

# The Need for Green Technologies

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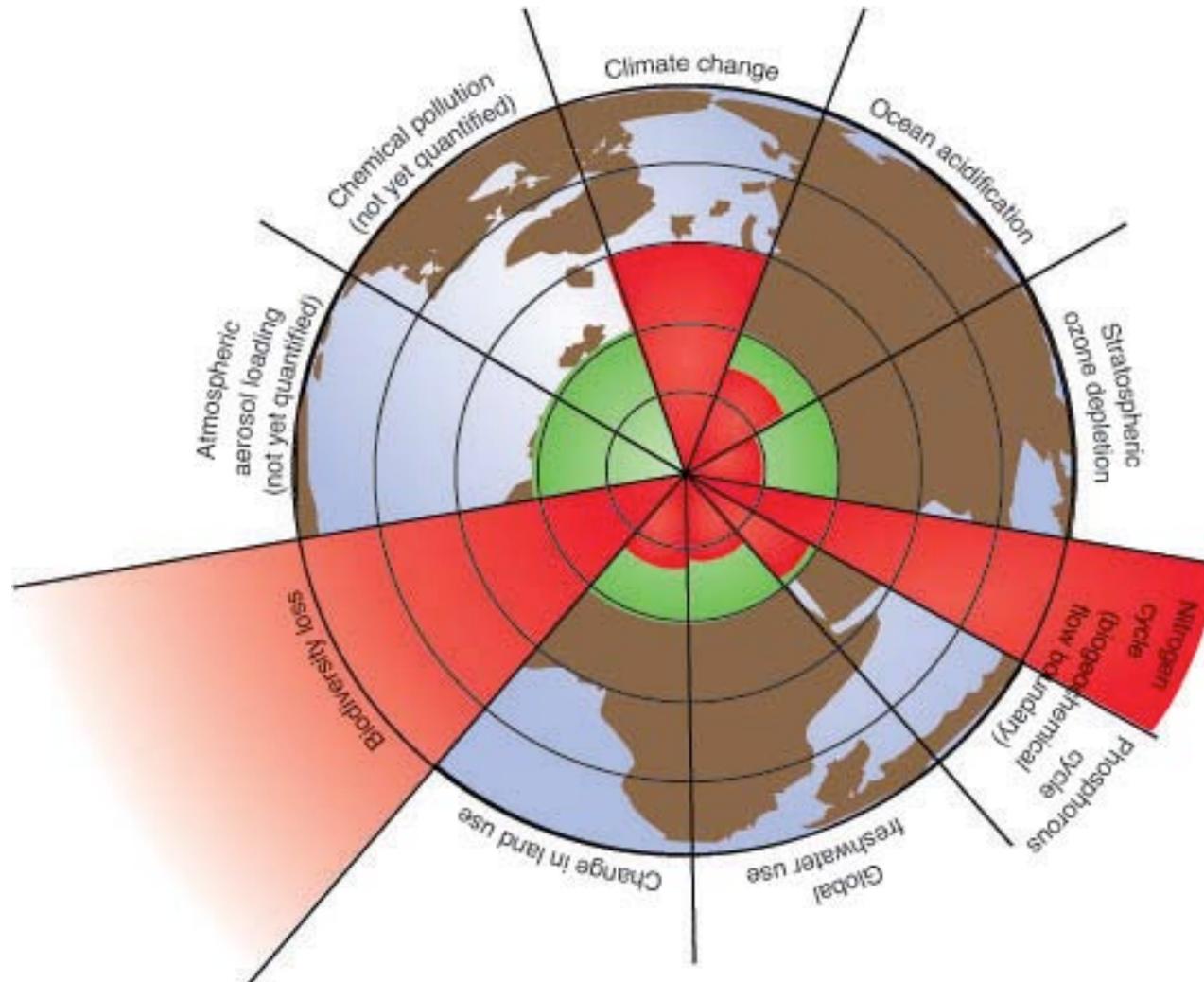
Green Technologies: Drivers, Barriers and Gatekeepers  
ASSAf / Dept of Science and Technology Symposium, 10<sup>th</sup> Sep 2013



# Overview

1. Global sustainability challenges
2. Sustainable innovation: some considerations
3. Conclusions

# Planetary boundaries



Source: Rockstrom et al (2009)

