resource use and economic growth

strongly linked, mutually dependent, or decoupling?

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economic growth 'cannot continue‘

BBC news, 2010/01/25 (news.bbc.co.uk)

report from the The New Economics Foundation (Nef)

"We urgently need to **change our economy to live within its environmental budget**," said Nef's policy director.

Andrew Simms added: "There is **no global, environmental central bank to bail us out if we become ecologically bankrupt**."

The report concluded that an **economy that respected environmental thresholds, which include biodiversity and the finite availability of natural resources, would be better placed to deliver human well-being in the long run**.

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overview

hindsight	**resource use** **→ what's it all about?**
insight	**drivers and links** **resource productivity and decoupling**
foresight	**scenarios and targeting future challenges**

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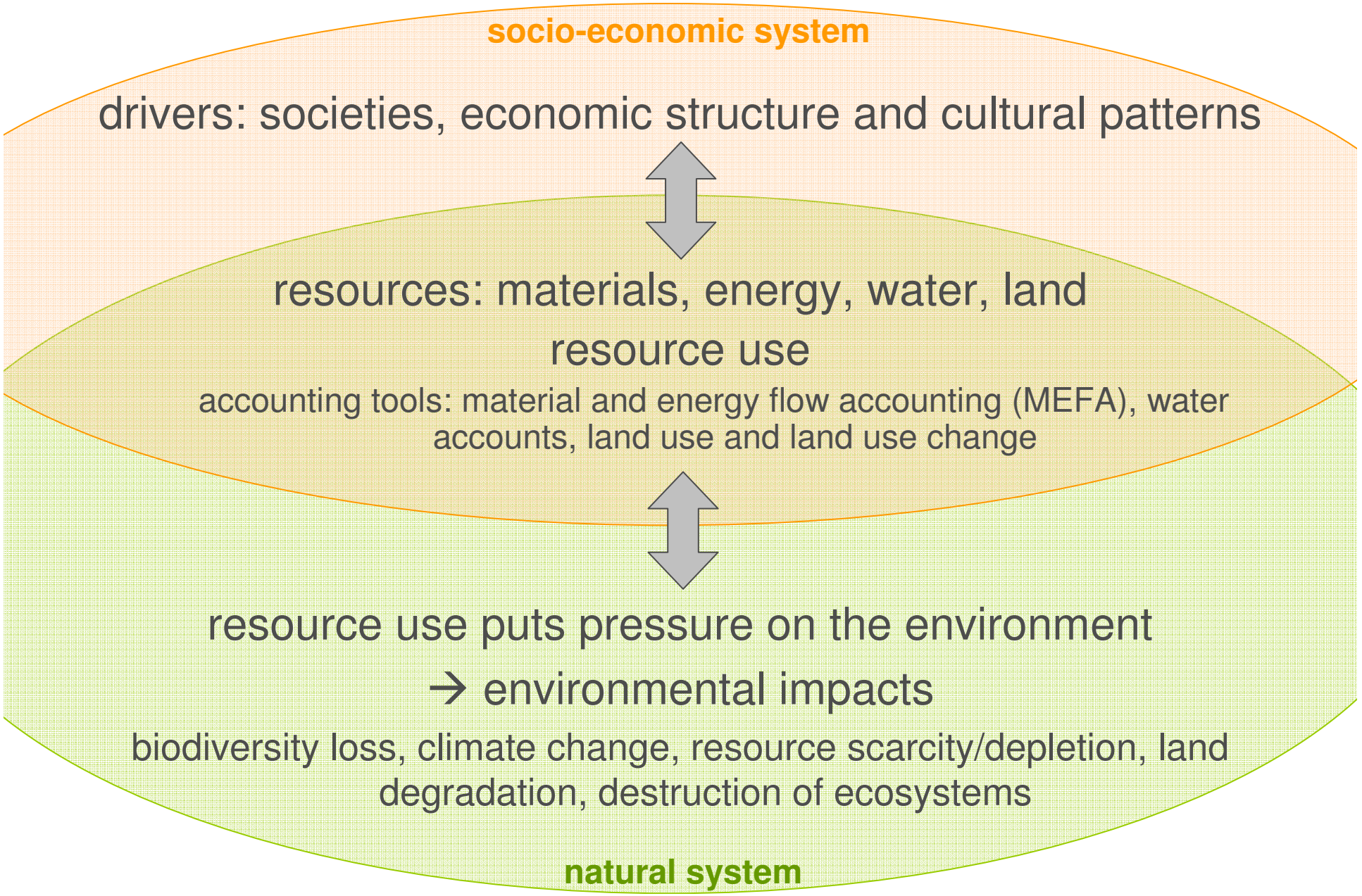
resource use



hindsight

resource use – what's it all about?

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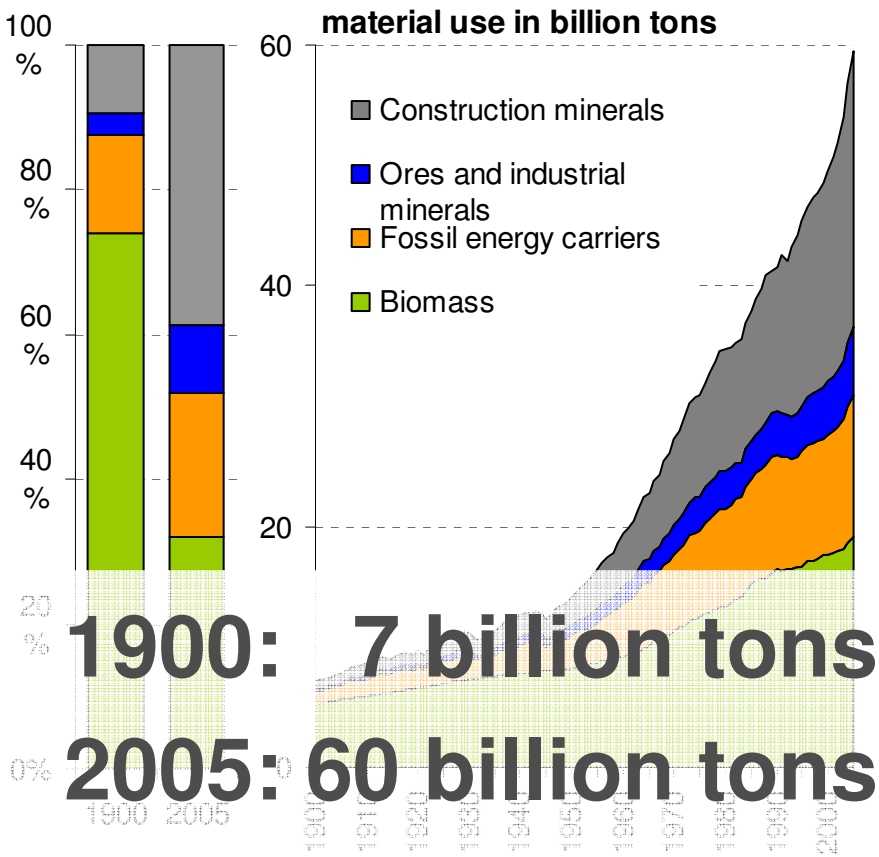
metabolic scale

