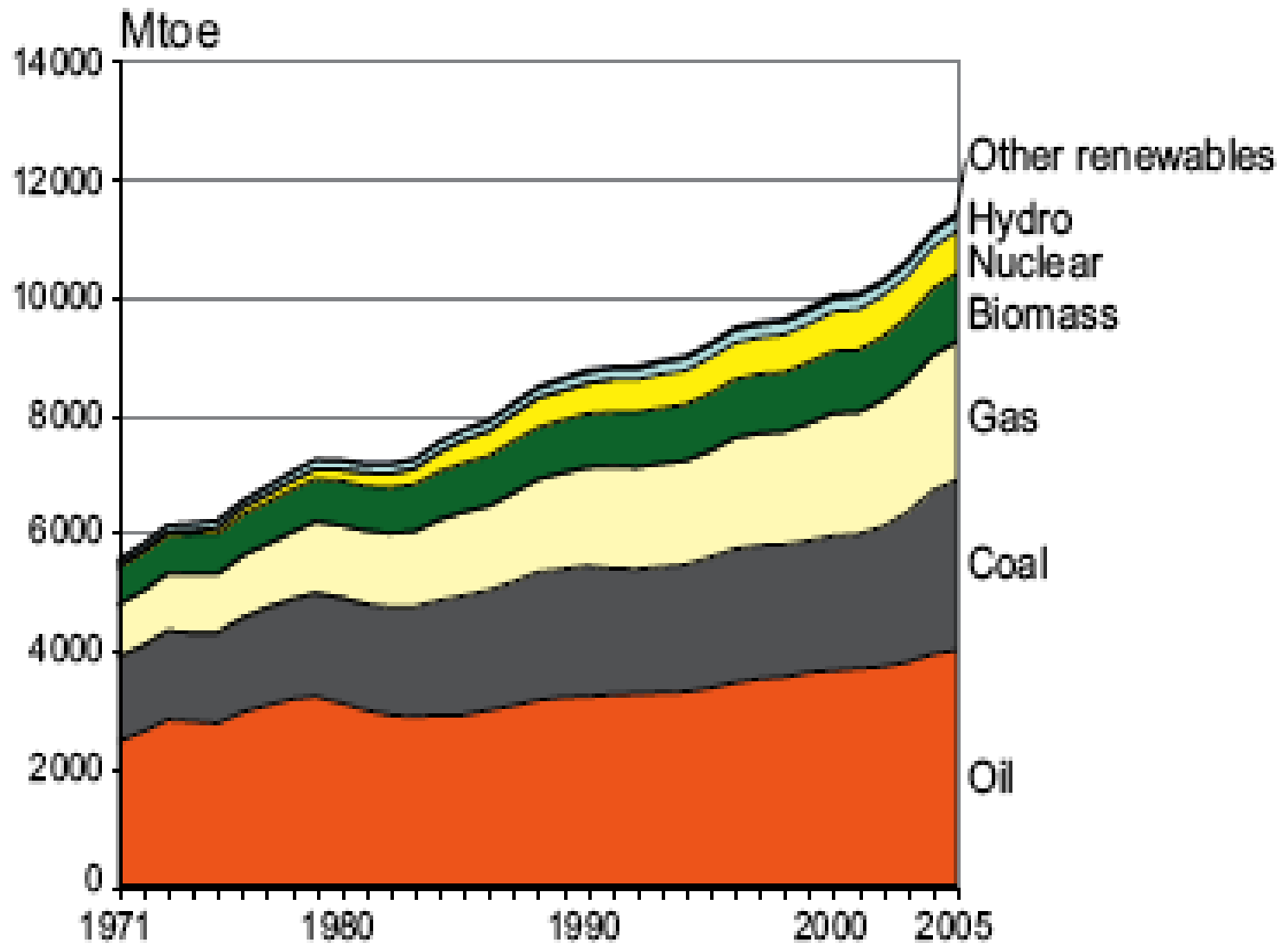


Energy, development and climate change

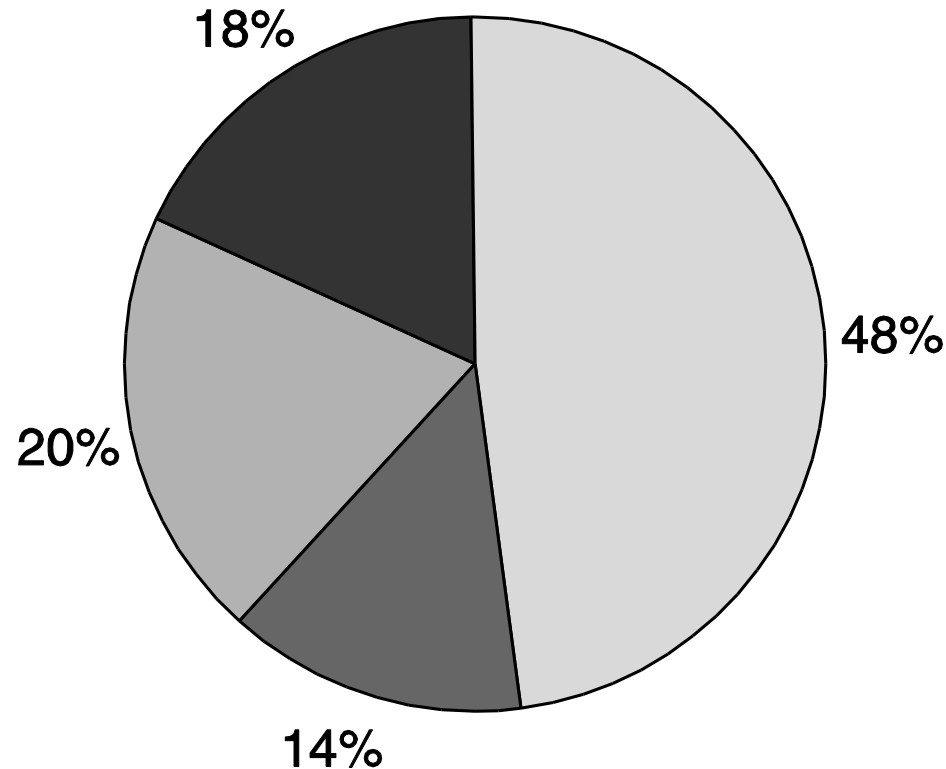
Sustainable energy and climate change
mitigation course

