



Chief Scientist

Chief Scientist for Australia
Professor Penny D Sackett

Science, Scientists, and a Sustainable World

Views from Down Under

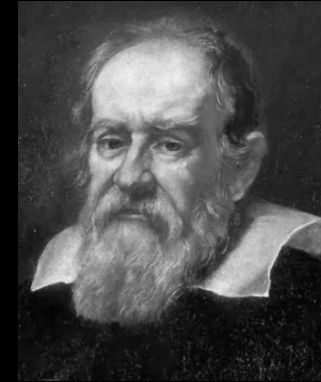
Presentation at the Club of Rome Aurelio Peccei
Lecture

Brussels, 14 January 2009

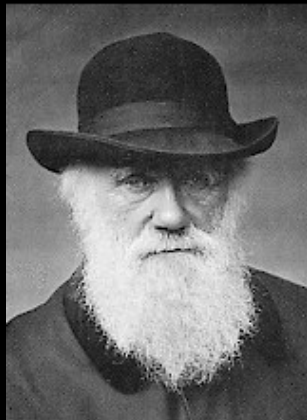
Celebrating Galileo and Darwin

400 years ago: Galileo refined Dutch design of telescope

- The Earth moves
- The Heavens are complex (not “perfect”)
- The Heavens change
- Celebrate as International Year of Astronomy



Portrait of Galileo Galilei by
Justus Sustermans 1636



200 years ago: Darwin was borne

150 years ago: *Origin of the Species* published

- Organisms most suited to environment survive
- Different or changing environments ---> diversity
- Species change (adapt)

A Young Nation



© Commonwealth of Australia

Population

- Doubled since 1960
(1930 for USA)
- 24% foreign born
(13% for USA)
- 40% have parent(s)
born overseas

