



Peak Oil, Peak Economy

Richard Heinberg

Post Carbon Institute

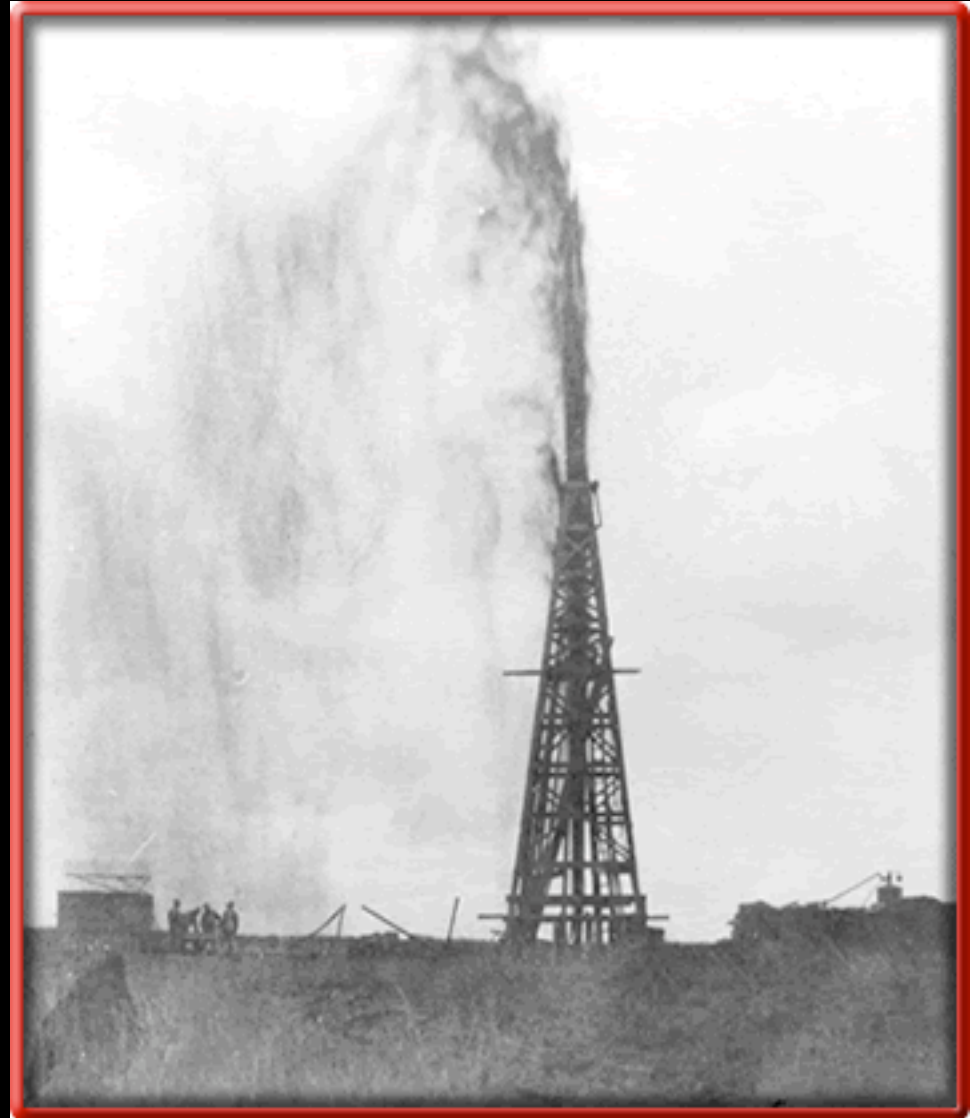
Energy



***For most of
history,
humans
relied on
renewable
energy
sources***

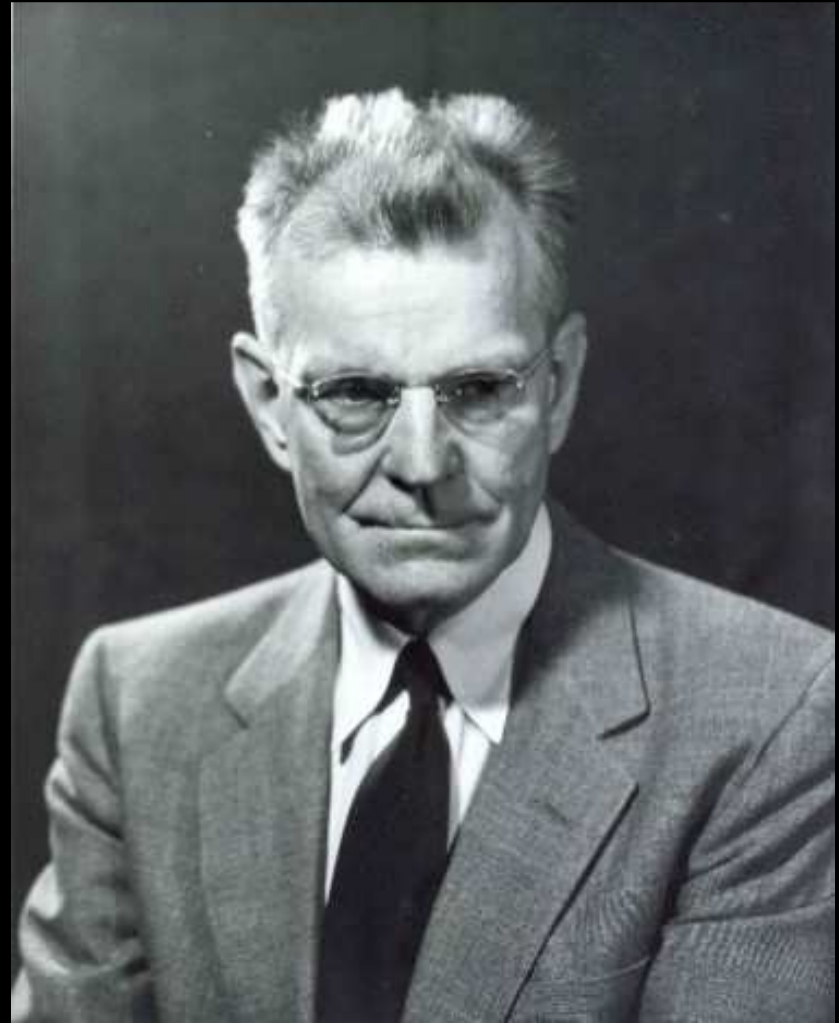
The fossil-fueled
industrial era—

*winning the
energy prize*

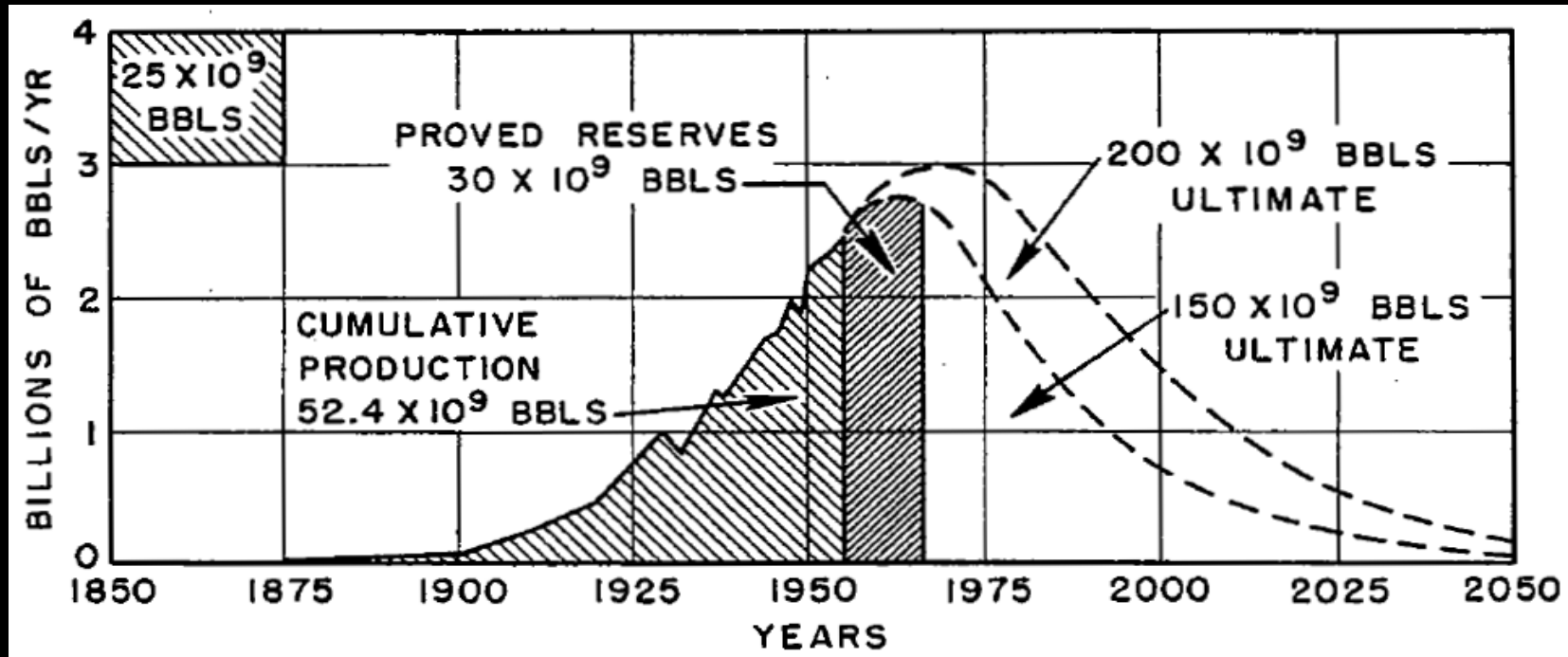


Marion King Hubbert

- Geophysicist at Shell lab in Houston, taught at MIT, UCLA
- Forecast peak year of US oil production