Dr. Bert Metz
CEU, March 2011

Sources of primary energy

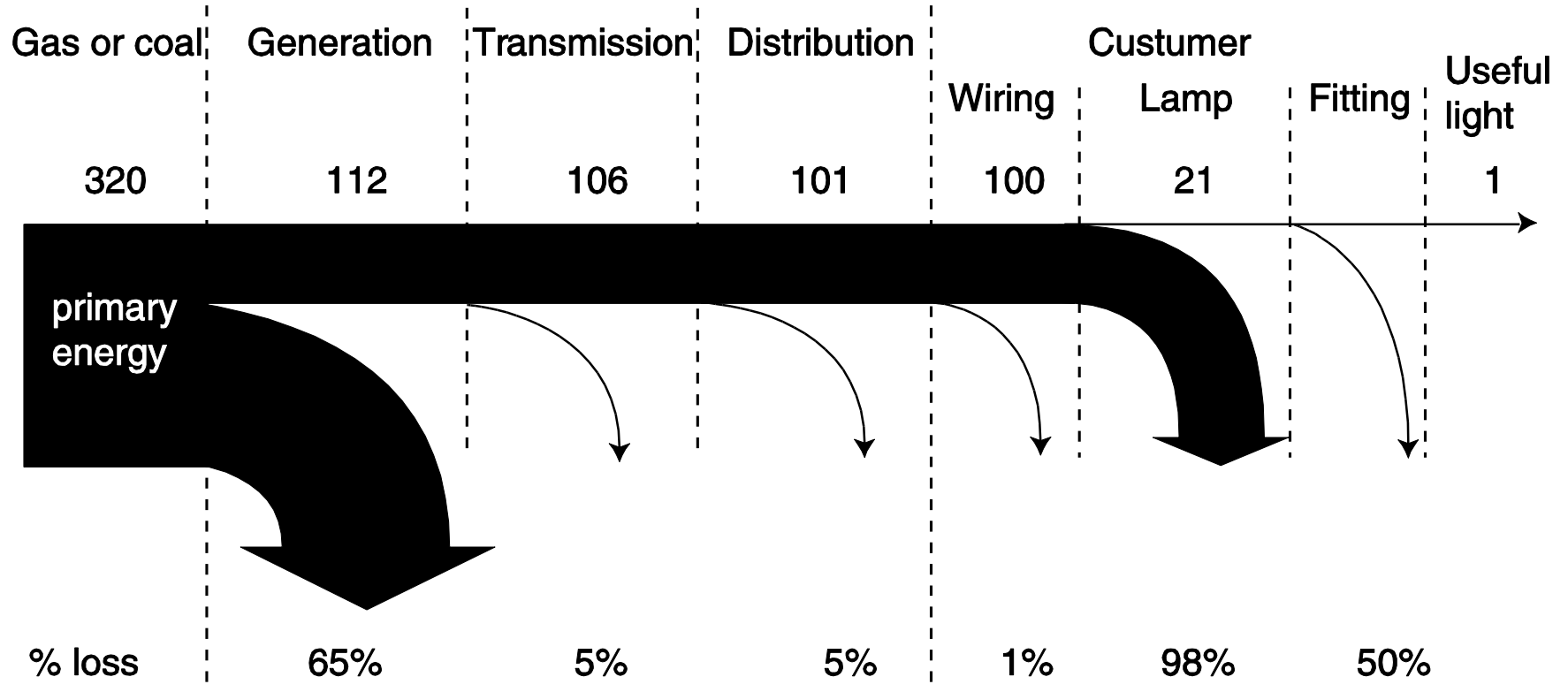


Primary energy use in major economic sectors

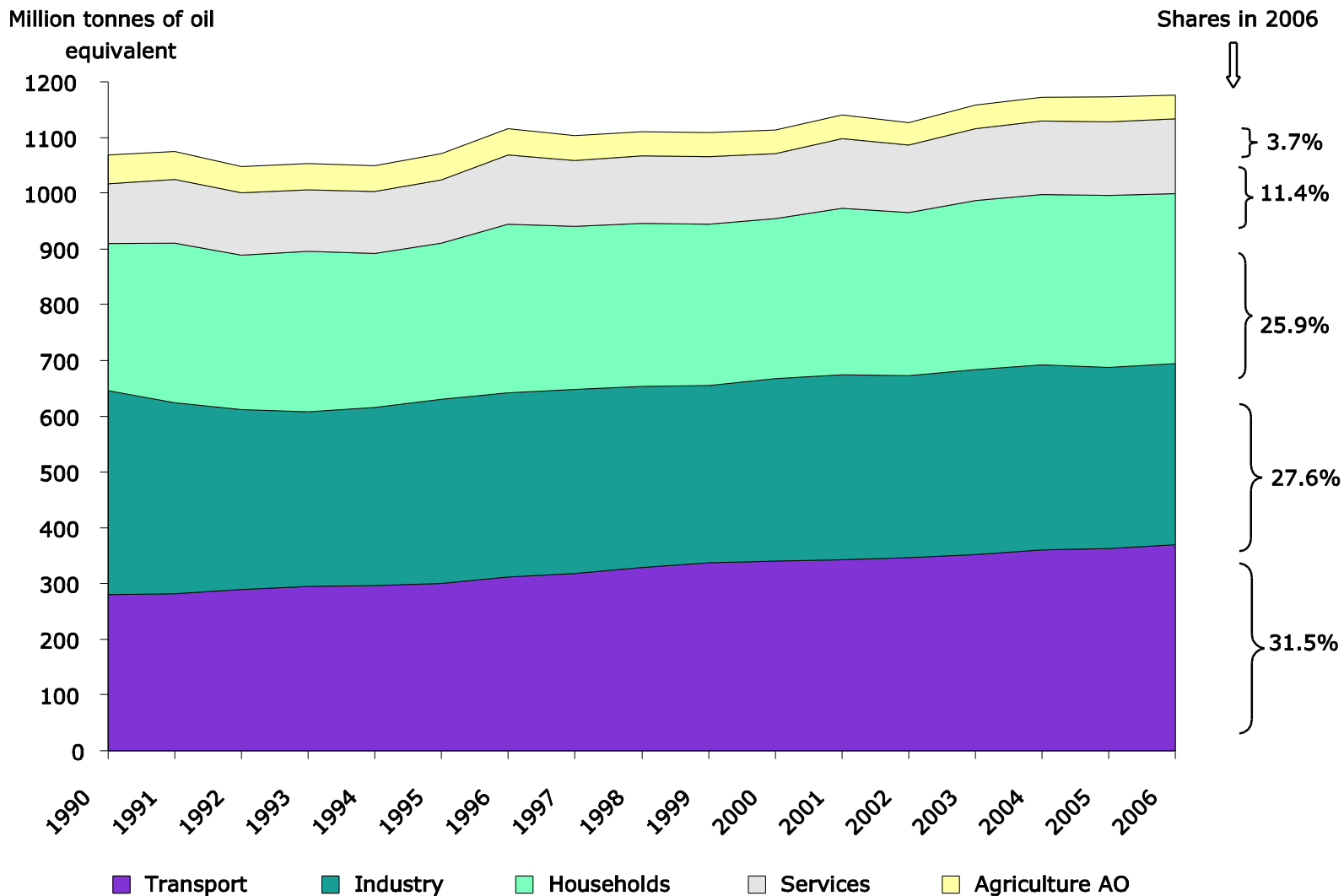


Energy supply Industry Transport Residential/services

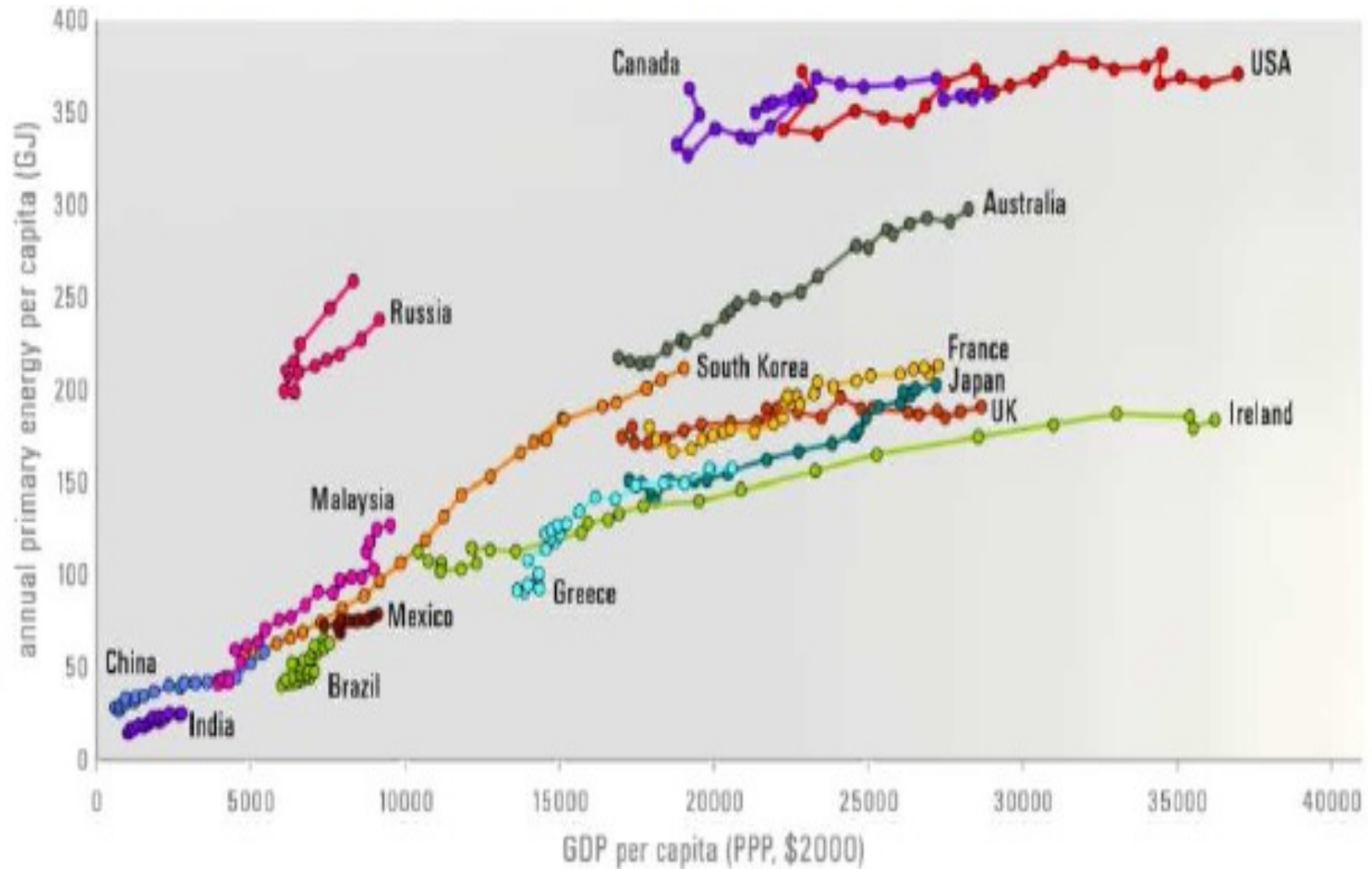
Primary energy, final energy and energy service