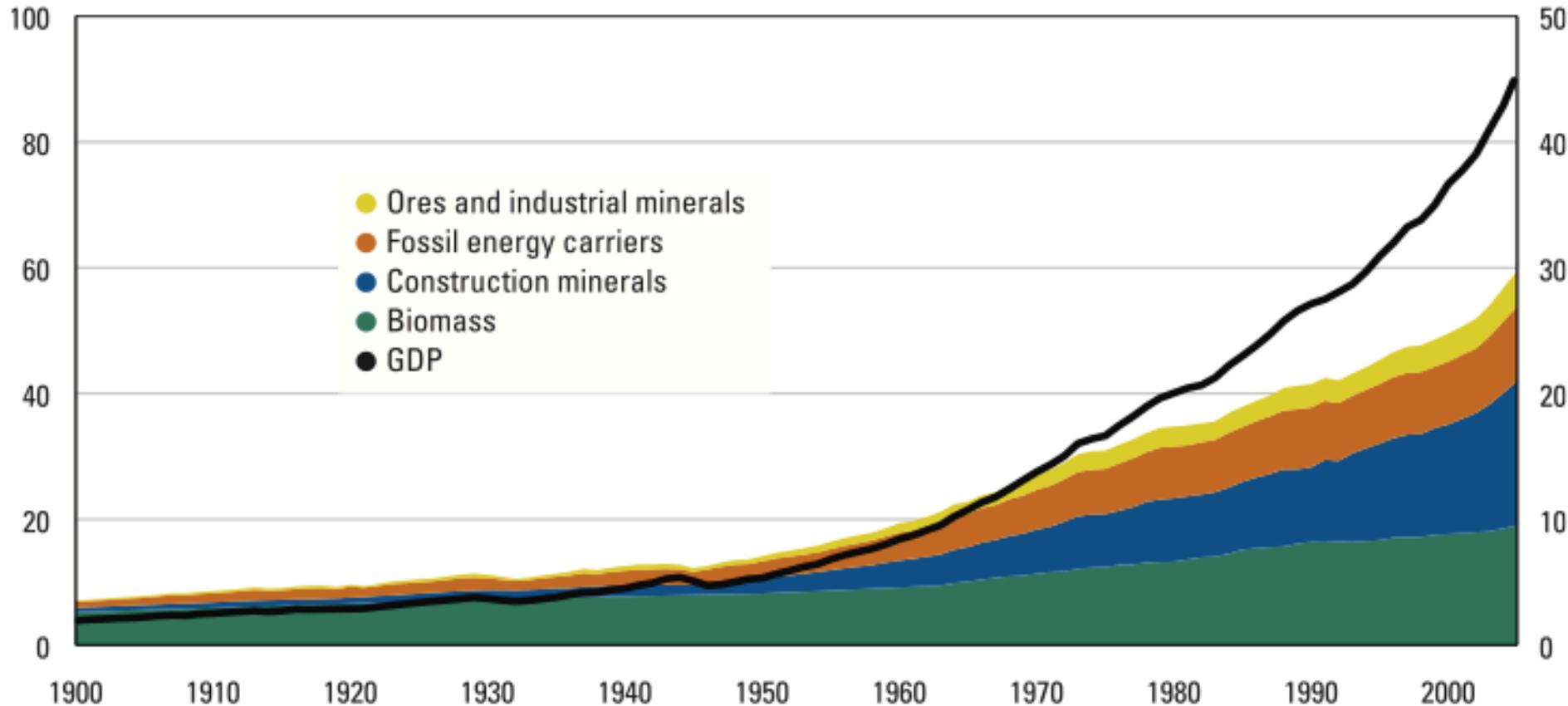
# Global material use continues to rise

## Material extraction

Billion tons

## GDP

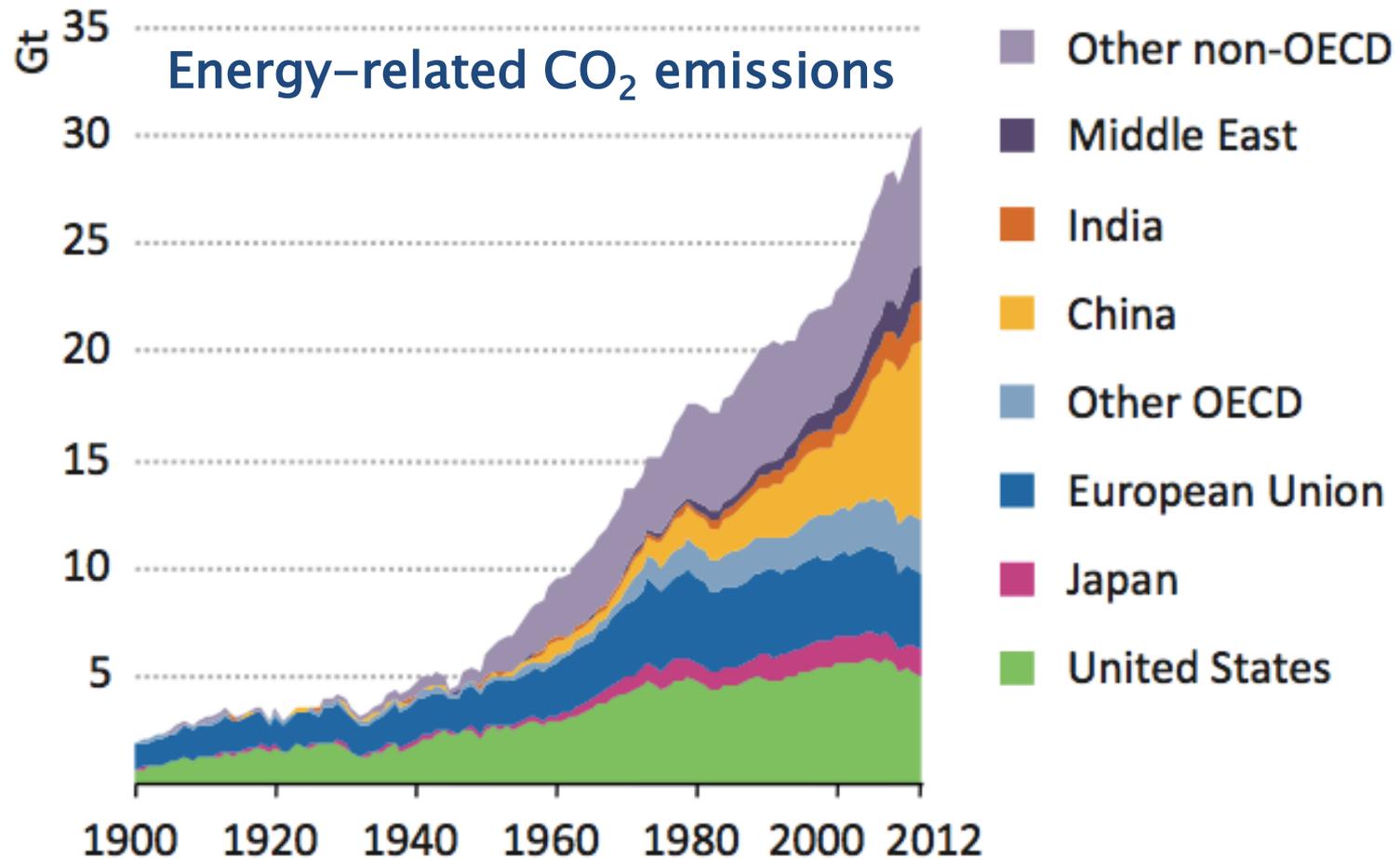
trillion ( $10^{12}$ ) international dollars



Source: Krausmann et al., 2009

(Quoted by UNEP International Resource Panel, 2012)

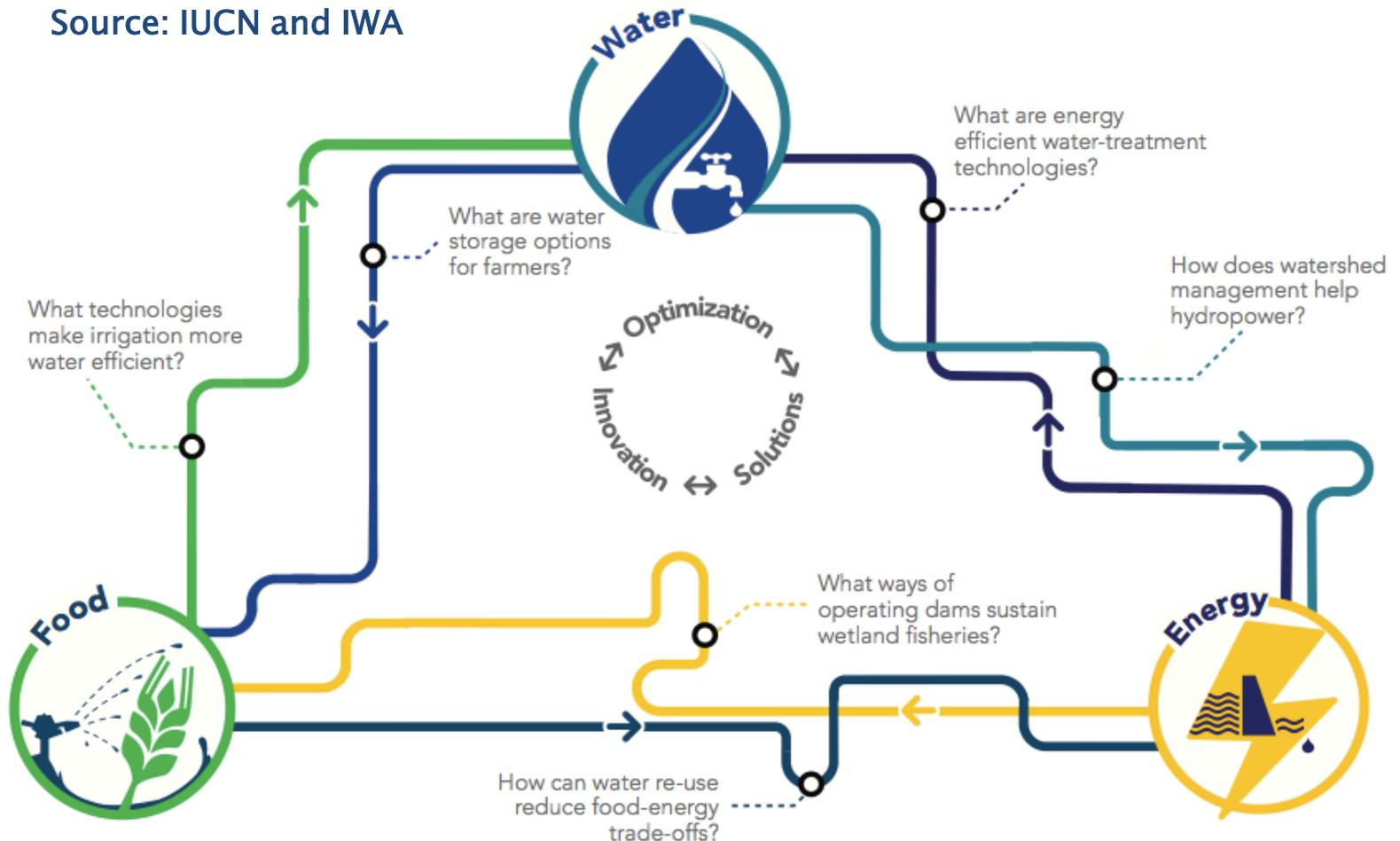
# Greenhouse gas emissions are rising rapidly