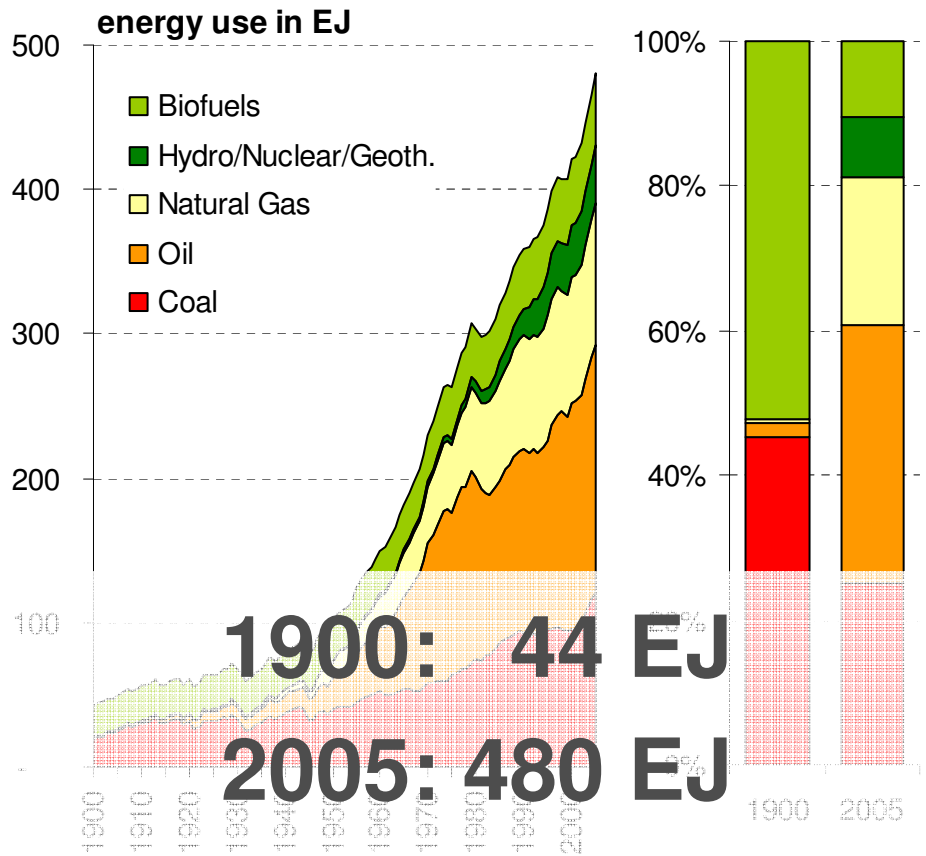
total material and energy use



1900: 7 billion tons

2005: 60 billion tons

→ factor 8,4



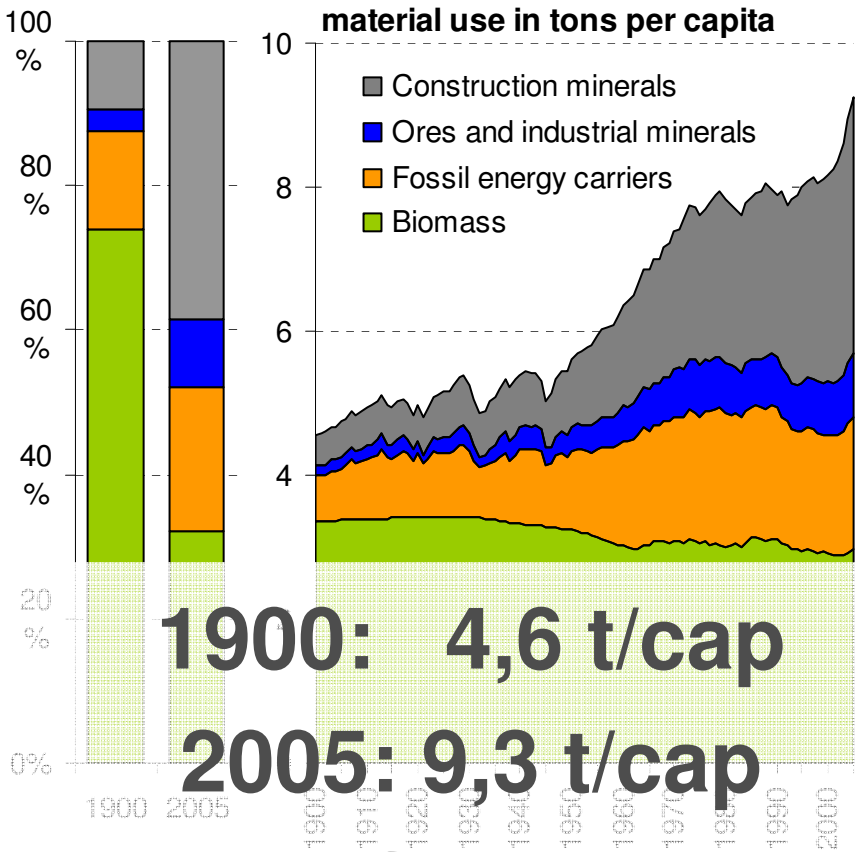
1900: 44 EJ

2005: 480 EJ

→ factor 11

metabolic rates

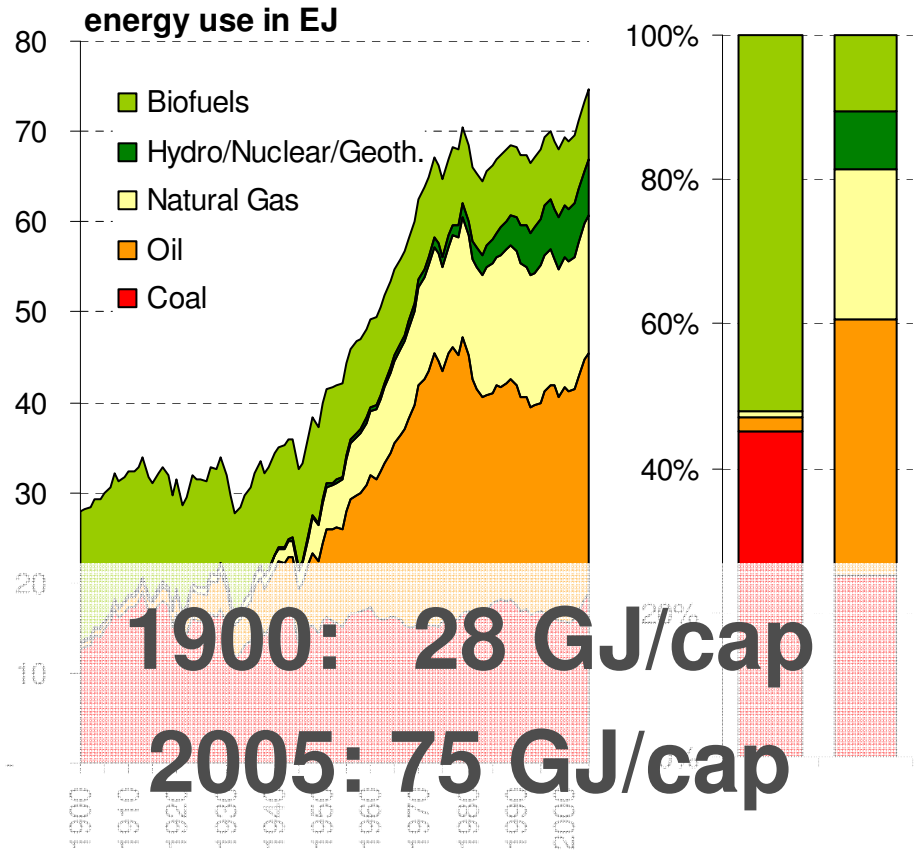
per capita material and energy use



1900: 4,6 t/cap

2005: 9,3 t/cap

