Resource Conference Vienna, 21 November 2016
"Prosperity without Growth of Natural Resource Use"

Decoupling of resource use and economic growth, and the role of international trade

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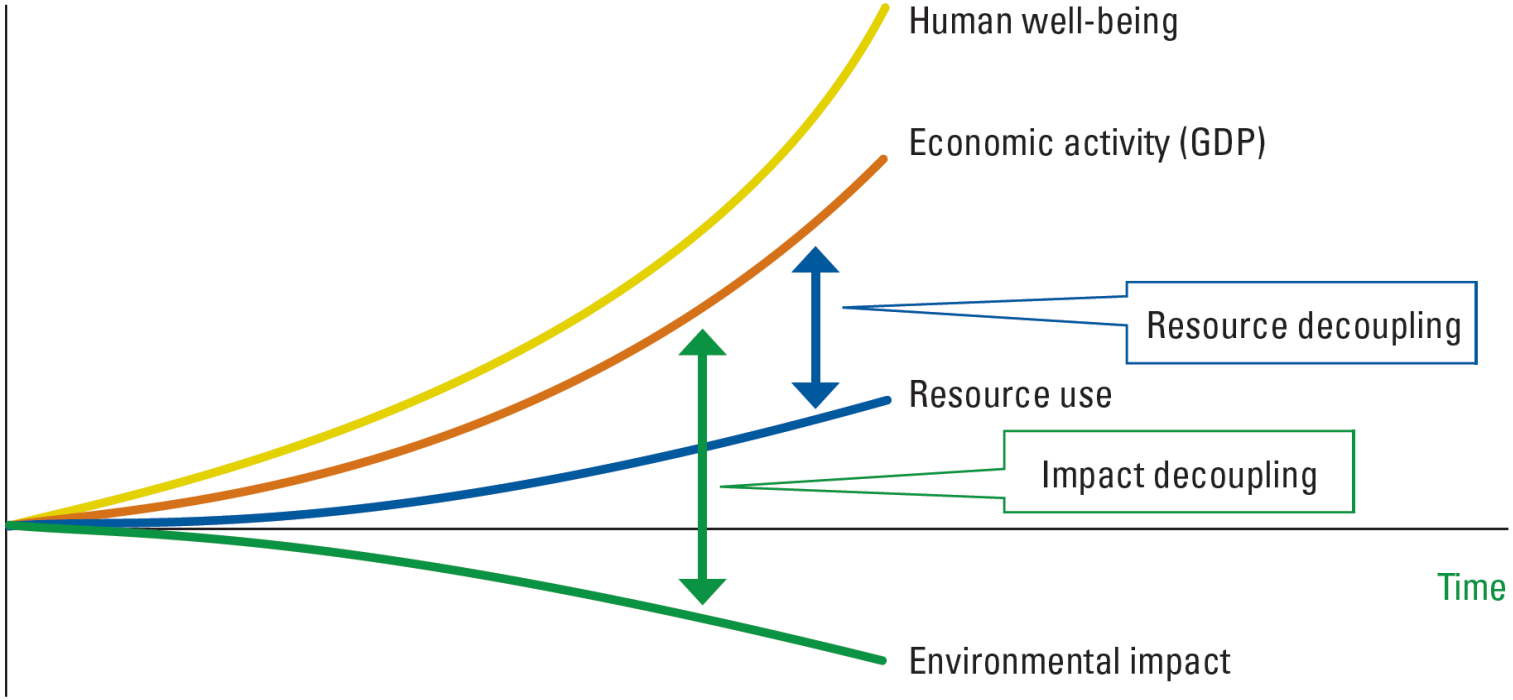
Introduction: A personal narrative on the course of the debate, early beginnings

- **1970s:** involvement in OECD program on social indicators and quality of life: failed without comprehensive outcome or impact. What I learned from this: You need a comprehensive theory, only few indicators, and a link to the economy.
- **1970s:** the environmental debate focused on pollution abatement (water, air, wastes), forest die-back... Also too many indicators, little causal connection with the economy, lack of a systemic perspective.
- **1980s:** I got the opportunity to start an interdisciplinary program on „society and environment“ (later: Social Ecology, at the IFF). Key ideas:
  - look at the economy‘s material and energy *inputs*
  - then the economy‘s material *outputs*, the wastes and emissions we try to avoid,
  - from a systemic perspective will follow.
  - Describe the metabolism of the national economy, respecting the materials balance (B.Ayres).
- **1990s:** Support from the Austrian Statistical Office (A.Franz) on environmental accounting, and the Ministry for Environment (M.Schuster). 1992 A.Steurer, Stoffstrombilanz Österreich – first material flow analysis of a national economy worldwide, based upon a comprehensive theory of socioeconomic metabolism.

Introduction, continued

- Meanwhile, the Brundtland Report 1987 brought forward the notion of sustainable development, and the issue of climate change gained international attention (IPCC first assessment report 1990). The systemic tension between the economy and the environment appeared to increase.
- In 1995, E.v.Weizsäcker published „Factor 4“, claiming that by technological change, given the right economic incentives, the industrial world could continue with economic growth while reducing environmental impact. This was the kickoff to the idea of DECOUPLING that should reconcile economic and environmental ambitions, reflected in the foundation of the International Resource Panel (IRP).
- When Ernst v.Weizsäcker invited me in 2006 to become one of the founding members of the IRP, I agreed. The IRP focussed on *resource inputs,* and I felt I brought with me the right methodology: material flow analysis.

The IRP‘s optimistic vision of decoupling



Source: UNEP-IRP, Decoupling Natural Resource Use and Environmental Impacts from Economic Growth (Authors: M.Fischer-Kowalski & M.Swilling) 2011, p.5

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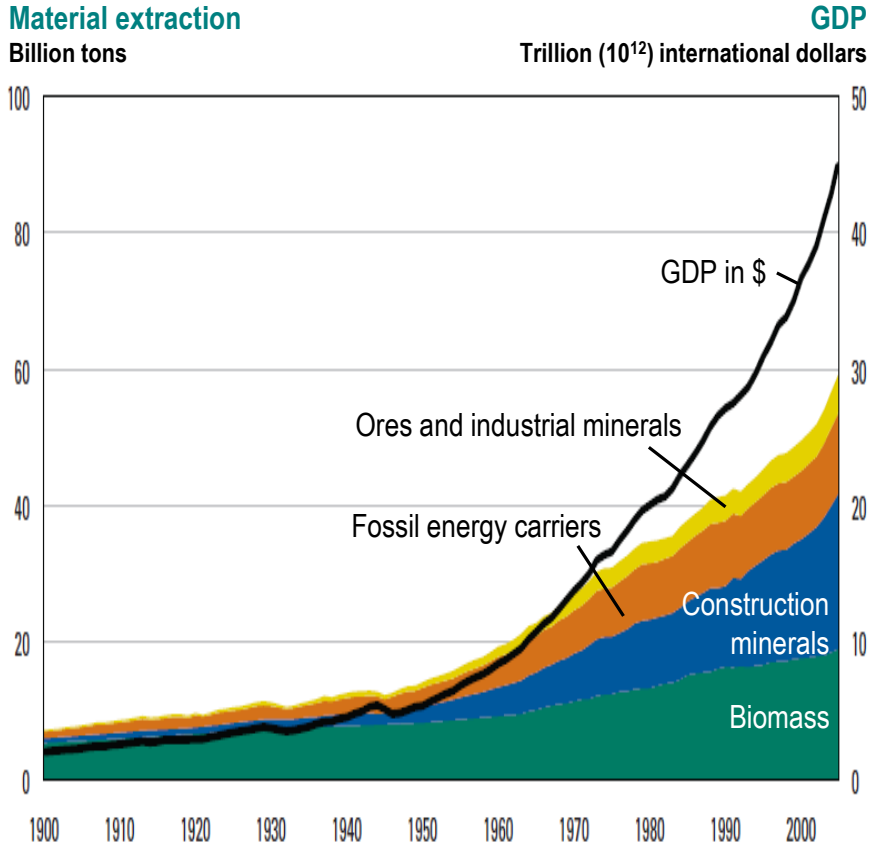
Decoupling? Decoupling!