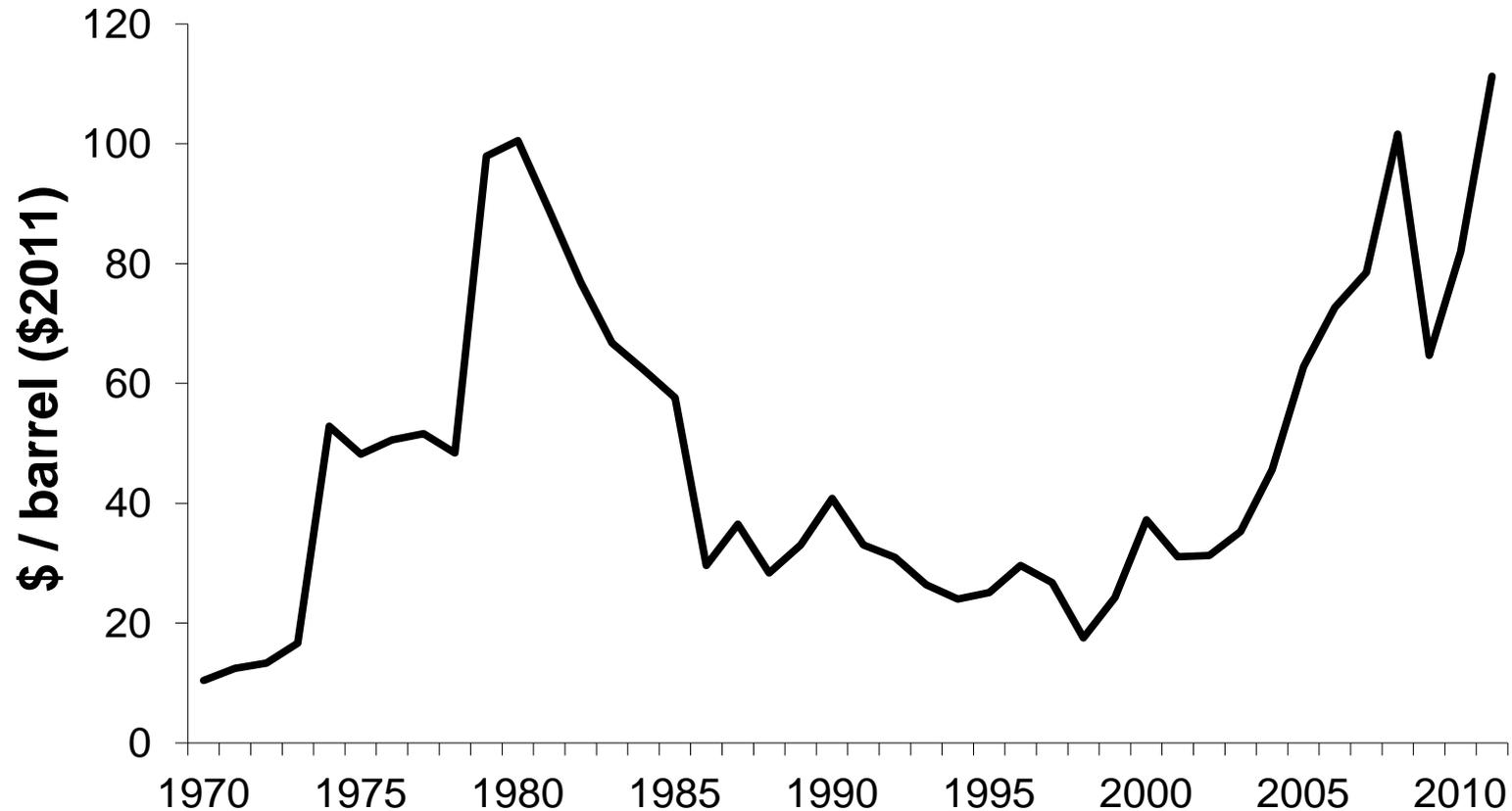
# Resources are interdependent: energy–food–water nexus

