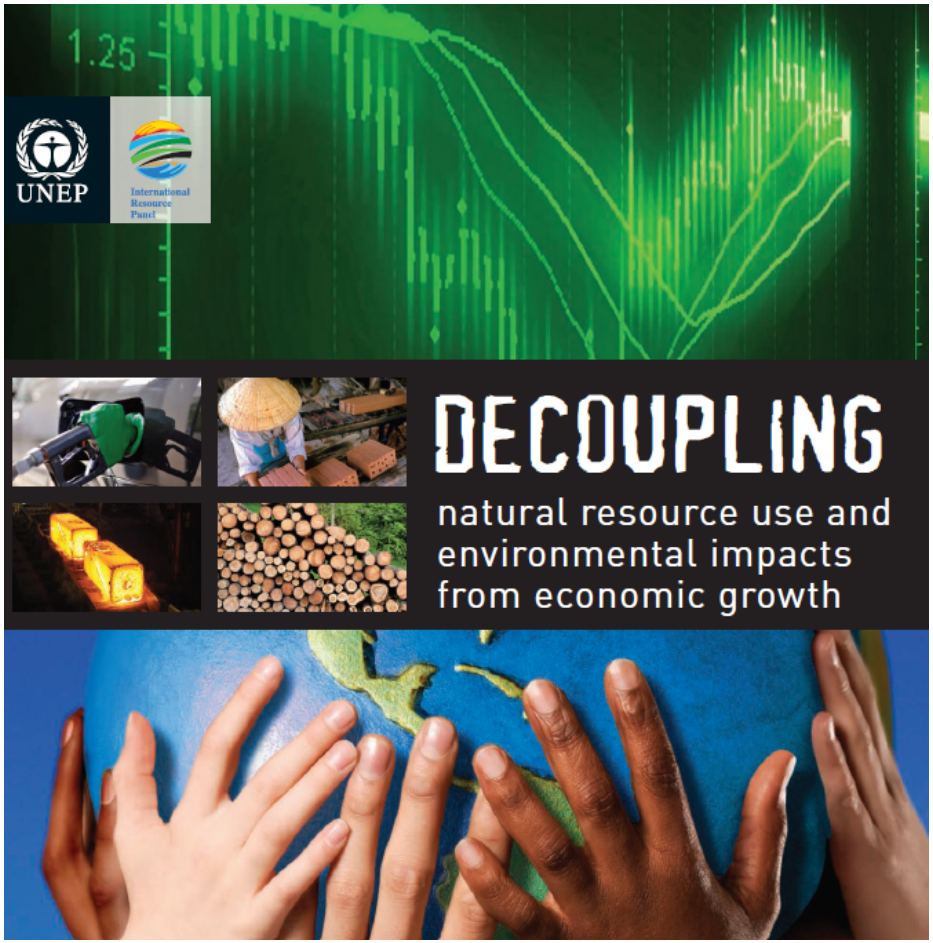
Decoupling natural resource use and environmental impacts from economic growth



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www.unep.org/resourcepanel/decoupling

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The structure of the report

- Defining decoupling and its importance.
- Long-term trends in resource use and negative environmental impacts, including scenarios
- Decoupling and the need for system innovations
- Decoupling and development dynamics
- Case studies from Germany, South Africa, China, and Japan
- Conclusions and challenges

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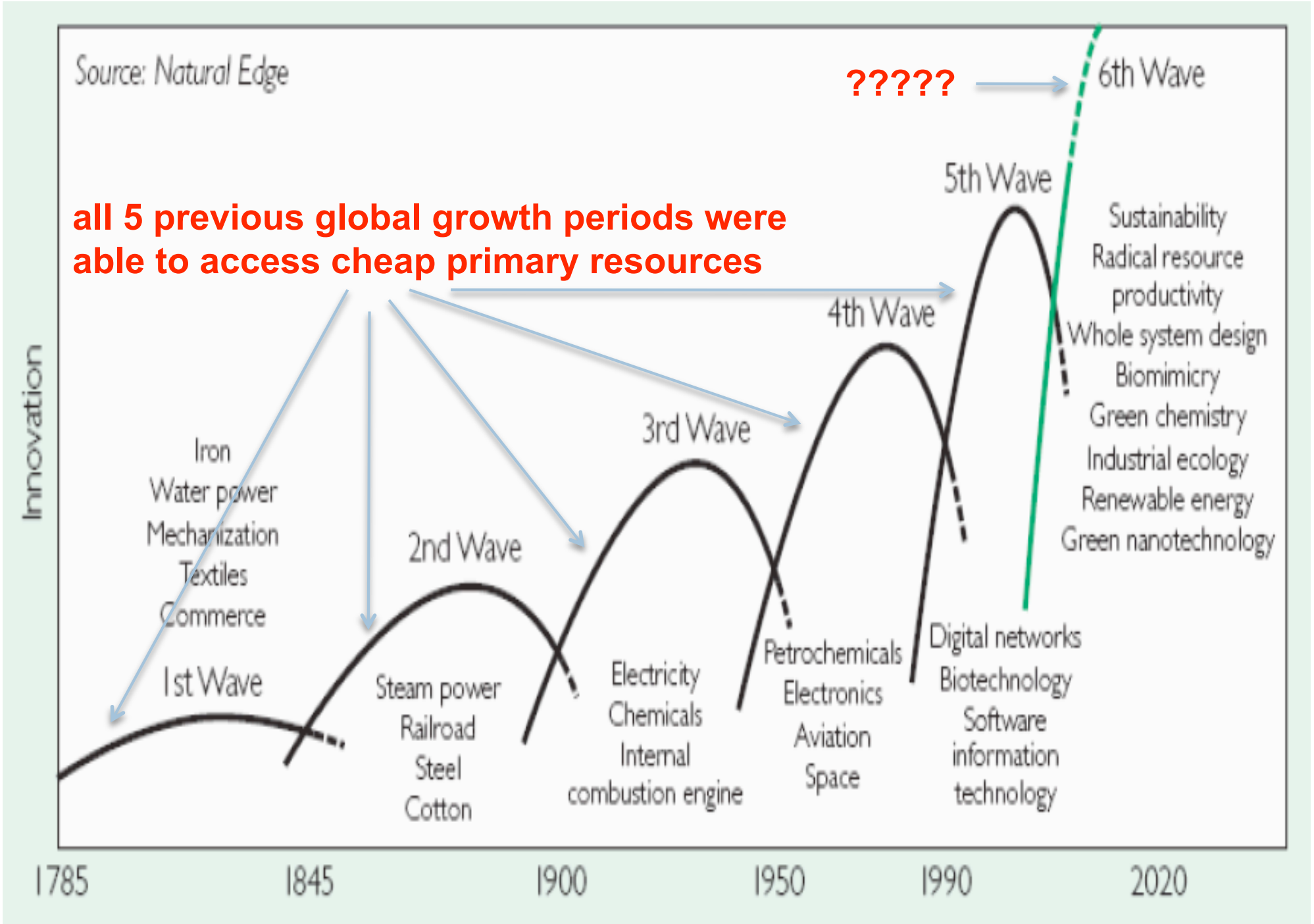
Source: Natural Edge
?????
6th Wave
5th Wave
all 5 previous global growth periods were able to access cheap primary resources
4th Wave
3rd Wave
2nd Wave
1st Wave
Innovation
Iron
Water power
Mechanization
Textiles
Commerce
Steam power
Railroad
Steel
Cotton
Electricity
Chemicals
Internal combustion engine
Petrochemicals
Electronics
Aviation
Space
Digital networks
Biotechnology
Software
information technology
Sustainability
Radical resource productivity
Whole system design
Biomimicry
Green chemistry
Industrial ecology
Renewable energy
Green nanotechnology
1785
1845
1900
1950
1990
2020

Four categories of primary raw materials

Fossil fuels

Construction minerals

Metal Ores & industrial minerals

Biomass

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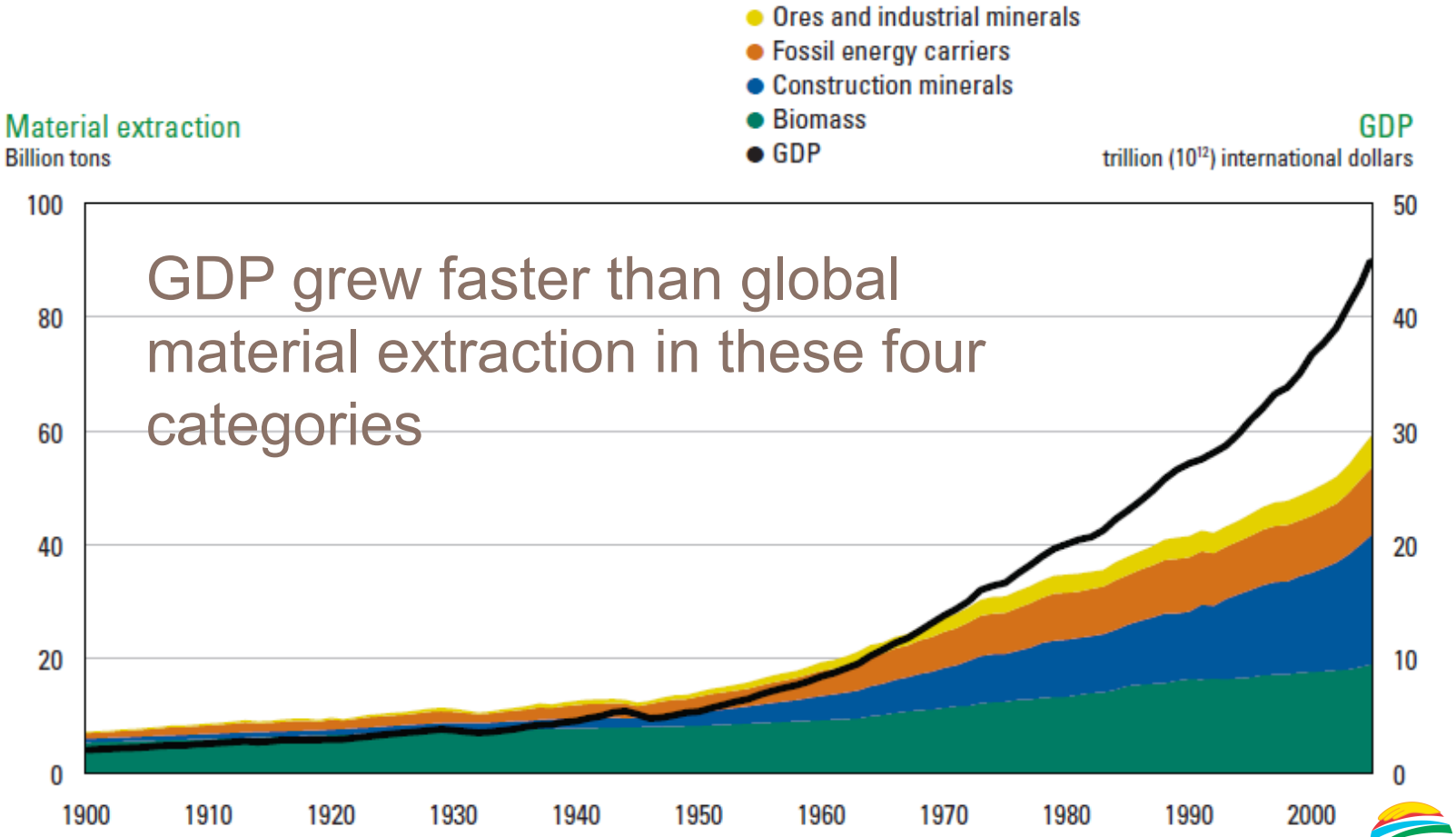
Resource Use & Decoupling