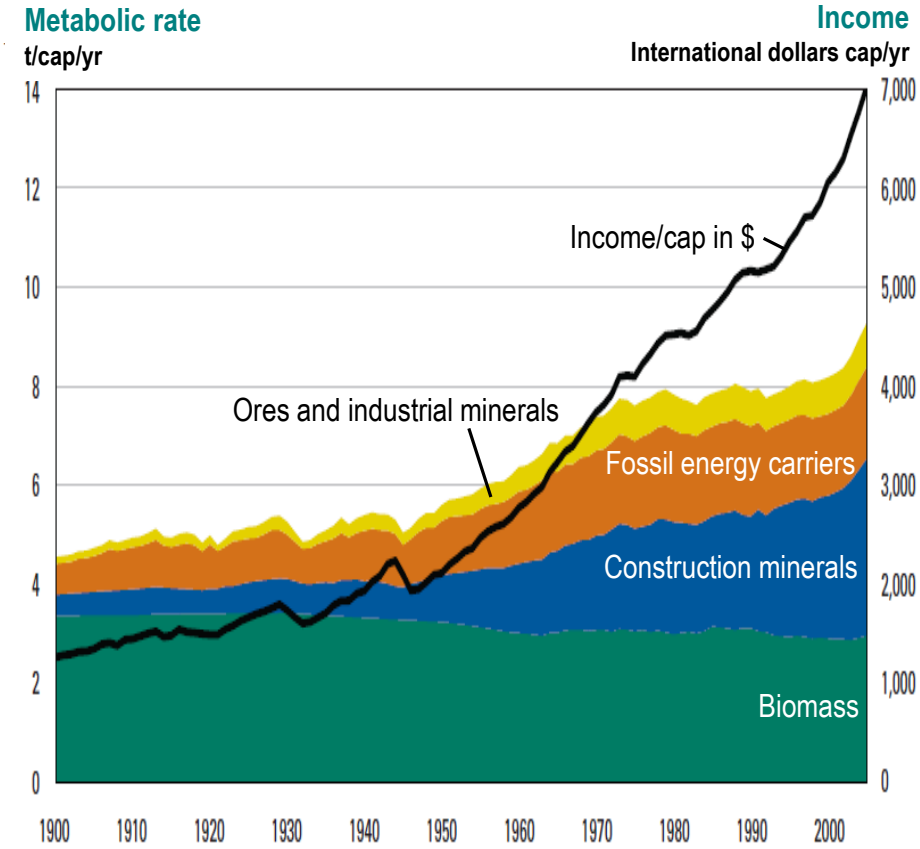
- When we look at the globe in the 20th and the early 21st century, we find the annual extraction of material resources to have expanded 10-fold, from about 7 billion tons annually (1900) to about 68 billion tons (2010).
- During the same period, the global economy, at constant prices, expanded 26-fold. Thus, it grew about three times as fast as the extraction and use of natural resources. A clear case of (relative) decoupling.
- In the same period, the human population grew about fourfold, from 1.6 billion tons to 6.9 billion tons.
- This means that the average resource use per person more than doubled, while income per person increased almost sixfold.
- This is part of, and facilitated by, a longer process, namely humans‘ logarithmic increase of the use of fossil fuels, allowing them to transit from an agrarian to an industrial sociometabolic regime

During the 20th century:
7 fold increase of global extraction of resources, but 23 fold increase in GDP

Global material extraction
1900-2005

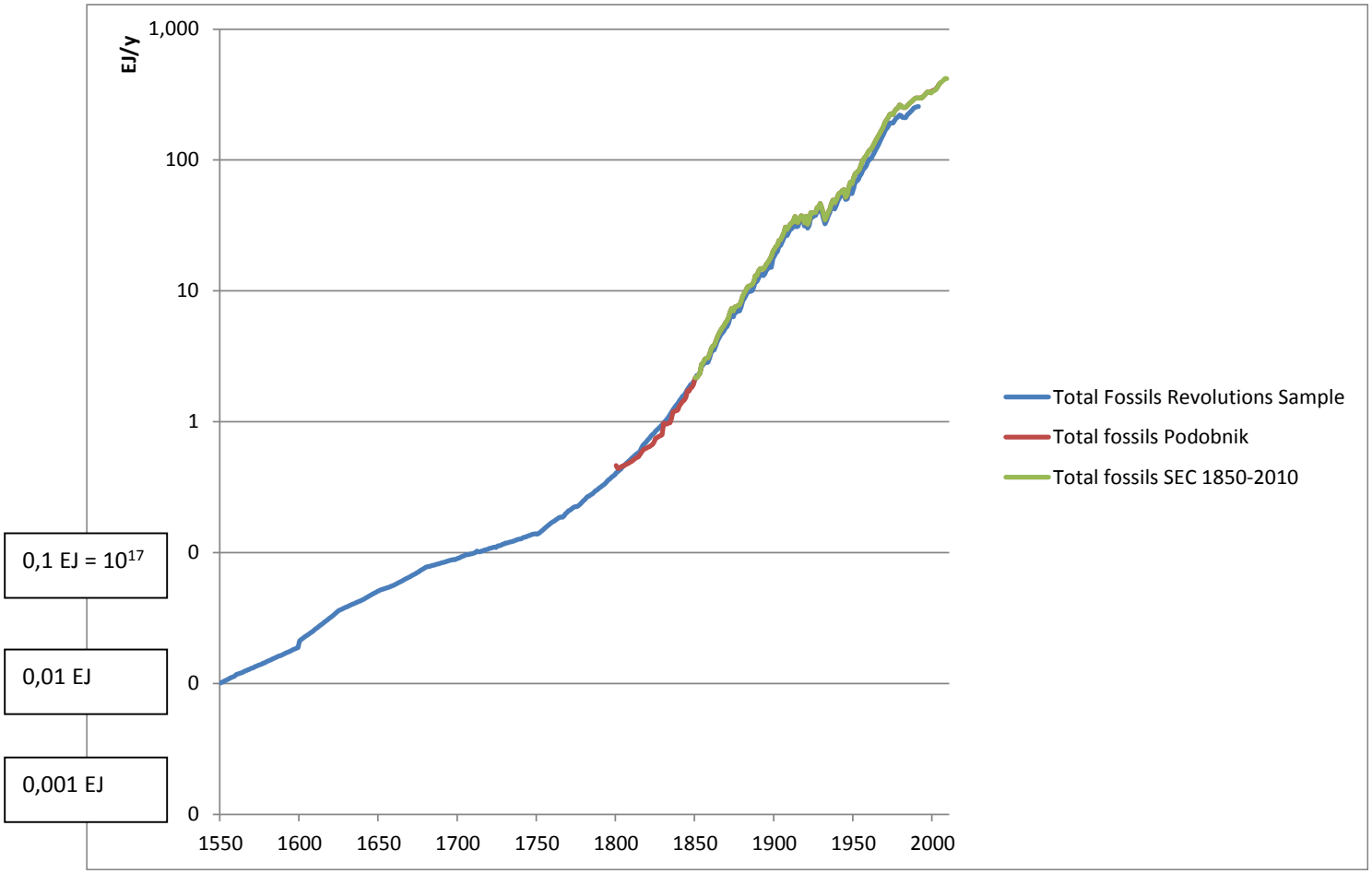


Global metabolic rates
1900-2005



Source: UNEP-IRP, Decoupling Natural Resource Use and Environmental Impacts from Economic Growth (Authors: M.Fischer-Kowalski & M.Swilling) 2011, p.11

