

Social transformation, resource use and sustainability transitions

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Special features of the Asia Pacific region

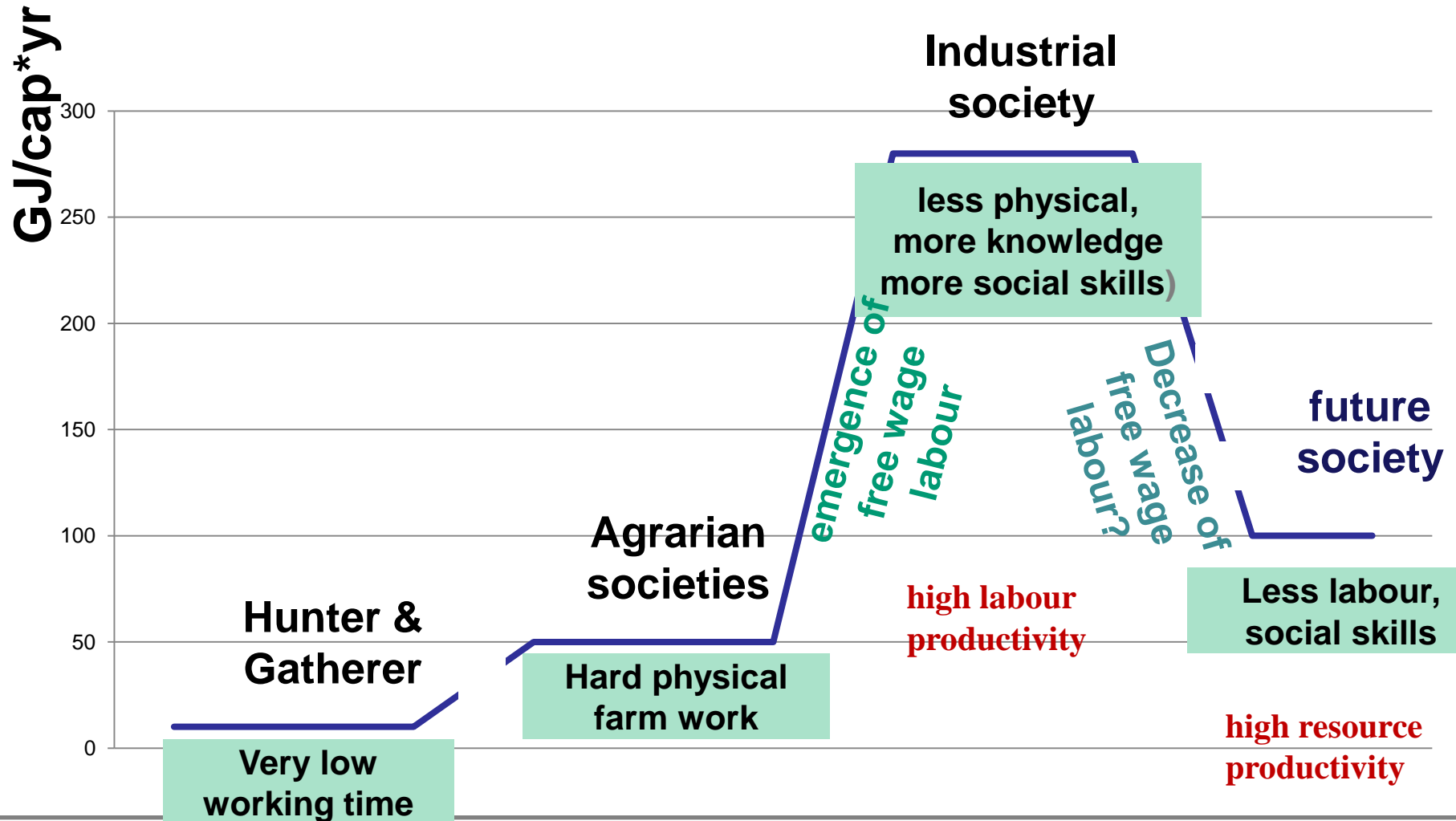
- The region of Asia and the Pacific is the most dynamic worldwide, and it is the most heterogeneous.
- In this region, two socio-ecological transformations that had in other world regions in history been separated by centuries happen more or less simultaneously.
 1. The transformation from biomass based, agrarian society to fossil fuel based, industrial society (for example: China, Vietnam)
 2. The transformation away from fossil fuel use towards renewable energy and sustainability (for example: Japan, Korea)
- Unlike in other regions in the past, these complex transitions happen in the context of a strained and declining world resource base (peak oil, declining ore grades, rising resource prices and new stress induced by climate change) and at an unprecedented speed.

Outline

1. The first Great Transformation associated with the transition to fossil fuel use, and its implications for a change in labour
2. The growth dynamics of the past century in income and resource use, and global trajectories
3. Outlook into a future that will be pretty different from past and present: changes and challenges.

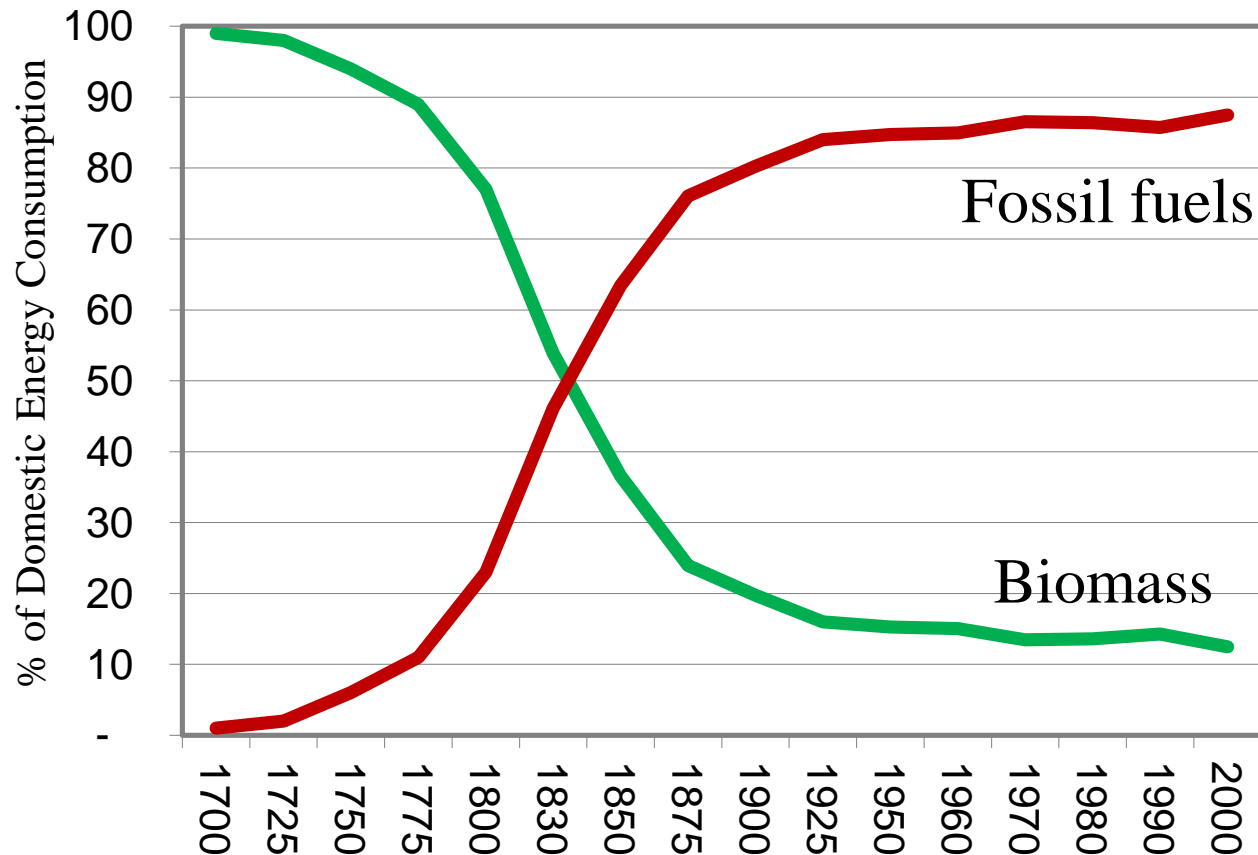
1. The Great Transformation to fossil fuel use and industrialization

