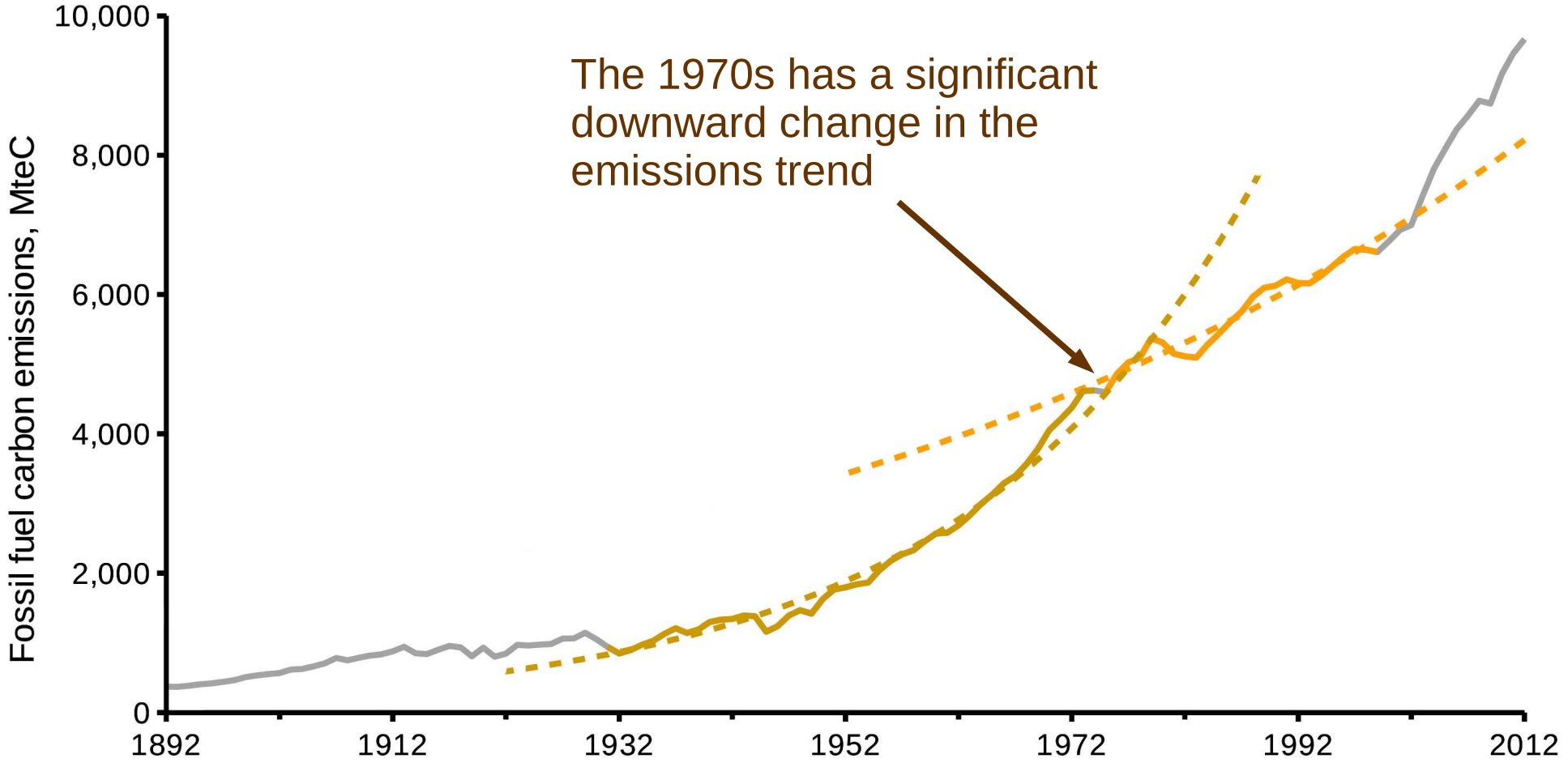
The transition from coal/town gas to oil and electricity

"It is wholly a confusion of ideas to suppose that the economical use of fuel is equivalent to a diminished consumption. The very contrary is the truth."

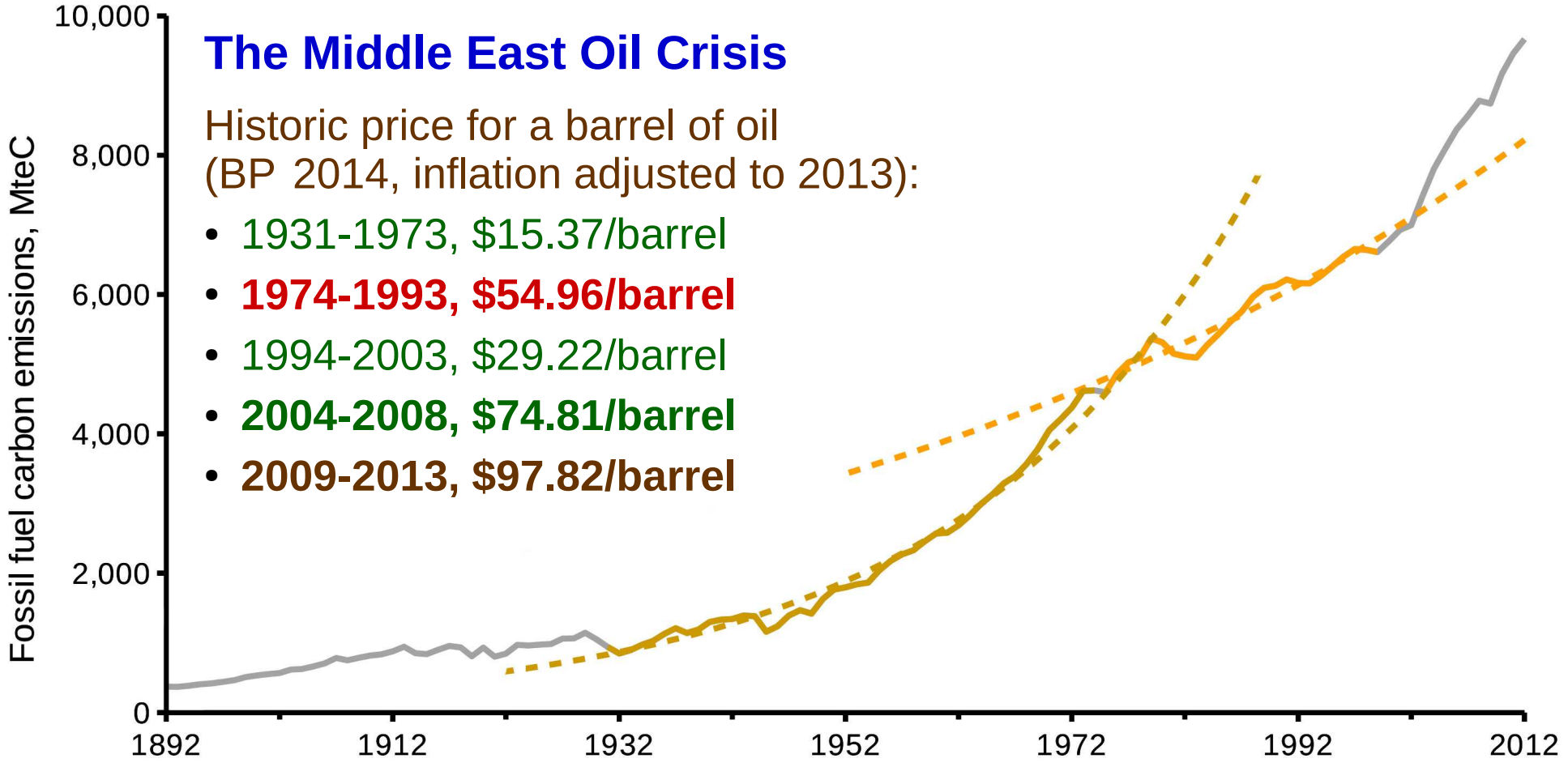
William Stanley Jevons
The Coal Question (1865)

