Climate change and the Nexus 0f Water, Food and Energy Security

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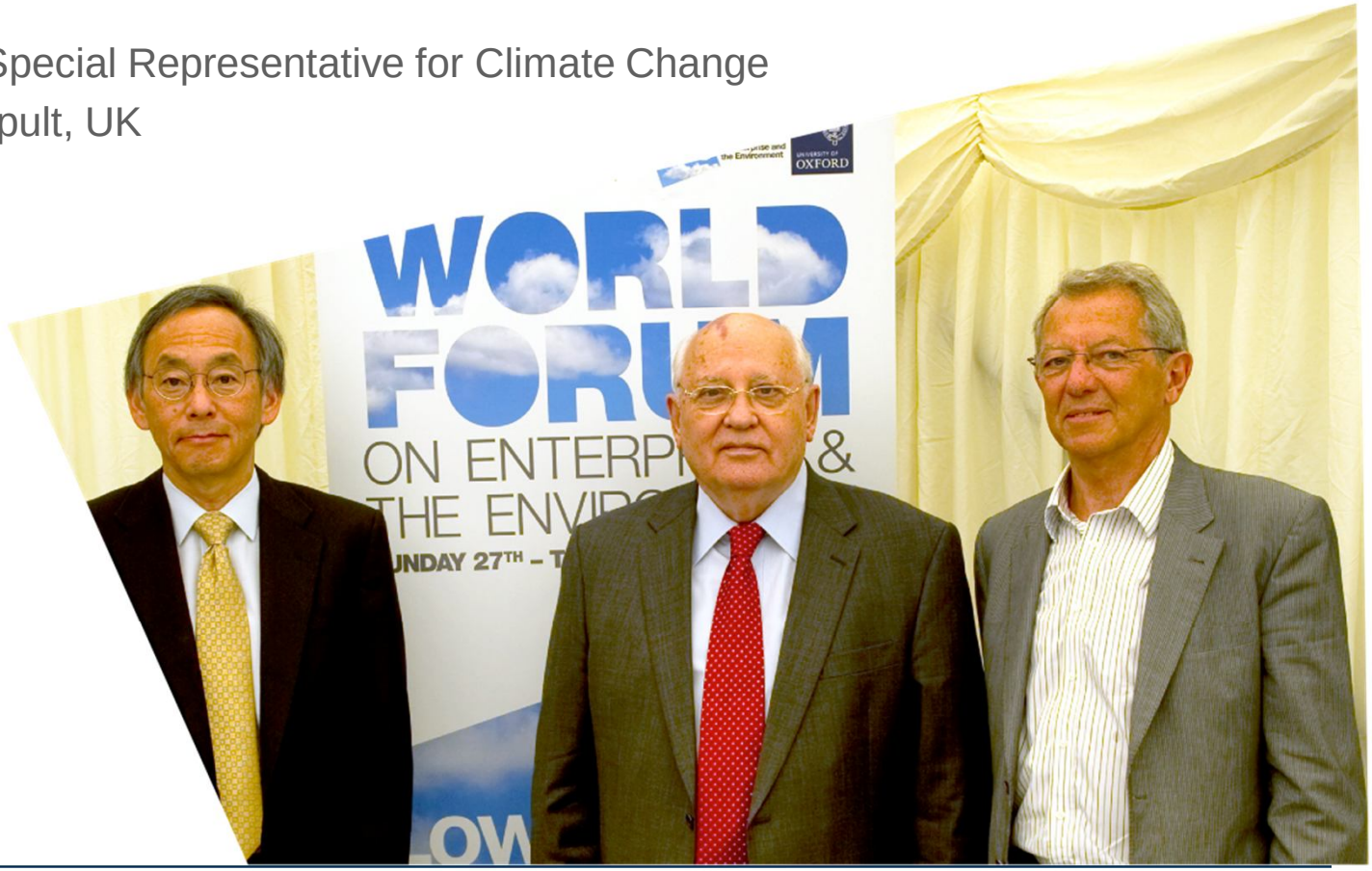
Chair, Future Cities Catapult, UK



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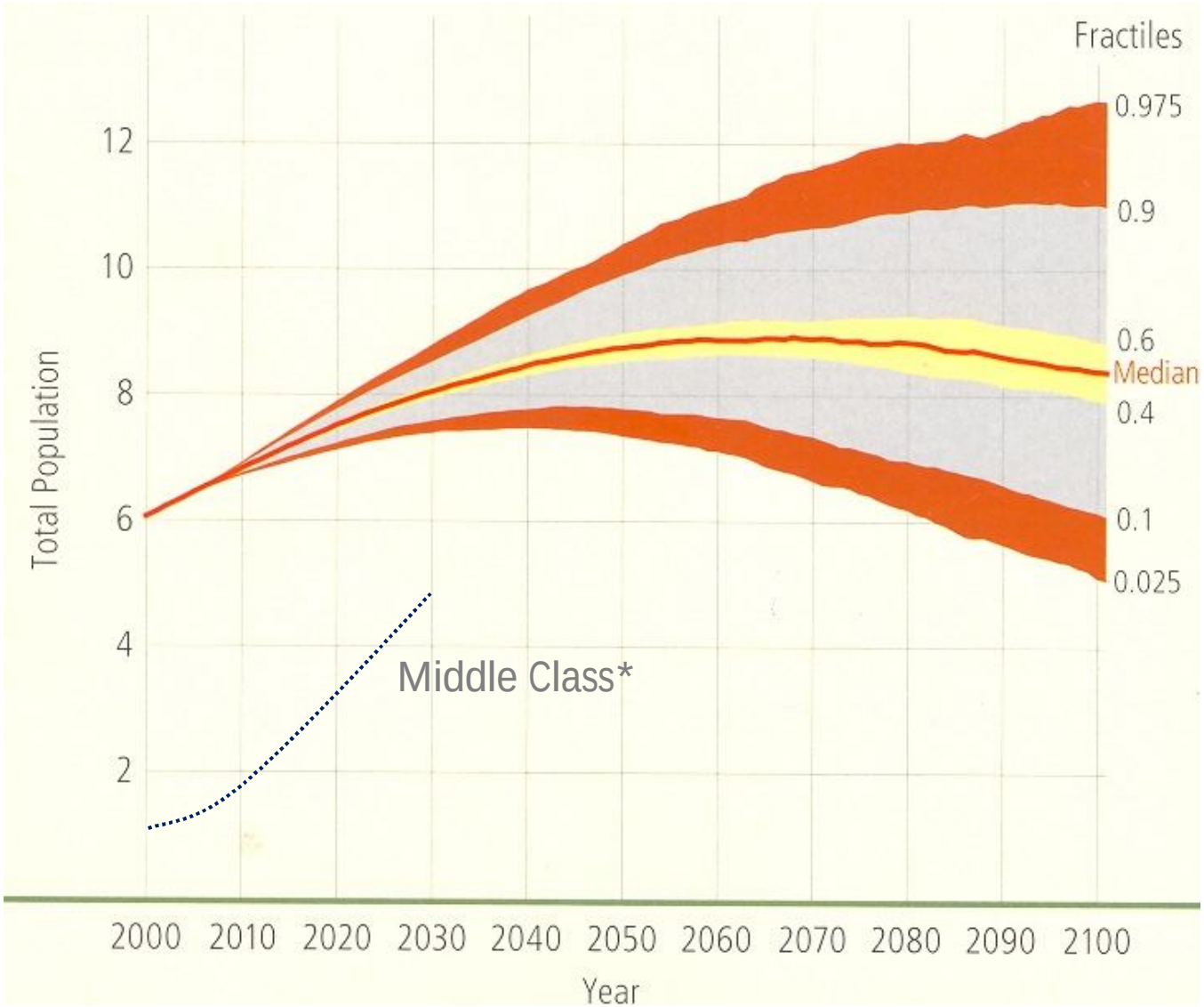
Kuala Lumpur

18th February 2014

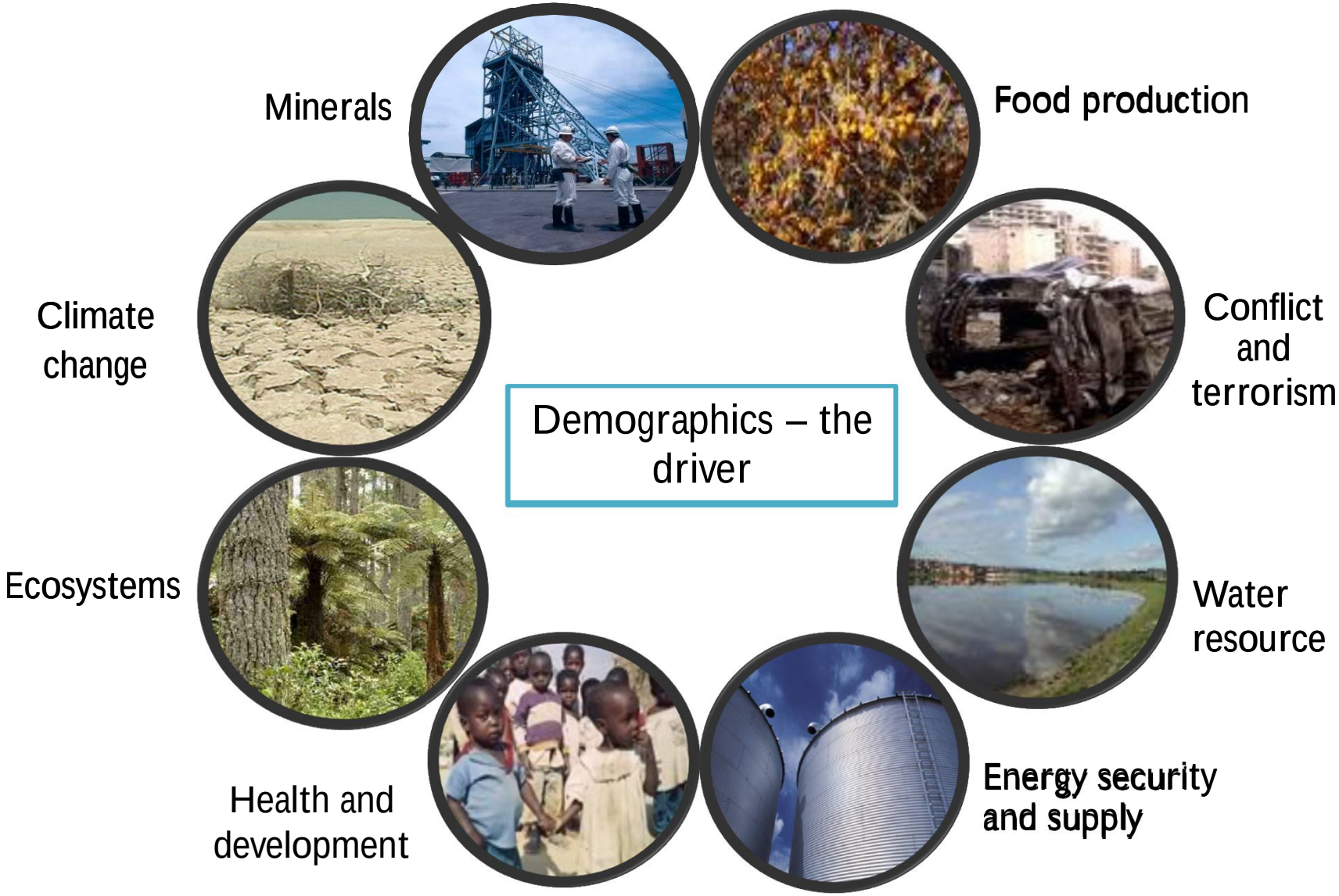
Total Population of the World in Billions