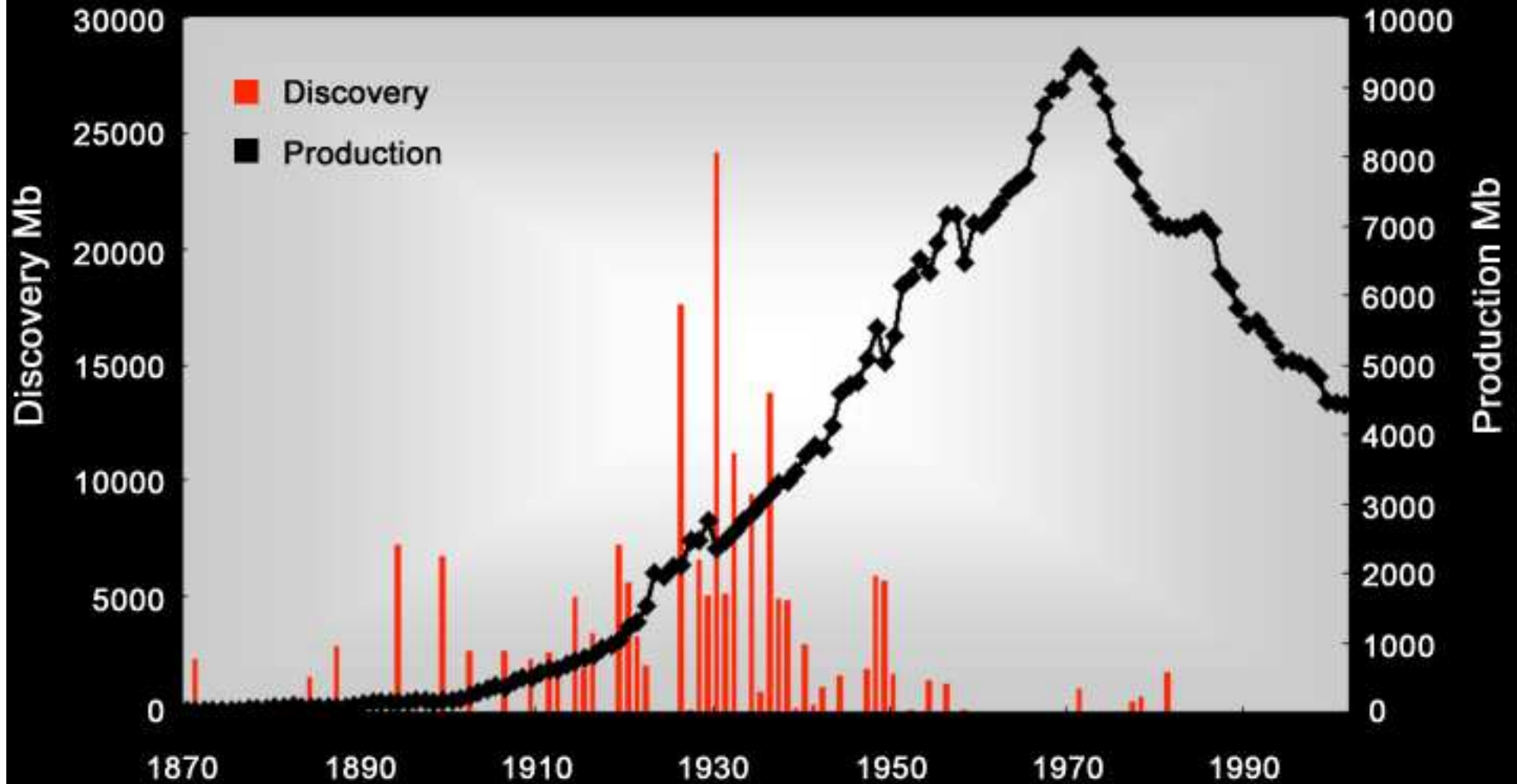


Hubbert's Peak

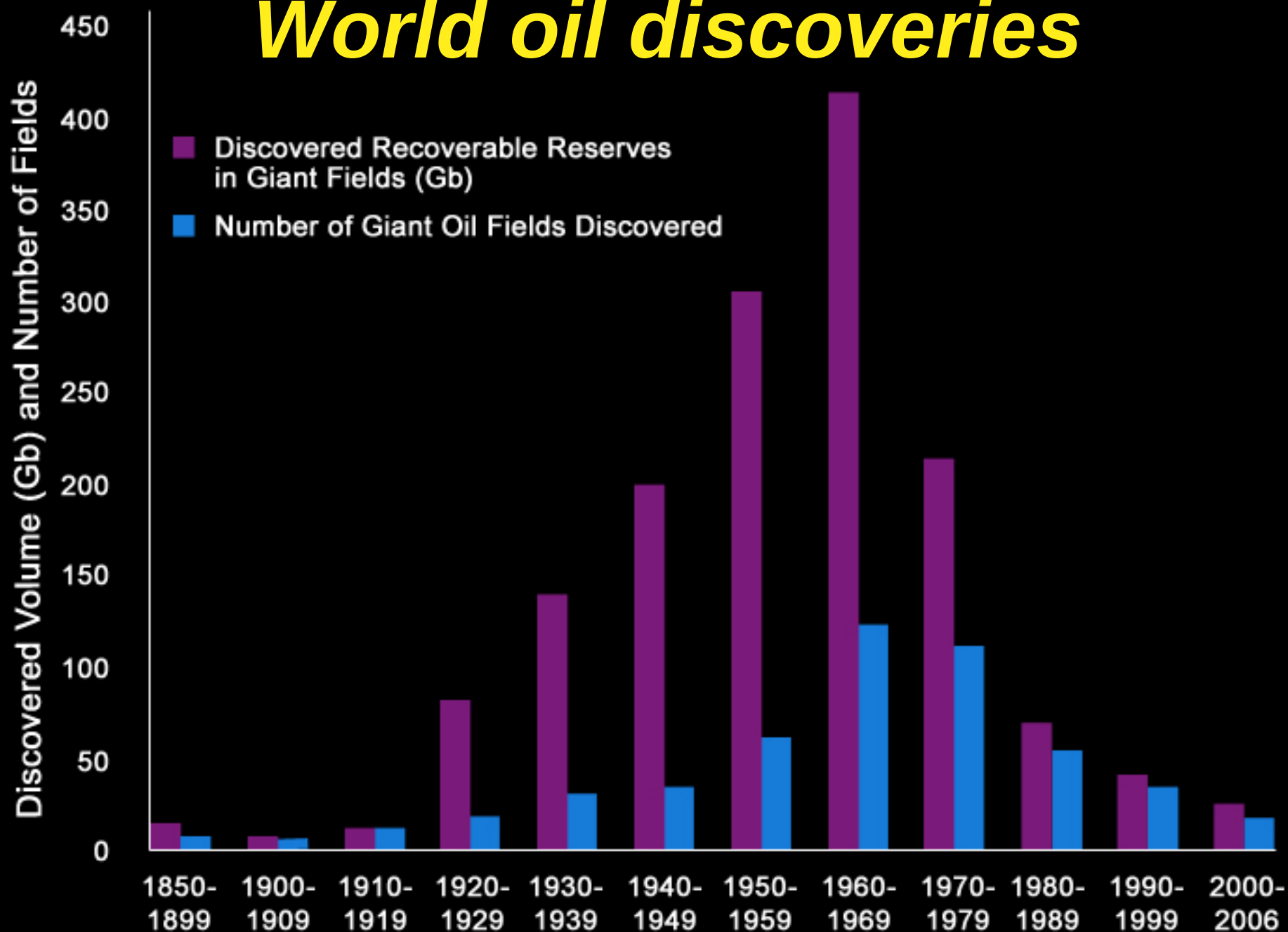


- From his 1956 paper
- For the larger estimate, he predicted a peak in 1970

Oil production – lower 48



World oil discoveries

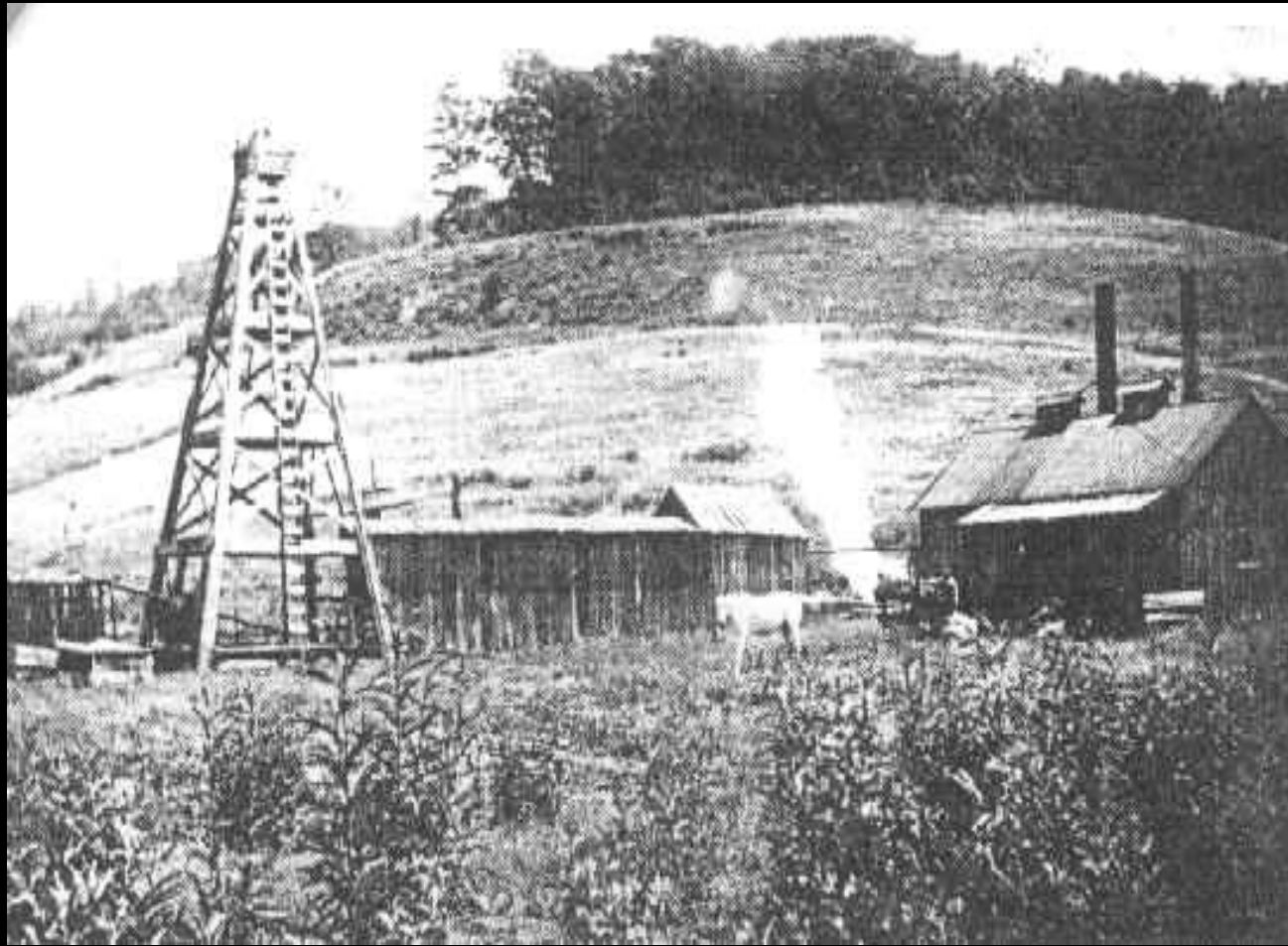


Global oil production falls when loss of output from countries declining exceeds gains from those expanding