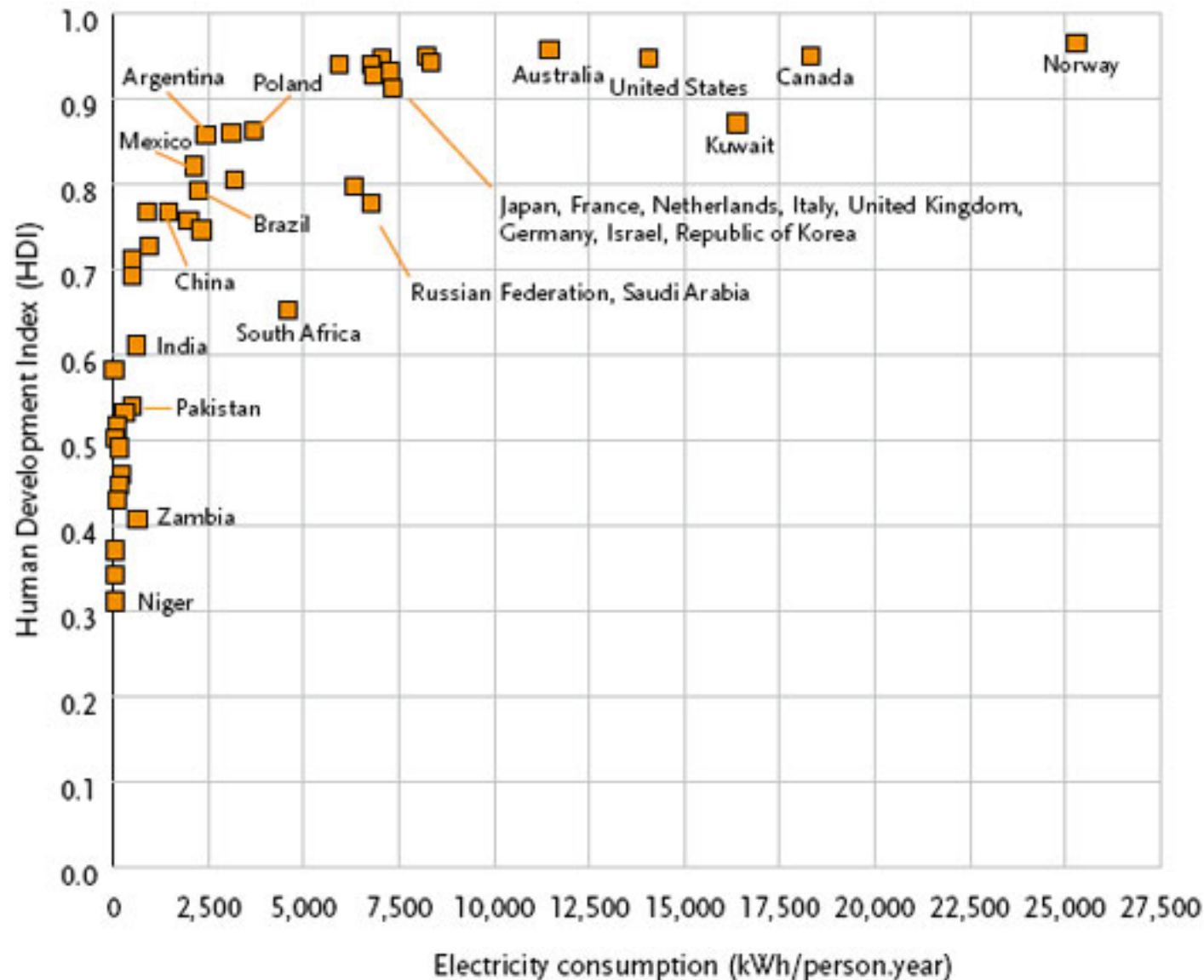
EU 27 final energy by sector



Primary energy and per capita income

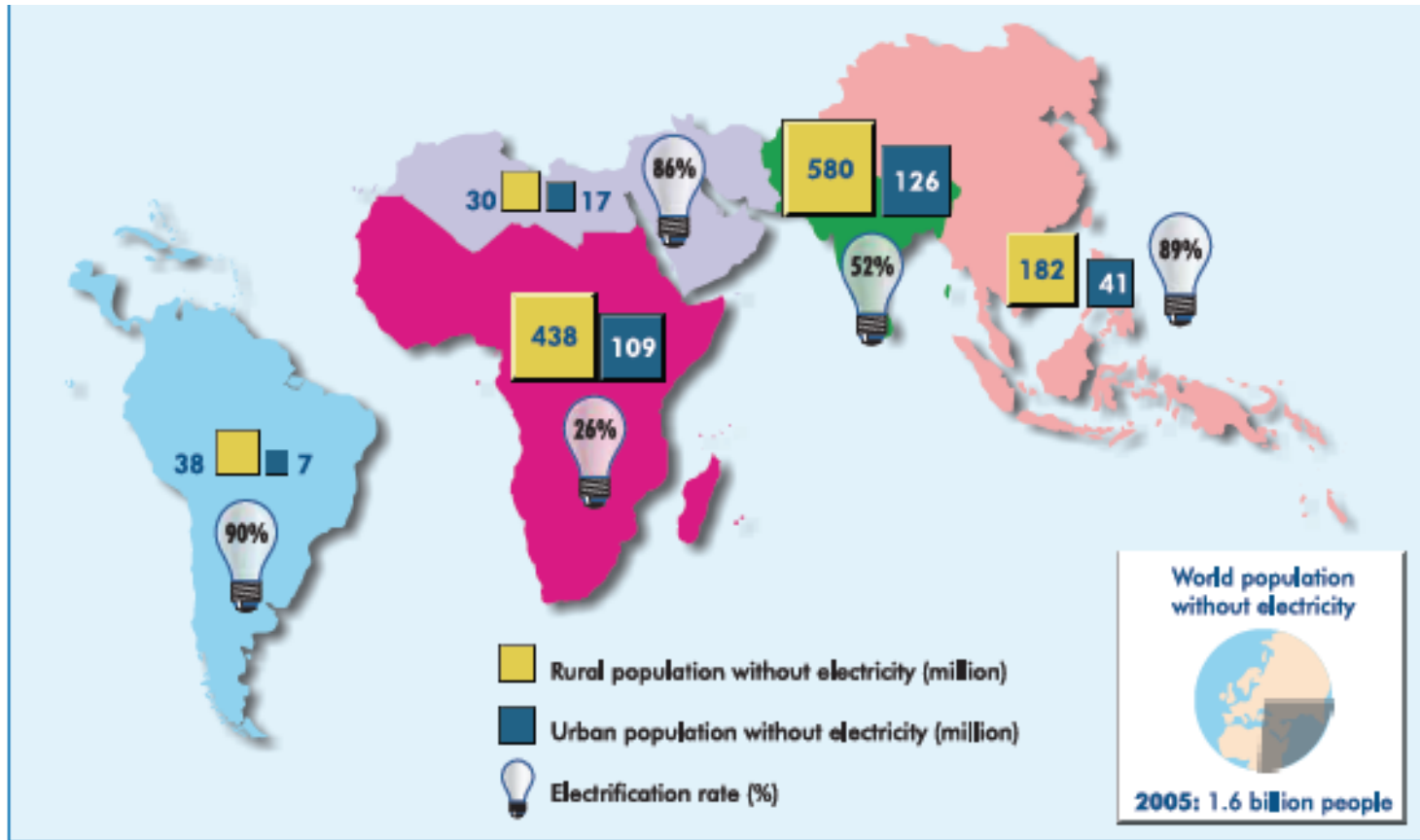


HDI and electricity use per capita, 2003/2004

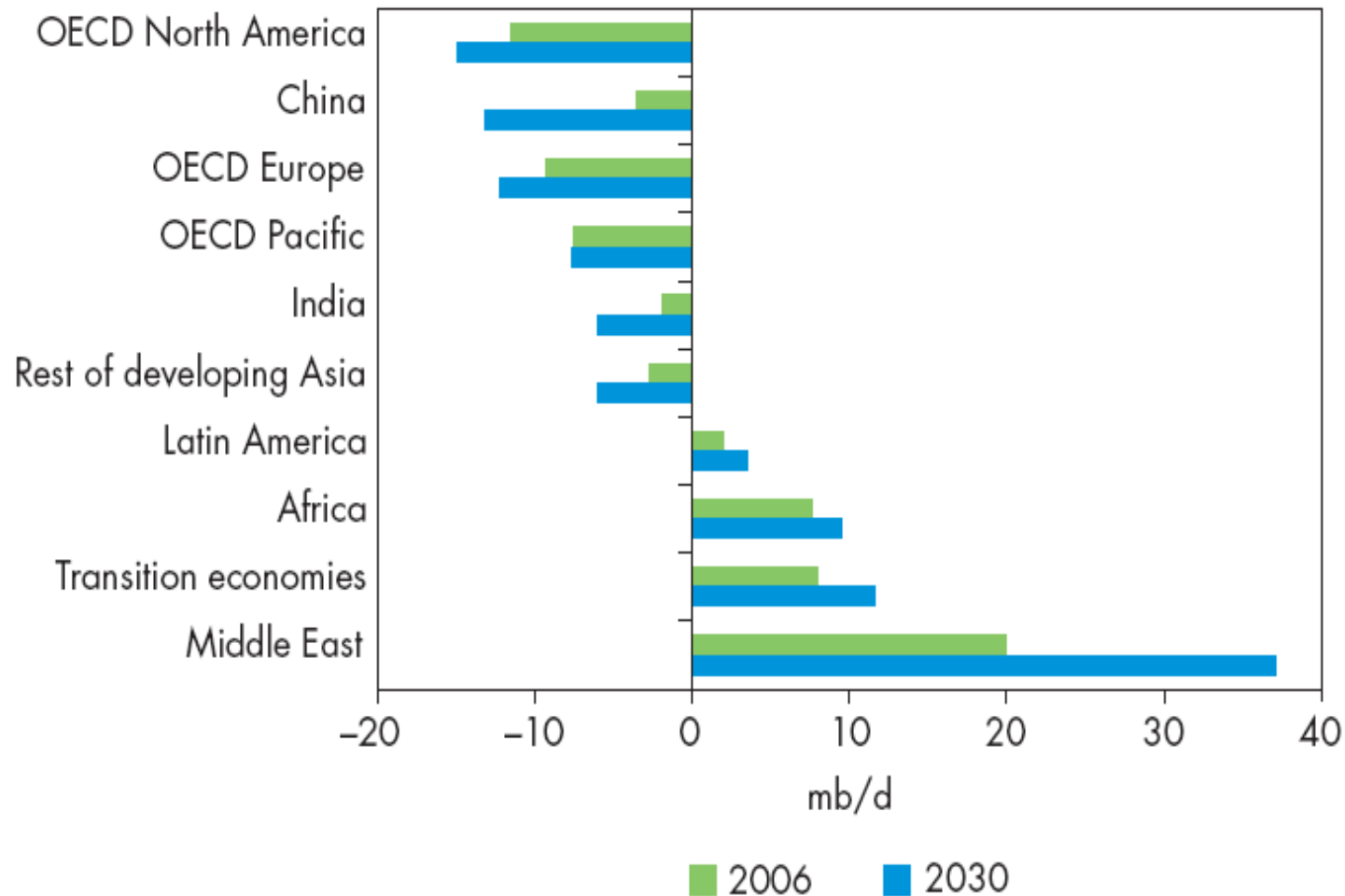


Source: UNDP, 2006

Access to electricity



Energy security: oil imports and exports



*Trade between WEO regions only. Negative figures indicate net imports.

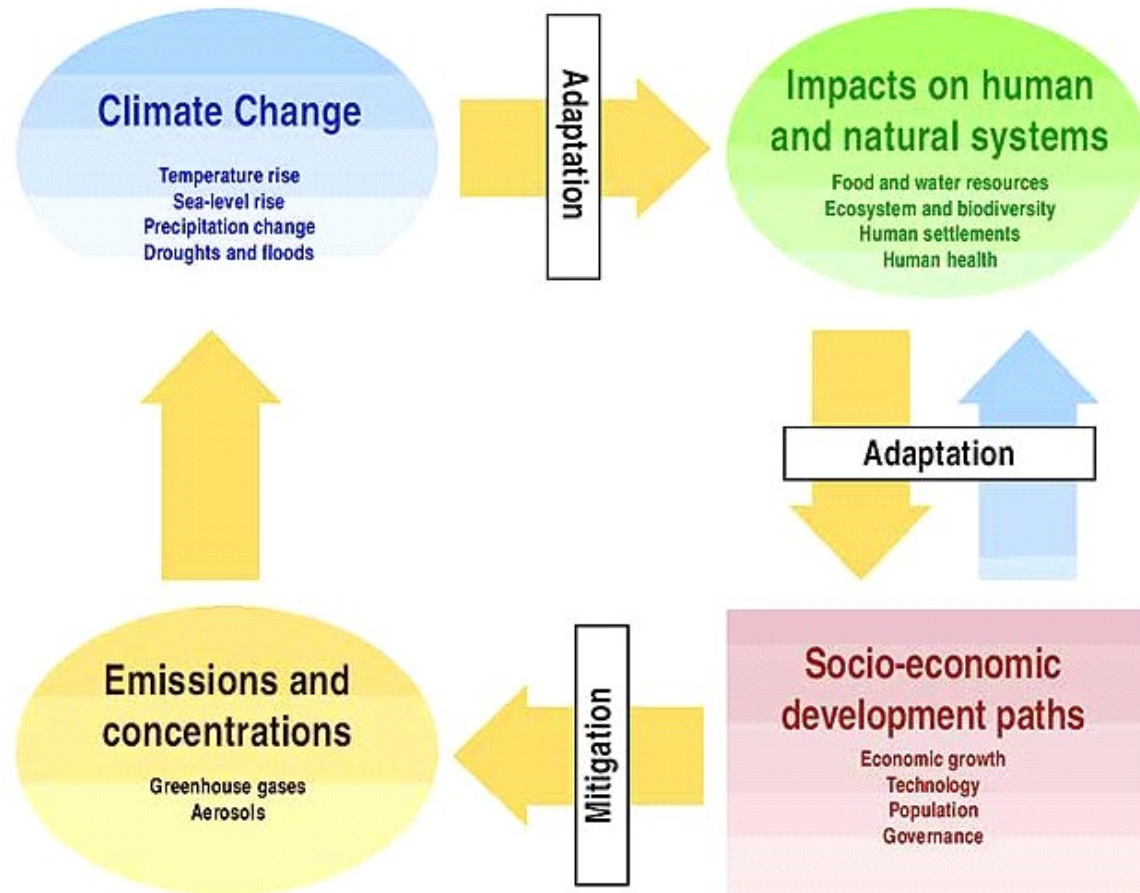
World coal reserves

Country	% of world reserves
USA	27
Russia	17
China	13
India	10
South Africa	5
Ukraine	4
EU	4
Kazachstan	3

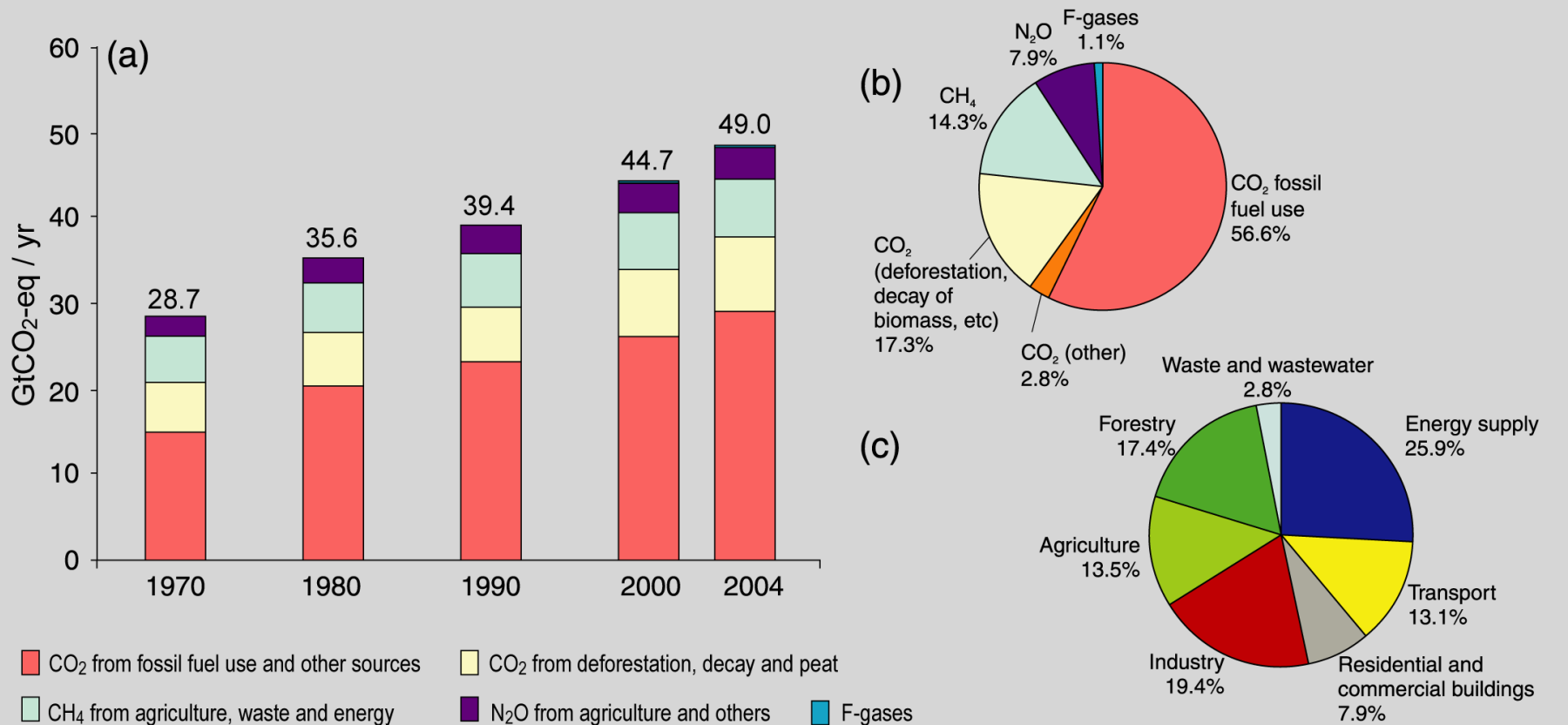
Natural gas import dependency

Region	% of demand imported currently	% of demand imported 2030 BAU
Japan	97	98
EU	40	70
North America	2	16
China		50
India		60

