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# Workshop on New Emission Scenarios

29 June – 1 July 2005  
Laxenburg, Austria

## Meeting report

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## PROGRAMME COMMITTEE

Bert	Metz	The Netherlands	IPCC WGIII Chair (Chair Programme Committee)
Rajendra	Pachauri	India	Chair IPCC
Anthony	Adegbulugbe	Nigeria	Centre for Energy Research and Development
Aysar Ahmed	Al-Tayeb	Saudi Arabia	Environmental Consultant
Fatih	Birol	France	IEA
Francisco	Delachesnaye	USA	U.S. Environmental Protection Agency
Brian	Fisher	Australia	Australian Bureau of Agricultural and Resource Economics
Henry	Jacoby	USA	MIT
Kejun	Jiang	China	Energy Research Institute,
Mikiko	Kainuma	Japan	National Institute for Environmental Studies
Tom	Kram	The Netherlands	Netherlands Environmental Assessment Agency
Emilio	La Rovere	Brazil	Institute for Research and Graduate Studies of engineering, Federal University of Rio de Janeiro
Martin	Manning	USA	Head TSU working Group I
Leo	Meyer	The Netherlands	TSU WGIII
Jennifer	Morgan	Germany	WWF
Nebojsa	Nakicenovic	Austria	IIASA
Jim	Penman	UK	DEFRA
Sarah	Raper	UK	University of Manchester
Greg	Tosen	South Africa	ESKOM
Ferenc	Toth	Austria	International Atomic Energy Agency (IAEA)
Jean-Pascal	van Ypersele	Belgium	Vice-chair WGII
Hoogwijk	Monique	Netherlands	Secretary, TSU, Working Group III

## Table of contents

1. Introduction.....	4
2. Organisation, invitation process and submissions .....	4
2.1. The organisation.....	4
2.2. Submissions of views.....	4
2.3. The nomination and invitation process .....	5
3. Short summary of the sessions.....	5
3.1. Opening session .....	5
3.2. Session 1: Historical IPCC scenarios; IS92, the “95” overview, SRES and TAR .....	5
3.3. Session 2: Evaluating user needs and requirements and overview of submissions.....	6
3.4. Session 3: Overview of scenario aspects; what types are most effective for what purposes (1)?.....	7
3.5. Session 4: Overview of scenario aspects; what types are most effective for what purposes (2)?.....	8
3.6. Session 5: Introducing the options for the roles that IPCC could play in the development and assessment of new emission scenarios in the period after AR4 .....	9
3.7. Session 6: (break out): Evaluation of scenario aspects that meet user requirements.....	10
3.8. Session 7: Evaluation of feedback from break out groups.....	11
3.9. Session 8 (break out): Discussing the options for the roles that IPCC could play in the development and assessment of new emission scenarios in the period after AR4 .....	12
3.10. Session 9: Feedback from break out groups: different options for IPCC .....	12
4. Conclusions and results of the meeting.....	13
4.1. Concluding session .....	14
4.2 Main conclusion.....	17
Annex I: Examples of different processes	
Annex II: Programme	
Annex III: Submissions of the views	
Annex IV: participant list	

## **1. Introduction**

In 2001 the Intergovernmental Panel on Climate Change (IPCC) published a set of scenarios in the Special Report on Emission Scenarios (SRES). These scenarios have been developed in a four year process with many scientists involved in the writing and the review process. The SRES scenarios played an important role in the Third Assessment Report (TAR) of the IPCC and will be used in the upcoming Fourth Assessment Report (AR4). The 21<sup>st</sup> IPCC plenary session (November 2003) decided that no new baseline scenario would be prepared for the AR4, in view of the time it takes before new scenarios are taken up by the research community and used in publications. The 23<sup>rd</sup> Panel session decided that two meetings under the auspices of Working Group III on the issue of the use of scenarios should take place. The first meeting aimed to discuss the use of SRES scenarios in AR4. This expert meeting took place 12 – 14 January 2005 in Washington DC and the results are available at <http://www.ipcc.ch/meet/washington.pdf>