Interactions between  
water, energy and food

Source: IUCN and IWA

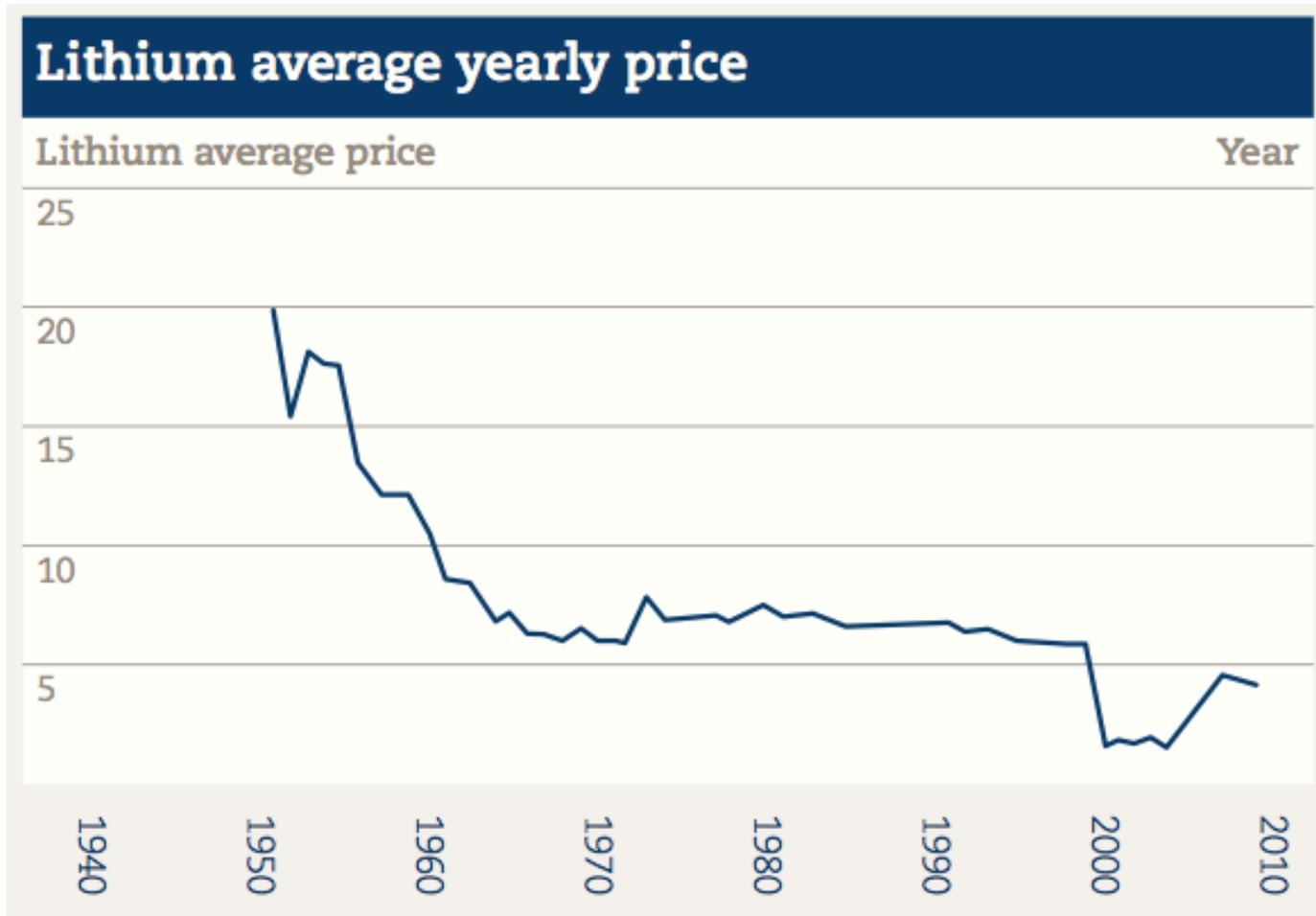


# Rising consumption = rising prices? Oil prices (1970–2011)



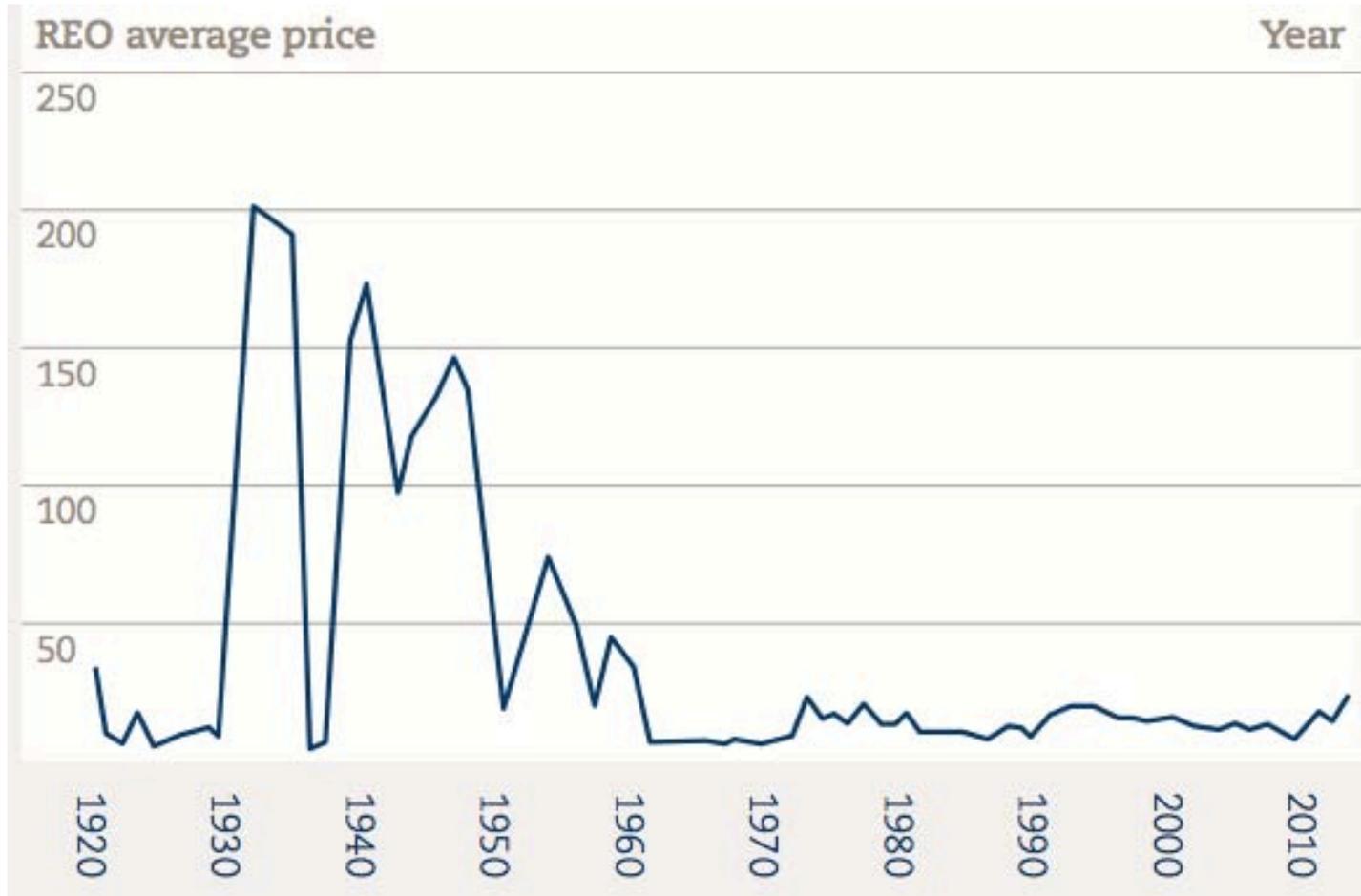
Source: BP Statistical Review of World Energy (2011)

# Rising consumption = rising prices? Lithium prices (1950–2010)



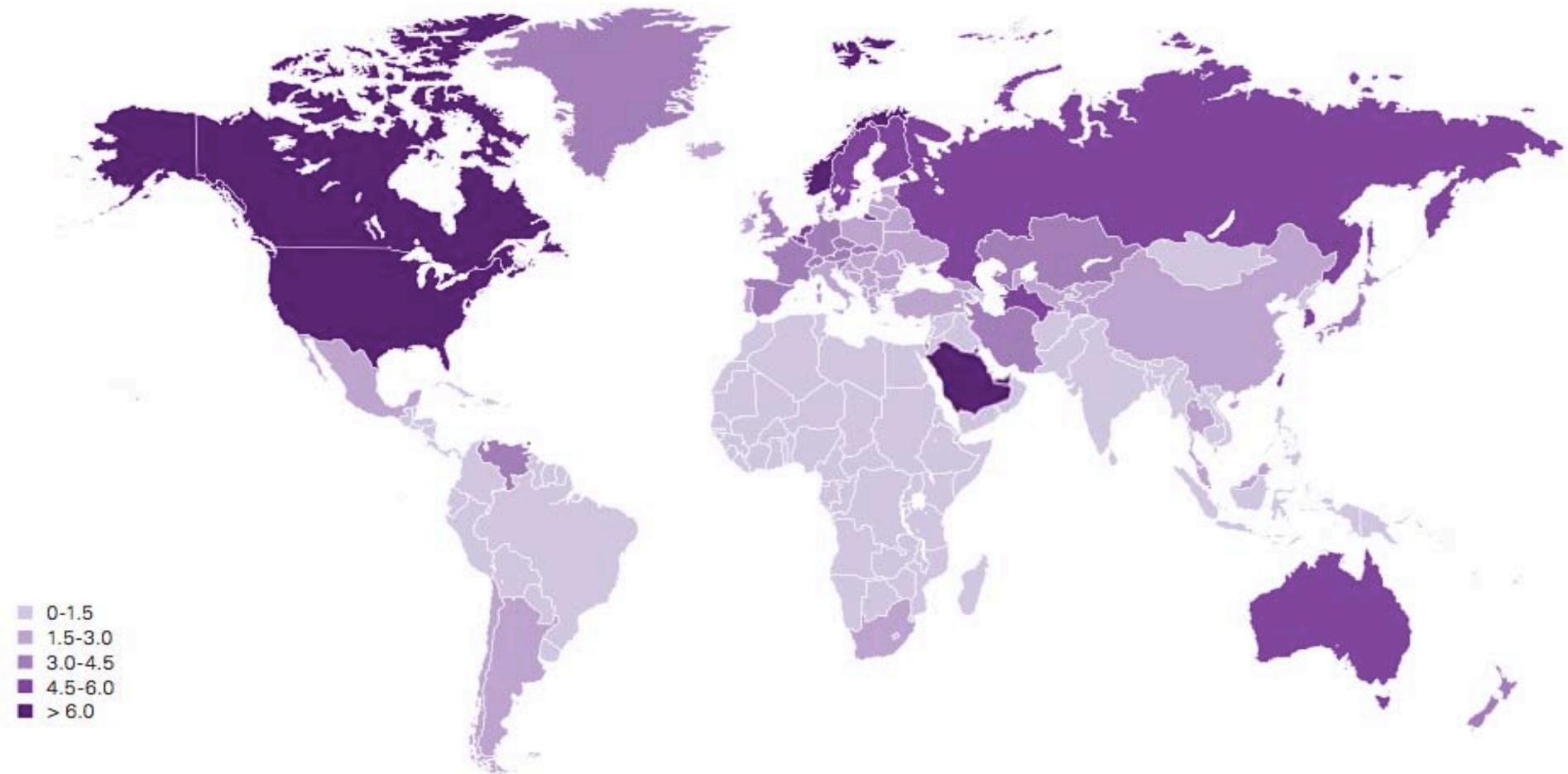
Source: UKERC Materials Availability Handbook (2013)