– hence, *'Jevons Paradox'*

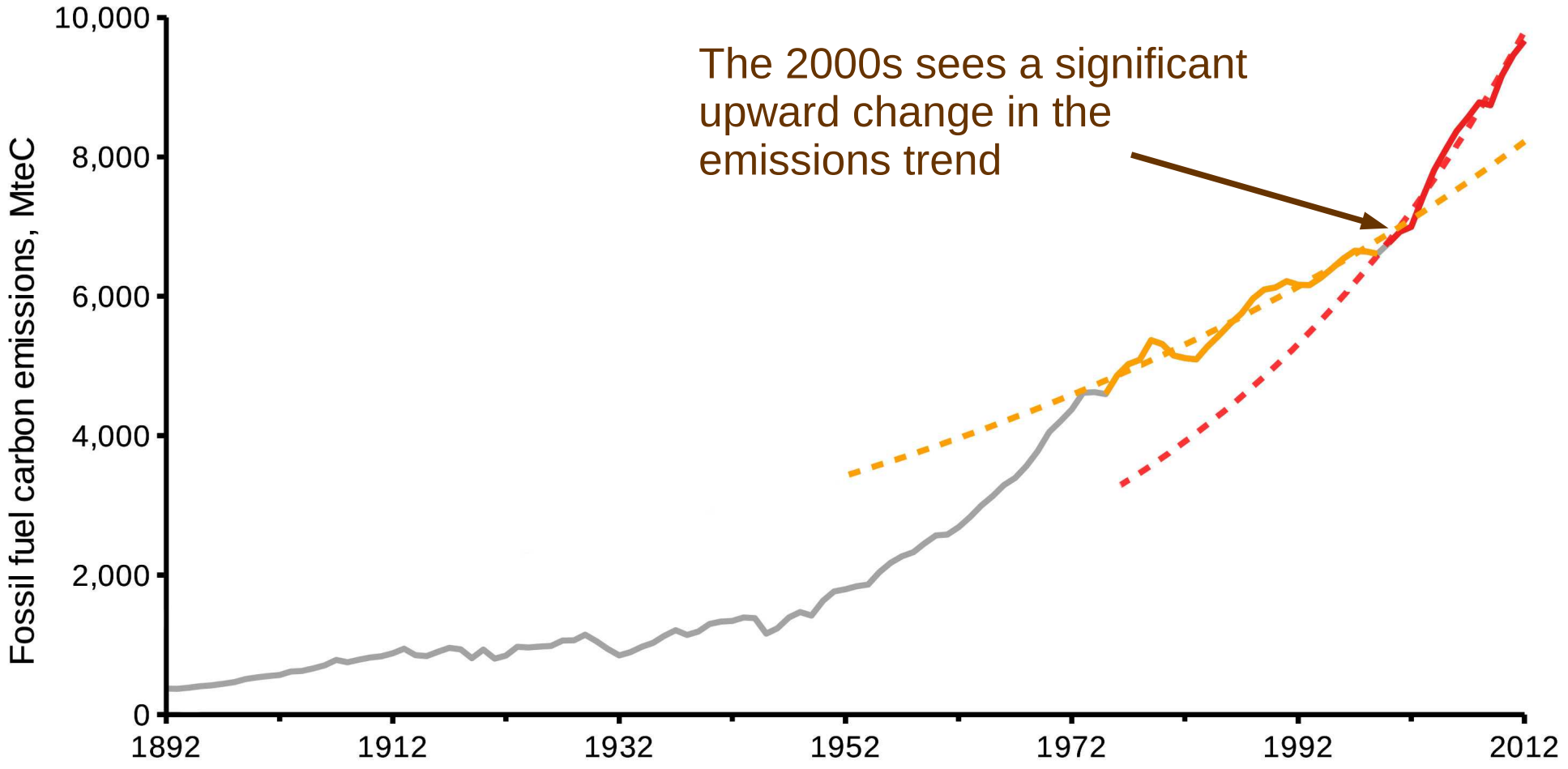
Carbon & growth



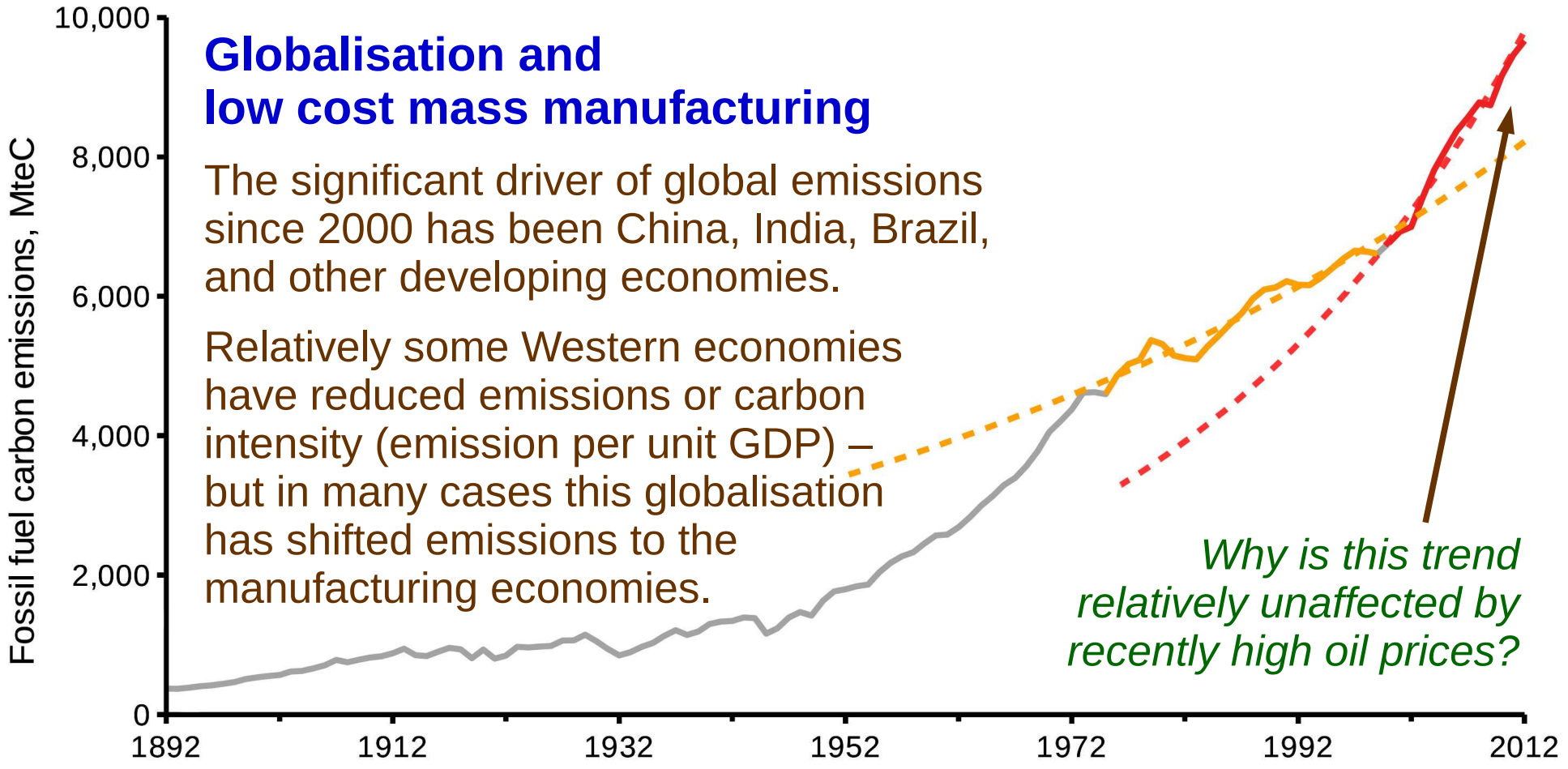
Carbon & growth



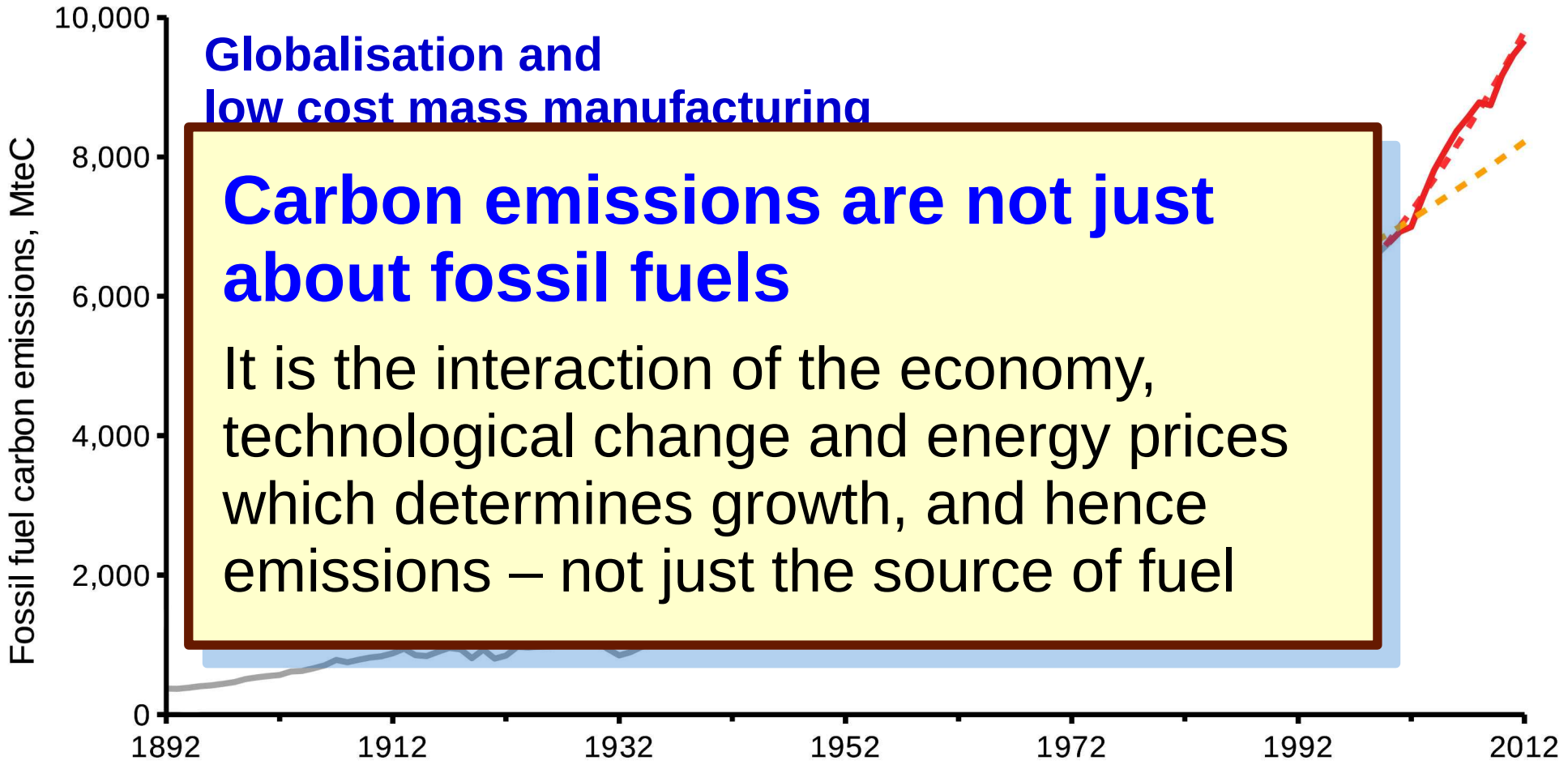