Figure 1. Global material extraction in billion tons, 1900–2005



Source: Krausmann *et al.*, 2009

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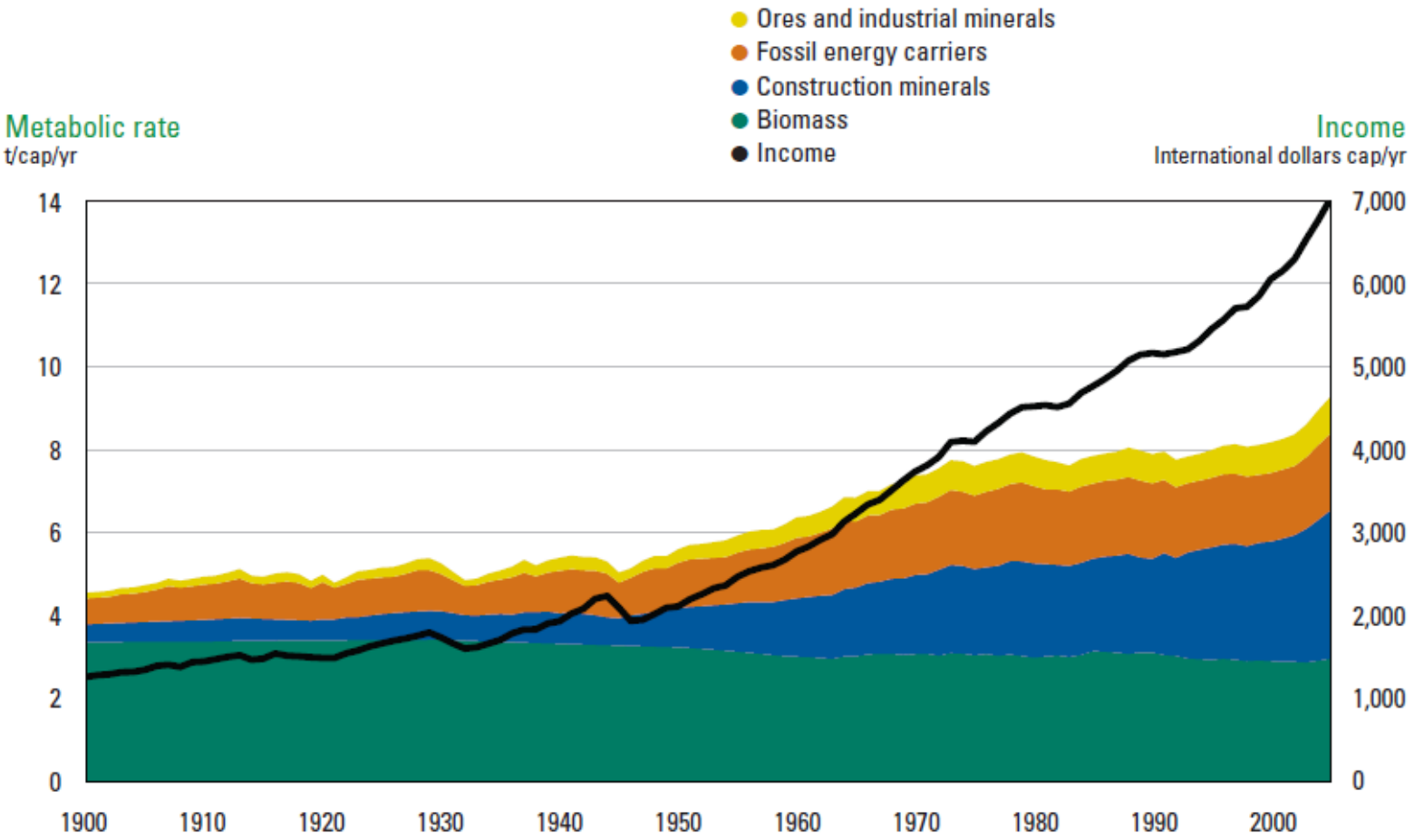
Long-term trends in resource use

Figure 4. Global metabolic rates 1900–2005, and income



Source: Krausmann *et al.*, 2009; based on Sec Database "Growth in global materials use, GDP and population during the 20th century", Version 1.0 (June 2009): http://uni-klu.ac.at/socec/inhalt/3133.htm)

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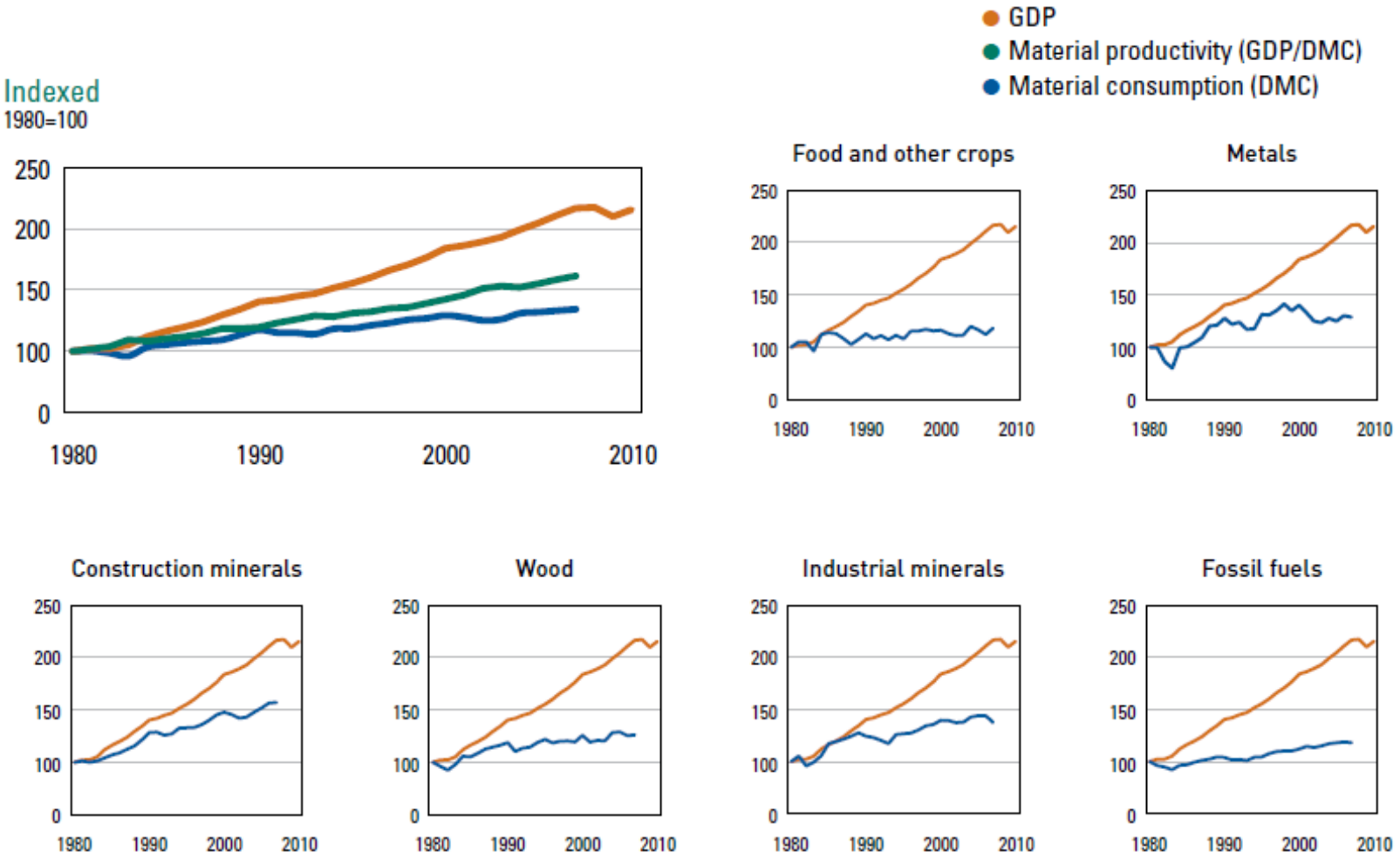
Long-term trends in resource use

