Europe's responsibility for a sustainable use of natural resources

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Addressing the key questions proposed by C. Manstein - outline

1. Prelude: where do we stand? What is the size of the challenge?

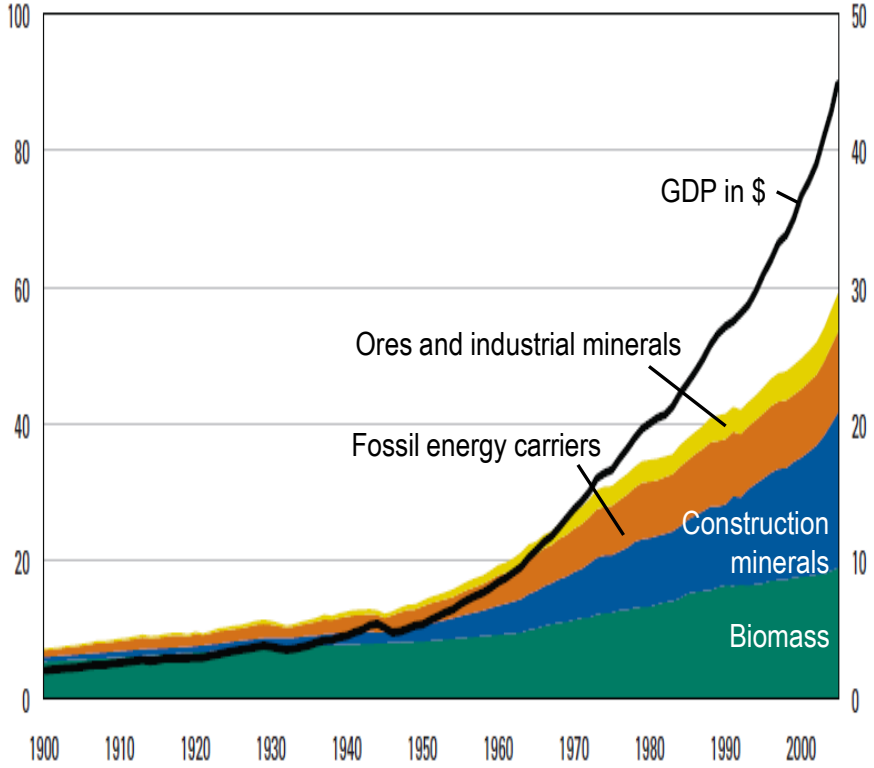
2. Qu's 3 and 5: "How to take into account planetary boundaries? How can global distributional justice be assured in the definition of global resource targets?"

3. Qu's 1 and 2: "How can quantitative targets for a sustainable resource use be derived? What environmental, social and economic perspectives and arguments must be taken into account?

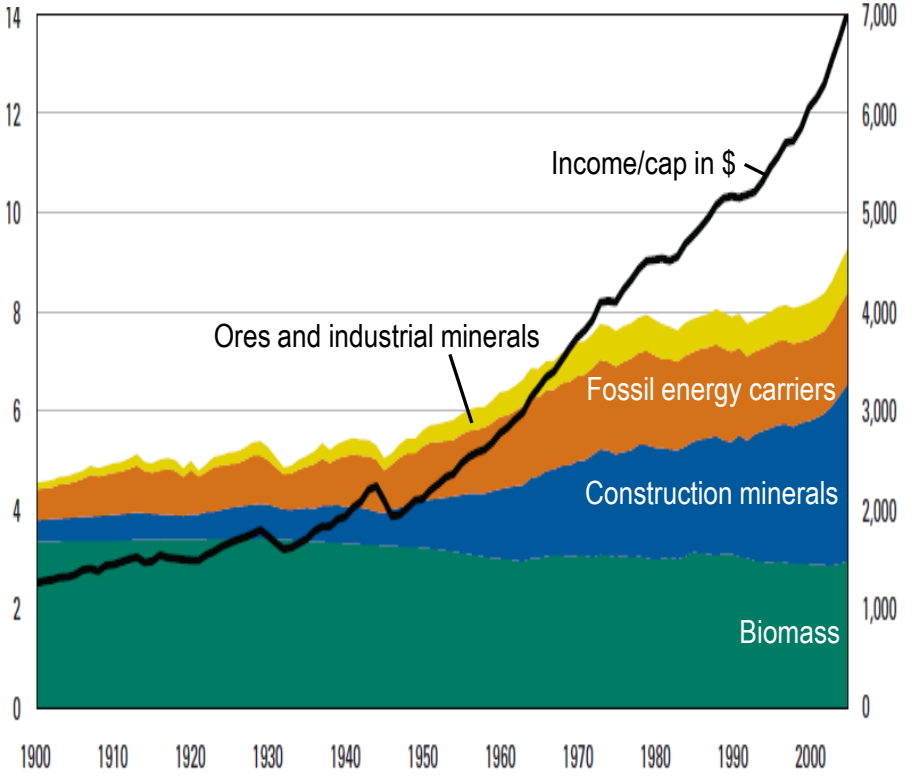
4. Qu 4: "What types of indicators could be most suitable to measure progress towards them?"

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

Global material extraction
1900-2005

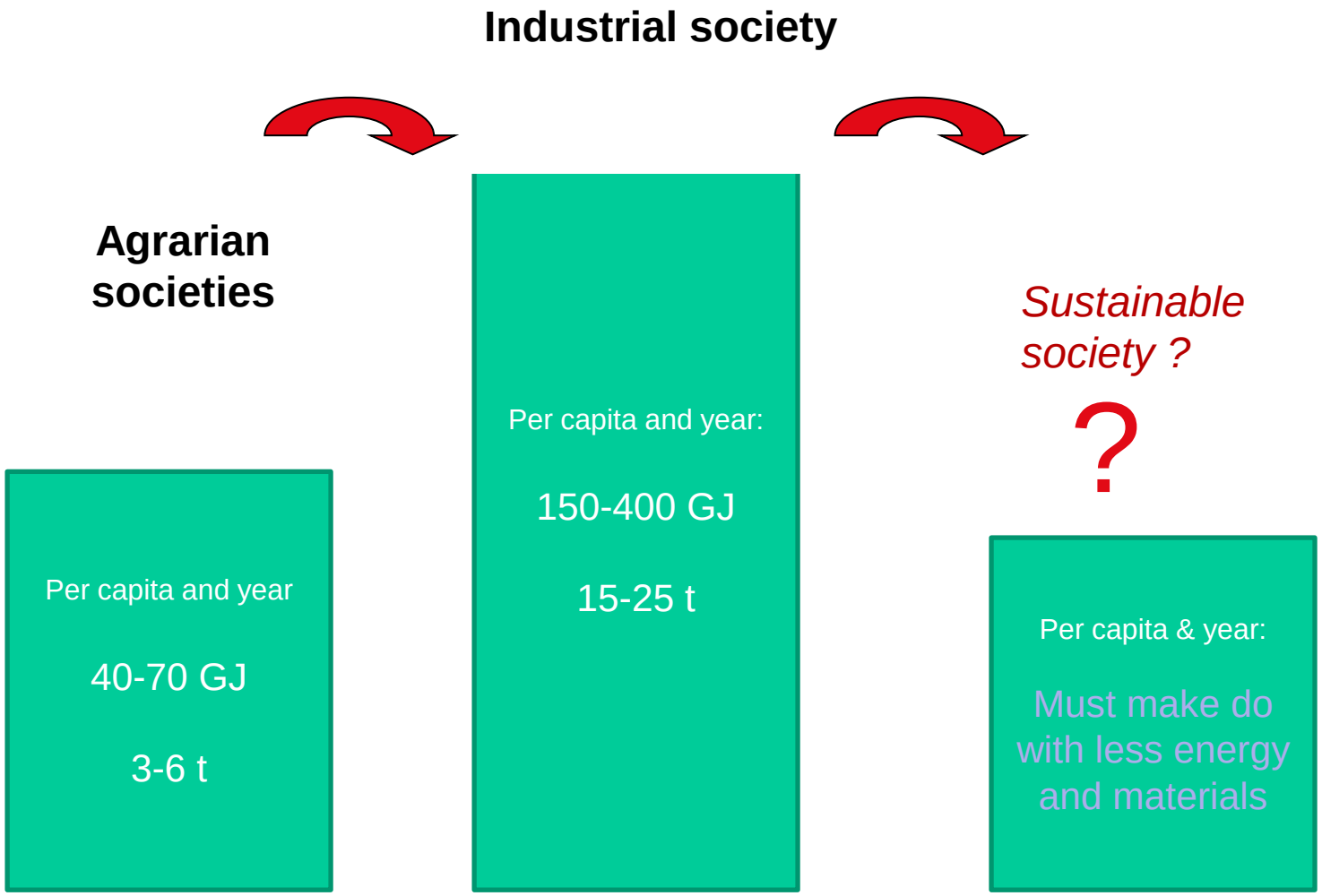


Global metabolic rates
1900-2005



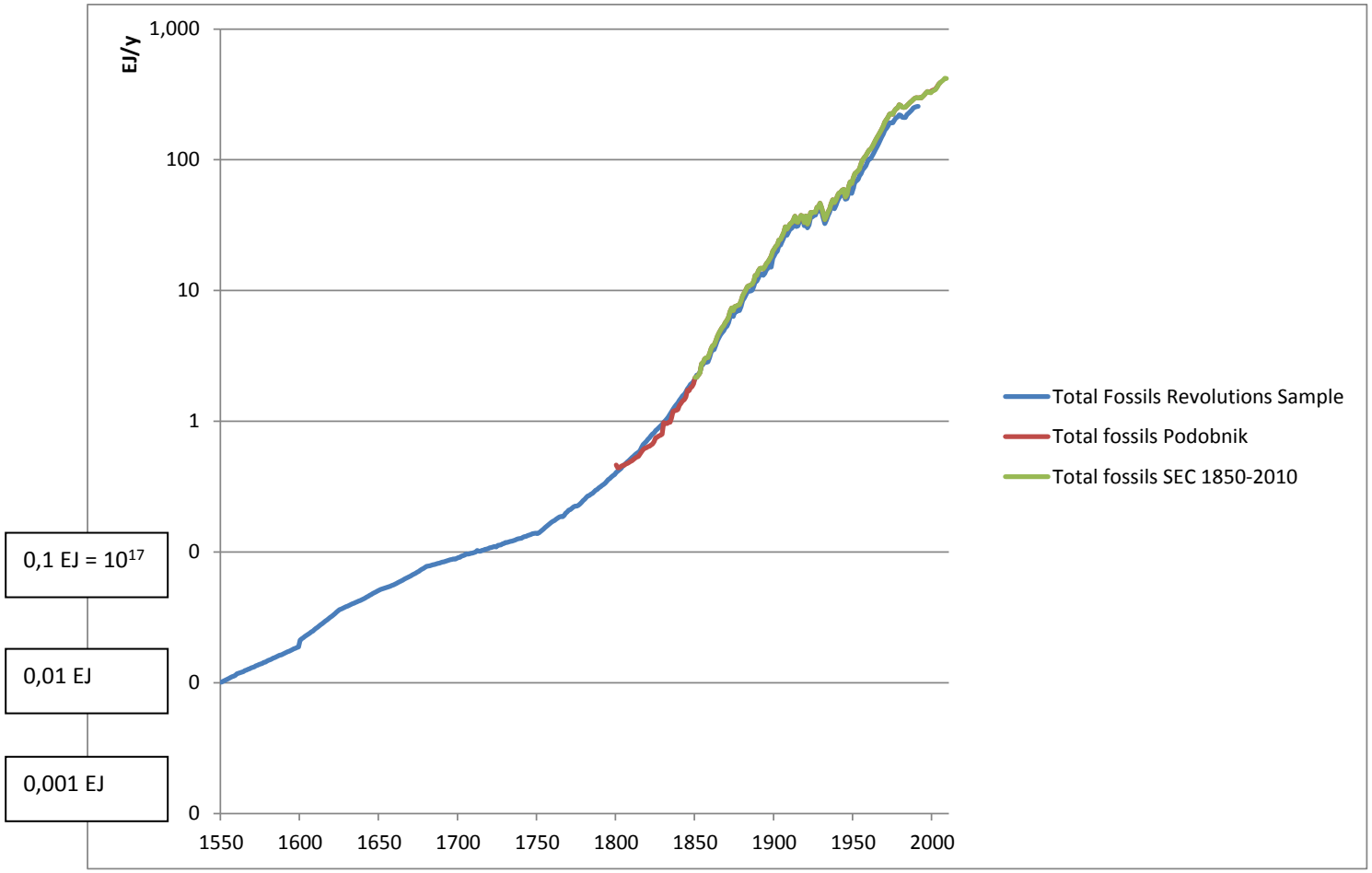
Source: UNEP International Resource Panel, Decoupling Report 2011