Became a nation in 1901



On an Ancient Land

Lake Thetis, WA



Stromatolites

Cyanobacteria

Living 2-3 K years old

At least 2.724 Gyr ago

Responsible for early oxygen



Jack Hills, WA

Zircons

Dated at 4.404 Gyr old

Indestructible packages

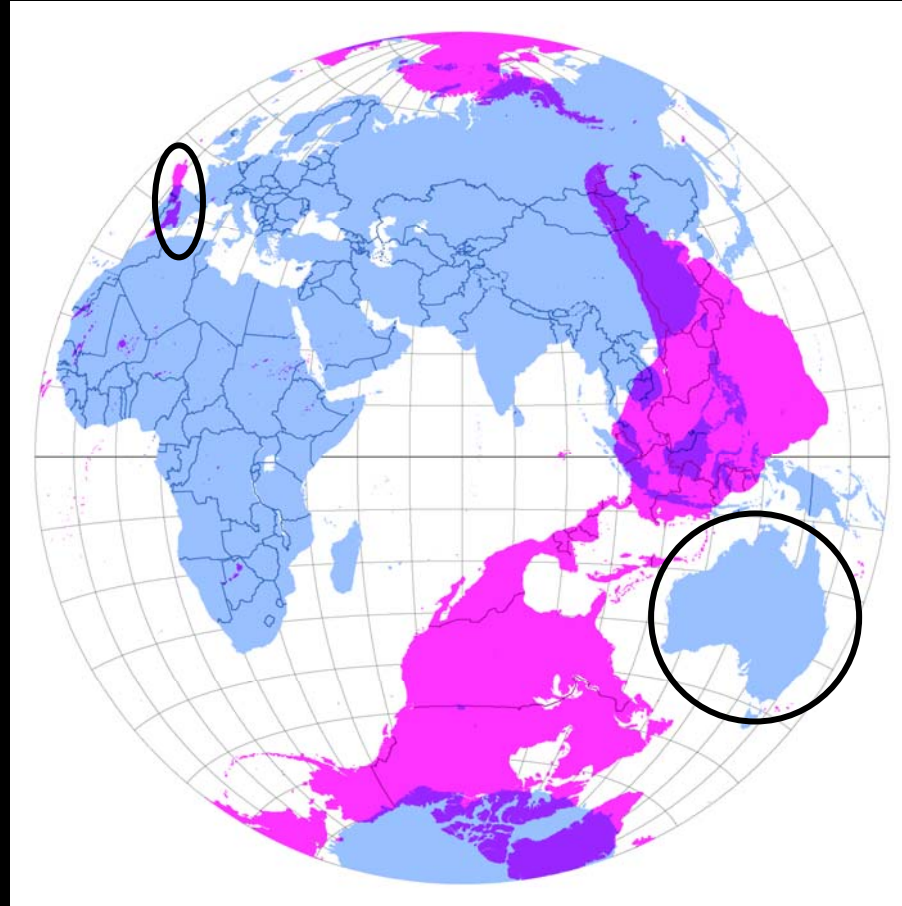
May have formed in presence of water



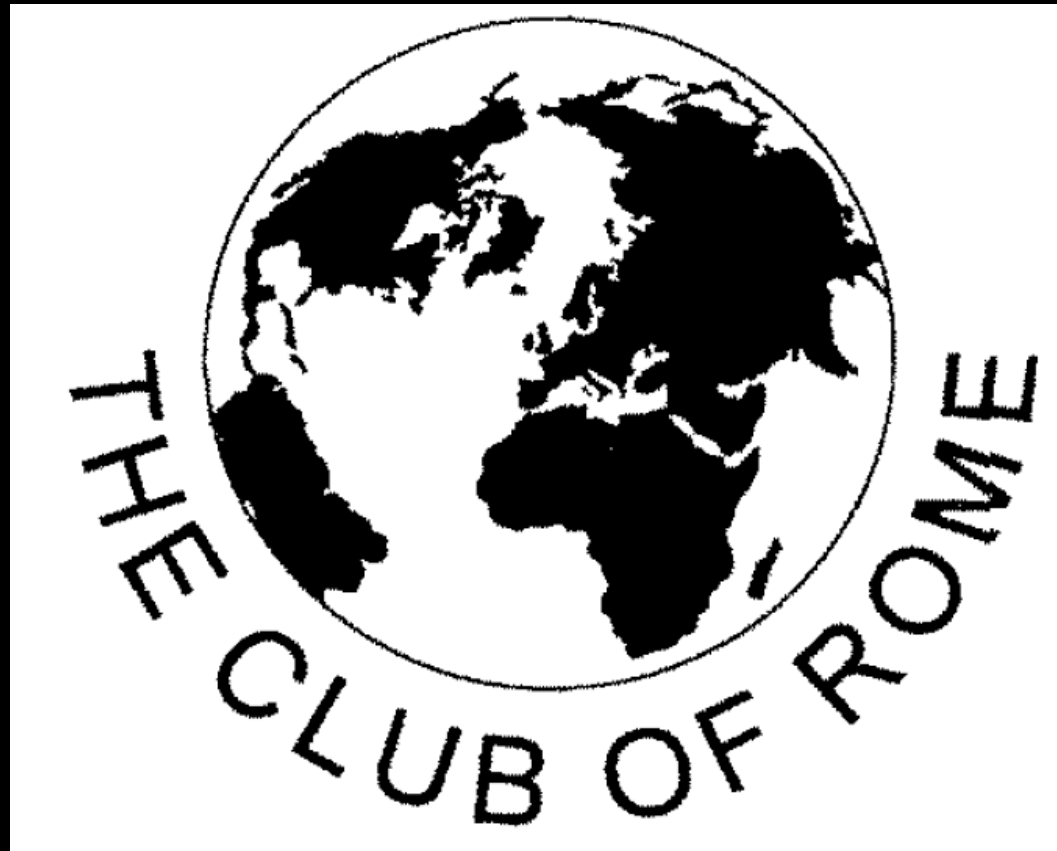
One of the Oldest Cultures



The Antipodes



A Matter of Perspective

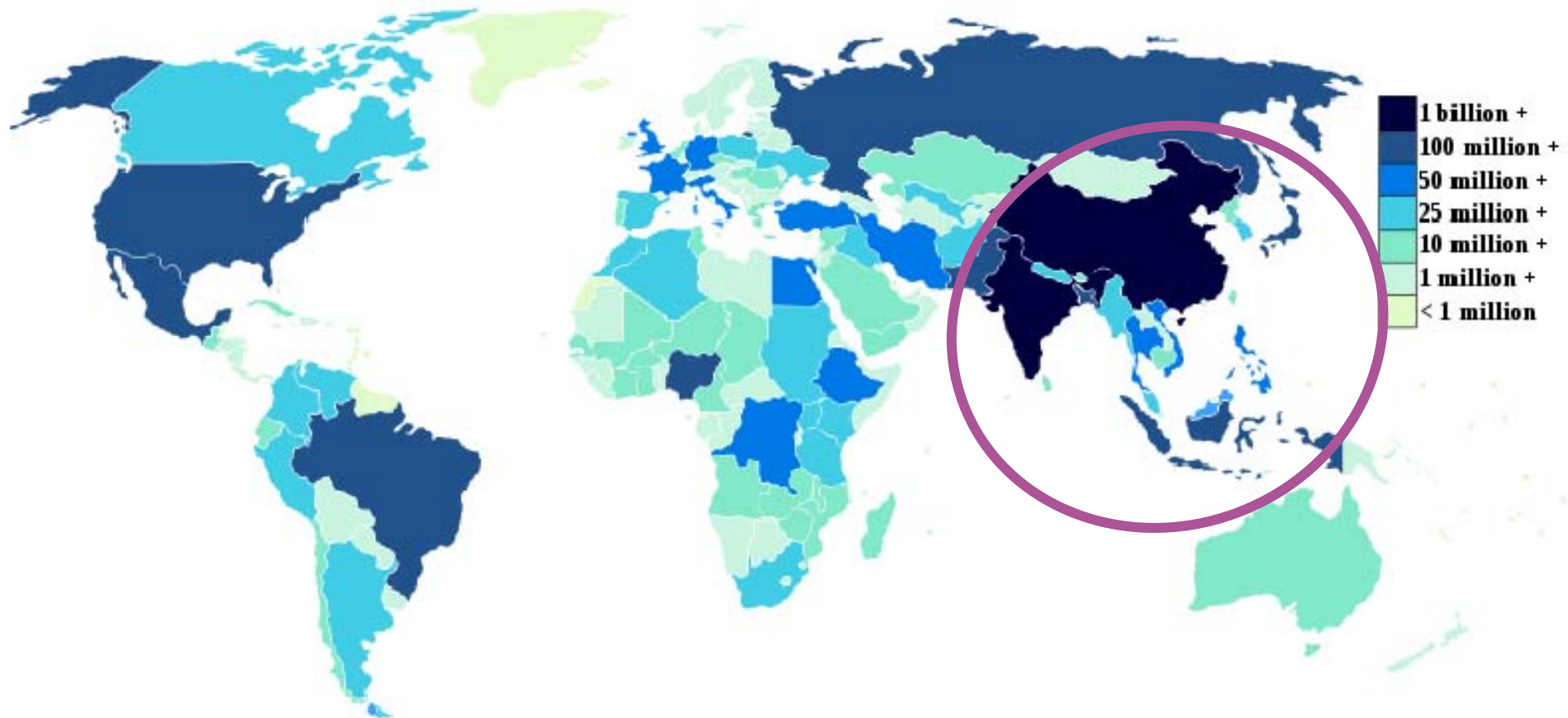


A Matter of Perspective



Different neighbours

One View: Populous Nations



Map of countries by population. Based on data from various country sources.