The IPCC at its 22<sup>nd</sup> Session (November 2004) decided that possible future roles of IPCC in new scenarios (to be used for AR5) would be discussed at its 24<sup>th</sup> Session (26-28 September 2005, Montreal, Canada). To prepare for these discussions, a second meeting on new emission scenarios was held from 29 June – 1 July 2005, hosted by IIASA in Laxenburg, Austria. It was decided that this meeting should be an IPCC Workshop with about 100 participants selected by the Chair of IPCC from government and organization nominations.

The objective of the workshop was to investigate the possible roles that IPCC could play in the development and assessment of new emission scenarios in the period after AR4. The workshop should achieve the objective by:

- (i) Evaluating user needs and requirements: what are the future needs of governments, scientists, private sector and NGOs dealing with climate change with respect to new emission scenarios; to what extent have current and past IPCC scenario approaches fulfilled those needs?
- (ii) Identifying what kind of scenarios could meet these user needs and requirements.
- (iii) Discussing options for the role of IPCC with regard to development of new scenarios, with a view to provide recommendations to the 24<sup>th</sup> Session of the IPCC in September 2005 for consideration and decision.

This report summarises the main findings of this meeting

## **2. Organisation, invitation process and submissions**

### ***2.1. The organisation.***

The meeting was organised with extensive assistance of a program committee, chaired by Bert Metz, co-chair of IPCC Working Group III. The program committee decided on the program, the speakers and chairs and the deliverables of the break out groups (see title page for members of the programme committee).

### ***2.2. Submissions of views***

As an important step in the preparation of the workshop, The IPCC Secretary requested ( 1 March 2005), governments and international organizations to submit their views on the following questions:

- (i) *What are your future needs with respect to new emission scenarios; to what extent have current and past IPCC scenario approaches fulfilled those needs?*
- (ii) *What kind of scenarios could meet your future needs and requirements?*

- (iii) *What possible roles could IPCC play in the development of new scenarios, in light of the outcomes of the discussion on objectives (i) and (ii)? Options may include:*
- a. *No specific role, other than assessing existing scenario literature,*
  - b. *Organize a process with the scientific community in developing new scenarios (driven by the modellers),*
  - c. *Develop new scenarios, as was the case with IS92 and SRES scenarios.*

This request was done in order to obtain a broad range of views from the main ‘clients’ of IPCC, being the governments that are members to the Panel, as input to the discussions at the workshop.

IPCC received 11 submissions from industrialised countries, 9 from developing countries and 2 from (international) organisations (see Annex II). The submissions have been published on the closed website prior to the meeting and have been distributed at the meeting.

### ***2.3. The nomination and invitation process***

The IPCC secretary, on behalf of the IPCC chair also requested governments and organisations to nominate participants (letter of 1 March 2005). The aim was to have participants from different emission scenario user groups: governments, scientists, private sector and NGOs, with expertise either in using emission scenarios and their results, or in developing emission scenarios. In total IPCC received around 230 nominations for participants and selected 111 invitees (excl. IPCC officials.) based on a balance of geographical background, developed / developing and EIT countries, expertise areas, user groups (climate modelling, impacts, adaptation, and mitigation science, policy makers, private sector and NGO) and gender. In total 91 experts participated. Among them were 48 scientists, 30 policy makers, 7 private sector and 3 NGOs. Among them were 17 women and 38 participants from developing countries or countries with economies in transition (see Annex III for the list of participants)

## **3. Short summary of the sessions**

### ***3.1. Opening session***

The workshop was opened by Leen Hordijk, Director of IIASA, Dr. Rajendra Pachauri, Chairman IPCC, Bert Metz, co-chair IPCC WGIII and Bert Bolin, previous and honorary chairman of IPCC. In the opening session a brief introduction was given on the previous IPCC scenarios. The first scenarios, the SA90, were developed in 1990, followed by the IS92 scenarios in 1992. After the evaluation of these scenarios in a Special Report in 1994, the IPCC decided in 1996 to start with the SRES process, resulting in the Special Report on Emission Scenarios in 2000.