Energy and resource use per capita depends on socio-metabolic regime



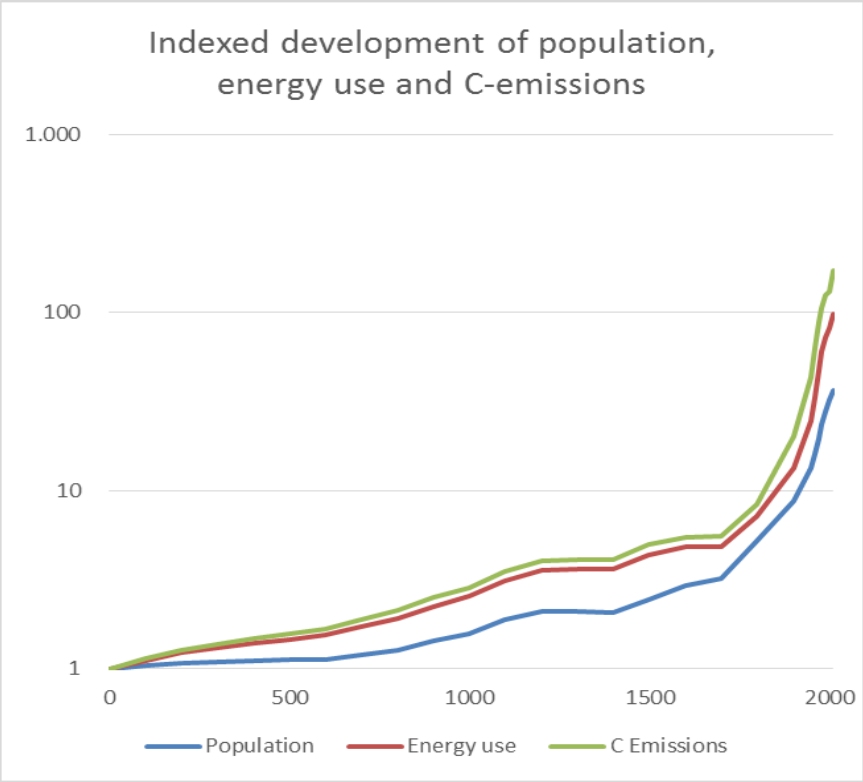
Sieferle et al. 2006; Fischer-Kowalski and Haberl 2007; Schandl et al. 2008

Global production of fossil energy 1550 -2000 (peat, coal, oil, gas, in EJ)



Source: Krausmann et al., SEC database 2013

IPAT: Human pressure/impact due to population numbers, affluence (energy use) and technological carbon emission intensity, AD 1 - 2010



Population increased from 190 – 6800 million, that is 36 fold.

Energy affluence increased from about 40 GJ/person to 120 GJ/person, that is 3 fold.

Carbon intensity rose from about 9tC/GJ to about 15tC/GJ, that is almost 2 fold.

Source: Fischer-Kowalski et al. 2014 Anthropocene Review

Not just a change in trend, but a veritable socio-ecological transition is ongoing, and another socio-ecological transition is required

- Since the turn of this 21st century, there has occurred the steepest rise of annual global resource extraction ever. Currently, the world economy is extracting annually more than 70 billion tons of biomass, construction materials, metals and fossil fuels from the earth, up from about 12 billion tons in 1970 (Schaffartzik et al., 2014).
- In particular, the growth in global resource extraction (and use) exceeds world population growth, substantial in itself, since the mid-1990s.

Questions 3 and 5:
How to take into account planetary boundaries?
How can global distributional justice be assured?

1. Contraction and convergence
2. The role of international trade

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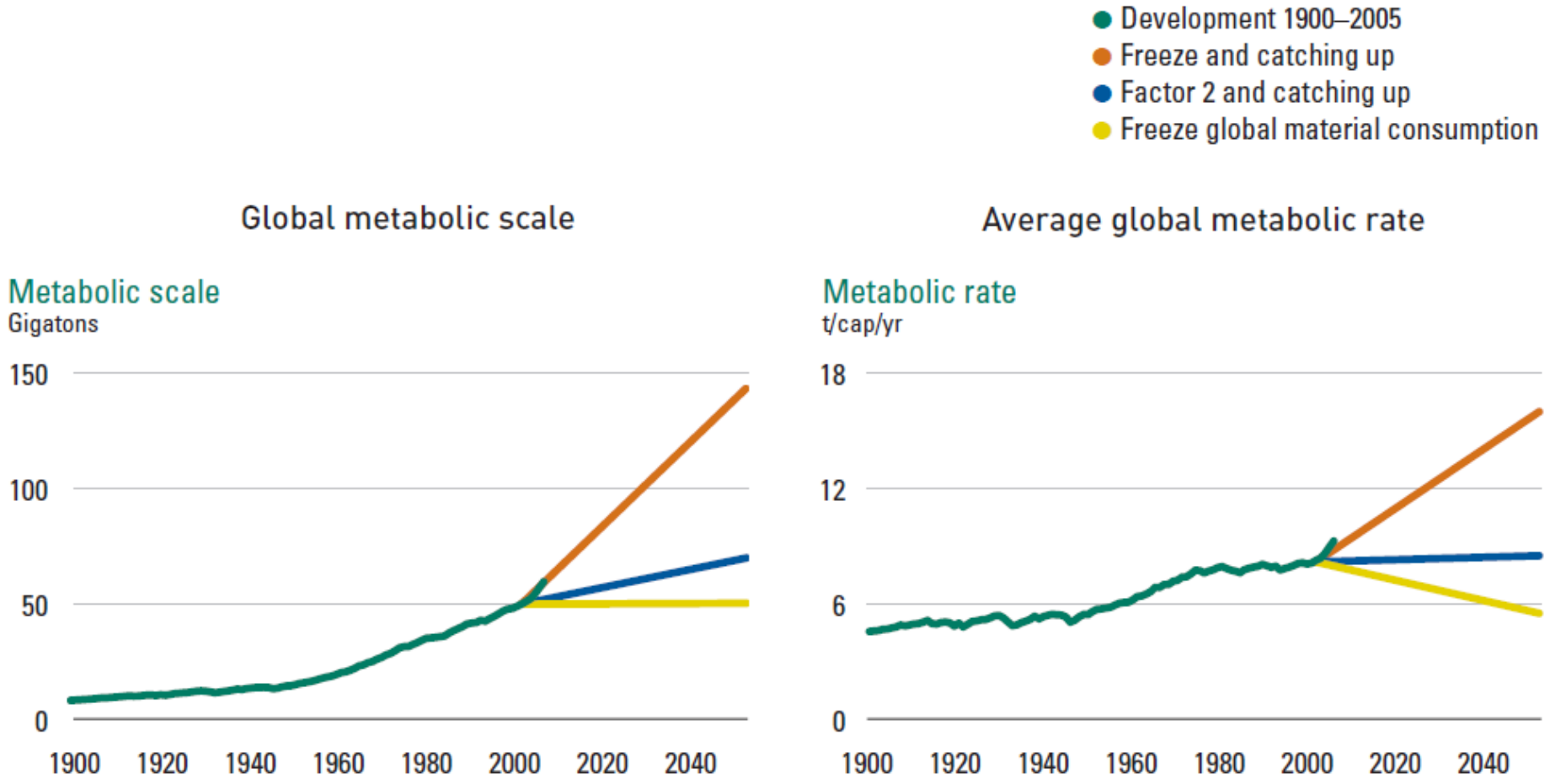
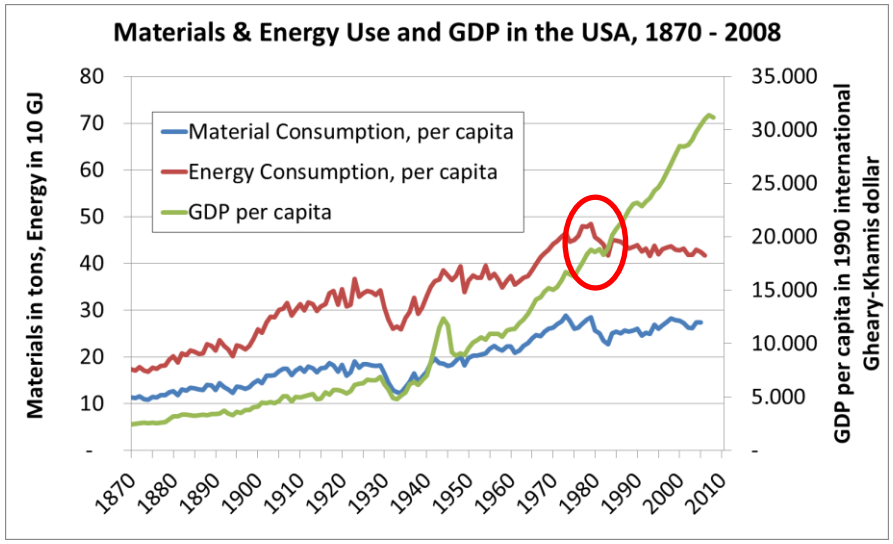
Convergence to (2000) European levels (15t/c):
=> tripling of annual global resource extraction by 2050