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Land, People, Economy



AUSTRALIA



EU

Land Mass	7.7 Billion km ² / 2 = 4.3 Billion km ²	
Water	1%	3%
Population	21 Million * 25 =	500 Million
Naturalized	24 %	4 %
Pop inc/year	1.2%	0.12%
Migration Rate	6.3 per 1000	1.2 per 1000
GDP ('08 PPP)	\$37,000	\$31,000
Inflation	4.8%	3.9%
Unemployment	4%	7%

Trade

AUSTRALIA



EU

Major
Exports

Major
Imports

Major
Exports

Major
Imports

Coal

Crude Petrol

Vehicles

Petroleum

Iron ore

Vehicles

Machinery

Tele equip

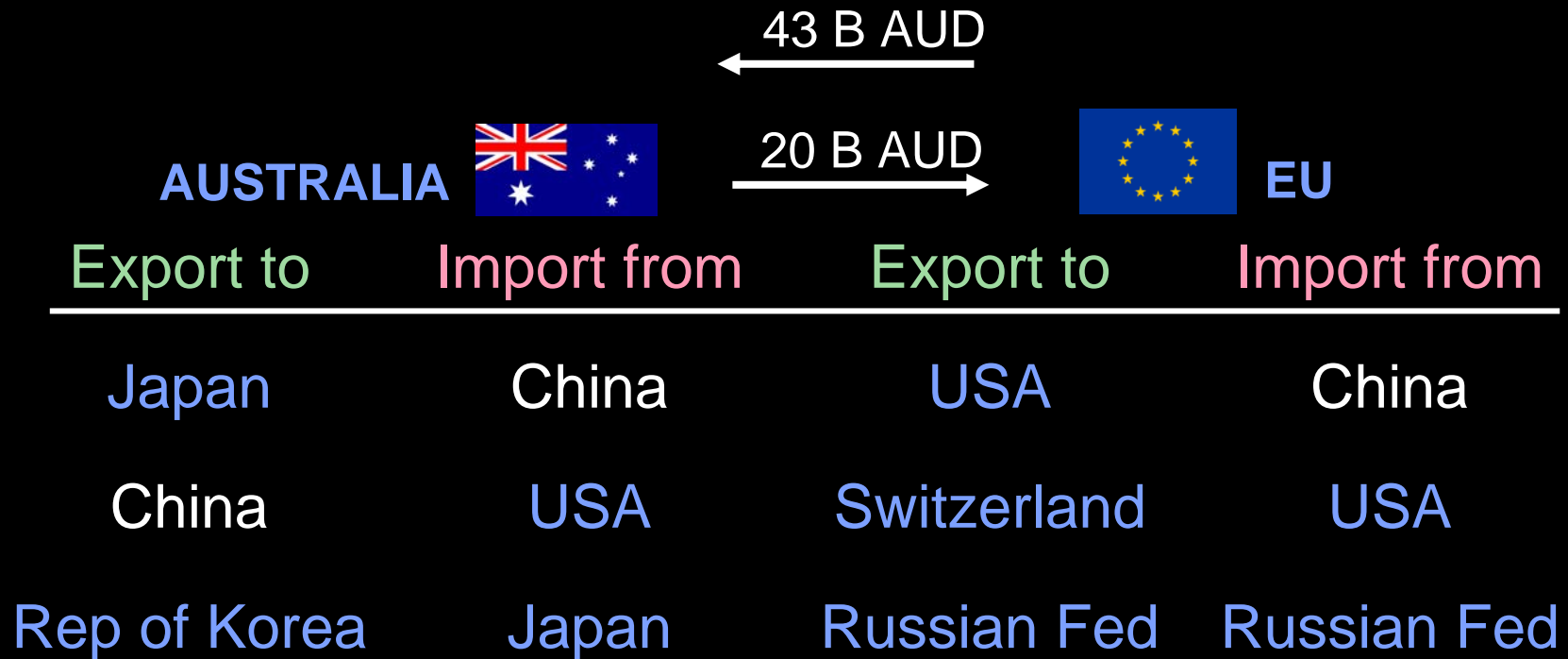
Gold

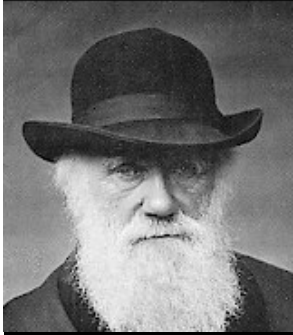
Ref Petrol

Appliances

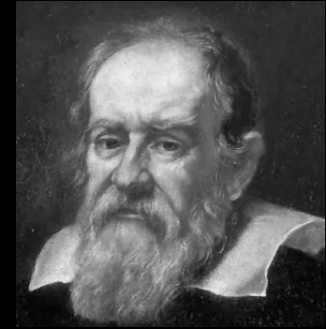
Appliances

Trade Partners





Limits to Growth



Enduring Concepts from 1972

Club of Rome's Project of the Predicament of Mankind :

Population and Economic Growth are linked and bounded by shrinking Resources and growing Pollution

2007 update: Greenhouse Gases: CO₂
Technology can extend timescale but not alter basic outcome

Limits and tragic consequences of overshoot require new thinking

Development and environment must be conceived as a joint issue

This is a challenge for our generation. It cannot be passed on to the next

Donella H. Meadows et al. (1972). *The Limits to Growth*. New York: Universe Books – commissioned by the Club of Rome



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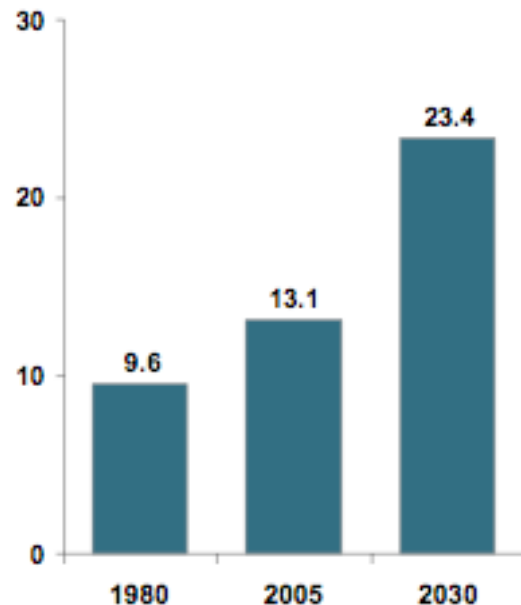
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Australia is preparing for a changing world . . .