Resource consumption and labour by sociometabolic regime



Source: after Sieferle et al. 2006, Schandl et al. 2008;
NEUjobs project

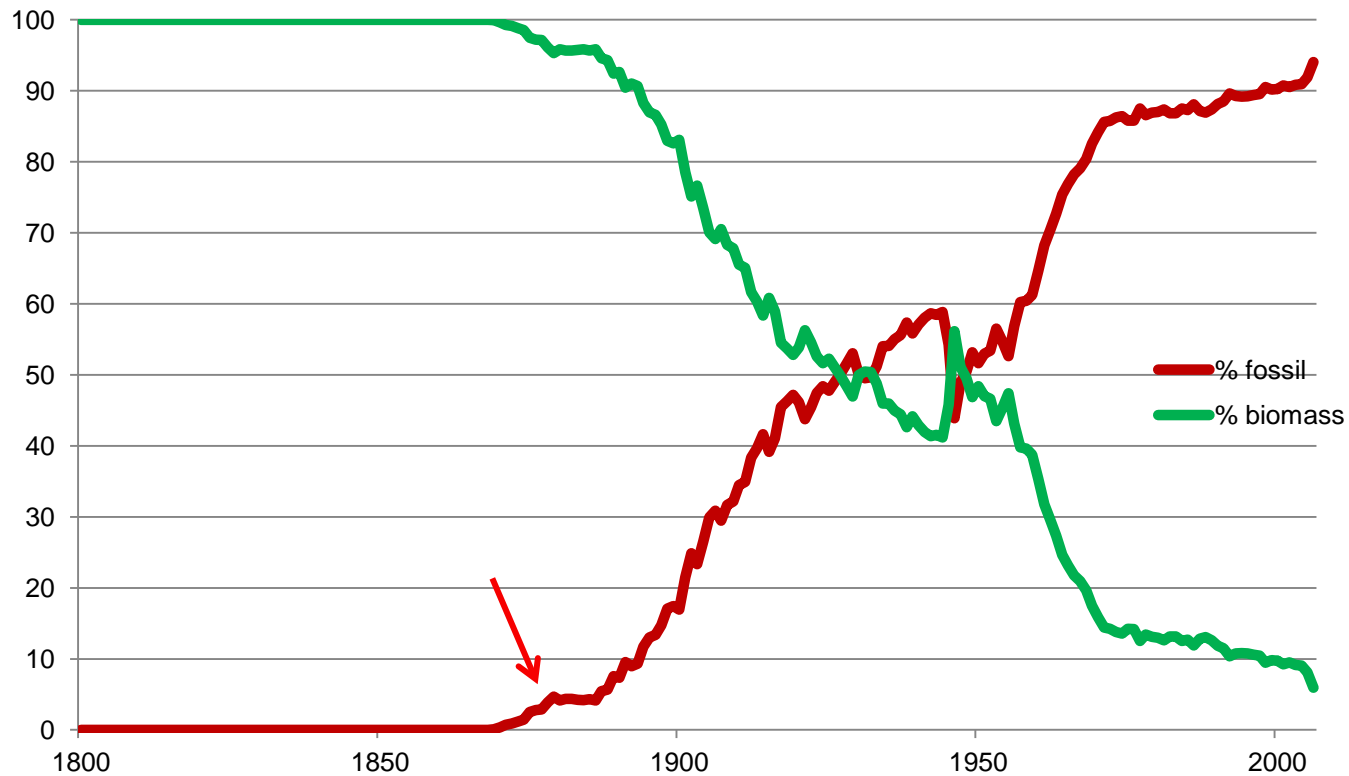
Energy transition in the UK 1700-2000



Domestic energy consumption (DEC) goes beyond what is usually defined as total primary energy supply (TPES). While TPES covers all “commercial”, technical sources of energy, DEC also, on top of this, includes energy intake in the form of food and feed (Haberl 2001).