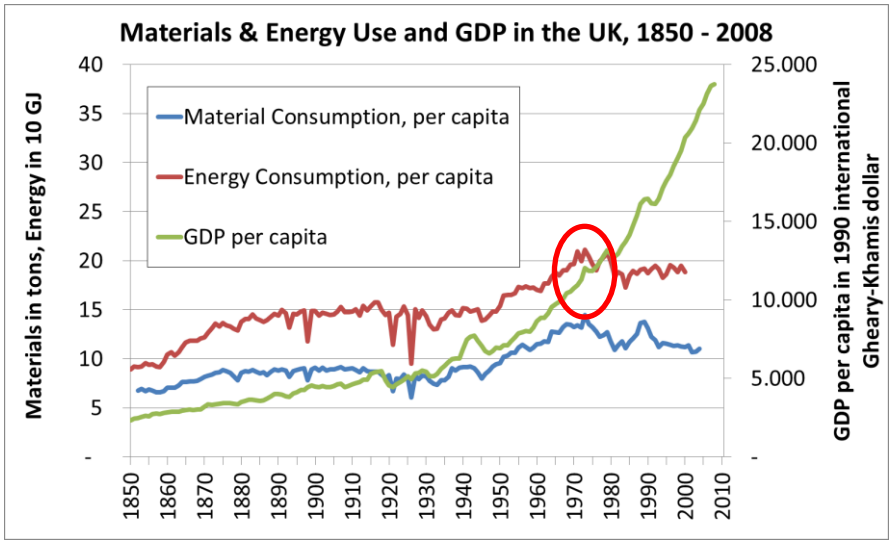
Convergence to (2000) p/c global levels (8t/c):
=> rise of annual global resource extraction by 1/3

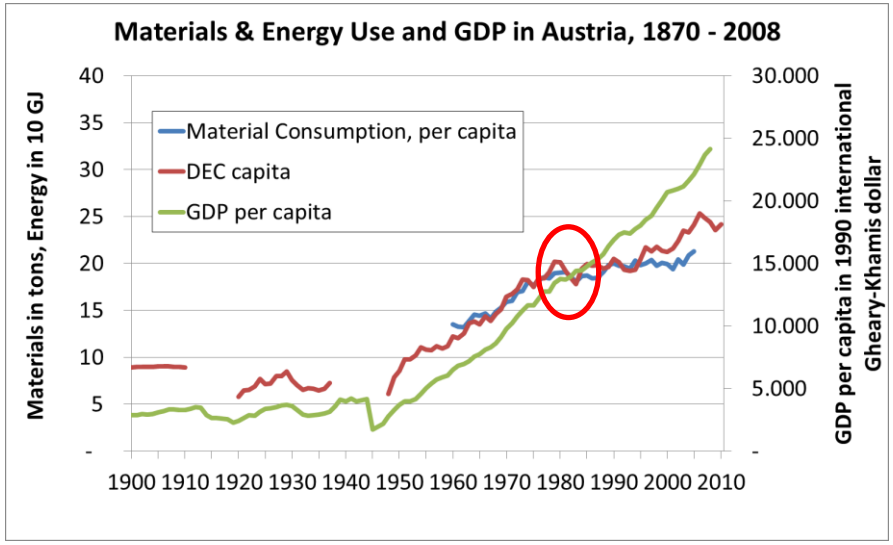


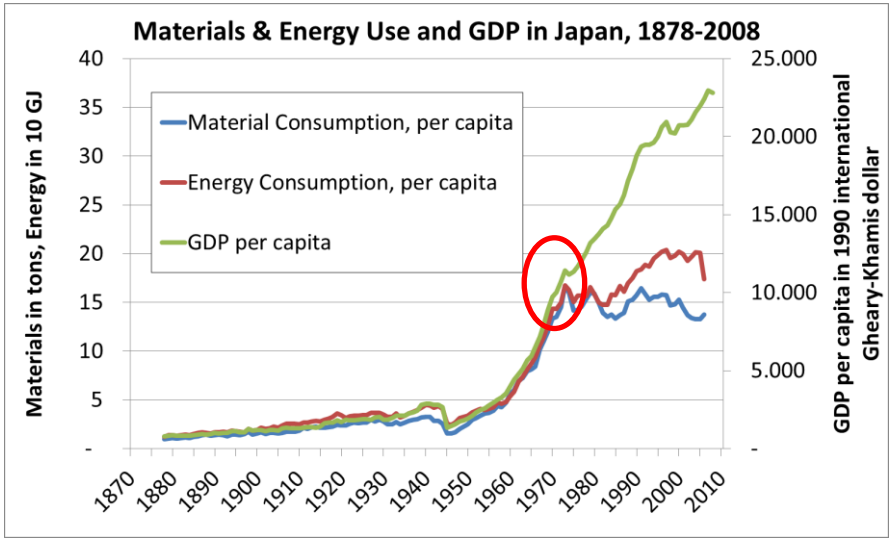
Source: UNEP International Resource Panel, Decoupling Report 2011

Structural breaks in Materials & Energy Use in most high income industrial countries in the 1970s



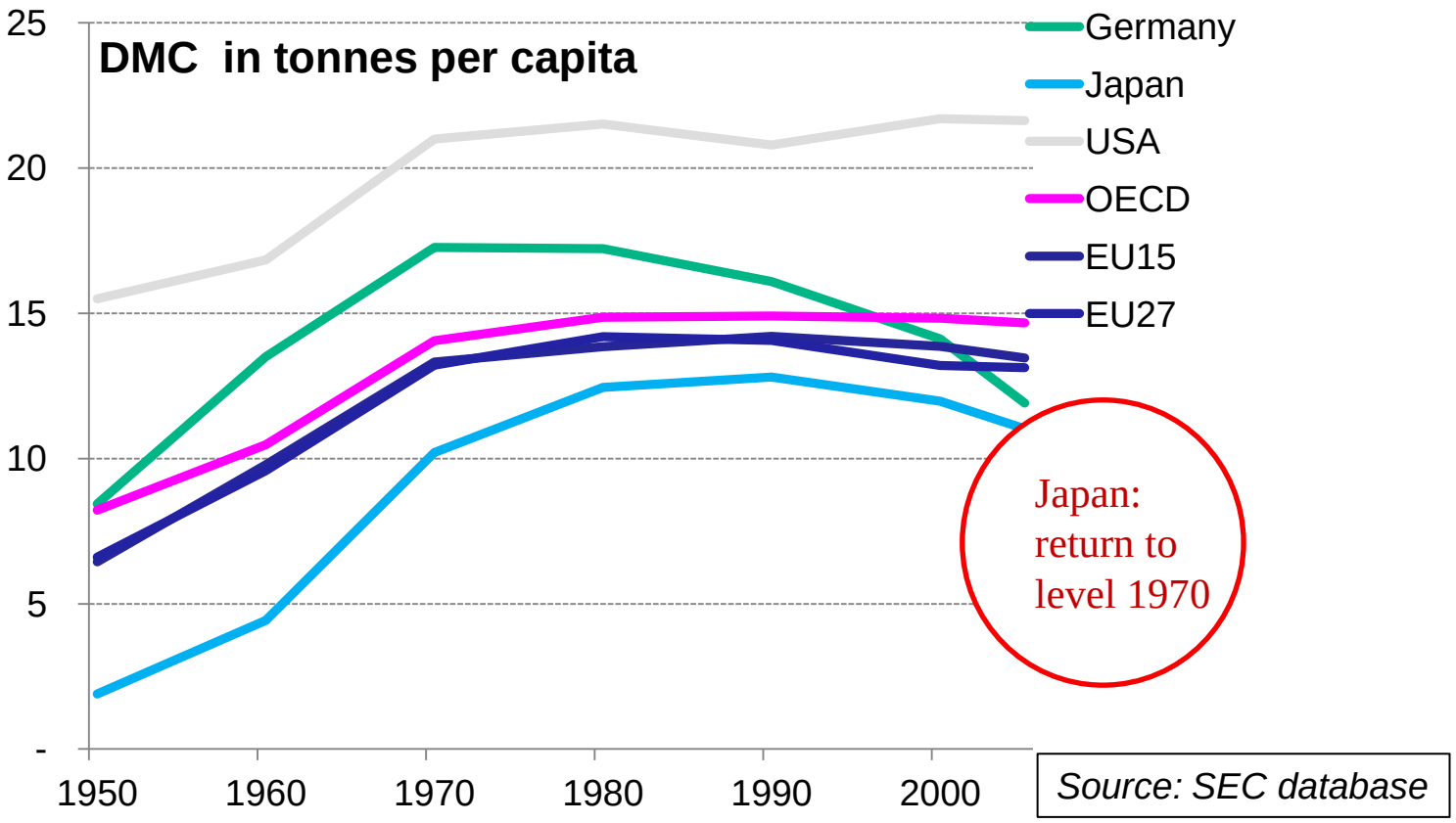






Gierlinger and Krausmann 2012 USA, Krausmann et al. 2011 Japan, SEC database UK and Austria, GDP data from Maddison 2010 (const. values)

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



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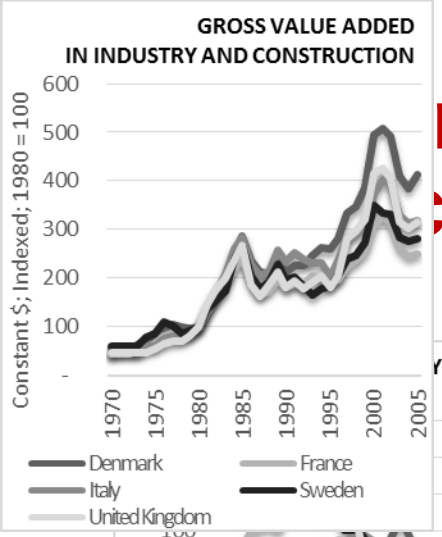