# Rising consumption = rising prices? Rare earth ore prices (1920–2012)



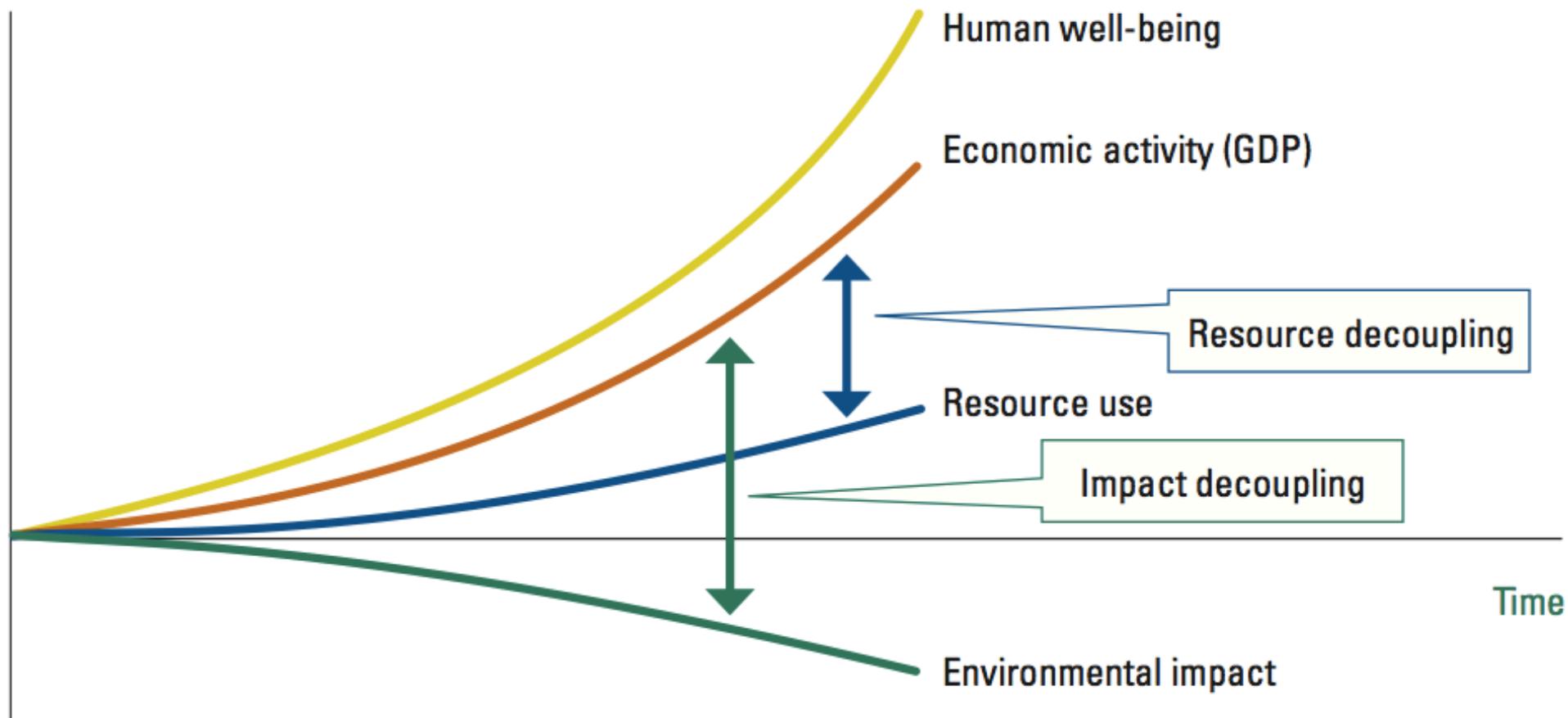
Source: UKERC Materials Availability Handbook (2013)

# Access to resources is not equitable: The case of energy consumption



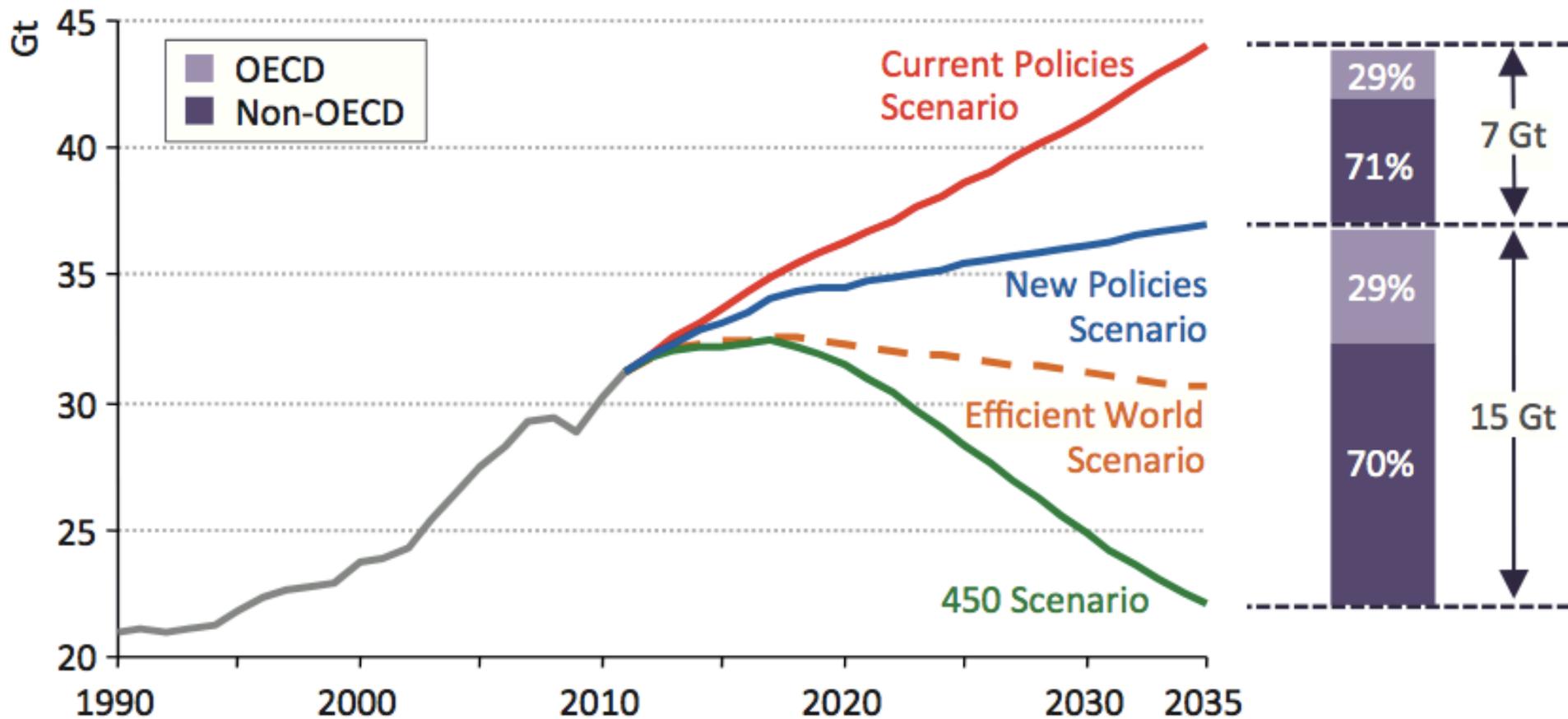
Per capita consumption, 2011 (mtoe) from BP Statistical Review of World Energy (2012)