In his keynote talk, Prof. Bolin stated that it would be important for any future scenarios to reflect the basic elements determining the emissions. On the short term emissions can be projected and the impacts related to these emissions should be analysed. Special attention should be given to the inertia of the earth system related to the impacts of the short term emissions. Disaggregation of the assumptions, the outcomes and the regions is crucial to make a good estimate of short term emissions.

### ***3.2. Session 1: Historical IPCC scenarios; IS92, the “95”overview, SRES and TAR***

In session 1 the previous IPCC scenarios were introduced and compared by Nebojša Nakićenović (IIASA). He summarized the purposes of scenarios as they have been given in the Special Report (1994) on evaluating IS 92 scenarios:

- Purpose 1: Evaluate the environmental and climatic consequences of “non-intervention” futures

- Purpose 2: Evaluate the environmental and climatic consequences of “intervention” futures
- Purpose 3: Examine the feasibility and costs of mitigating GHGs from different regions and sectors
- Purpose 4: Describe possible emissions reductions for different countries and regions.

	SA90	IS92	SRES	TAR
Purpose 1	YES	YES	YES	NO
Purpose 2	YES	NO	NO	YES
Purpose 3	NO	NO	NO	YES
Purpose 4	NO(?)	NO(?)	NO(?)	NO(?)

According to Prof Nakićenović, there seems an interesting contradiction when considering different user groups as scientific assessments require complexity: the treatment of uncertainties across models, inclusion of drivers, spatial and temporal disaggregated assessments – all require large ensembles of scenarios. On the other hand policy makers’ prefer simplicity and a focus on single projections, or “high likelihood” scenarios (BAU).

### ***3.3. Session 2: Evaluating user needs & requirements and overview of submissions***

In this session, chaired by Brian Fisher (ABARE) the a summary of the submitted views were presented by Leo Meyer and statements were given on the user needs and requirements from various backgrounds: from a climate modelling perspective (Martin Manning (head TSU WGI), from an impact, adaptation and vulnerability perspective (Tim Carter, SKYE)), from a mitigation analysis perspective (Jiang Kejun, ERI), from a policy perspective (Jim Penman, DEFRA), a private sector perspective (Brian Flannery, Exxon Mobile) and an ENGO perspective (Jennifer Morgan, WWF).

The needs and requirements emerging from these presentations were broad. The needs and requirements from the different user groups were not contrasting and had a strong overlap. Summarizing, the following user needs and requirements have been proposed:

- Consistent, transparent and accurate emission scenarios, especially consistent set of assumptions and input and /or output of emission scenarios;
- A basis for risk and impact analyses, should reveal what outcomes of particular sets of decisions would be, the framework for decision making would be the UNFCCC;
- More regional, local/national and/or sectoral disaggregated scenarios, for aerosols a very high resolution is required;
- Technological development specifically included;
- Multi-gas scenarios and more insight in the distribution of pollutants, both spatial as vertical distribution;
- Medium and short term (20 – 30 years) (reference or baseline) scenarios, as well as long-term (> 30 years) scenarios;
- Include linkages with adaptation and include feedbacks with impacts & adaptation
- Include of linkages and feedbacks with economic development and land-use change
- Baseline/reference/BAU combined with mitigation/policy scenarios for short/medium term; long term stabilisation scenarios
- Integrate with feedbacks and impacts with other issues is important, non –climate (air pollution, stratospheric ozone, land use) policy areas.
- Include sufficient information on the possible uncertainties.
- Develop probability density functions for reference and stabilisation scenarios
- Not too many scenarios, because of the increased complexity and the lack of variation in GCM modelling results.

- Scenario starting points that are consistent with contemporary global emission inventories and trends.