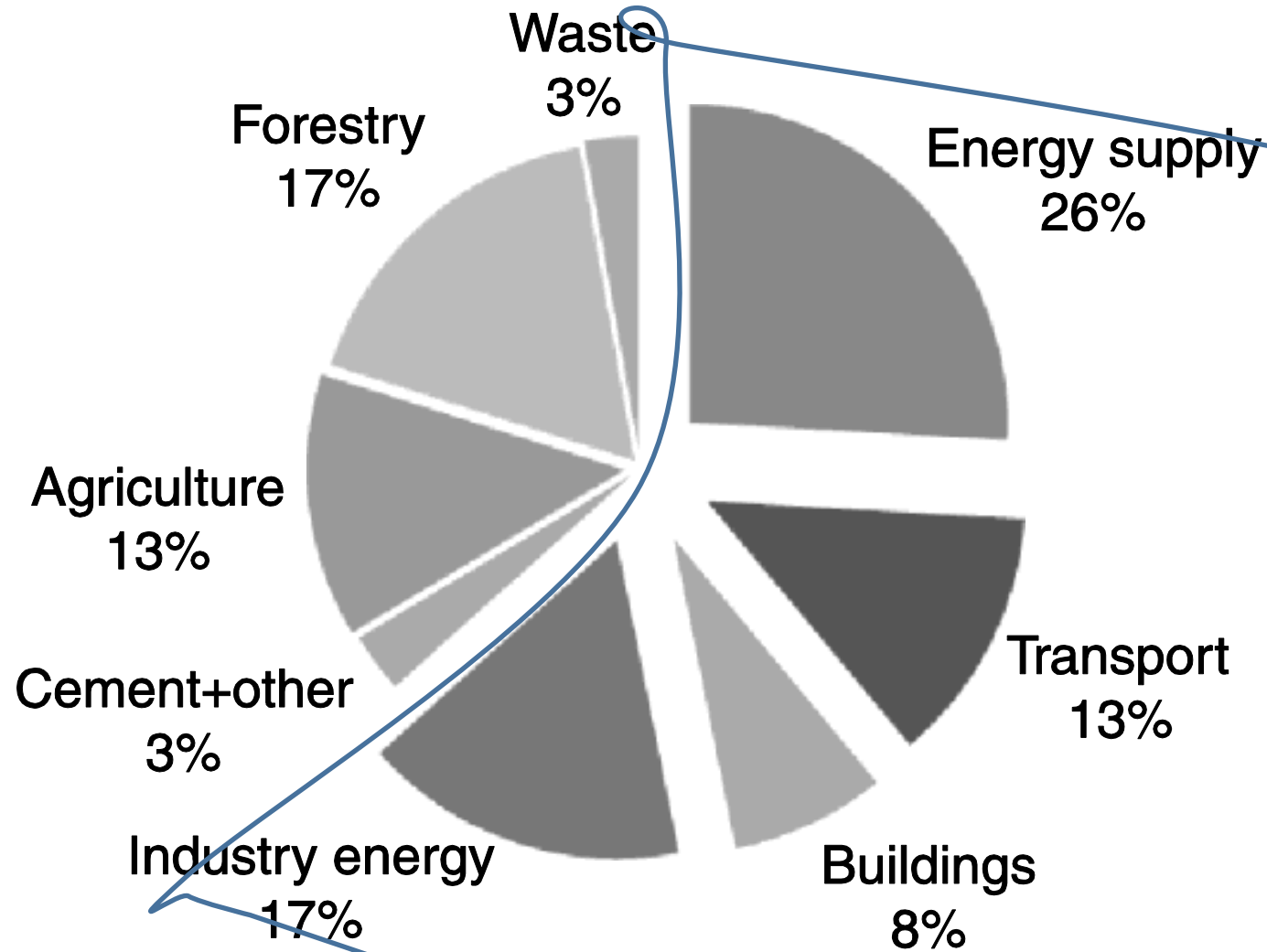
Development and climate change



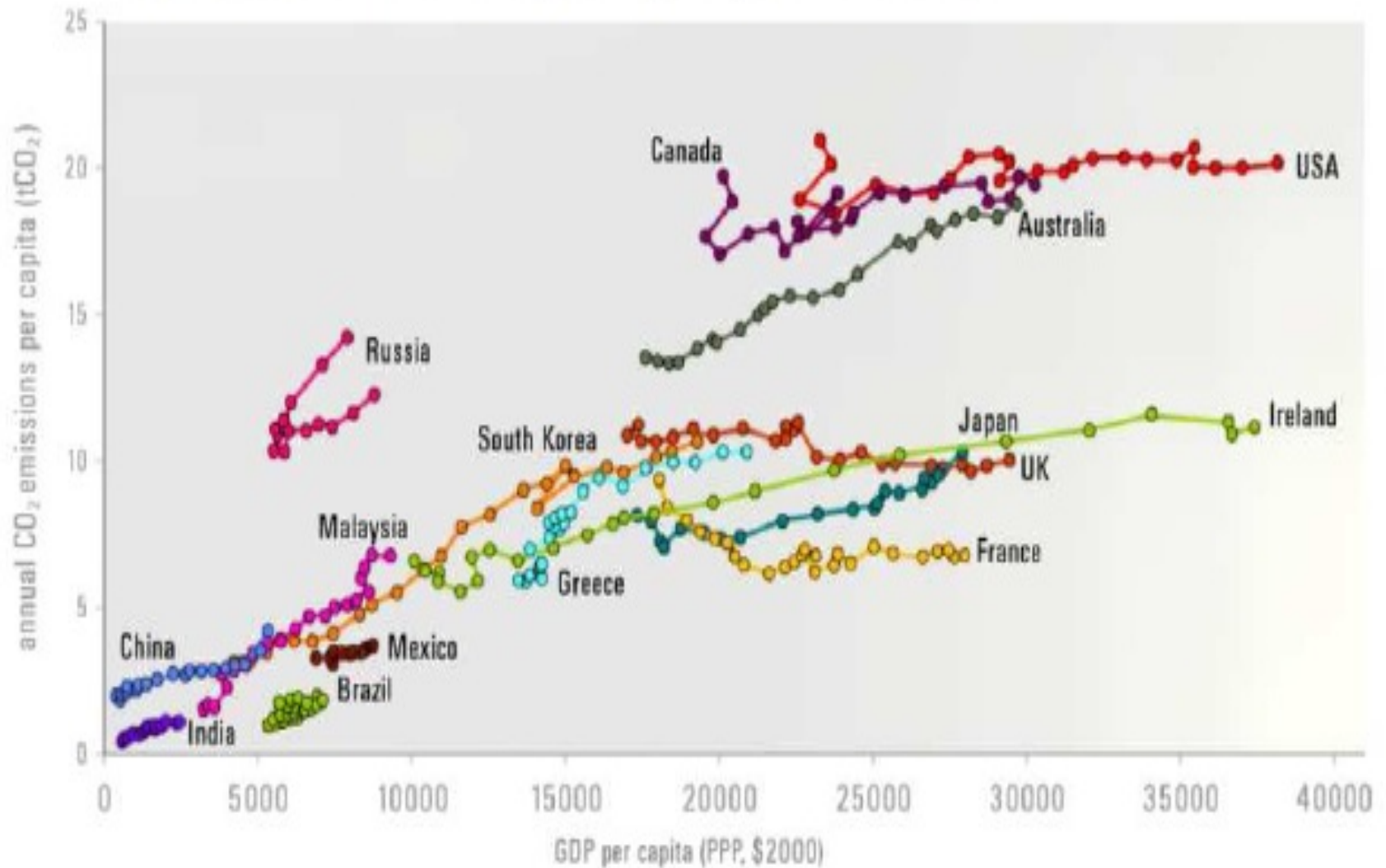
Emissions of Greenhouse Gases increased by 70% between 1970 and 2004



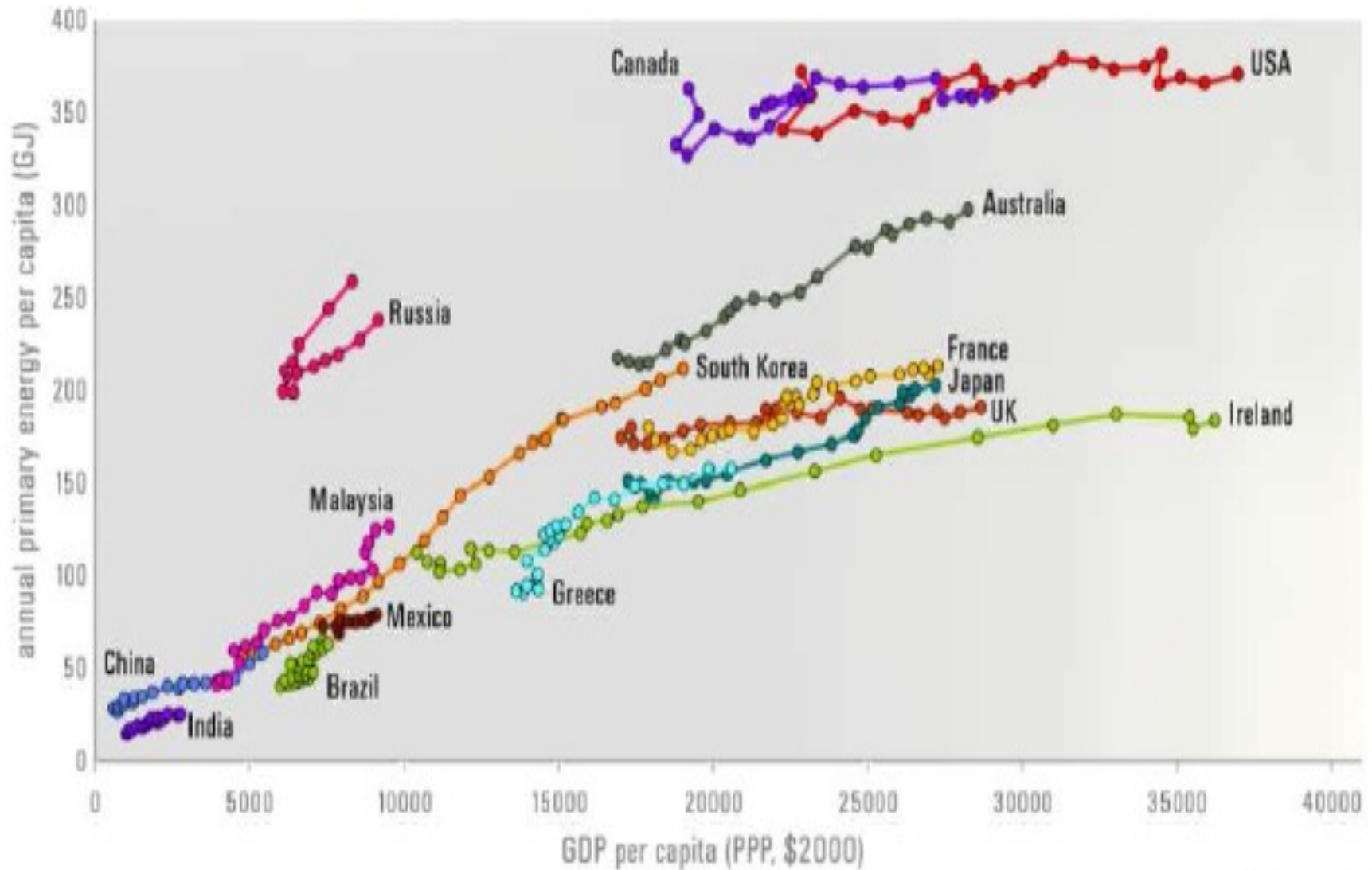
64% of GHG emissions are from energy use