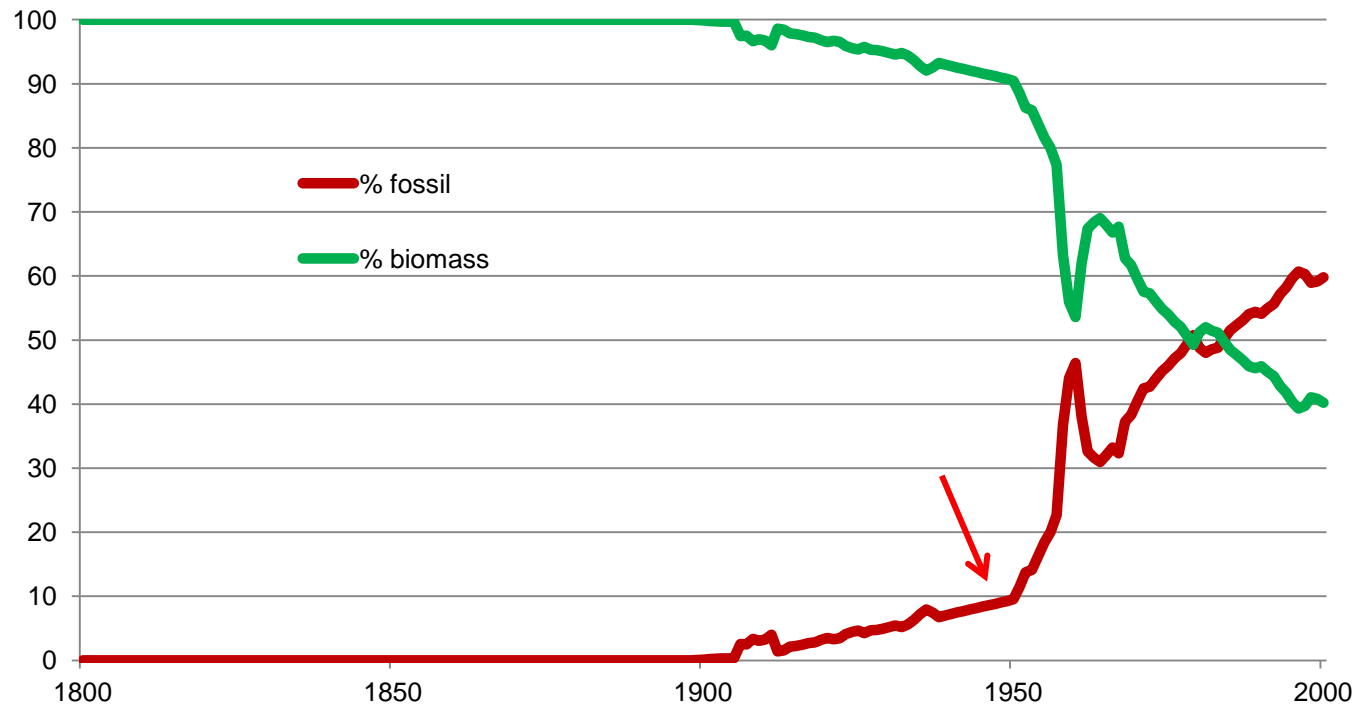
Energy transition in Japan

Sources of Energy in % - Japan
1800-2000



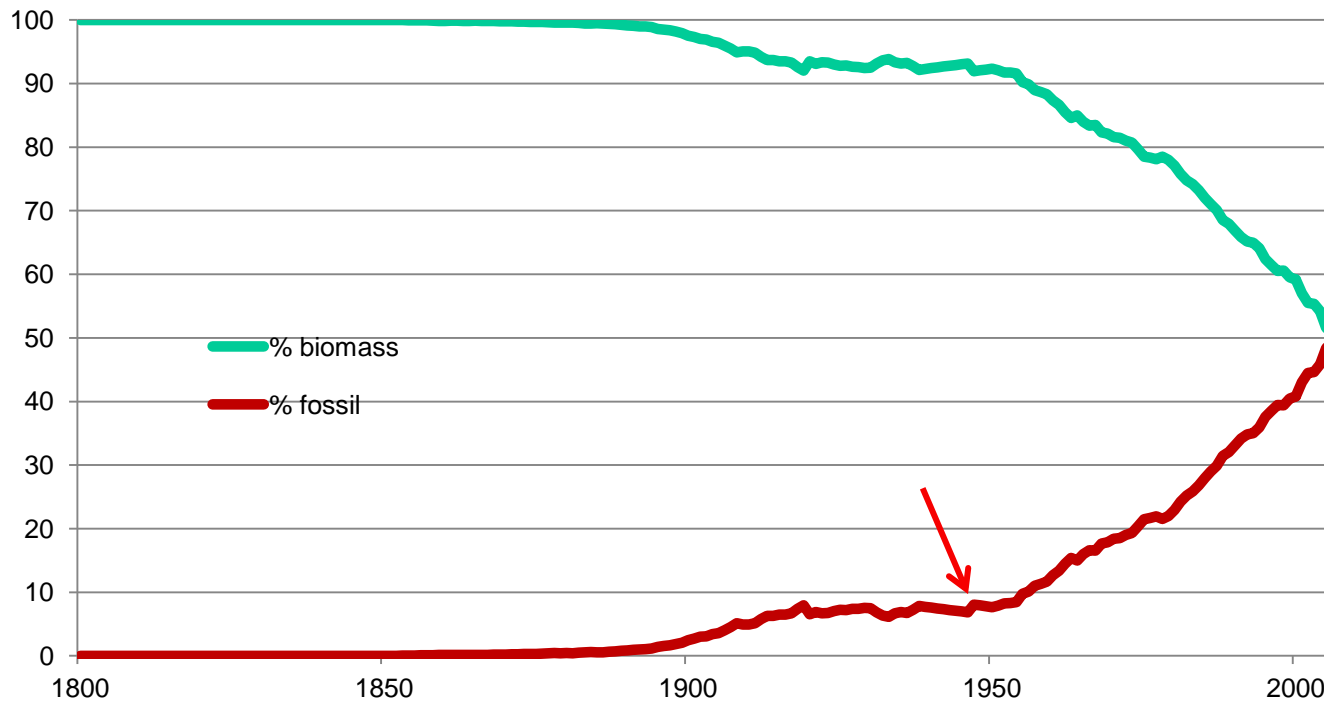
Energy transition in China

Sources of Energy in % - China 1800-2000



Energy transition in India

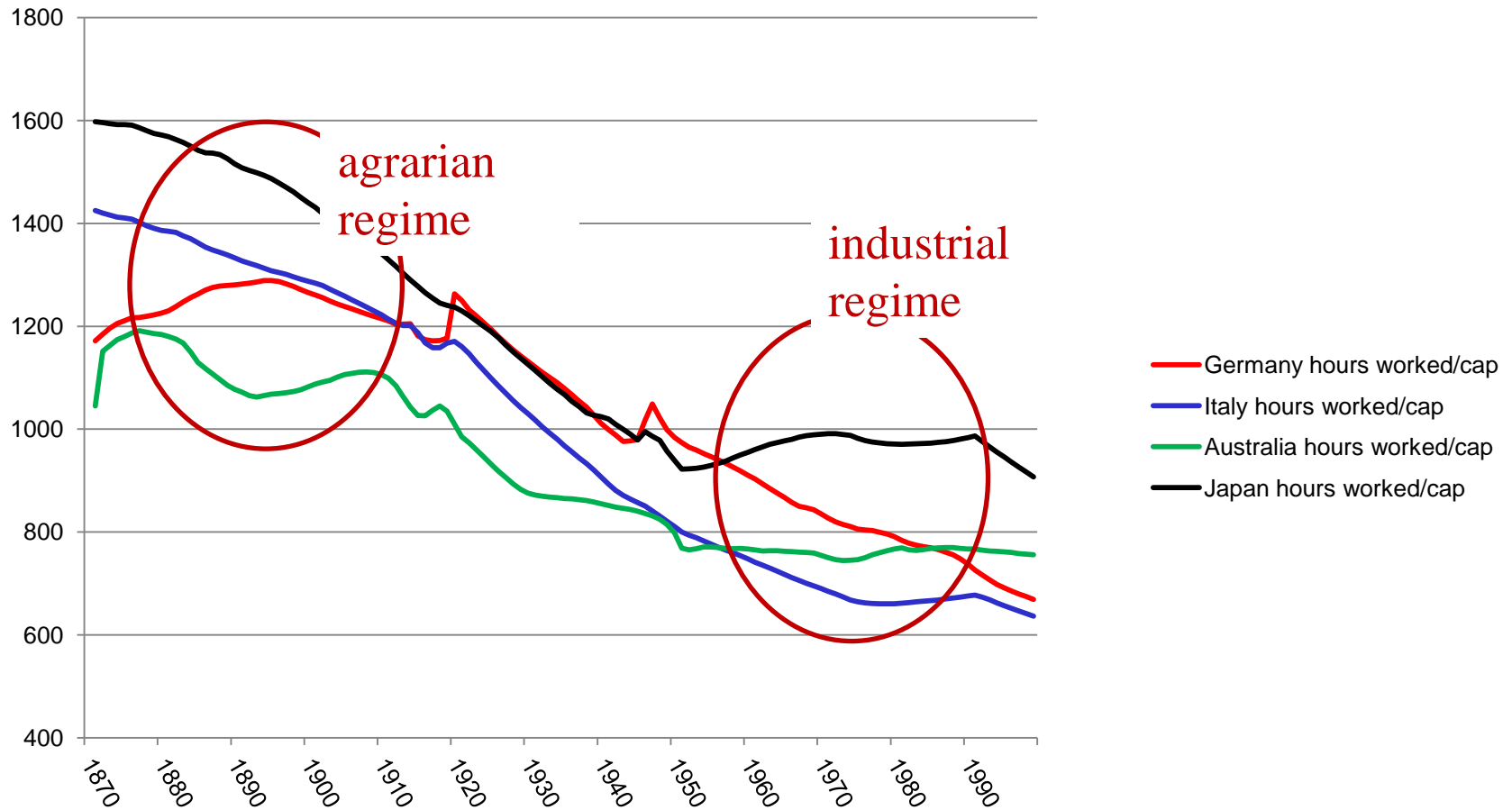
Sources of Energy in % - India
1800-2000



Labour under agrarian conditions:

- **Labour in agriculture (> 90%):**
 - In peripheral or unproductive regions: household based self-employment, largely subsistence oriented
 - elsewhere: manorial systems with bonded serfs or slaves
- **Working hours gradually increasing:**
 - With population growth, improved yields per hectare are achieved with ever more labour (*E.Boserup*)
- **Labour outside agriculture (< 10%)**
 - slave and compulsory labour (mining, construction)
 - Household based self-employment (crafts & trades, transportation)

Annual working time per capita population 1870 - 2000



Source: Maddison 2001, p.348

Labour under early industrial conditions (coal age): The birth of free wage labour

Quantity:

- Multiplication of the demand for labour: so much additional physical power is brought into the economy that the labour demand is so high that it can absorb the rapidly increasing population (demographic transition), males, females and children.
- More energy does not substitute, but facilitate the use of additional human labour.

Social form:

- Free **wage labour**, a very minoritarian form at first, gradually grows to become most dominant. Gradually, often by revolutions, serfdom and slavery are abolished.
- In contrast to the landed aristocracy, **industrialists** see themselves as hard-working, responsible for the labour process, and drivers of technical innovation. They are not a leisure class, but laborious.

Labour in the oil based industrial regime:

- Large fractions of the population are formally relieved from work and receive retirement pensions.
- Low qualified **physical work** is gradually externalized to the global periphery, and structural unemployment of low qualified people in the centres becomes a problem. Qualification and **knowledge** becomes central.
- Since the 1970s, information and communication technologies enhance, but also substitute for **knowledge based** work.
- Beyond knowledge, **social skills** turn into a major requirement of much of the growing amount of communication based work (education, marketing, health care, arts, sales work, most services...).
- The growth of **labour productivity** begins to decline.

In effect, the transformation of the agrarian to the fossil fuel based industrial regime...

...triggers a huge social transformation:

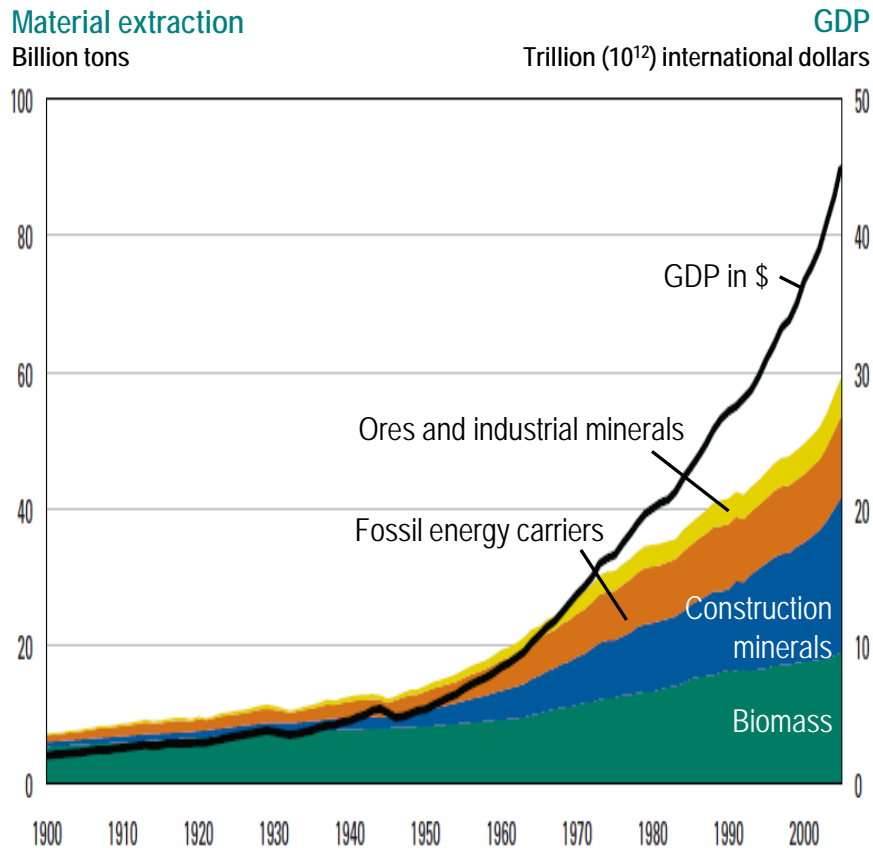
- massive increase of societal energy and resources use
- a demographic transition, starting with unprecedented population growth
- rapid urbanization, as now there are labour opportunities in cities, and sufficient food can be transported from farther distances
- there is a transformation from integrated subsistence labour to differentiated urban jobs, increasingly depending on markets and formal qualification

Question: will the transition away from fossil fuels, towards renewable energy, create similarly large social change?