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



Source: Krausmann et al., SEC database 2013

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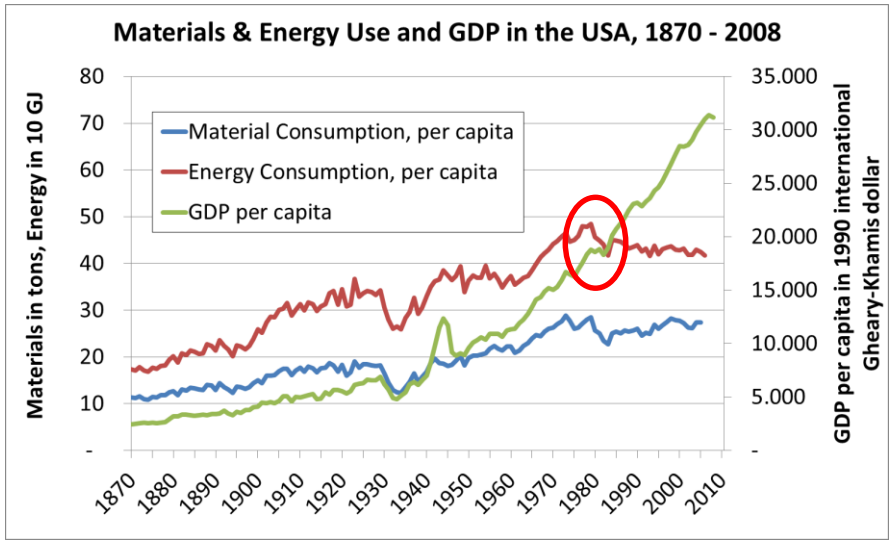
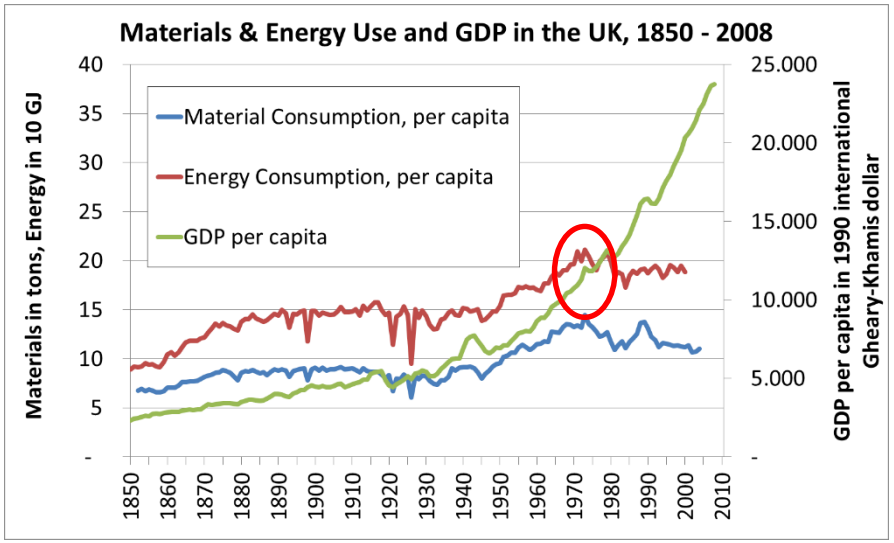
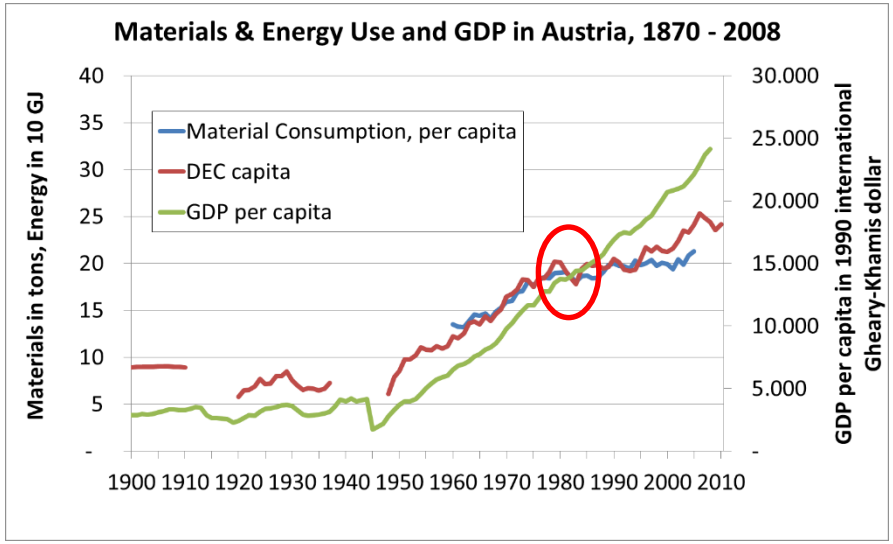
An interesting observation

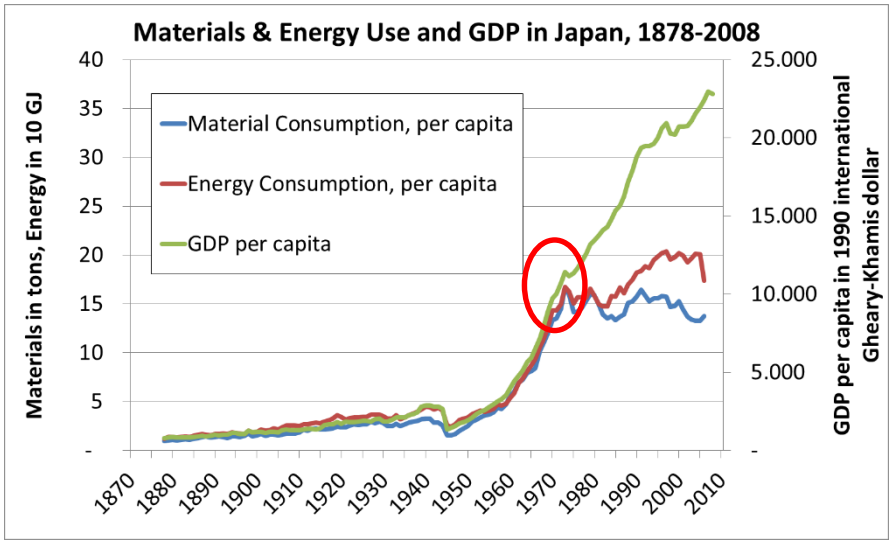
- The major take-off, both of resource use and income, happened after the second World War, globally and in Western industrial countries in particular („great accelleration“).
- From about 1970 on, global resource extraction/use per capita is stagnating, while income keeps rising. Thus, there is stronger decoupling.
- From about 2000 on, resource use per capita resumes its strong incline. What happened?
- We find countervailing tendencies: while resource use in Western industrial countries is stagnating or starts declining (decoupling from GDP), resource use in Asia rises strongly, shows the opposite of decoupling, with per capita resource use reaching almost European levels by 2010.

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









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

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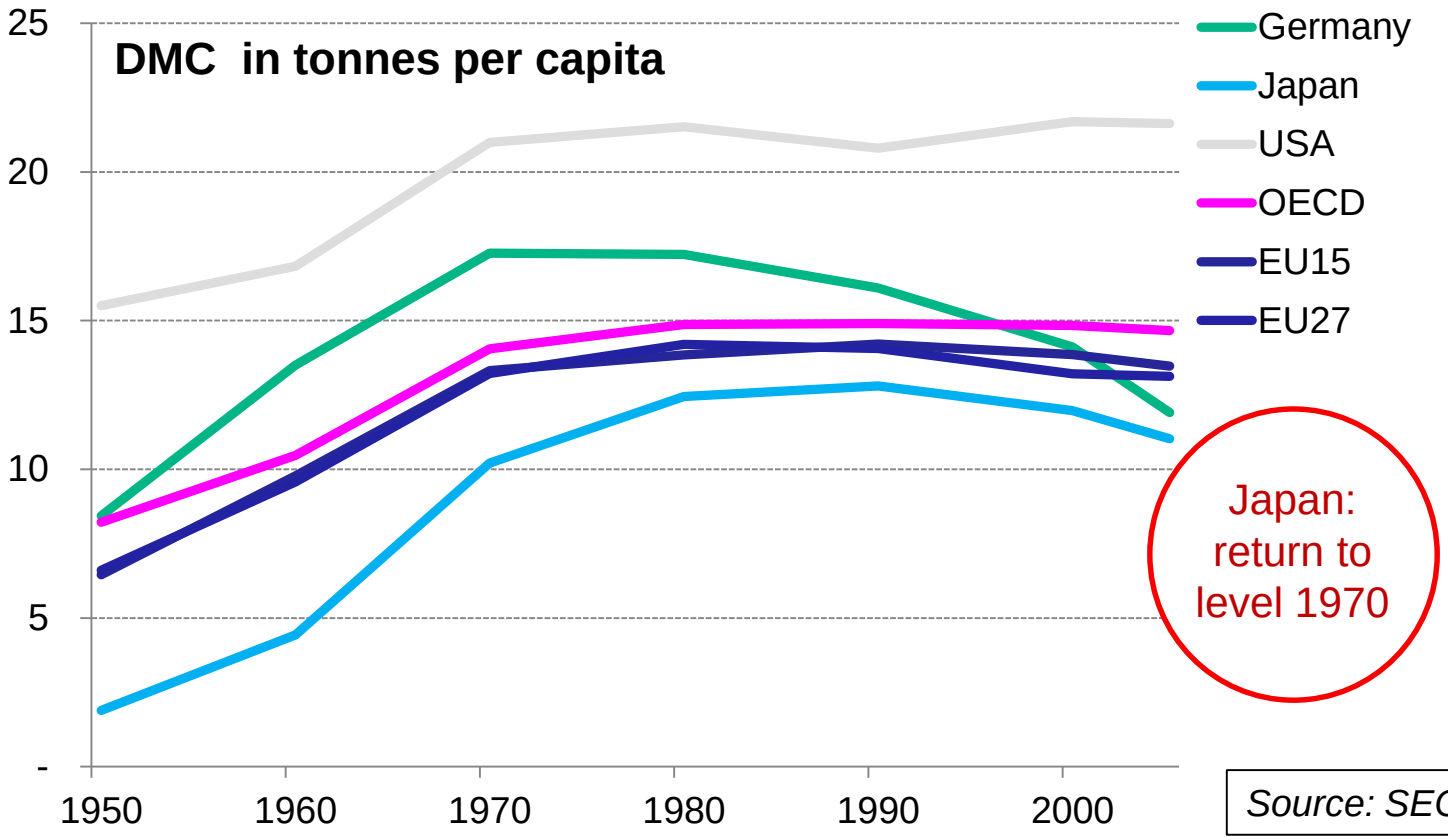
Since the 1970s: stagnation or decline of resource use in high income countries