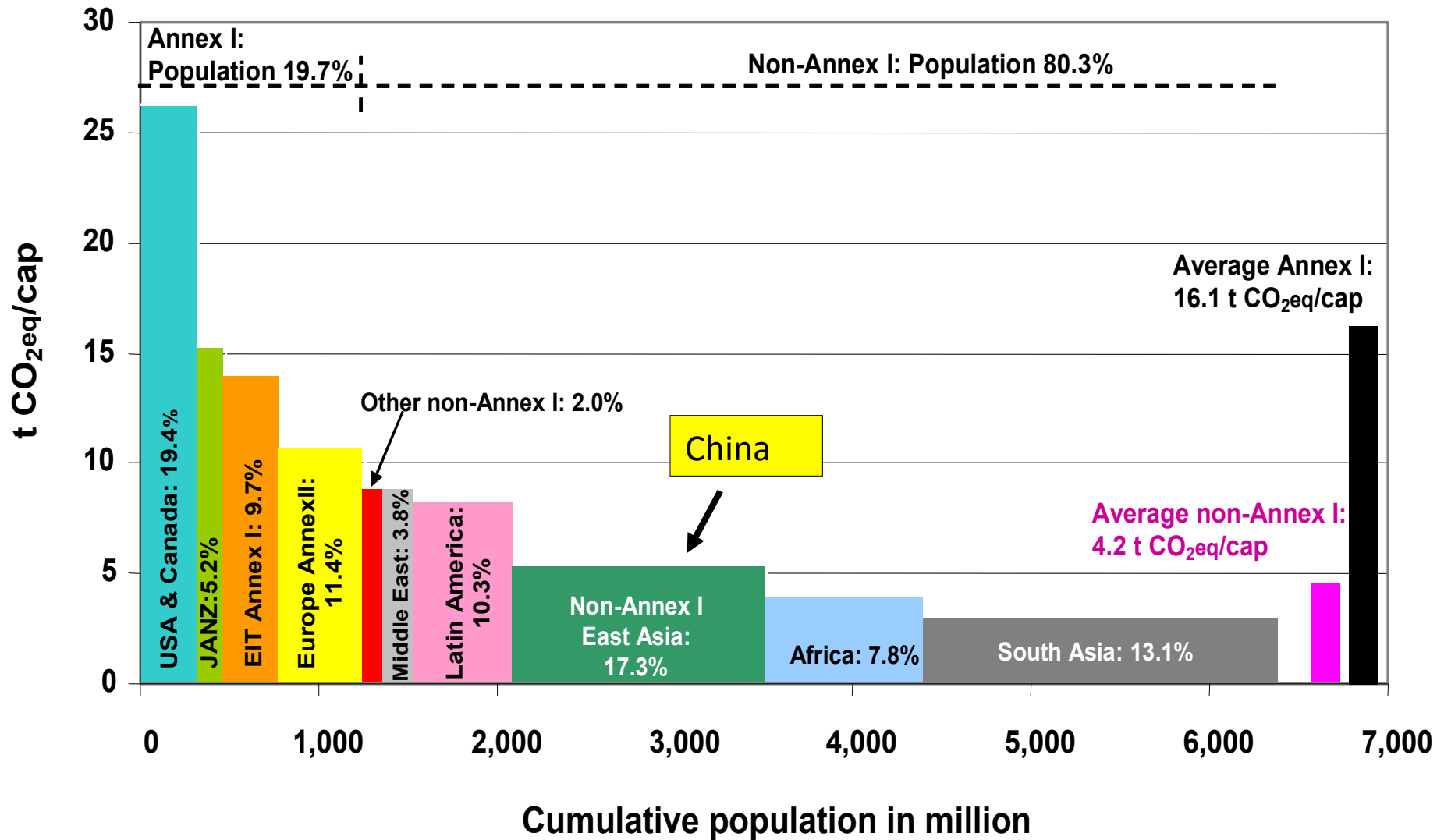
Emissions of CO₂ and per capita income



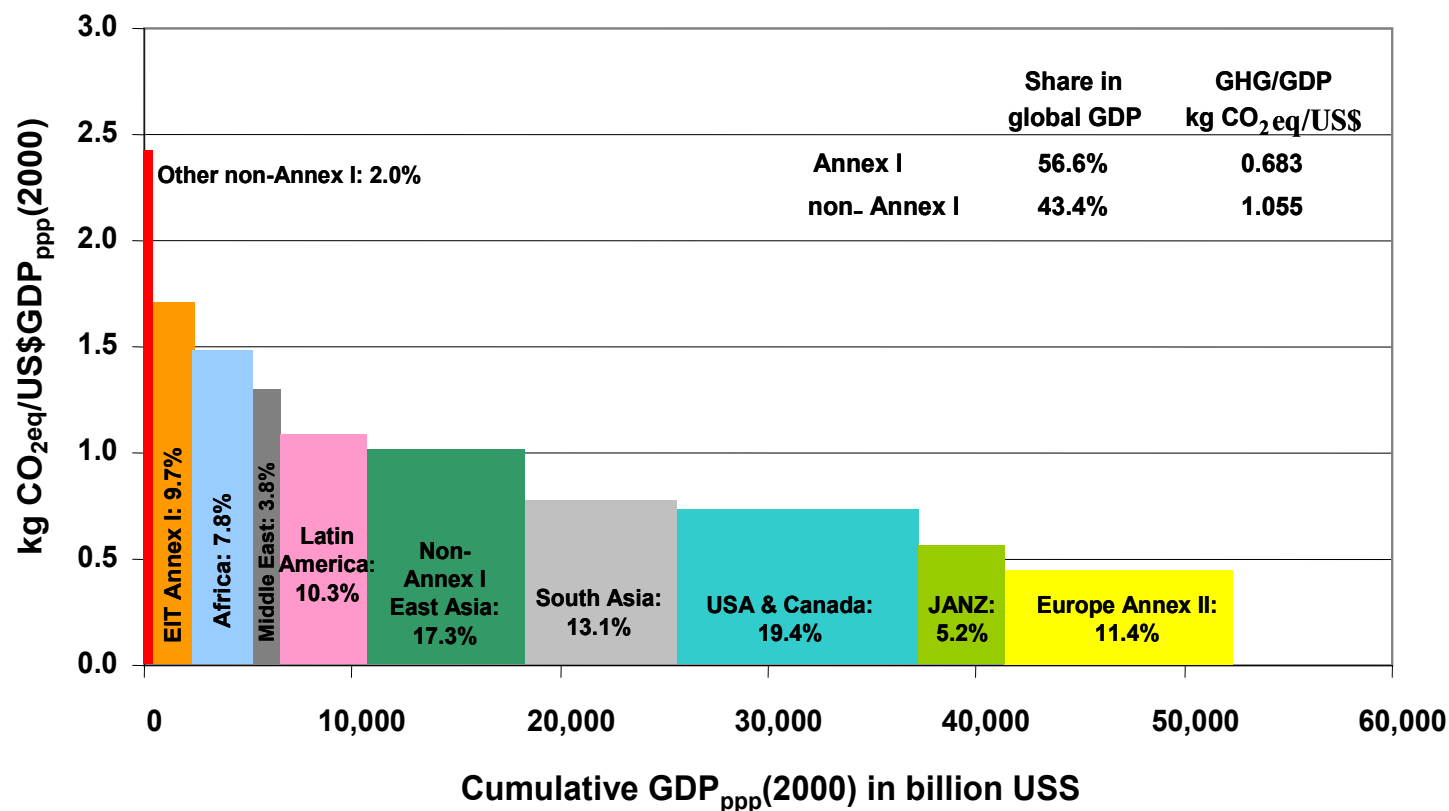
Primary energy and per capita income



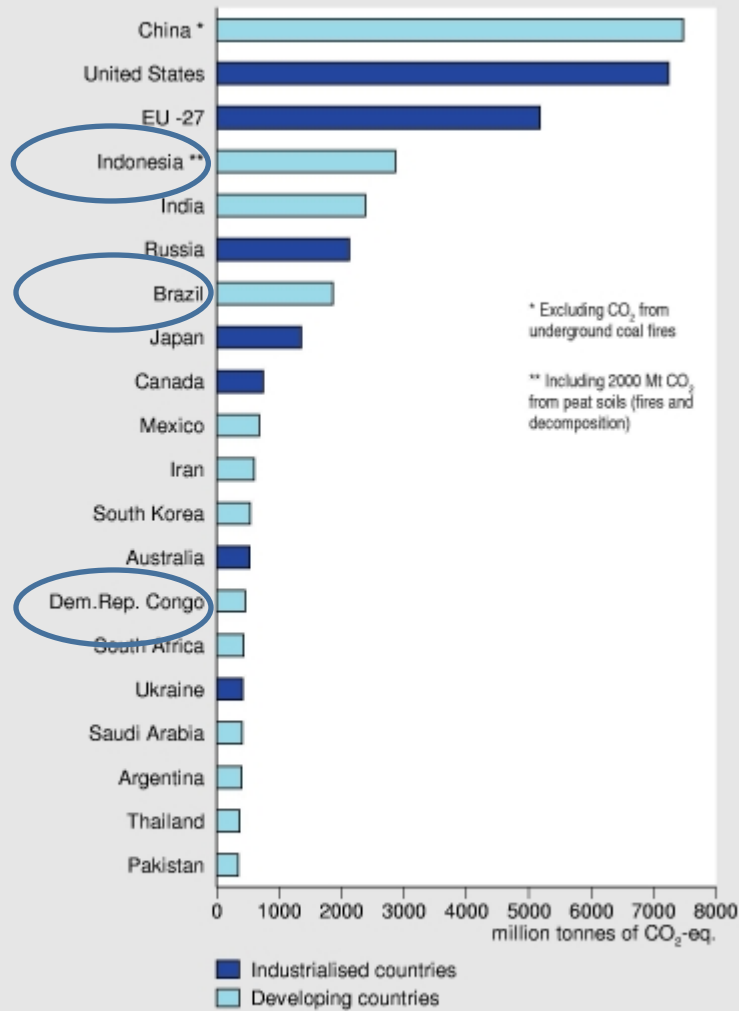
Differences in per capita emissions



Emissions per unit of GDP

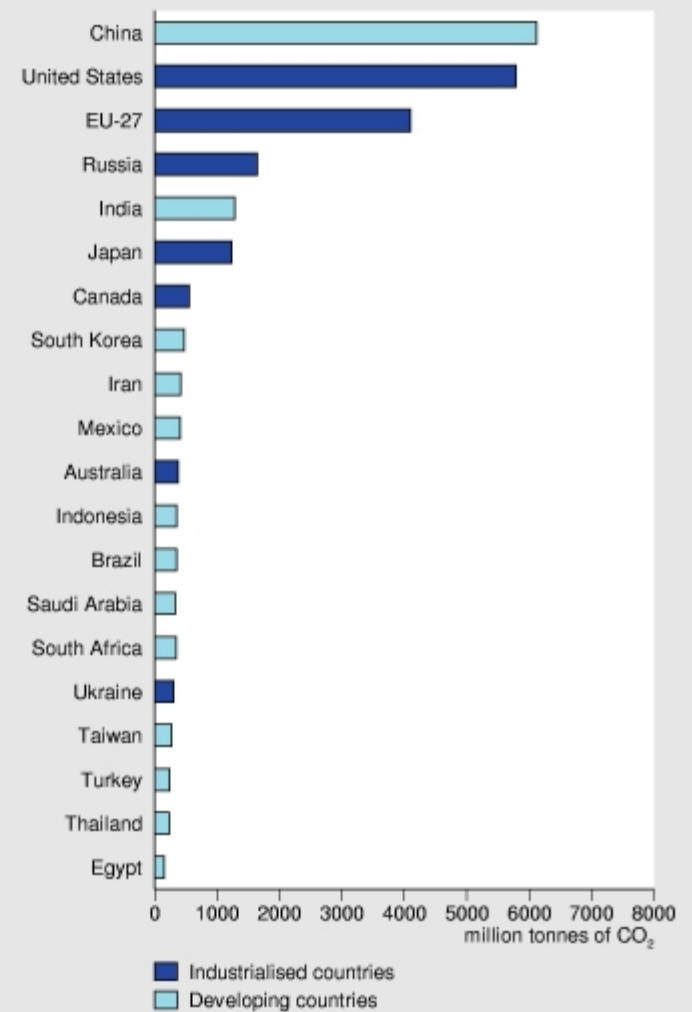


Top-20 of GHG emitting countries in 2005



Source: UNFCCC; IEA (fuel), EDGAR 3.2/4.0 (other) as in IEA (2007).