Carbon & growth



Carbon & growth



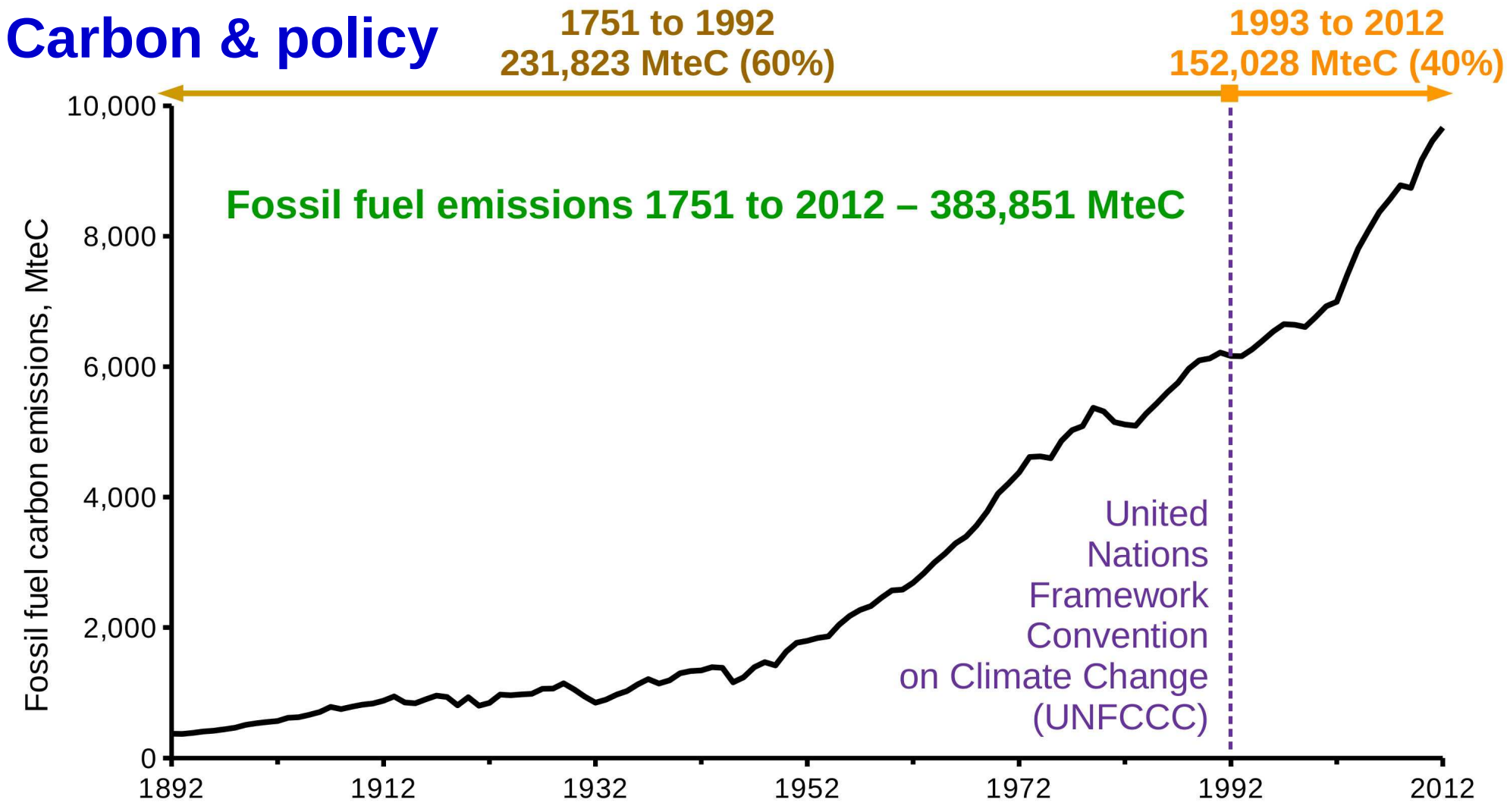
Carbon & growth



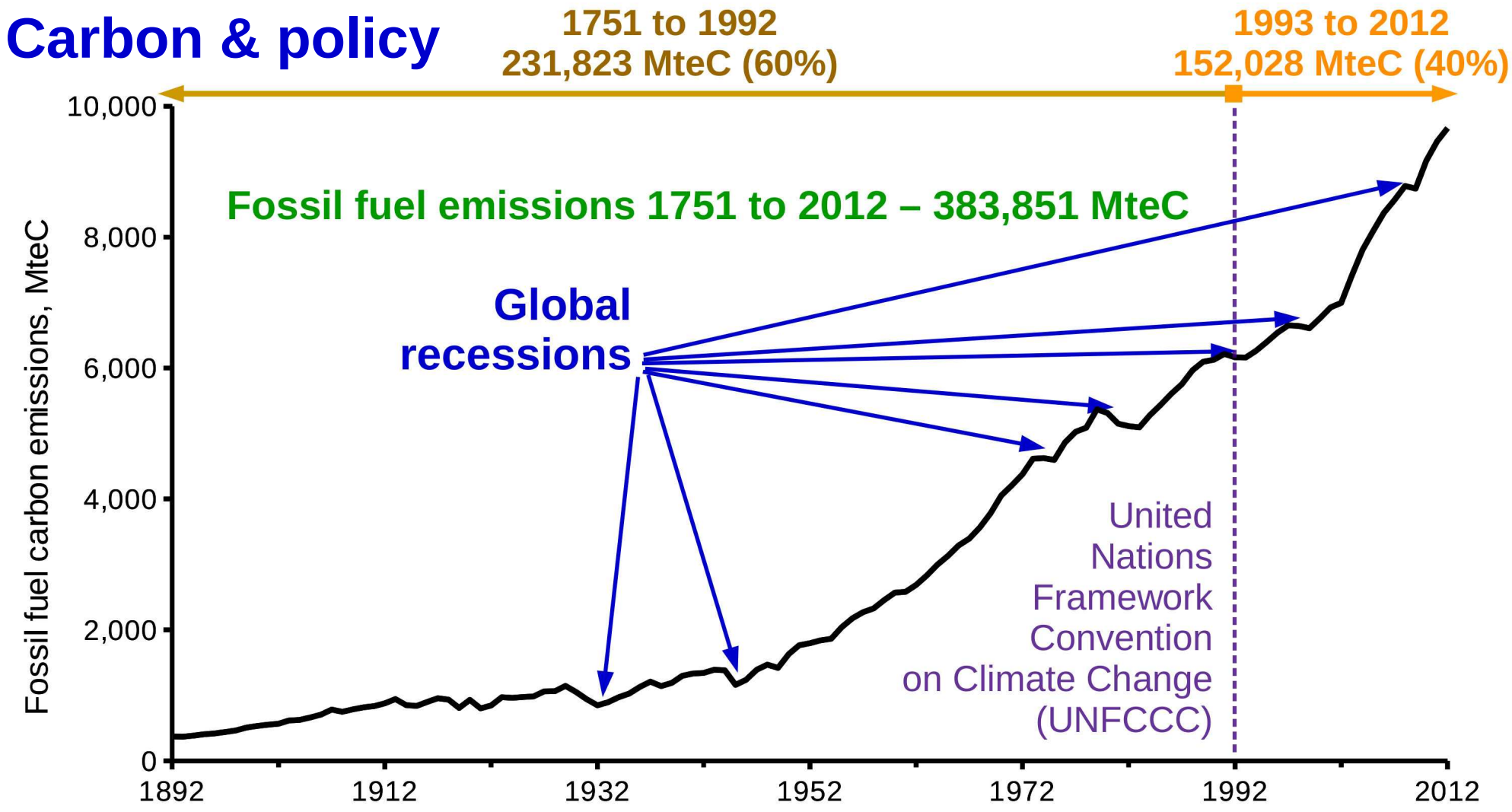
Carbon emissions are not just about fossil fuels