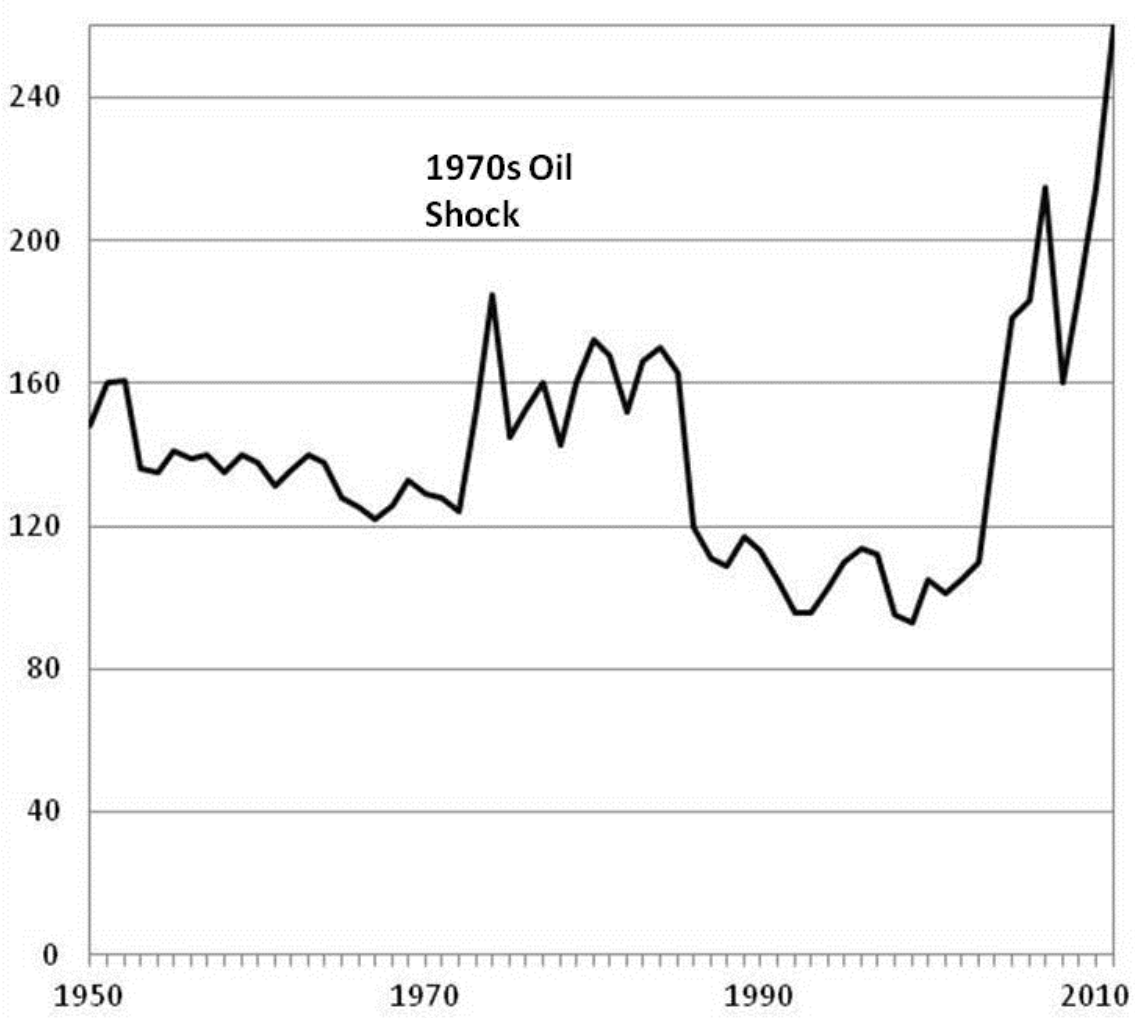
*Middle class here defined as daily per capita spending of between $10 and $100 in PPP terms

Source: IIASA

21st Century Challenges

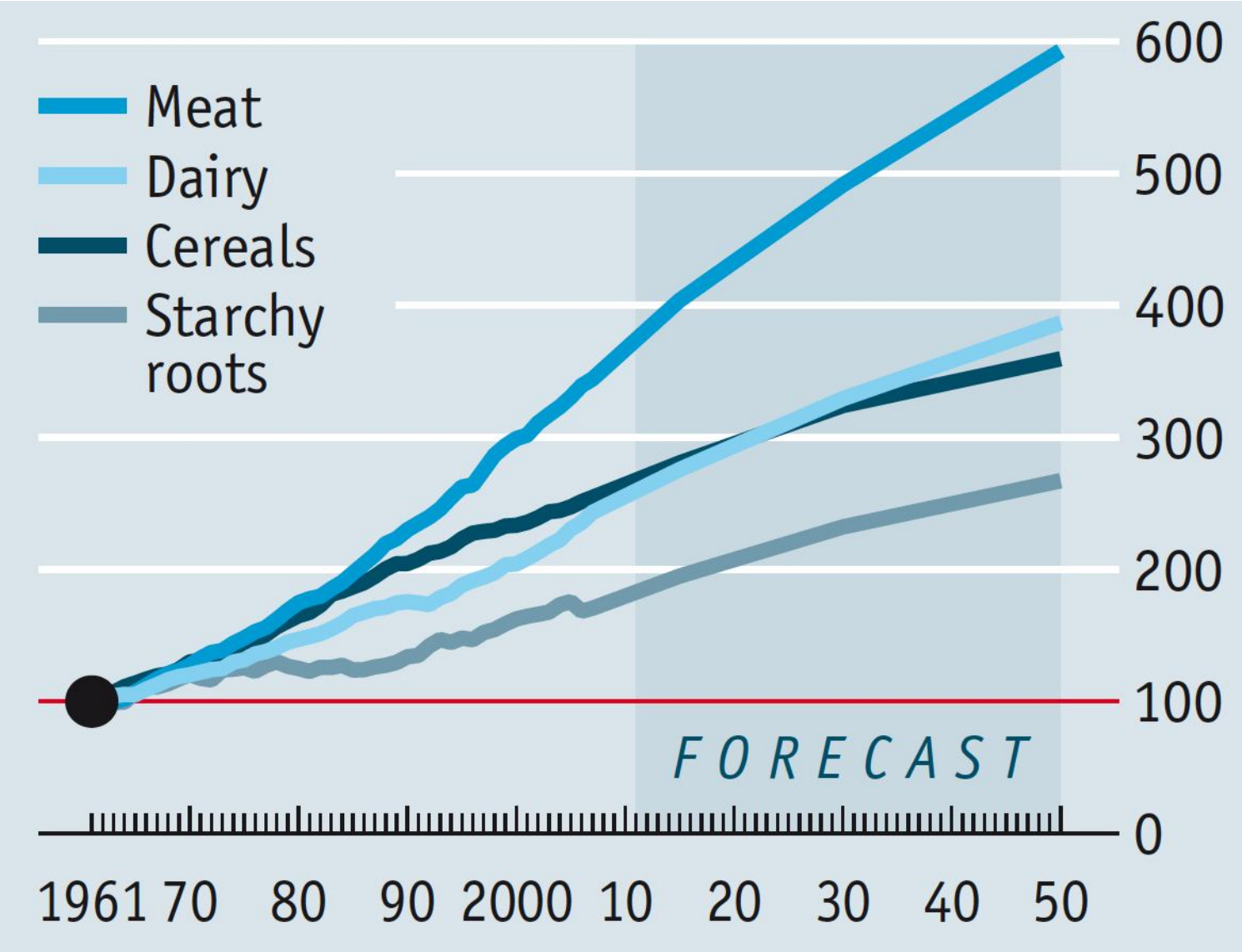


MGI Commodity Price Index (years 1999-2001=100)