World Crude Oil Production





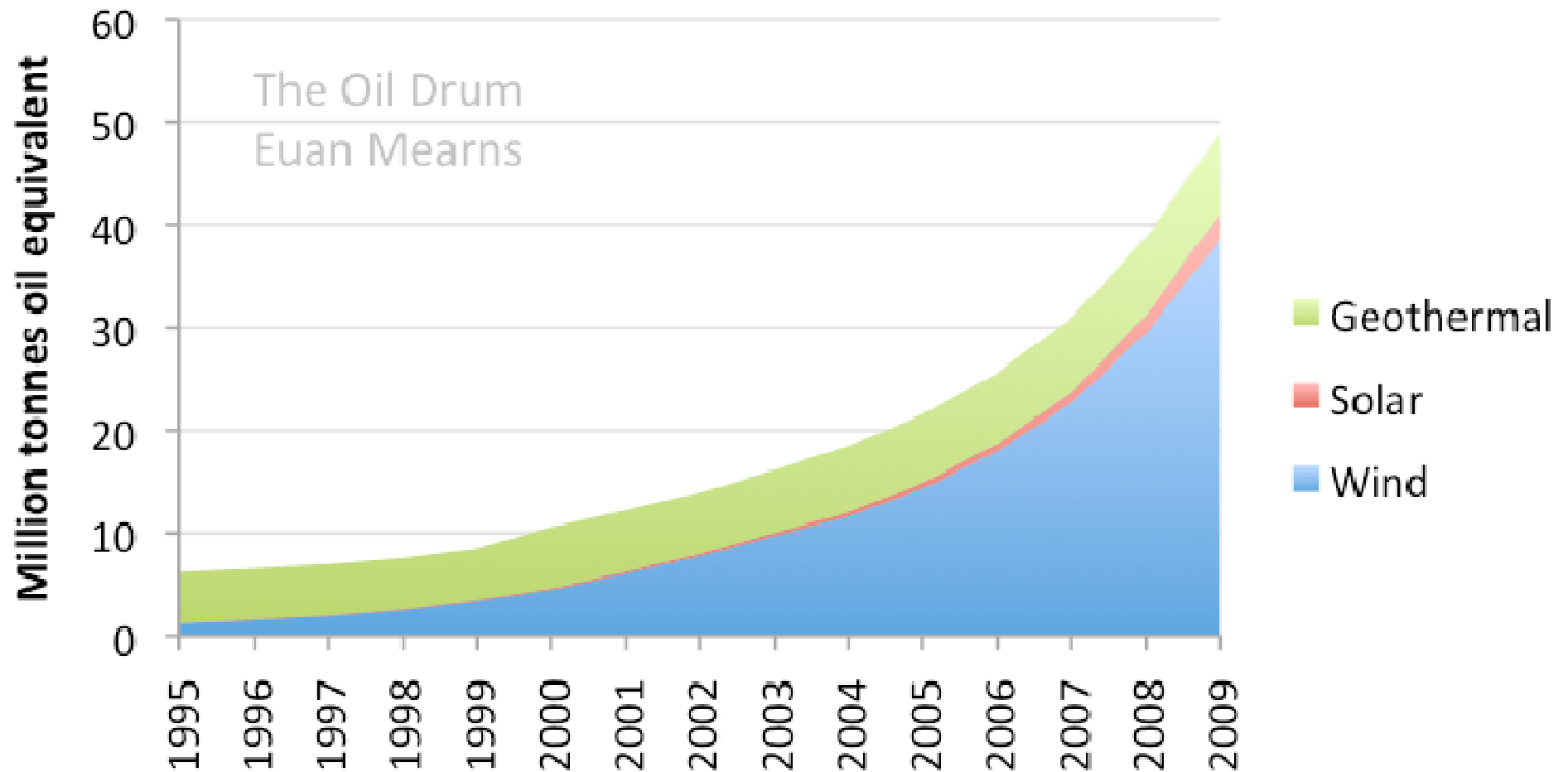




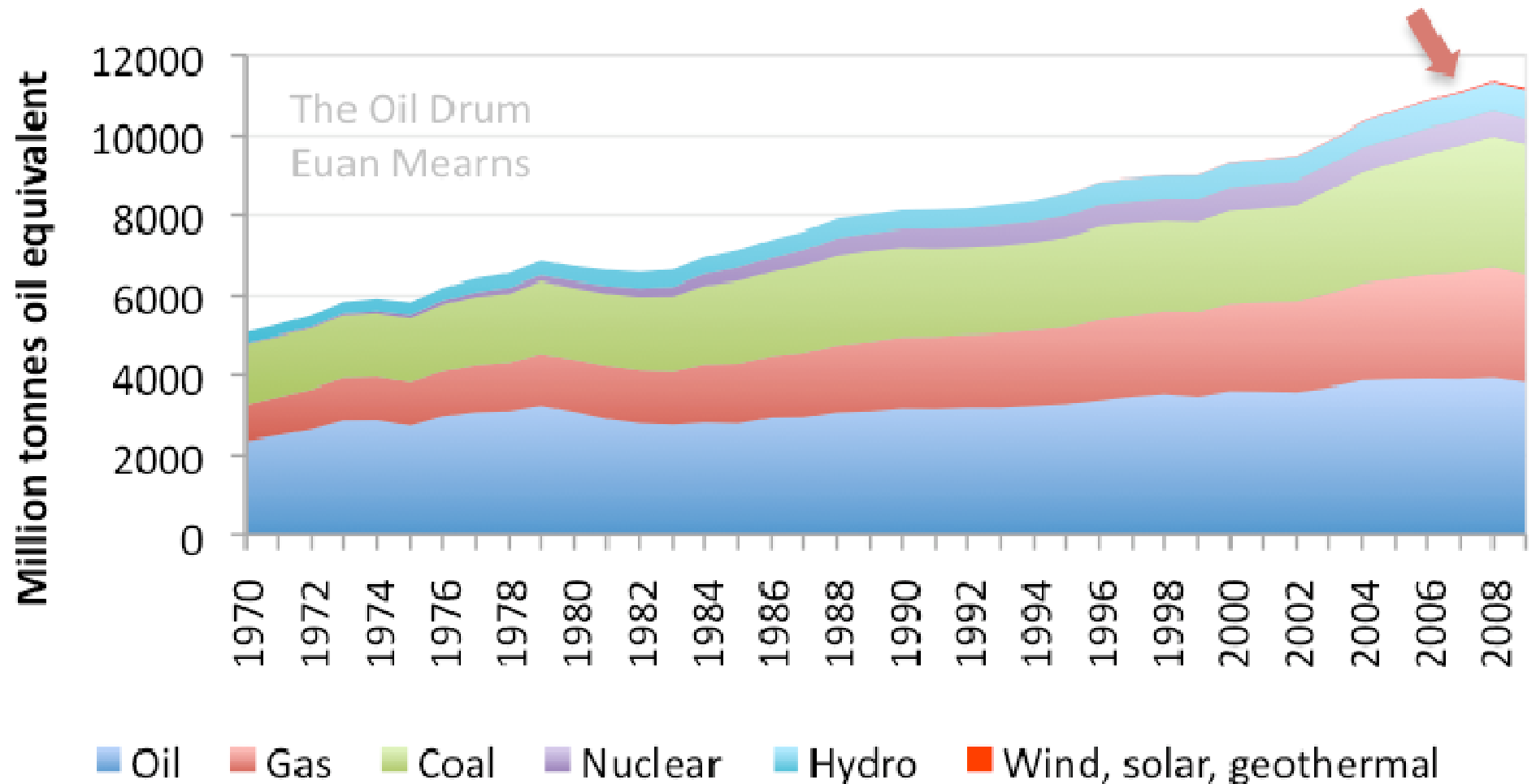


Peak Oil means the end of affordable travel

World renewable energy production



World primary energy production



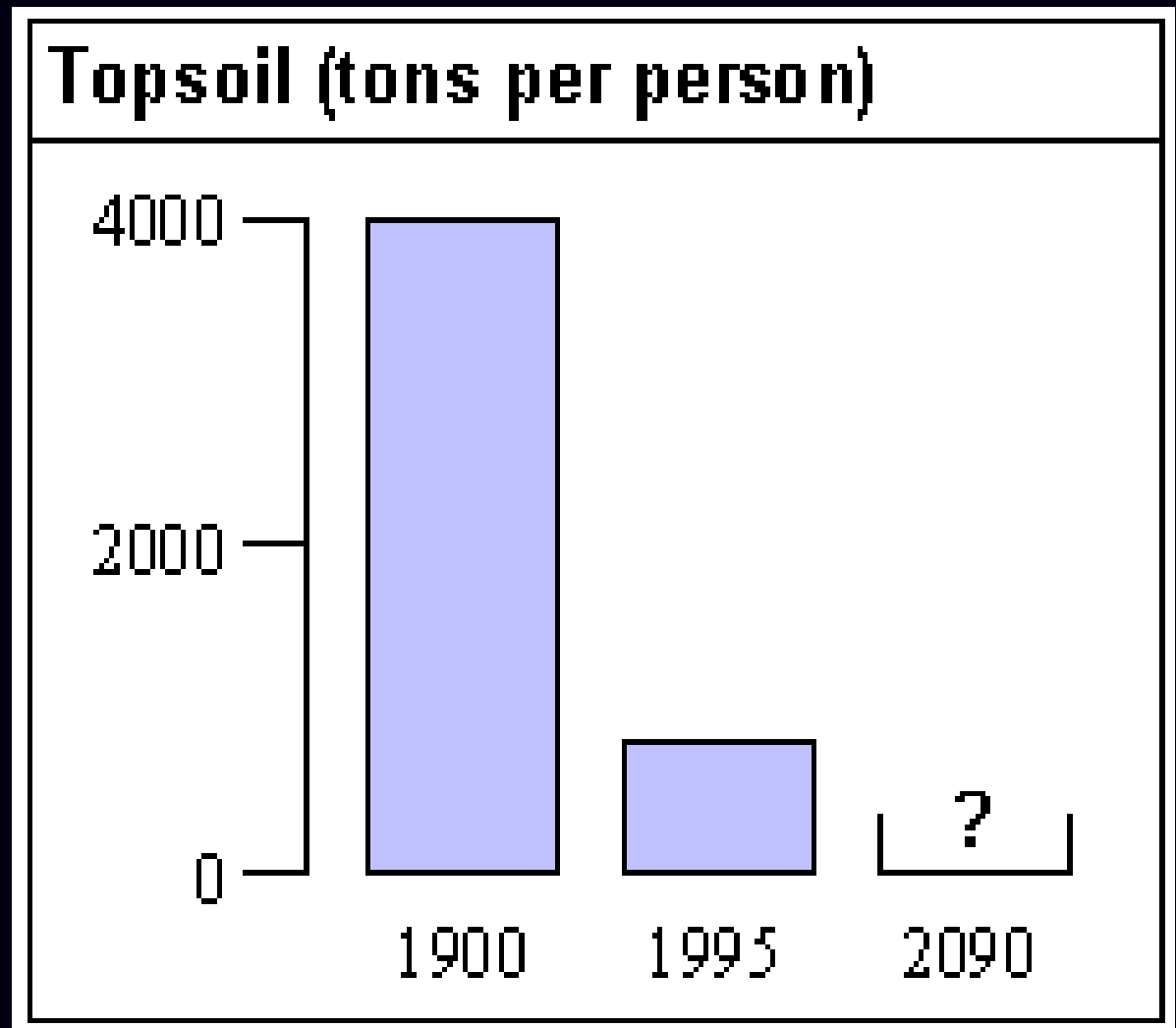
Food



Peak Oil means Peak Food

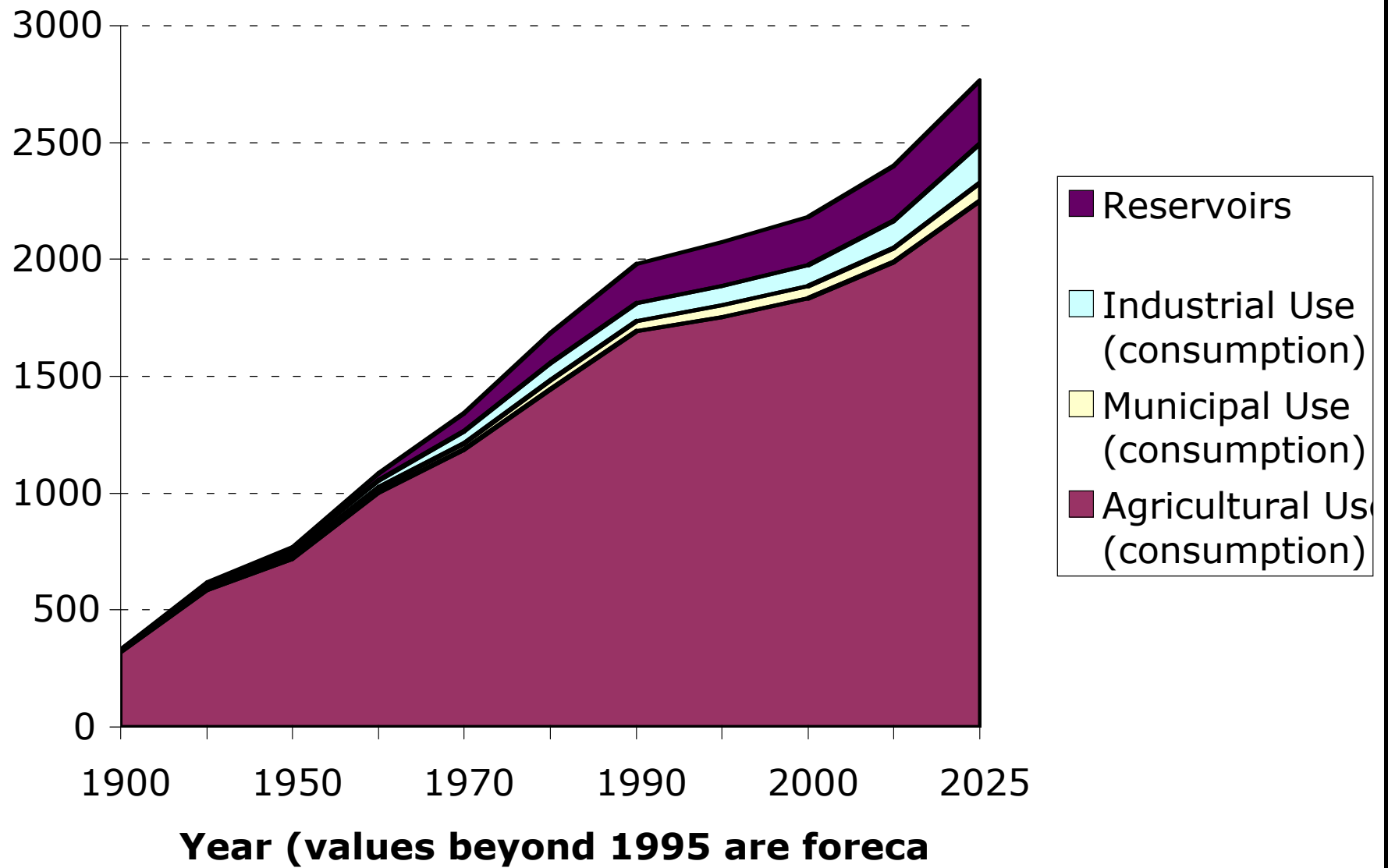


soil erosion
claims 24
billion tons
of topsoil
per year



Water

World Water Use: Consumpt

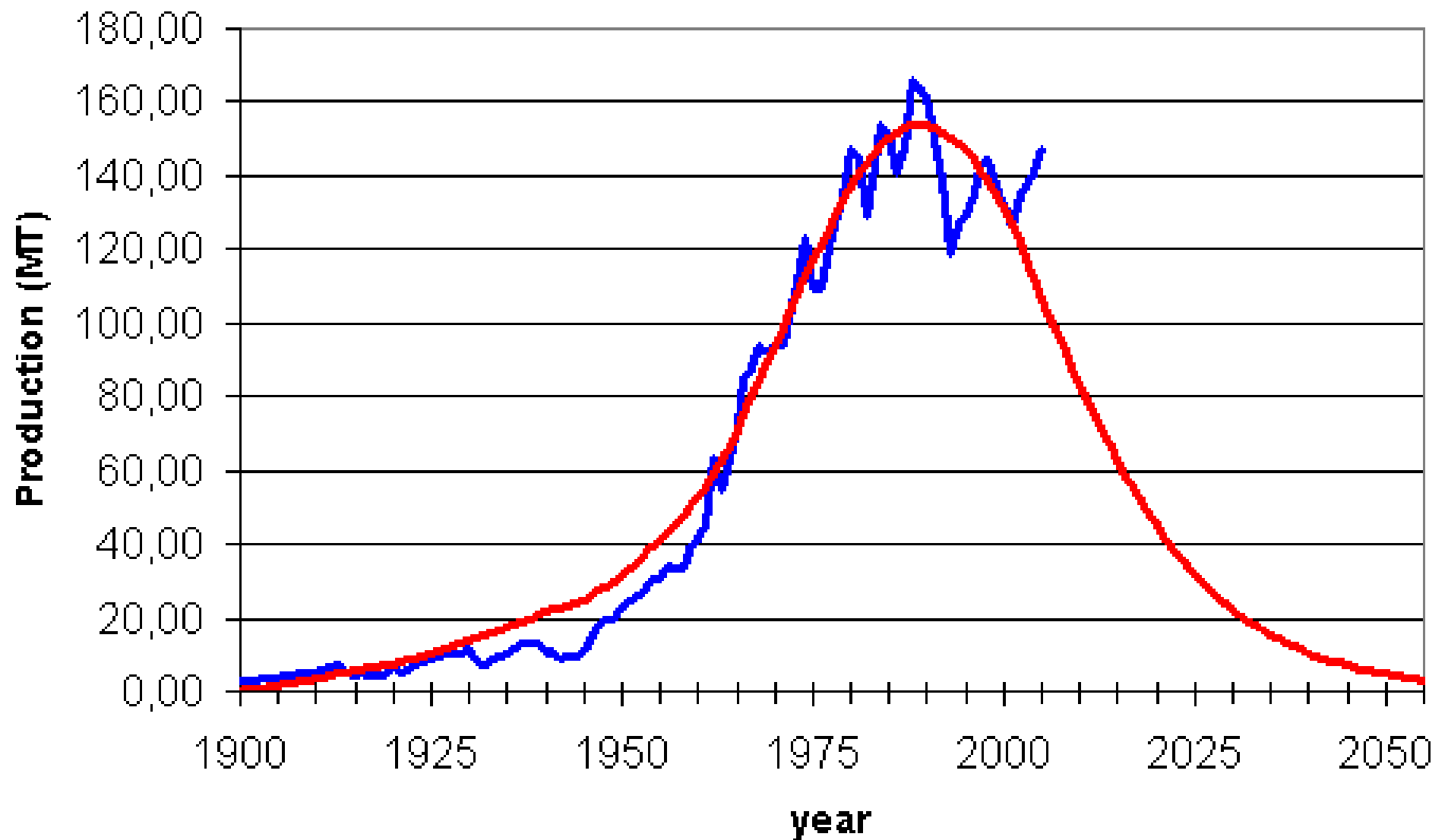


Minerals

Depleting materials