Source: SEC database

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

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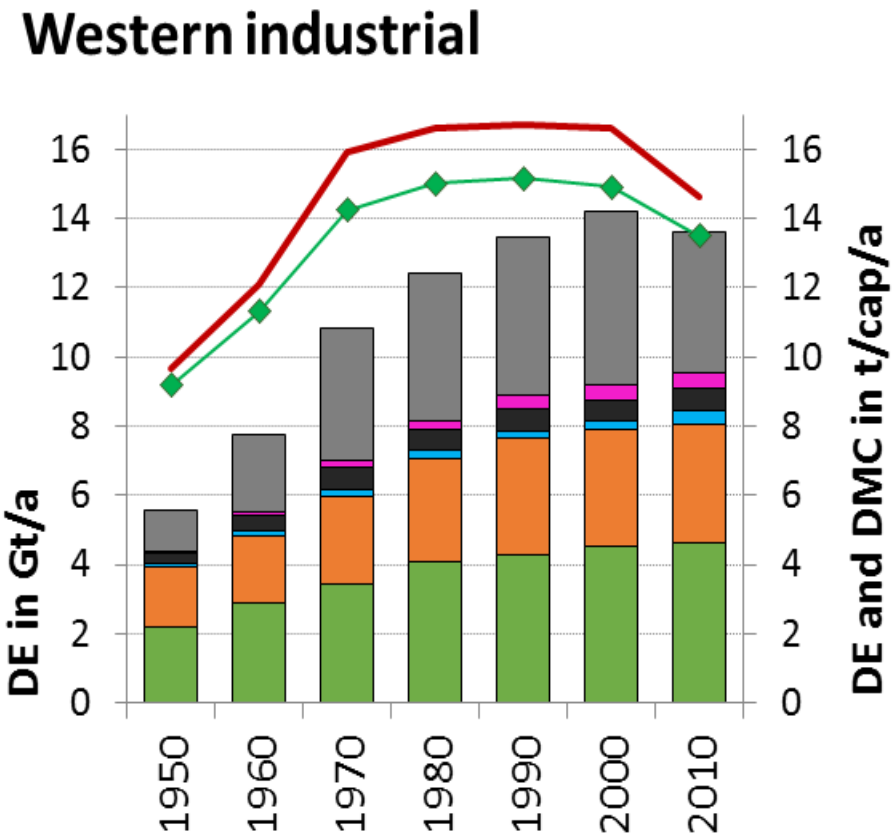
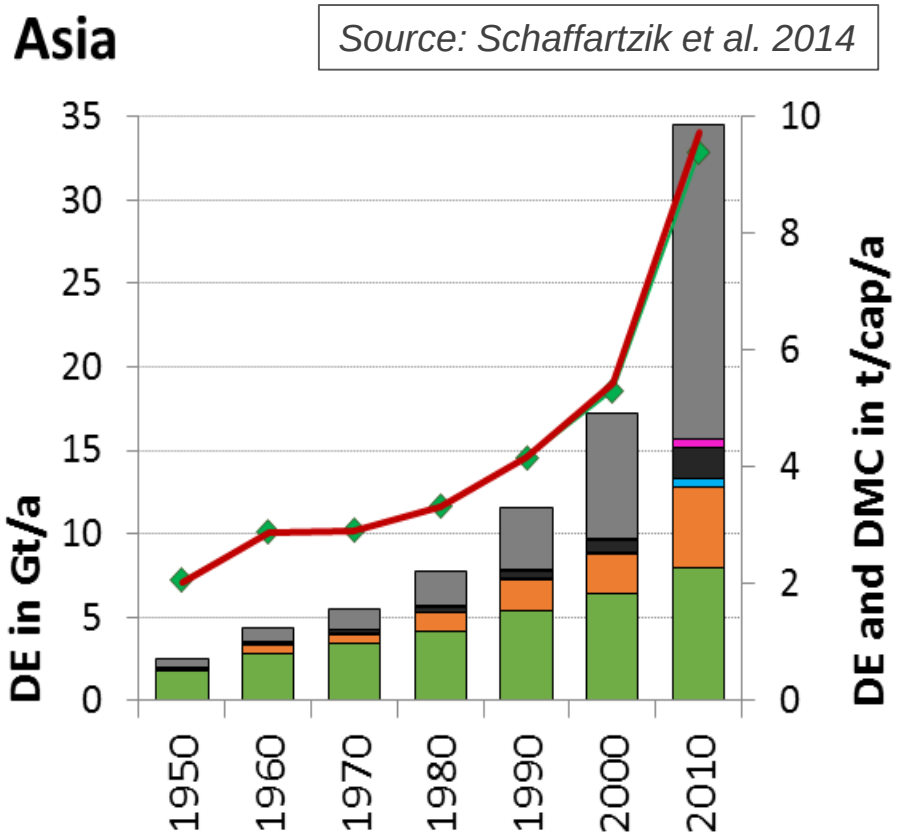
Material flow profiles by world regions





Source: Schaffartzik et al. 2014

biomass
fossil fuels
metal
waste rock
ind.minerals
c.minerals
DE [t/cap/a]
DMC [t/cap/a]

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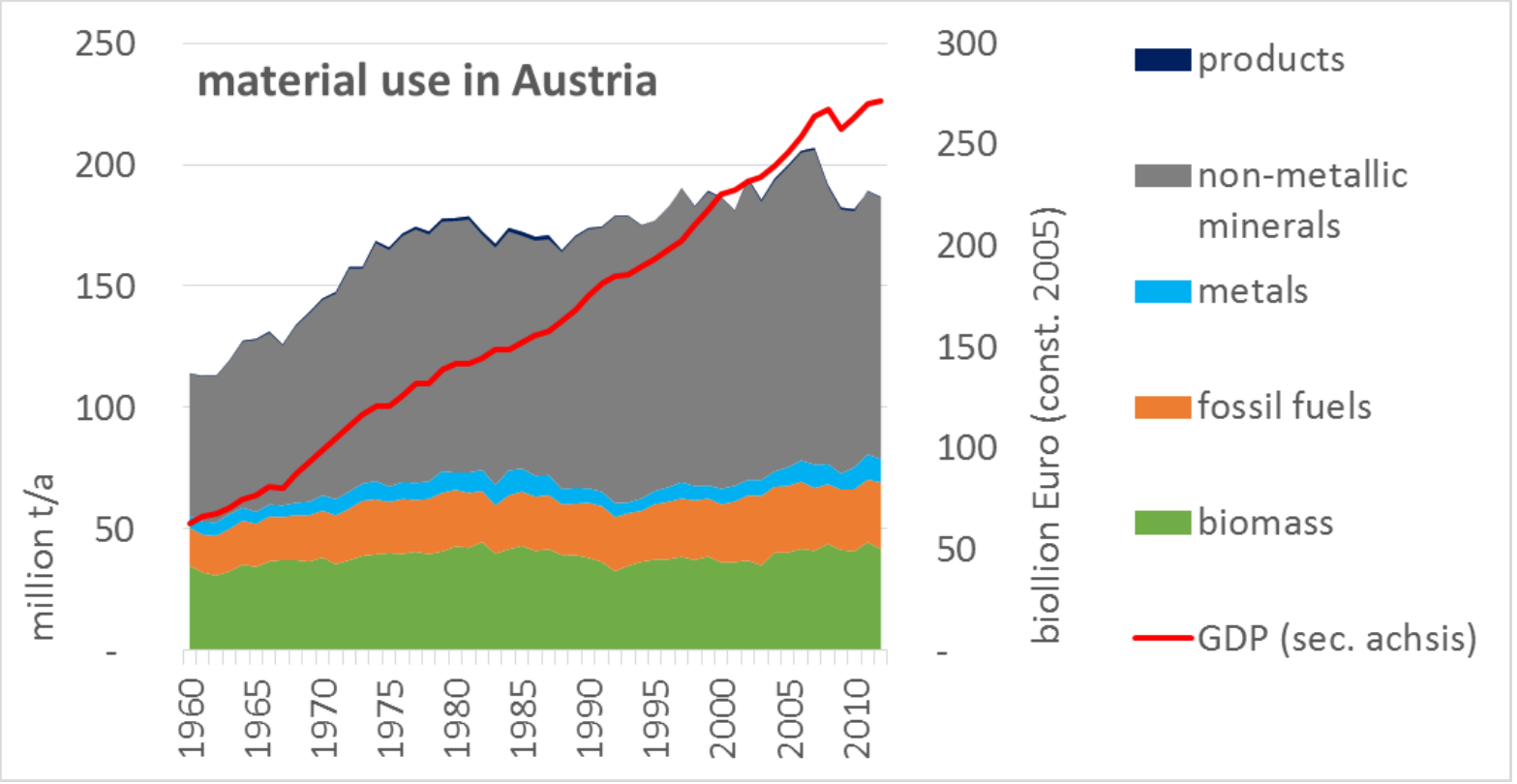
Resource use dynamics and decoupling in Austria