→ factor 2

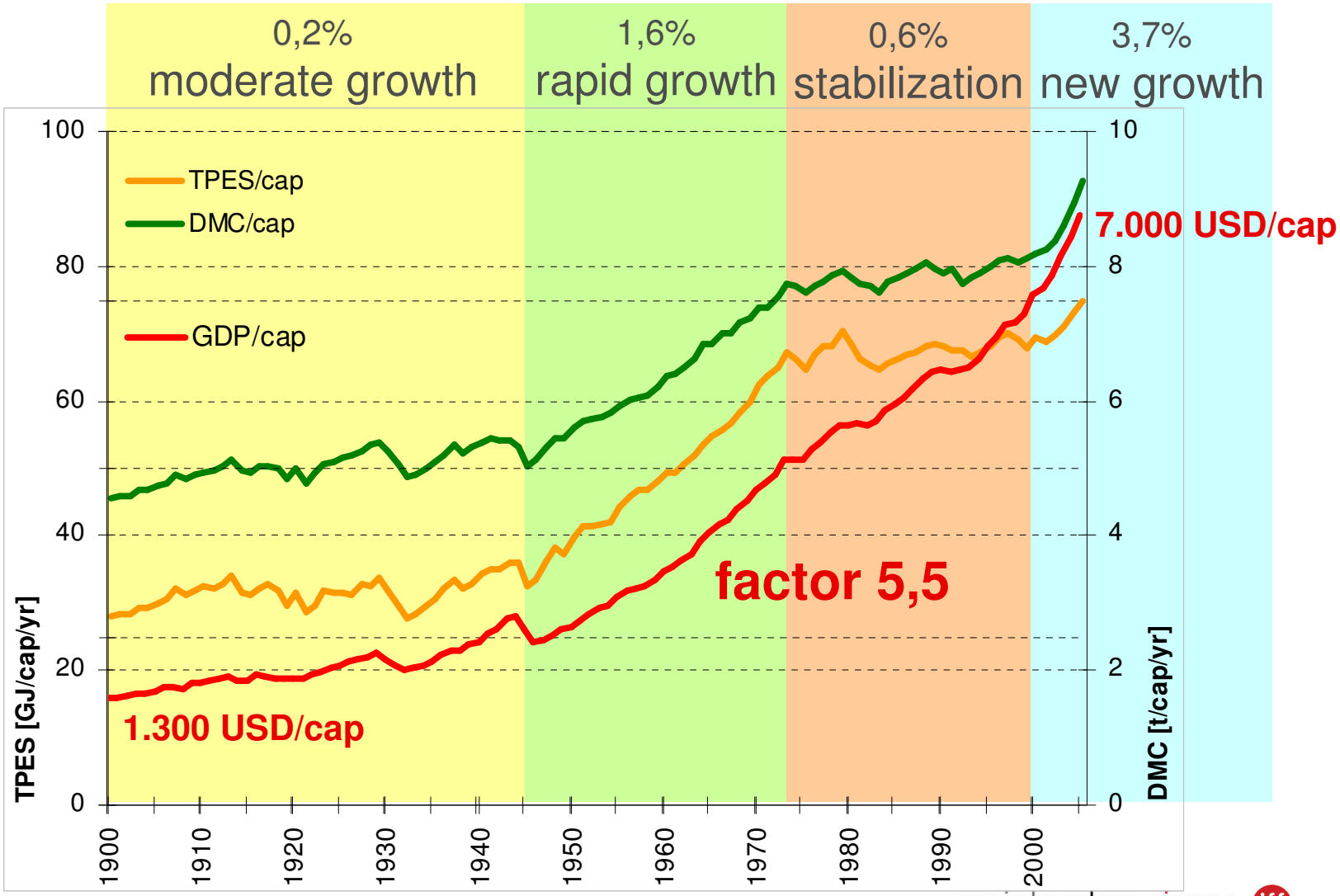


1900: 28 GJ/cap

2005: 75 GJ/cap

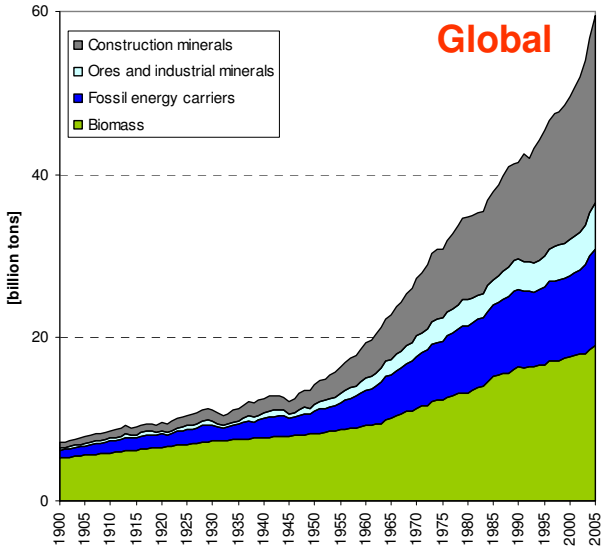
→ factor 2,7

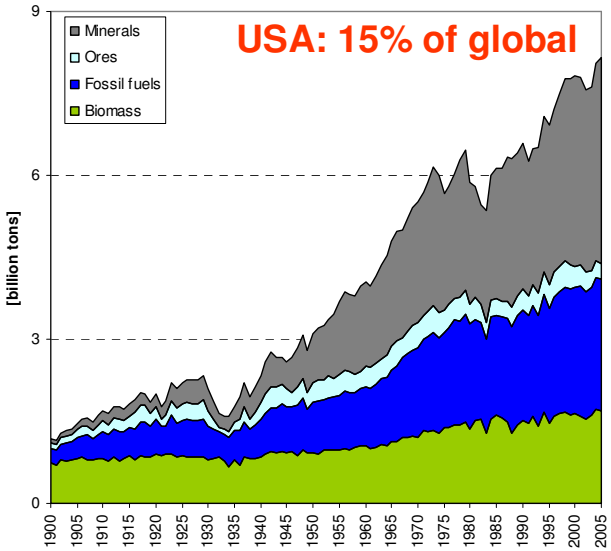
growth phases

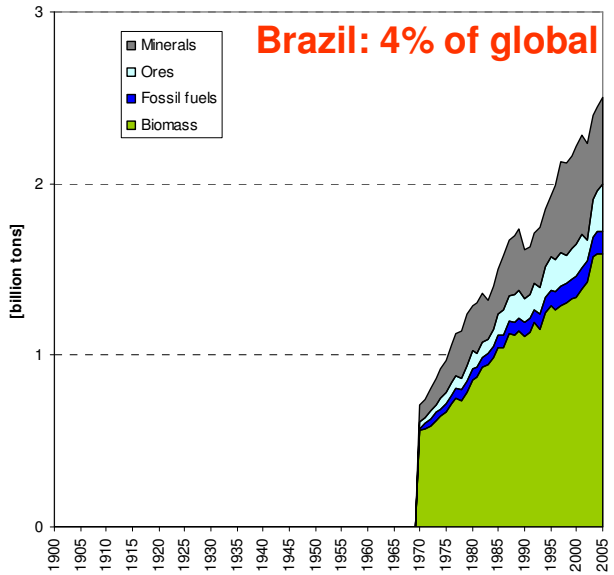


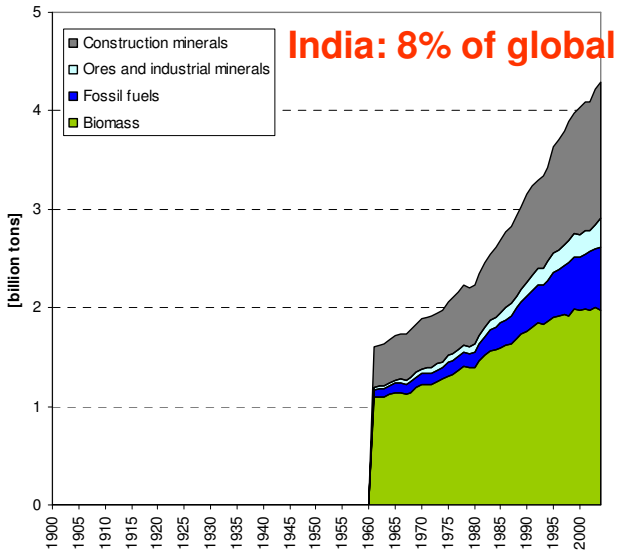
metabolic scale: national trends

material use (DMC)