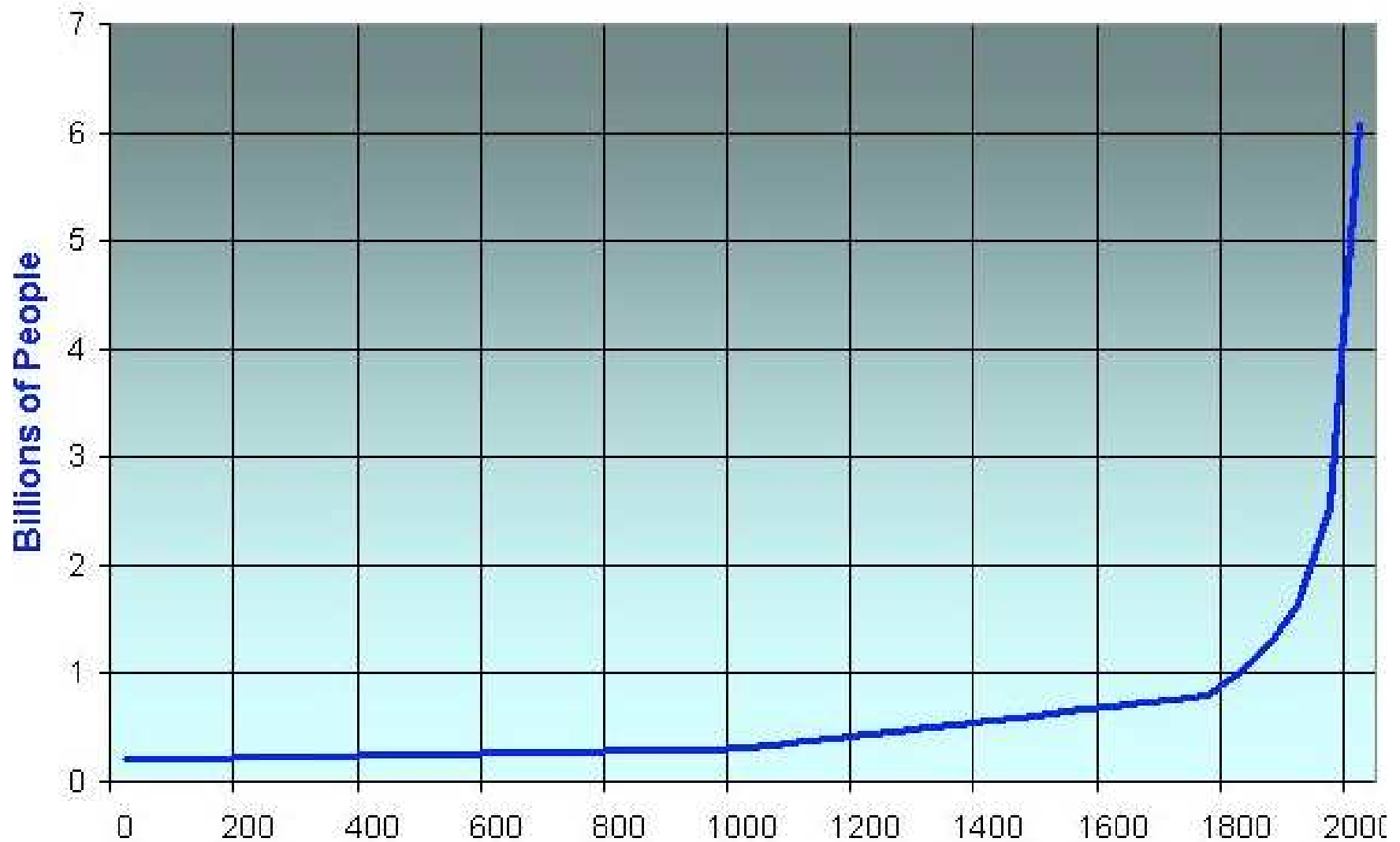
Antimony	China	Thermoelectric/paraelectric materials
Barium	China	Thermoelectric/paraelectric materials
Bismuth	China, Mexico	Thermoelectric/paraelectric materials
Cobalt	Kinshasa, Australia	Photovoltaics
Gallium	China	Photovoltaics
Germanium	Belgium, Canada	Photovoltaics
Indium	China, Canada	Photovoltaics, thermo/paraelectric mat'ls
Manganese	Gabon, S. Africa	Photovoltaics
Nickel	Canada	Fuel cells
Platinum	S. Africa	Fuel cells, para/thermoelectric materials
Rare Earths	China	Fuel cells, para/thermoelectric materials