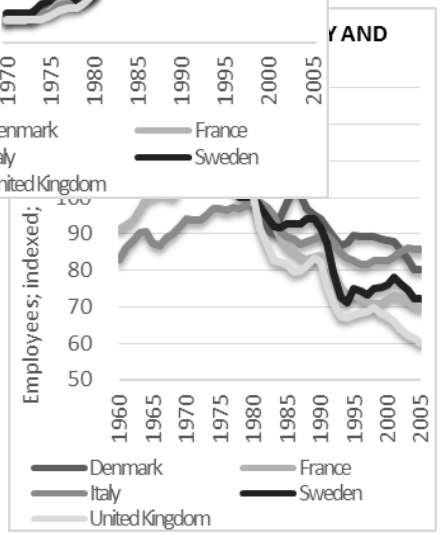

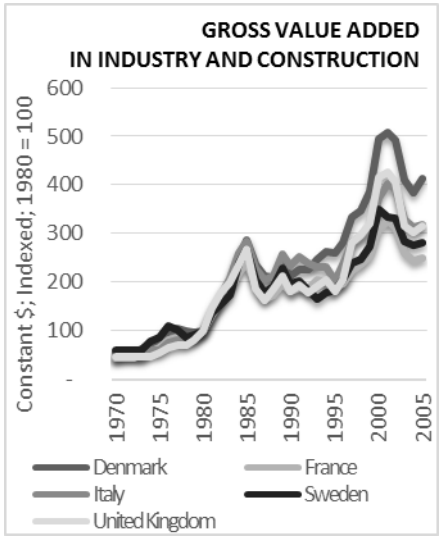

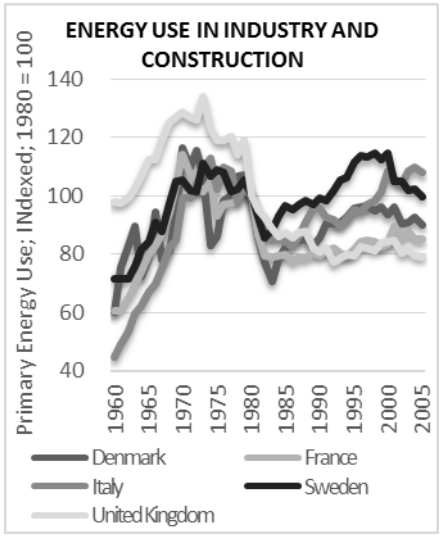

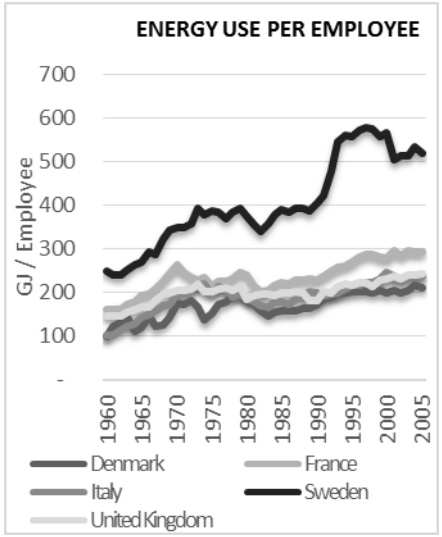

Source: Draxler, 2014

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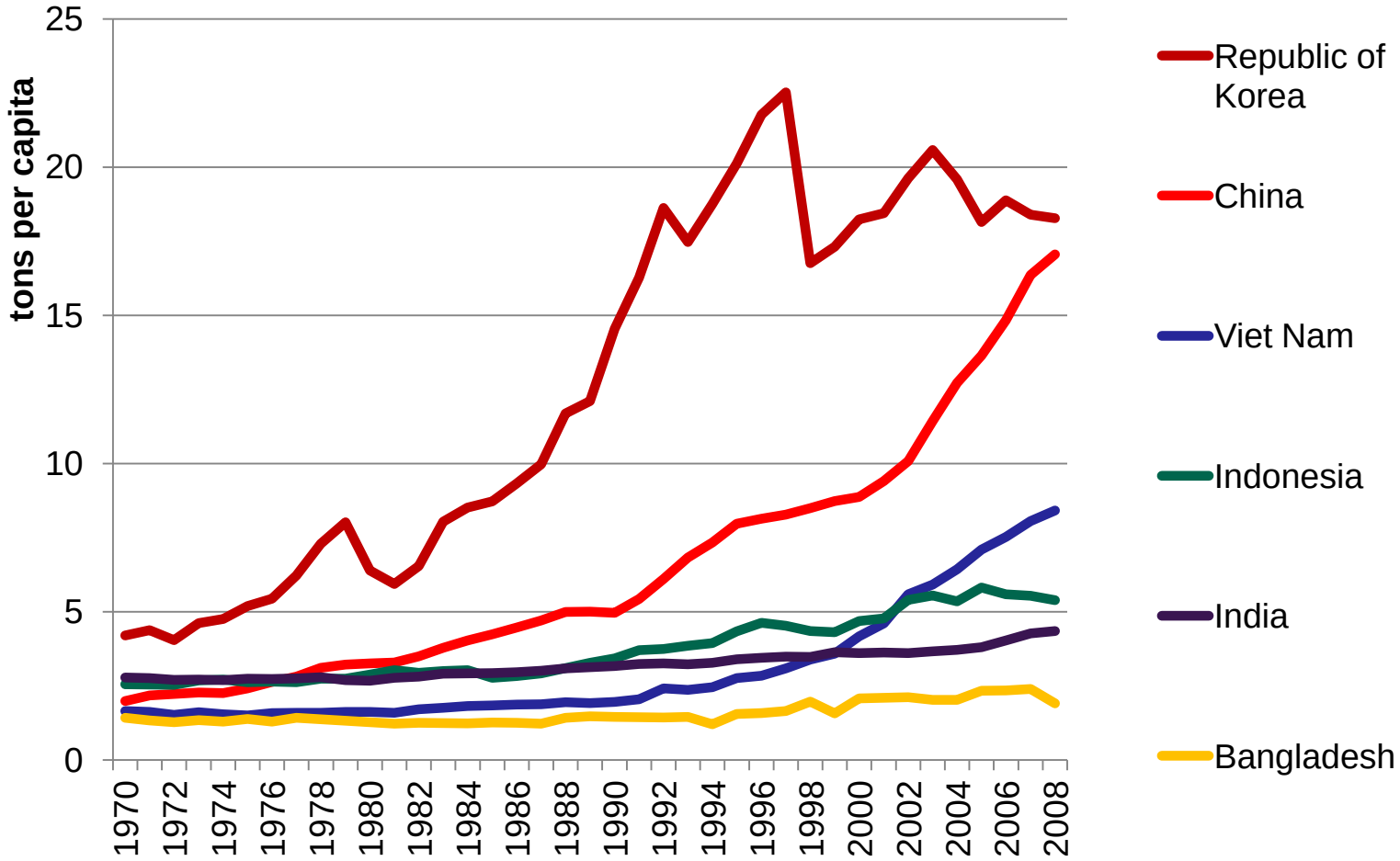
Resource use in Asian countries



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]

Changing context for the future of Europe

The two most important changes that are on-going refer, first,

- to the increasing international competition for resources, with large countries like China and – less visibly, because somewhat delayed, but no less relevant – India catching up and so far emulating the Western fossil-fuels-based resource-intensive development path.
- Second, there is an unprecedented rise in the price of natural resources. Both changes will create a context for European economic development that contrasts strongly with the 20th century context of Western dominance and a gradual decline in resource prices.

These structural changes tend to be underrated in many forward-looking scenarios and projections. In terms of available natural resources, Europe faces a future more uncertain than often recognized.

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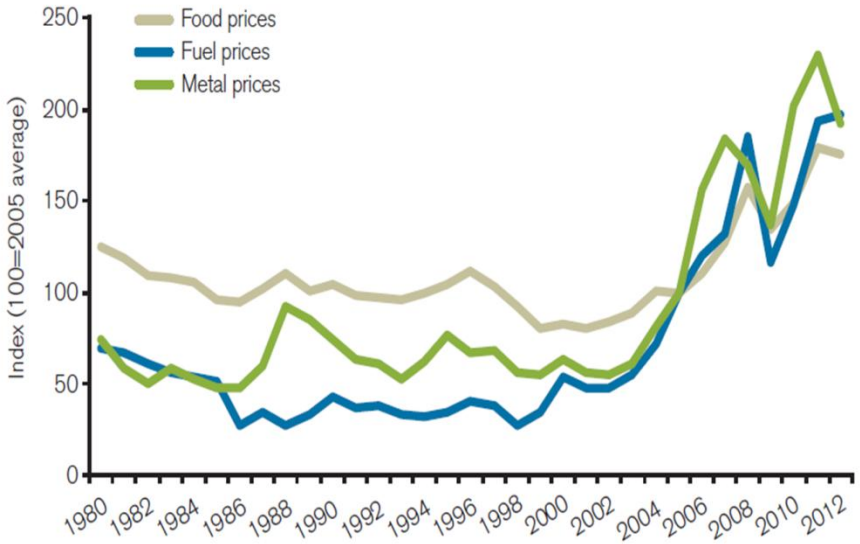
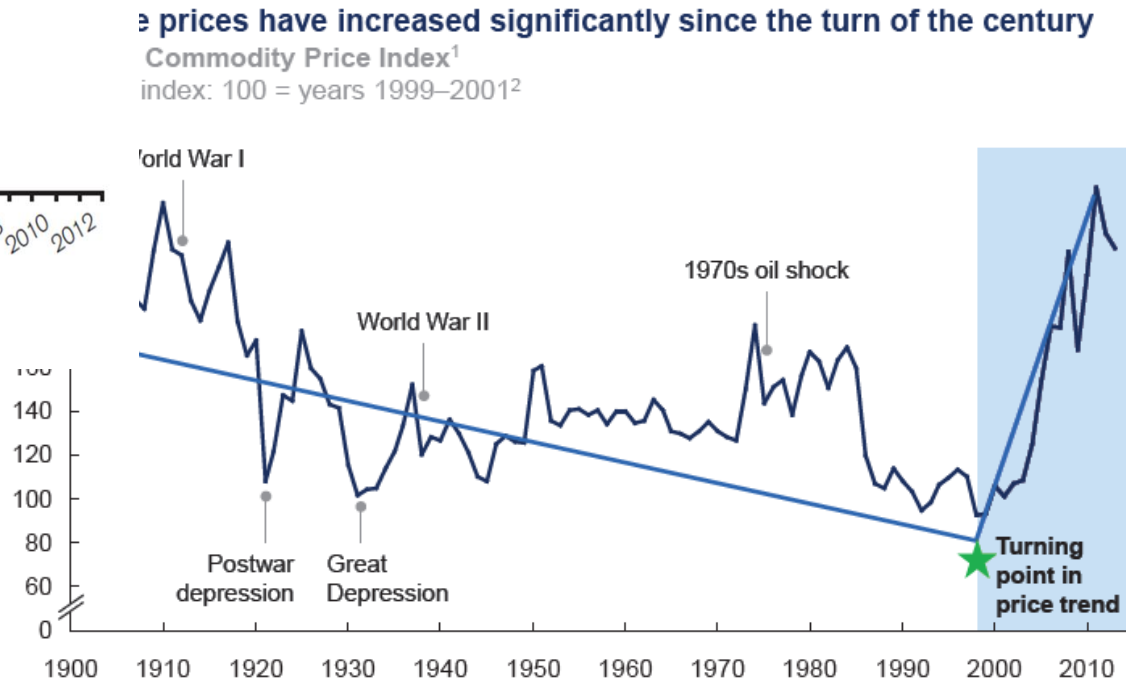
Raw material prices throughout the 20th century and beyond