Top-20 of CO₂ emitting countries in 2006



Source: UNFCCC; IEA (fuel), EDGAR 3.2/4.0 (other) as in IEA (2007).

Personal emissions (UK)

Activity	Emission (tCO ₂ eq/cap/yr)
Home heating	1.2
Hot water, cooking	0.4
Lighting, appliances	0.7
Transport: motorcycle, car	1.2
Transport: bus, rail	0.1
Transport: air	1.8
Other direct	0.6
Indirect emissions from food	2.1
Indirect emissions from consumer goods	3.1
Indirect emissions from workplace	1.3
TOTAL	12.5

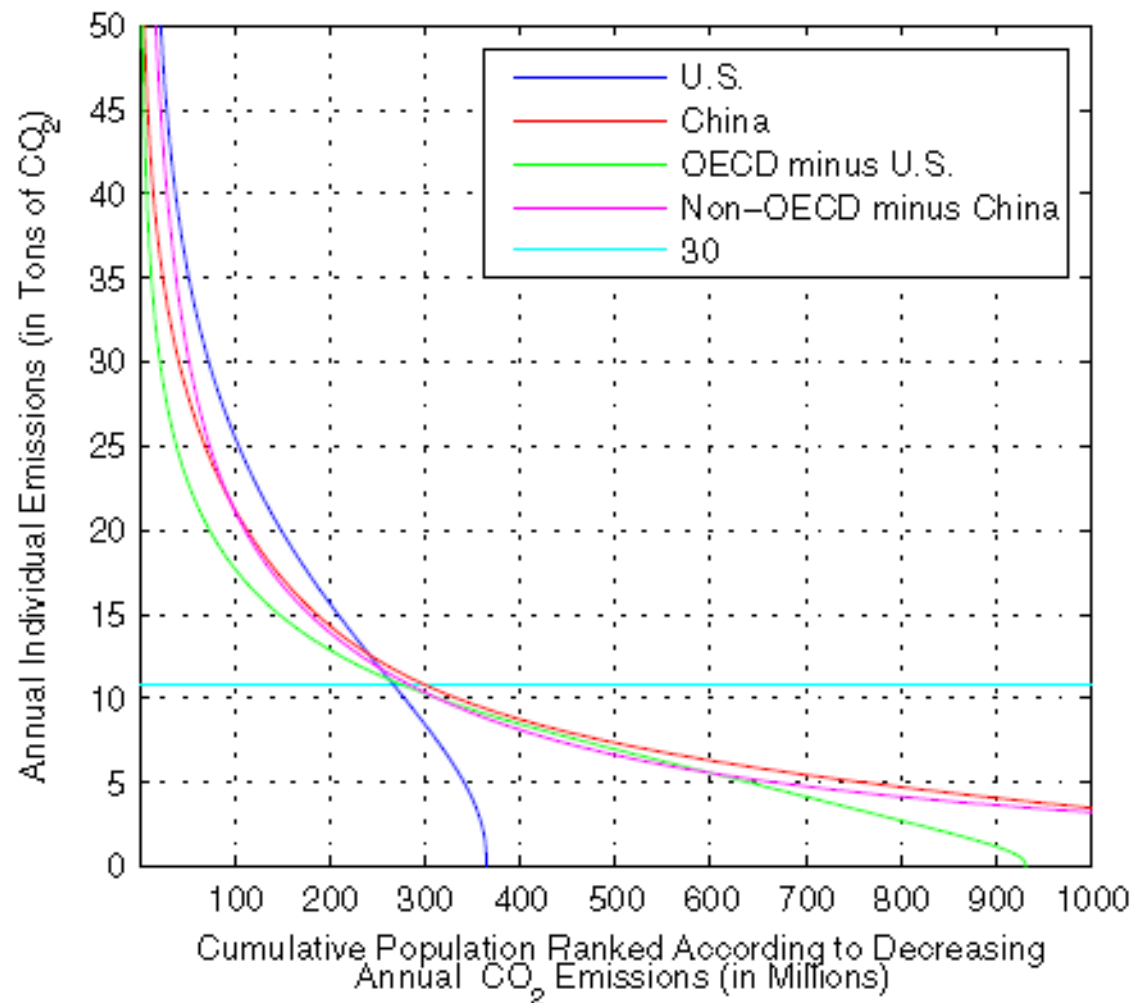
UK:

[actonco2.direct.gov.uk/
index.html](https://actonco2.direct.gov.uk/index.html)

Australia:

www.carbonneutral.com.au/

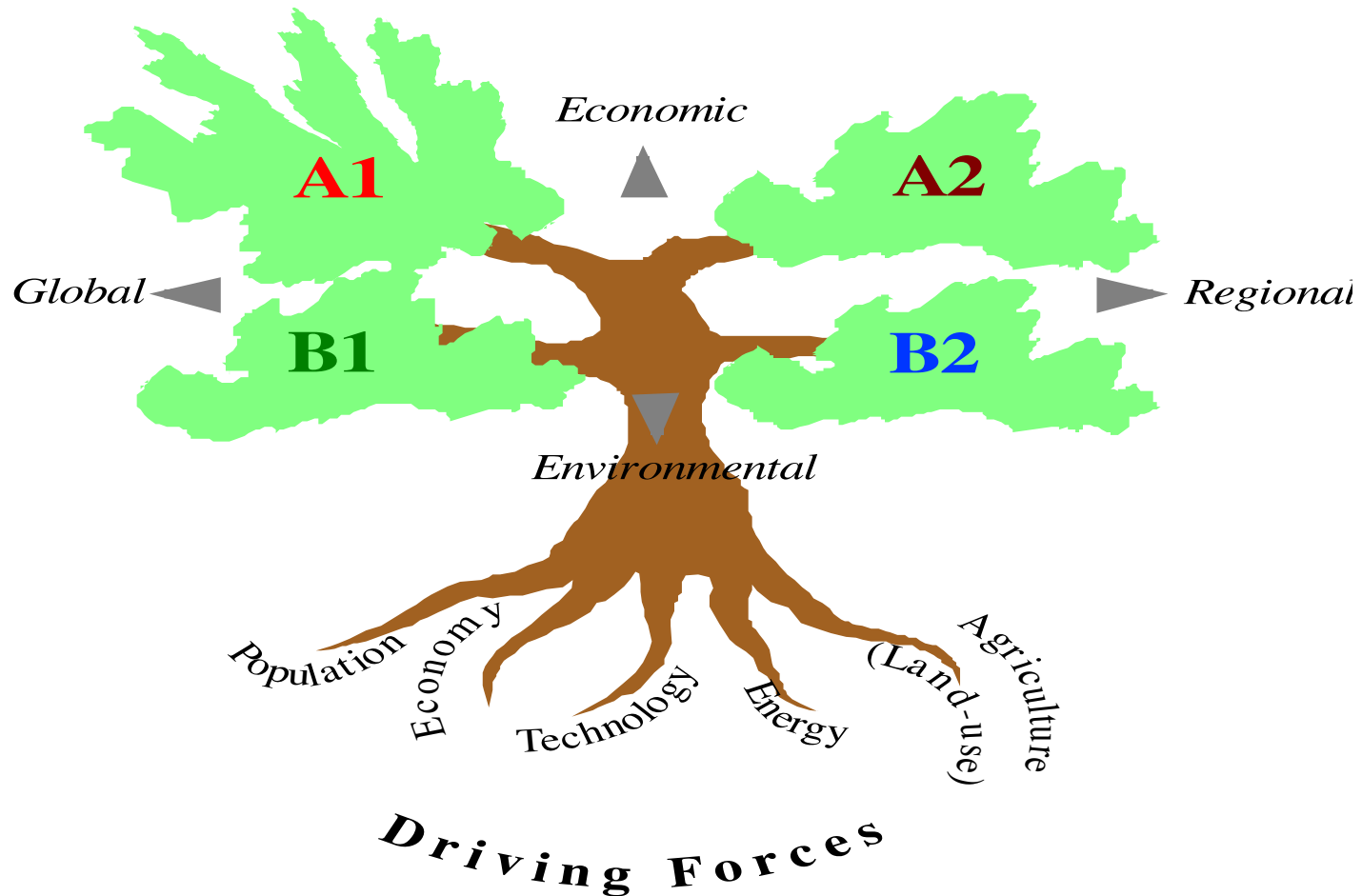
Distribution of emissions in countries, 2030



Source: Chakravarty, S., et al, PNAS vol 106, no 29, p 11884-11888

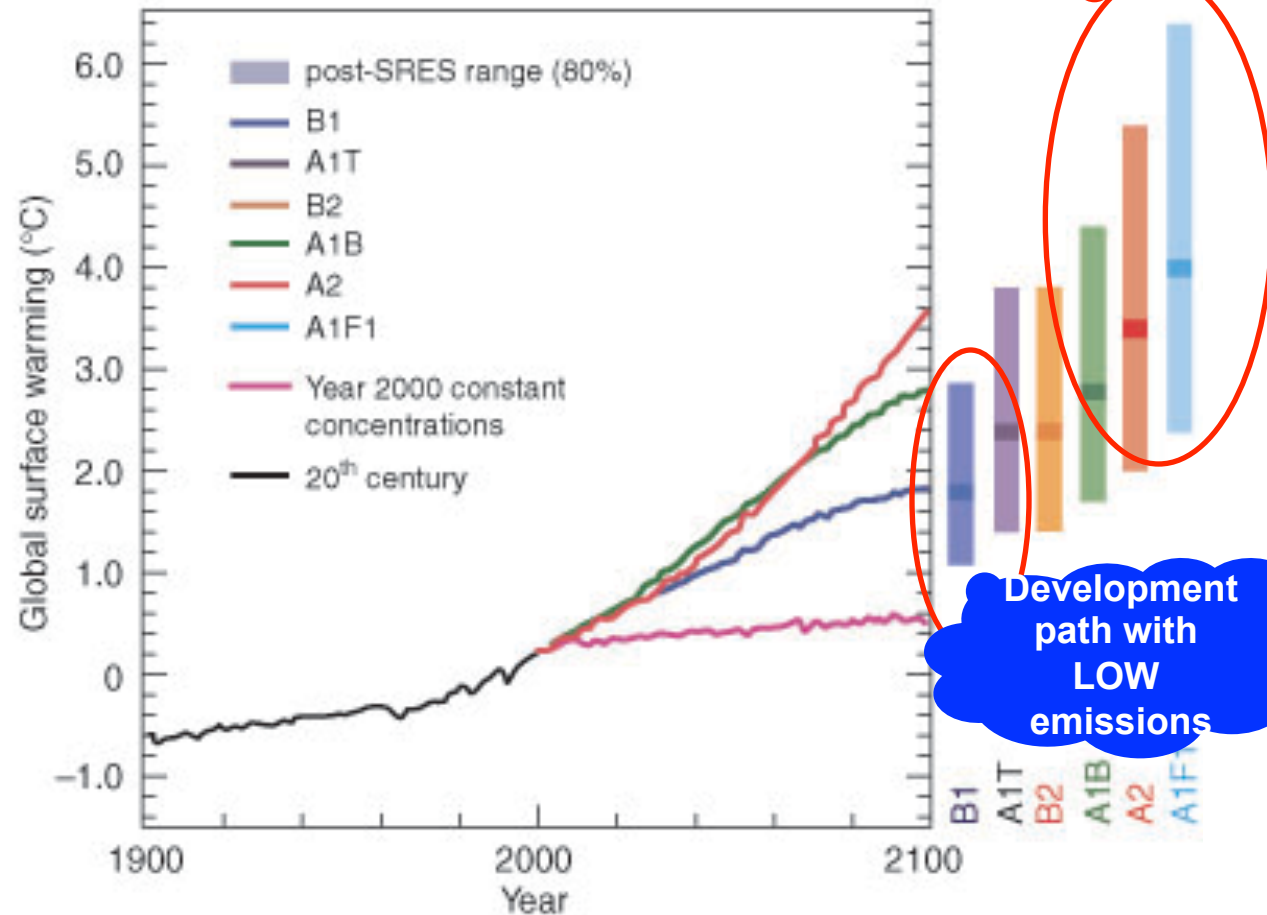
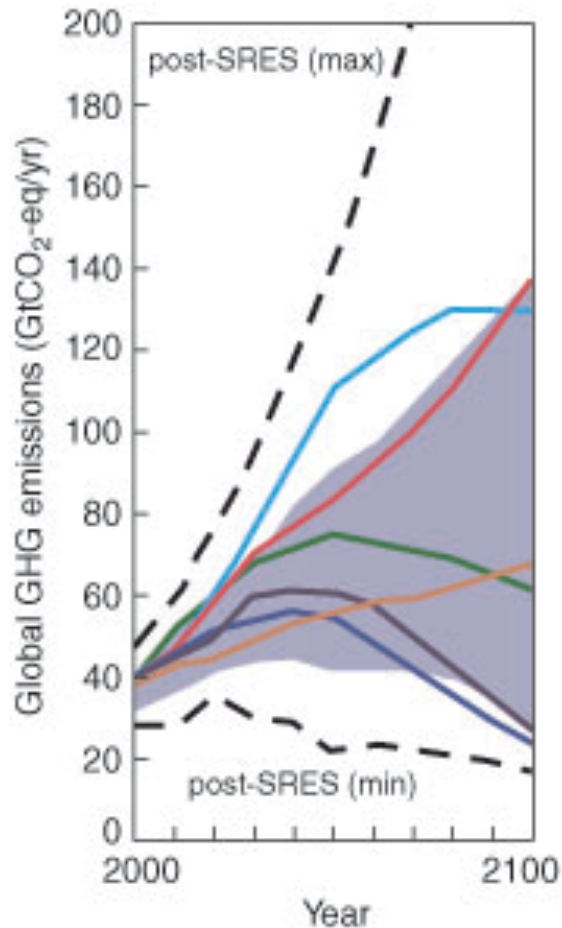
Fig. 4. Regional emission distributions in 2030, revealing the number of individuals above the cap of 10.8 tCO₂/yr (corresponding to a global target of 30 GtCO₂ in 2030). The regional efforts are comparable: The U.S. has 270 million people who, relative to "Business As Usual" for 2030, in aggregate reduce emissions by 4.4 GtCO₂; the OECD minus U.S. has 280 million who reduce 2.1 GtCO₂; China has 300 million who reduce 2.9 GtCO₂; and the non-OECD minus China has 280 million who reduce 3.5 GtCO₂.