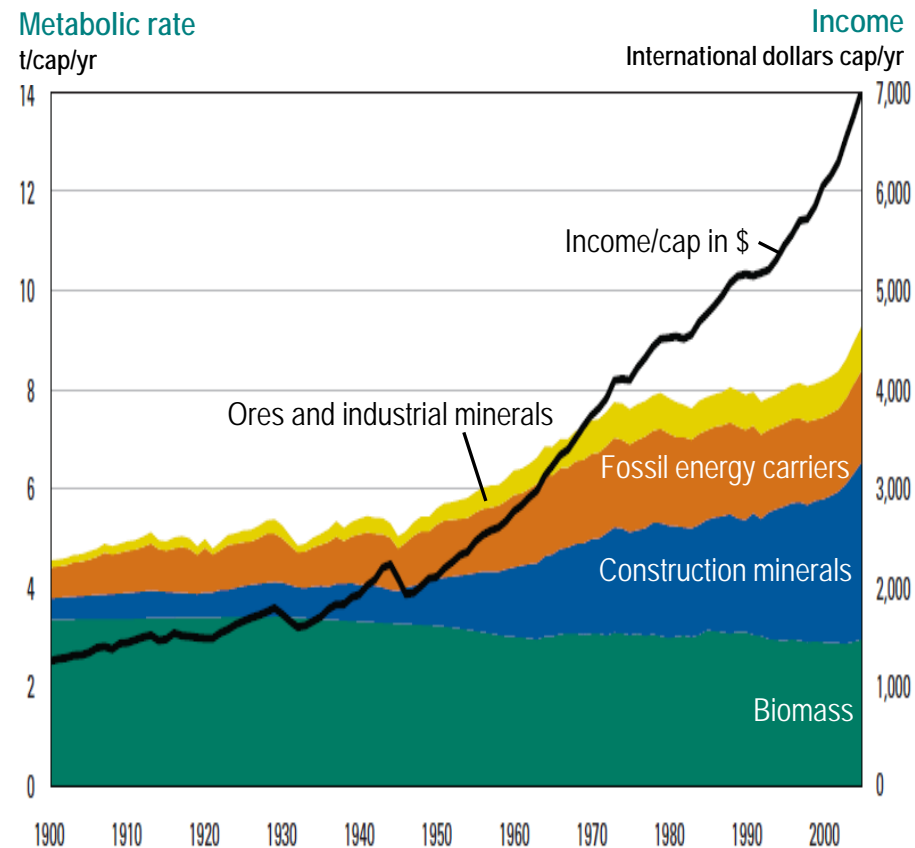
2. The growth dynamics of resource use in the past century

During the 20th century: sevenfold increase of global extraction and use of resources

Global material extraction 1900-2005



Global metabolic rates 1900-2005



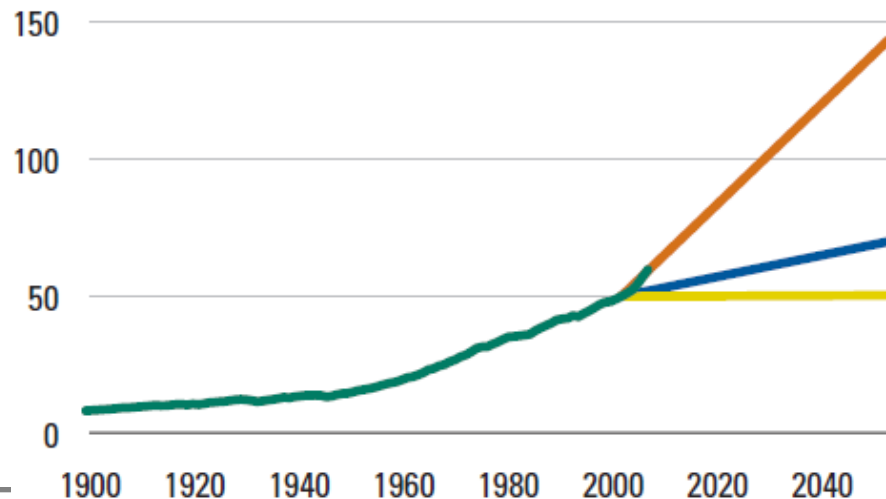
Source: UNEP International Resource Panel, Decoupling Report 2011

IRP Trend scenario: another tripling of annual global resource extraction by 2050

- Development 1900–2005
- Freeze and catching up
- Factor 2 and catching up
- Freeze global material consumption