Sources:
USA: Gierlinger 2009
Brazil: Mayer 2009
India: Lanz 2009

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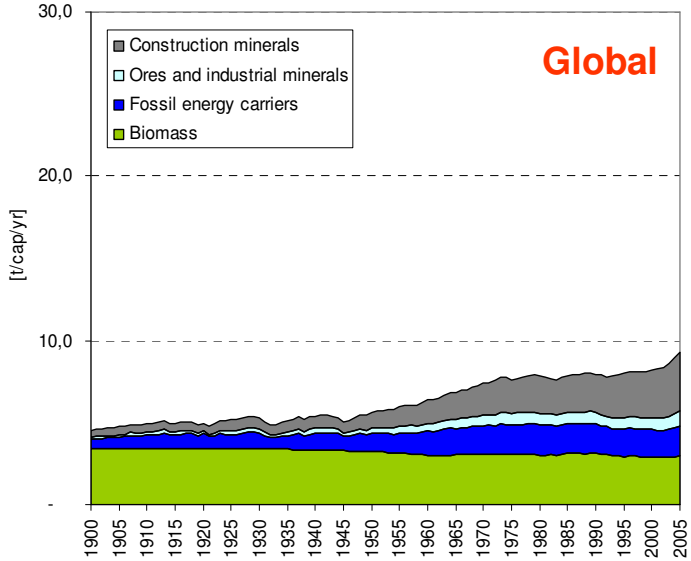
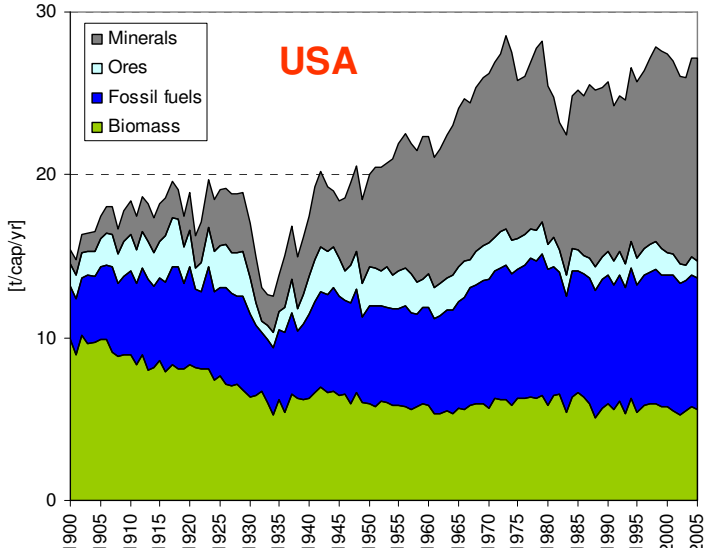
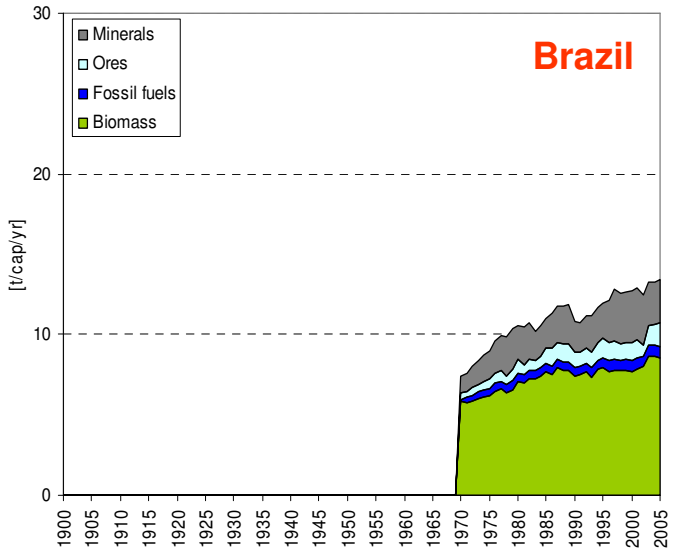
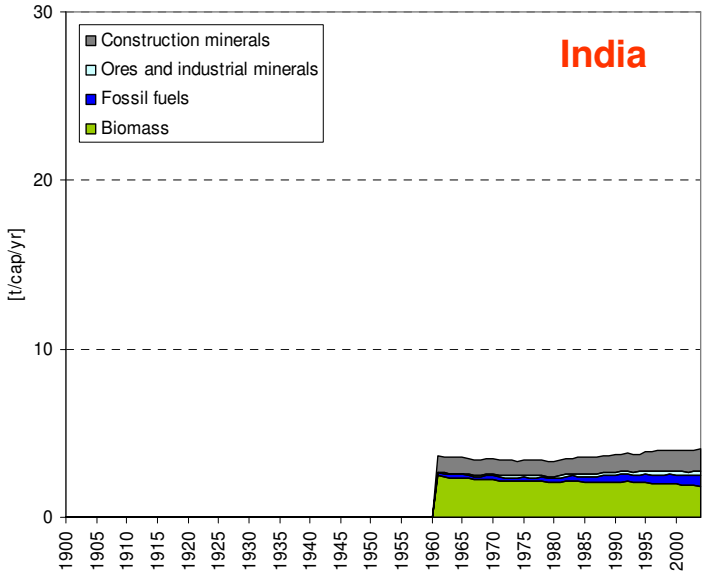
metabolic rates: national trends

per capita material use (DMC)









Sources:
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insight

drivers of resource use
resource productivity, decoupling

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drivers of resource use

population

people need resources for their living → growing world population results in growing resource use.

development

- the transition from the agricultural to the industrial regime leads to a significant increase in res. use.
- industrialization further drives resource use

population density

areas of low population density leave more space for extraction processes, agriculture and livestock farming, and the absorption of wastes and emissions.