Development paths behind the IPCC SRES scenarios

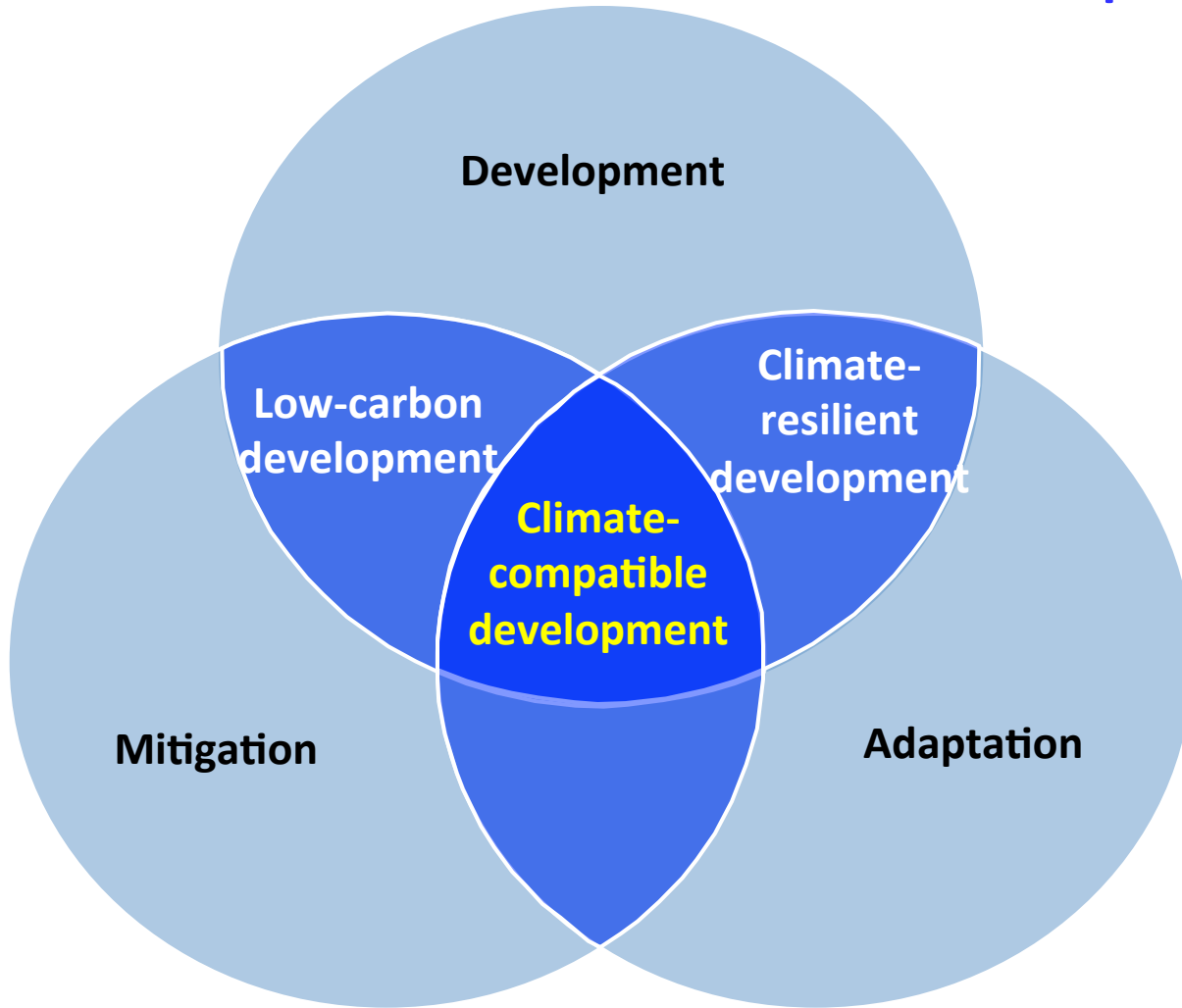


Projected climate change without climate policy

Development path with HIGH base emissions

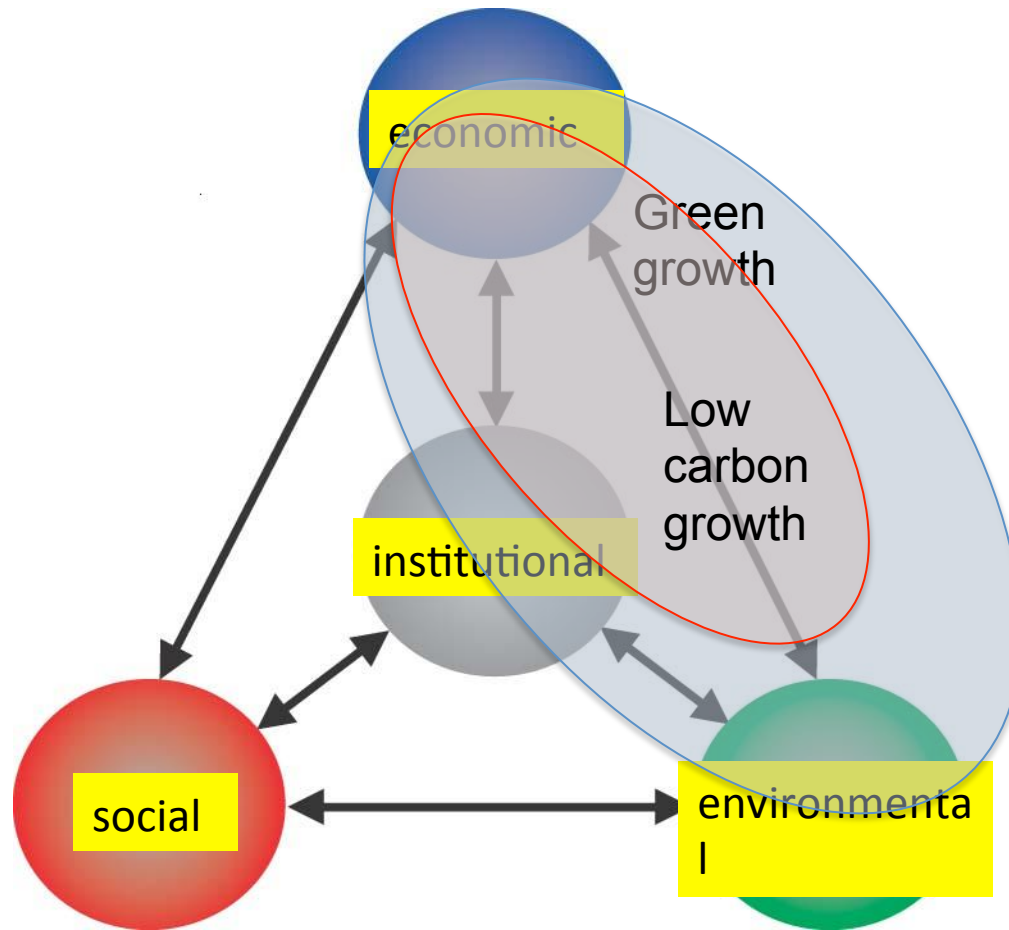


The response to climate change must be rooted in development



- Development is essential for eradicating poverty
- Climate change can undermine development
- Low carbon and climate resilient development (“climate compatible development”) as the answer