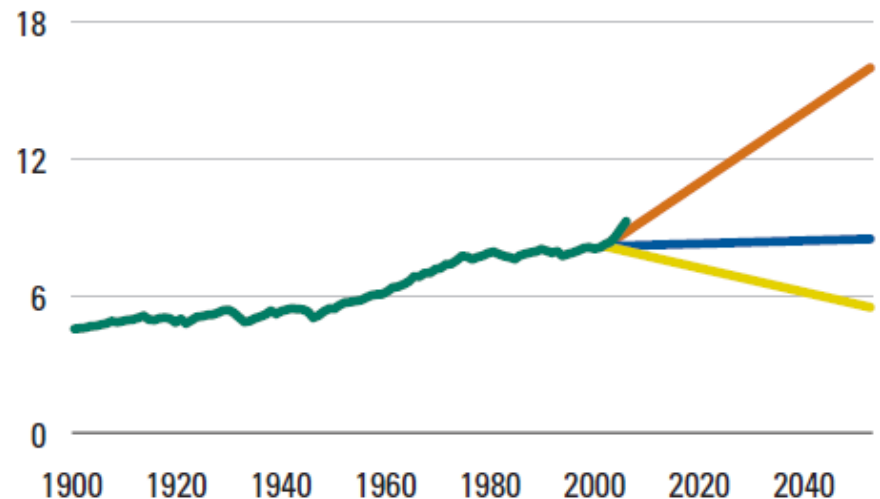
Global metabolic scale

Metabolic scale
Gigatons



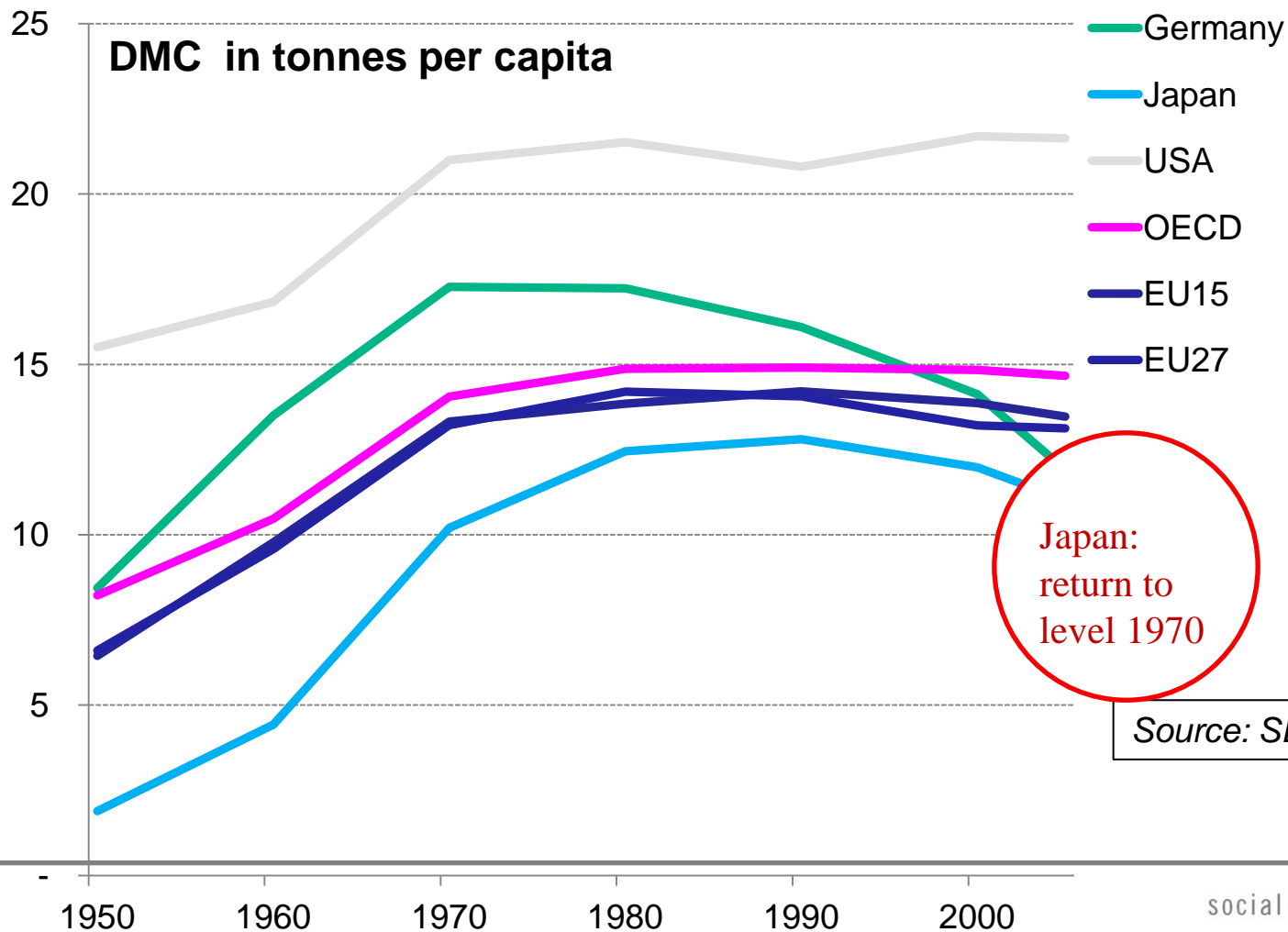
Average global metabolic rate

Metabolic rate
t/cap/yr

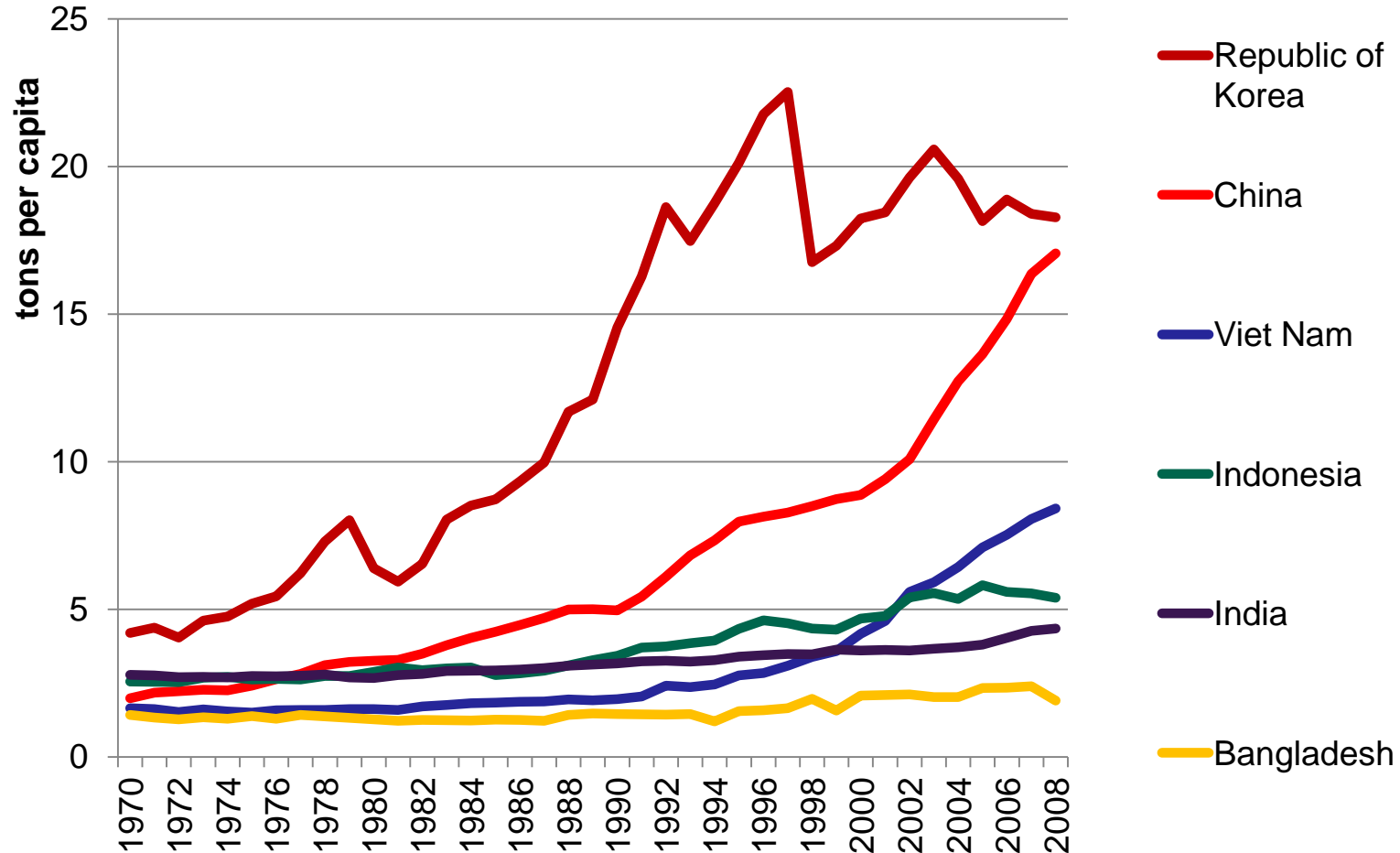


Source: UNEP International Resource Panel, Decoupling Report 2011

Since the 1970s: stagnation of resource use in high income countries, despite income growth



Resource use in industrializing Asian countries



Singh et al. (2012) India's biophysical economy, 1961 – 2008. Sustainability in a national and global context. *Ecological Economics* 76, 60-69.

CSIRO (2012) CSIRO and UNEP Asia-Pacific Material Flows online database. <http://www.cse.csiro.au/forms/form-mf-start.aspx> [accessed 12.11.2012]

Towards the end of the 20 century, global social-metabolic dynamics lead to a dead end...

- While high income economies materially stagnate, the „historic“ Great Transformation happens in emerging economies: they transit from agrarian to fossil-fuel based industrial.
- Their population size is much larger. They emulate the industrial countries model of welfare by high resource consumption.
- Taken together, these dynamics generate a global trend of energy- and resource use (and CO² emissions) which is not only unsustainable, but cannot be sustained.

3. Outlook: future change and challenges

Exhaustion of the global mineral resource base?