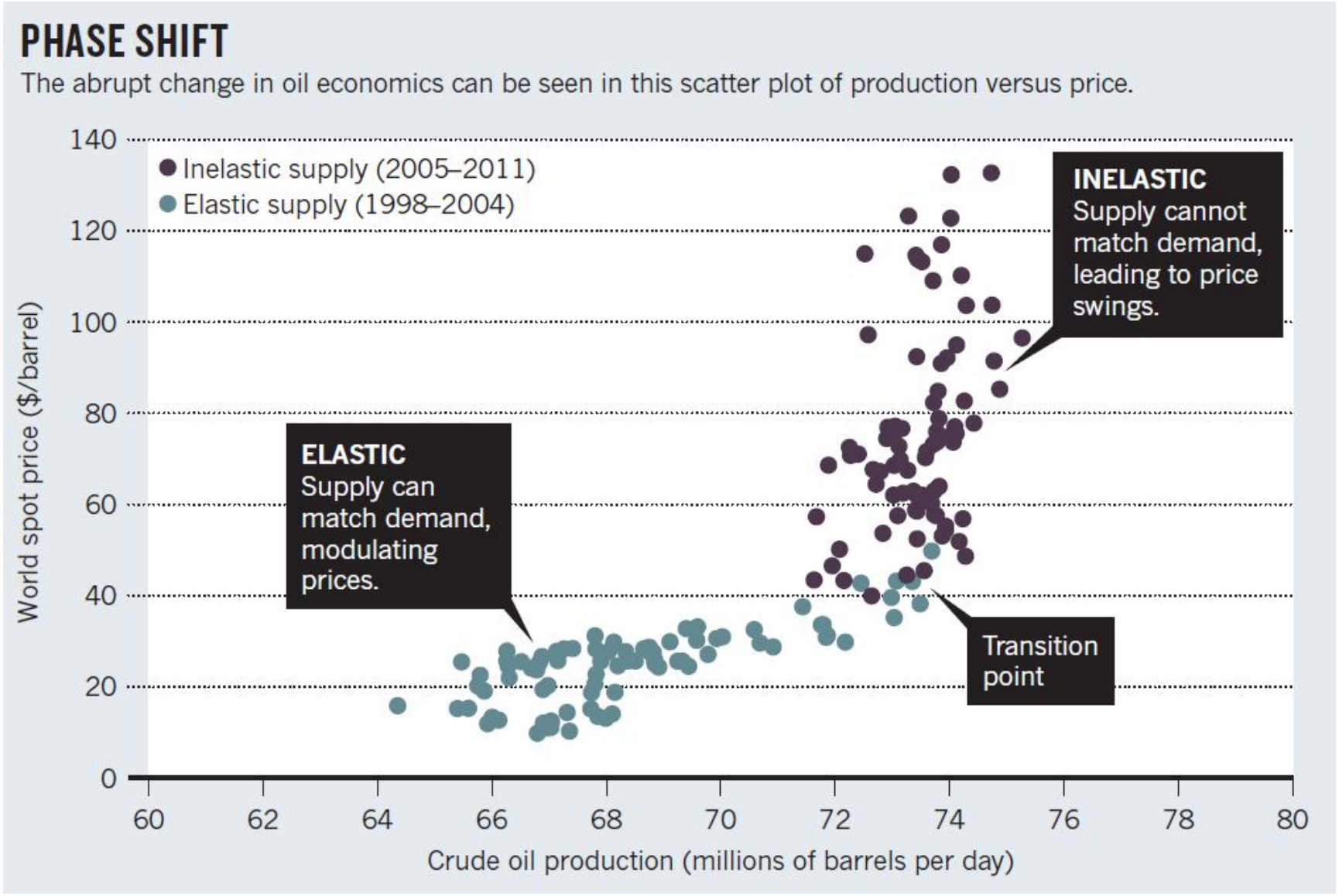
Source: McKinsey Global Institute 2011

Global Food Demand



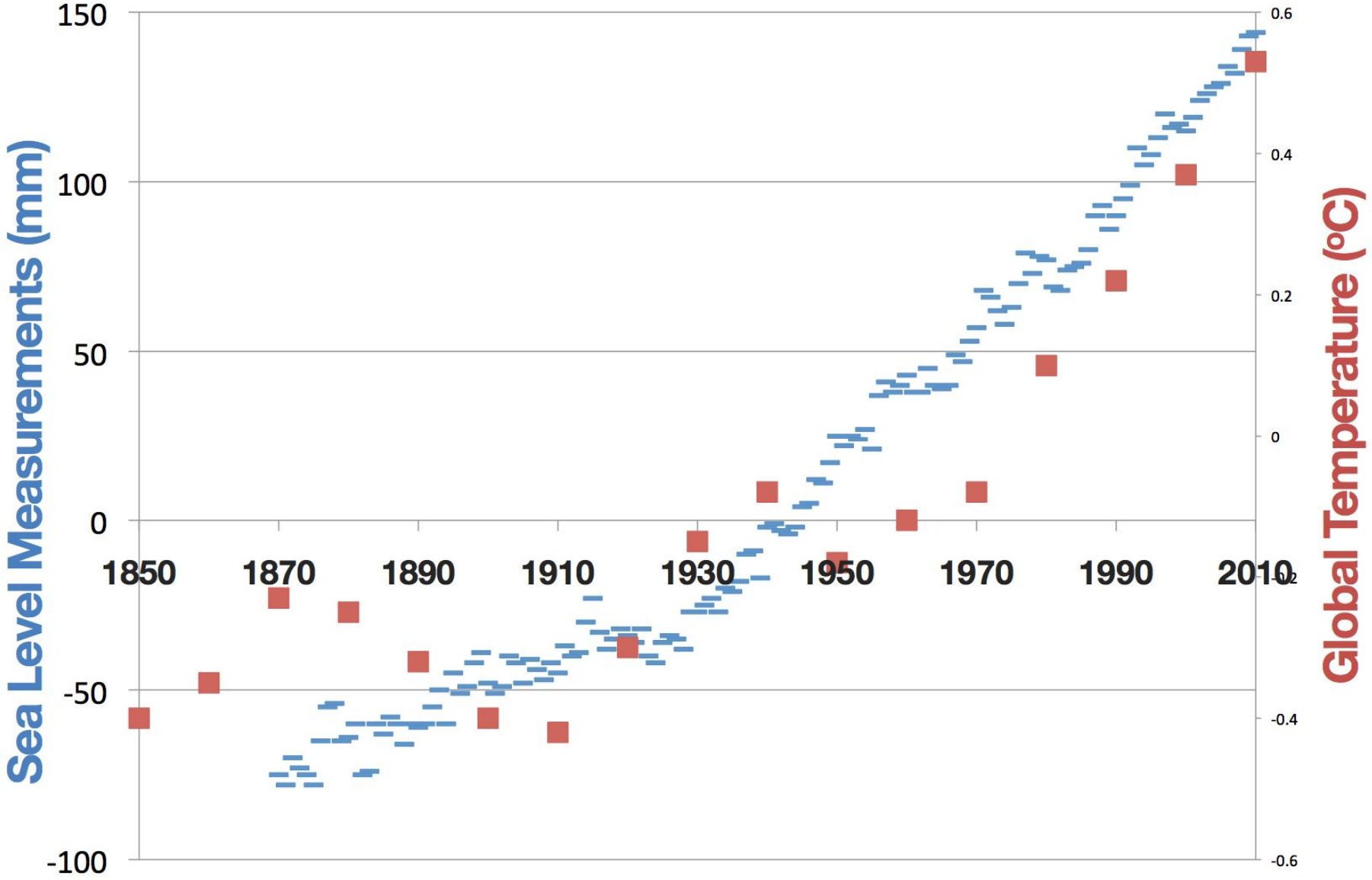
Source: FAO

Crude Oil Price versus Crude Oil Production from 1998 to present



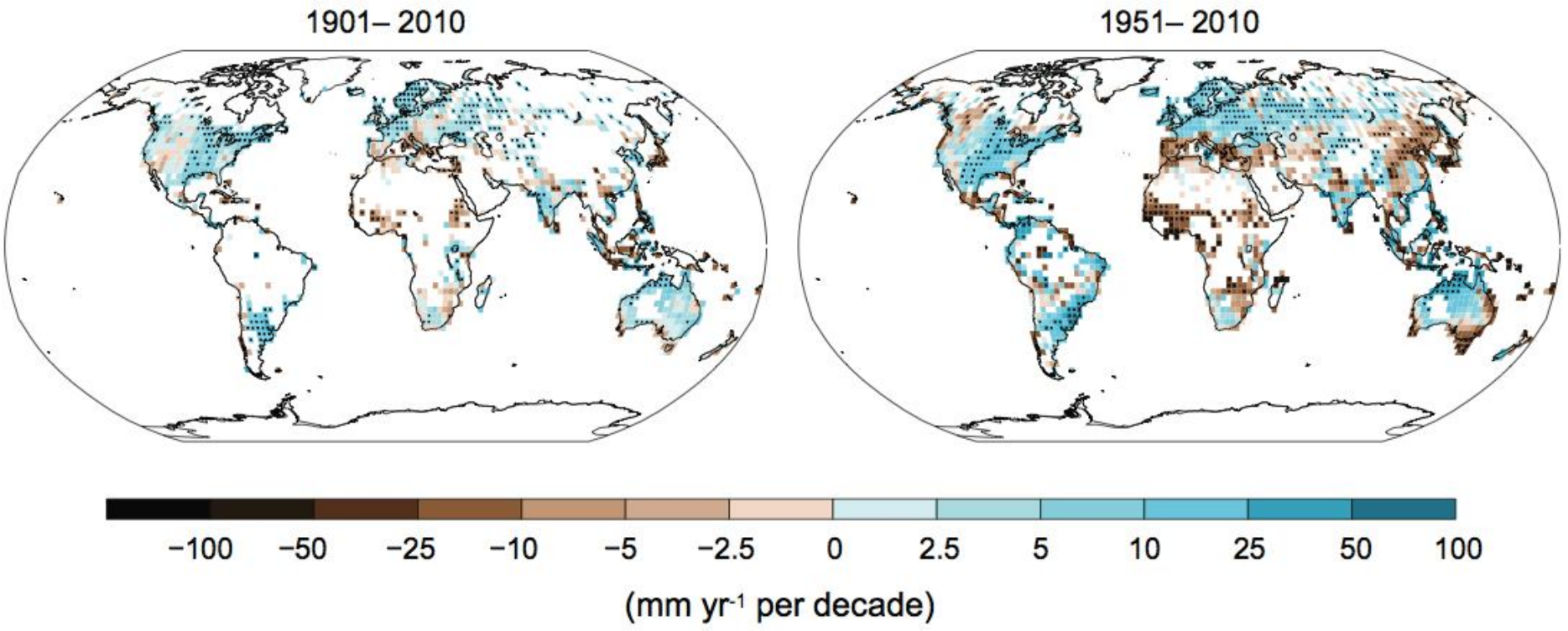
Source: Murray, J. and King, D. (2012) Oil's Tipping Point has Passed, Nature, Volume 481, 433-435