### 3.4. Session 3: Overview of scenario aspects; what types are most effective for what purposes (1)?

In this session chaired by Arnulf Gröbler (IIASA) an overview was given on what types of scenarios are most effective. Different methodological aspects were introduced (Ferenc Toth, IAEA), uncertainties in relation to scenarios (Richard Moss, co-chair TGICA & US Climate change science program, University of Maryland), maintaining consistency in driving forces (Shukla (IIMA), presented by Holger Rogner (IAEA) and the relationship between baseline scenarios and policy intervention scenarios (Emilio la Rovere, COPPE/UFRJ), were furthermore covered.

#### Introduction to scenario types (Ferenc Toth)

Eight contrasting scenario types and designs have been introduced

“Input only”: external factors, drivers for models, analyses (IPCC) vs “Self-contained”: complete “future history” of driving forces and implications: effects, feedbacks, responses (MEA).

“Reference + variants”: persistent trends and “dynamics as usual” (saturation/depletion/collisions/trend breaks) (IS92) vs “Contrasting futures”: 1/2/3 dimensions of opposite poles of main future directions (drivers or outcomes) (SRES,MEA)

“Skeleton”: numbers only, w/some explanations (IS92) vs “Storylines”: also include narrative descriptions (SRES) (not equivalent to the quantitative-qualitative contrast)

“Deterministic”: no likelihood assigned (IPCC to date) vs “Probabilistic”: a likelihood of occurrence is derived or estimated (RA/RM: key to assess hedging costs/benefits and to craft hedging strategies)

The usefulness of each scenario type for different scenario purposes have been indicated and scored on the usefulness for different scenario purposes:

Scenario type/Purpose	Input only	self contained	Reference + variants	Contrasting futures	Skeleton	Storylines	Deterministic	Probabilistic
Scientific assessment	XXXX	X	XXXX	X	XXXX	X	XXXX	X
Exploration	X	XXXX	X	XXXX	XX	XXX	XXXX	X
Public policy making	X	XXXX	XXXX	X	X	XXXX	X	XXXX
Public policy planning	X	XXXX	XXXX	X	X	XXXX	X	XXXX
Strategic planning	XX	XXX	X	XXXX	X	XXXX	XXX	XX
Education	X	XXXX	XXX	XX	X	XXXX	XXXX	X
Moralizing	X	XXXX	XX	XXX		XXXXX	XXXX	X

Many combinations of scenarios are possible; there is flexibility to choose the most appropriate design according to purpose & function. Some combinations appear to be difficult:

- Self-contained and skeleton as self-contained scenarios need storylines
- Contrasting futures and skeleton as contrasting futures scenarios need storylines, to ensure the contrast in the scenarios.
- It seems difficult to assign probabilities to contrasting futures scenarios

**Dealing with uncertainty in scenarios (Richard Moss)**

Uncertainties are a key issue in all climate change scenarios. Scenarios should support analysis of most significant uncertainties of all important parameters. There are two broad approaches for analyzing scenario uncertainty:

- Using narratives
- Using probabilistic approaches

These two approaches are distinct but complementary. Combining the two approaches improves the results and the communication. For future scenarios it would be important for IPCC to improve consideration of uncertainty in the overall design of its next assessment. It needs to take into account the feedbacks between affluence and capacity to adapt and mitigate.

**Maintaining consistency in drivers (Shukla/Rogner):**

The drivers within storylines are not independent of each other, there are relationships and dynamics between drivers, e.g. fuel prices, energy resource endowments, etc. Consistency between the most important driving forces is a necessary prerequisite for plausible scenarios, and disaggregated scenarios need even greater attention for consistency. Furthermore, the storyline content need to be comprehensive; this means that there should be a check whether there are no missing drivers, missing relationships, missing dynamics, missing milestones (e.g. convergence, stabilization). Especially missing dependencies is a major cause for inconsistency within scenarios. Alternate approaches for storylines are probabilistic approaches and agent based scenarios. These approaches need evaluation and consideration.