Tellurium	Belgium, Germany	Solar cells, semiconductors
Titanium	Australia, S. Africa	Solar cells
Zinc	Canada, Mexico	Photovoltaics, fuel cells

World rock phosphate production



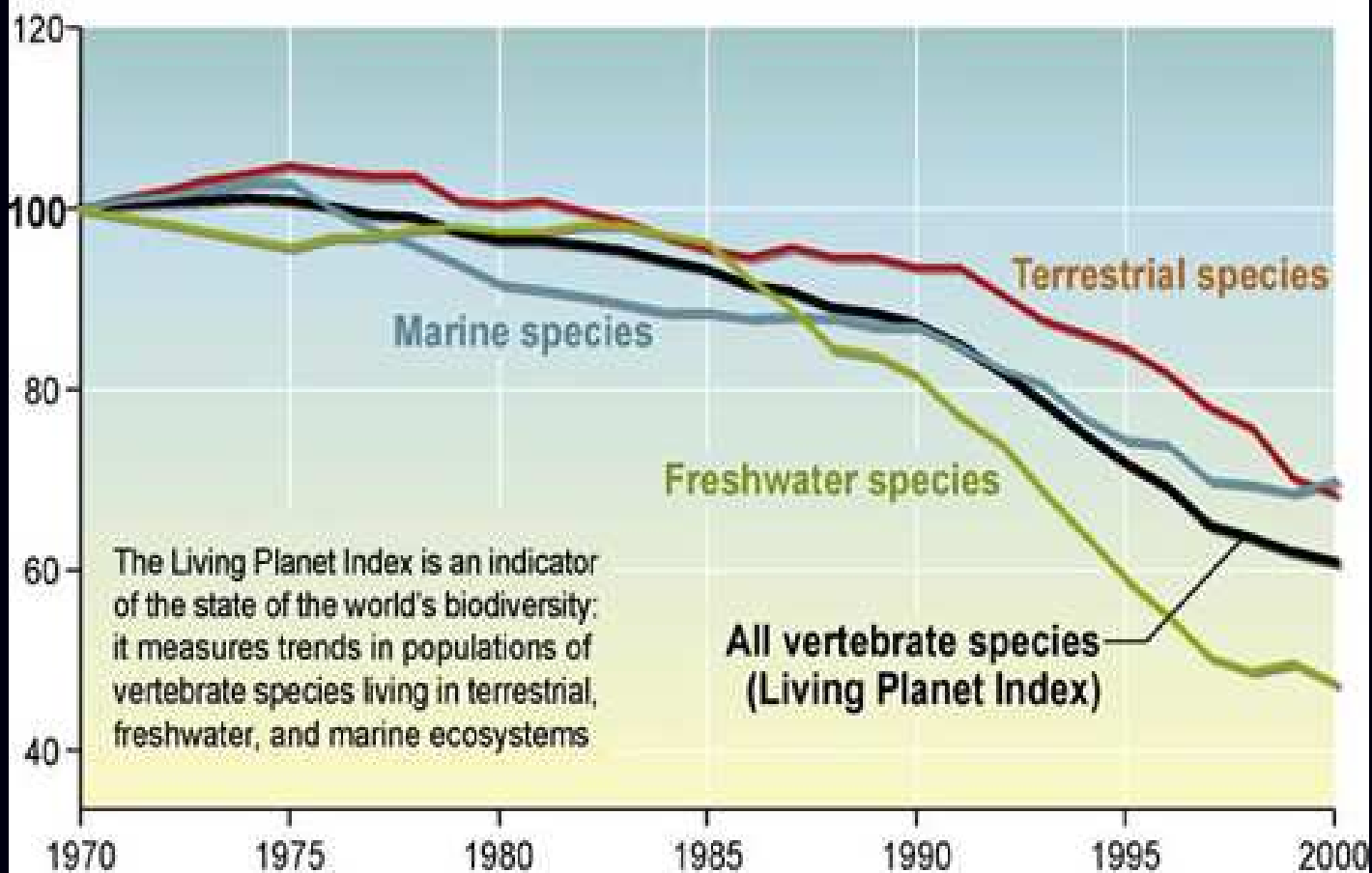
Population

World population



Biodiversity

Population Index = 100 in 1970



Source: WWF, UNEP-WCMC

30 percent of amphibians, 21 percent of mammals, and 12 percent of bird species are under threat of extinction

Climate

SPECIAL REPORT GLOBAL WARMING

TIME

BE
WORRIED.
BE **VERY**
WORRIED.