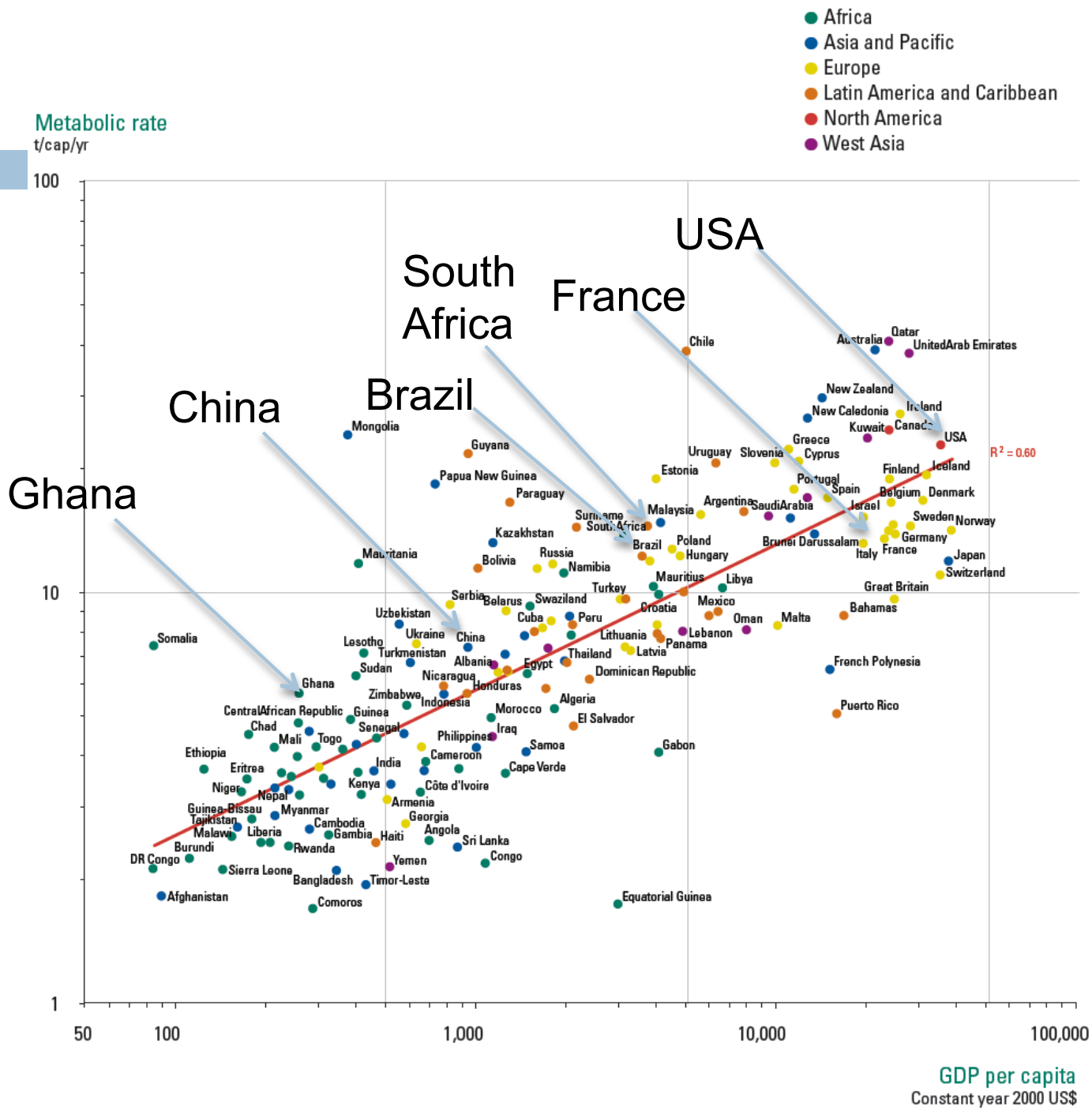
Figure 2.3. Gross Domestic Production and Domestic Material Consumption in OECD countries, 1980–2000



Source: OECD, 2008b. Data update provided by OECD on 1 April 2011, http://www.oecd.org/dataoecd/55/12/40464014.pdf

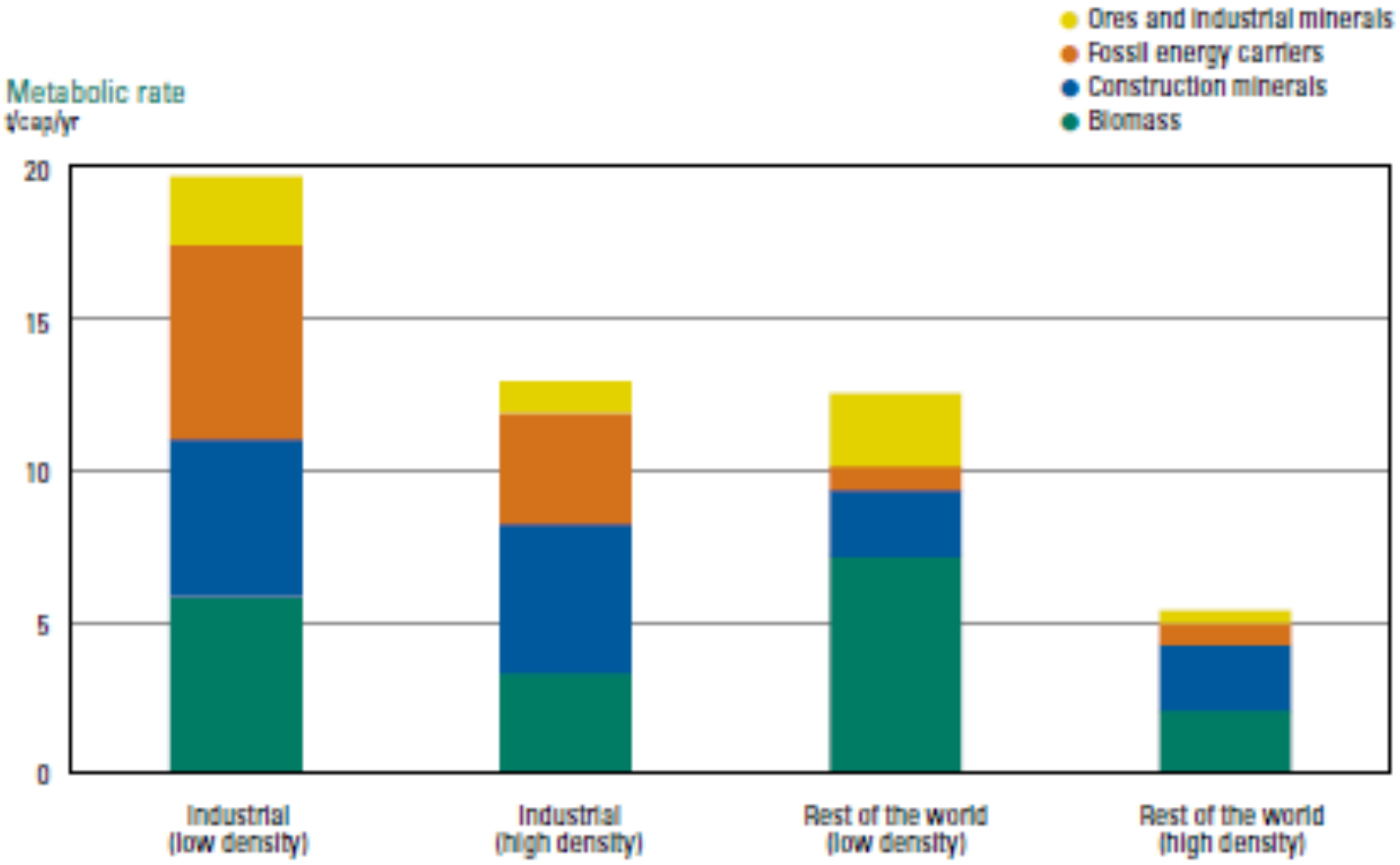
Interrelation between resource use & income

Figure 2.6. The global interrelation between resource use and income (175 countries in the year 2000)



Average metabolic rates by development status and population density

Figure 2.7. Average metabolic rates (resource use in tons/capita) by development status and population density



High-density means a population density of 50 people/km² or higher. Share in world population: 13% industrial, high density, 6% industrial, low density, 62% rest of the world, high density, 6% rest of the world, low density.
Source: Krausmann *et al.*, 2008

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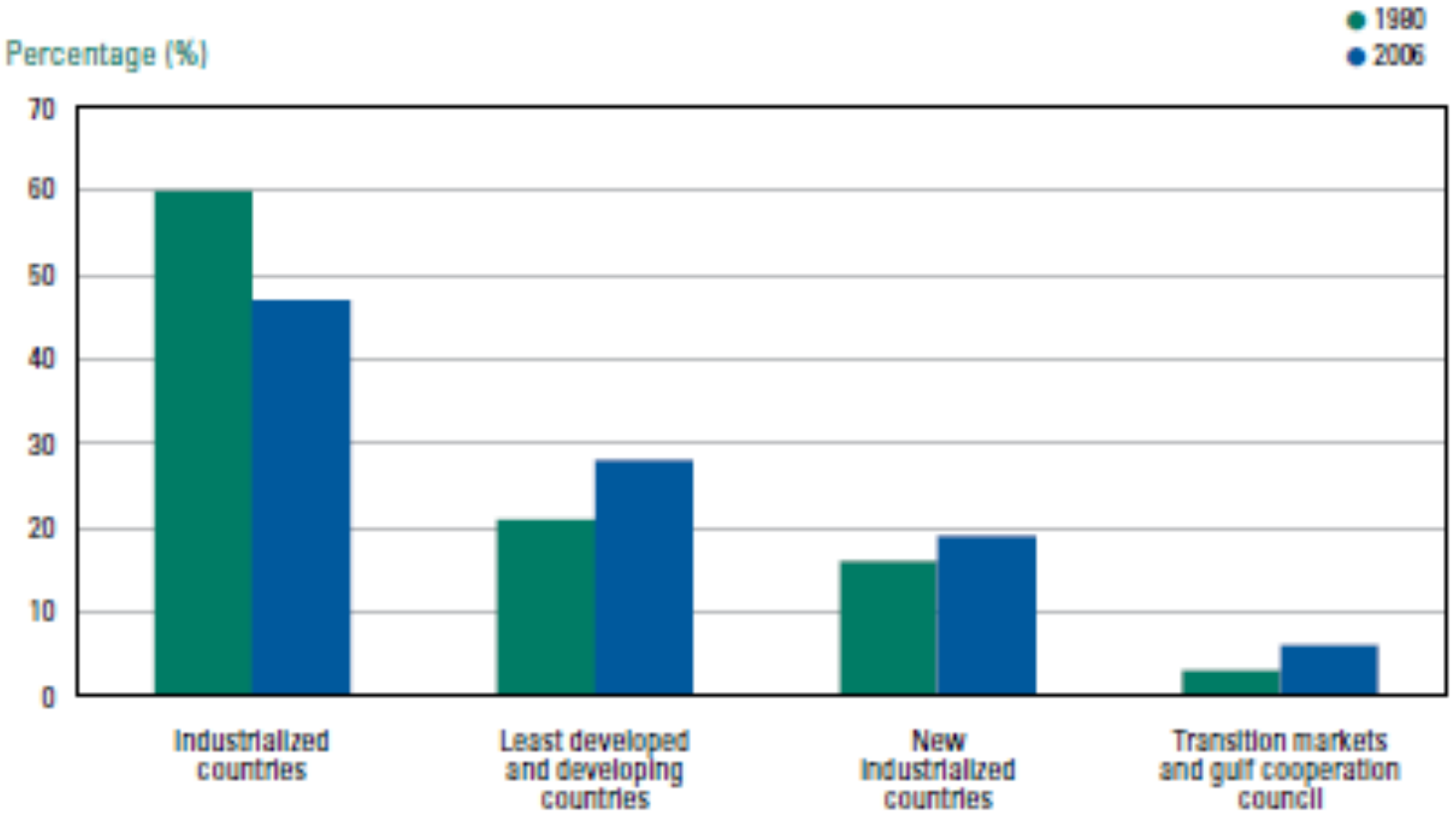
Global shift in the extraction of minerals and ores

Figure 2.11. Global extraction of industrial minerals and ores 1980 and 2006, by type of country



Source: SERI, Mosus data base, own calculation, http://seri.at/projects/completed-projects/mosus