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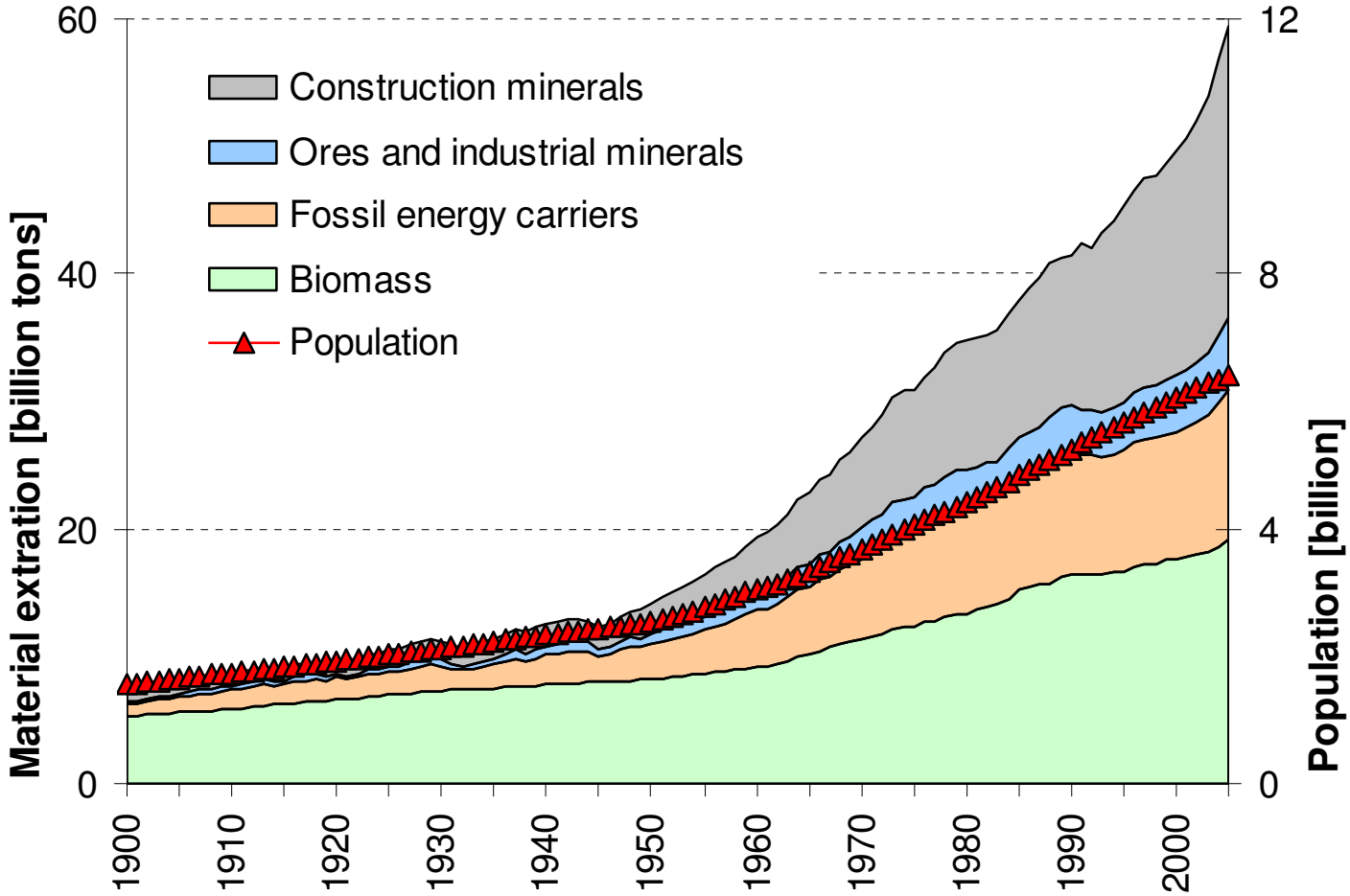
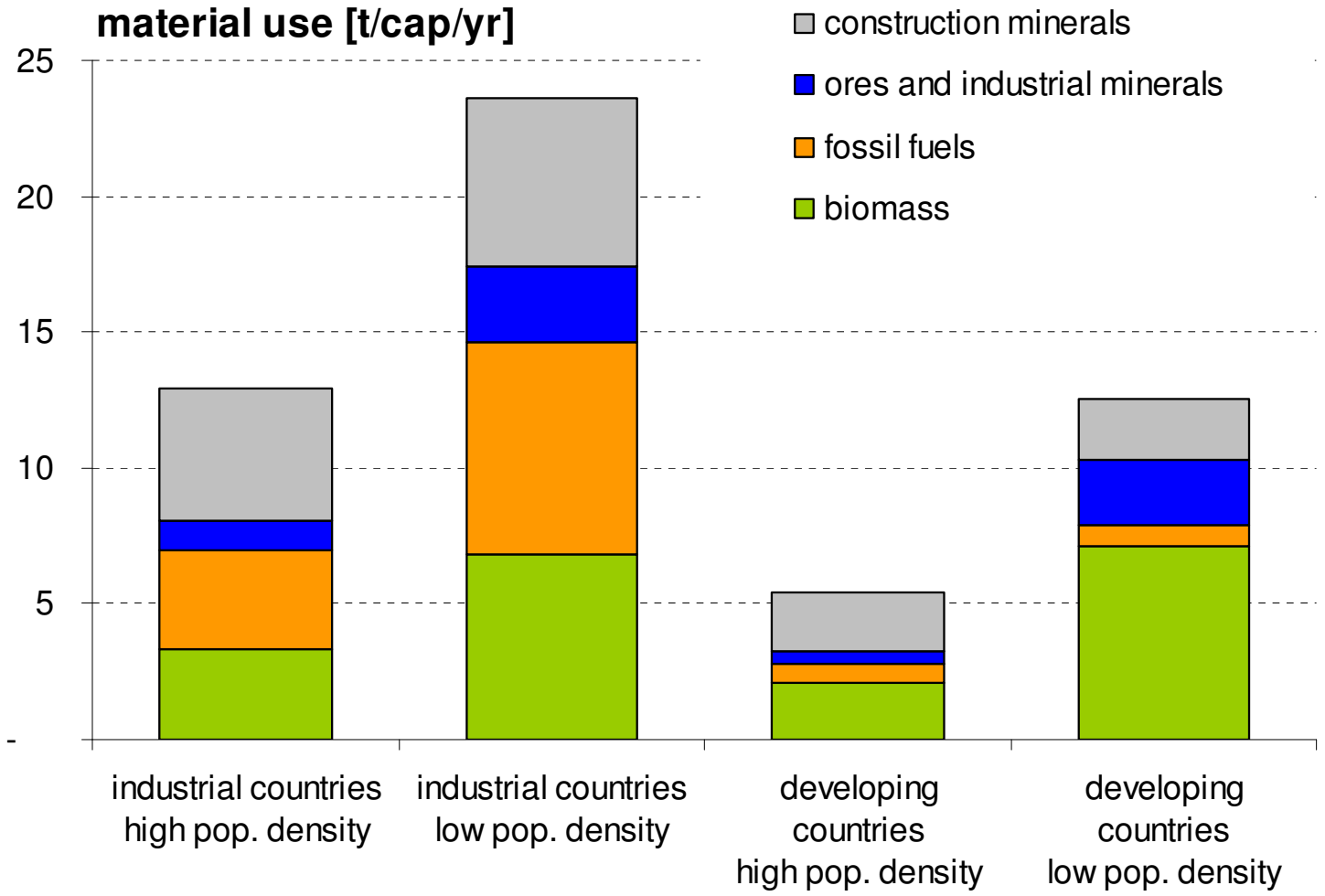
population and material use

strong link in the early decades



development a. population density

how do they link to resource use?