Sea Level and Temperature Measurements

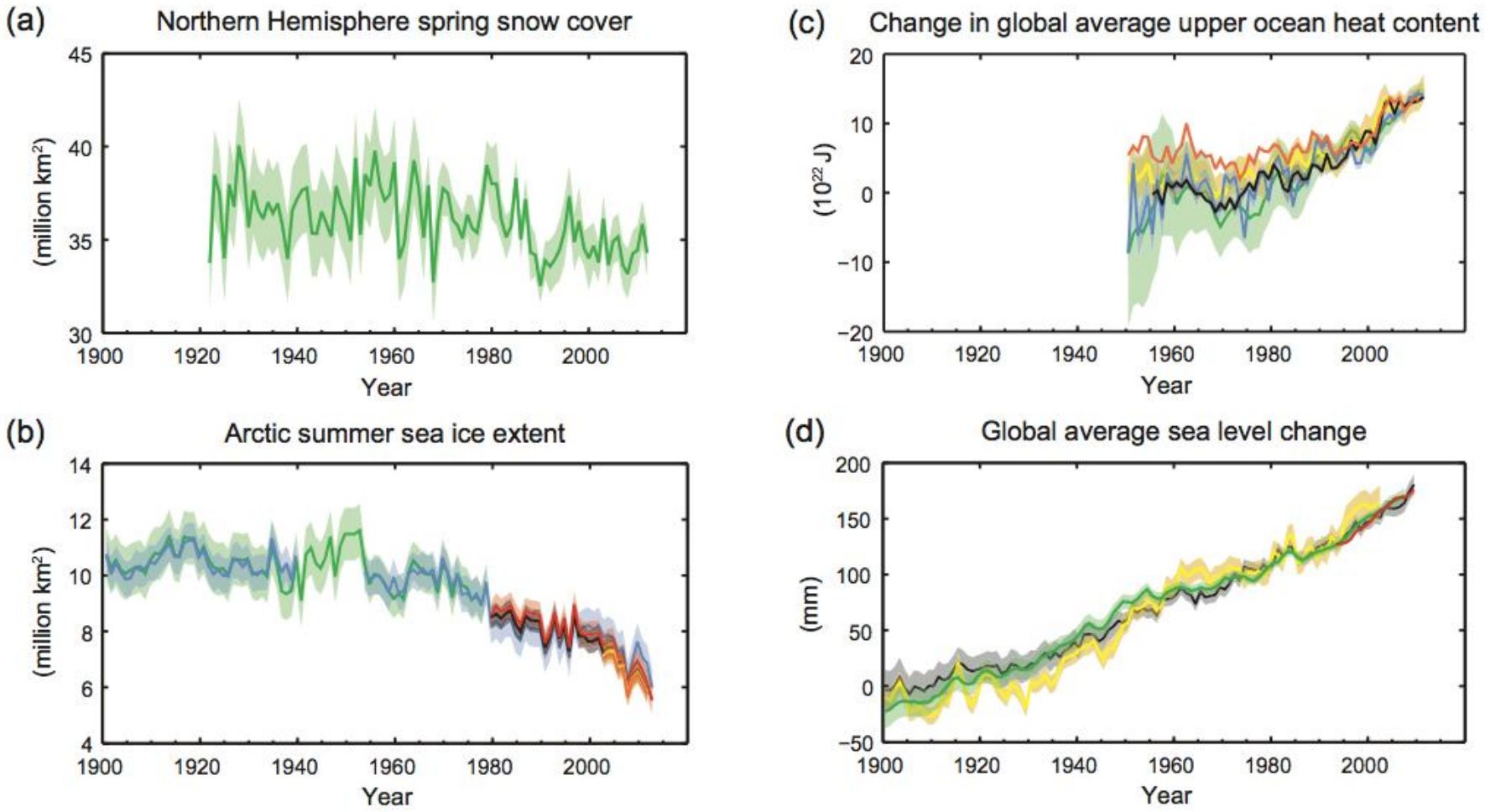


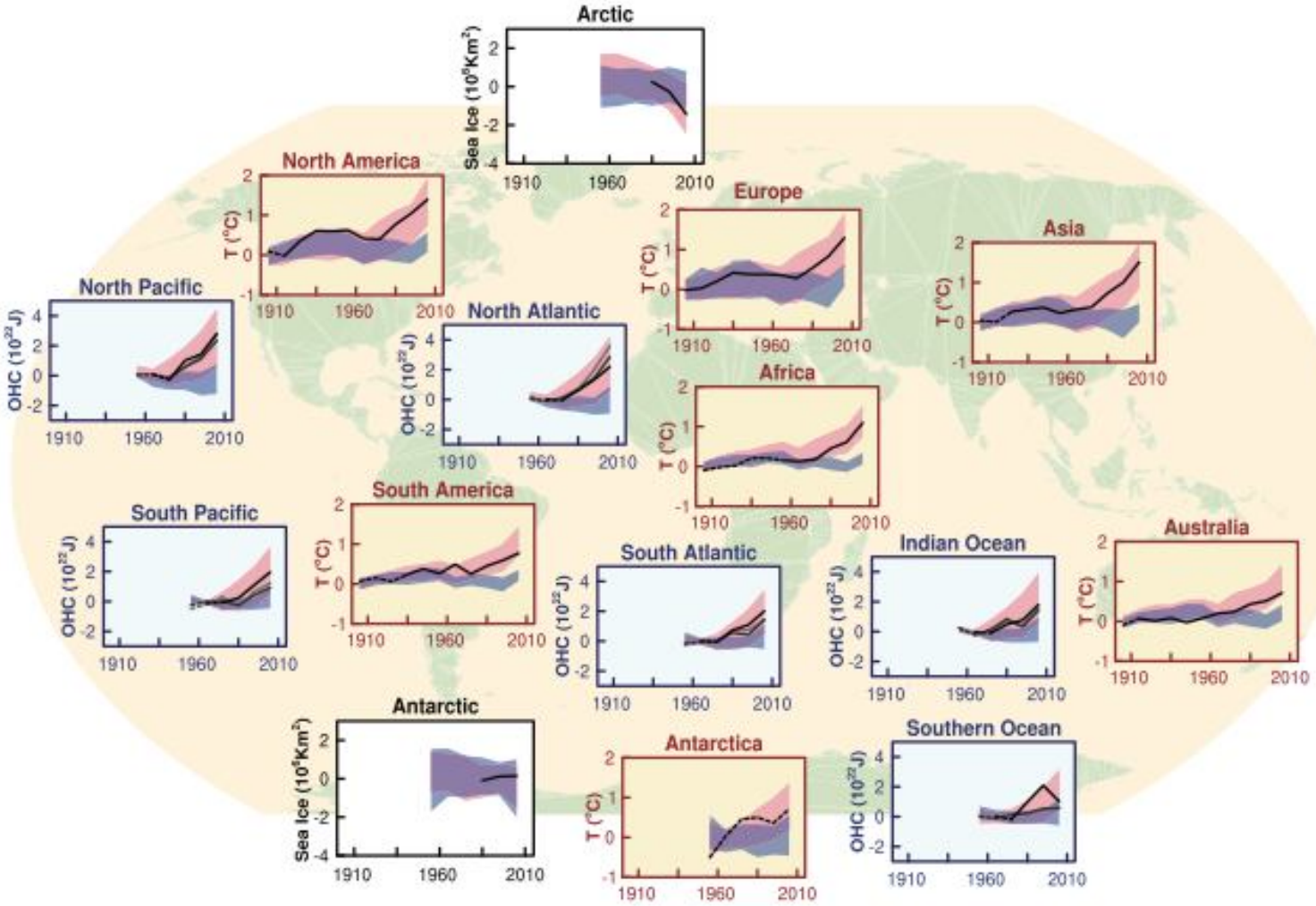
Source: Met Office & Proudman Oceanographic Laboratory Liverpool