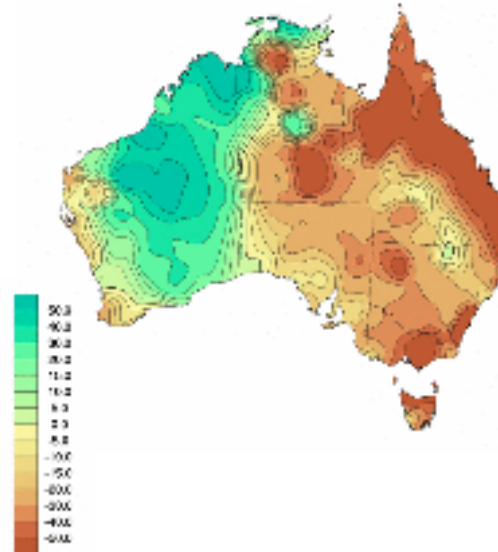
Ageing Population

Proportion of population aged 65+ (%)

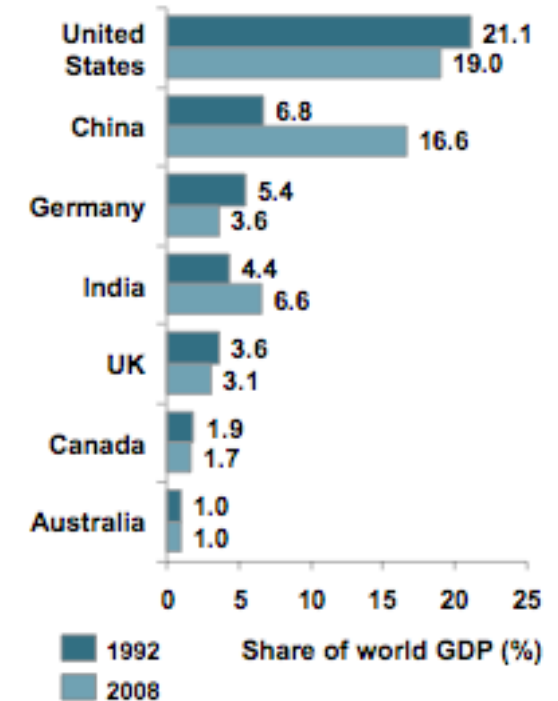


Climate Change

Trend in annual total rainfall, 1970-2007 (mm/10yrs)