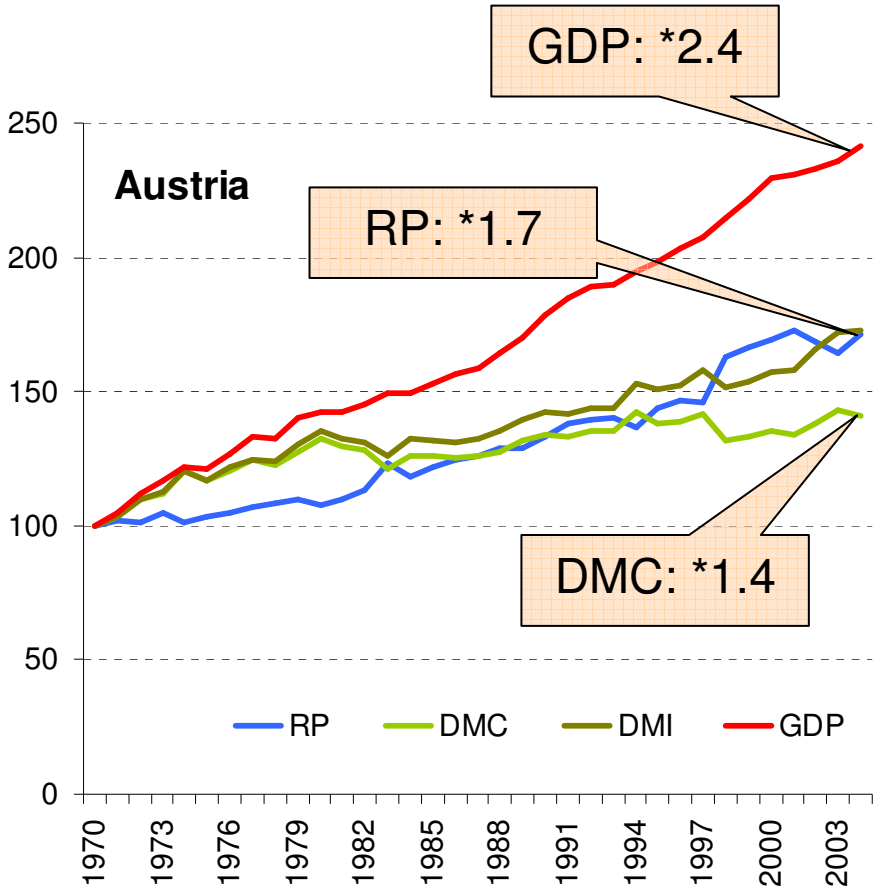


decoupling from economic growth

the starting point for tackling resource use

- Economic development as a driver of resource use
  → decoupling economic growth from resource use
  → resource productivity (GDP/DMC)
- How to improve resource productivity?
  - Reduce resource use: reduction, recycling, reuse, remanufacturing
  - Trade and outsourcing of material intensive processes has to be considered
- Absolute and relative decoupling
  - relative decoupling: resource use grows, but slower than the economy
  - absolute decoupling: resource use declines in absolute terms, resource productivity grows faster than economic development

resource productivity, decoupling
Austria



Source: Eurostat 2007 2004: DMC/cap: 19 t/cap

AUT Strategy for Sustainable Development: increase RP by factor 4

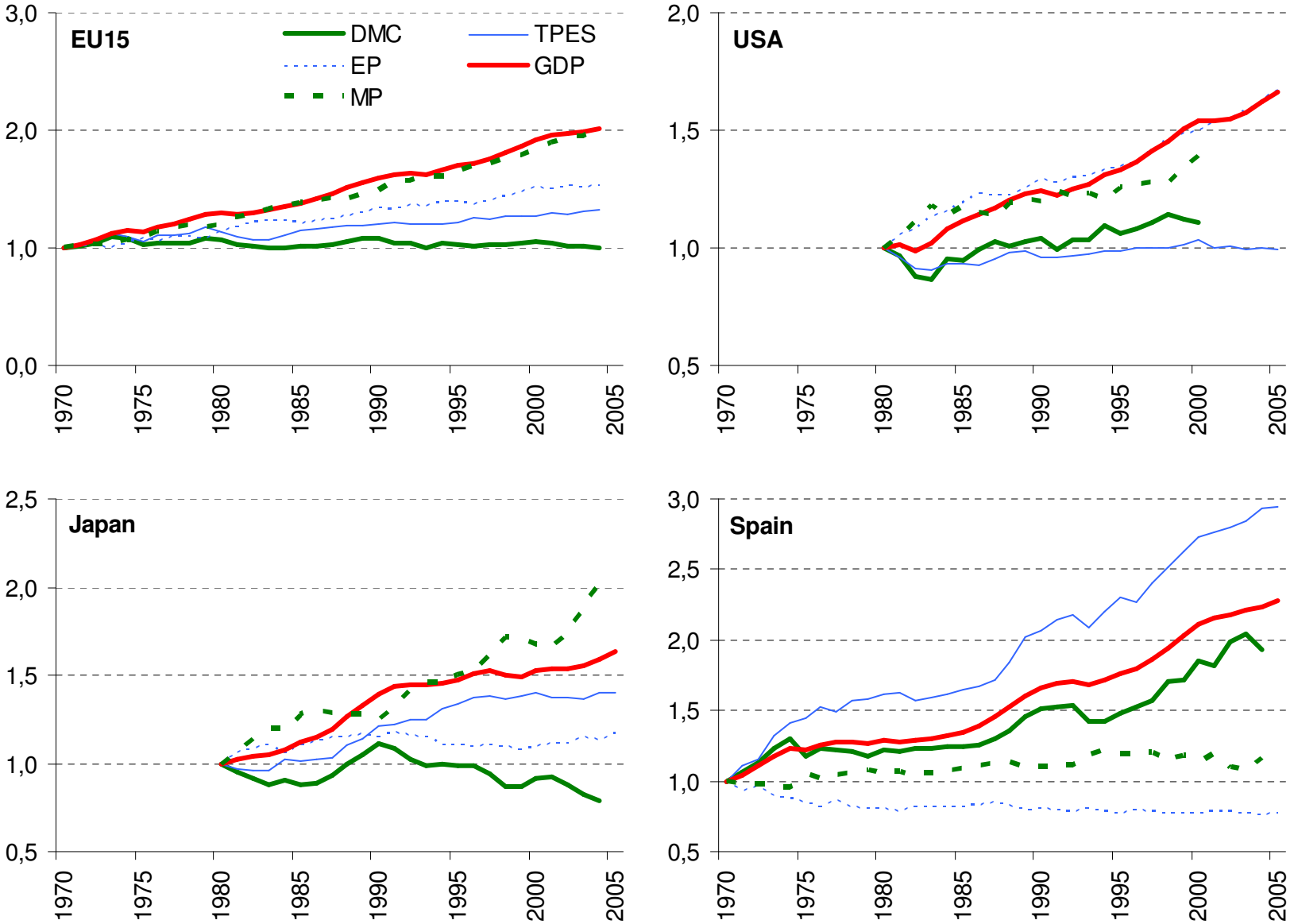
(assumption: within 30 years)

- GDP annual growth of 2%
  Stabilized DMC
  → RP: factor 1.8
- GDP growth of 2%
  RP increase by factor 4
  → DMC: - 60%
  DMC/cap: 8 t/cap

resource productivity, decoupling

Sources: EU15, Spain: Eurostat 2007,
USA: Soc.Ecol. database, Japan: Ministry of the Env., 2007