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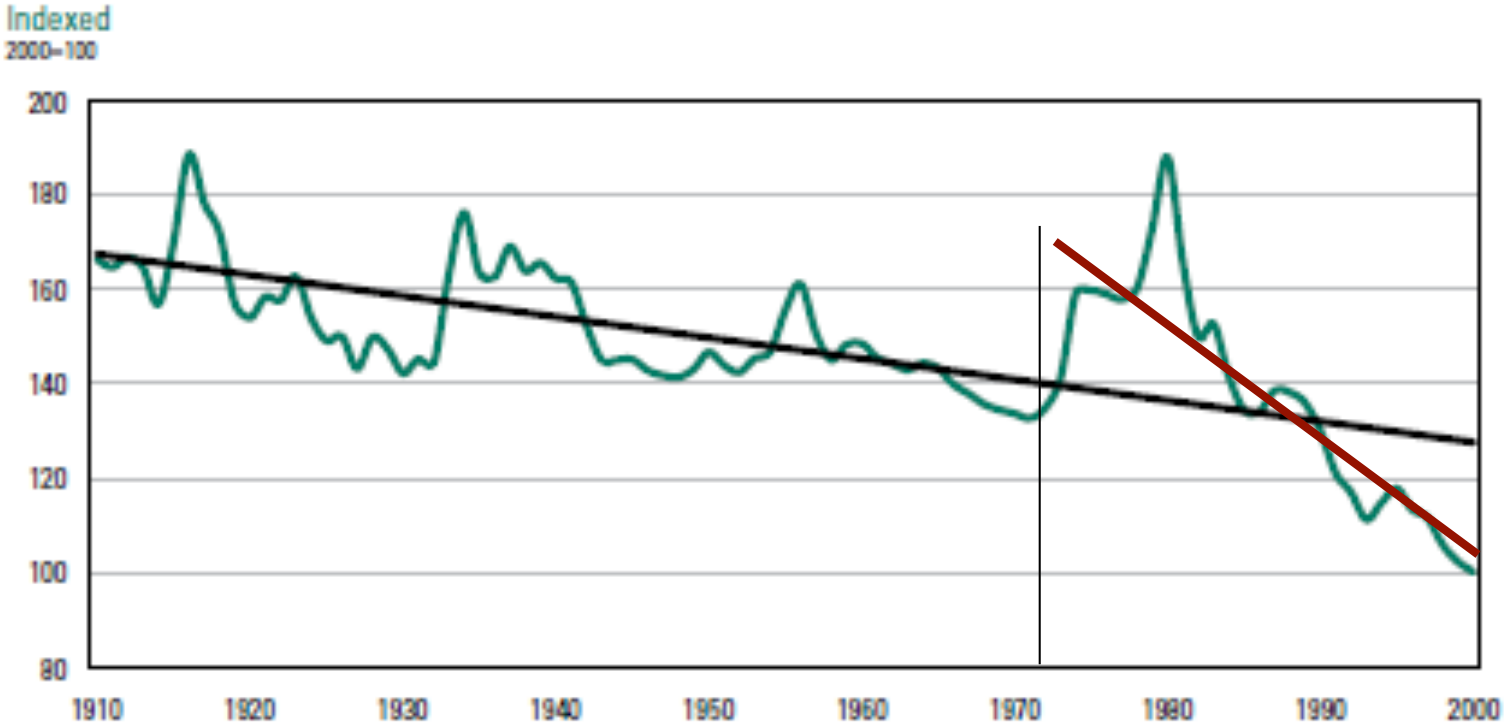
A hundred years of decline of resource prices

Figure 2.4. Composite resource price index (at constant prices, 1900–2000)



Source: Wagner *et al.*, 2002

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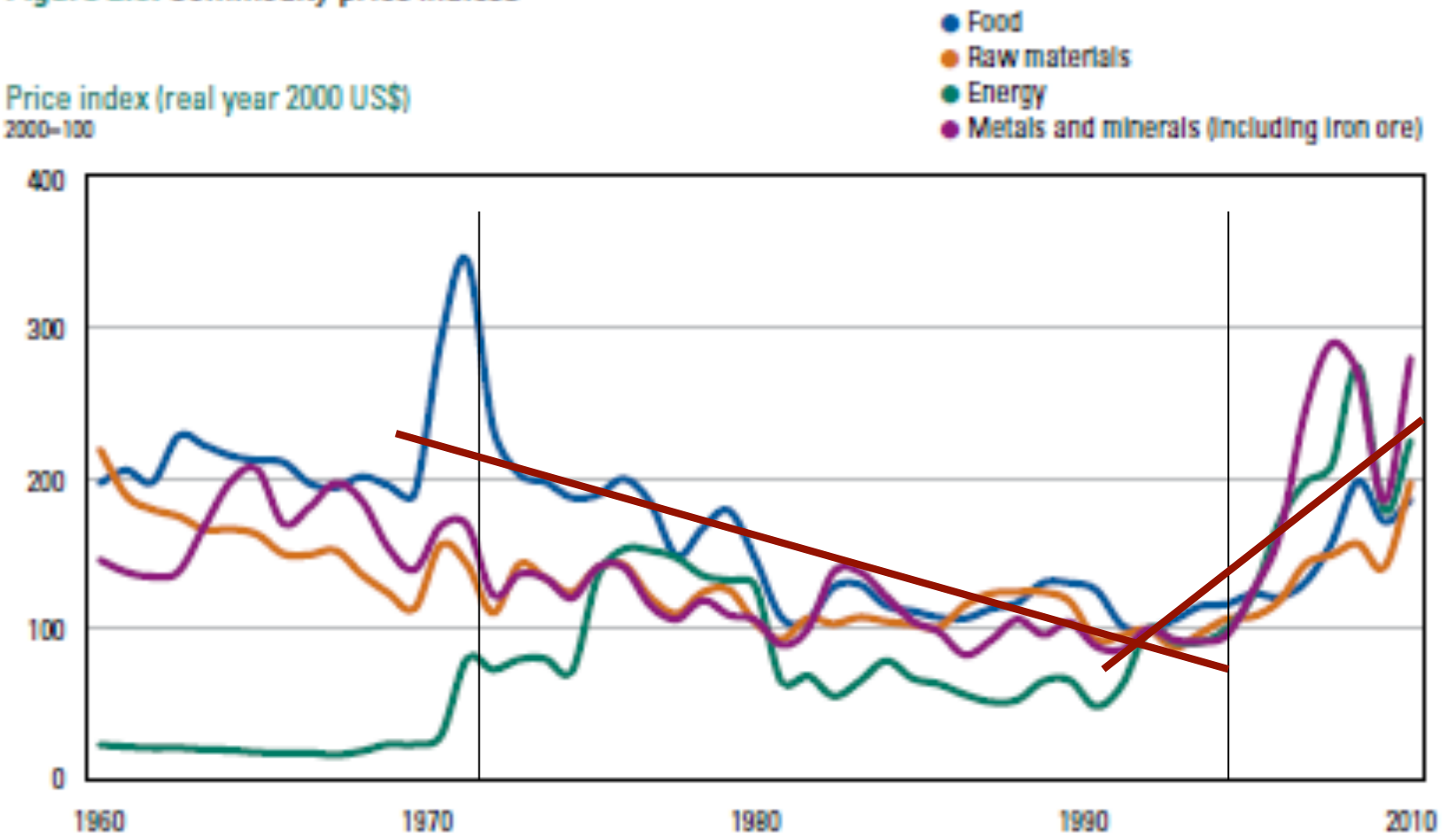
Resource prices on the rise, recently

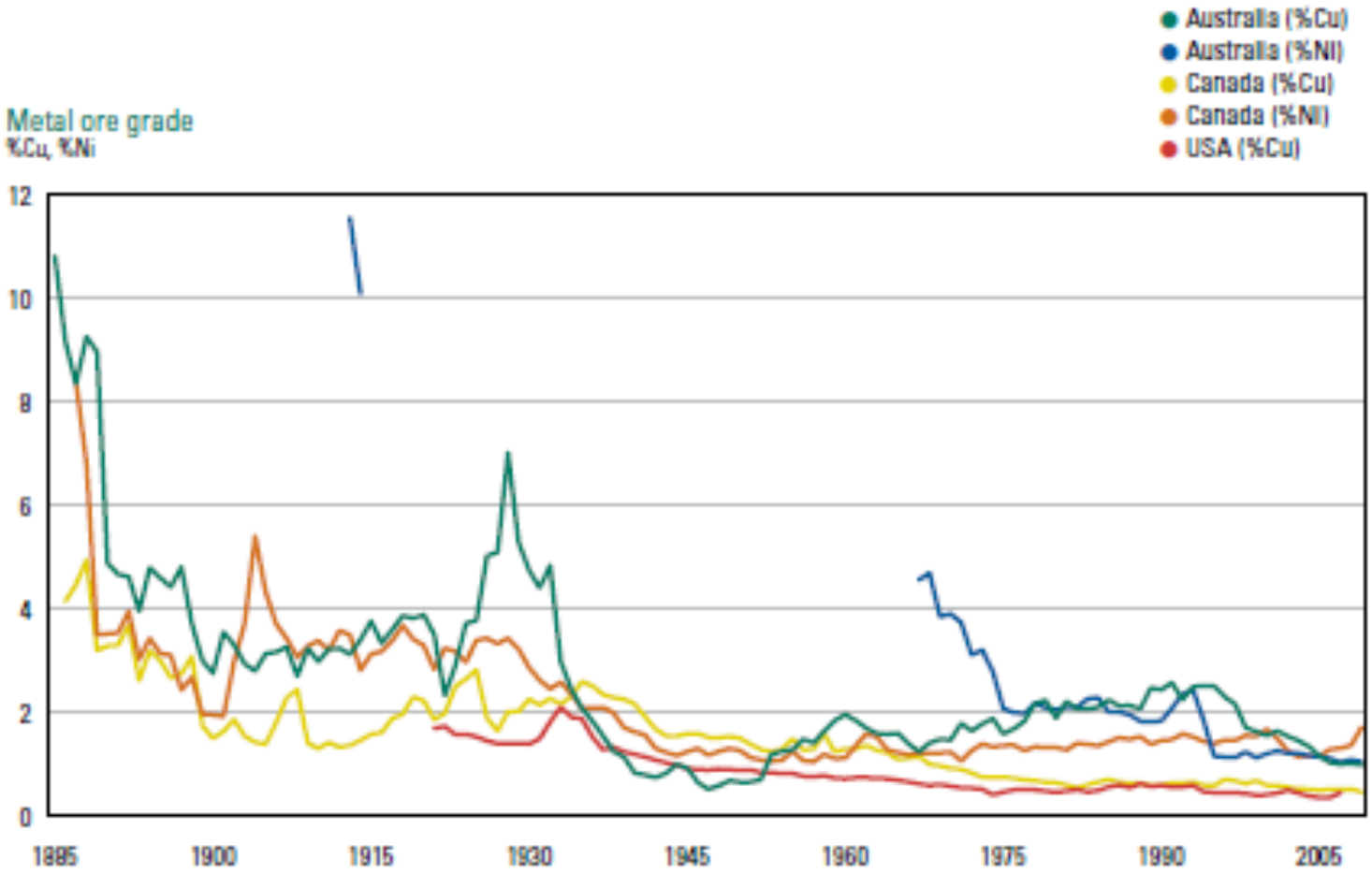
Figure 2.5. Commodity price indices



Source: World Bank Commodity Price Data (Pink Sheet), historical price data, available from http://blogs.worldbank.org/prospects/global-commodity-watch-march-2011