World GDP Shifts

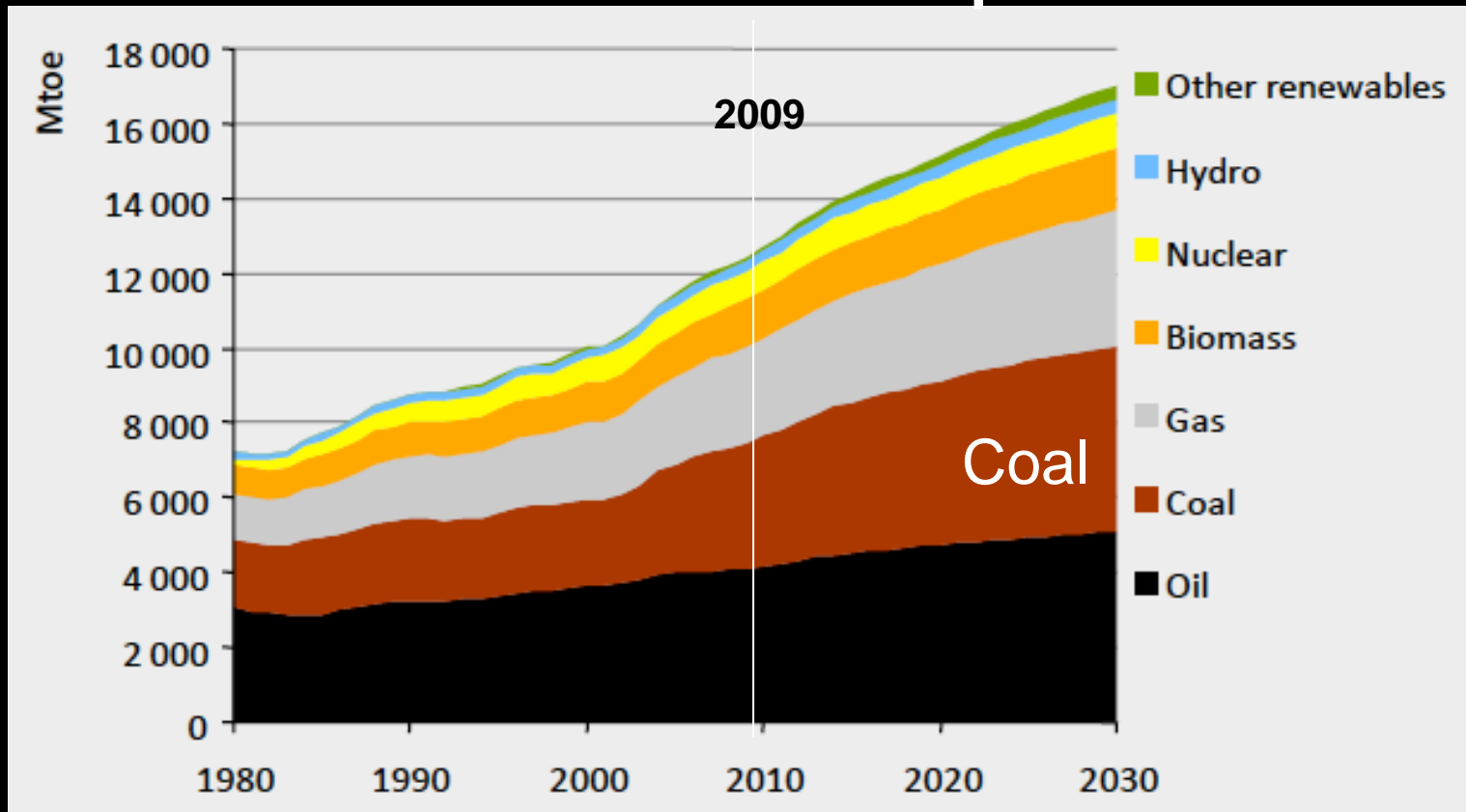


Key themes from the Australian 2020 Summit

Source:
1: Australian Bureau of Statistics, *Population projections, Australia* (2006);
Australian Bureau of Statistics, *Population by age and sex* (2006);
2: Australian Bureau of Meteorology (2008);
3: IMF, *World Economic Outlook Database* (2007)



. . . that continues to depend on coal



IEA World Energy Outlook 2008

Australia is the top coal exporter,
producing 30% of world coal trade¹

¹Australian Department of Resources, Energy and Tourism

Climate change is important to Australia . . .

- Fossil Fuels important to Australian economy
- Rising sea levels threaten largely coastal population
- Water is already very scarce
- Droughts and bush fires are already common
- Large number of increasingly endangered and unique species
- Enormous threat to barrier reef environments



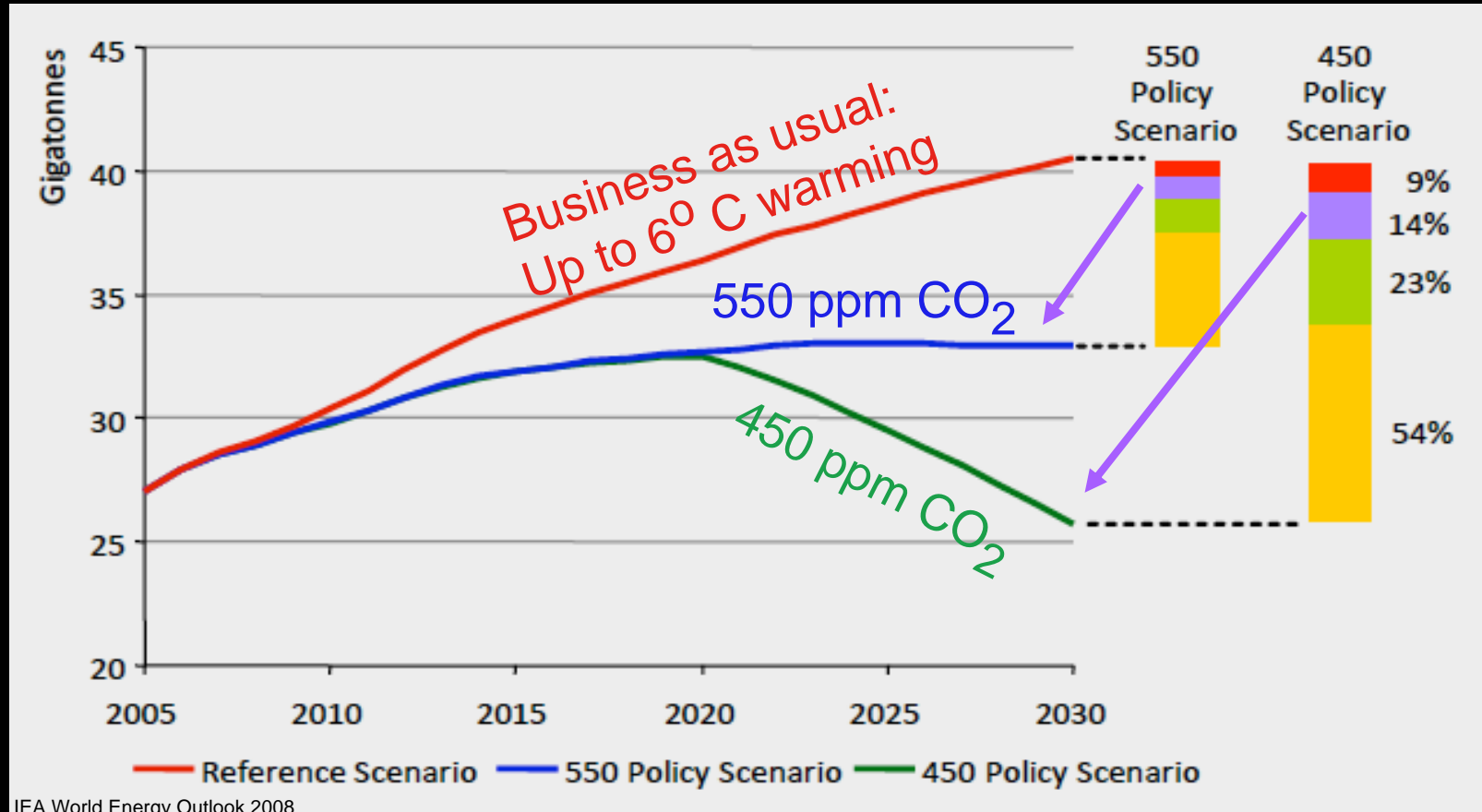
. . . and thus high on Australian agenda

- Ratified Kyoto Agreement
- Set carbon emission targets for 2020:
 - Unconditionally reduce 5% below 2000 levels
 - 15% below if an international agreement is put into place
 - Long-term target of 60% reduction below 2000 levels by 2050
- Cap and Trade on CO₂
- Target of 20% renewable energy by 2020
- Major assistance for industries in transition
- Declared Climate Change a National Security Priority
- Funds for green technologies
- Establishing Global Carbon Capture and Storage Initiative