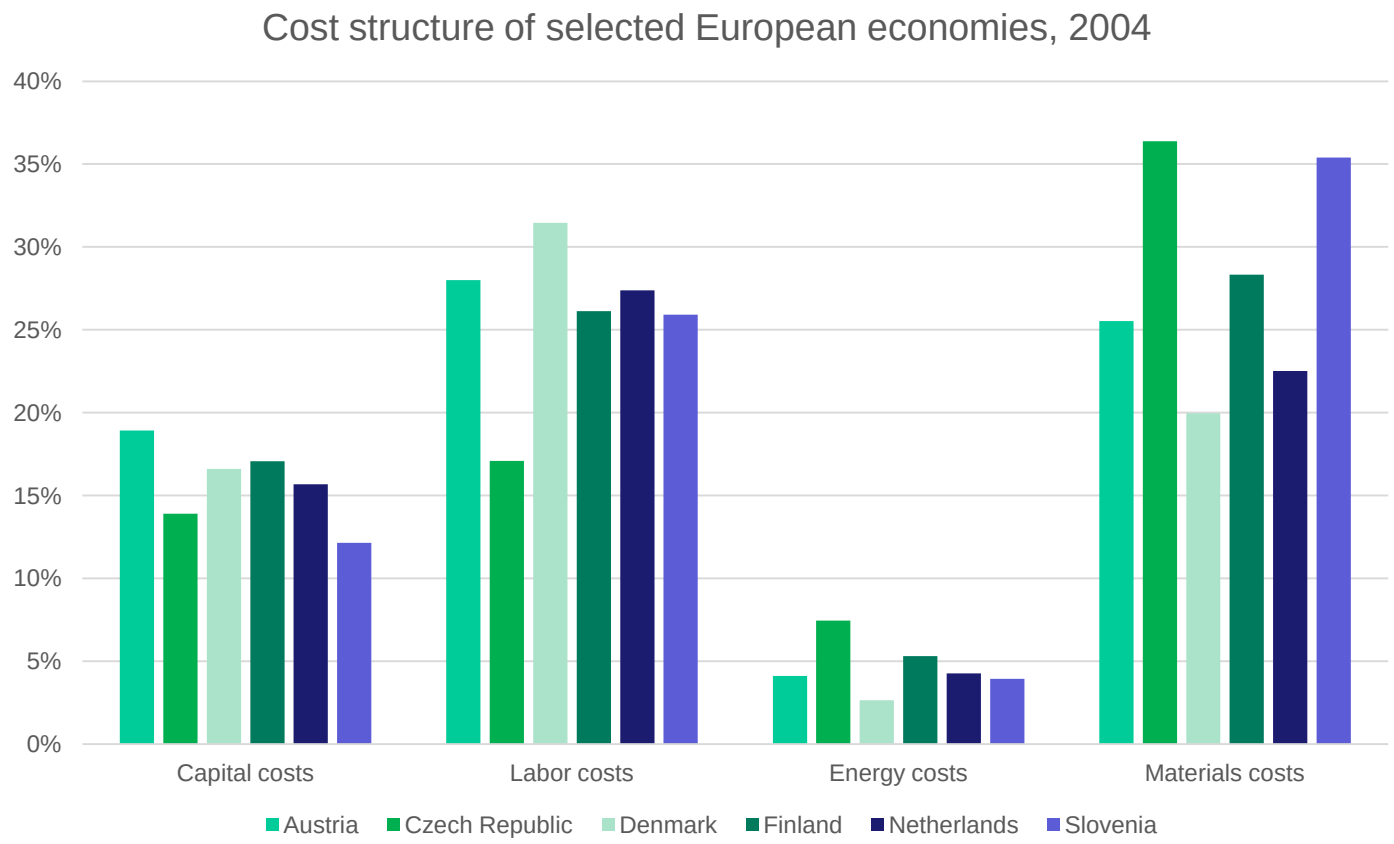
Source: Chatham House based on IMF (2012).



1 Based on arithmetic average of four commodity sub-indexes: food, non-food agricultural raw materials, metals, and energy.
2 Data for 2013 are calculated based on average of the first three months of 2013.
SOURCE: Grilli and Yang; Pfaffenzeller; World Bank; International Monetary Fund; Organisation for Economic Co-operation and Development statistics; Food and Agriculture Organization of the United Nations; UN Comtrade; McKinsey Global Institute analysis

Source: McKinsey 2012

Cost structure in Europe: shares of capital, labor, energy and materials



Source: EU-KLEMS database ed. 2008, own calculations

http://www.foreurope.eu/fileadmin/documents/pdf/Policybriefs/WWWforEurope_PB_no05_D204.1.pdf

Contraction and convergence ongoing?

- A certain degree of contraction and convergence is ongoing, but on an unsustainable level, risking resource depletion and severe international conflicts
- Could Europe initiate a radical change, and what would be the price to pay for it?
- WWWforEurope modelling answers until 2050:
  - By shifting focus slightly (R&D, taxation) from labor/capital saving to energy/resource saving, material use (DMC/c) could be reduced and more employment created, GDP-neutral
  - By radical CO2 taxation (rising from 25€/t linearly to 250€/t), redistributed to employers and employees by lowering social security payments, GHG-emissions would fall by 50%, DMC by 20%, and employment increases (despite slightly reducing GDP growth)
- Strong co-benefits of decarbonization policy on resource use

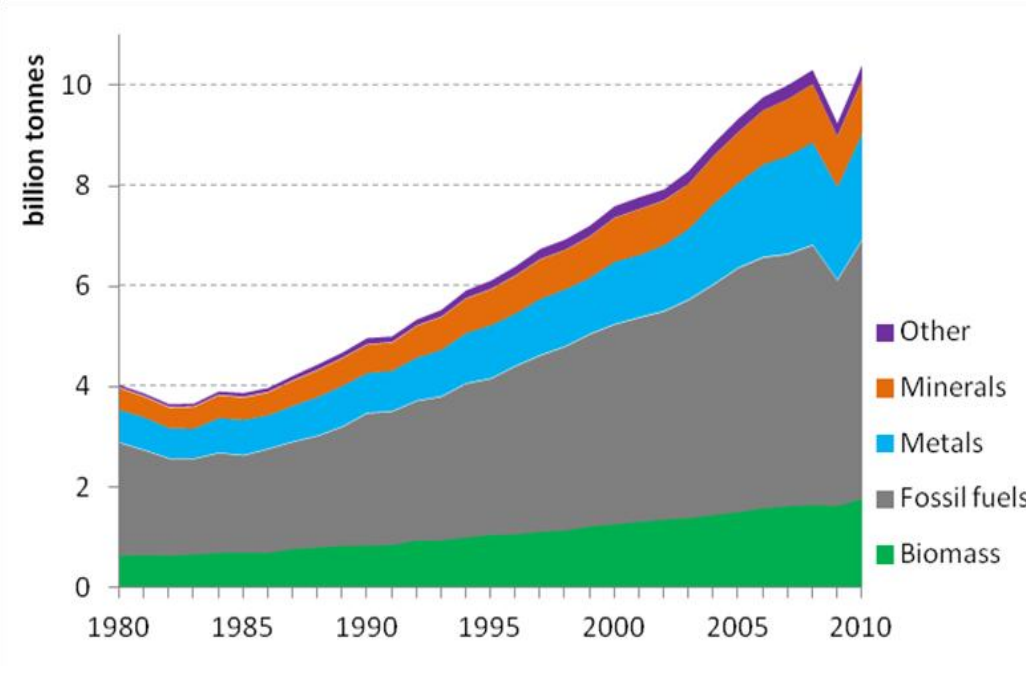
The role of international trade for distributional justice

- Perspective 1: international trade allows developing and emerging countries to generate income and thus helps to reduce global inequality

- Perspective 2: international trade allows high income industrial countries to consume a high share of the world‘s natural resources at a relatively low price while reducing the environmental burden in their own territory *(material footprint perspective)*

changing composition of traded commodities

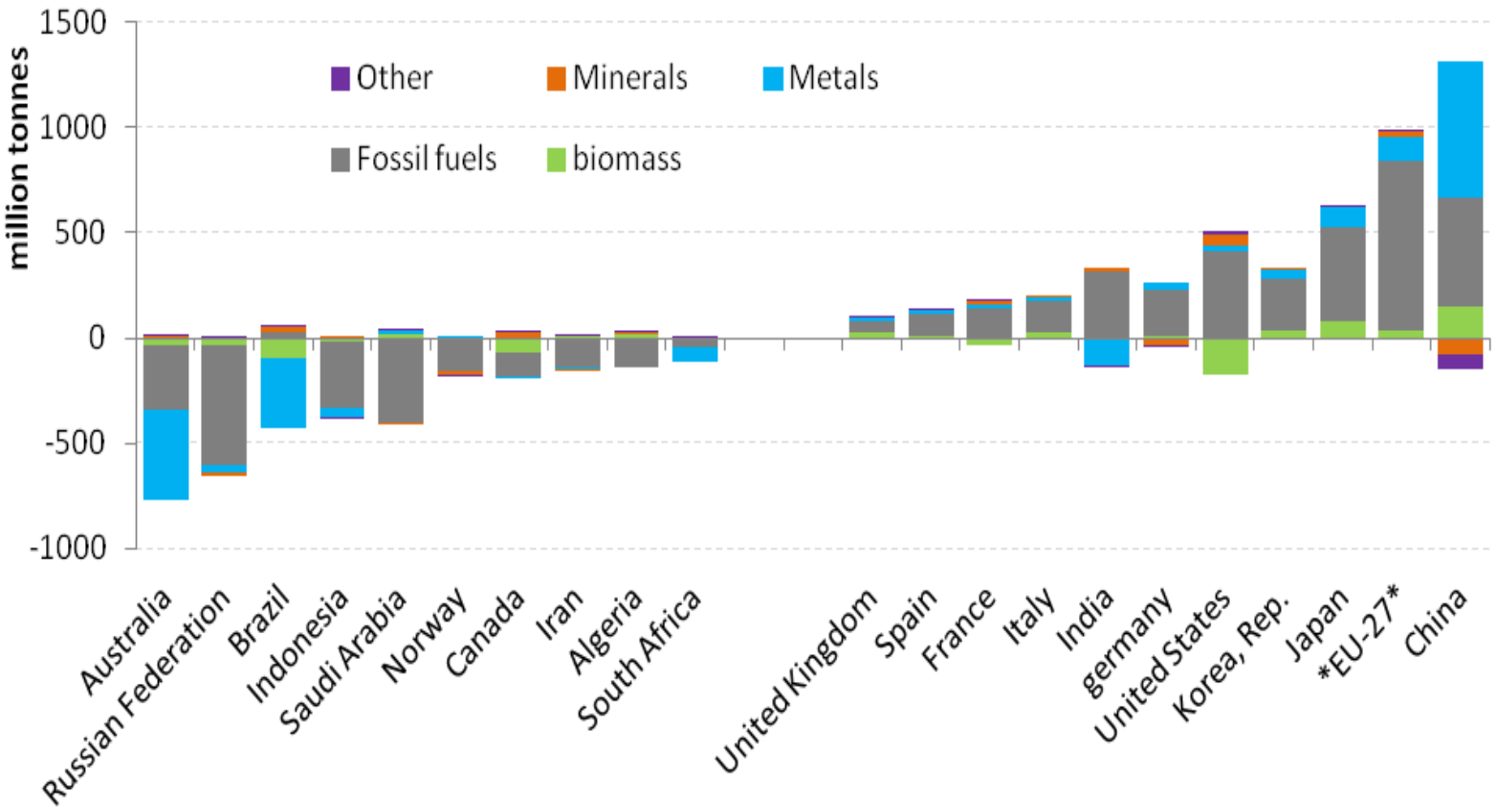
- **fossil fuels are the biggest fraction** in material trade; fossil fuels are fuelling global transport and trade.
- **Trade with metals shows the highest dynamics**, materials of key relevance for industrialization. Critical metals and global scarcity became an important issue in recent years.
- **Biomass** trade is increasing but decreasing in its relative importance among the other material categories.
- **Non-metallic minerals** are of minor importance in trade; they are abundant resources, bulk materials of heavy weight and little economic value. Long-distance transport of these materials is economically not viable.



