"Scenarios and Honest Brokerage - An IPCC Perspective"

ERMITAGE Workshop, 25-26 September 2012, Potsdam

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Five forms of climate scepticism

„The collapse of the fact/value dichotomy“
The policy arena: the COP16 outcome

Advance unedited version

Draft decision ~/CP.16

Outcome of the work of the Ad Hoc Working Group on long-term Cooperative Action under the Convention

The Conference of the Parties

Recalling its decision 1/CP.13 (the Bali Action Plan), and decision 1/CP.15.

Seeking to secure progress in a balanced manner, in the understanding that, through this decision, not all aspects of the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention are concluded, and that nothing in this decision shall prejudice prospects for, or the

The Conference of the Parties...

[…] recognizes that deep cuts in global greenhouse gas emissions are required […] to hold the increase in global average temperature below 2°C …

[…] also recognizes the need to consider, […] strengthening the long-term global goal […], including in relation to a global average temperature rise of 1.5°C.
Exploring the solution space

Reduction of CO$_2$ emissions

- Increasing energy efficiency
- Non-fossil energy
- CO$_2$ capture at plant (CCS)

Population
- Per capita production

CO$_2$ emissions

Carbon cycle

Radiative forcing

Ecosystem impacts, incl. ocean acidification

Temperature change

Impacts

Adaptation

Other GHG emissions
- Non-CO$_2$ mitigation

CO$_2$ released

CO$_2$(A)/CO$_2$

CO$_2$/E

E / GDP

GDP / Pop

Pop

Edenhofer/Seyboth 2012

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

WHO

UNEP
Exploring and assessing the solution space: ’seven virtues’ of assessment making

1. Reviewing comprehensively the relevant scientific, technical and socio-economic literature
2. Describing consistent transformation pathways
3. Evaluating costs, risks and opportunities of different pathways in a consistent way within and across Chapters and WGs
4. Specifying underlying value judgements and worldviews
5. Communicating quantitative and qualitative uncertainties
6. Using neutral language along good scientific practice
7. Making text, figures and tables accessible
Only 6 scenarios from 3 models in the lowest category…

Table 3.10: Properties of emissions pathways for alternative ranges of CO₂ and CO₂-eq stabilization targets. Post-TAR stabilization scenarios in the scenario database (see also Sections 3.2 and 3.3; data source: after Nakicenovic et al., 2006 and Hanaoka et al., 2006)

<table>
<thead>
<tr>
<th>Class</th>
<th>Anthropogenic addition to radiative forcing at stabilization (W/m²)</th>
<th>Multi-gas concentration level (ppmv CO₂-eq)</th>
<th>Stabilization level for CO₂ only, consistent with multi-gas level (ppmv CO₂)</th>
<th>Number of scenario studies</th>
<th>Global mean temperature C increase above pre-industrial at equilibrium, using best estimate of climate sensitivity</th>
<th>Likely range of global mean temperature C increase above pre-industrial at equilibrium</th>
<th>Peaking year for CO₂ emissions</th>
<th>Change in global emissions in 2050 (% of 2000 emissions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>2.5-3.0</td>
<td>445-490</td>
<td>350-400</td>
<td>6</td>
<td>2.0-2.4</td>
<td>1.4-3.6</td>
<td>2000-2015</td>
<td>-85 to -50</td>
</tr>
<tr>
<td>II</td>
<td>3.0-3.5</td>
<td>490-535</td>
<td>400-440</td>
<td>16</td>
<td>2.4-2.8</td>
<td>1.6-4.2</td>
<td>2000-2020</td>
<td>-60 to -30</td>
</tr>
<tr>
<td>III</td>
<td>3.5-4.0</td>
<td>535-590</td>
<td>440-485</td>
<td>21</td>
<td>2.8-3.2</td>
<td>1.9-4.9</td>
<td>2010-2030</td>
<td>-30 to +5</td>
</tr>
<tr>
<td>IV</td>
<td>4.0-5.0</td>
<td>590-710</td>
<td>485-570</td>
<td>118</td>
<td>3.2-4.0</td>
<td>2.2-6.1</td>
<td>2020-2060</td>
<td>+10 to +60</td>
</tr>
<tr>
<td>V</td>
<td>5.0-6.0</td>
<td>710-855</td>
<td>570-660</td>
<td>9</td>
<td>4.0-4.9</td>
<td>2.7-7.3</td>
<td>2050-2080</td>
<td>+25 to +85</td>
</tr>
<tr>
<td>VI</td>
<td>6.0-7.5</td>
<td>855-1130</td>
<td>660-790</td>
<td>5</td>
<td>4.9-6.1</td>
<td>3.2-8.5</td>
<td>2060-2090</td>
<td>+90 to +140</td>
</tr>
</tbody>
</table>