Source: Commonwealth of Australia. (2008). *Carbon Pollution Reduction Scheme: Australia's Low Pollution Future*

Carbon Capture & Storage is one Key

World CO₂ Emissions

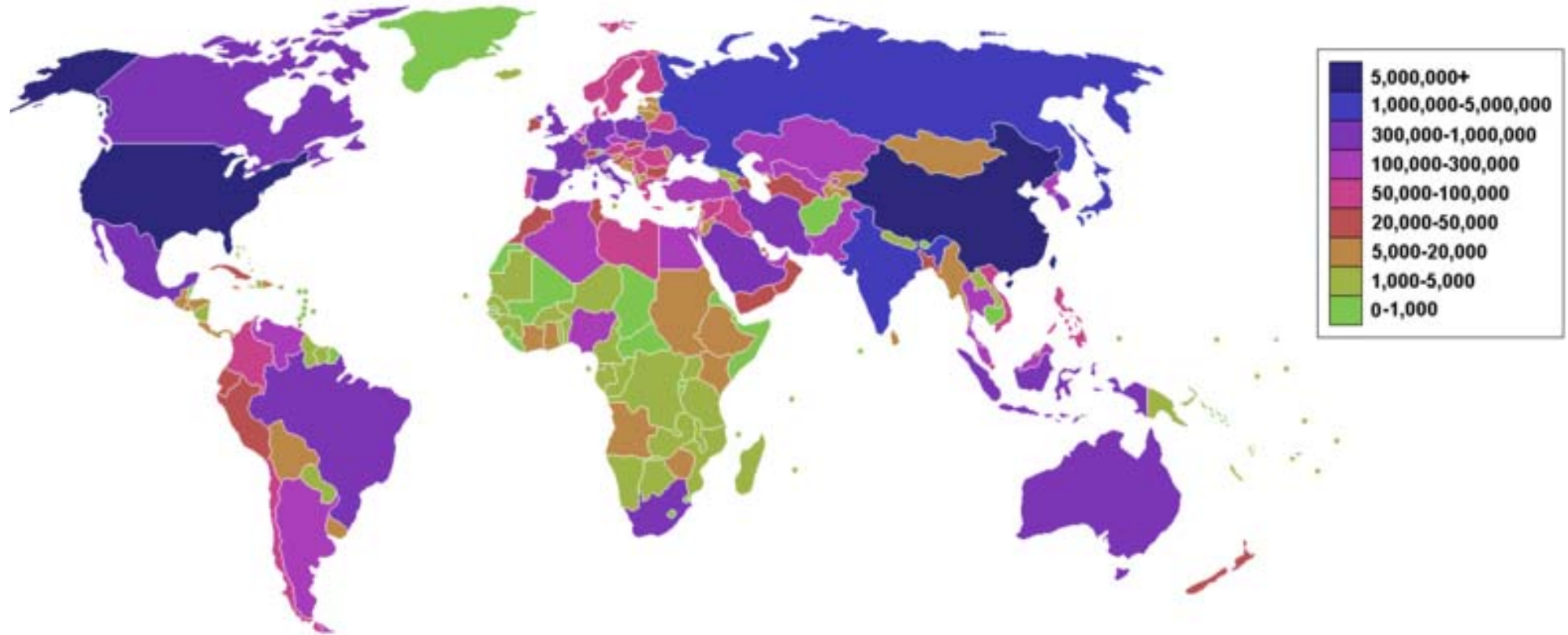


 **Efficiency Now**

 **Phase-in Renewables**

 **Start Large-Scale CCS**

How Nature sees CO₂: Total Emissions



Annual CO₂ emissions (in thousands of metric tons). Based on 2004 emissions data, collected in 2007 by the US Department of Energy's Carbon Dioxide Information Analysis Center (CDIAC) for the United Nations

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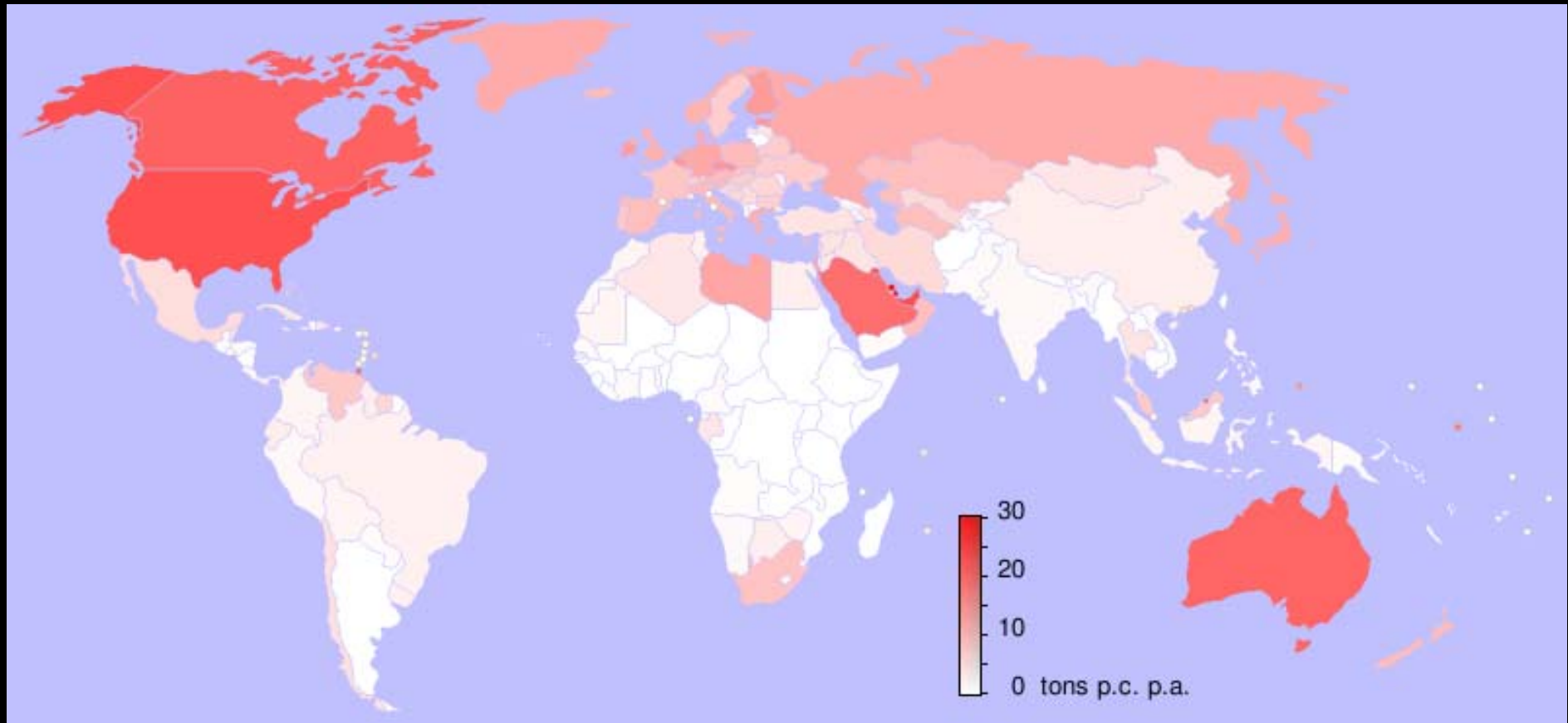
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How Societies see it: CO₂ Emissions per person