**Baseline and policy intervention and standard response (stabilization) scenarios (Emilio La Rovere):**

Baseline scenarios include non-climate policies with significant effects on climate. They can be used as illustrating cost/benefits of non-action versus action on climate change.

For future work, it can be useful to:

- Study non-intervention baselines to evaluate results of climate policies; avoided emissions and impacts;
- Develop baseline scenarios including climate policies, as these are needed for better exploration of possible futures;
- Focus on multi-gases and sinks;
- Investigate different stabilization metrics.

**3. 5. Session 4: Overview of scenario aspects; what types are most effective for what purposes (2)?**

Session 4 is a continuation of session 3, chaired by Gilberto Gallopin (UN Division of Environment and Human Settlements). It included presentations on the integration of climate change with other issues like with air pollution (Ron Prinn, MIT) and land-use and ecological issues (Dale Rothman, Macaulay Institute) and on the regional and sectoral breakdown of short term scenarios (Laura Cozzi, IEA).

**Integration with air pollution (Ron Prinn):**

Emission projections need to include all the major human-driven emissions forcing climate change; this would include greenhouse gases, other anthropogenic forcings (e.g. land cover changes, aerosols) and natural forcings. Economics/emission models need to include all major emitting sectors and all major emitting nations/regions.

There are strong linkages and feedbacks between the anthropogenic gases, like O<sub>3</sub>, NO<sub>x</sub>, SO<sub>x</sub>, and CH<sub>4</sub>. For instance, tropospheric ozone negatively influences the biological CO<sub>2</sub> sink. The effects on the climate can also be opposing and therefore there is a need to integrate climate change and air pollution carefully. Probabilistic emission projections are needed, with special attention to the ‘tails’ in the distribution.

### **GHG emissions integrated with environmental and sustainability scenarios (Dale Rotman)**

There are inter-linkages between:

- individual environmental impacts;
- environmental impacts and ecosystem services;
- ecosystem services and human well-being;
- temporal, spatial and within society between groups.

The pros and cons of embedding emission scenarios in integrated scenarios are:

Pros:

- Promise of better representation of inter-linkages and feedbacks;
- Identification of synergies and tradeoffs;
- Leverage existing and ongoing works;
- May be easier for users to cope with a “generic” set of scenarios.

Cons:

- May cloud climate policy issues;
- May lead to less detail on specific issues;
- Transaction costs in working across more disciplines (conceptual frameworks, terminology);
- Where do you stop?

### **Regionally, economically or sectorally disaggregated short and medium-term scenarios (Laura Cozzi)**

The World Energy Model of the IEA is an example of a regionally, economically, sectorally disaggregated least-cost model with a timeframe until 2030. The outputs are the energy supply, demand and trade and related CO<sub>2</sub> emissions. The model is updated every 2 years.

The IEA analyses one reference case and one alternative scenario (policy and technology simulation). The model and its results have been increasingly used by energy community (from industry to governments, from financial institutions to academia). It also delivered input to the Johannesburg Summit. For the future they will also consider going beyond 2030.

### ***3.6. Session 5: Introducing the options for the roles that IPCC could play in the development and assessment of new emission scenarios in the period after AR4***

This session was chaired by Pierre Boileau (Environment Canada) and the role that IPCC could play was presented from different perspectives. As an input to the discussion, a range of options has been formulated:

- a) No specific role, other than assessing existing scenario literature,
- b) Organize a process with the scientific community in developing new scenarios (driven by the modellers),
- c) Develop new scenarios, as was the case with IS92 and SRES scenarios.