Source: Dittrich, 2012; amount of trade measured as (imports + exports)/2

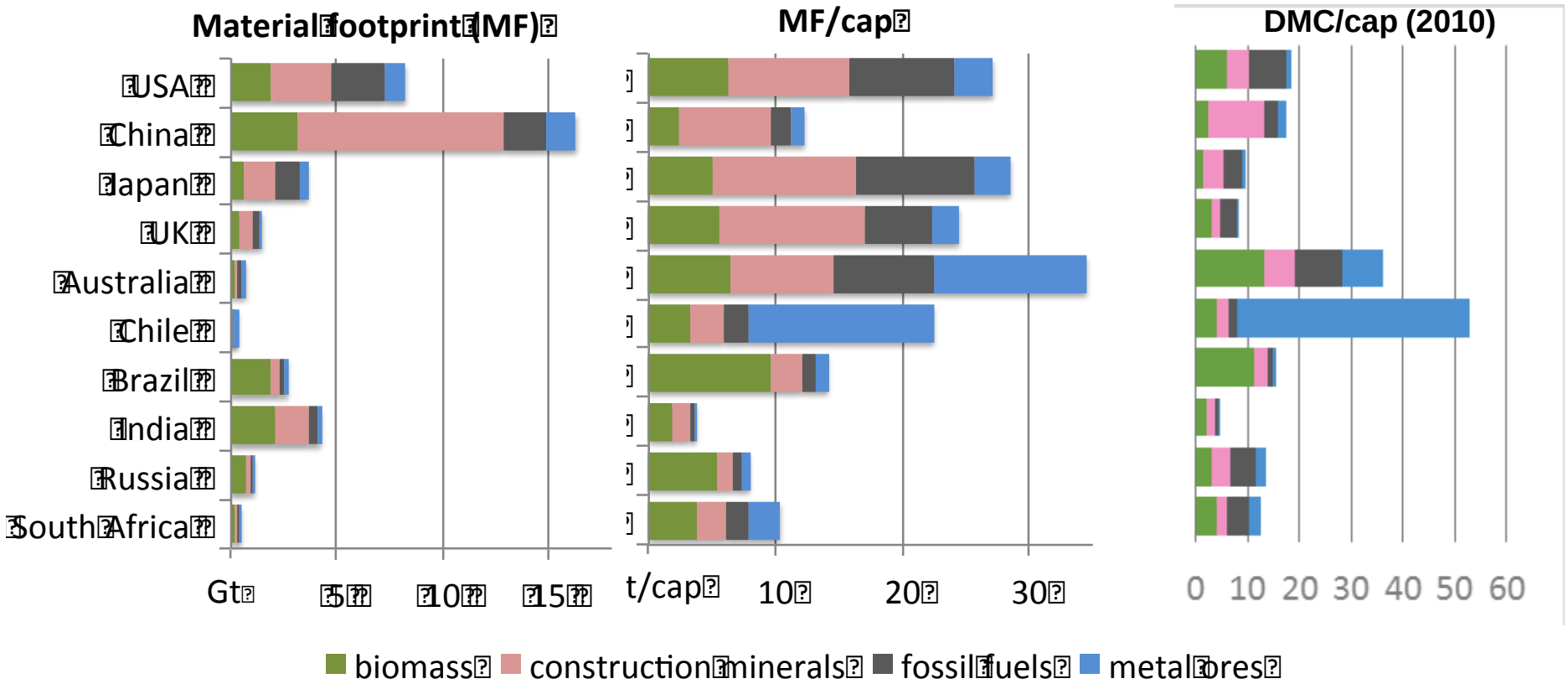
What, if fossil fuel demand decreases as requested by climate change policy?

Largest net exporters and importers by material composition of net trade in 2010.



Source: Dittrich, 2012

Material footprint (2008) and DMC (2010) (=domestic resource extraction + RME$_{im}$ – RME$_{ex}$)



Sources: MF: Wiedmann et al 2013
DMC: Schaffartzik et al. 2013

Qu 4: What types of indicators are most suitable to measure progress? How can indicators assist and reward policies that lead in the right direction?

- The „right direction“ on the global level: reducing the human pressure on the resource base of the Earth: resource use „degrowth“
  - Global resource extraction can shrink with population decline
  - Global resource extraction can shrink with declining metabolic rates (extraction / capita)
- This is no easy policy program on national levels:
  - it may directly confront ideas of prosperity and development,
  - it has no clear targets to offer (how much to save for the children? How much for the grandchildren?...)

National policies can legitimately pursue the following with regard to resources:

1. They can plan on action to avert serious threats or avoid unnecessary risks („resource security“, „energy security“, avoid climatic challenges for their country, avoid penalty payments to superordinate bodies)
2. They like to pursue programs that promise „more for less“.
   - More income
   - More services
   - More wellbeing (jobs, security, health, fairness,…)
   - More intact environment (nationally; globally?)
   - Less resource use
   - Less risks, less dependencies
3. They will be more happy with indicators that show them as successful

Two examples of targettable (and currently popular) indicators

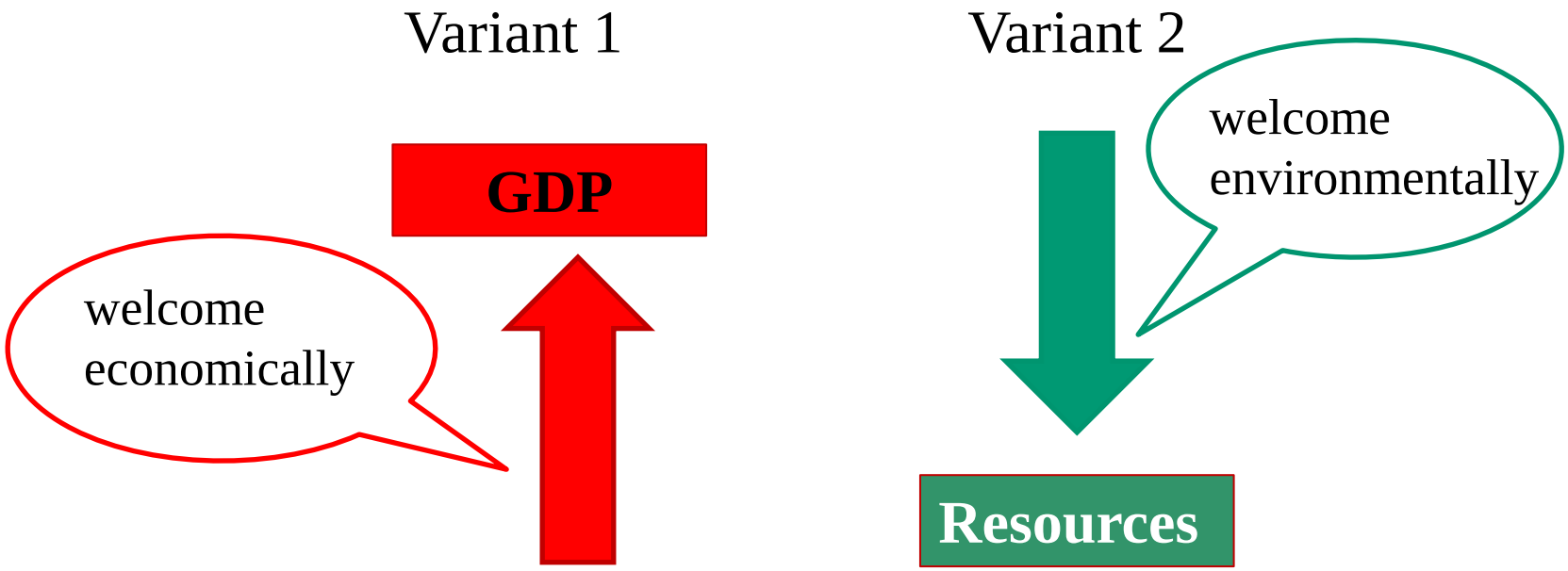
1. Increasing „resource productivity“
2. Increasing the „circularity of the economy“