It is the interaction of the economy, technological change and energy prices which determines growth, and hence emissions – not just the source of fuel

Carbon & policy



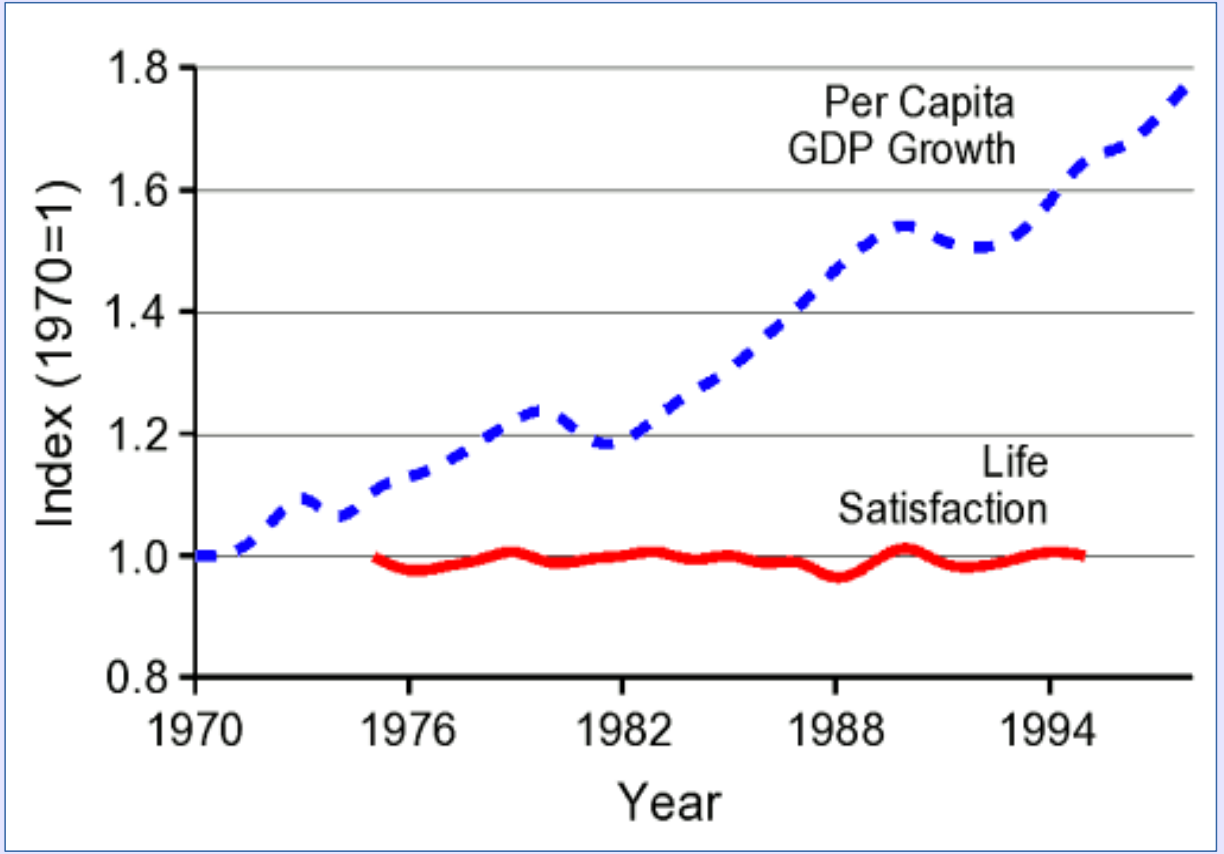
Carbon & policy



Why is growth a largely 'uncontested good'?

The idea of economic growth is that it gives us all more to make us 'happier'.

Recent studies suggest that this is not the case, and that fifty years of growth at the core of our economic policy has not made us significantly happier (and at the same time it has caused serious ecological problems).



Source: *Redefining prosperity,*
Sustainable Development Commission 2003

“Name that classical economist!”

“Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio. A slight acquaintance with numbers will shew the immensity of the first power in comparison of the second... This implies a strong and constantly operating check on population from the difficulty of subsistence. This difficulty must fall somewhere; and must necessarily be severely felt by a large portion of mankind.”

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Reverend Thomas Malthus
(1766-1834)

Grand-daddy of “Malthusianism”

An Essay on the Principle of Population

(1st ed., 1798)

“Name that classical economist!”

“In a country which had acquired that full complement of riches... which could, therefore, advance no further... both the wages of labour and the profits of stock would probably be very low. In a country fully peopled in proportion to what either its territory could maintain or its stock employ, the competition for employment would necessarily be so great as to reduce the wages of labour to what was barely sufficient...”

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Adam Smith
(1732-1790)

Grand-daddy of modern economics

An Inquiry into the Nature and Causes of the Wealth of Nations

(Book I, Chapt. 9, 1776)

“Name that classical economist!”

“It must always have been seen, more or less distinctly, by political economists, that the increase of wealth is not boundless: that at the end of what they term the progressive state lies the stationary state, that all progress in wealth is but a postponement of this, and that each step in advance is an approach to it.”

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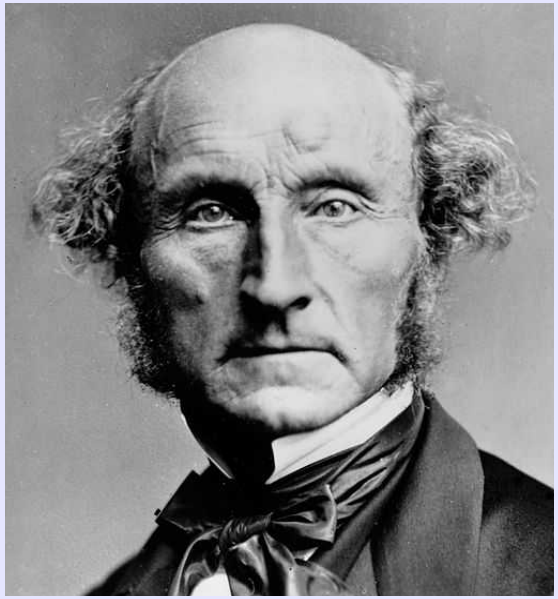
John Stuart Mill
(1806-1873)

Grand-daddy of PPE



Principles of Political Economy with some of their Applications to Social Philosophy

(Book IV, Chapt. 4, 1865)

“Name that classical economist!”

“If we lavishly and boldly push forward in the creation and distribution of our riches, it is hard to over-estimate the pitch of beneficial influence to which we may attain in the present. But the maintenance of such a position is physically impossible. We have to make the momentous choice between brief greatness and longer continued mediocrity.”

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William Stanley Jevons
(1806-1873)

Grand-daddy of ecological economics

The Coal Question

(concluding paragraph, 1865)

Classical economics doesn't go on forever!

How did we get from the classical economist's belief that growth must end at some point – to be replaced by steady-state or decline – to a belief that growth can carry on indefinitely; and, in fact, that “high and stable levels of economic growth” are necessary to achieve a 'sustainable' economy?