Declining Ore Grades

Figure 2.14. Ore grades of nickel and copper mines, 1885–2010



Source: Giurco *et al.*, 2010

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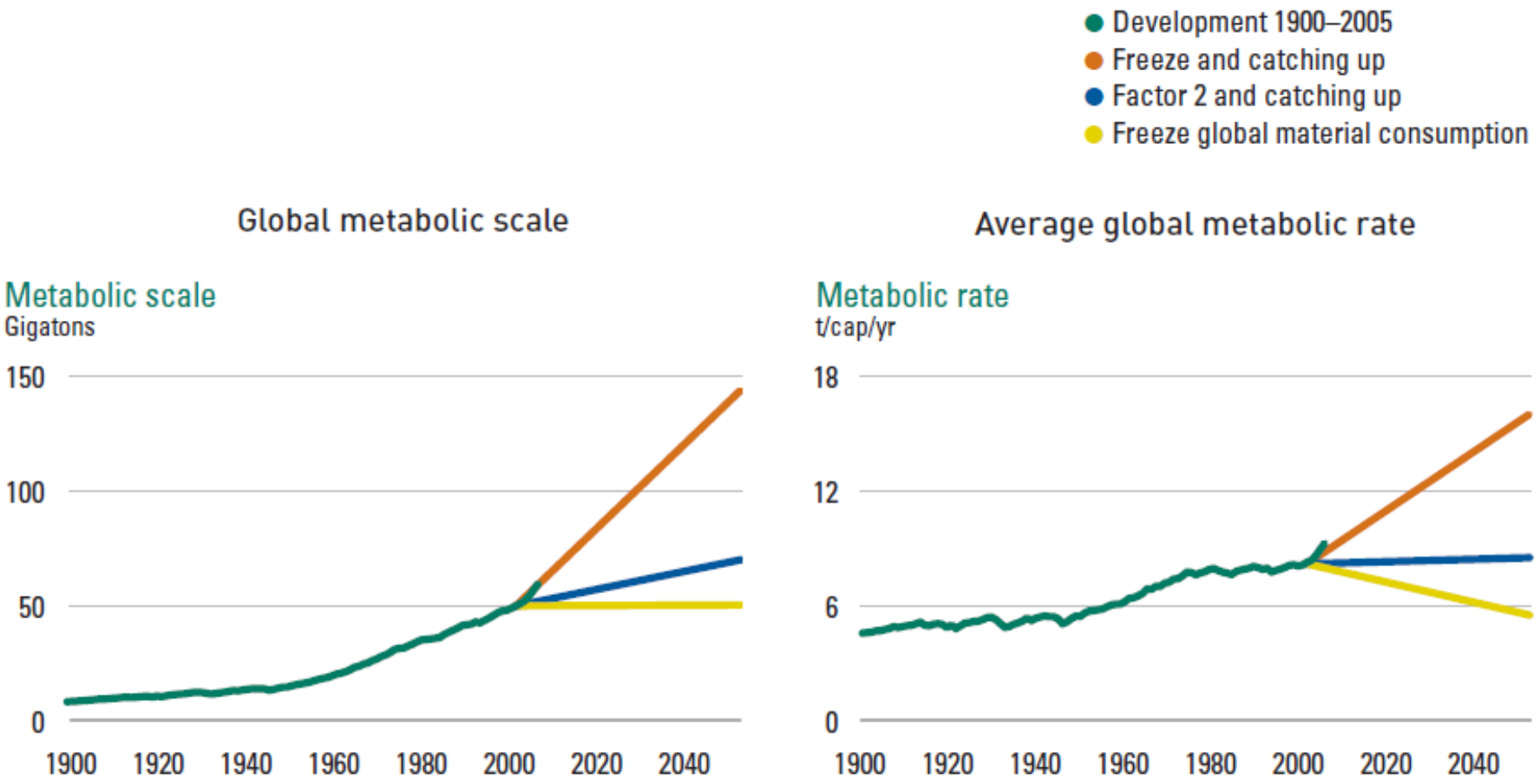
Three future scenarios for 2050

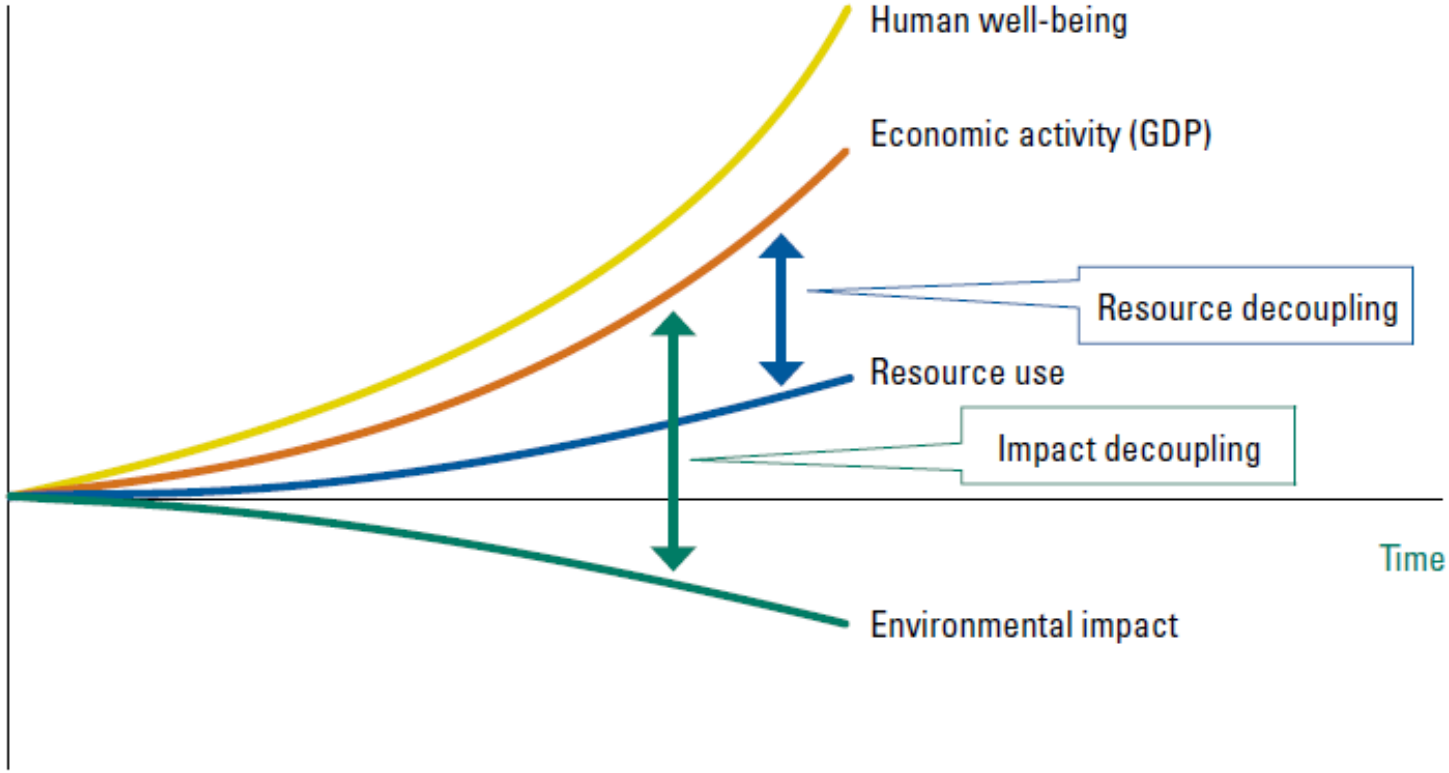
Figure 2.15. Resource use according to three different scenarios up to 2050



Source: Krausmann *et al.*, 2009 (Development 1900–2005) and own calculations (see text)

The concept of decoupling

Figure 1. Two aspects of 'decoupling'



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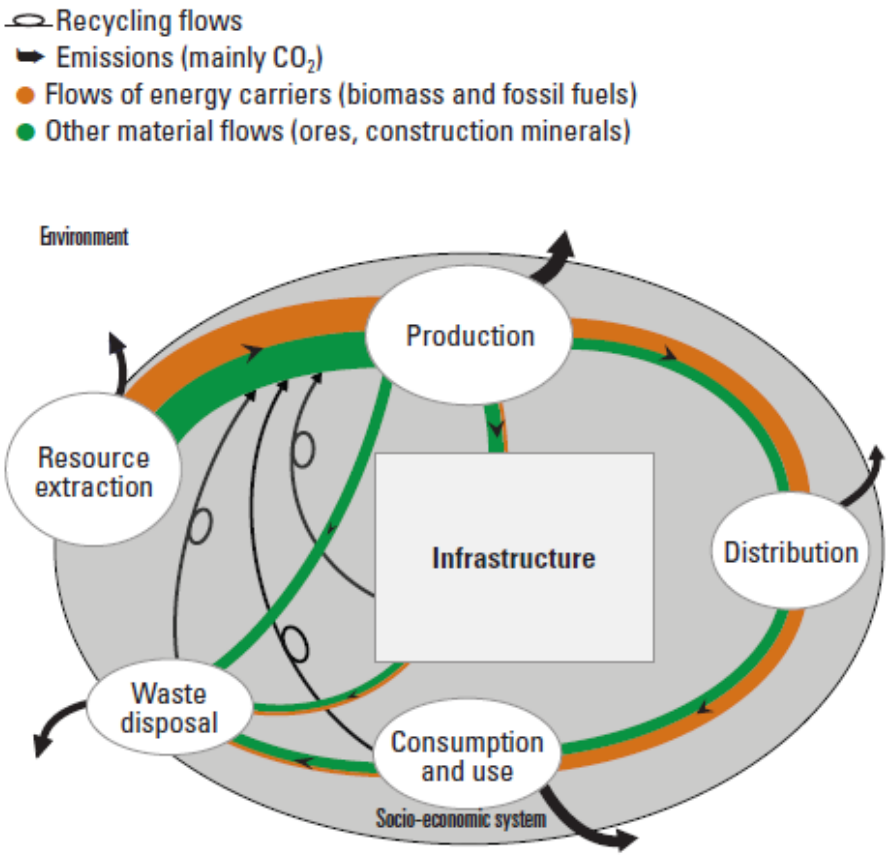
The life cycle of resources