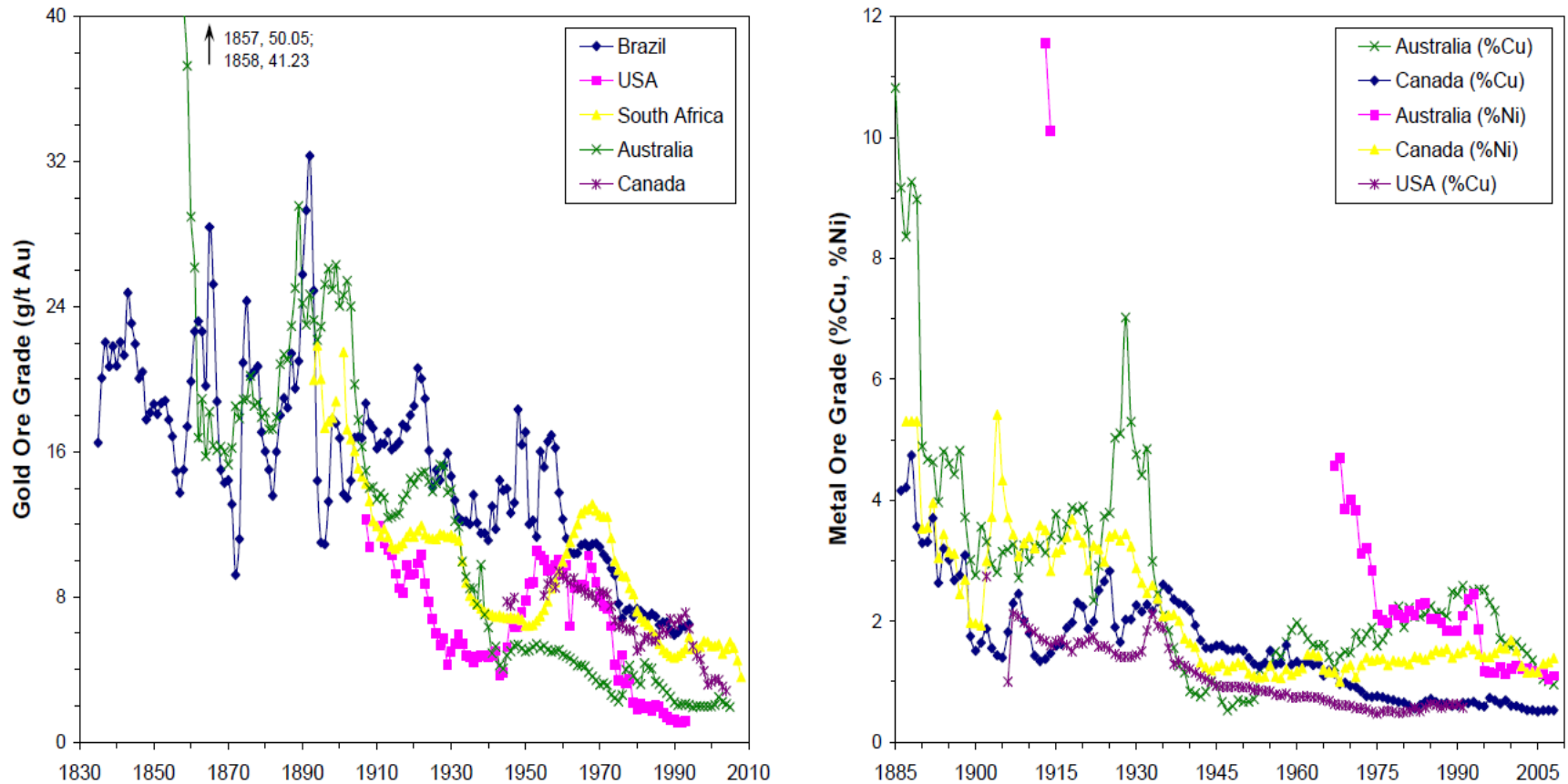
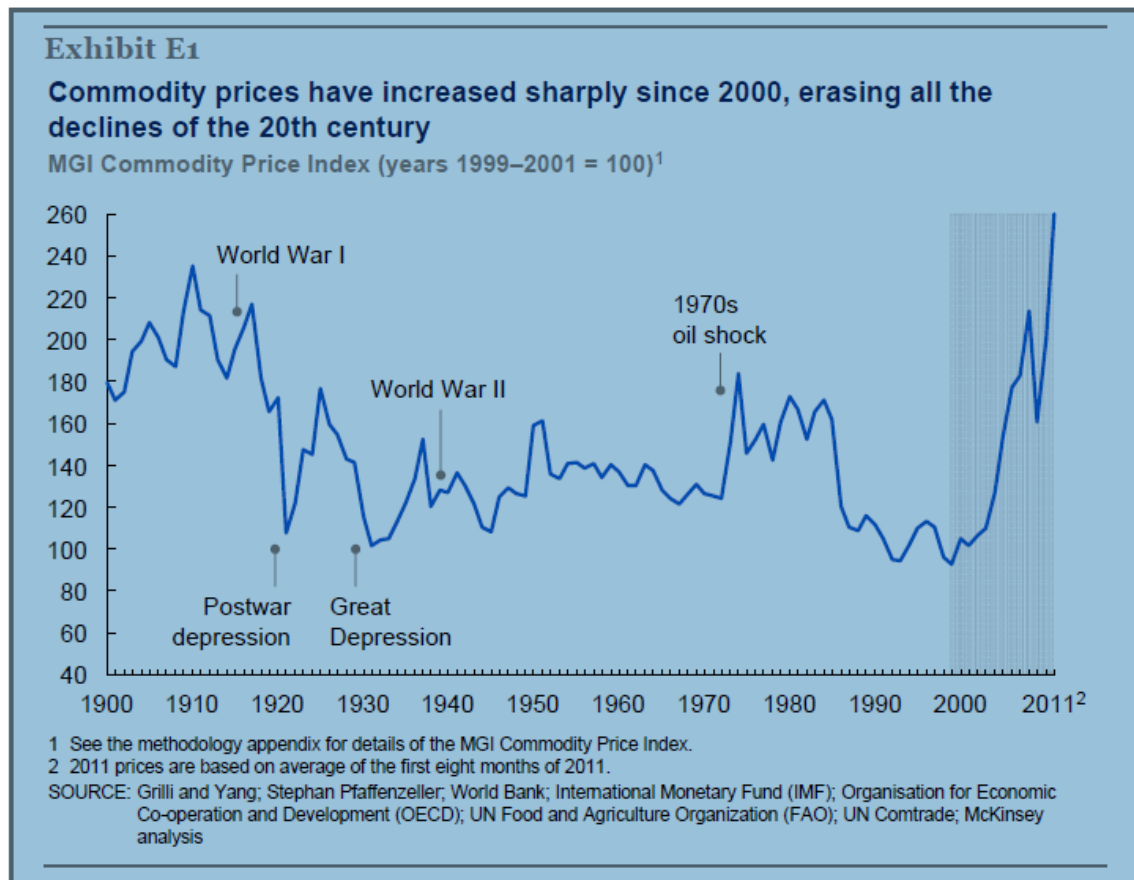


Figure A2.1: Declining ore grades in the major producing countries

Source: Giurco et al, 2010, p.28: based on Mudd 2010, 2009, 2007

Unprecedented rise in commodity prices



Source: **McKinsey** Global Institute. 2011. Resource Revolution: Meeting the world's energy, materials, food and water needs. www.iwar.tu-Darmstadt.de

Key messages from McKinsey's (2011) *Resource Revolution*

- Over the past century, progressively cheaper resource prices have underpinned economic growth.
- Lately, prices have risen. Resource price inflation and volatility could further increase.
- At least \$ 1 trillion more investment in the resource system (1/3 more than currently) is needed per year to meet future demands
- Need to achieve a resource productivity revolution comparable to the labour productivity revolution of the 20th century
- Supply of oil and natural gas could fall by approx. 6% per year, supply of coal by 3%
- Growing concern about inequality might require action

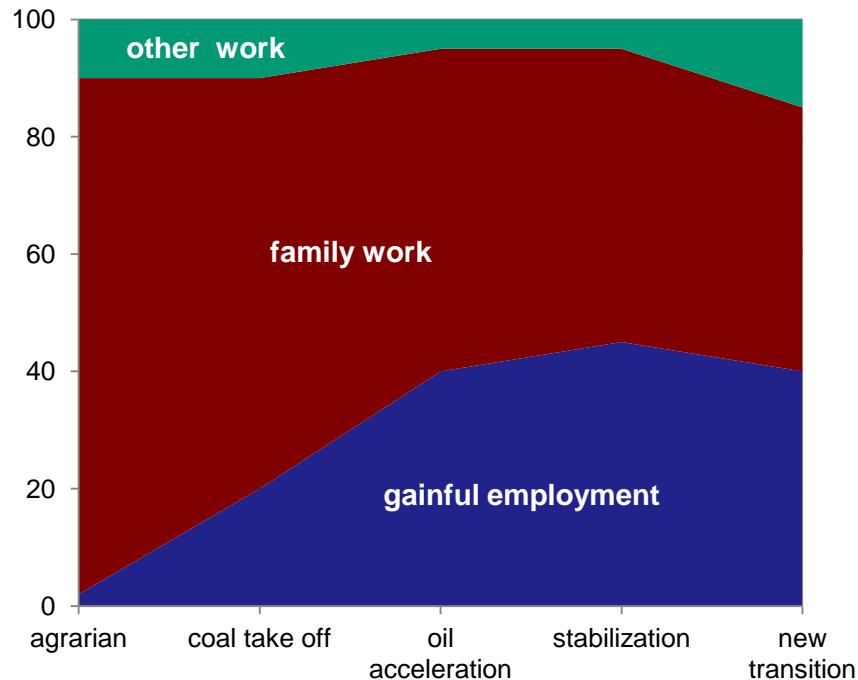
„The resource intensive growth model of the past“ will have to be abandoned

In this situation, transition to sustainability...