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“Today we see no limit to economic growth. Our capital and technology give rise to all kinds of new business sectors and opportunities for employment. In Smith's time, however, the economy was dominated by agriculture, and he mistakenly sees the impossibility of developing land beyond its fertility as a limit to economic growth.”

The Condensed Wealth of Nations
Eamonn Butler, Adam Smith Institute, 2011

The Problem of Growth

What is growth?

There is a currently an ongoing debate in the world of theoretical economics as to the causative mechanisms which create economic growth.

At the root of this debate is the issue of how much “the environment” influences growth.

Key terms, in order:

- Production functions (1950s);
- The Solow residual (1960s);
- Endogenous growth theory (1970s);
- Trickle-down economics (1980s).

The Problem of Growth

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Classical/neoclassical economic view:

- Adding capital (money), 0.3% per point
- Adding labour (people), 0.7% per point

Adam Smith, Karl Marx, John Maynard Keynes, Joseph Schumpeter, Milton Friedman

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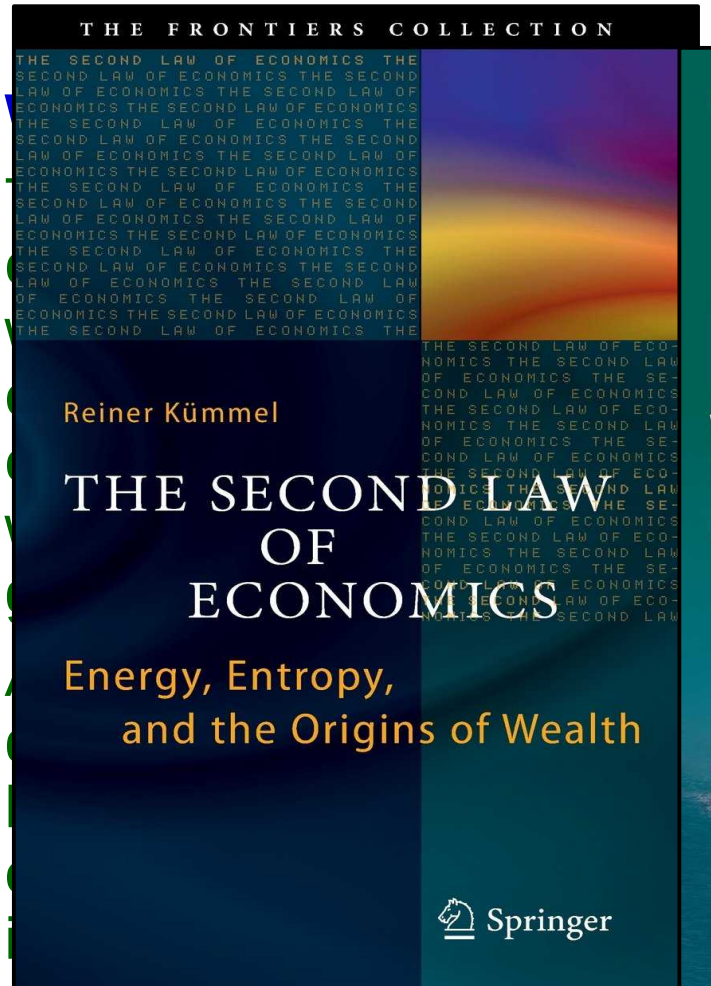
Adam Smith, Karl Marx, John Maynard Keynes, Joseph Schumpeter, Milton Friedman

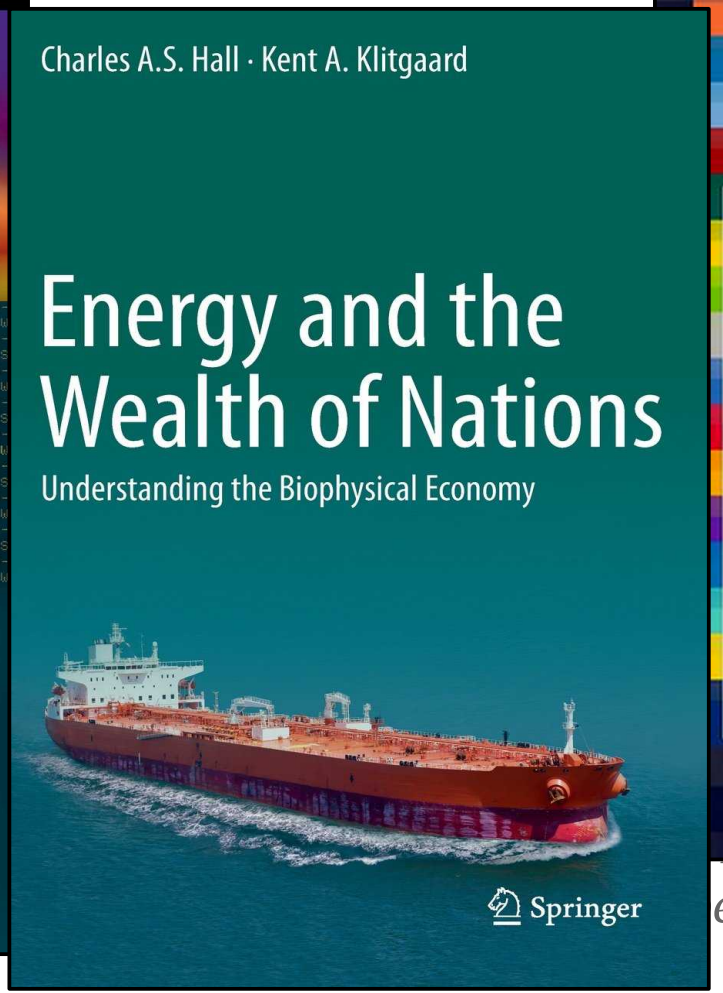
“Ecological” economic view:

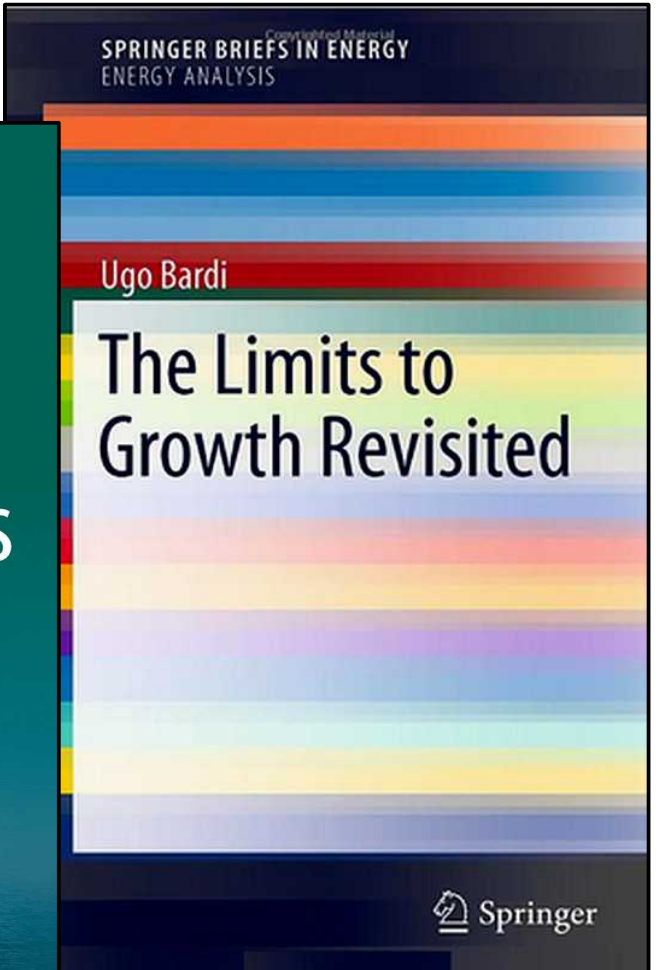
- Adding energy/resources, 0.5% per point
- Improved efficiency/innovation, 0.2% /point
- Adding capital (money), 0.1% per point
- Adding labour (people), 0.2% per point

Nicholas Georgescu-Roegen, Kenneth Boulding, Robert Solow, Reiner Kümmel, Robert Ayres, Benjamin Warr

