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

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

Became a nation in 1901

Population

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

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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.
## Land, People, Economy

<table>
<thead>
<tr>
<th></th>
<th>AUSTRALIA</th>
<th>EU</th>
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<tbody>
<tr>
<td>Land Mass</td>
<td>7.7 Billion km²</td>
<td>4.3 Billion km²</td>
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<tr>
<td>Water</td>
<td>1%</td>
<td>3%</td>
</tr>
<tr>
<td>Population</td>
<td>21 Million * 25 = 500 Million</td>
<td></td>
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<tr>
<td>Naturalized</td>
<td>24%</td>
<td>4%</td>
</tr>
<tr>
<td>Pop inc/year</td>
<td>1.2%</td>
<td>0.12%</td>
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<tr>
<td>Migration Rate</td>
<td>6.3 per 1000</td>
<td>1.2 per 1000</td>
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<tr>
<td>GDP (‘08 PPP)</td>
<td>$37,000</td>
<td>$31,000</td>
</tr>
<tr>
<td>Inflation</td>
<td>4.8%</td>
<td>3.9%</td>
</tr>
<tr>
<td>Unemployment</td>
<td>4%</td>
<td>7%</td>
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<tr>
<td>Major Imports</td>
<td>Major Exports</td>
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<td>---------------</td>
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<tr>
<td>Coal</td>
<td>Crude Petrol</td>
<td></td>
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<tr>
<td>Iron ore</td>
<td>Vehicles</td>
<td></td>
</tr>
<tr>
<td>Gold</td>
<td>Ref Petrol</td>
<td></td>
</tr>
<tr>
<td>Vehicles</td>
<td>Machinery</td>
<td></td>
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<tr>
<td>Petroleum</td>
<td>Tele equip</td>
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<tr>
<td>Appliances</td>
<td>Appliances</td>
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</tbody>
</table>
## Trade Partners

<table>
<thead>
<tr>
<th>Export to</th>
<th>Import from</th>
<th>Export to</th>
<th>Import from</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>China</td>
<td>USA</td>
<td>China</td>
</tr>
<tr>
<td>China</td>
<td>USA</td>
<td>Switzerland</td>
<td>USA</td>
</tr>
<tr>
<td>Rep of Korea</td>
<td>Japan</td>
<td>Russian Fed</td>
<td>Russian Fed</td>
</tr>
</tbody>
</table>

**Exchange Values:**
- AUSTRALIA to EU: 43 B AUD
- AUSTRALIA to EU: 20 B AUD

14 January 2008 Club of Rome Brussels
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

Australia is preparing for a changing world . . .

- Ageing Population
- Climate Change
- World GDP Shifts

Key themes from the Australian 2020 Summit

Source:
2. Australian Bureau of Meteorology (2008);
... that continues to depend on coal

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

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

Carbon Capture & Storage is one Key

Business as usual: Up to 6°C warming

Efficiency Now  Phase-in Renewables  Start Large-Scale CCS

IEA World Energy Outlook 2008
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.
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)
Long-term Global Equity?

Long-term Global Equity?

Tonnes CO2 Per Capita Per Yr

Total CO2

Qatar, Kuwait, United Arab Emirates, Trinidad and Tobago, Brunei Darussalam, Bahrain, United States, Canada, Norway, Australia, Estonia, Saudi Arabia, Oman, Kazakhstan, Mexico, China, India

0
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
Progress or Pollution?

Image created using data from the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS).

Source: NASA Visible Earth
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
Science, Scientists, and a Sustainable World

Views from Down Under

If the stromatolites can do it, we can do it