# Can resource use be decoupled from economic development?



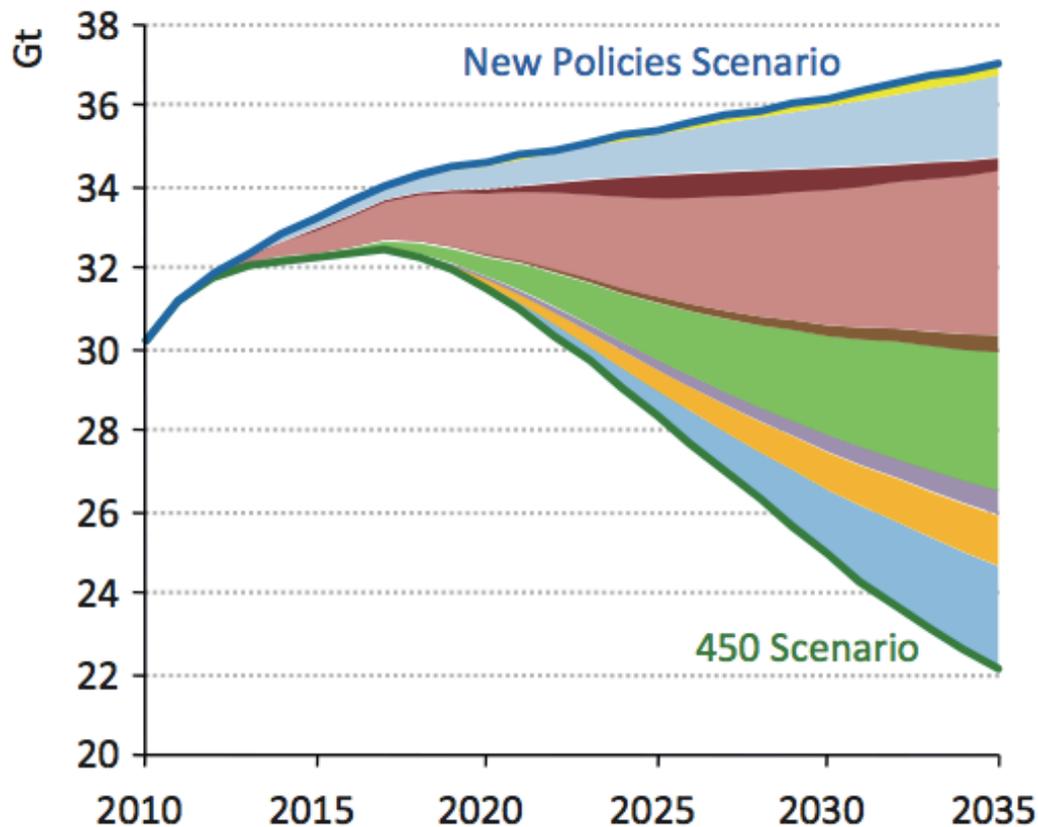
Source: UNEP International Resource Panel (2012)

# Energy and climate change: Resource and impact decoupling needed



Source: IEA World Energy Outlook (2012)

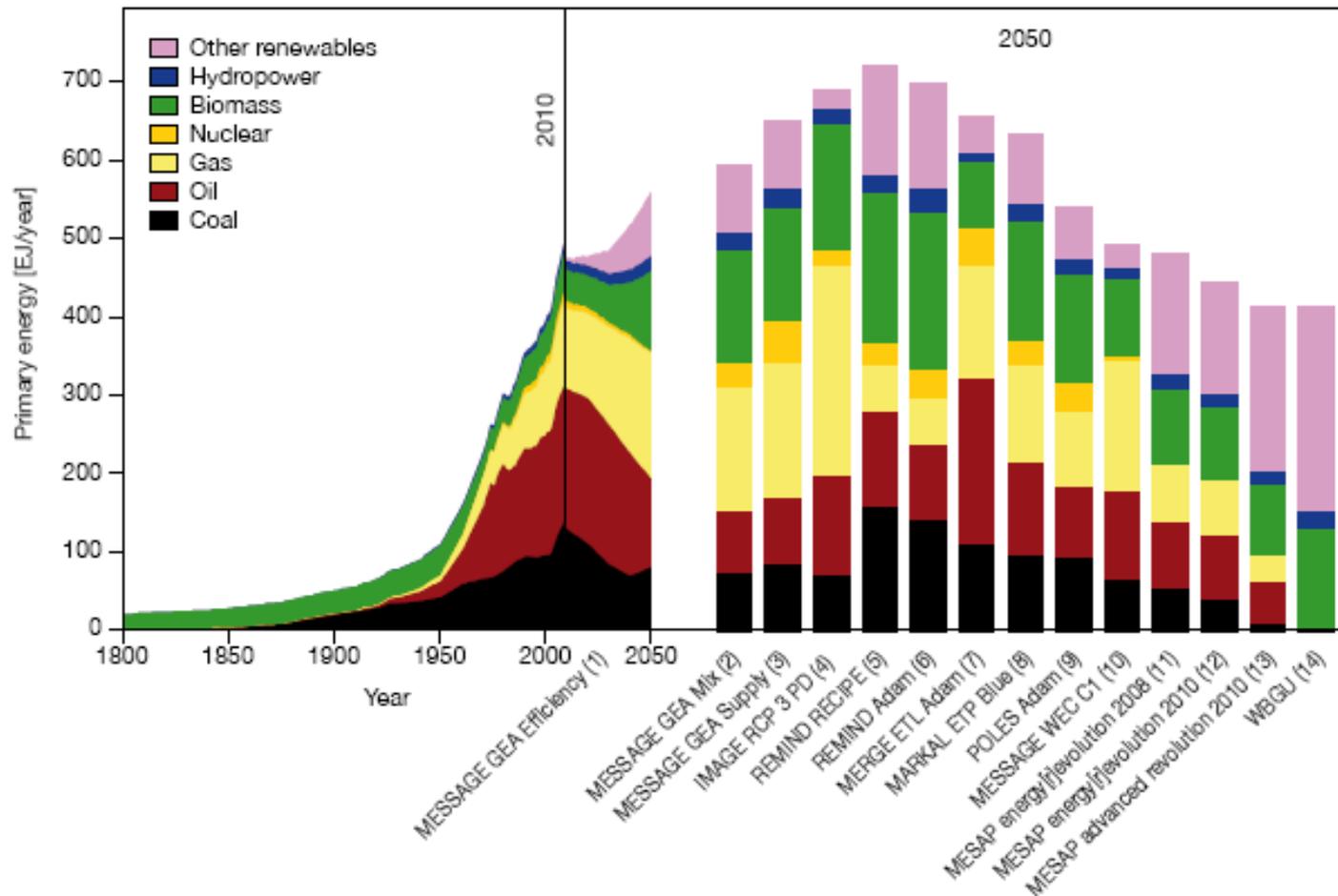
# Different pathways to sustainability



CO <sub>2</sub> abatement	2020	2035
Activity	2%	2%
End-use efficiency	18%	13%
Power plant efficiency	3%	2%
Electricity savings	50%	27%
Fuel and technology switching in end-uses	2%	3%
Renewables	15%	23%
Biofuels	2%	4%
Nuclear	5%	8%
CCS	4%	17%
<b>Total (Gt CO<sub>2</sub>)</b>	<b>3.1</b>	<b>15.0</b>

Source: IEA World Energy Outlook (2012)