1. More income with less resources: raising resource productivity

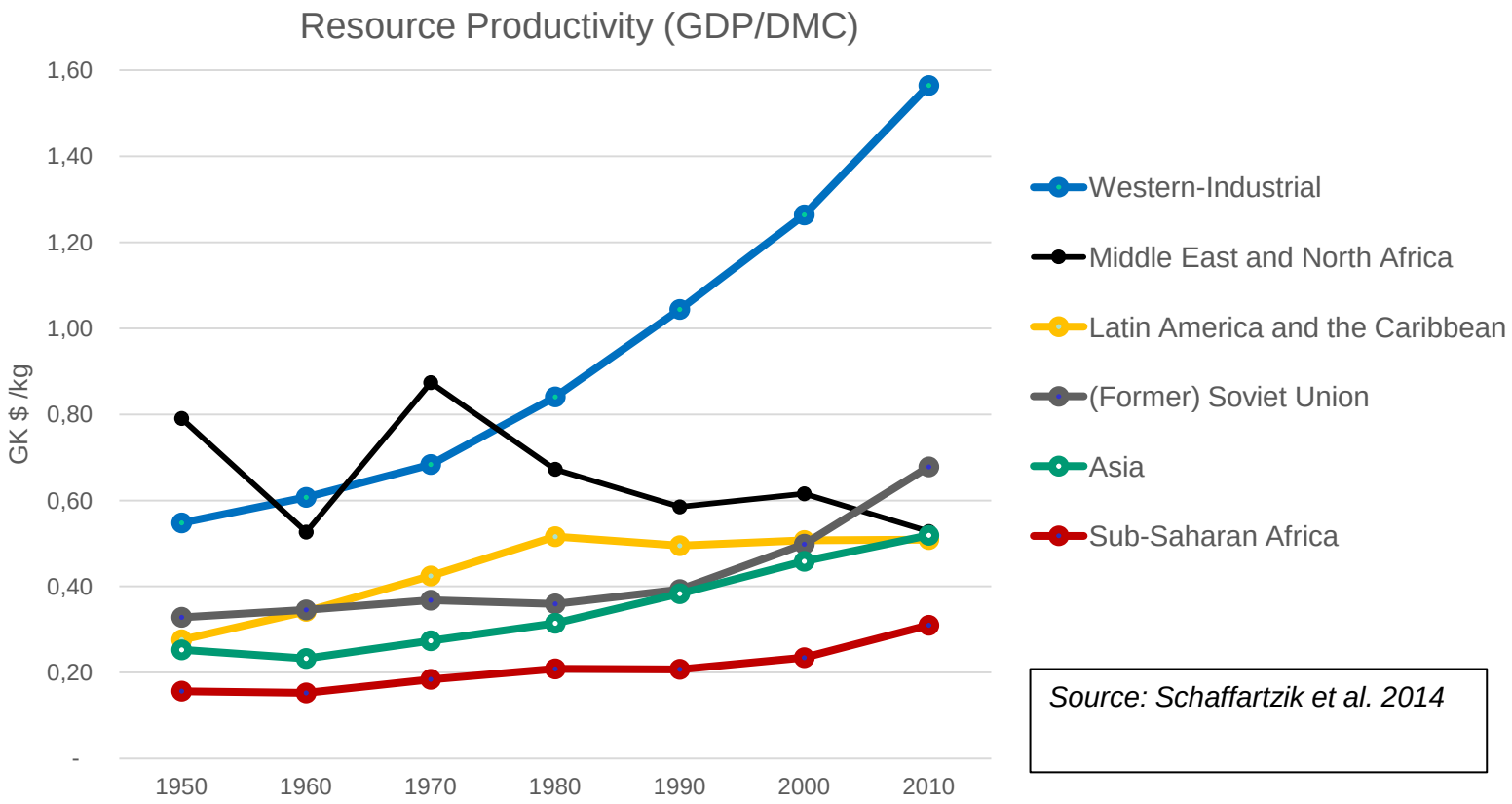
Definitions of resource productivity:

- GDP / DMC
- GDP / RMC
- GDP / DMI
- GDP / MF

Mechanisms that raise resource productivity

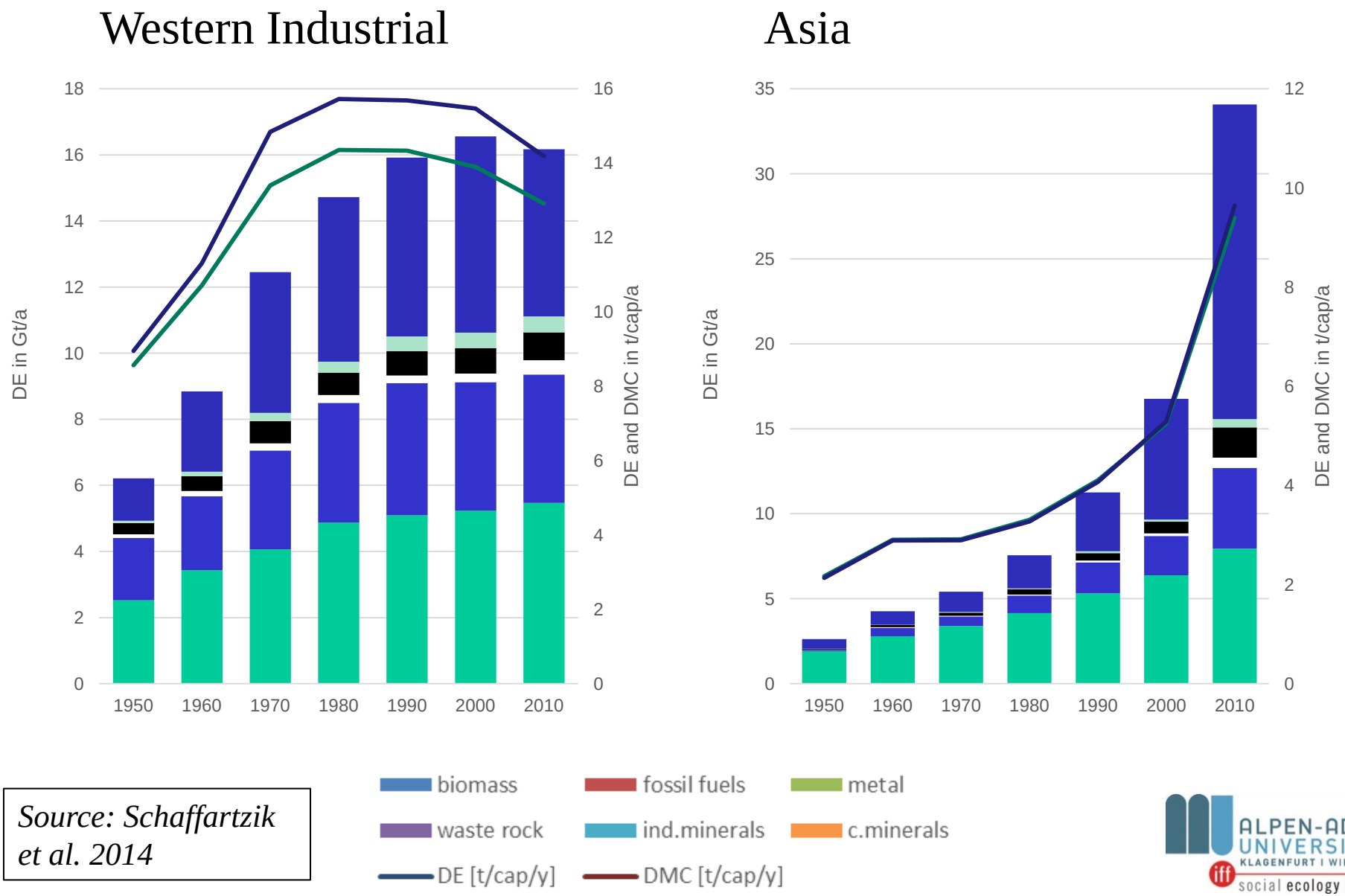


Changes in Resource productivity by world regions 1950 - 2010



Source: Schaffartzik et al. 2014

Material flow profiles by world regions



Source: Schaffartzik et al. 2014

Conclusion: resource productivity targets, but…

Not just resource productivity, but also absolute values, and weight/capita need to be targetted: absolute reductions!