For Austria, a country with resource use above the European average, the „1970s syndrome“ does not show as strongly as for other Western countries: there is a certain continuous decoupling, but an absolute decline of resource use occurs only in the very last years.



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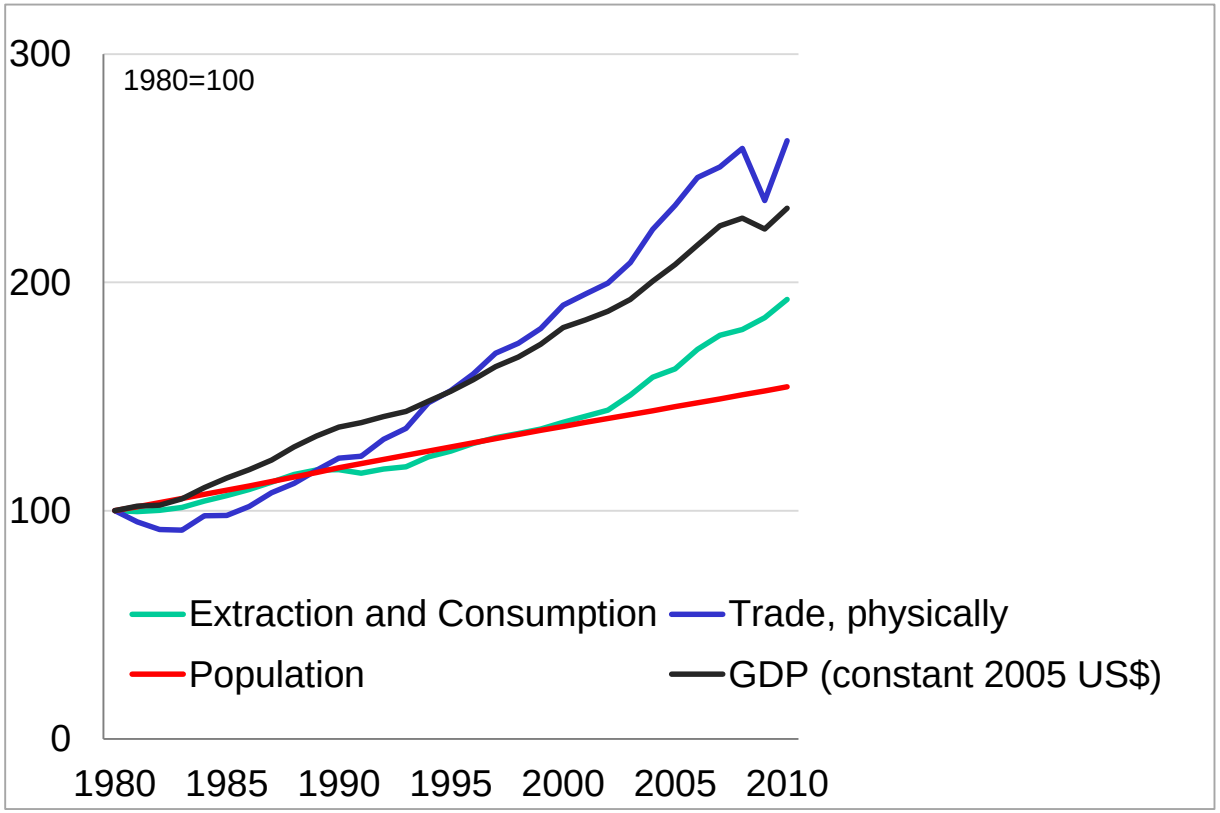
Resource use of national economies and trade

- The increasing momentum of global rise in resource use after 2000 is largely a function of „catching up“ of the global South, in particular China, facilitated by trade liberalization.
- Global trade in the past decades has been growing faster than world GDP. A strong driver have been the high consumption levels in Western industrial countries sustained by commodities delivered by the rest of the world.
- Nevertheless, the world of trade is changing: Not only is Asia also a net receiver of traded goods, also the bilateral trade of low income countries is on the rise.

Dynamics of international trade 1980-2010



In the past decades, the physical volume of world trade has increased faster than the human population, the volume of resources extracted globally and than World GDP

Source: UNEP-IRP, International Trade in Resources (Authors:M.Fischer-Kowalski, M.Dittrich, N.Eisenmenger, et al.) 2012

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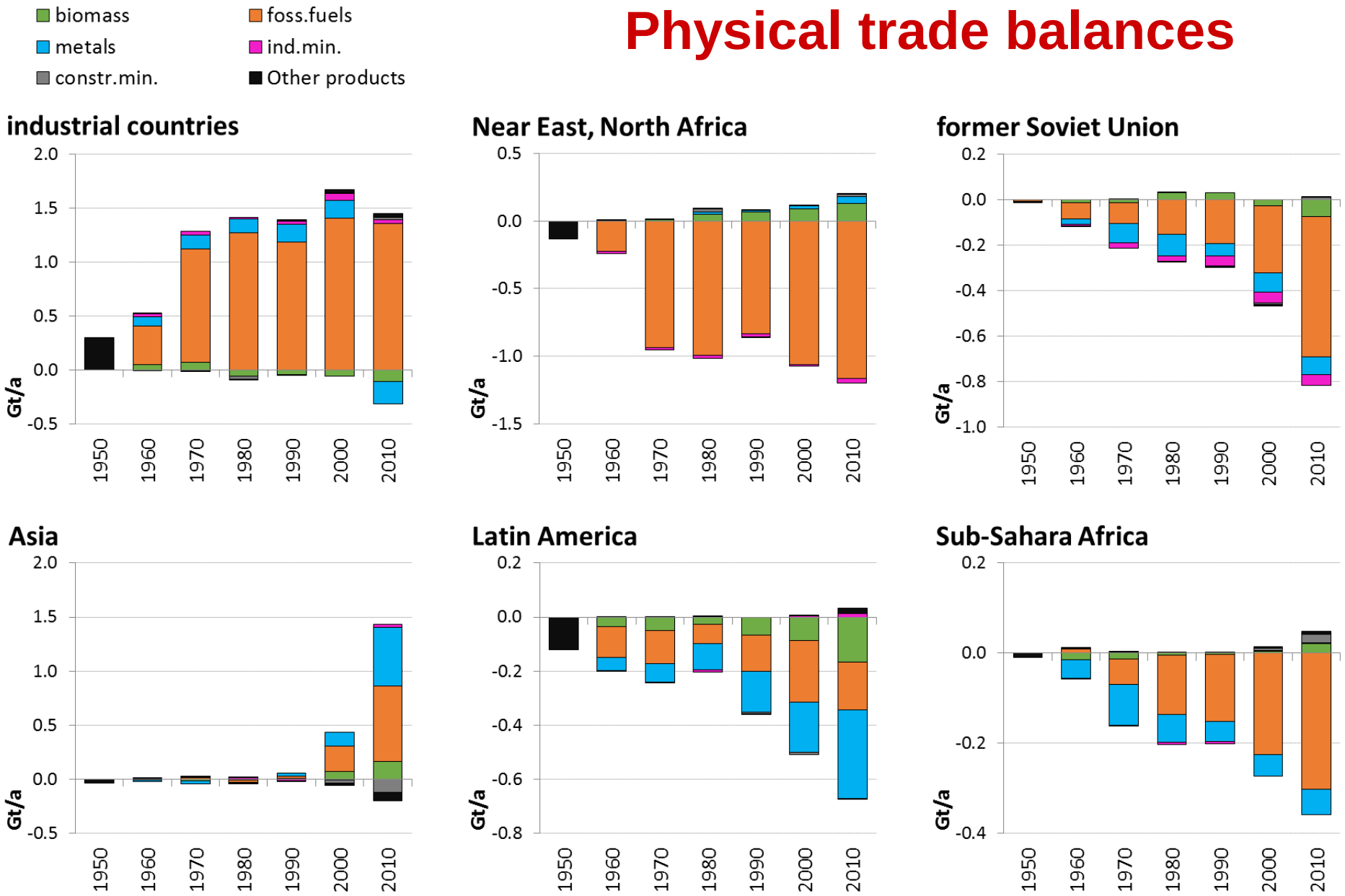
Source: Schaffartzik et al. 2014