Notes:  
a. Warming for each stabilization class is calculated based on the variation of climate sensitivity between 2°C – 4.5°C, which corresponds to the likely range of climate sensitivity as defined by Meehl et al. (2007, Chapter 10). 
b. Ranges correspond to the 70% percentile of the post-TAR scenario distribution. 
c. ‘Best estimate’ refers to the most likely value of climate sensitivity, i.e. the mode (see Meehl et al. (2007, Chapter 10) and Table 3.9)

Fisher et al. (2007), AR4
Low Stabilization Scenarios Beyond AR4

• …but already many more available for AR5
• Exploration of RCP3-PD within the scenario process

Knopf/Luderer/Edenhofer (2011).
Implications for the Scenario Process

**WG I**
Extreme events
Sea level rise

**WG II**
Differential impacts:
\[\Delta(2^\circC/3^\circC)\]
\[\Delta(3^\circC/4^\circC)\]

**WG III**
Differential mitigation costs:
\[\Delta(2^\circC/3^\circC)\]
\[\Delta(3^\circC/4^\circC)\]

Iteration

Complete picture of impact and mitigation costs for policy relevance

\[\Delta(2^\circC/3^\circC), \Delta(3^\circC/4^\circC)\]
Policies
Scenario Process

Establish coherent scenario process
Scenario Process

IAP

Impact, Adaptation, Vulnerability

IAM

Integrated Assessment Models

CM

Climate Models

RCPs

RCP8.5
RCP6
RCP4.5
RCP3PD

RCPs
Scenario Process

Impact, Adaptation, Vulnerability

Climate change pattern ensembles

RCPs

IAM
Integrated Assessment Models

CM
Climate Models

RCPs
RCP8.5
RCP6
RCP4.5
RCP3PD

IAV

IPCC
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

WMO
UNEP
Scenario Process

WoSES Workshop
November 2010 in Berlin

IAV
Impact, Adaptation, Vulnerability

IAM
Integrated Assessment Models
RCP8.5
RCP6
RCP4.5
RCP3PD

CM
Climate Models
SSP „space“ relevant for climate change

Inverse approach: Cover the range of socio-economic challenges for mitigation & adaptation

Increasing socio-economic challenges for adaptation

Increasing socio-economic challenges for mitigation

SSP 1
SSP 2
SSP 3
SSP 4
SSP 5

Kriegler 2012
SSP narratives

- SSP 1: Sustainable development
  - SRES B1
- SSP 2: Middle of the road
  - Current trends continued
- SSP 3: Fragmented world
  - SRES A2
- SSP 4: Divided in rich & poor
- SSP 5: Coal & gas powered growth
  - Increasing SE challenges to mitigation
  - Lock-in to fossil & resource intensive production

Increasing SE challenges to adaptation

Kriegler 2012
SSP narratives

- **SSP 5**: Coal & gas powered growth
- **SSP 3**: Fragmented world
- **SSP 2**: Middle of the road
- **SSP 1**: Sustainable development
- **SSP 4**: Divided in rich & poor

Increasing SE challenges to mitigation

Lock-in to fossil & resource intensive production

Increasing SE challenges to adaptation

Human development

Kriegler 2012
New scenario architecture

Kriegler 2012
Post-AR4 scenarios in WGIII

- Describe consistent transformation pathways
- Explore the costs, risks and opportunities of different long-term stabilization targets...
- …in perfect and imperfect worlds

Table 10.2: Categorization of the 164 scenarios reviewed in this section based on CO₂ concentration levels in 2100, the inclusion of delayed participation in mitigation (second-best policy), and constraints on and/or variations in the deployment of fossil energy with CCS, nuclear energy and RE. The CO₂ concentration categories are defined consistently with those in the IPCC Fourth Assessment Report (AR4), WGIII (Fisher et al., 2007). Note that Categories V and above are not included here and Category IV is extended to 600 ppm from 570 ppm, because all stabilization scenarios lie below 600 ppm CO₂ in 2100 and because the lowest baseline scenarios reach concentration levels of slightly more than 600 ppm by 2100. Data adapted from Krey and Clarke (2011) modified to include two additional scenarios.
Example from the SRREN: mitigation in a technologically constrained world
While pursuing certain ends, unintended side-effects may require the reevaluation of means and ends.

Relies on continuous iteration between policy and science.

Edenhofer/Kowarsch 2012
There is always more than one way...