Map based on 1990-2004 data calculated by the US Department of Energy's Carbon Dioxide Information Analysis Center (CDIAC)

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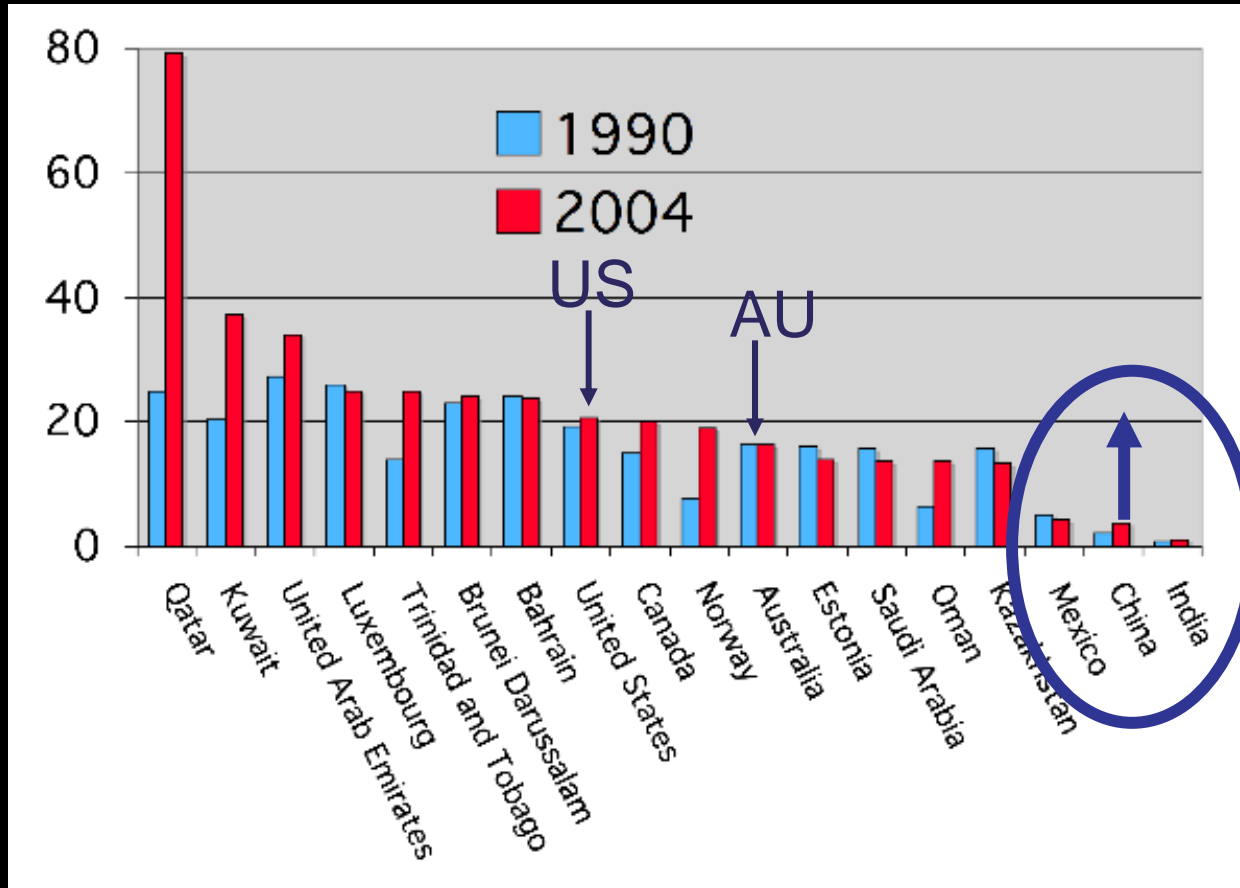


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Long-term Global Equity ?