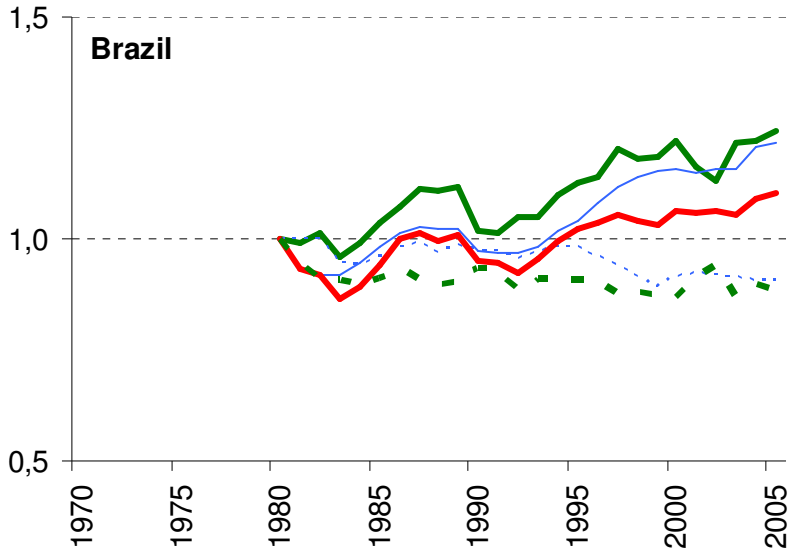
industrialized countries

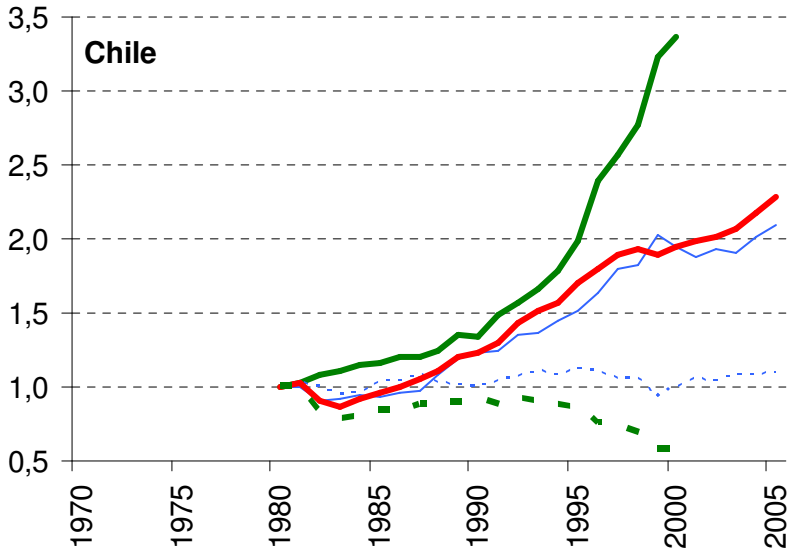


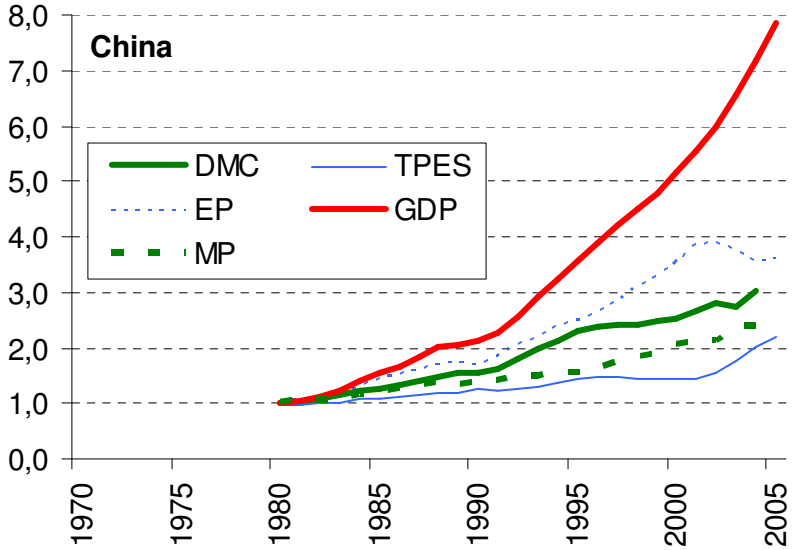
resource productivity, decoupling

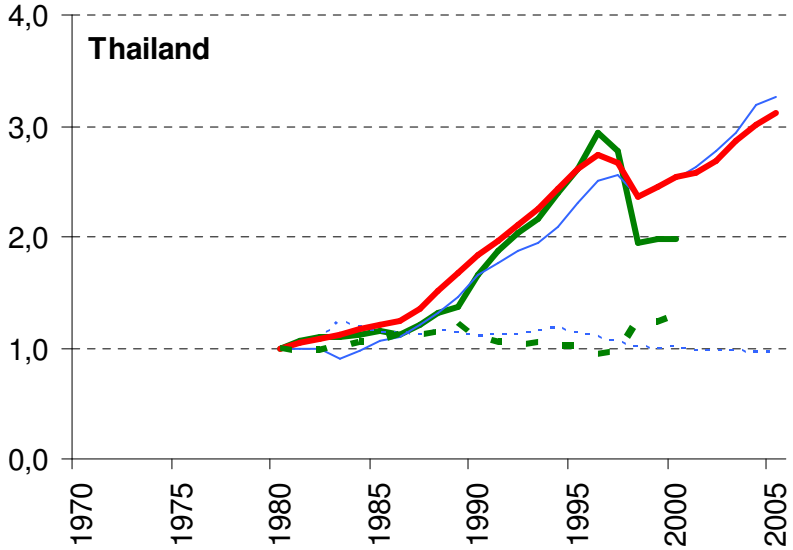
developing countries

Sources: Brazil, China, Thailand: Social Ecology database,
Chile: Giljum 2004









resource productivity, decoupling

the answer to limited resources?

- Relative decoupling
  - a quite common pattern, especially in phases of stabilized growth
  - however, relative decoupling is often (over)compensated by accelerated economic growth → rebound effect
- Absolute decoupling
  - hardly any long lasting evidence
  - if yes → major structural change

→ gains in resource productivity alone are not likely to solve the problem.

foresight

scenarios and future challenges

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3 scenarios

development of material use until 2050

scenario 1: freeze and catching up

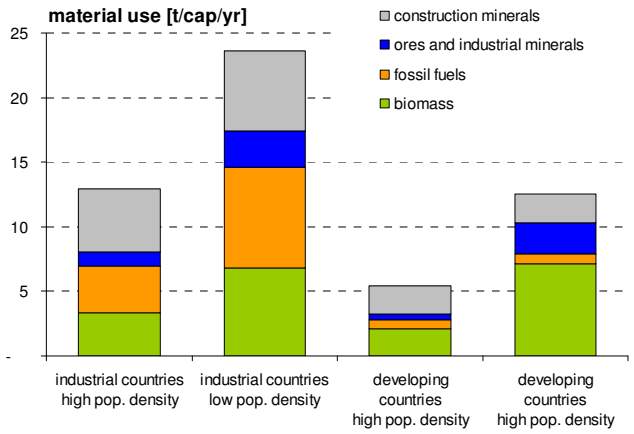
industrialized countries maintain their metabolic rates of 2000, developing countries catch up to these rates