The Problem of Growth

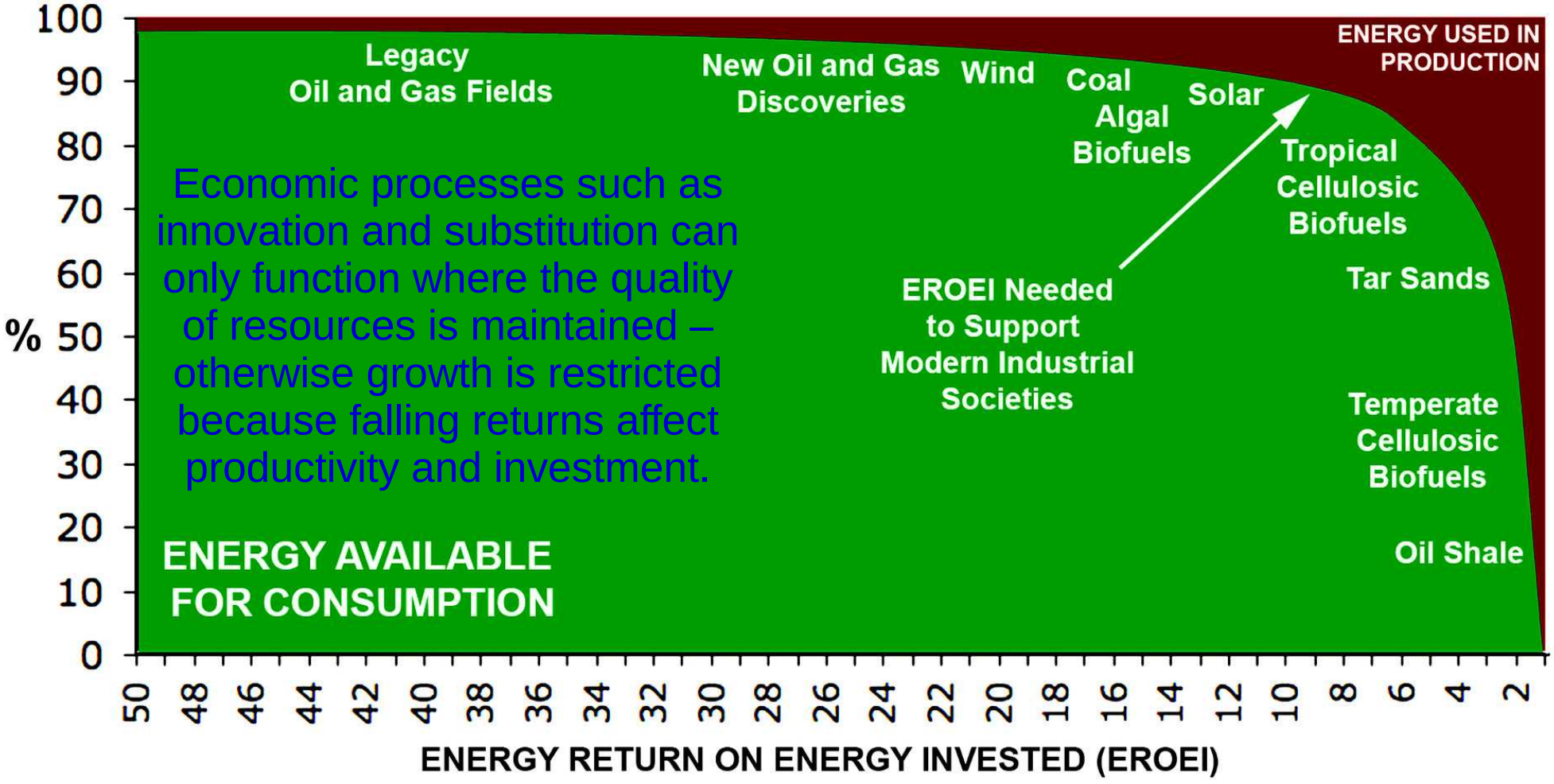




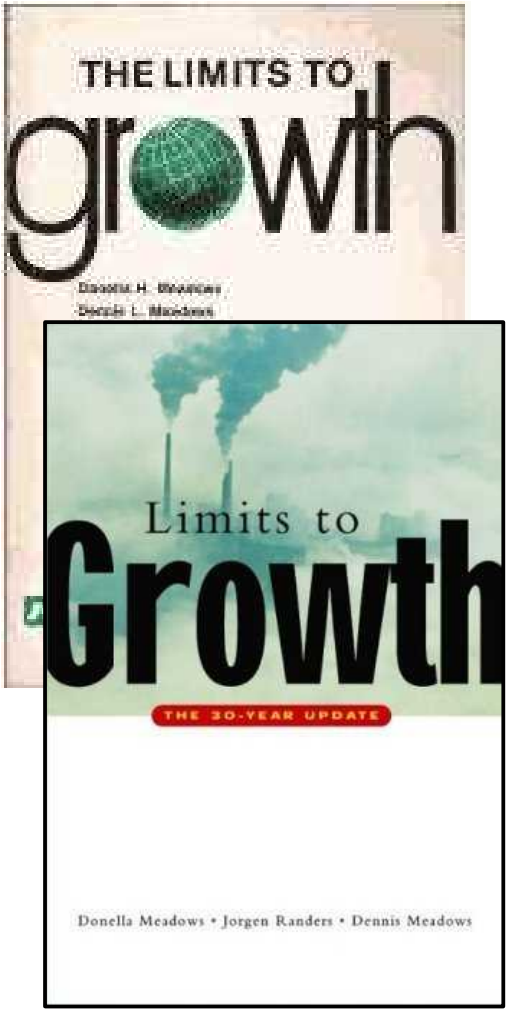


ert Ayres, Benjamin Warr

The Problem of Worsening Resource Efficiency



Living life at the “limits”



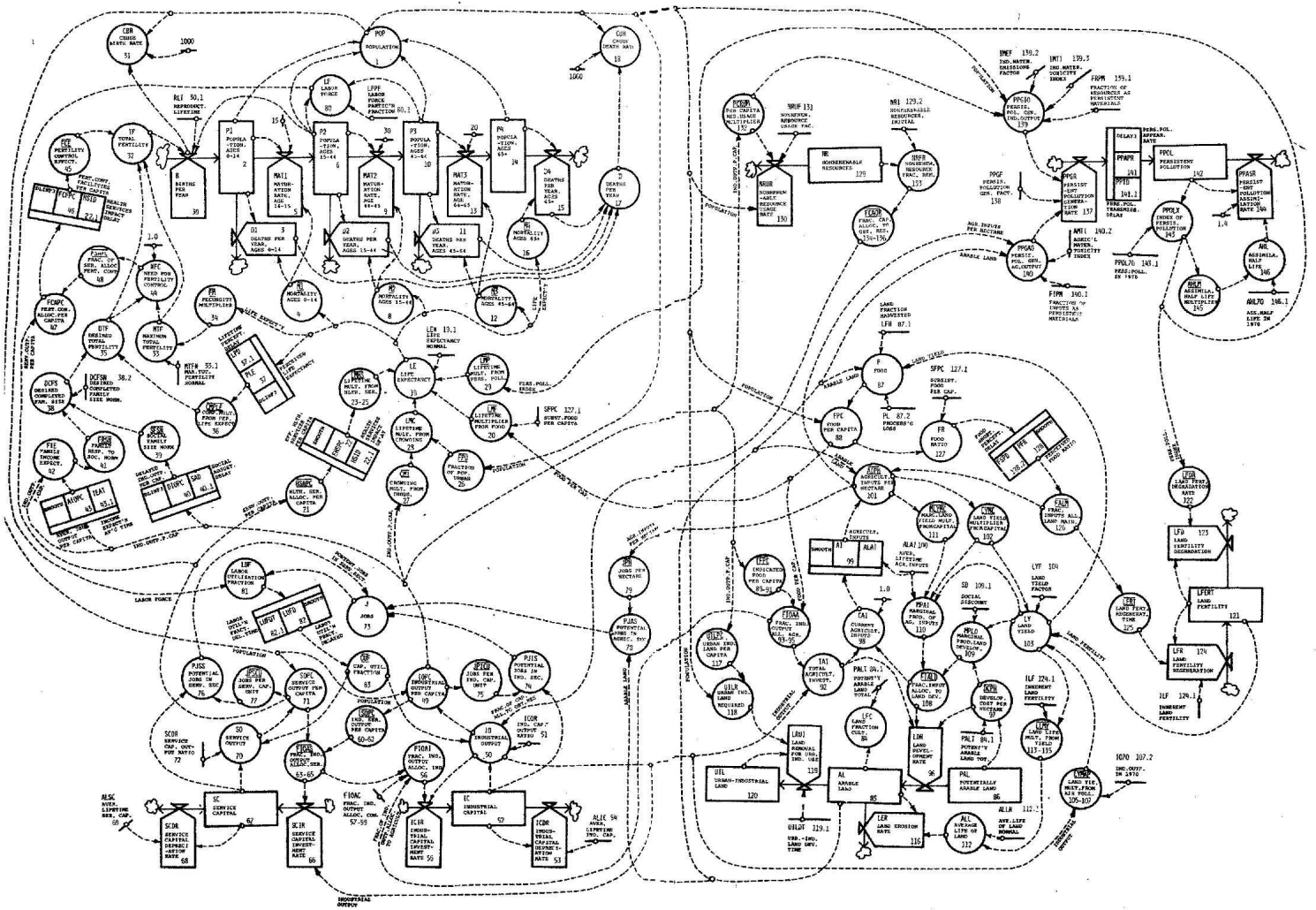
Energy is not like other resources – it's an essential pre-requisite of economic activity and growth. The problems foreseen by the 1972 *Limits to Growth* report are happening roughly as predicted; the shift from “conventional” to “unconventional” energy and mineral resources is an indication of the limits to human development.