Physical trade balances

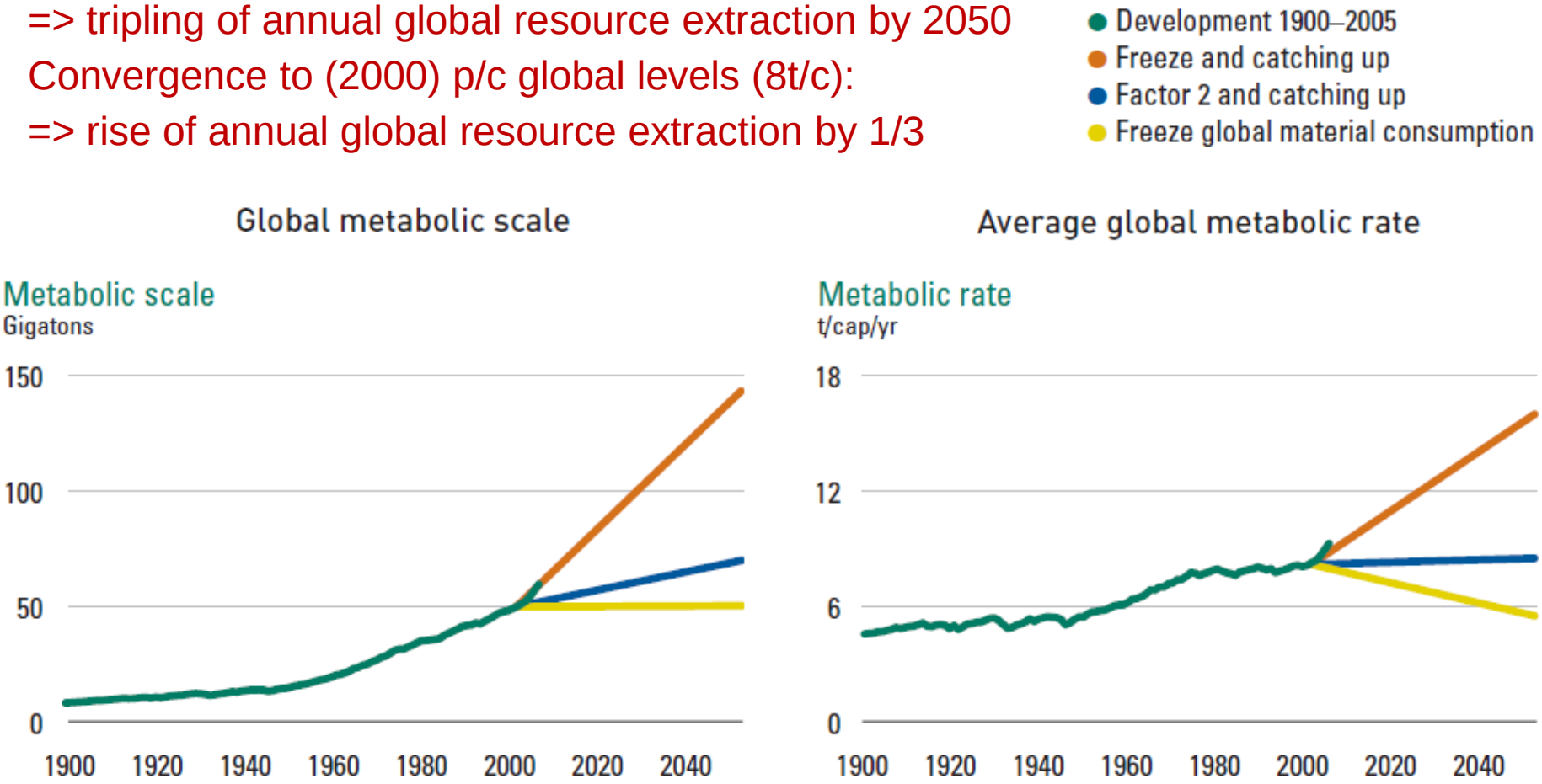


How sustainable is this development?

1. With reference to the World‘s resource base: global material resource use, at current trends, will collide with global supply, and require ever more energy colliding with climate protection requirements (+biodiversity decline...).
2. With reference to international equality: Some parts of the world make their transition to better lives, better incomes. Three billion people live in countries that grow their population, but barely improve their living standard.
3. With reference to employment in Europe: pressure on increasing labor productivity (not resource productivity), and importing (cheaper) labor services instead. Workers‘ incomes stagnate, while corporate incomes soar.
4. This is not a sustainable pathway, and not a pathway that people like.

Projection of future global resource extraction

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-IRP, Decoupling Natural Resource Use and Environmental Impacts from Economic Growth (Authors: M.Fischer-Kowalski & M.Swilling) 2011, p.30

Exhaustion of the mineral resource base?