# Different pathways to sustainable energy in 2050

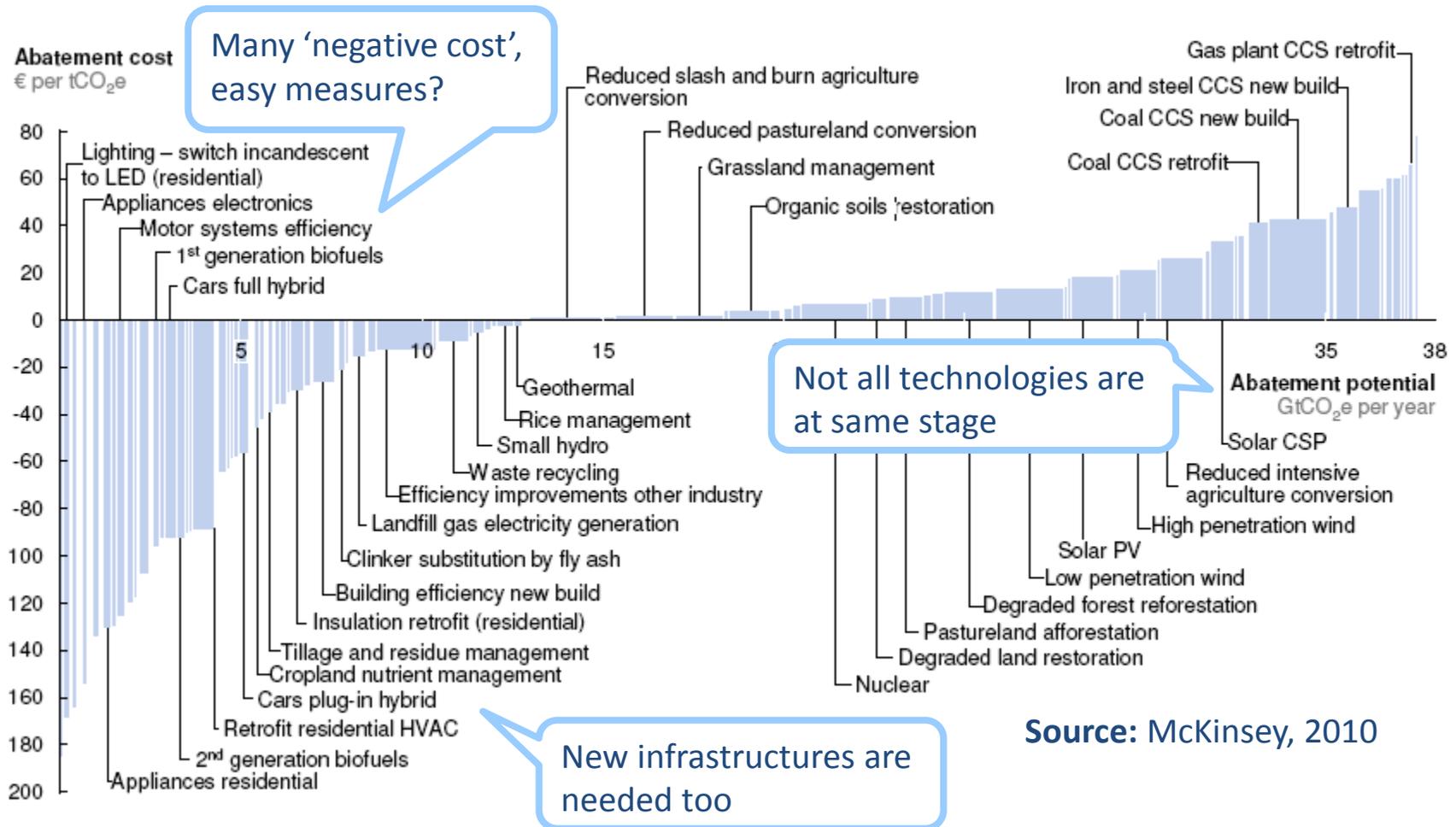


# Innovation in 'green technologies': some considerations

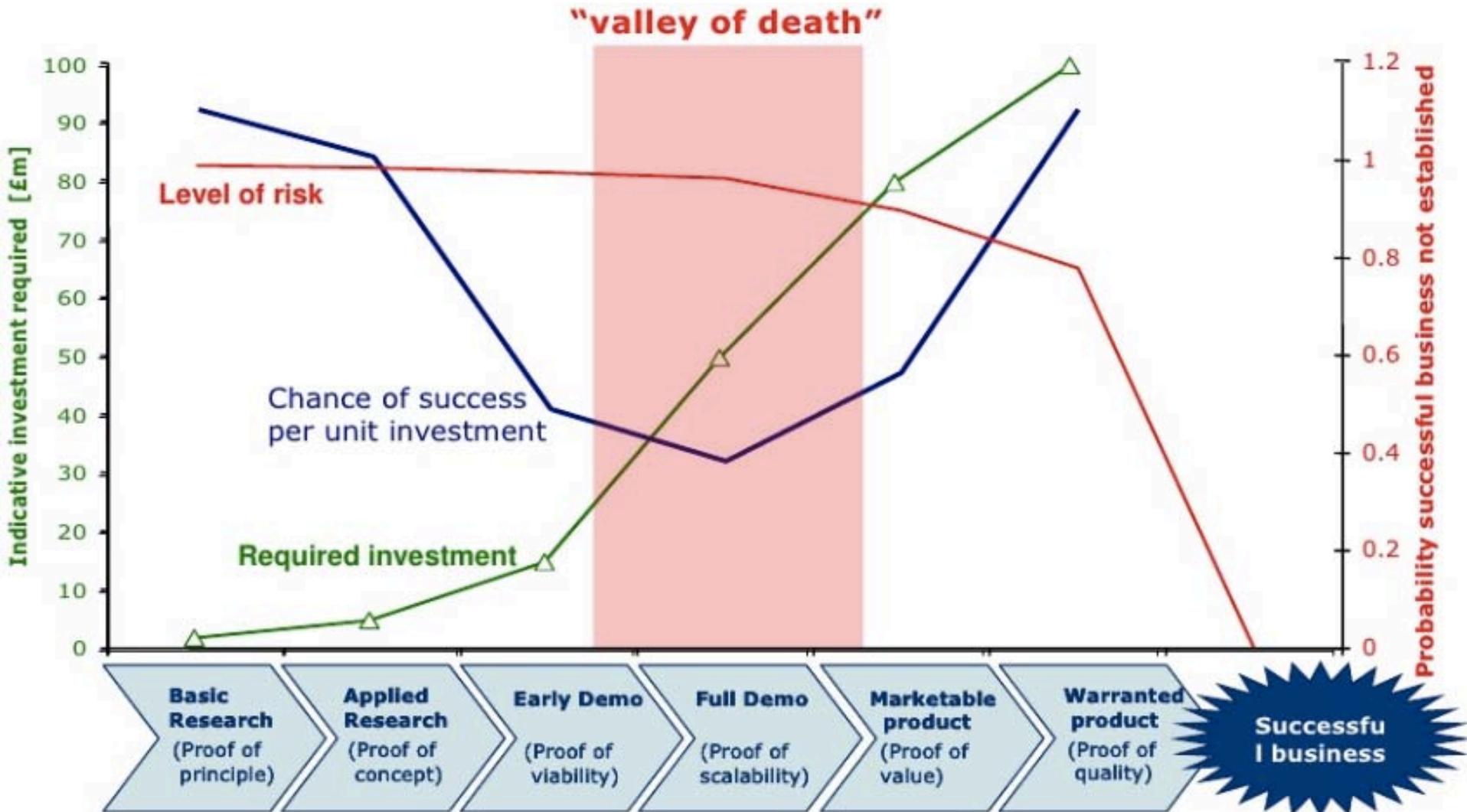
# 1. Innovation systems

- Innovation covers a spectrum of ‘technology stages’: from R&D to commercial deployment
- Innovation is not a linear process – it is networked and involves multiple relationships between actors
- Innovation can include the development of new technologies and products; but also associated social, institutional and organisational changes
- Increasing recognition that government policy has a role to play in supporting innovation at many stages