Planning a sustainable future requires that the political process accepts there are 'limits to growth'. Unfortunately the political world chooses to ignore the growing body of evidence on these trends.

Living life at the “limits”

“Limits to Growth” was one of the first econometric studies to use *'systems theory'* in its design.

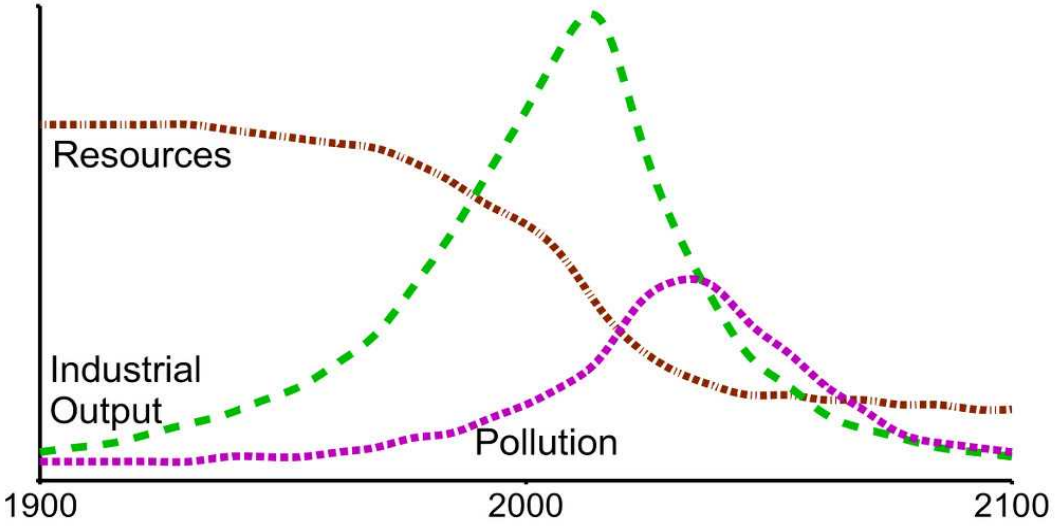
Their *'World'* model doesn't just use numbers within functions – it is an iterative process which uses feedback mechanisms to dynamically model change over time.

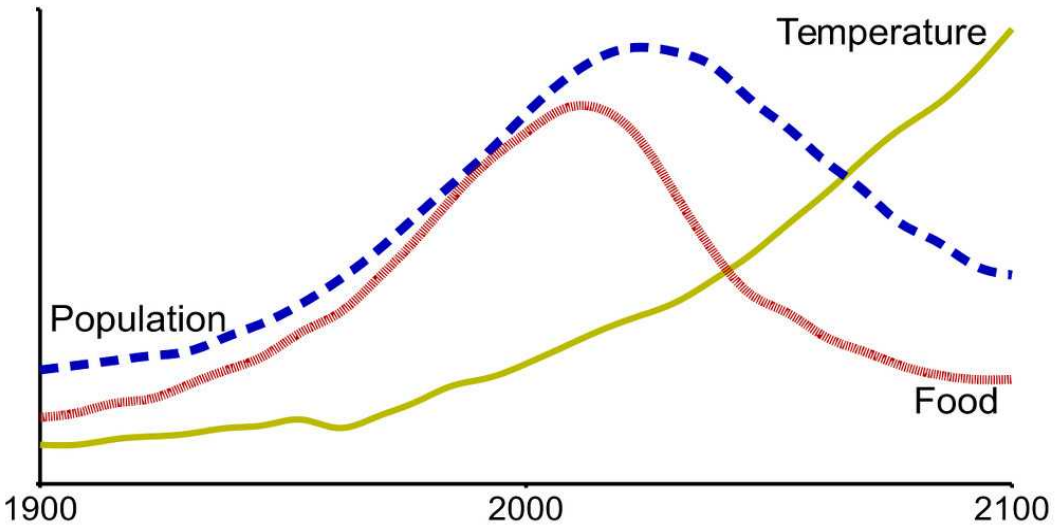


Living life at the “limits”

Limits to Growth is a 'biophysical', not simply a 'human' process:

- Energy and resources are finite within Earth's 'isolated' system *(First Law of Thermodynamics)*;
- Efficiency will always present a diminishing return *(Second Law of Thermodynamics)*;
- 'Uneconomic' efficiencies may often have the most beneficial effect on the environment;
- Forestalling action will always be the worst option! (precautionary principle).





“Perspectives on Limits to Growth 2012”

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Growth isn't possible

Why we need a new economic direction

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Perspective

Can a collapse of global civilization be avoided?

Paul R. Ehrlich† and Anne H. Ehrlich

Department of Biology, Stanford University, Stanford, CA 94305, USA

Environmental problems have contributed to numerous collapses of civilizations in the past. Now, for the first time, a global collapse appears likely. Overpopulation, overconsumption by the rich and poor choices of technologies are major drivers; dramatic cultural change provides the main hope of averting calamity.

Revisiting the Limits to Growth After Peak Oil

In the 1970s a rising world population and the finite resources available to support it were hot topics.

Charles A. S. Hall and John W. D

In recent decades there has been considerable discussion in academia and the media about the environmental impacts of human activity, especially those related to climate change and biodiversity, but far less attention has been paid to the diminishing resource base for humans. Despite our inattention, resource depletion and population growth have been continuing relentlessly. The most immediate of these issues appears to be a decline in oil reservoirs; a phenomenon commonly referred to as "peak oil" because global production appears to have reached a maximum and is now declining. However, a set of related resource and economic issues are continuing to come home to roost in ever greater numbers and impacts—so much so that author Richard Heinberg speaks of "peak everything." We believe that

COMMENT

FORUM Asking the right questions can revitalize research p.436

BOOKWORM Joseph Rotblat's crusade for nuclear disarmament p.438

CORRESPONDENCE How to create the Universe from a sea of nothing p.440

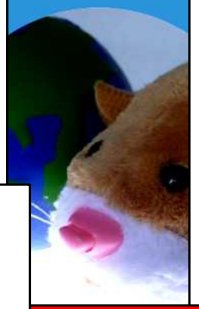
OBITUARY James Crow, genetic pioneer and accomplished musician p.444

Production at oil fields globally, including at the Kern River oil field in Bakersfield, California, is declining at about 6–6%, a year.

Oil's tipping point has passed

The economic pain of a flattening supply will trump the environment as a reason to curb the use of fossil fuels, say **James Murray** and **David King**.

Leverage Points
Places to Intervene in a System



Tracking the ecological overshoot of the human economy

Mathis Wackernagel*†, Niels B. Schulz‡, Diana Deumling*, Alejandro Callejas Linares‡, Martin Jenkins¶, Valerie Kapos‖, Chad Monfreda*, Jonathan Loh‖, Norman Myers, Richard Norgaard††, and Jørgen Randers‡‡**

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Sustainability requires living within the regenerative capacity of the biosphere. In an attempt to measure the extent to which humanity satisfies this requirement, we use existing data to translate human demand on the environment into the area required for the production of food and other goods, together with the absorption of wastes. Our accounts indicate that human demand may well have exceeded the biosphere's regenerative capacity since the 1980s. According to this preliminary and exploratory assessment, humanity's load corresponded to 70% of the capacity of the global biosphere in 1961, and grew to 120% in 1999.