Observed change in annual precipitation over land

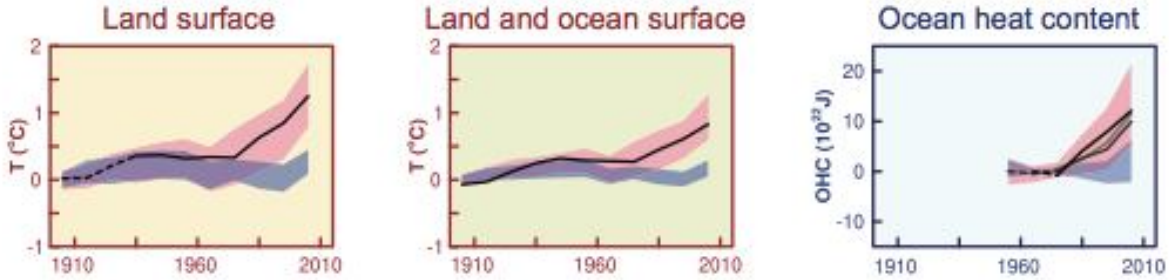


Global climate system trends

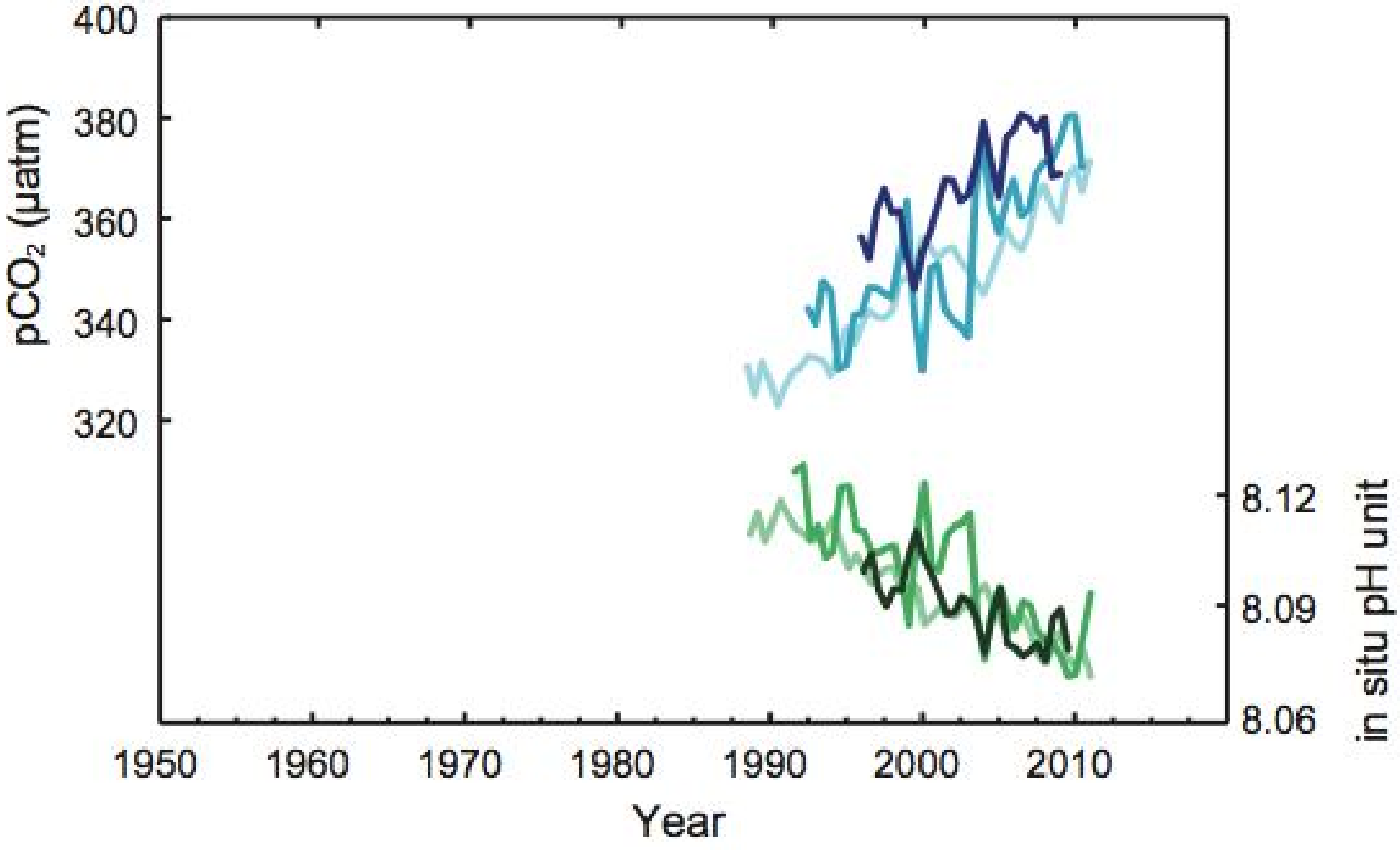


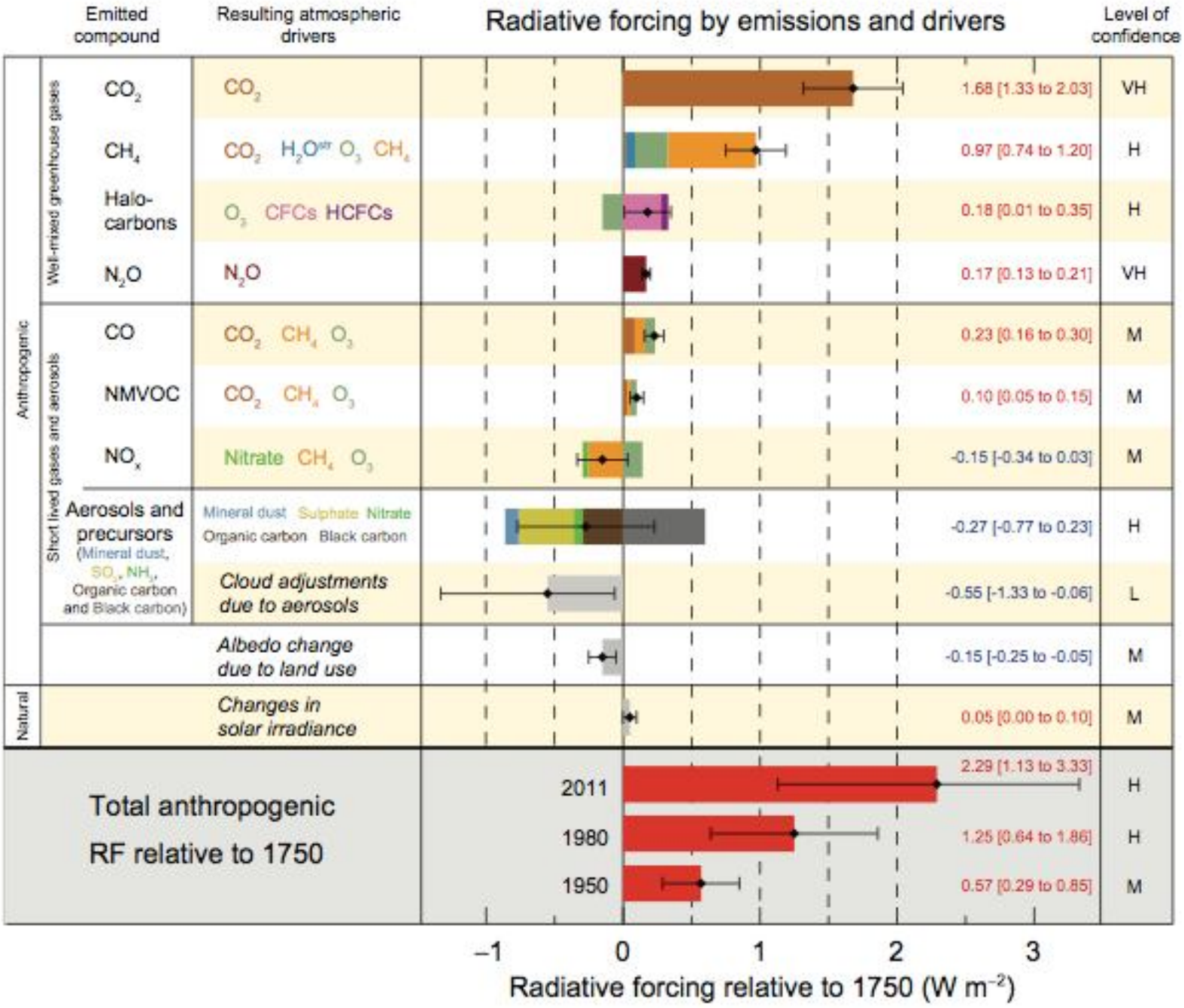


Global averages

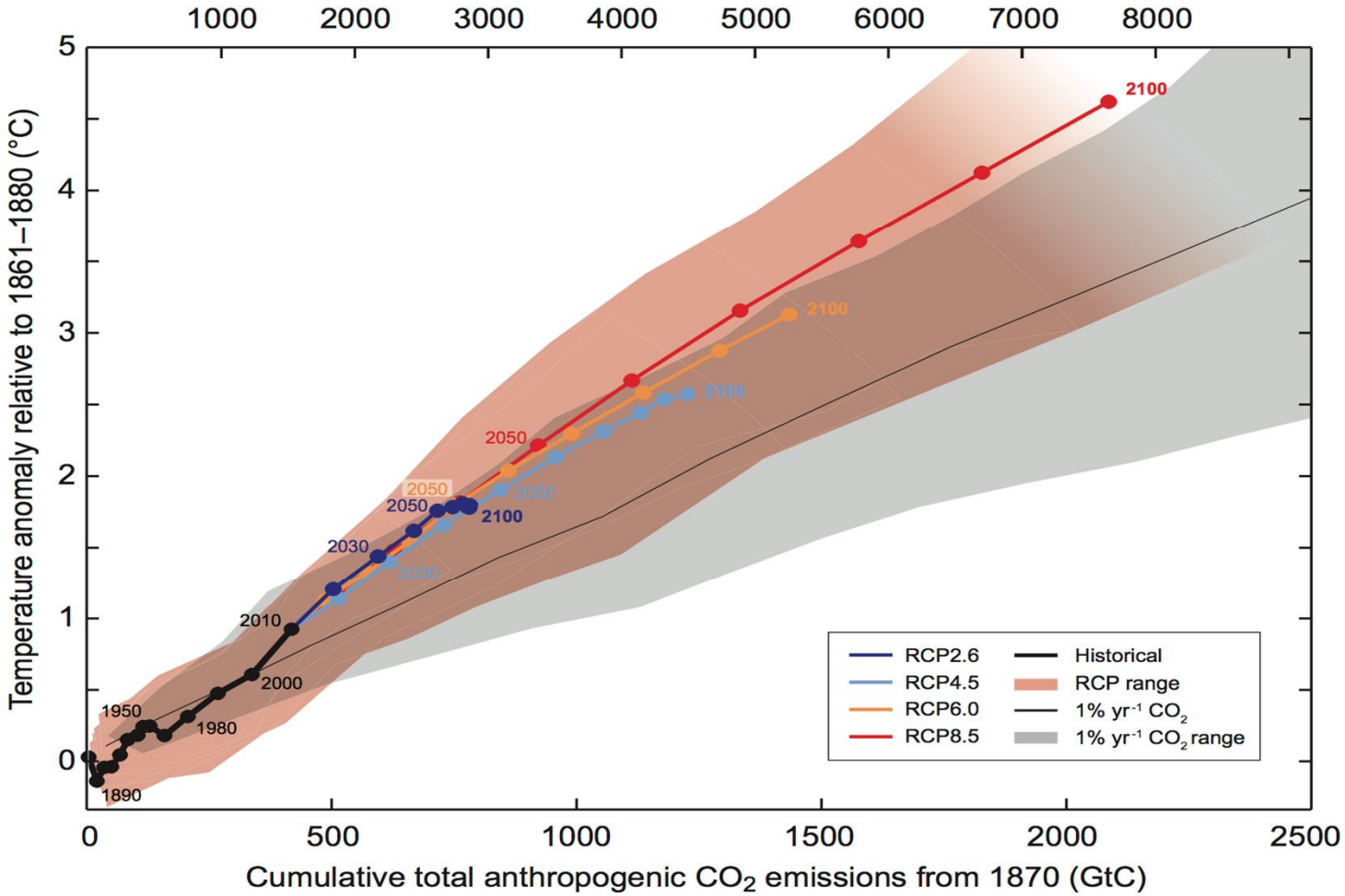


Surface ocean CO_2 and pH

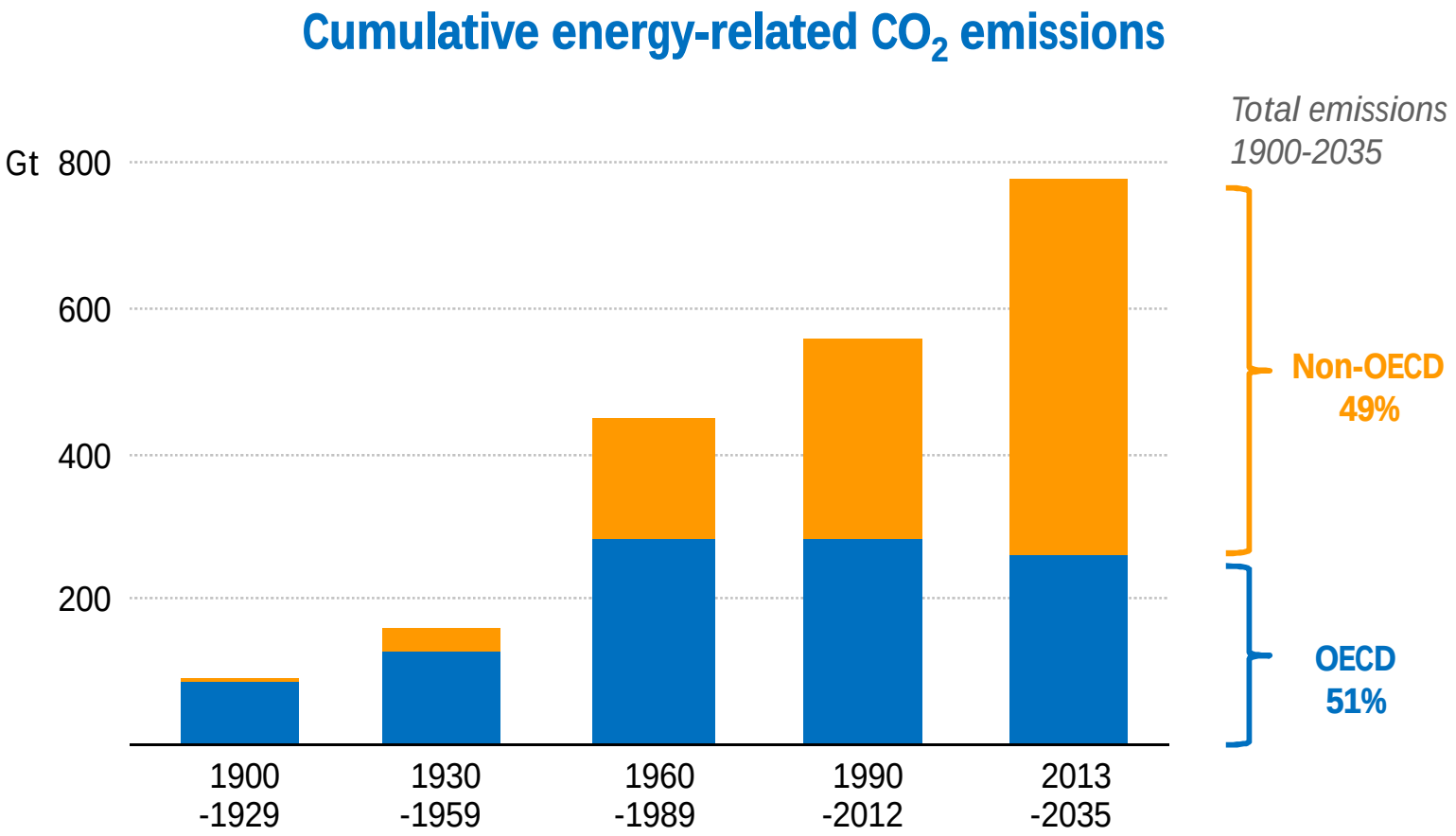



Emitted compound
Resulting atmospheric drivers
Radiative forcing by emissions and drivers
Level of confidence
Anthropogenic
Natural
Well-mixed greenhouse gases
Short lived gases and aerosols
CO2
CH4
Halo-carbons
N2O
CO
NMVOC
NOx
Aerosols and precursors (Mineral dust, SO2, NH3, Organic carbon and Black carbon)
CO2
CO2 H2Ostr O3 CH4
O3 CFCs HCFCs
N2O
CO2 CH4 O3
CO2 CH4 O3
Nitrate CH4 O3
Mineral dust Sulphate Nitrate
Organic carbon Black carbon
Cloud adjustments due to aerosols
Albedo change due to land use
Changes in solar irradiance
1.68 [1.33 to 2.03]
0.97 [0.74 to 1.20]
0.18 [0.01 to 0.35]
0.17 [0.13 to 0.21]
0.23 [0.16 to 0.30]
0.10 [0.05 to 0.15]
-0.15 [-0.34 to 0.03]
-0.27 [-0.77 to 0.23]
-0.55 [-1.33 to -0.06]
-0.15 [-0.25 to -0.05]
0.05 [0.00 to 0.10]
VH
H
H
VH
M
M
M
H
L
M
M
Total anthropogenic RF relative to 1750
2011
1980
1950
2.29 [1.13 to 3.33]
1.25 [0.64 to 1.86]
0.57 [0.29 to 0.85]
H
H
M
−1
0
1
2
3
Radiative forcing relative to 1750 (W m−2)

Cumulative total anthropogenic CO_2 emissions from 1870 ($GtCO_2$)



Emissions off track in the run-up to the 2015 climate summit in France

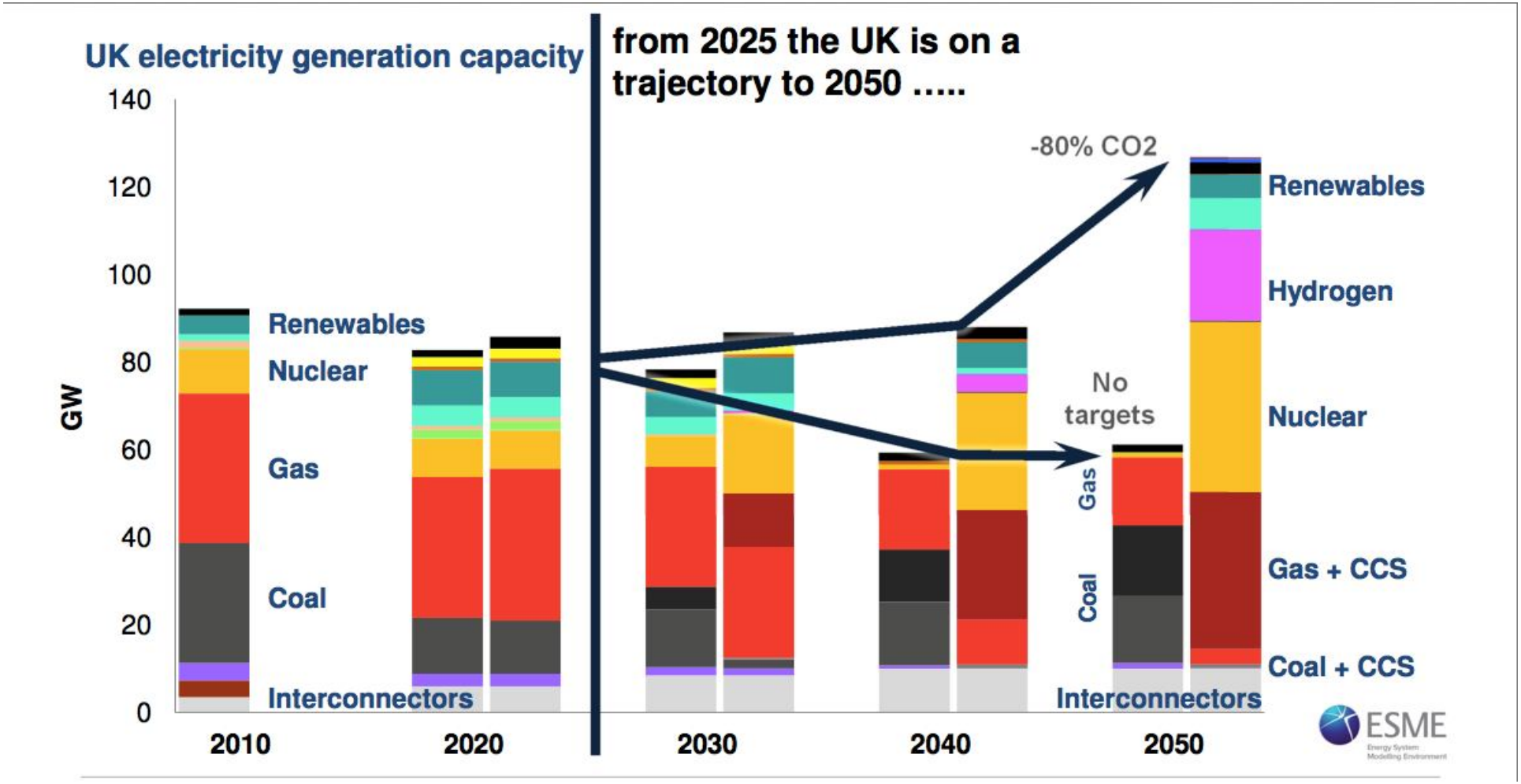


Non-OECD countries account for a rising share of emissions, although 2035 per capita levels are only half of OECD

