Possible US-China Collaboration on Climate

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Outline

1. Magnitude of the problem - global emissions and the urgency of immediate action.


3. Possible contribution of US and China to the solution.
1. Magnitude of the problem - global emissions and the urgency of immediate action.
### GHG atmos. concentrations and likely ave. temp. increase by 2100

<table>
<thead>
<tr>
<th>Level</th>
<th>CO2 (ppm)</th>
<th>CO2 e (ppm)</th>
<th>Likely tempΔ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-1750</td>
<td>280</td>
<td>?</td>
<td>0 C</td>
</tr>
<tr>
<td>current</td>
<td>390</td>
<td>460</td>
<td>2.2 C</td>
</tr>
<tr>
<td>350.org target</td>
<td>350</td>
<td>450</td>
<td>2 C</td>
</tr>
<tr>
<td>Stern target</td>
<td>450</td>
<td>550</td>
<td>-&gt; 3 C + ?</td>
</tr>
</tbody>
</table>

Source: Anderson & Bows, 2009

\[ \text{CO2 e} = \text{CO2} + \text{methane} + \text{nitrous oxide} + \text{others} \]

Scientists contemplate 4C beyond 2100

Source of confusion

www.eci.ox.ac.uk/4degrees
## Projected Impacts of Climate Change

<table>
<thead>
<tr>
<th>Global temperature change (relative to pre-industrial)</th>
<th>0°C</th>
<th>1°C</th>
<th>2°C</th>
<th>3°C</th>
<th>4°C</th>
<th>5°C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food</strong></td>
<td></td>
<td></td>
<td><strong>Falling crop yields in many areas, particularly developing regions</strong></td>
<td></td>
<td></td>
<td><strong>Falling yields in many developed regions</strong></td>
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<td></td>
<td></td>
<td></td>
<td><strong>Possible rising yields in some high latitude regions</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Water</strong></td>
<td><strong>Small mountain glaciers disappear – water supplies threatened in several areas</strong></td>
<td><strong>Significant decreases in water availability in many areas, including Mediterranean and Southern Africa</strong></td>
<td></td>
<td></td>
<td><strong>Sea level rise threatens major cities</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Ecosystems</strong></td>
<td><strong>Extensive Damage to Coral Reefs</strong></td>
<td><strong>Rising number of species face extinction</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Extreme Weather Events</strong></td>
<td><strong>Rising intensity of storms, forest fires, droughts, flooding and heat waves</strong></td>
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</tr>
<tr>
<td><strong>Risk of Abrupt and Major Irreversible Changes</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>Increasing risk of dangerous feedbacks and abrupt, large-scale shifts in the climate system</strong></td>
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</tr>
</tbody>
</table>
Paths to stabilization targets

- Model comparison with five energy-economy models (EMF)
- Business as usual = no climate policy; start date of 2000
- 3 CO2e stabilisation targets: 550ppm, 450ppm (=350CO2), 400ppm

![Graph showing emission pathways for CO2](image)

**Falling global emissions before 2020:**
- Rich countries immediately, poor by 2025

**550 ppm CO2e target needs**
- 50% global drop by 2050:
  - Rich countries by 75-85%
Current world energy path

Primary Energy (EJ)

CO2-free = 15%

CO2 emitting = 85%

Next 50 years?
Share of “CO2e - free” energy and CO2e concentrations

Only possible if all energy investment is CO2-free from today

CO2e-free share up from 15% to 60% in just 20 years – impossible.

CO2-free share = biomass + other renewables + nuclear + fossil fuels with CCS (15% in 2010)

Source: Nakicenovic

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Energy system evolution to 2050 to achieve 550 ppm CO2e

Electricity generation ≈ 90% CO2-free by 2050 in developed countries, 60% in developing countries
(renewables, natural gas, gas & coal with carbon capture and storage, nuclear).

Buildings ≈ 80-90% CO2-free by 2050 in developed countries, 60% in developing countries
(electric-driven heat pumps, passive solar heating and cooling, biofuels, photovoltaics, solar hot water, hydrogen?)