scenario 2: freeze global DMC

global resource consumption stabilizes at the level of the year 2000

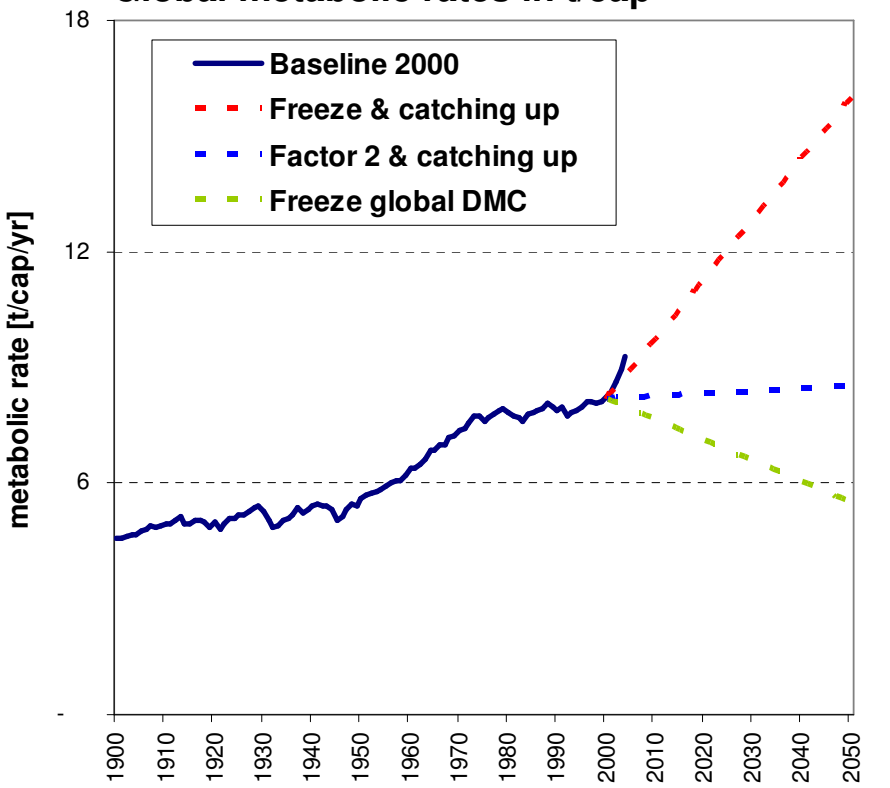
scenario 3: factor 2 and catching up

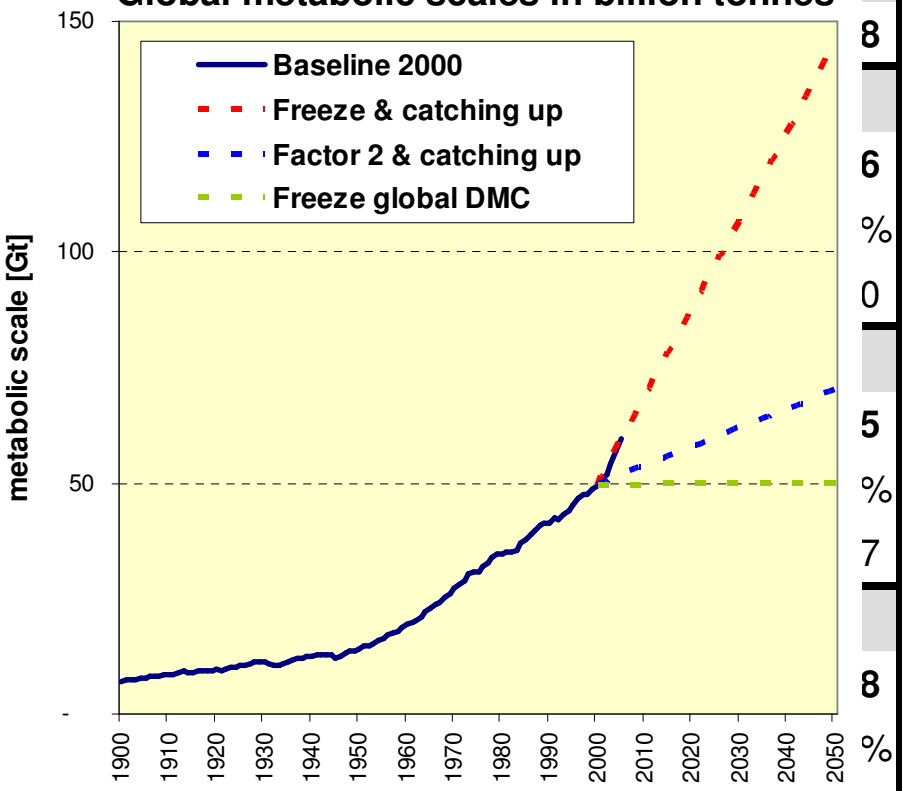
industrialized countries reduce their metabolic rates by a factor 2, developing countries catch up to these levels



scenario results

	industrial high dens.	industrial low dens.	developing high dens.	developing low dens.	
	HDI	**LDI**	**HDD**	**LDD**	**global**
baseline					
Factor	0,5	0,5	1,2	1,3	1,0





8
6
%
0
5
%
7
8
%

targeting

which level of resource use is sustainable?

biomass

- Limited land area
- Competing land uses – wilderness vs human use, nutrition vs biofuels

→ Land productivity, land degradation, ecosystem functioning

fossil energy carriers

- Limited capacity of ecosystems to absorb wastes and emissions

→ Link to CO2 emissions and climate change policies

ores and industrial minerals

- Limited availability – in an economically usable form
- Limited capacity of ecosystems to absorb wastes and emissions
- Toxicity in extraction, production and waste treatment

→ recycling, reuse, remanufacture in order to use less from natural stocks but reuse societal stocks

construction minerals

- Sealing of land and competing land uses (fragmentation of landscape/habitat)
- Energy and material demand through built up/use (mobility, heating)

→ address via fossil fuels and metals

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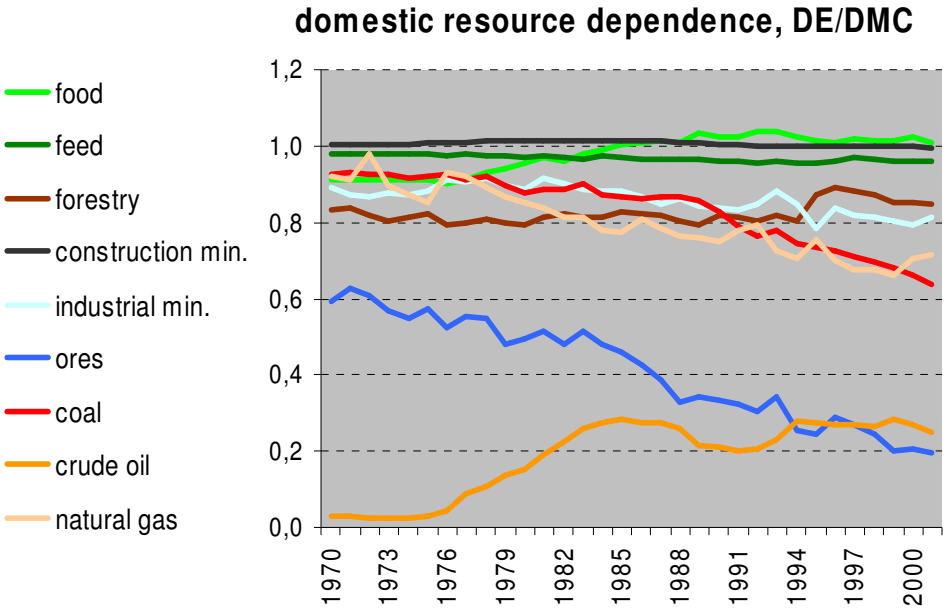
upcoming challenges

- Population growth: exp
- Developing countries: (Brazil, China, India, Ir
- Least developed count transition to industrializ
- Industrialized countries decoupling – but often dependence on import of environmental burde



- Relative scarcities will challenge the international division of labour, aggravated conflicts over the access to resources → price increases, risk of supply, e.g. EU dependence on metals and fossil fuels; the new "buying" of land across national boundaries

conclusions

the total amount of resources used has to be reduced

- efficiency gains → resource productivity
- rethinking economic growth,
  structural change → not a thread but an opportunity!
  - not a decrease in standard of living but reorientation
  - consider constraints of materials/material groups and mutual links and dependencies
  - national measures should consider global consequences, e.g. shifting environmental burdens abroad through trade

context, data and publications

work context

- In collaboration with Fridolin Krausmann, Marina Fischer-Kowalski, Julia Steinberger
- “GLOMETRA - The global metabolic transition: Long term trends and patterns of socioeconomic material and energy use” Project funded by the Austrian Science Fund FWF, 2008-2010
- “UNEP International Panel for Sustainable Resource Management”, Project funded by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, 2007-2009

data download

http://www.uni-klu.ac.at/socec/inhalt/1088.htm

publications

- Krausmann, F., Gingrich, S., Eisenmenger, N., Erb, K.H., Haberl, H., Fischer-Kowalski, M. 2009. Growth in global materials use, GDP and population during the 20th century, *Ecological Economics* (in press).
- Krausmann, F., M. Fischer-Kowalski, H. Schandl, and N. Eisenmenger 2008. The global socio-metabolic transition: past and present metabolic profiles and their future trajectories. *Journal of Industrial Ecology 12(5/6),* 637-656.

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thank you for your attention

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