Figure 3. The life cycle of resource extraction and use



Note: flows of resources, emissions and wastes according to European proportions
Source: Fischer-Kowalski, 2011

Decoupling affects different parts of the life cycle in different ways

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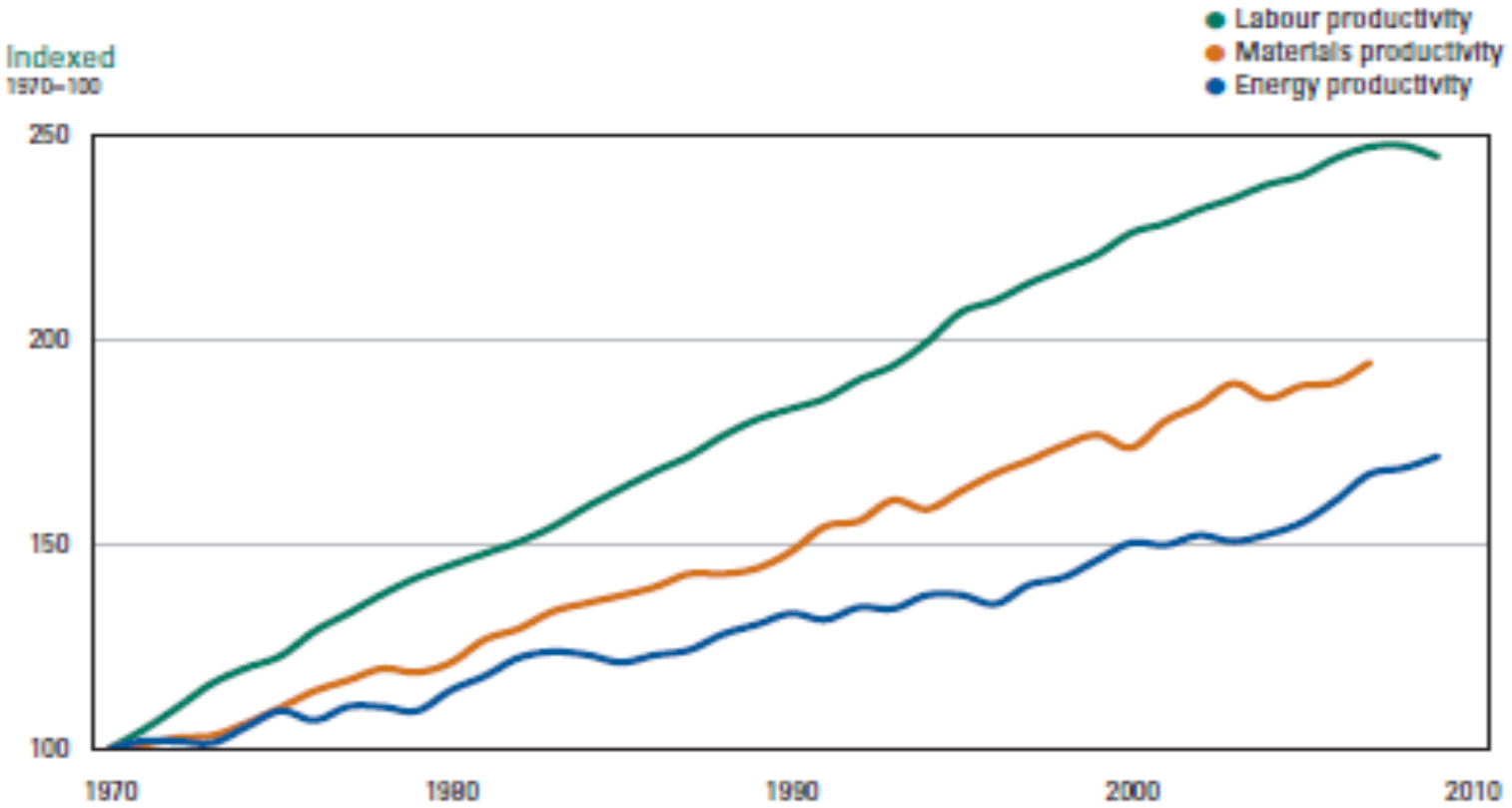
Labour, materials & energy productivity

Figure 3.2. Resource productivity, labour productivity and energy productivity in EU-15



Note: Labour productivity in GDP per annual working hours; material productivity in GDP per domestic consumption (DMC) and energy productivity in GDP per total primary energy supply (TPES).
Source: EEA, 2011

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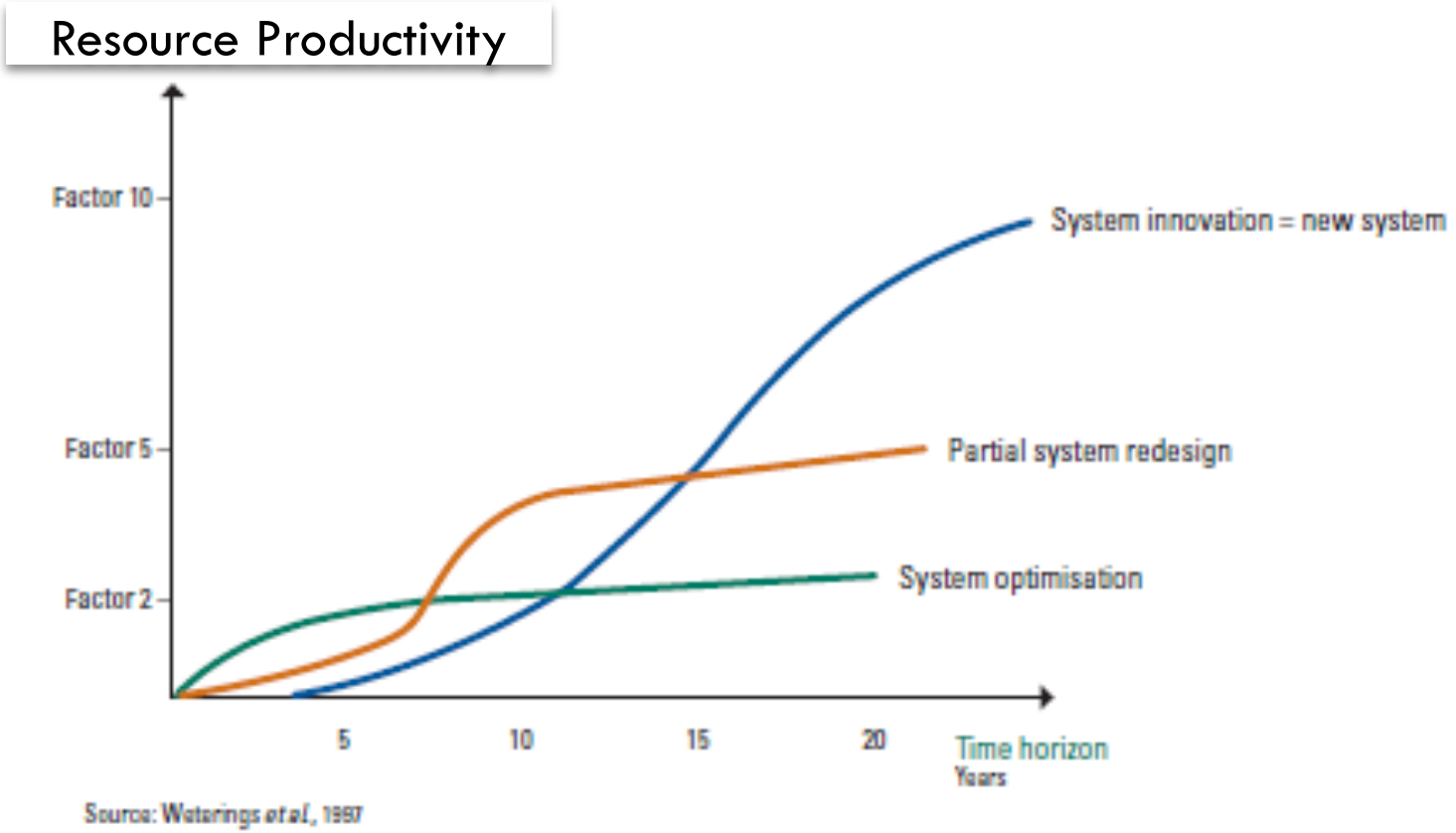
Sustainability-Oriented Innovation will be key

Figure 3.4. Conceptual model of innovations



Source: Weterings *et al.*, 1997

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Decoupling and system innovations

Innovation is key to decoupling from escalating resource-use & environmental impacts

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3 key issues ....

- Trade, special case of Africa
- Rethinking growth
- Role of cities

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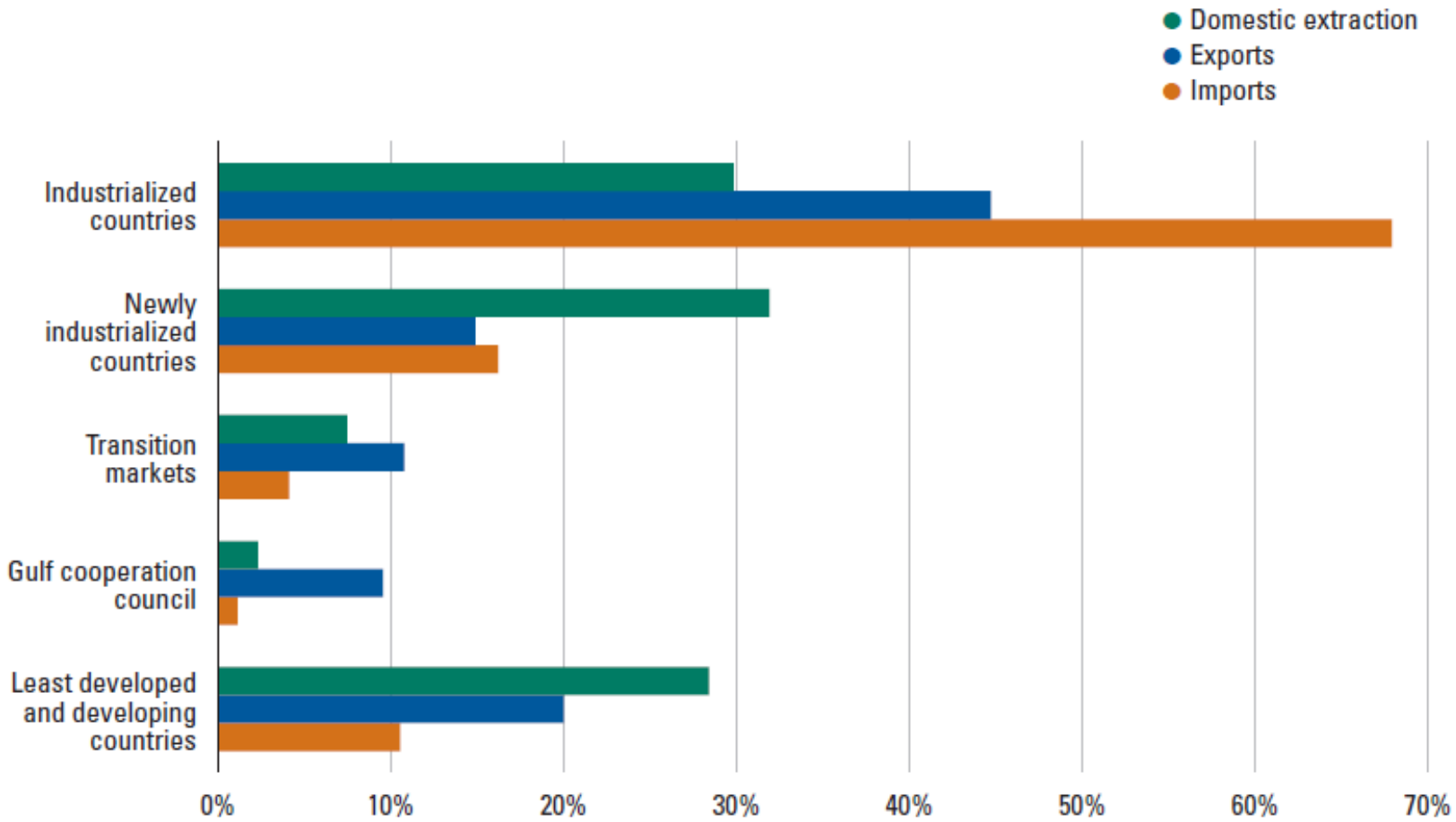
Decoupling, trade and development dynamics