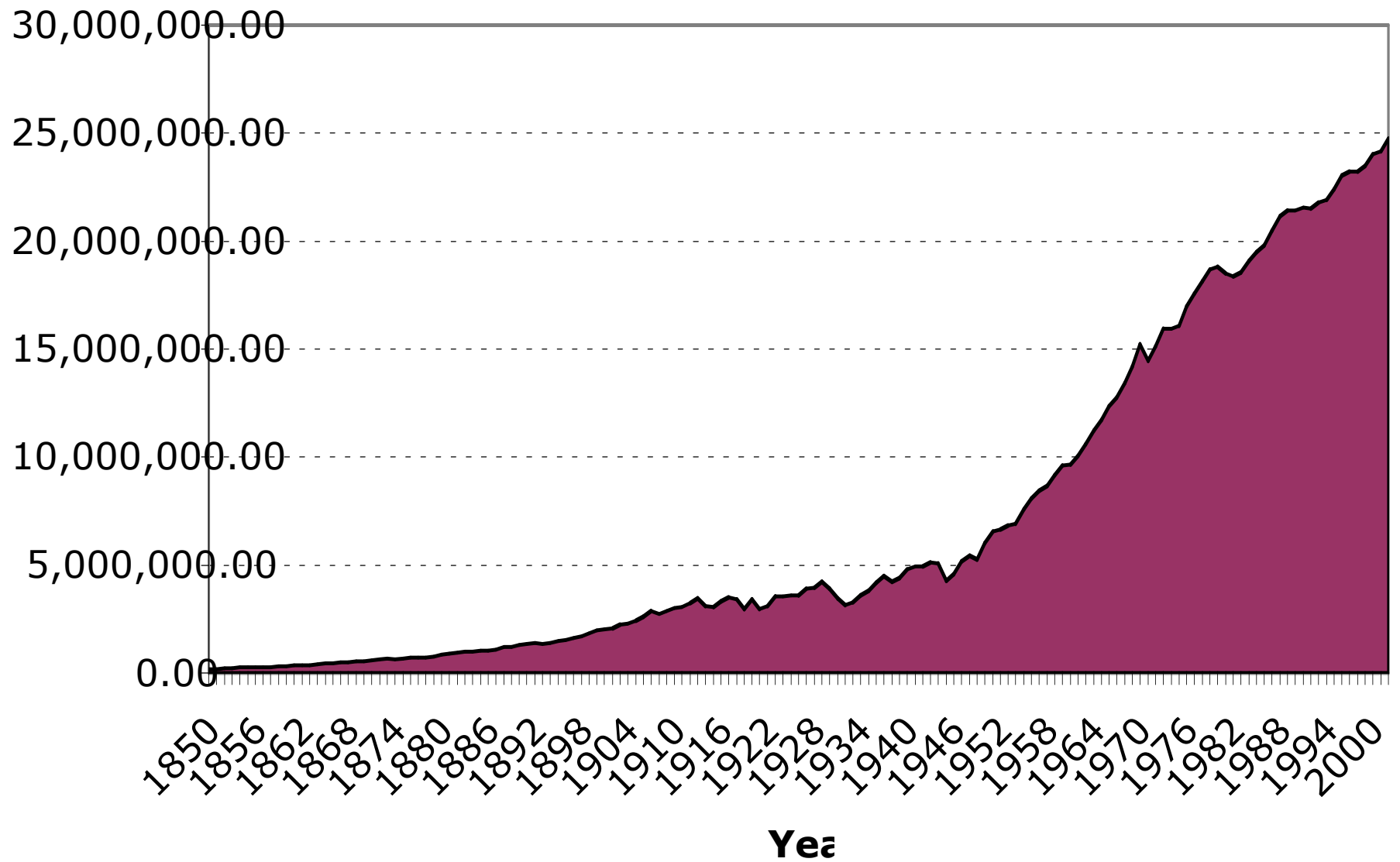
Climate change isn't some vague future problem—it's already damaging the planet at an alarming pace. Here's how it affects you, your kids and their kids as well.

EARTH AT THE **TIPPING POINT**
HOW IT THREATENS YOUR **HEALTH**
HOW **CHINA & INDIA** CAN HELP
SAVE THE WORLD—OR DESTROY IT
THE CLIMATE **CRUSADERS**



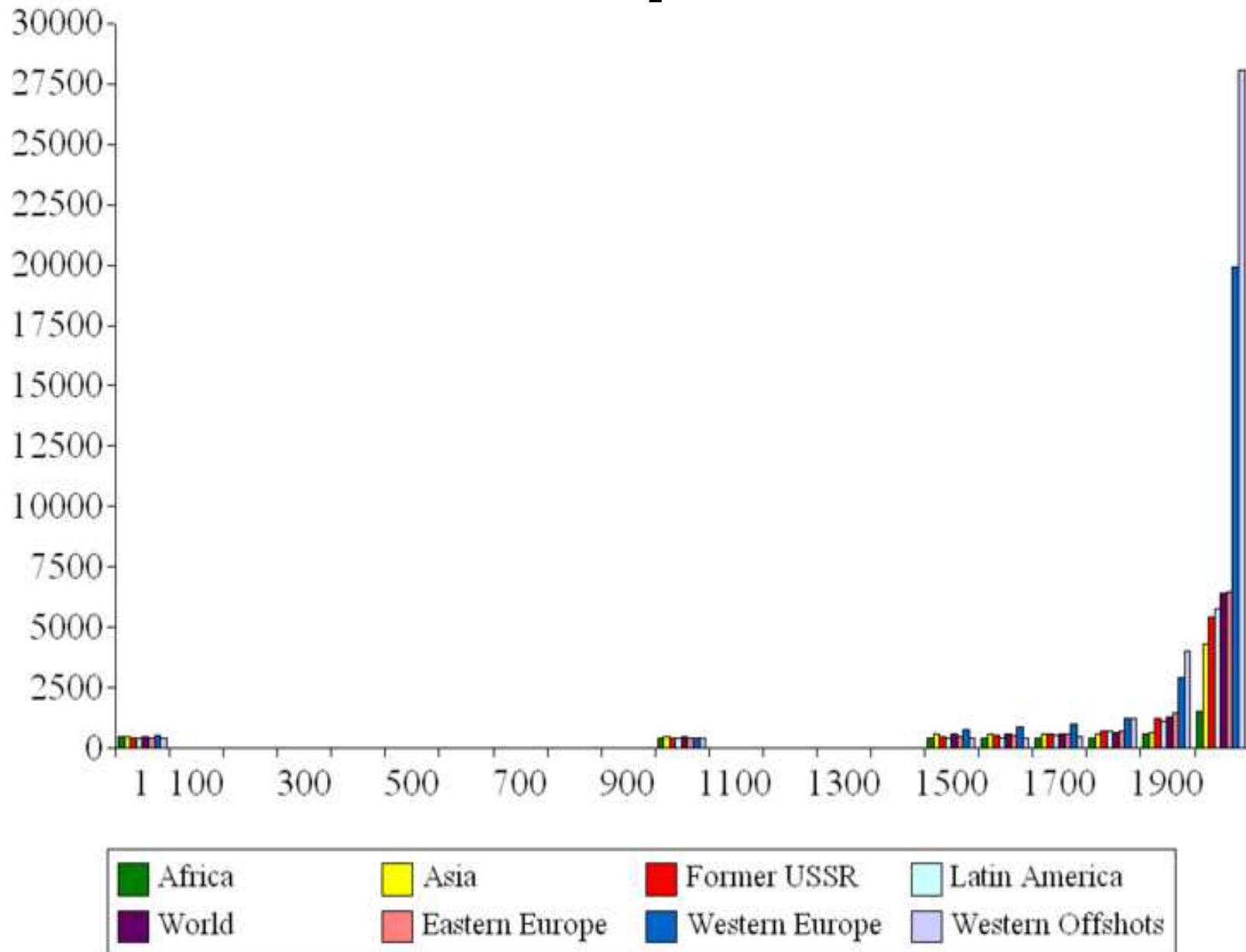
*We're
performing a
giant science
experiment
with the
Earth's
atmosphere*