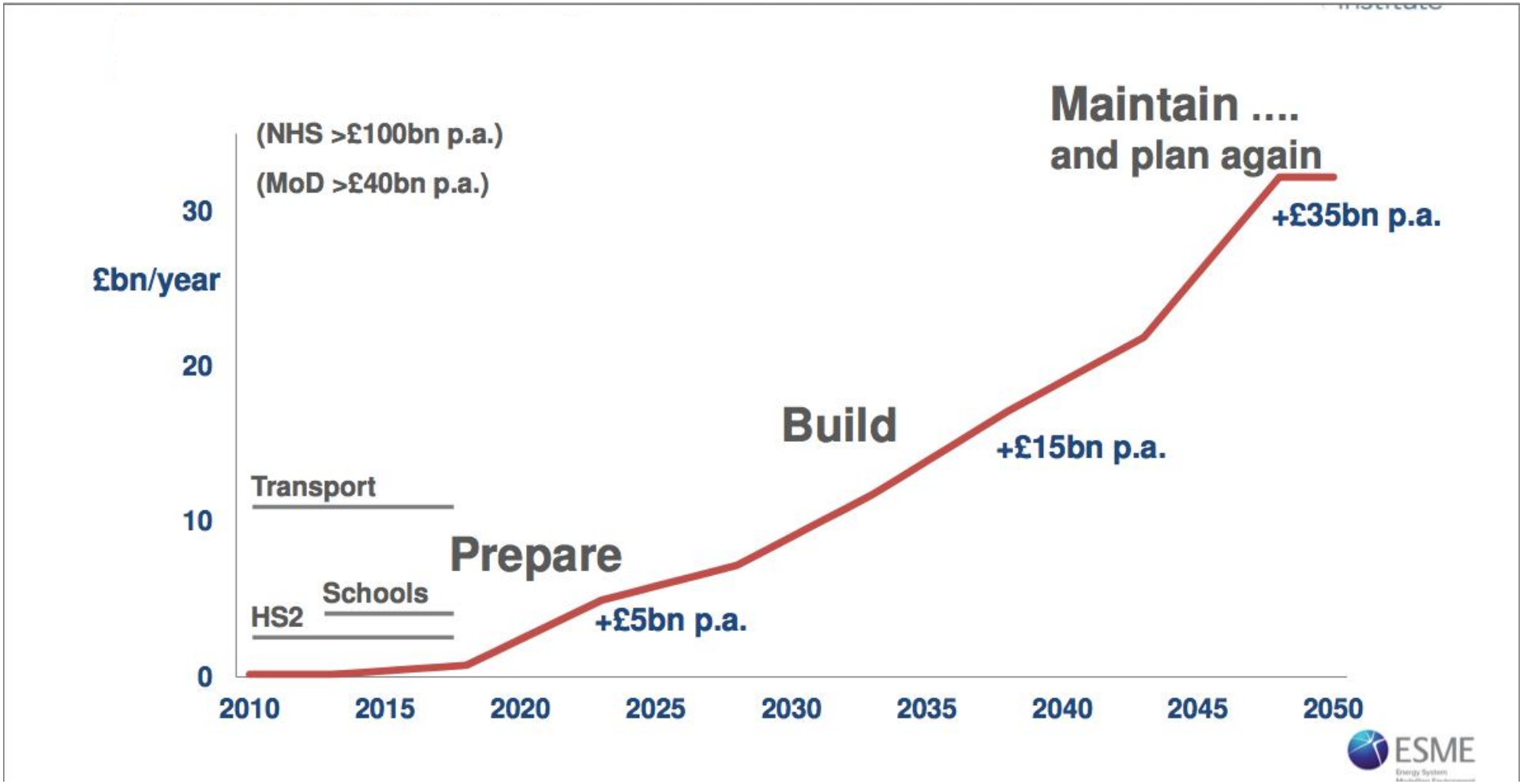
UK Policy

- 80% CO2 reduction by 2050
- Defossilise the grid by 2050
- Transfer the surface transport sector onto the grid

UK electricity generation capacity



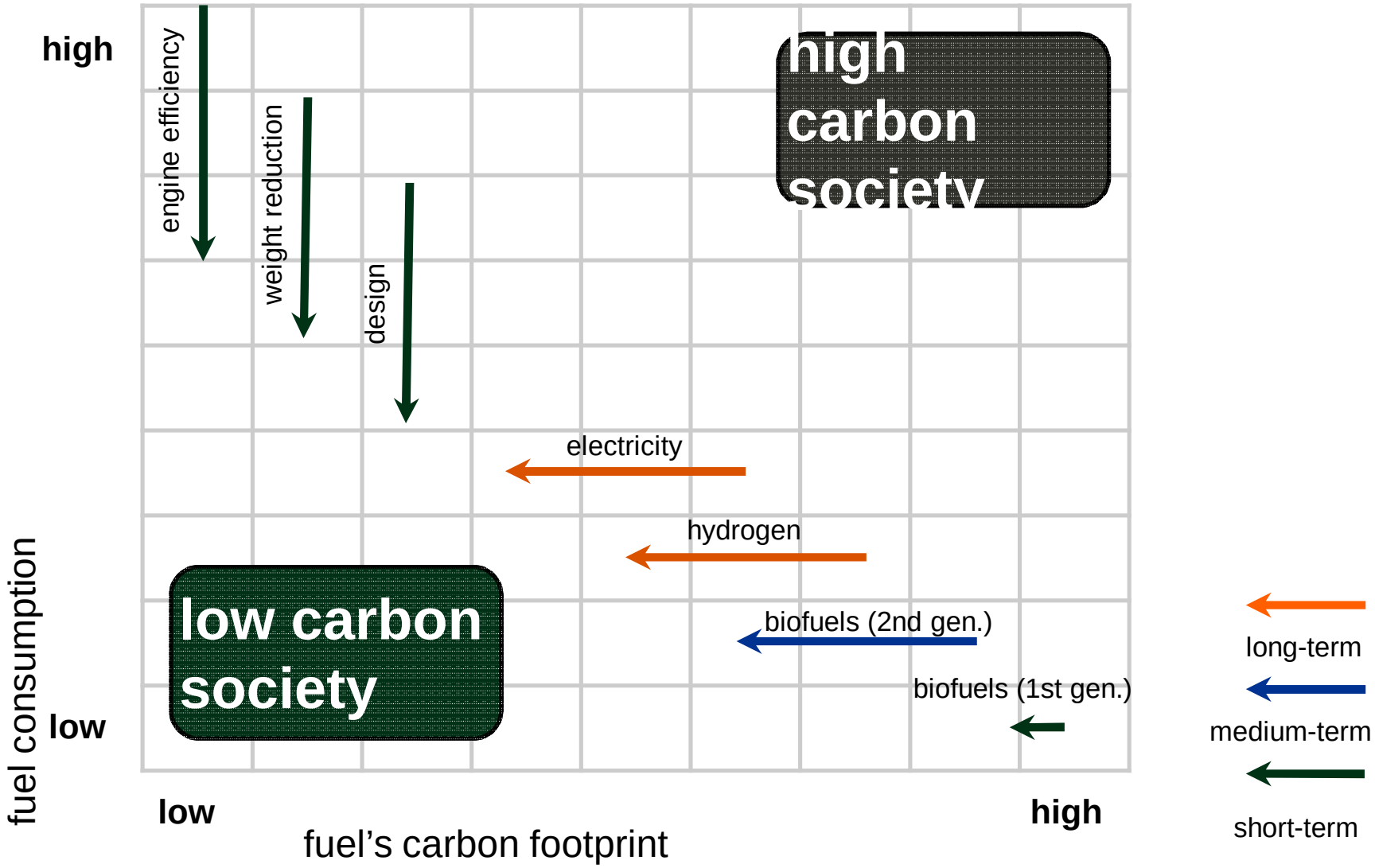
Incremental capital investment in energy infrastructure



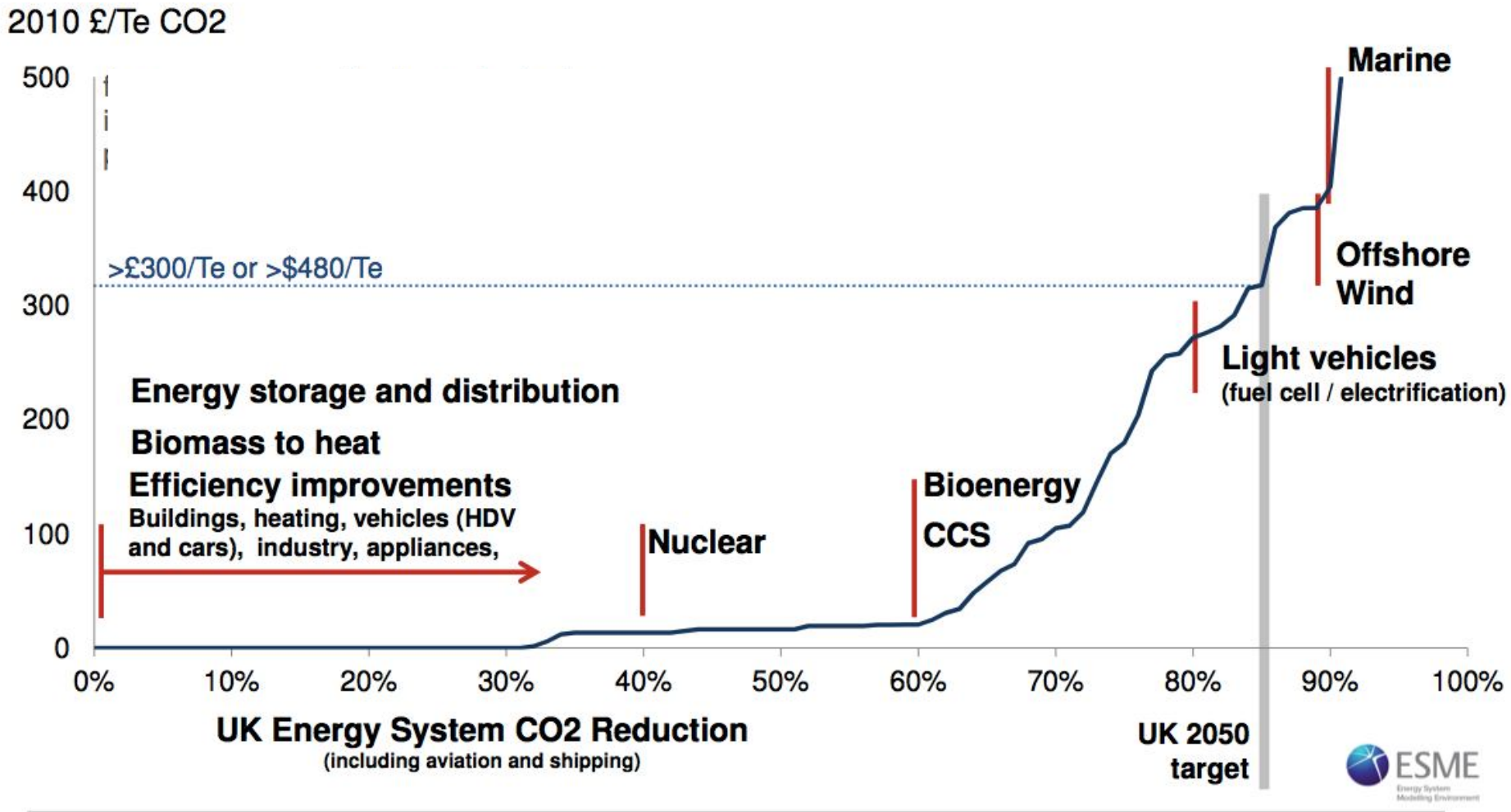
Q : " can radical technological innovation reduce the cost of supply?"