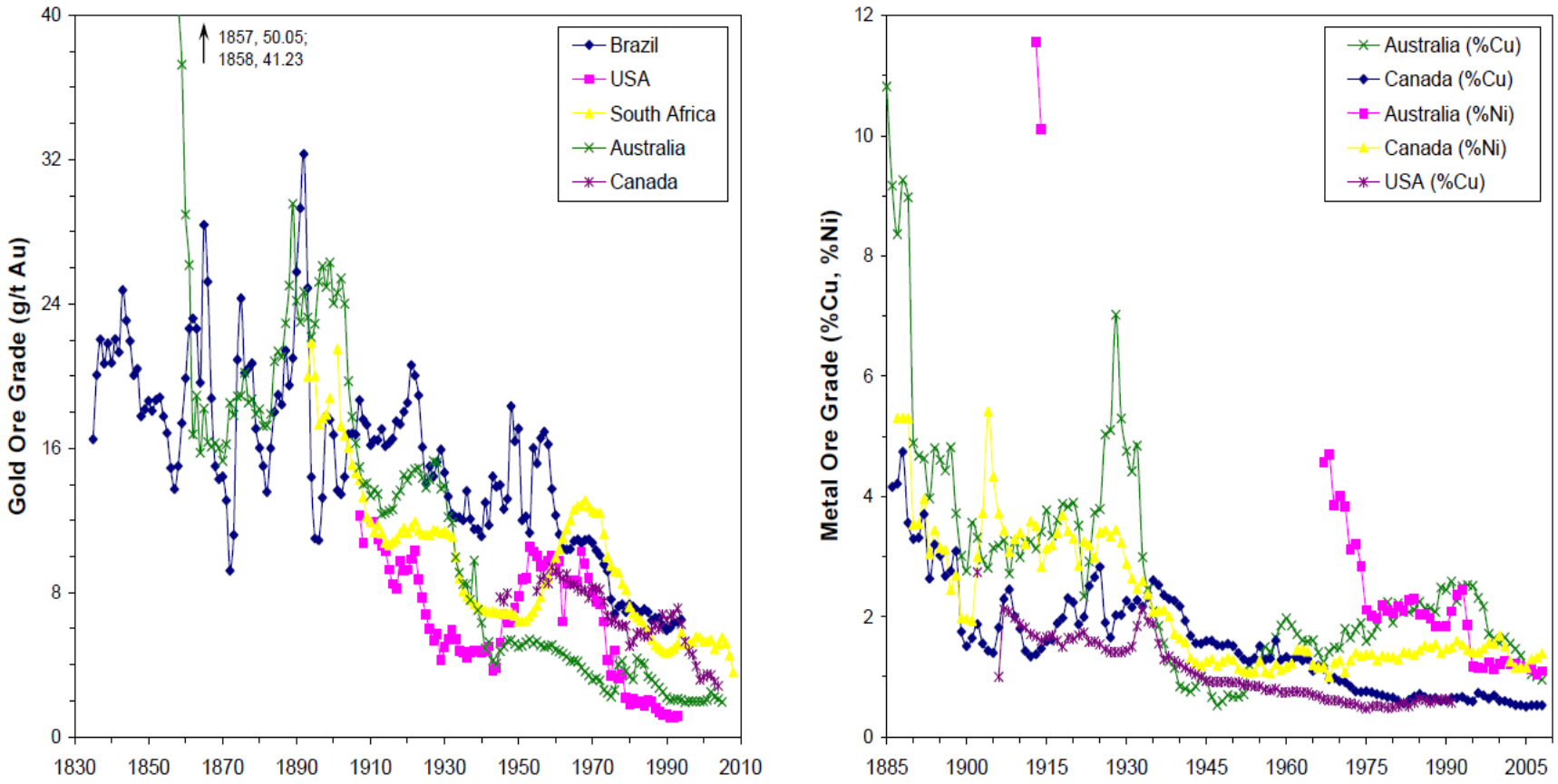


Figure A2.1: Declining ore grades in the major producing countries

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

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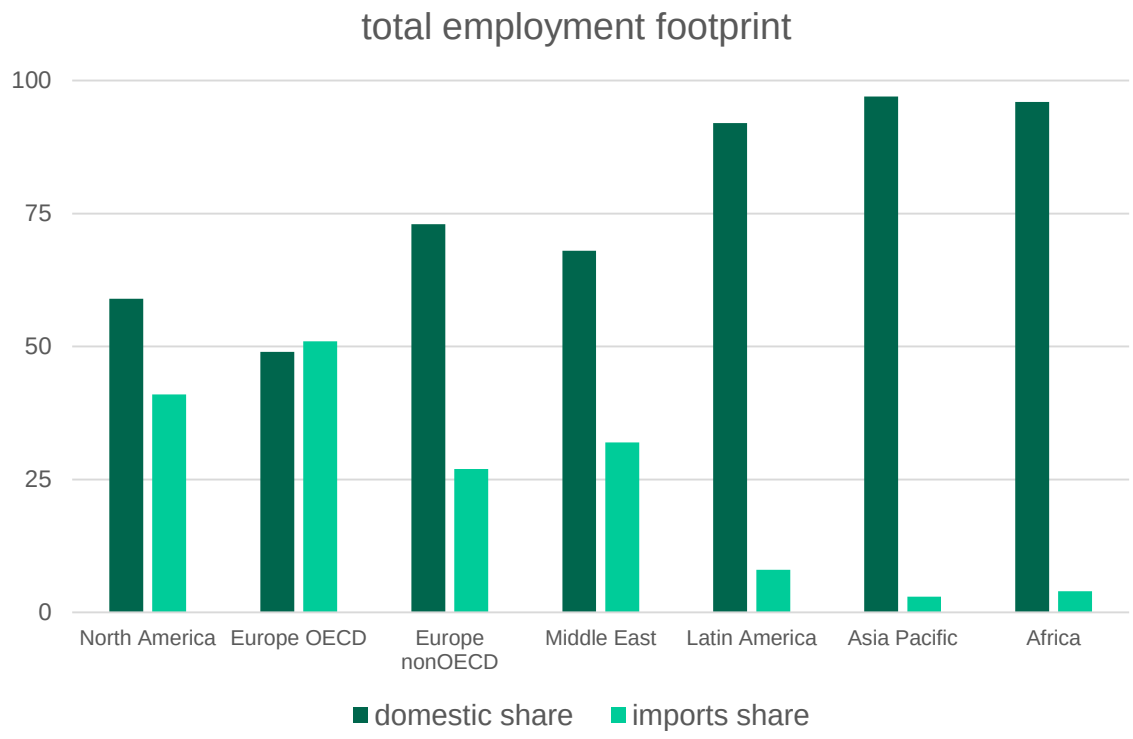
Employment footprint: amount of labor required to satisfy domestic consumption



source: Simas et al., 2014; based on EXIOBASE model

READ:
In **North America,** of all labor hours required for satisfying domestic consumption, 60% are provided domestically, and 40% are embodied in imports.
In **Asia Pacific**, of all labor hours required for domestic consumption, 95% are provided domestically and 5% are embodied in imports.
OECD Europe has the largest share of required labor embodied in imports (51%).

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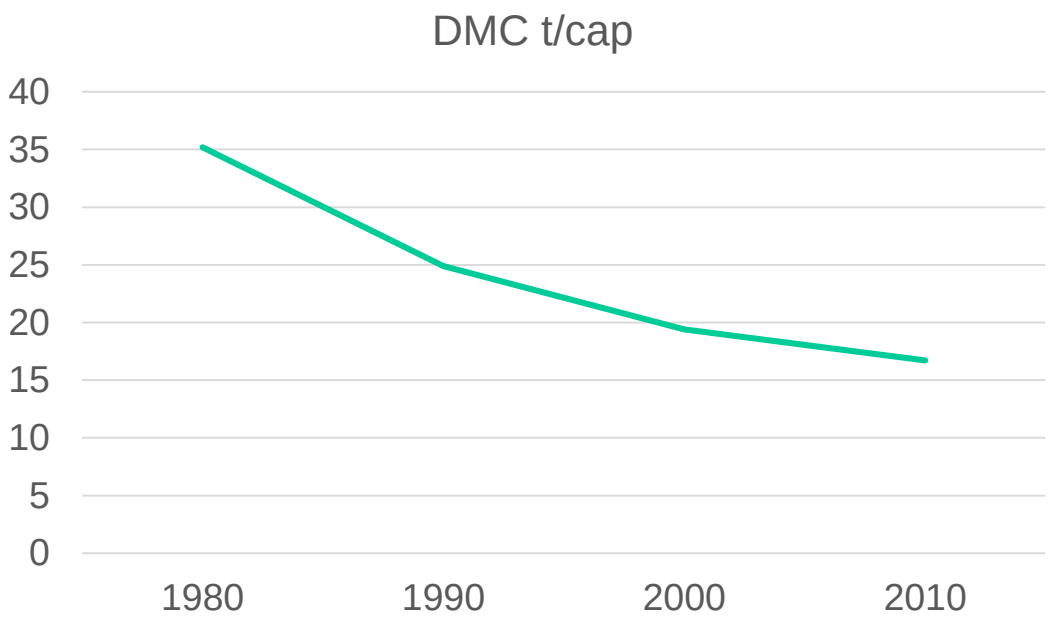
4. This is not a sustainable pathway, and not a pathway that gives people life satisfaction.

Globally, we need ever fewer resources for a good life (HDI > 0,8) !



At which level of resource use do countries globally achieve a Human Development Index beyond 0,8? (standard for „high development“)

Resources required per person declined by 50% between 1980 and 2010!

source: Schaffartzik et al.2015
https://www.bmlfuw.gv.at/dam/jcr:27656ef3-2f2e-4719-a2c2-ca9efe0d86cc/Report_Resource%20Use%20in%20Austria%20%202015_engl.pdf