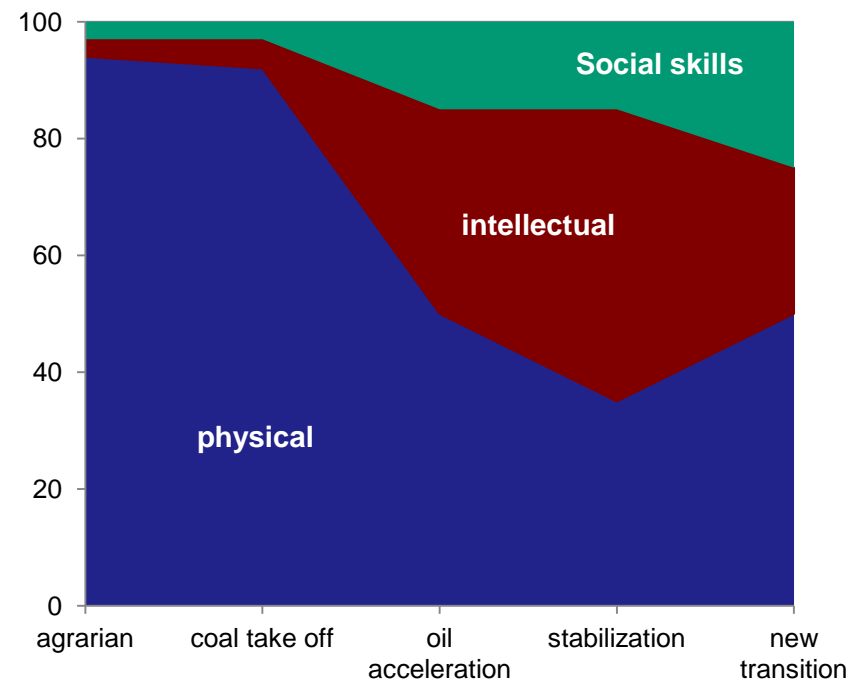
- means for everybody: transition away from fossil fuels
- means for high income industrial countries: downsizing their social metabolism, their energy- and resources use (3R, circular economy...)
- Means for developing and emerging economies: count on climate change, reduce vulnerability, and seek ways for „leap frogging“ the development alternatives instead of emulating pathways into a deadlock

The changing nature of labour across sociometabolic regimes

Institutional form



Quality of work



Unwise and wise investments

1: infrastructure

Unwise investment

Large infrastructure investments in mobility by automobiles. Particularly in cities, cars are the problem, not the solution.

Wise investment

Plan for low-energy urban forms: public transportation; smallscale, mixed neighborhoods that allow mobility by foot and byke.

Unwise investment

Shift towards concrete and steel as dominant construction material
(=resource intensive, only downcycling)

Wise investment

Explore modern uses of traditional construction materials (bamboo, mud...);
take care of good insulation and ventilation

Unwise and wise investments

2: agriculture

Unwise investments

Build your agriculture upon monocultures, high mineral fertilization (phosphorus might expire!), mechanical energy and genetic engineering (seed dependency).

Wise investments

Invest in soil maintenance (reforestation, composting...); plant oil seeds to feed tractors; strengthen and modernize traditional forms of water management (e.g. cisterns...) – consider climate change!

Start large scale education initiatives for farmers, their wives and children.
There is no measure as effective against population growth as educated and empowered women!

Unwise and wise investments

3: energy

Unwise investments

Expand your energy system on the basis of coal, oil and gas, and by highly centralized (therefore vulnerable) infrastructure.

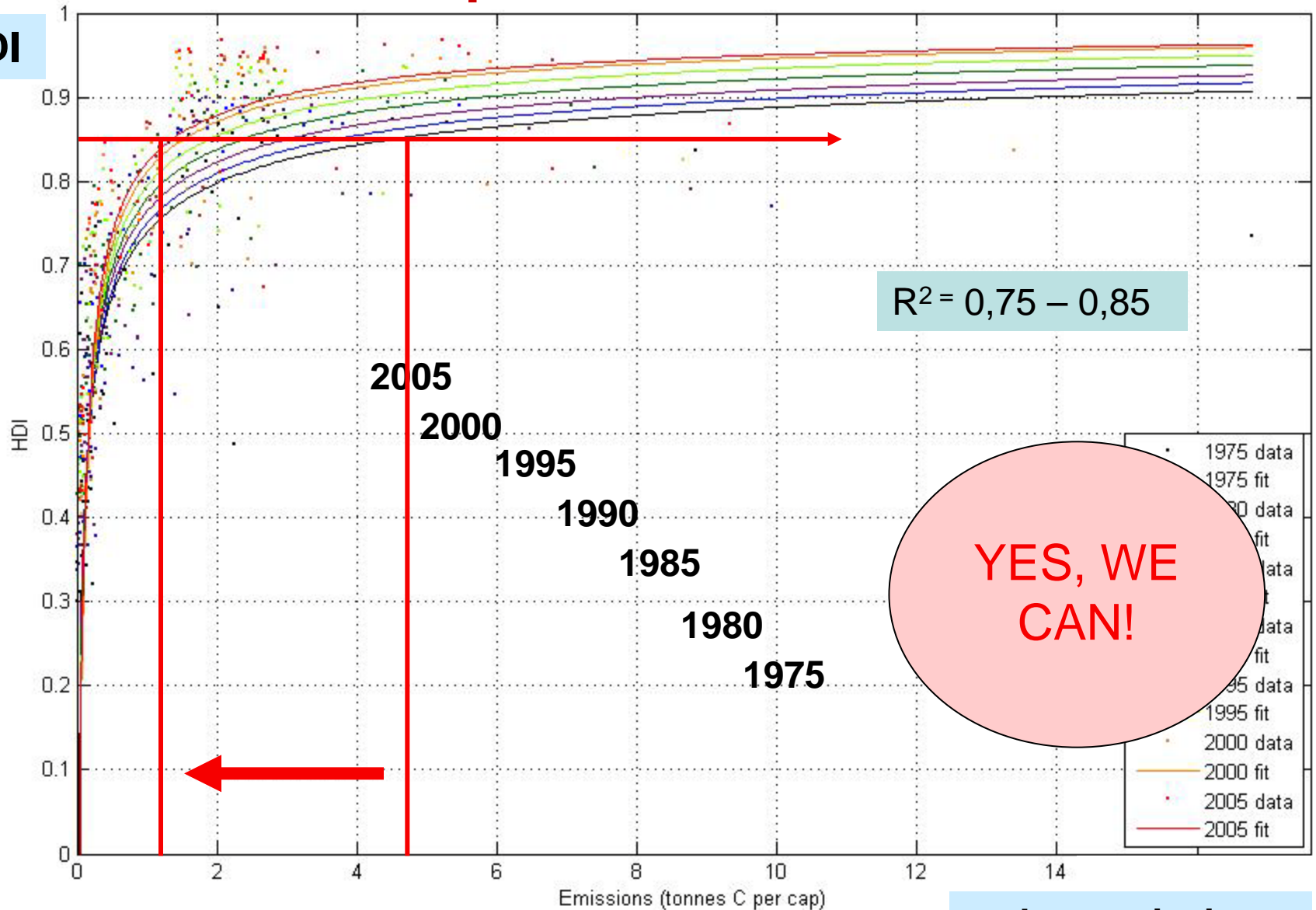
Wise investments

Invest in renewable energy (solar, wind, geothermal...) and flexible networks; strengthen decentralized energy generation and energy saving.

Renewable energy also means dematerializing = savings on transport and transport infrastructure.