Vehicles ≈ 90-100% CO2-free by 2050 in developed countries, 80% in developing countries
(electric, biofuel, hydrogen?)
Message from independent studies

World not on the path to 450 CO2e (=350 CO2) - impossible.

World not on the path to 550 CO2e - impossible without immediate dramatic action in rich countries, followed closely by others.

World not on a path to 650 CO2e - sum of Copenhagen commitments.

World on a path leading beyond 800 ppm CO2e by 2100 - measured by current fossil fuel combustion investments.

Path has significant damages from extreme weather, disease, ecosystem ruin, sea level rise and ocean acidification - to be experienced by people alive today - certainly our children.
China, coal and CO2

Coal dominates Chinese energy system - 65% of total energy and 85% of electricity generation.

400% growth in coal use since 1986 associated with dramatic increase in access to electricity and rapid economic growth. Mistake to downplay the socio-economic benefits from coal.

Since 1970, China’s annual CO2 emissions have climbed from 5% of global total to 22%, overtaking US.

In spite of concerns about local air pollution and rail bottlenecks constraining internal coal transport, rapid growth in coal use in China likely to continue.
CO2 emissions from fuel combustion: China and US

Source: China National Bureau of Statistics and US EPA
Fuel Combustion CO₂ Trajectory in China

Source: International Energy Agency forecast
US, coal and CO2

Coal produces 50% of US electricity.

Share of renewables and natural gas is increasing, but
- existing coal industry and coal-dependent regions will resist phase-out, and
- action on climate likely to require wholesale electrification of transportation and increased electricity use in buildings and industry.

Critical issue will be cost of retrofitting carbon capture and storage on to existing coal facilities versus natural gas-fired power, renewables (with associated storage), and perhaps nuclear.
US and China: carbon copies

Economies strongly interdependent in trade and finance.

Both rich in coal resources.

Both heavily dependent on coal for electricity generation.

Both low in petroleum resources relative to demand (import dependence).

Both lead, by far, global CO2 emissions (almost 40% combined).

Both see themselves as world leaders. But unwilling to show leadership on climate action - in part because of coal dependence in electricity sector.
3. Possible contribution of US and China to the solution.
Three decades of failed climate efforts

Past “successes” addressing environmental threats
  - Acid emissions, smog creating emissions, ozone-depleting emissions, lead emissions, etc.

Climate: cyclical interest, yet three decades of mostly failure
  - 1980s - rising awareness led to 1988 G7 commitment,
  - 1990s - international negotiations to 1997 Kyoto commitment
  - 2000s - heightened awareness (Al Gore, IPCC, Stern) led to uncoordinated, unilateral efforts but no slowing of global emissions.
  - 2010s - ?

Key reason? High “start” cost / risk of CO2-free energy options
  - Carbon capture and storage expensive and uncertain
  - Most renewables require very expensive energy storage
  - Nuclear poses big risk to environment and global peace
  - Entrenched use of petroleum in transportation - path dependence
Alternative paths to a successful global climate effort

Some experts argue that international climate negotiations have failed because of naïve assumptions about achieving consensus on a timetable and a fair allocation of effort.

Suggest instead that efforts by subsets of countries (the EU?, 10 major emitters? Other?) have a better chance of success.

Piecemeal efforts might even be limited to just one greenhouse gas (CO2?) and just one sector of the economy (electricity?).

Given the importance of coal for electricity generation in the US and China, along with the strong linkages between the two countries, this might be an area for a piecemeal, bi-lateral effort.
US politicians unable to take action unless part of a global effort - bills proposed by US politicians have included eventual obligations on countries exporting goods to US. Not-so-veiled trade threat.

US currently shifting to regulatory approach, starting with electricity. Regulations will cause rising electricity prices to US industry relative to competitors with unregulated coal-fired power. Similar trade threat issues will arise.

Potential for US-China collaboration motivated by sticks and carrots. US seeks a comparable China effort to regulate its coal-electricity sector. Uses trade threats but also offers assistance with technology development and marketing.

For which CO2-free alternatives? Coal with CCS, natural gas, renewables, nuclear.