Accounting for Humanity's Use of the Global Biosphere

The human economy depends on the planet's natural capital, which provides all ecological services and natural resources

undergone collapse, a loss of sparized by a dramatic decline nt and China, have recovered that of Easter Island or the All those previous collapses s and civilizations persisted ibrates valleys, new civiliza- sses, overexploitation of the ume [3].

civilization—the worldwide, society in which we all are to with collapse by an array of ll engaged in what Prince d scale' [4], facing what the called a 'perfect storm' of

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A COMPARISON OF THE LIMITS TO GROWTH WITH THIRTY YEARS OF REALITY

Graham Turner

Socio-Economics and the Environment in Discussion
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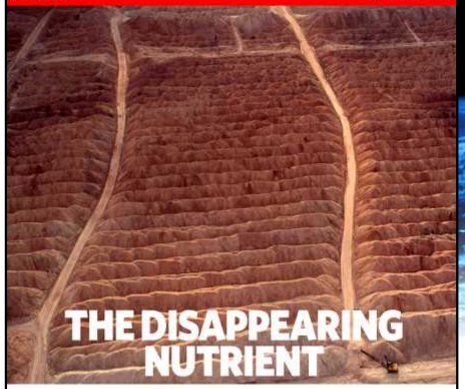
WS FEATURE



THE DISAPPEARING NUTRIENT

hosphate-based fertilizers have helped spur agricultural gains in the past century, but the wo may soon run out of them. **Natasha Gilbert** investigates the potential phosphate crisis.

en years ago, Don Mavinic was working on a way to get rid of a pesky precipitate that plugs up the works of waste-water treatment plants. Known as struvite, olid crud forms in pipes and pumps when eria are used to clean up sewage sludge. Mavinic, a civil engineer at the University British Columbia in Vancouver, Canada, ized that struvite was more than just rub- . A combination of phosphate, magnesium ammonium, struvite contains many of the rtial nutrients that plants need. Mavinic developed a way to remove the precipitate

phosphorus in the form of phosphate, which has an essential role in RNA and DNA and in cellular metabolism. Every year, China, the United States, Morocco and other countries mine millions of tonnes of phosphate from the ground (pictured above), the bulk of which is turned into fertilizer for food crops. But such deposits are a finite resource and could disappear within the century.

Experts disagree on how much phosphate is left and how quickly it will be exhausted. But many argue that a shortage is coming and that it will leave the world's future food supply

"It is a very curious thing that someth important is so poorly understood and w talked about in the larger political arena Arno Rosemarin, a water-resources spec at the Stockholm Environment Institute has researched global phosphate use. All international leaders have not tended to fo the potential for phosphate shortages, the has been proposed for discussion next mo a United Nations meeting on global food rity — an indication that it is starting to a the attention of the international community

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Synthesis Report

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Assessing Rare Metals as Supply-Chain Bottlenecks in Low-Carbon Energy Technologies

Leverage Points
Places to Intervene in a System

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Sciencexpress Research Articles

Planetary boundaries: Guiding human development on a changing planet

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The planetary boundaries framework defines a safe operating space for humanity based on the intrinsic biophysical processes that regulate the stability of the Earth System. Here, we revise and update the planetary boundaries framework, with a focus on the underpinning biophysical science, based on targeted input from expert research communities and more general scientific advances over the past 5 years. Several of the boundaries now have a two-tier approach, reflecting the importance of cross-scale interactions and the regional-level heterogeneity of the processes that underpin the boundaries. Two core boundaries—climate change and biosphere integrity—have been identified, each of which has the potential on its own to drive the Earth System into a new state should they be substantially and persistently transgressed.

The planetary boundaries (PB) approach (*1*, *2*) aims to define a safe operating space for human societies to develop and thrive, based on our evolving understanding of the functioning and resilience of the Earth System. Since its introduction, the framework has been subject to scientific scrutiny [e.g., (*3*–*7*)] and has attracted considerable interest and discussions within the policy, governance, and business sectors as an approach to inform efforts towards global sustainability (*8*–*10*).

In this analysis we further develop the basic PB framework by (i) introducing a two-tier approach for several of the boundaries to account for regional-level heterogeneity; (ii) updating the quantification of most of the PBs; (iii) identifying two core boundaries; and (iv) proposing a regional-level quantitative boundary for one of the two that were not quantified earlier (*1*).

The basic framework: Defining a safe operating space

Throughout history, humanity has faced environmental constraints at local and regional levels, with some societies dealing with these challenges more effectively than others (*11*, *12*). More recently, early industrial societies often used local systemsess and sinks

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Living life at the “limits”

In 2007 the Australian Government commissioned the CSIRO to review the 'Limits to Growth' hypothesis.

The result, published in 2008, was not quite what many had anticipated...

"As shown, the observed historical data for 1970-2000 most closely matches the simulated results of the LtG 'standard run' for almost all outputs reported; this scenario results in a global collapse before the middle of this century...
contemporary issues such as peak oil, climate change and food and water security resonate strongly with the feedback dynamics of 'overshoot and collapse' displayed in the LtG standard scenario."

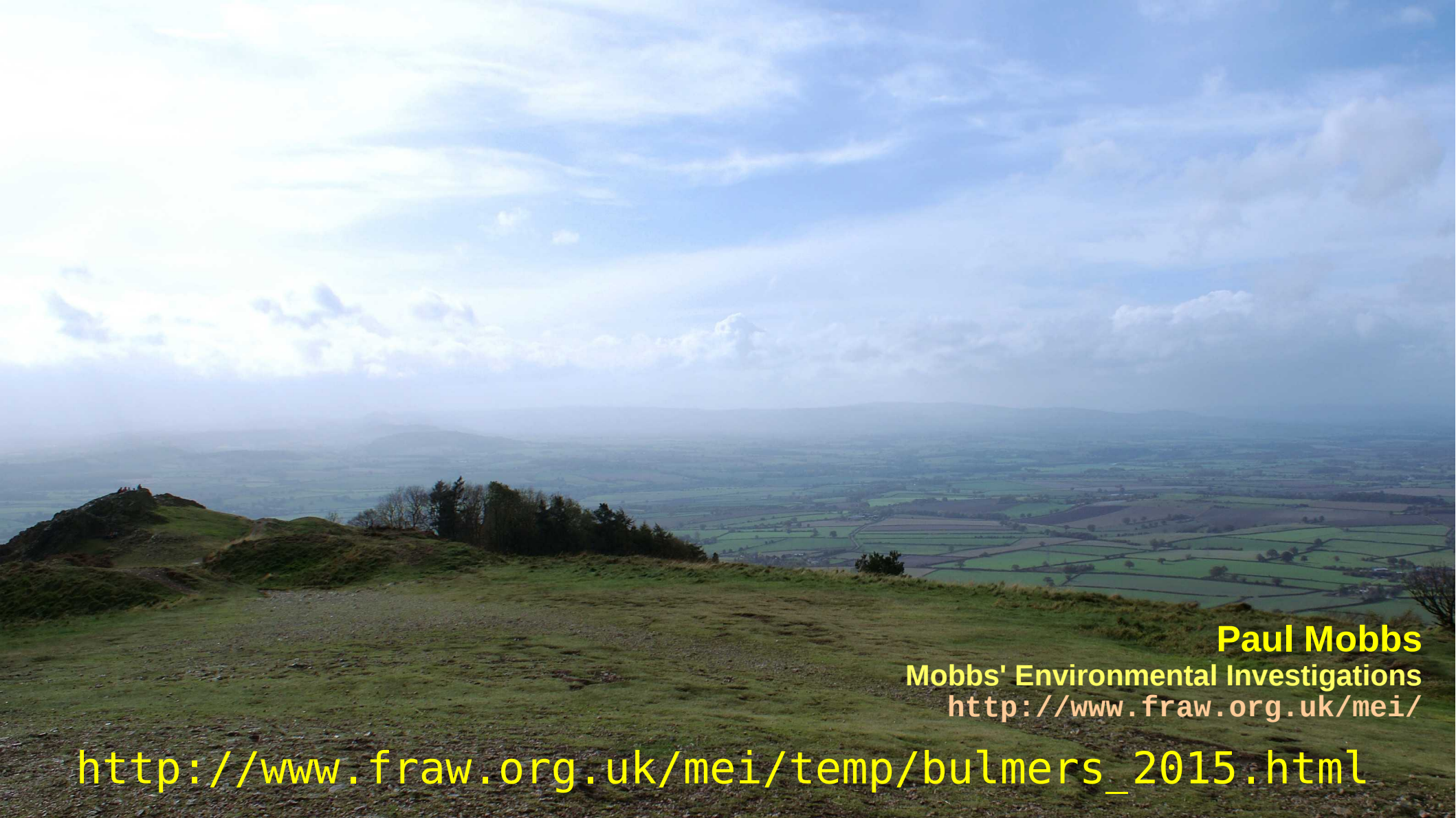
“With out thoughts we make the world”

Is it the end? *(as we know it?)* Well done for sitting through this extremely heavy presentation which contradicts about 95% of the mainstream media's view of economics and the environment!

In conclusion, a few 'thinking points':

- The foreseeable changes ahead necessitate a change of lifestyle/outlook, not a change of brand or product;
- If you only think of carbon you're going to make some short-sighted decisions – *think of the totality of impacts*;
- Fundamentally, you can't solve a problem of consumption with more, albeit slightly different consumption.

This problem requires us to work on the content of the space between our ears, not the space around us!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