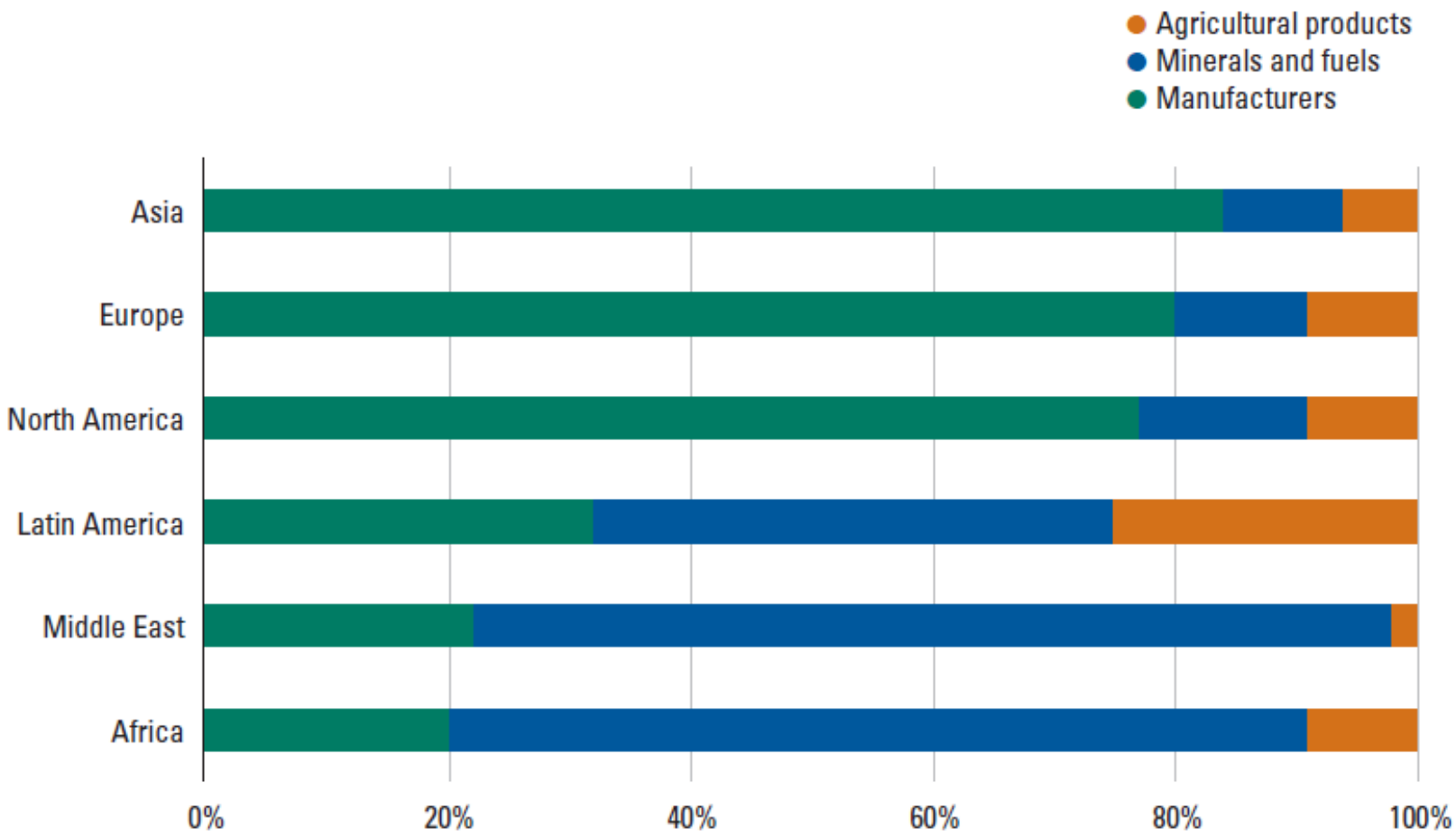
Figure 4.2. Raw material extraction and trade by country type



Source: Drawn from SEC database, http://www.uni-klu.ac.at/socec/inhalt/3812.htm, see Steinberger *et al.*, 2010

Economic structure and trade

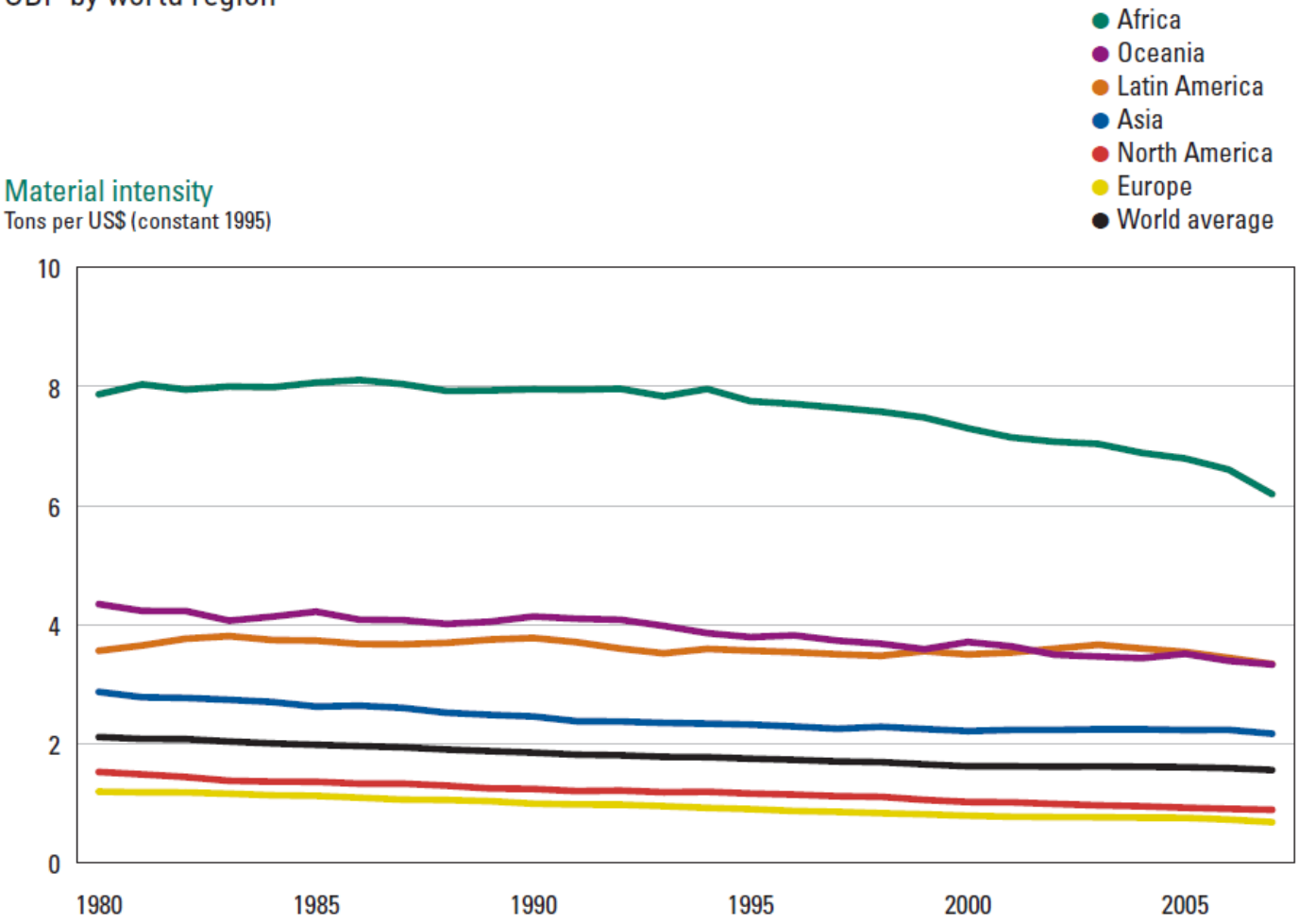
Figure 4.1. Composition of exports (in monetary units) by world regions, 2006



Source: WTO, 2008

Material intensity of economies

Figure 4.6. Material intensity of the world economy: Domestic extraction of materials per unit of GDP by world region



Source: Behrens *et al.*, 2007

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Africa – resource curse or leapfrogging?