A : **Yes, but we need to target our innovation support .....**

Reducing Emissions: Road Transportation



First appearance of major technologies in order of increasing effective carbon price



We must harness the power of the sun

In tackling climate change, solar power must be at the forefront of research into non-carbon energy sources

David King and **Richard Layard**
The Observer, Sunday 29 September 2013

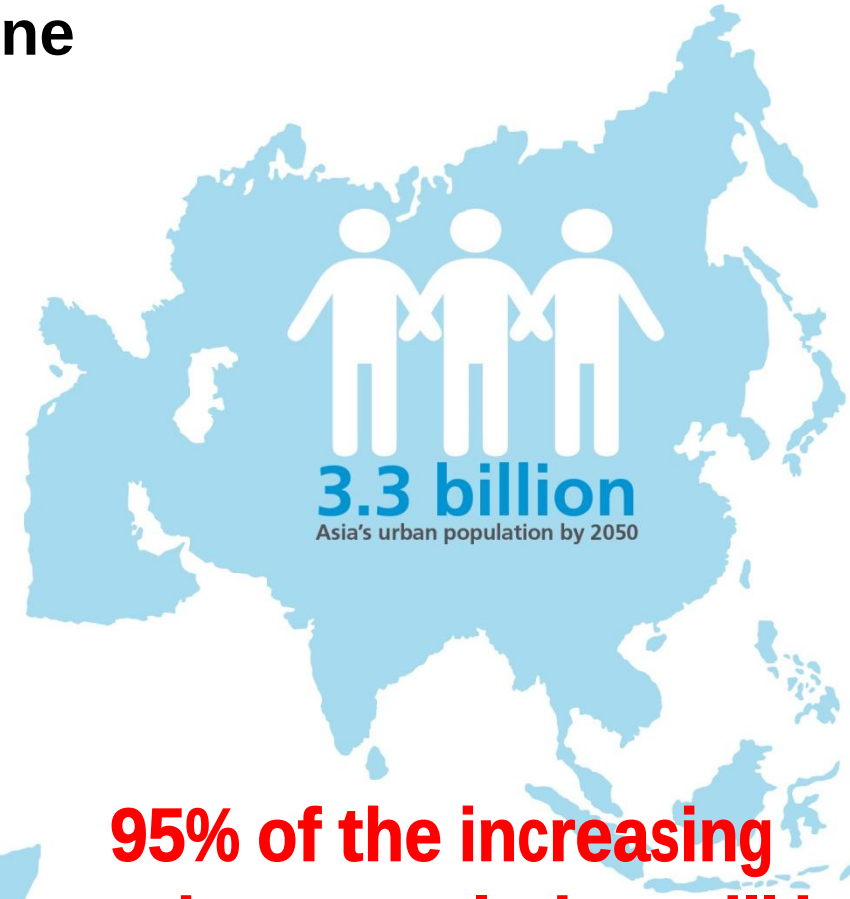
Jump to comments (317)

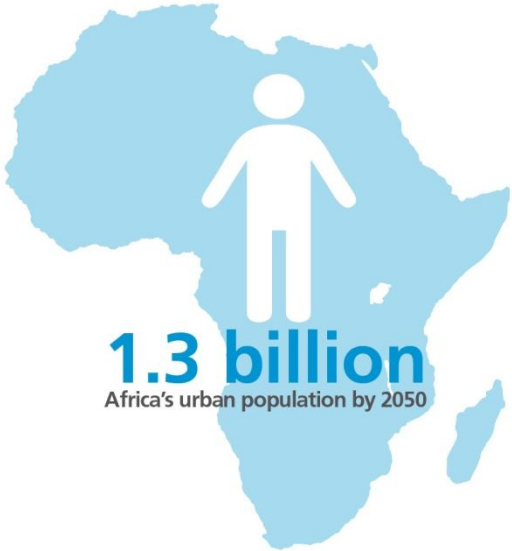
Rays of hope: the solar power tower outside Seville, Spain. Photograph: Denis Doyle/Getty Images

Last Friday's report from the United Nations confirms the huge danger from our continued dependence on fossil fuel. But one simple thing can break this dependence. It needs to be cheaper to produce non-carbon energy than it is by digging up coal, gas or oil. Once this happens, most

Cities are on the frontline

Nexus of challenge is the city - *cities in developing world face steepest challenge*



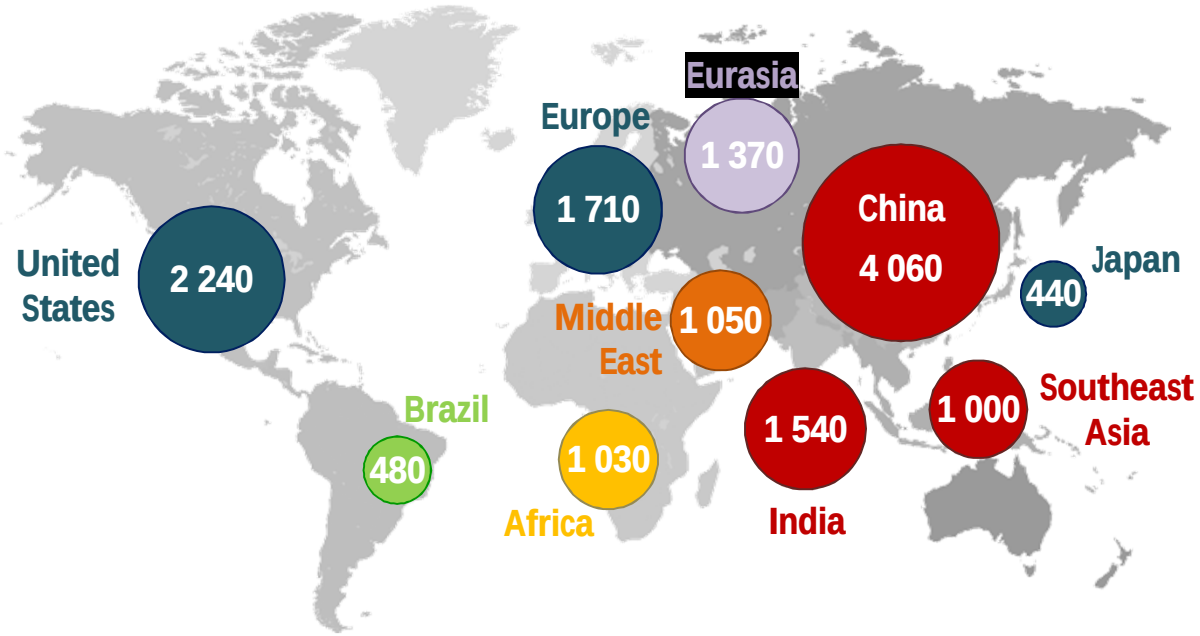


95% of the increasing urban population will be in developing countries – mainly in smaller cities

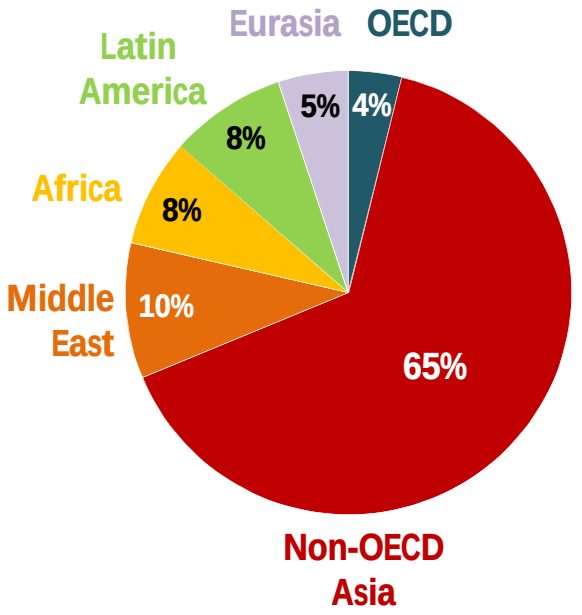
FUTURE PROOFING CITIES

The engine of energy demand growth moves to South Asia

Primary energy demand, 2035 (Mtoe)



Share of global growth 2012-2035



China is the main driver of increasing energy demand in the current decade, but India takes over in the 2020s as the principal source of growth

Waste towers over residents in Manila. The city has just banned disposable plastic shopping bags to curb the tide of rubbish in the city, which exacerbates its flooding problem

Photograph: Noel Celis/AFP

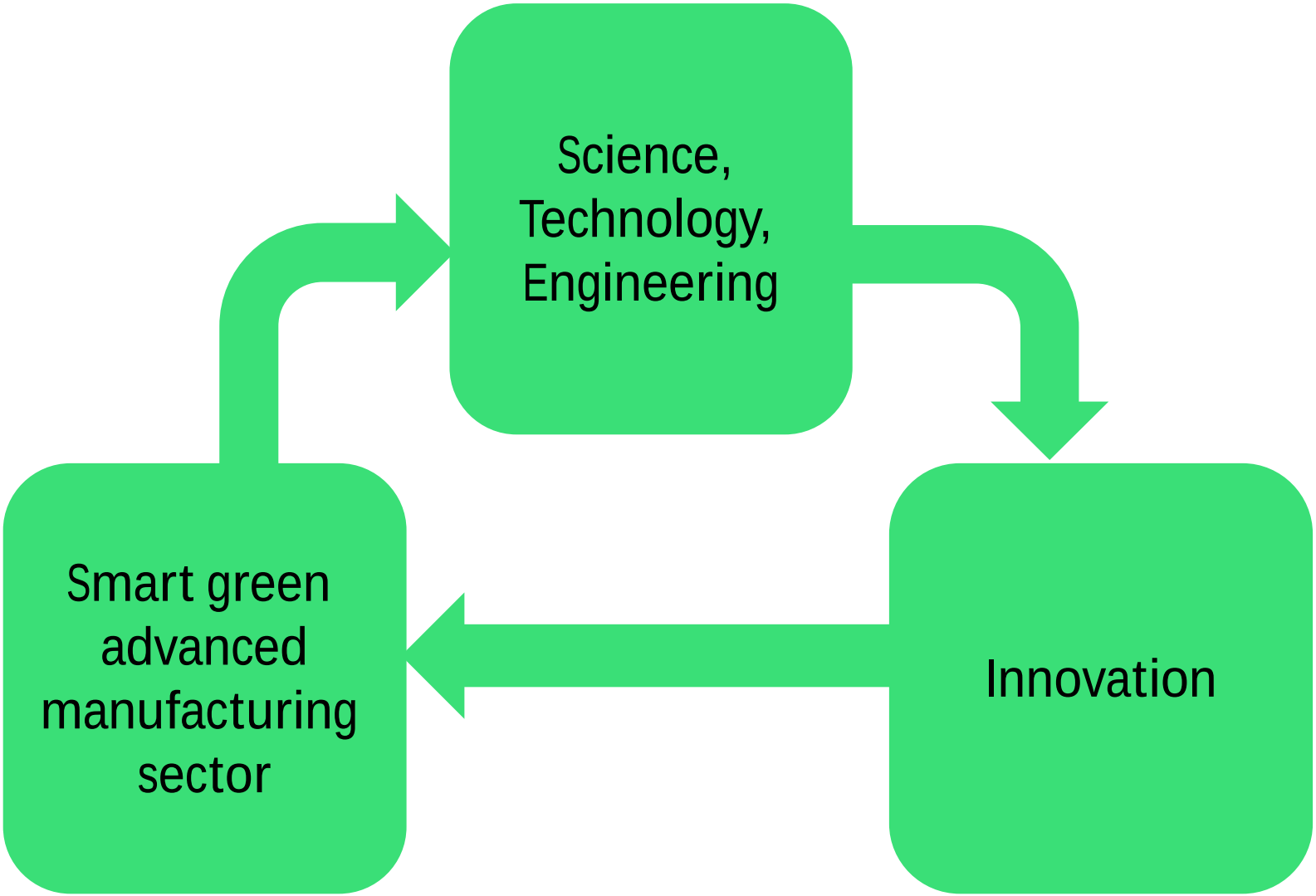
“Circular Economy”