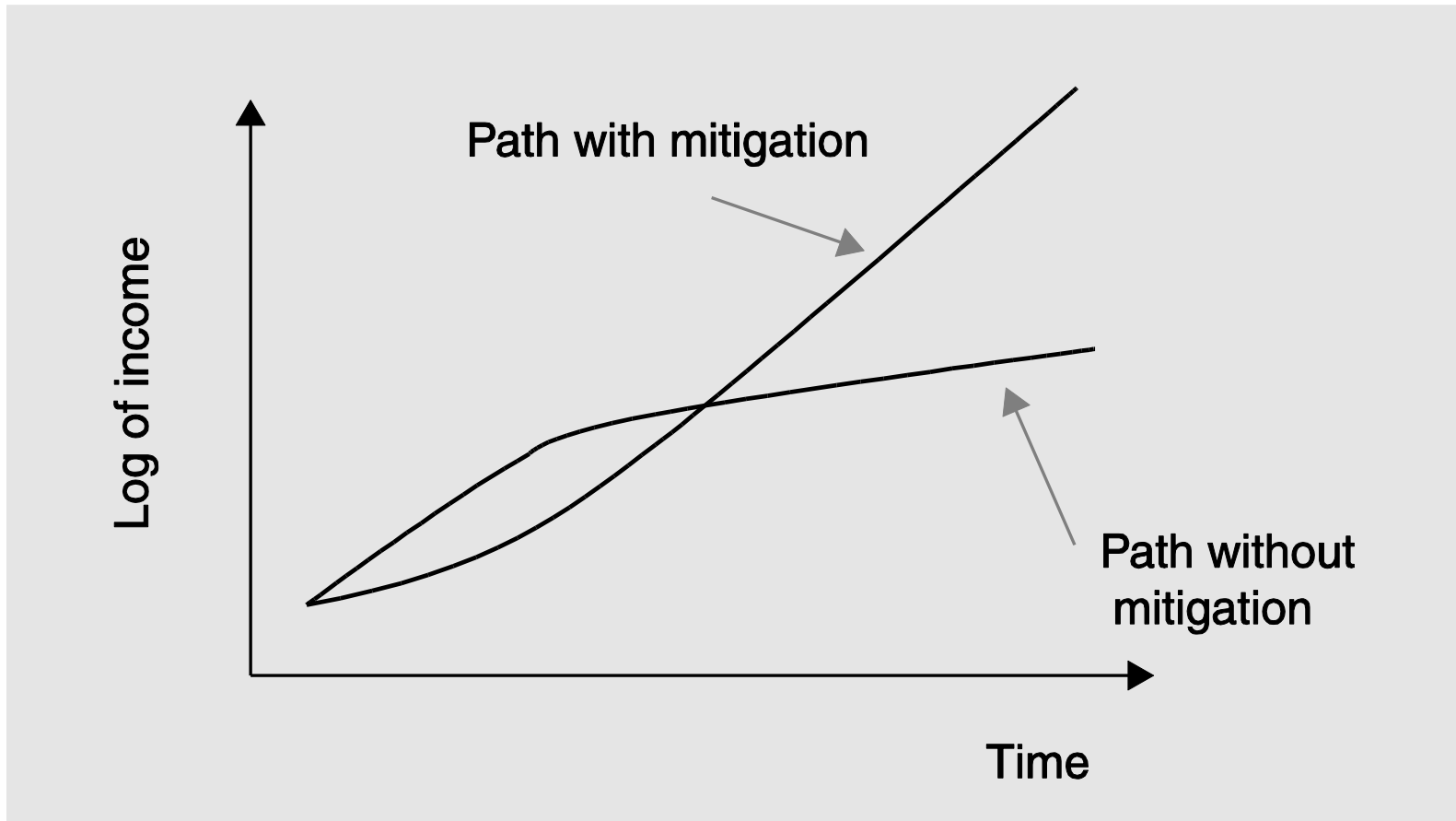
Making development more sustainable



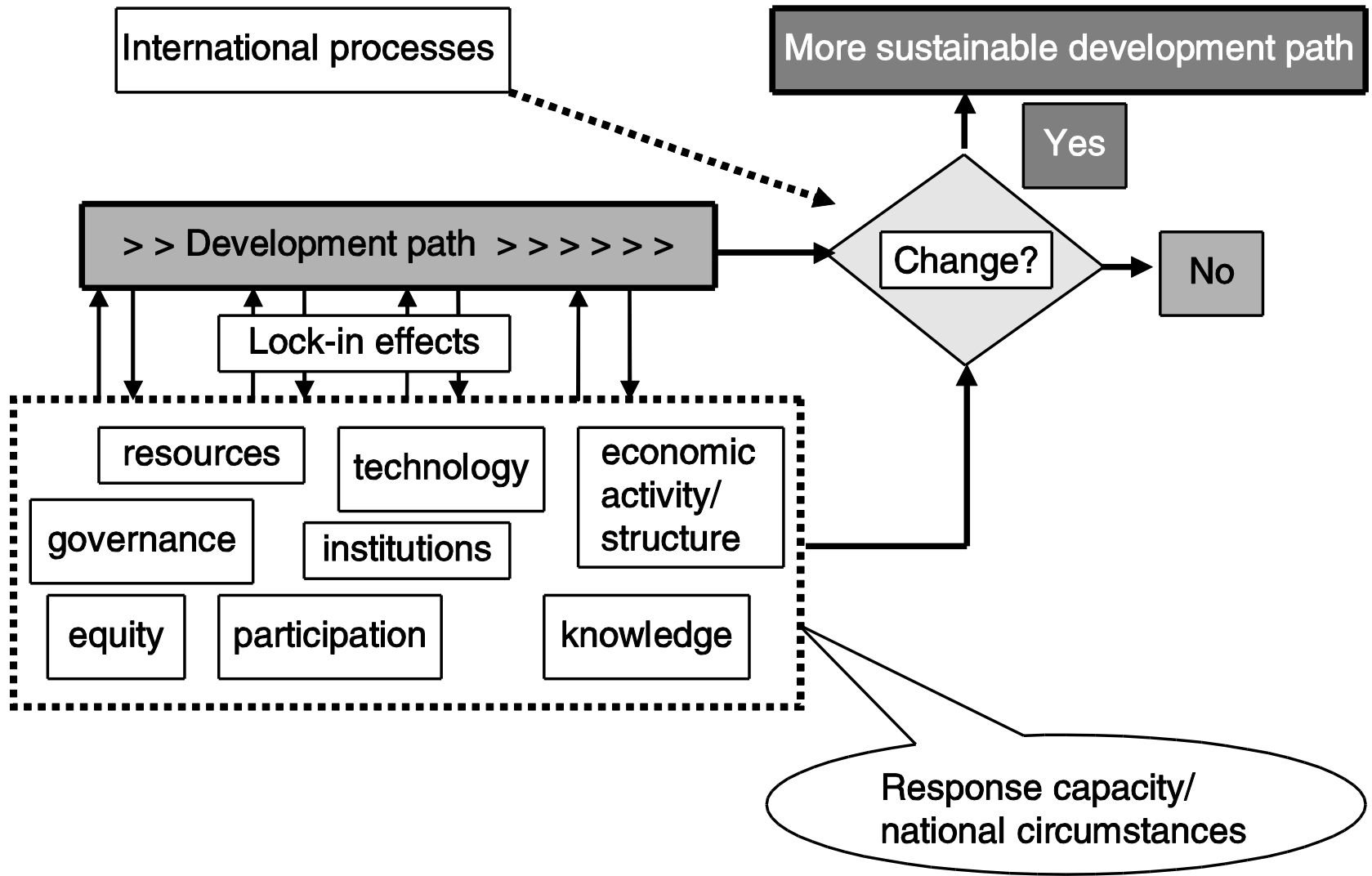
Mainstreaming climate change in development policies

- Modernising industry to become competitive
- Improving energy security and reducing oil imports
- Providing clean and efficient transport to people
- Improving air quality to protect health
- Ensuring a strong and sustainable agriculture and forestry sector
- Greening macro-economic policy
- Providing electricity to the poor
- Developing coastal regions sustainably
- Building a good public health system
- Protect nature and biodiversity

Economic growth and mainstreaming climate change can go hand in hand



Changing development paths is not so simple



How to change development paths?

- Develop capacity for change
- Start at the top
- Coordinate actions
- Climate proofing
- Prepare long term low carbon, climate resilient development plan (= green growth plan)

Low carbon (and climate resilient) growth plans as a strategic instrument for *all* countries to plan their transition

Focus: Development, and mainstreamed mitigation + adaptation

Time horizon: Long term and short/medium term

Content: Priorities, transition strategies, policies/measures and international support

LCGP (=low carbon/ climate resilient growth plans)

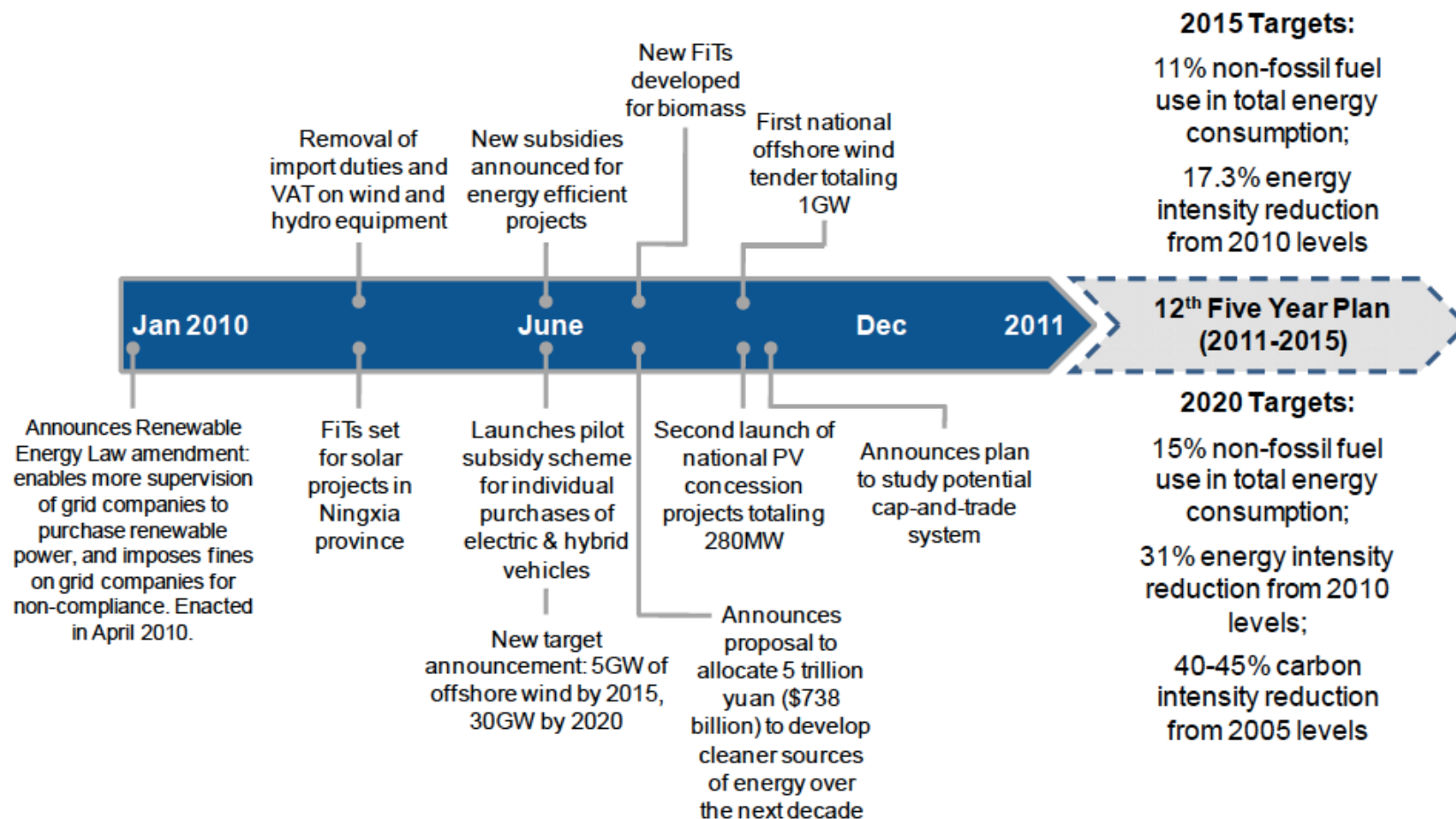
Differentiation: Both developing + developed

Process: Ownership, participation, best practices, review, support,

Low carbon development, examples

- Brazil:
 - Program for Incentive of Alternative Electric Energy Sources (PROINFA): reduce electricity sector emissions by 14 % below BAU levels in 2020
 - Brazil's ethanol program (flex fuel vehicles and cost competitive ethanol): reduce transportation emissions by 18 % below BAU levels in 2020
 - No net forest cover loss by 2015
 - GHG emissions 20% below 2005 by 2020
- China:
 - Renewable Energy Law and the Tenth Five-Year Plan: reduce electricity sector emissions by 5 % below BAU in 2020
 - Medium and Long Term Energy Conservation Plan:
 - reduce cement sector emissions by 15 % below BAU levels in 2020
 - reduce iron and steel sector emissions by 9% below BAU levels in 2020
 - Fuel efficiency standards for passenger cars, SUVs, and multi-purpose vans: reduce transportation sector emissions by 5% below BAU levels in 2020

China Renewable Energy Expansion



Source: DB Climate Change Advisors

Low carbon development, examples (2)

- India:
 - Reduce transportation sector emissions by up to 15 % below BAU levels in 2020
 - 20 MW solar PV capacity by 2020
- Korea:
 - National Green Growth Plan
 - GHG emissions 4% below 2005 by 2020
- South Africa:
 - National long term climate change strategy
 - GHG emissions 34% below BAU by 2020, 42% by 2025 and peaking between 2020-2025 (conditional)
- Indonesia :
 - GHG emission 26% below BAU by 2020
 - 0.5Mha/yr tree planting; 0.3 Mha/yr forest rehabilitation and stop illegal deforestation
- OECD: Green growth Strategy 2011
- EU:
 - GHG emissions 80-95% below 1990 by 2050
- US:
 - GHG emissions 80% below 1990 by 2050

OECD