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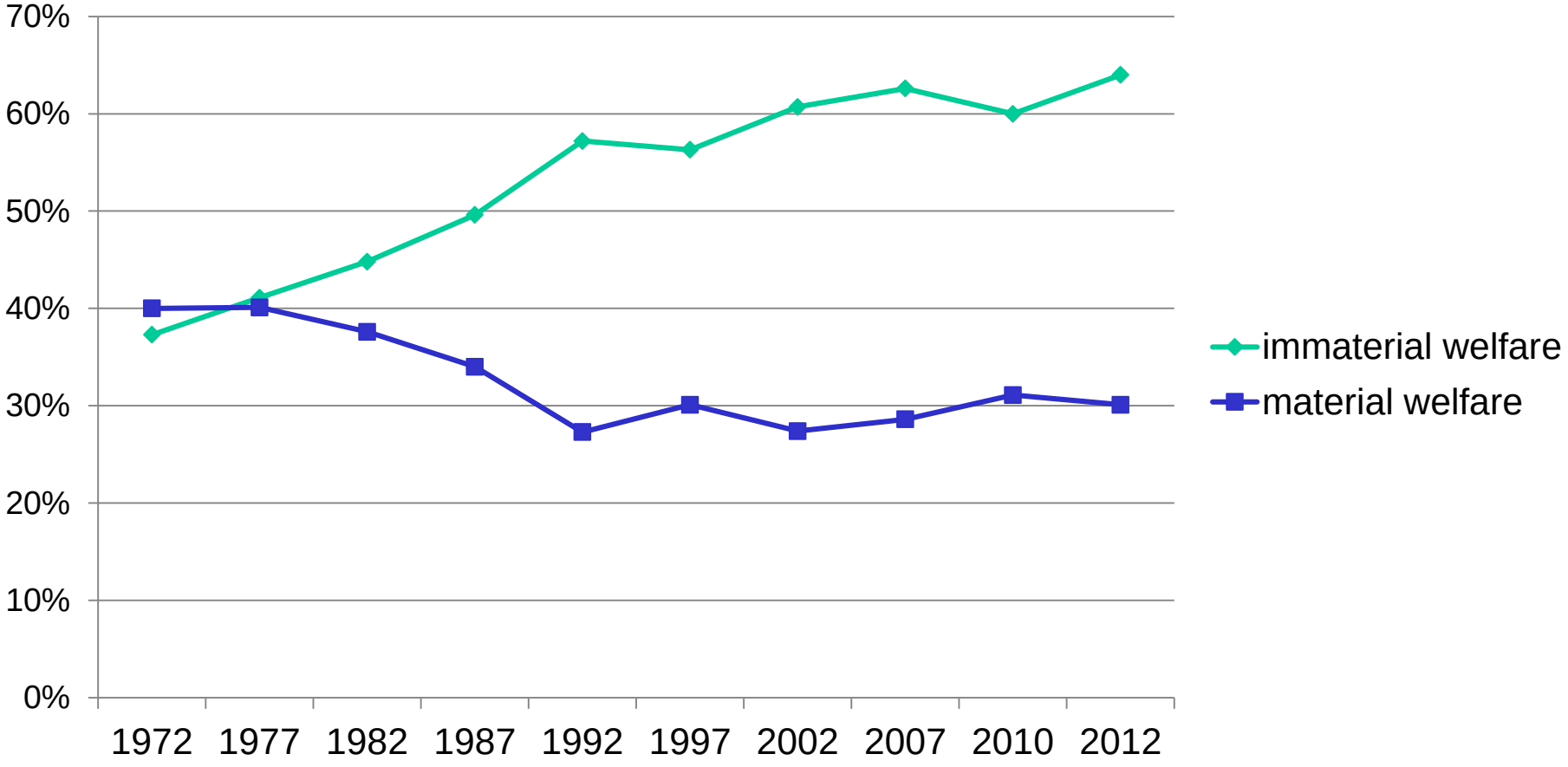
Preferences of Japanese Citizens: immaterial welfare taking over



Source: Public Survey about Living for Citizens, Cabinet Office of Japan

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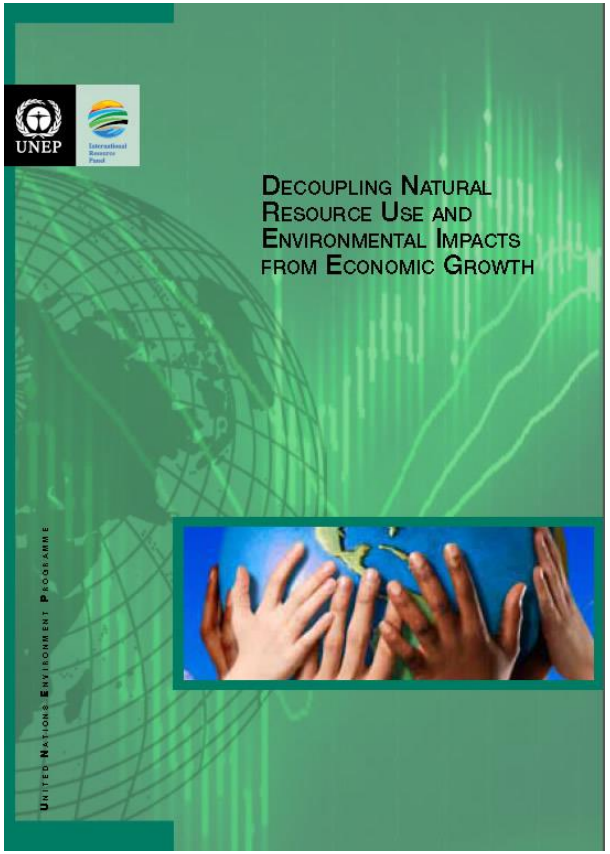
Conclusions: Time for a major change?

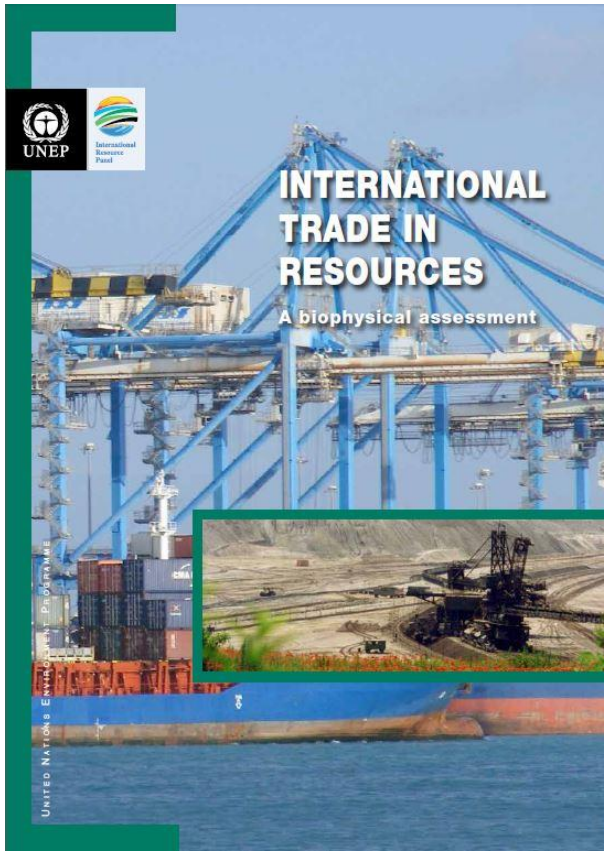
1. **Decoupling resources/economic growth is possible**: It can be shown that a spontaneous “decoupling”, that is a stagnation or even decline of resource use while economic growth continues, did and does occur.
2. **Decoupling resources/human wellbeing is possible:** It can be shown that a spontaneous “decoupling”, that is a stagnation or even decline of resource use while human wellbeing improves, did and does occur.
3. **But: Spontaneous Decoupling is not enough.** Not enough to avoid resource exhaustion, back up climate policies, and allow for a more equitable world, as outlined in the sustainable development goals.

IRP Assessment Reports

using material flow data



2011



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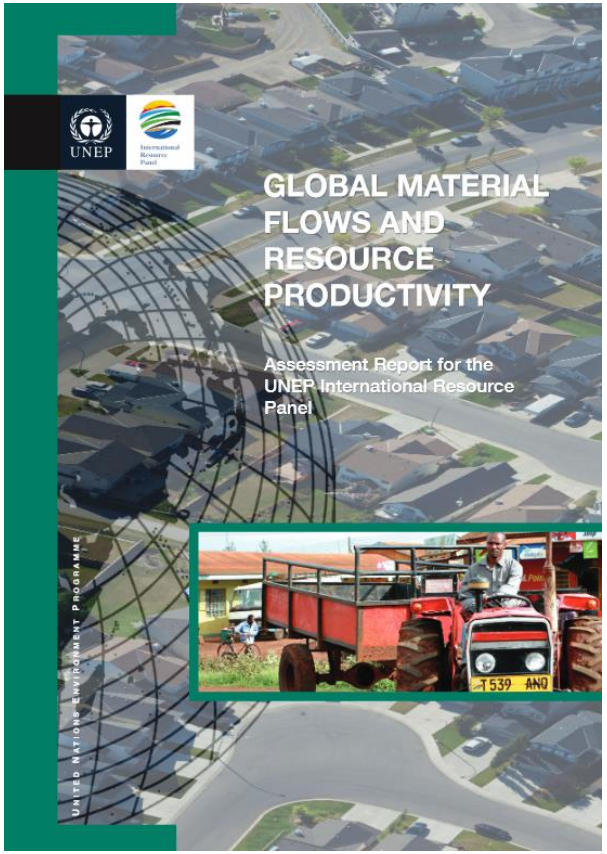

2016

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