Source: Ellen MacArthur Foundation

Personal Urban Mobility

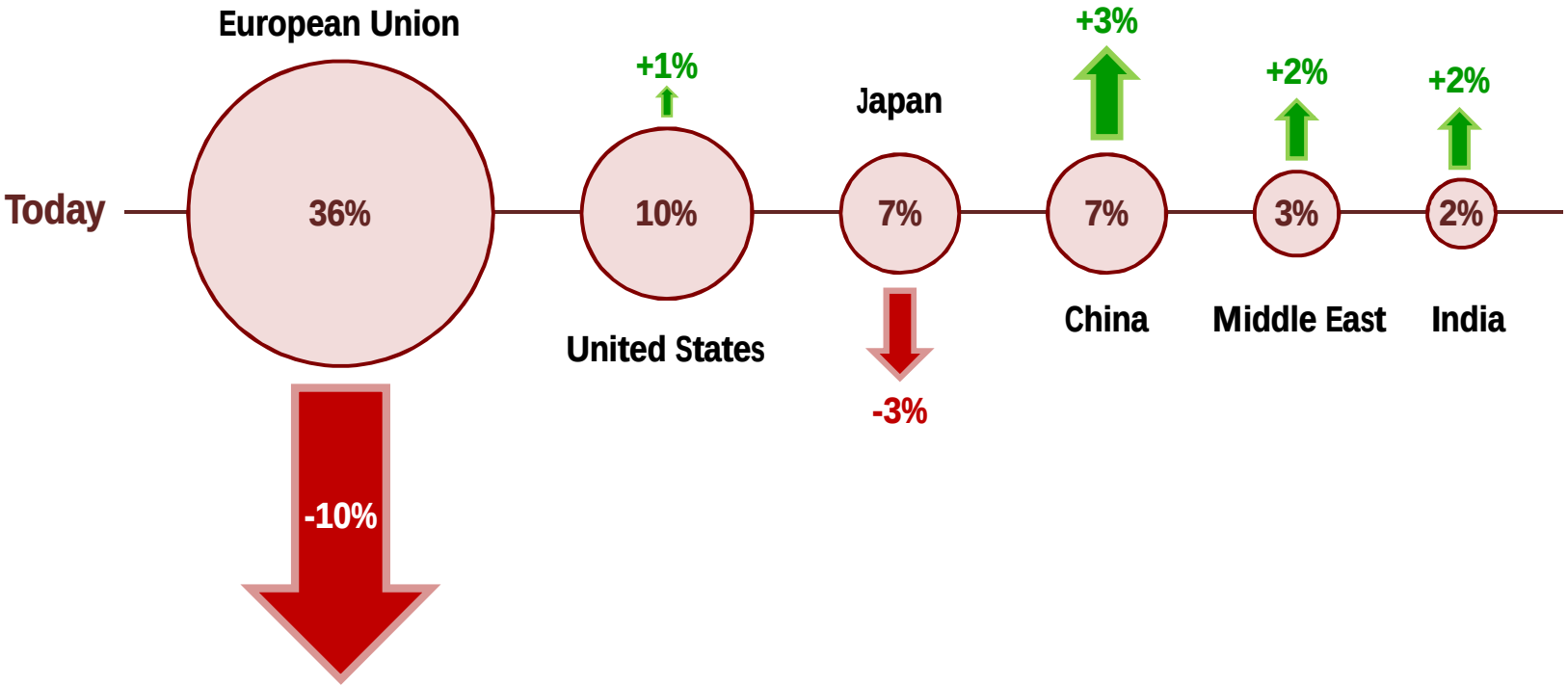
left: Gordon Murray Design T25 right: C. Borroni-Bird (GM) in O.R. Inderwildi & D.A. Kind (Eds.), 'Energy, Transport & the Environment, Springer 2012

Emergence of Smart Green Advanced Manufacturing Sector



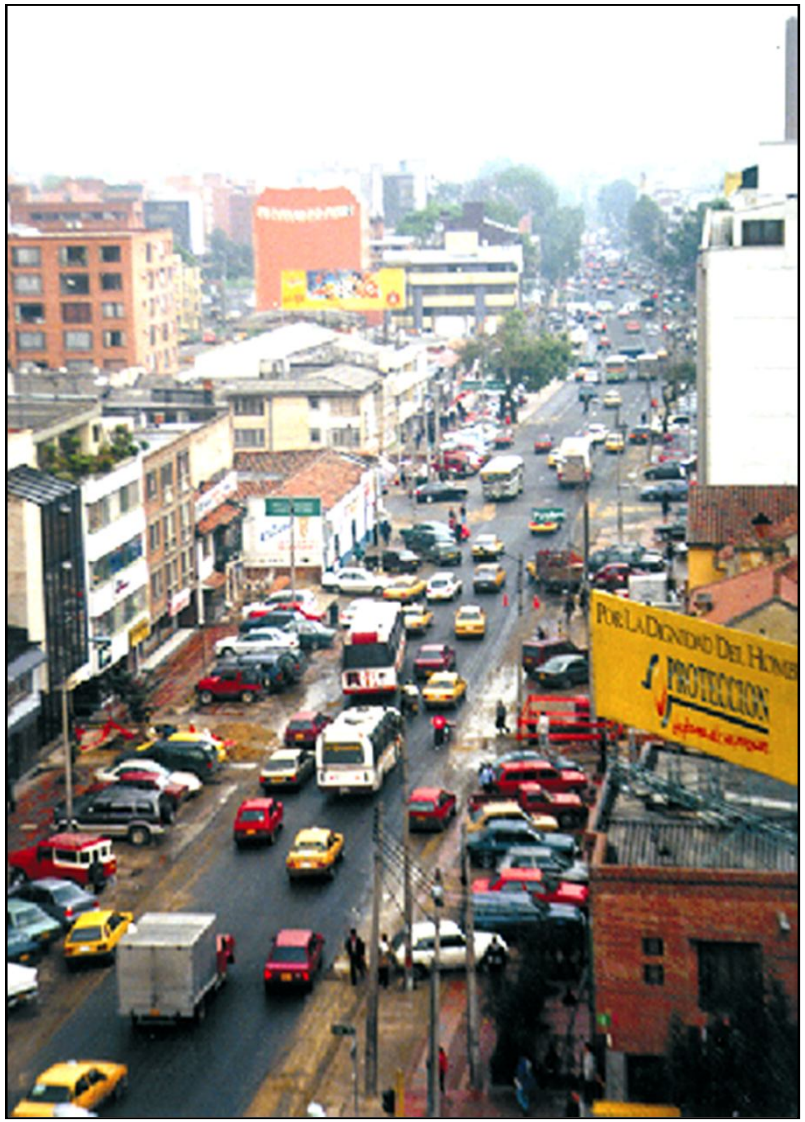
An energy boost to the economy?

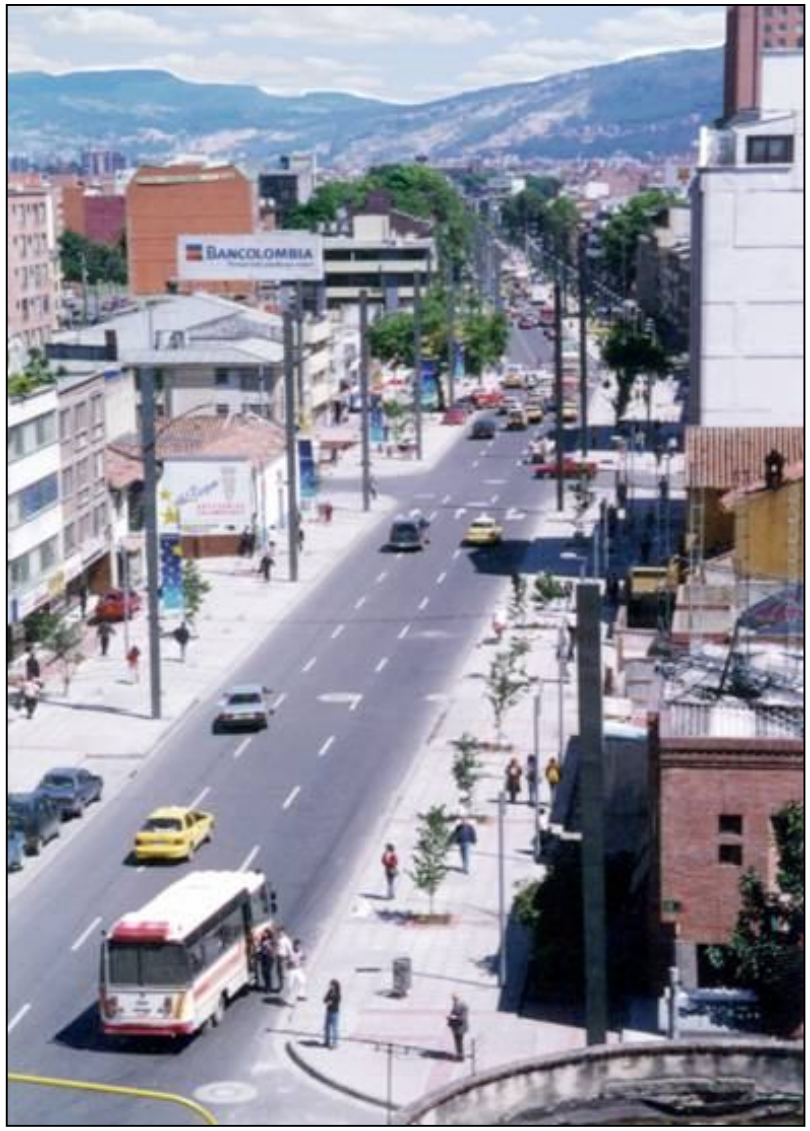
Share of global export market for energy-intensive goods



The US, together with key emerging economies, increases its export market share for energy-intensive goods, while the EU & Japan see a sharp decline

People vs. Cars: Bogota





Source: Courtesy of Enrique Penalosa