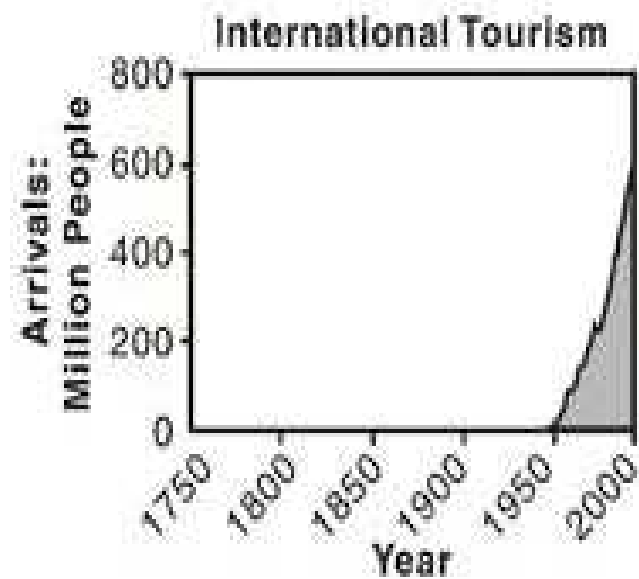
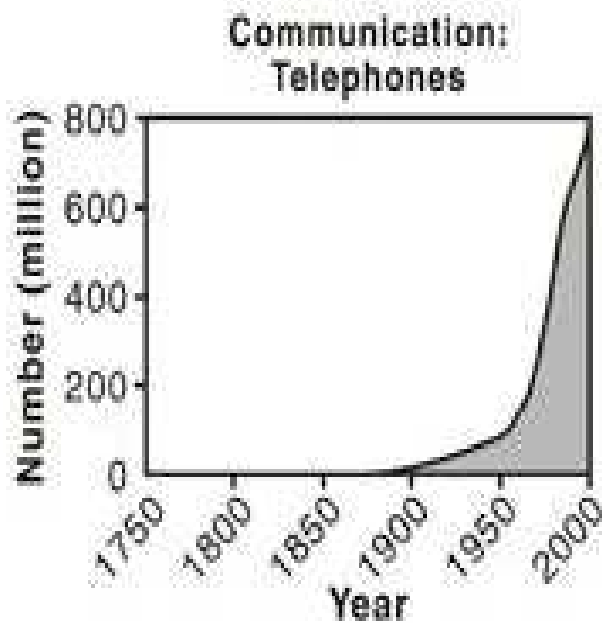
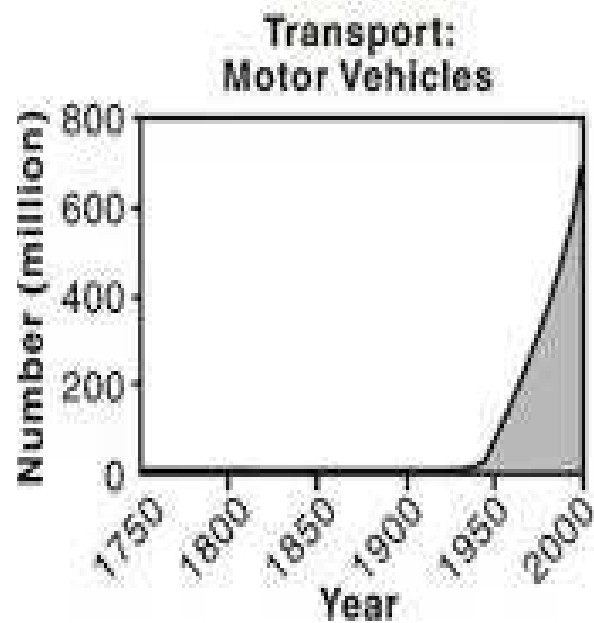
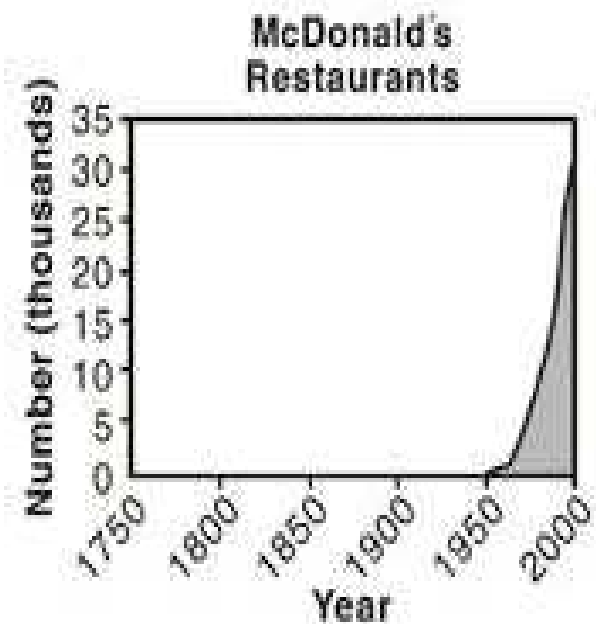
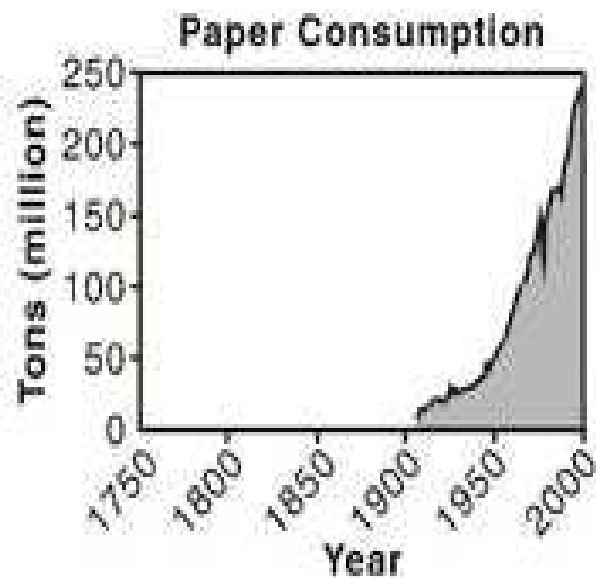
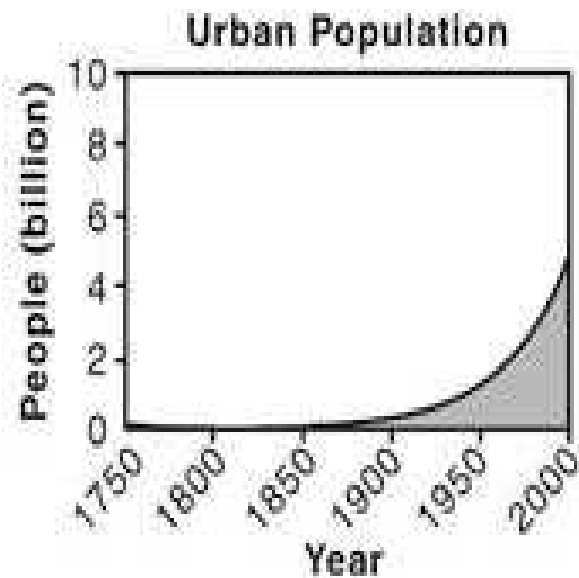
World Total Carbon Dioxide