GDP/DMI, GDP/DMC

Production oriented

DE

DMI, DMC

DMI/c

DE/c, DE/area

DMC/c

GDP/RMC, GDP/MF

Consumption oriented

RMC

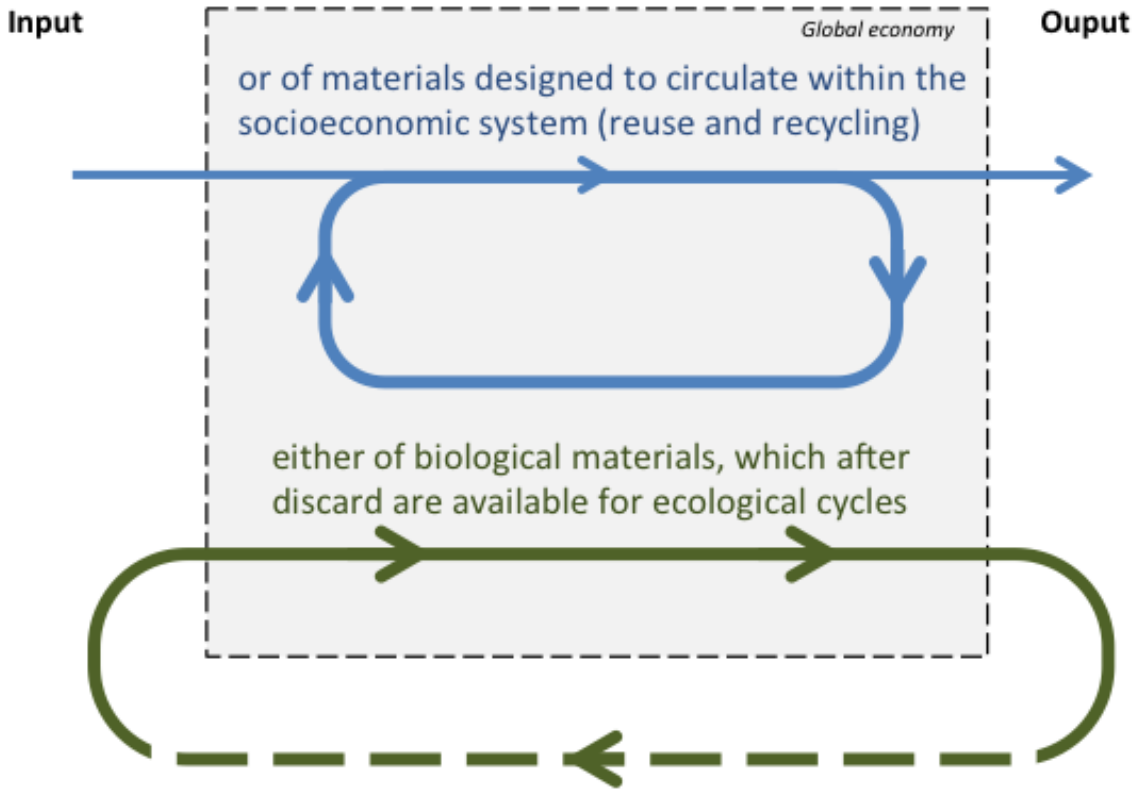
MF material footprint

MF/c

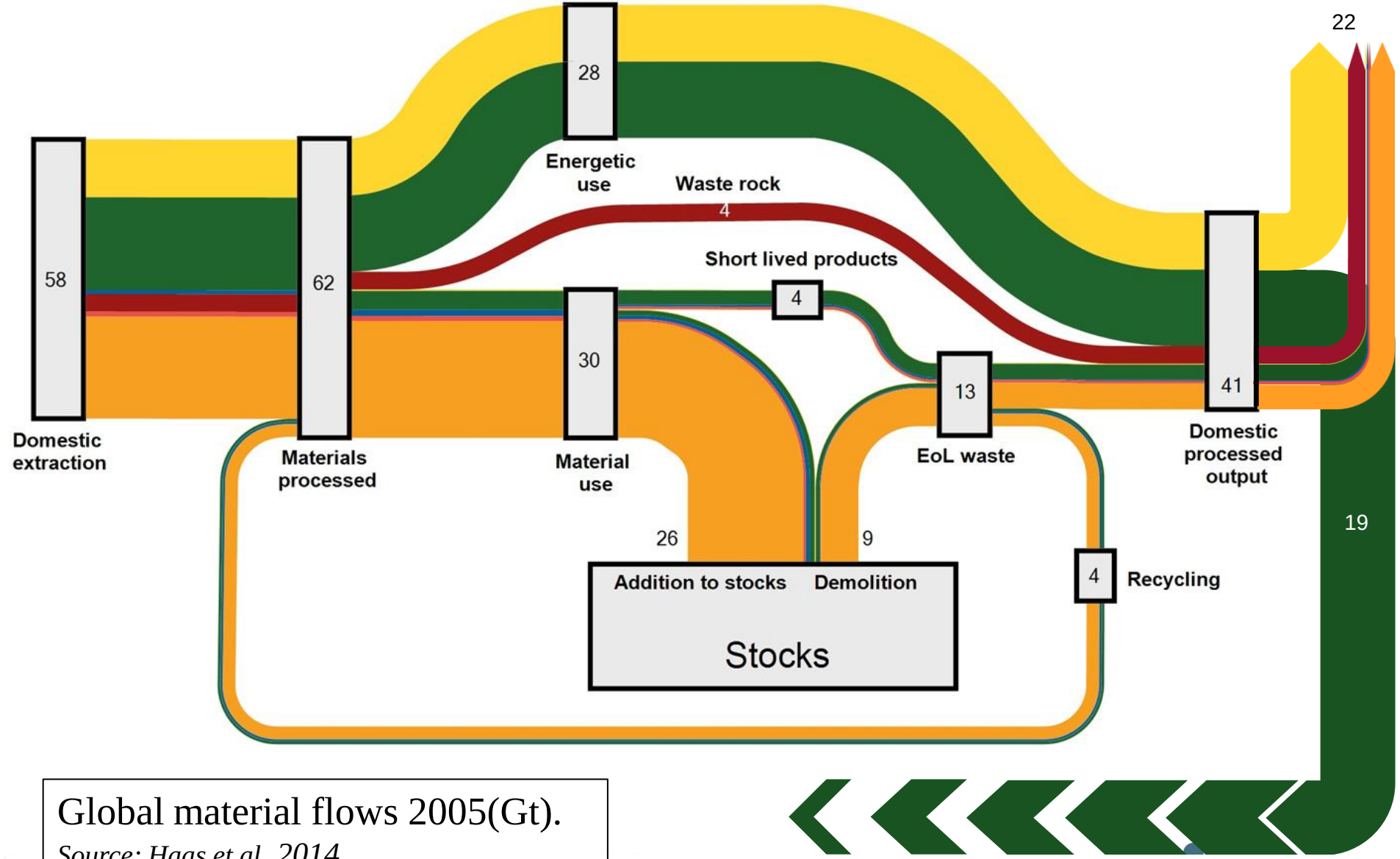
(MF from multiregional input-output models, includes upstream requirements of traded products)

2. Increasing the circularity of the economy

In a Circular Economy (CE) material flows are made up (GEO5 2012):



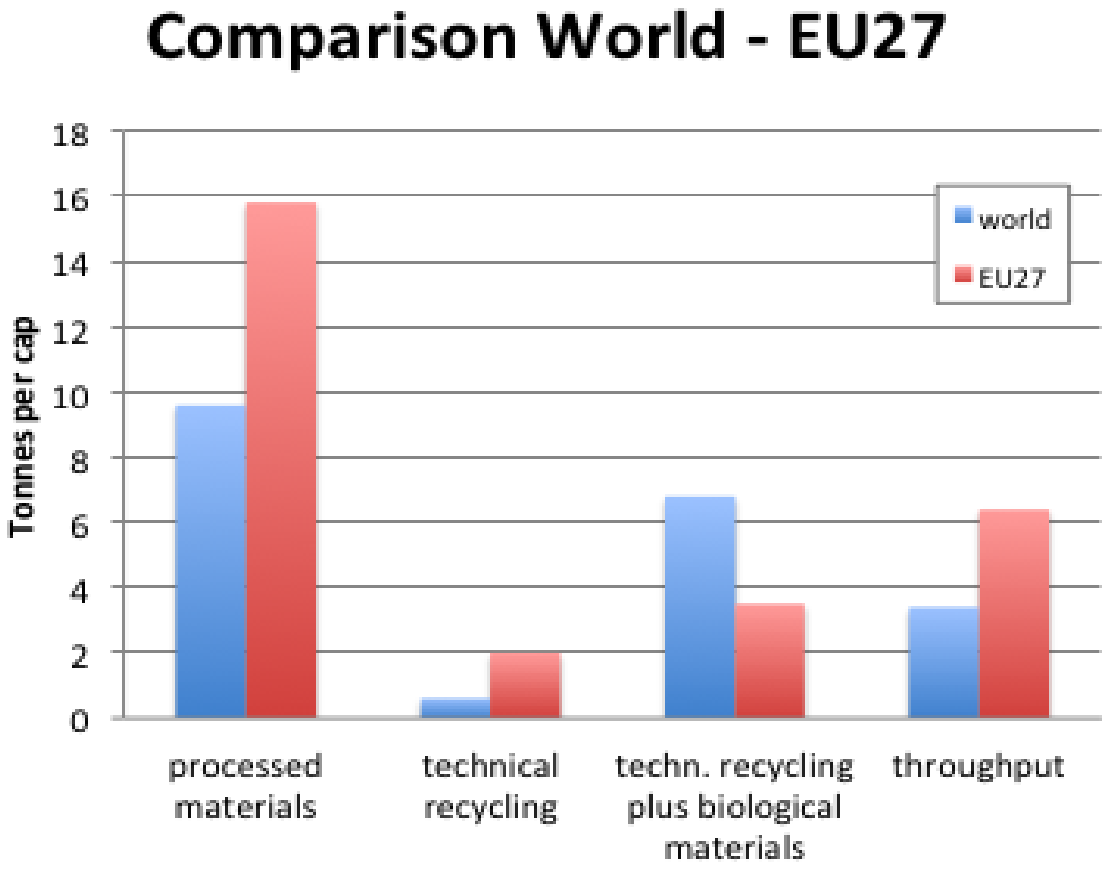
Circularity of Economy: Translation into MFA language



Global material flows 2005(Gt).

Source: Haas et al. 2014

Degree of circularity in 2005



EU27: More recycling, but more throughput, too.
Practically the same circularity (~ 38%)

Source: Haas et al 2014

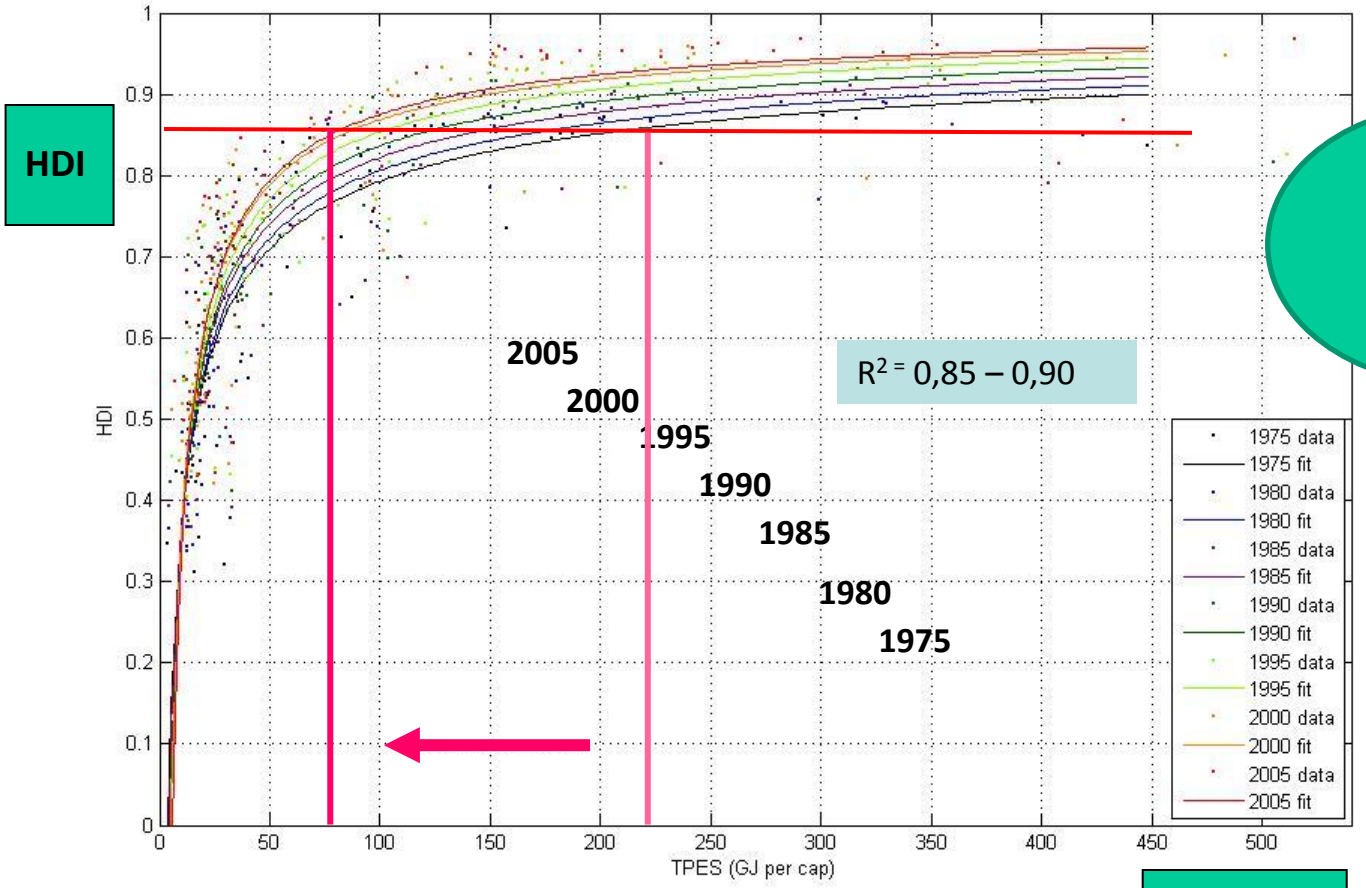
Conclusions concerning circularity

1. Recycling as one key strategy has the potential to increase circularity, but has severe limitations in the current state
2. Two structural barriers:
   - large fraction are energy flows especially fossil fuels
   - Large and growing fraction of the materials accumulates as in-use stocks

   these flows keep the degree of circularity low
3. Sustainably produced biomass which is recycled within the biosphere can be an important component of a Circular Economy
4. Still, even with high circularity the level of throughput needs to stay within planetary boundaries – present growth dynamics are counterproductive and remain a major challenge

From: W.Haas et al, 2014

Global modern energy use and human development 1975-2005 (by countries)



Yes, we can!

source: Steinberger & Roberts 2009