# 2. Green innovation will be diverse: Carbon abatement technologies

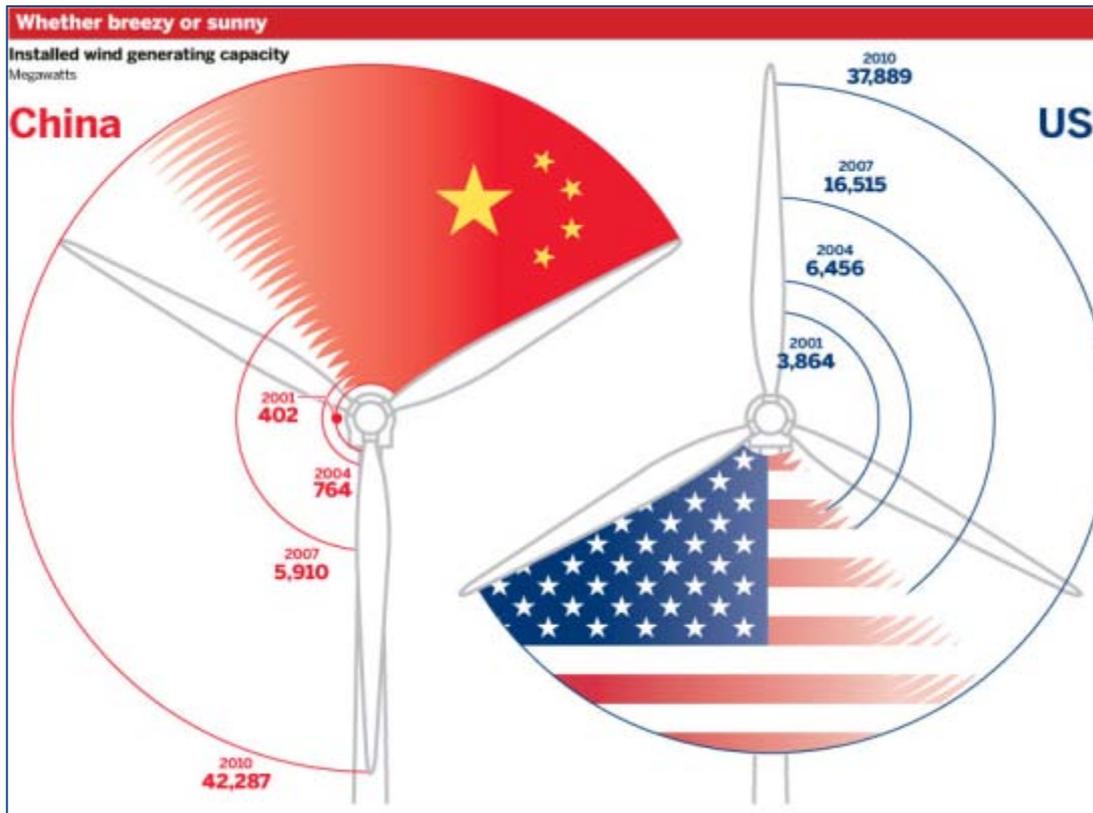


# 3. From R&D to deployment: An uncertain (and expensive) road?

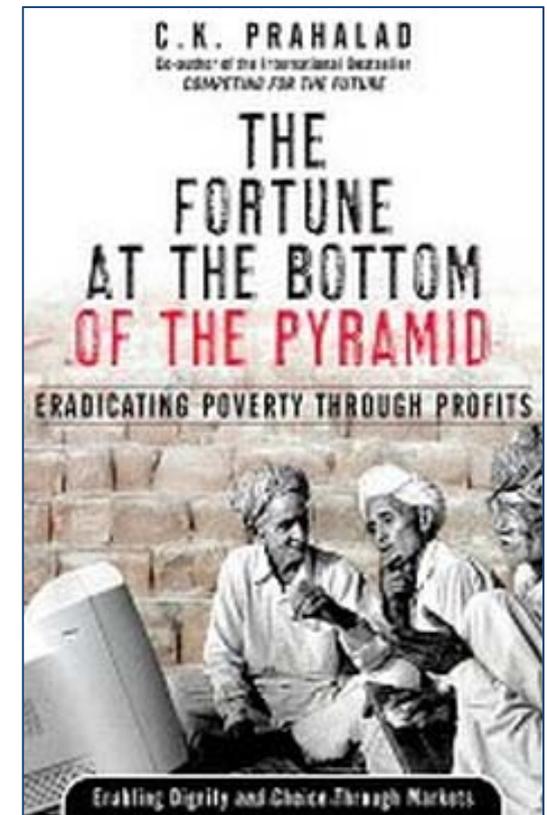


Source: The Carbon Trust

# 4. Globalisation of innovation: A stronger role for developing countries

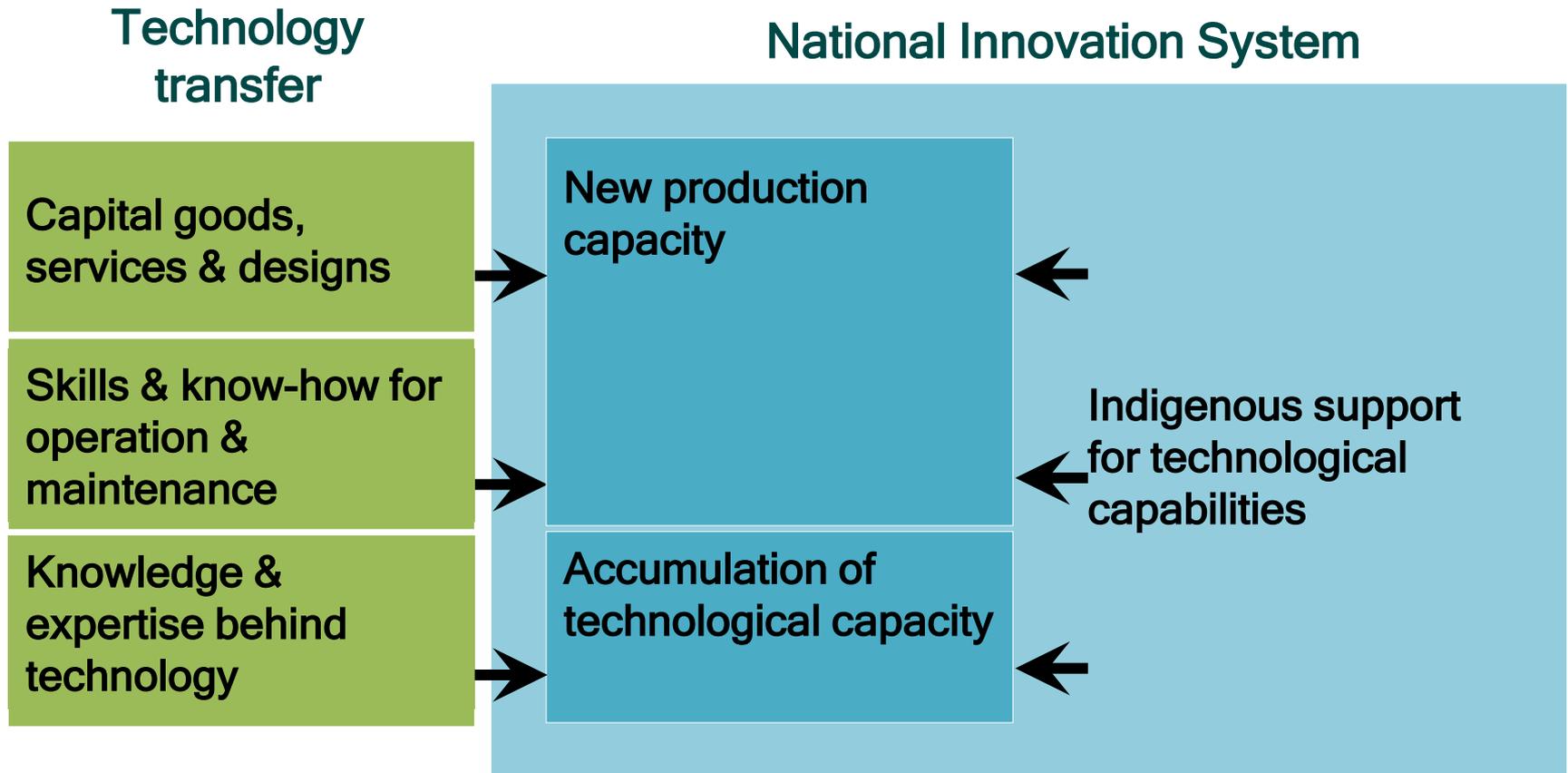


Source: Financial Times, 29<sup>th</sup> Nov 2011



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# 4. Globalisation of innovation: A stronger role for developing countries



# 5. Can green innovation be accelerated?

**‘In many cases, such as driving low-carbon growth or decarbonising energy systems, large scale system-wide changes need to happen in a relatively short space of time. This presents both costs to the environment and potentially costs to growth.’**

**OECD (2011) Towards Green Growth**

# 5. Can green innovation be accelerated?

**‘Industrial economies have become locked in to fossil fuel-based technological systems through path a dependent process driven by technological and institutional increasing returns to scale.**

**This condition, termed carbon lock-in, arises through a combination of systematic forces that perpetuate fossil fuel-based infrastructures in spite of their known environmental externalities and the apparent existence of cost-neutral or cost effective remedies’**

**Greg Unruh (2000) ‘Understanding carbon lock-in’**

# Conclusions

- The world faces a series of related sustainability challenges, many of which require urgent action
- There's a need to use resources more efficiently and mitigate the impacts of resource use
- Green innovation will be essential in many sectors to meet these challenges successfully
- Actions by government, businesses and civil society will need to take into account national, sectoral and other differences between technologies and contexts
- In many cases, systemic change will be required to decouple growth from negative environmental impacts

# Thanks

<http://www.ukerc.ac.uk>

<https://twitter.com/watsonjim2>