Economy

World GDP/capita 1-2003 AD





***Meanwhile, we developed
economic institutions
and theories***



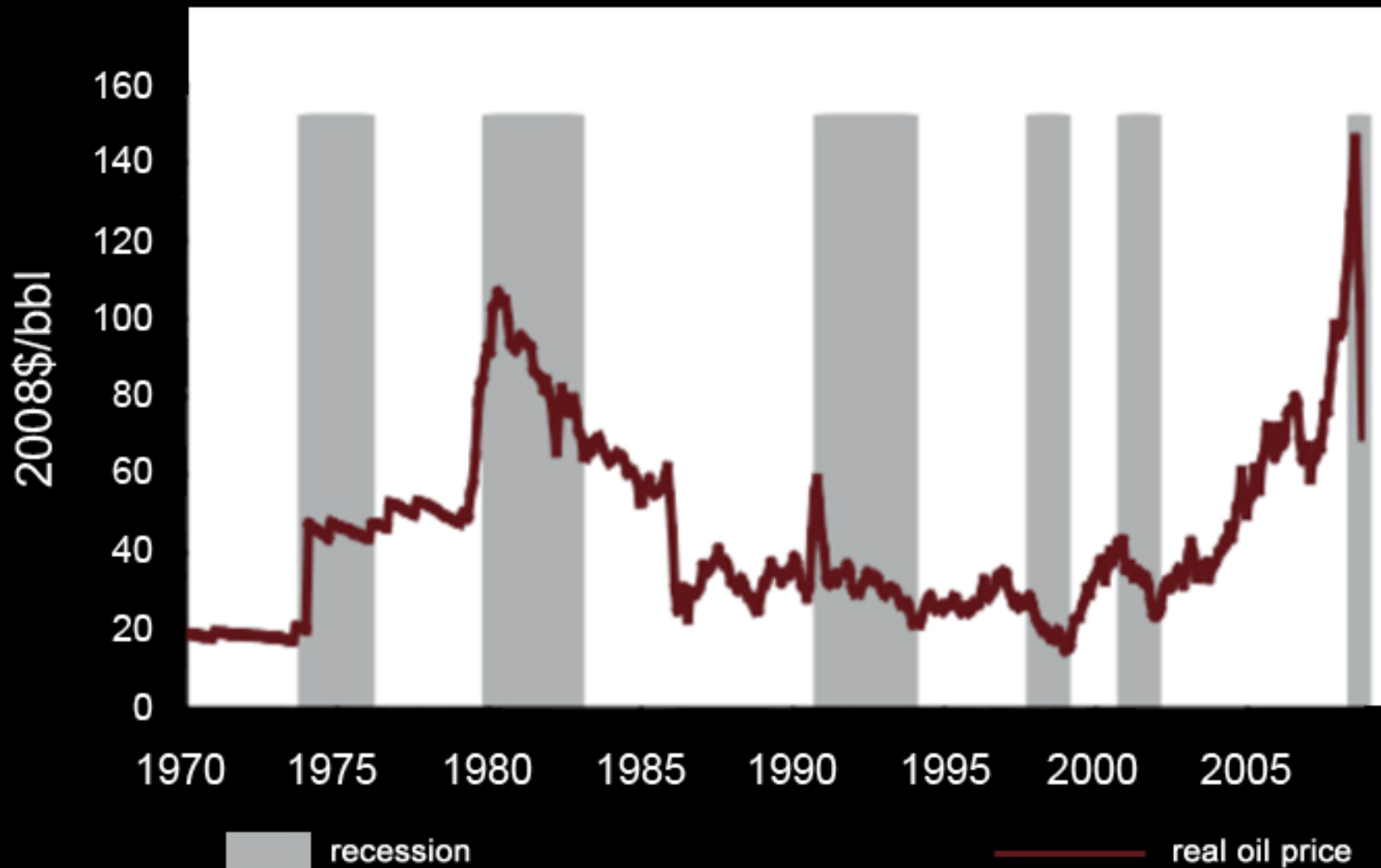
Growth becomes institutionalized

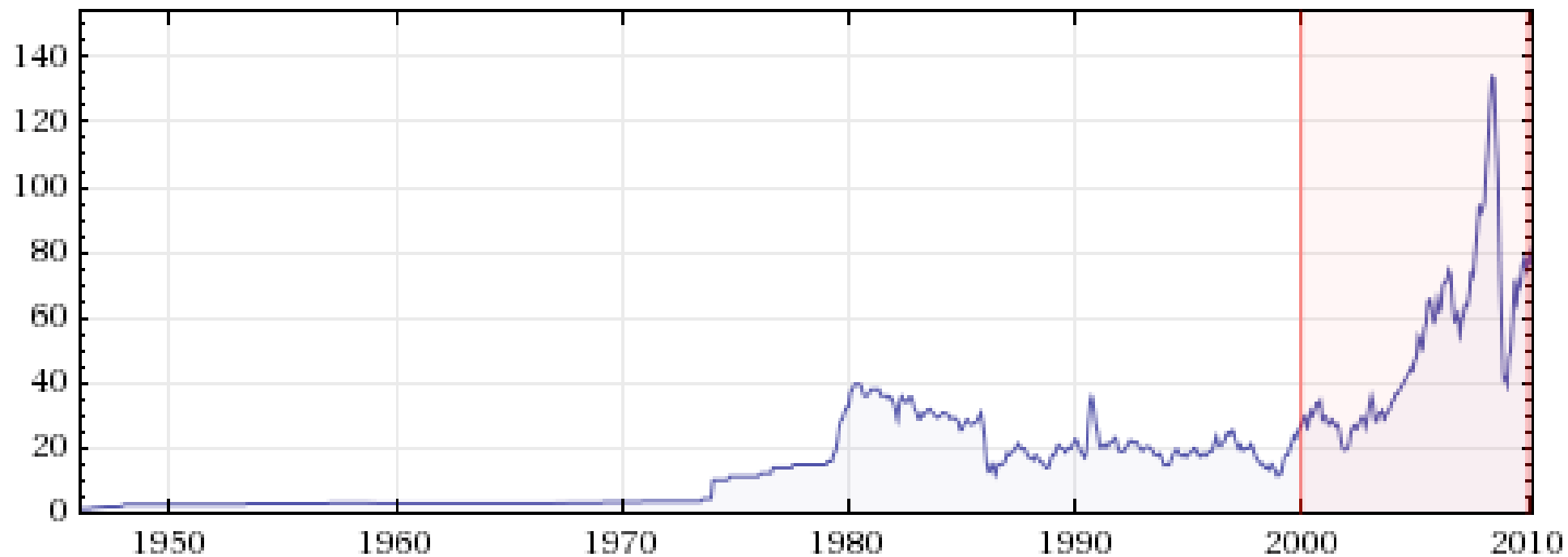
- With continual growth in energy (from fossil fuels), population, and consumption, it was assumed that economic growth could continue forever

Growth becomes institutionalized

- With continual growth in energy (from fossil fuels), population, and consumption, it was assumed that economic growth could continue forever
- With compound interest, fractional reserve banking, and debt leverage, growth became necessary to the monetary health of nations

Past recessions & oil spikes





(from Jan 1946 to Mar 2010) (in US dollars per barrel of oil equivalent)



THE LIMITS TO GROWTH

The headline-making report on the imminent global disaster facing humanity—and what we can do about it before time runs out. "One of the most important documents of our age!"

—Anthony Lewis,
The New York Times



DONELLA H. MEADOWS/DENNIS L. MEADOWS
JØRGEN RANDERS/WILLIAM W. BEHRENS III

 A POTOMAC ASSOCIATES BOOK

What to do?

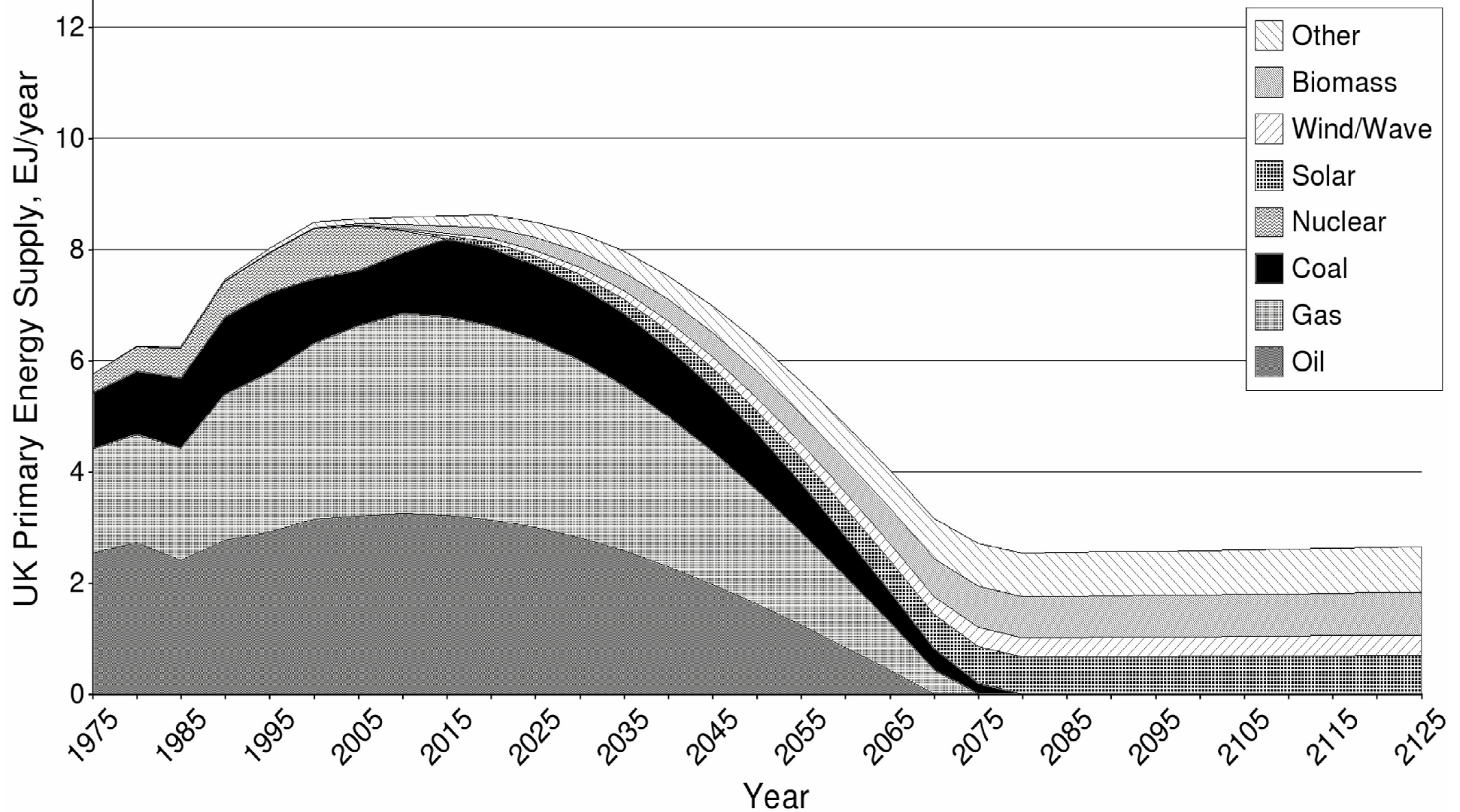
Evaluating Energy Options

- Energy return on investment
- Size of resource
- Infrastructure requirement
- Convenience of use
- Environmental impact
- Renewability
- Scalability
- Location of resource

There is ***no credible scenario***
in which alternative energy
sources can make up for fossil
fuels once declines begin.

Reduce Fossil Fuels and Develop Renewables

(from Paul Mobbs – Energy Beyond Oil)



The sustainability revolution
will be driven by crisis



Resilience

The ability to absorb shocks and
continue to function

Resilience characteristics

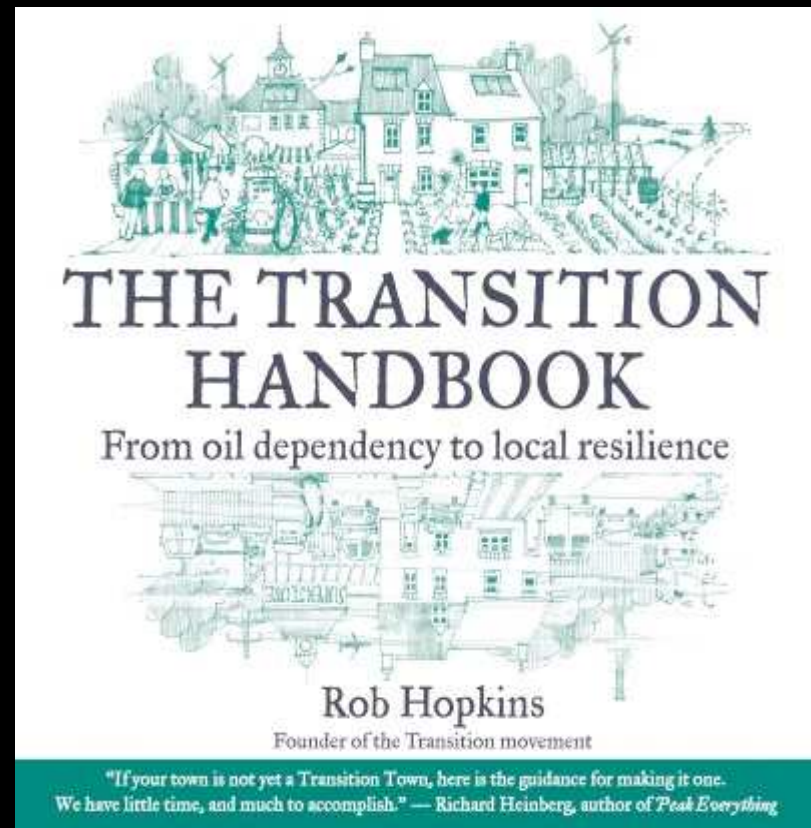
- Redundancy in critical systems
- Dispersed system control points
- Dispersed inventories
- Balancing feedback loops

Emphasize what is not at peak

- Community
- Satisfaction from honest work well done
- Intergenerational solidarity
- Cooperation
- Free time
- Happiness
- Artistry
- Beauty of the built environment

Transition Towns

- A bottom-up community organizing model that puts together all of these strategies and more
- “Life can be *better* without fossil fuels...”



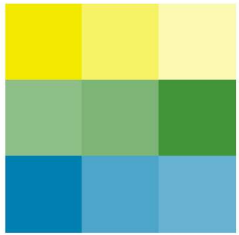
Imagine life after growth,
a world without fossil fuels,
the best case scenario

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**Now imagine a path
from here to there,
and start to build it**

Remember:
crisis = opportunity

This is the biggest opportunity of
our lifetimes. Who will seize it?



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