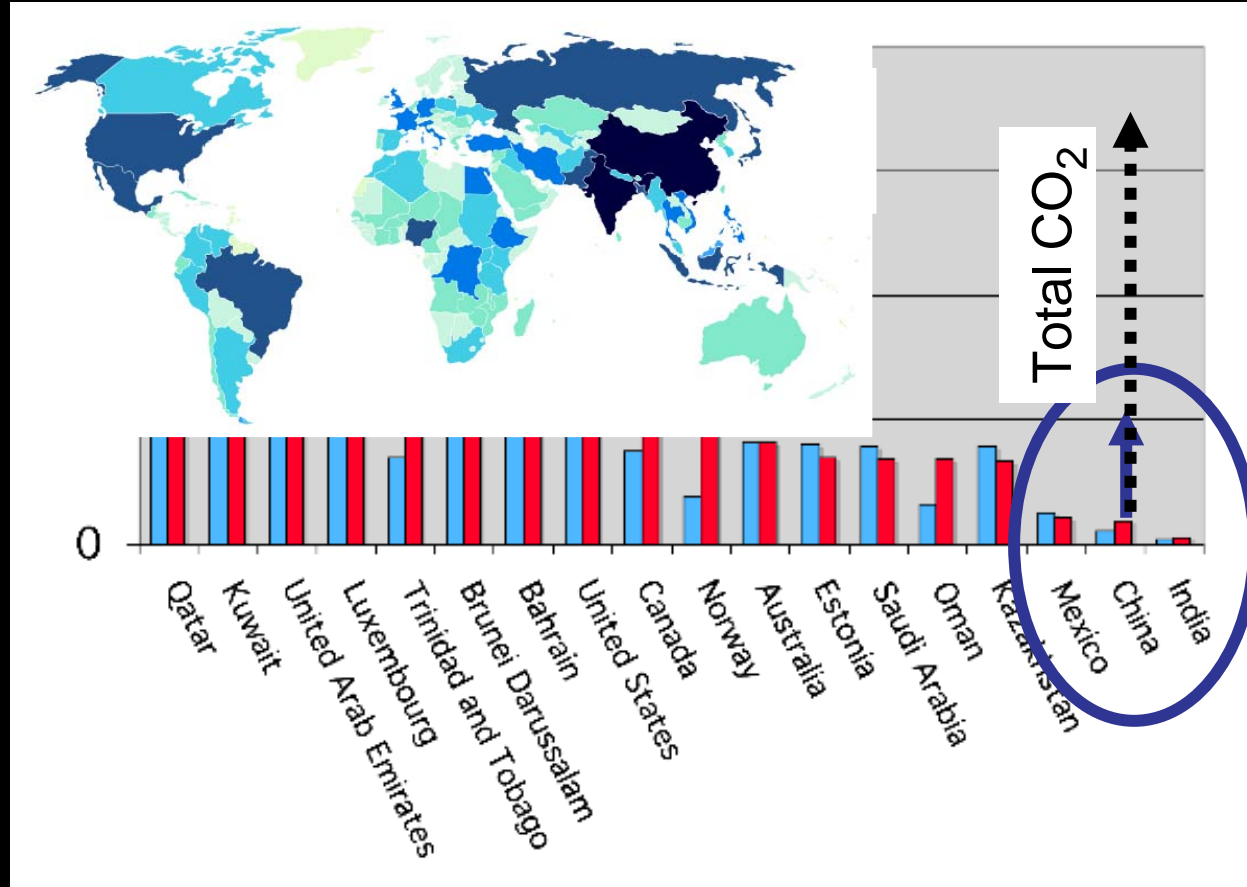
Tonnes CO2 Per Capita Per Yr



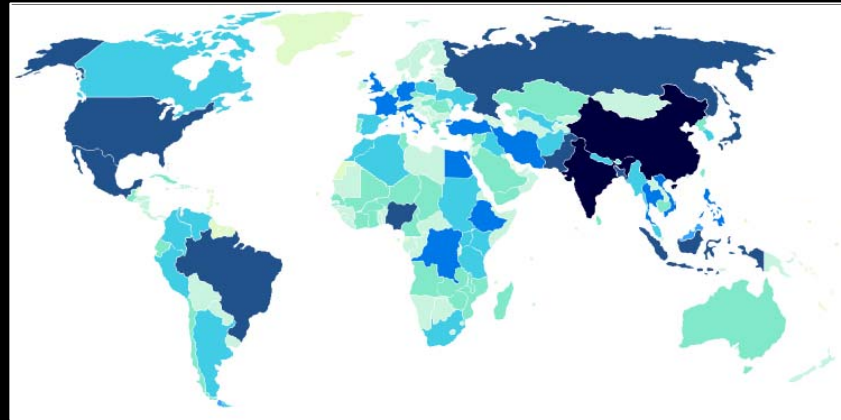
Source data: UNDP 2007/2008 Human Development Report: <http://hdrstats.undp.org/indicators/237.html>

Long-term Global Equity ?

Tonnes CO2 Per Capita Per Yr



Long-term Global Equity ?



Would require

- Accounting of emissions embedded in trade
- Migration accounting in national emissions budget
- Revolution(s) in clean energy and efficiency
- Political and social will
- A new meaning of economic success



The Eye of the Beholder



Image created using data from the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS)
Source: NASA Visible Earth

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Progress or Pollution?



Image created using data from the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS).
Source: NASA Visible Earth

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From Here to Sustainability

- CO₂ (or GHG) emissions cannot be seen as a proxy for wealth, social well-being, or economic growth
- More importantly, emissions must not actually link strongly to wealth and well-being
- We must find a new way
- We must find multiple ways



The Role of Scientists

The World is Listening
But what is it Hearing ?

- Engage public and governments on science and policy
- Explain relevant concepts
 - Non-linearity processes
 - Probabilities and risks
 - Interconnectivity and feedback loops
 - Exponential growth, equilibrium and overshoot
- Learn about science outside own discipline
- Speak as an expert within discipline
- Lessons from Galileo and Darwin: Things change, adapt
- Not all planets are habitable, take care of this one





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If the stromatolites can do it, we can do it