Human development vs. Carbon emissions

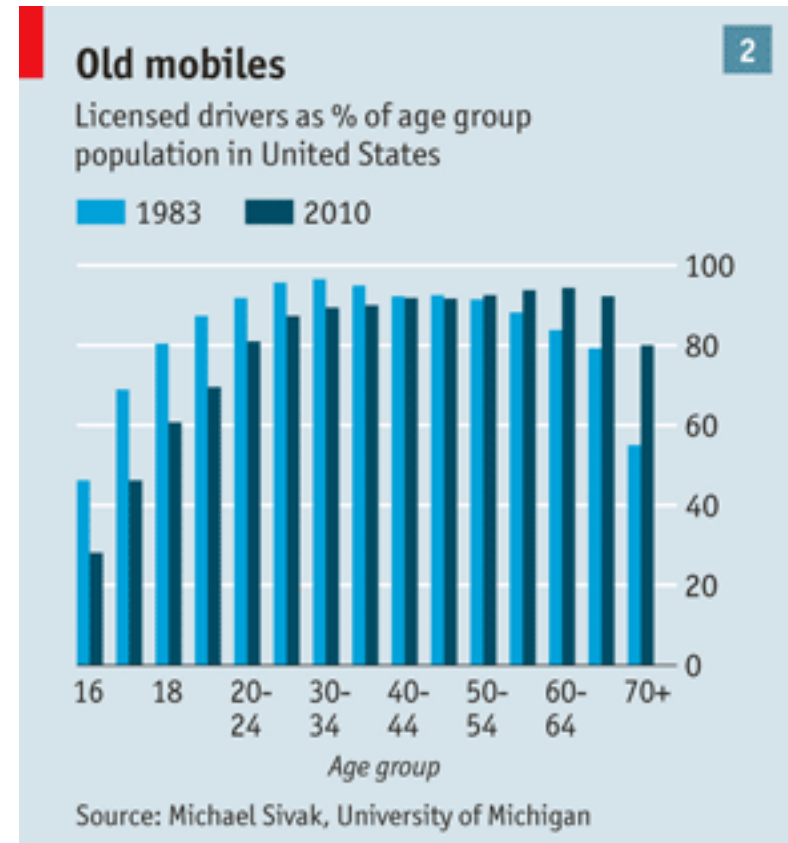
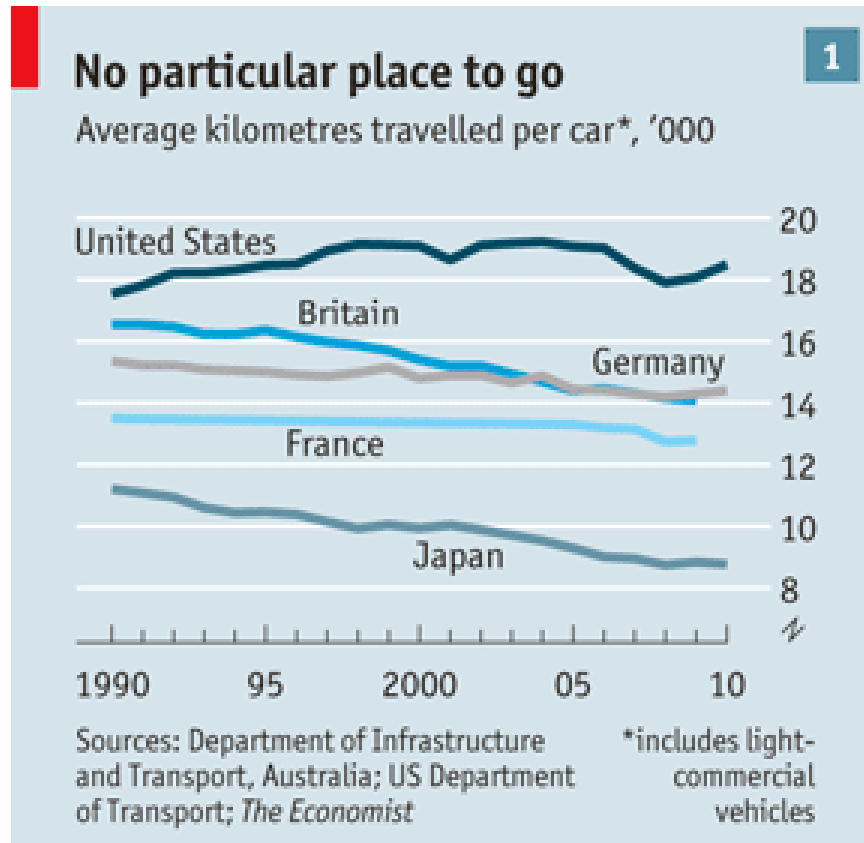
HDI



carbon emissions

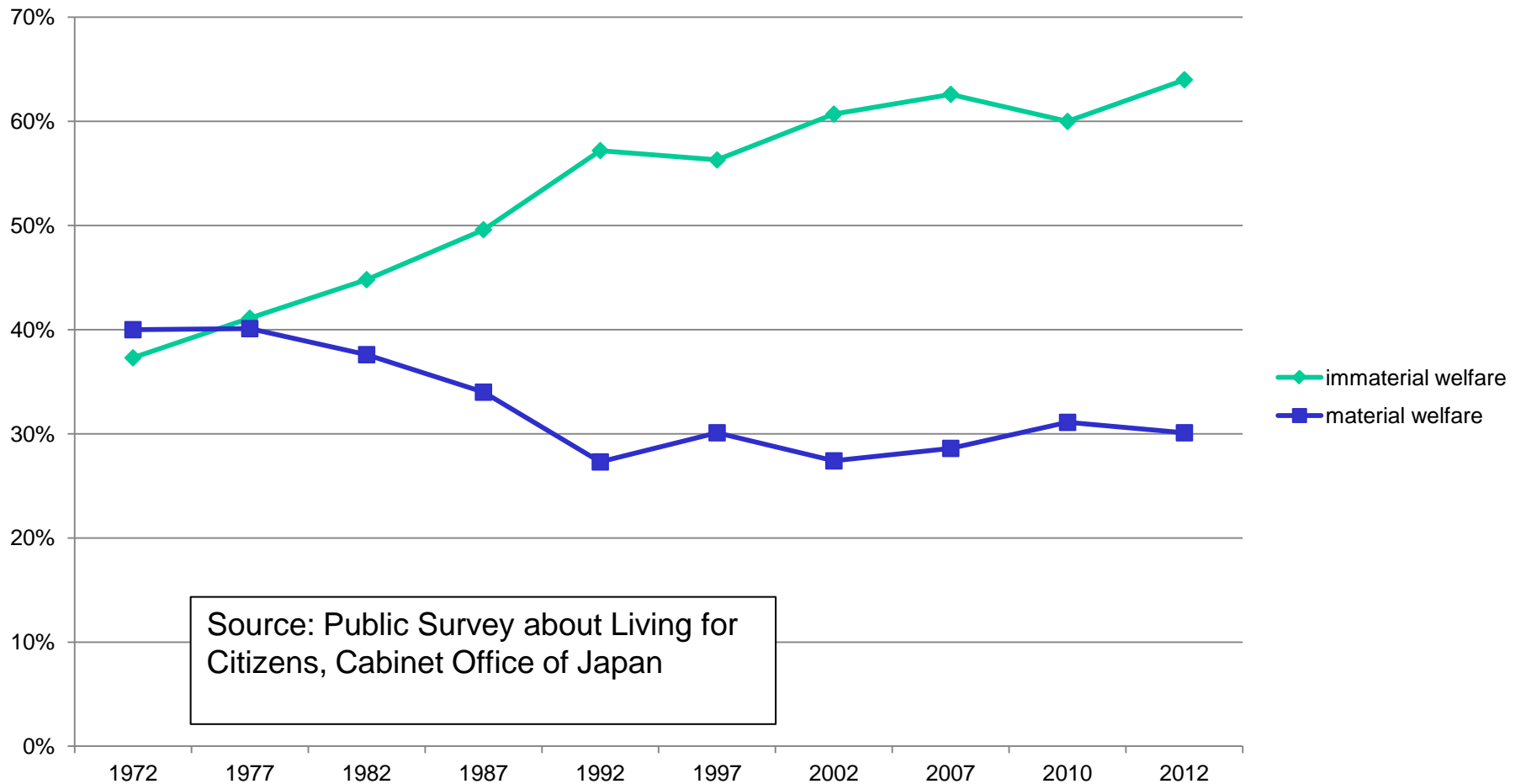
Source: Steinberger & Roberts 2010

The *Economist's* final kick: Peak Car?



The Future of Driving. Seeing the Back of the Car? The Economist
Sept. 22nd, 2012. <http://www.economist.com/node/21563280>

Preferences of Japanese Citizens: immaterial welfare taking over



Major recent global sustainability reports

- **McKinsey** Global Institute. 2011. Resource Revolution: Meeting the world's energy, materials, food and water needs. www.iwar.tu-Darmstadt.de
- **Randers, J.** 2012. 2052. A Global Forecast for the Next Forty Years. A Report to the Club of Rome. White River Junction, Vermont: Chelsea Green Publishing.
- **Raskin, P. D., C. Electris, R. A. Rosen.** 2010. The Century Ahead: Searching for Sustainability. Sustainability. 2: 2626-2651.
- **The Royal Society.** 2012. People and the Planet. London: The Royal Society.
- **UNEP,** International Resource Panel. 2011. Decoupling Resource use and Environmental Impacts from Economic Growth. Paris: UNEP
- **WBGU** (German Advisory Council on Global Change) 2011. World in Transition. A Social Contract for Sustainability. Flagship Report. Berlin: WBGU.