- Growing faster than ever before
- Diversification, resource sector down to 24%
- But primary resources still 80% of exports
- Prices are too low, resource rents not properly invested
- In a world of depleting resources, resource wars on the rise (Sudan, W. Sahara, DRC, Nile region, etc) – failing states
- Decoupling helps Africa to rethink development

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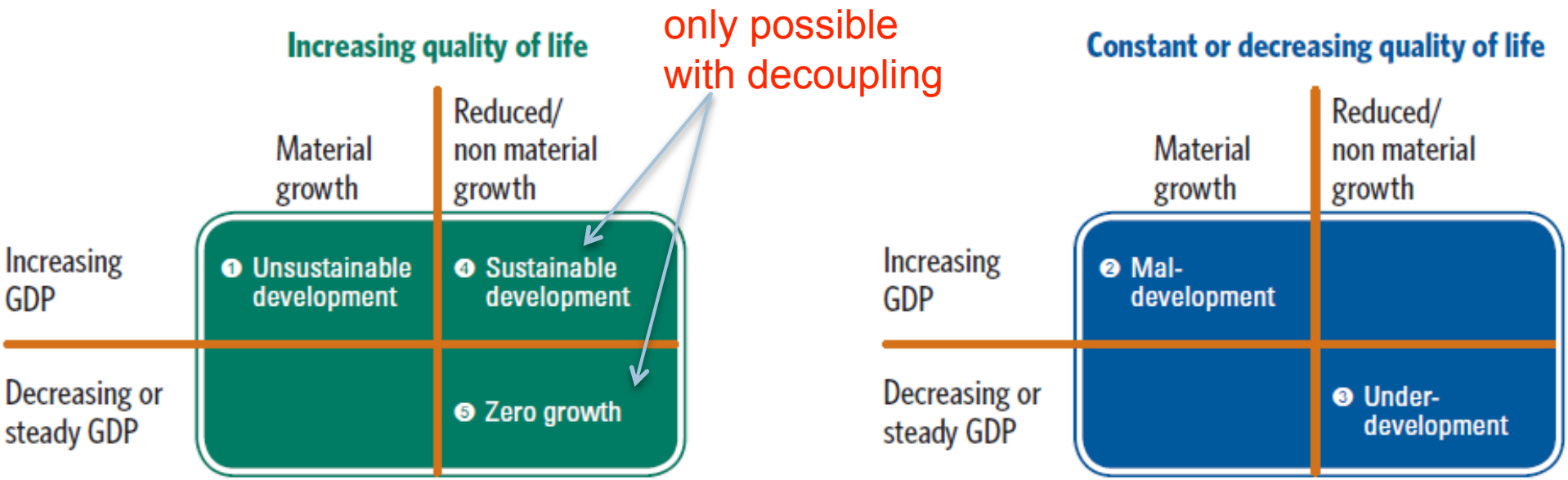
Rethinking growth

Figure 3.1. The different guises of development



Source: Redrawn from Gallopin, 2003, p. 27

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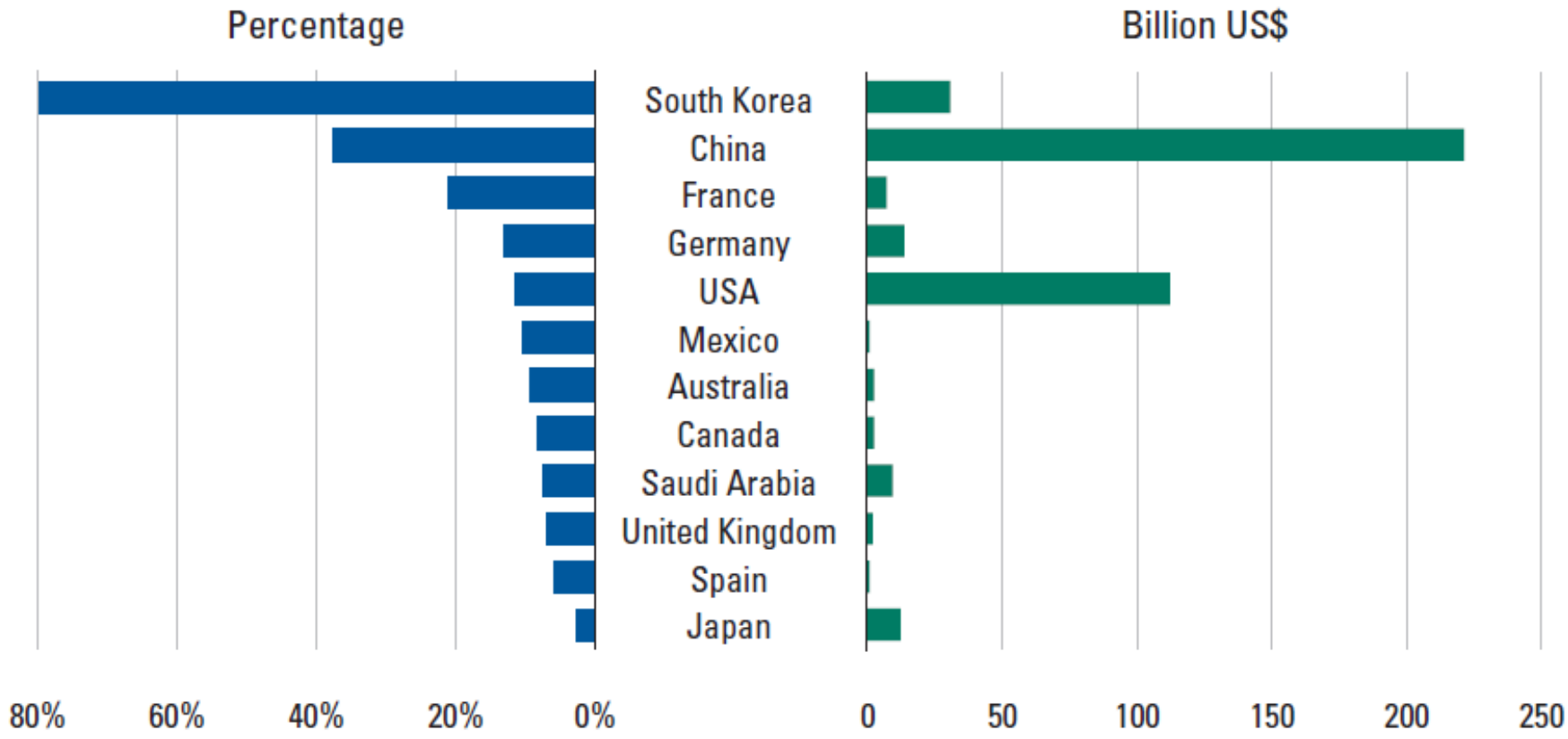
Government investments

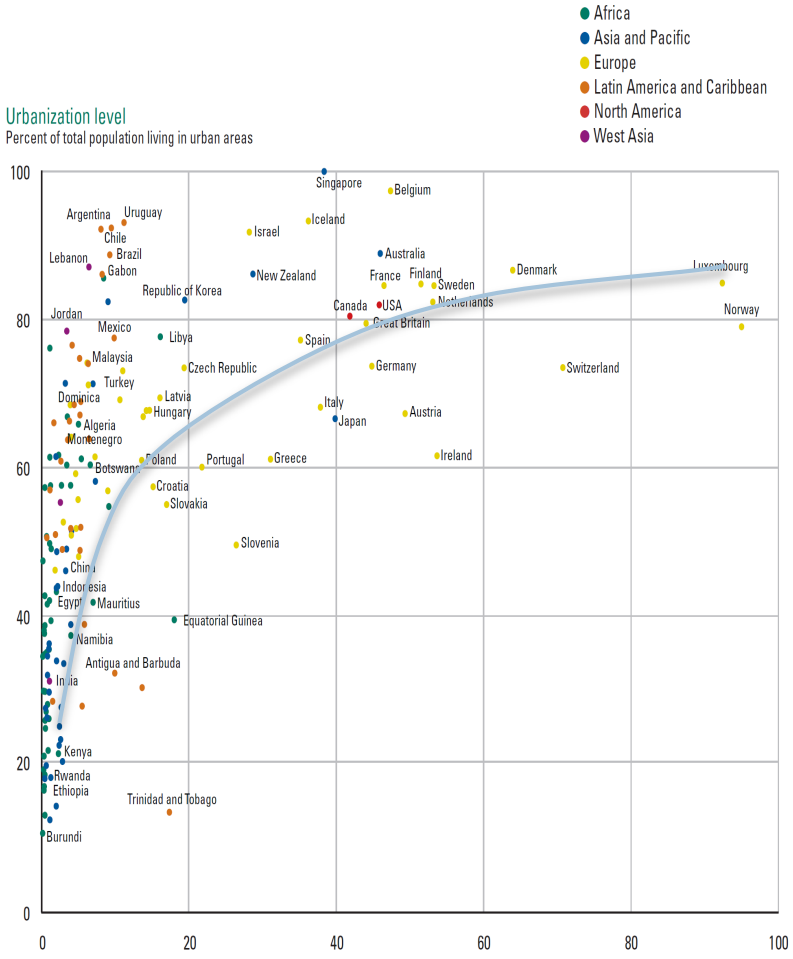
Figure 4.7. Eco-friendly spending, total amount and percentage of total fiscal stimulus package



Source: HSBC, 2009

Cities as innovation centers for decoupling

Figure 3.6. The relation between urbanization level (%) and Gross National Income (GNI)



Note: Country names were added for outliers, large population nations and places where space allowed. Care is needed in interpreting this figure because of the different criteria used by governments to define urban areas.
Source: Adapted from Satterthwaite, 2007, with 2008 (GNI) and 2009 (Urbanisation) data

- pop: from 6bn – 9bn in 2050
- 50% urbanized by 2007, next 3bn will be in African & Asian cities
- large bulk of 60Gt of resources & 500 Exajoules of energy consumed in cities
- most of the economic recovery investments going into urban infrastructure
- but what kinds of infrastructures? for what kinds of urban futures?
- cities have always been the centers of innovation
- 1000s of experiments already underway

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The country case studies

1. **Germany**
2. **China**
3. **South Africa**
4. **Japan**

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Lessons learned from the 4 case studies

- **Governments are responding to concerns** about increasing resource scarcity that is affecting economic growth.
- **None have full-fledged policies** for achieving comprehensive resource and impact decoupling, but all are taking significant steps toward more sustainable use of resources and reduced environmental impacts.
- The **language of resource efficiency**, resource productivity, dematerialization, and material flows **has entered mainstream policy development**, in different ways in each country.
- **Diversity in approaches** to decoupling is to be expected, but the general logic of the approach is appealing.

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Major policy challenges 1

- How can decoupling resource flows and associated environmental impacts be linked to related challenges, such as climate change, degrading ecosystem services, and pollution?
- How can the absolute physical limits of non-renewable resources best be communicated?
- How can current decoupling trends be accelerated, for example through improved innovation?
- What market signals can be used to give resource productivity increases a higher priority?

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Major policy challenges 2

- What will convince governments and financial institutions to adopt sustainable resource management as essential to a "Green Economy"?
- How can cities become centers for innovation in practical decoupling?
- How can decoupling contribute to reducing levels of global inequality and help fight poverty?

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Decoupling & the Green Economy

Decoupling is about shifting from *debt-financed consumption* (which is unsustainable) as the primary economic driver of our economies, to *sustainability-oriented investments* in innovation as the primary economic driver of our economies.

This unites the developed & developing world:

- provides developed economies with a way out of the recession by creating new opportunities for investment, &
- it ensures that poverty is eradicated in the developing world using policies that result in real resource efficient growth rather elite consumption premised on new infrastructures that foster resource & energy intensive growth

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