Leo Meyer (TSU WGIII) summarized the views as they had been submitted by governments and two organisations. Most submissions preferred some active role (b or c) of IPCC in the development of new emission scenarios, varying from a supporting or facilitating role, where the scientists would

independently develop new scenarios, to full control by IPCC itself over the development of new scenarios,

A panel of speakers presented their personal views on the possible role of IPCC after the AR4 as seen from their perspectives: Bill Hare (Greenpeace, Environmental NGO), Mustafa Babiker (Arab Planning Institute, Developing Country and OPEC), John Weyant (Stanford University, scientific community), Francisco de la Chesnaye (US EPA, USA), David Warrilow (DEFRA, UK), Shikegi Kobayashi (Toyota, Japan and private sector) and Javier García (Environmental National Commission, Chile)

The speakers argued that there is a link between the type of scenarios that are needed and the role that IPCC could play. Furthermore, all argued that assessing literature is IPCC's main task and should be done anyway.

**Bill Hare** pointed out that a weak role of IPCC would lead to poor comparability of future emission scenarios, which would degrade the abilities to make integrated assessments. SRES was a big success but we need to go beyond that by regionalisation, include air pollution, different sustainable development pathways, and probabilistic approaches.

**Mustafa Babiker** saw several roles for IPCC, both in development of holistic (aggregated) scenarios as well as of disaggregated scenarios. The latter are of specific important to developing countries and should include adaptation. IPCC could help to harmonize methodologies, to make aggregation to the 'holistic' level possible. IPCC could also play a role in capacity building in the construction of scenarios.

**John Weyant** preferred IPCC not to be in control of the whole process. Credibility would be best assured by the scientific community. IPCC could be helpful to that in an advisory role.

**Francisco de la Chesnaye** pointed out that role a) is consistent with the IPCC mandate and there would be no role for IPCC in developing scenarios itself. He saw a common ground emerging on role b).

**David Warrilow** stated that IPCC should assess literature and also facilitate the production of a common set of emissions scenarios to ensure the consistency in terms of transparency of assumptions and continuity. Government needs like simplicity and transparency in assumptions, some elements of probability, widespread acceptability should be ensured by this process. For the same reasons

**Shikegi Kobayashi** mentioned that Japan believes that option c would be most appropriate. Option b) may be acceptable, but the main thing is to achieve consistent and scientifically robust outcomes.

**Javier Garcia** highlighted the need to improve the spatial and temporal resolution of emission scenarios, and the need for country- specific emission factors. IPCC could play a role in developing the methodologies and capacities allowing especially developing countries to build national scenarios.

### ***3.7. Session 6: (break out): Evaluation of scenario aspects that meet user requirements.***

The following questions are addressed and linked with the user requirements

- Merits and practical limitations of different kinds of scenarios
- Exploration of how user requirement can be addressed with different types of scenarios

The participants were grouped in 4 user groups: 1) climate system, vulnerability and adaptation scientists, 2) mitigation scientists 3) and 4) Government, Private sector and NGOs. In each of the latter two parallel groups, a scenario scientist was available as a resource person.

### ***3.8. Session 7: Evaluation of feedback from break out groups***

In this session, the break out groups reported back to the plenary. The session was chaired by Holger Rogner (IAEA). The merits, limitations and usefulness of different types of scenarios were presented. The types of scenarios have been clustered in couples of contrasting scenario types.

The groups produced independently similar results. In general it was concluded that there is a need for, transparent, credible and comparable scenarios, but not too many.

#### *Single baseline (reference + variants):*

+ A single baseline can reflect current trends likely to continue in the short term and are easier to communicate. Variants of this baseline can be designed to allow climate modellers to investigate specific questions (e.g. the importance of aerosol emissions).

- Single baselines do not adequately reflect long-term uncertainty in development pathways and are less relevant for longer term mitigation, adaptation, impact and vulnerability research

#### *Multiple baselines*

+ Multiple baselines span a wider range of socio-economic and emissions outcomes. By better reflecting uncertainty, they are more useful to mitigation, adaptation, impact and vulnerability research or assessment.

- Too many baselines make communication of results difficult. Also, some baselines may not produce substantially different emissions pathways and therefore will not produce significant differences in outcomes for the climate modelling community (although even in this case differences in socio-economic assumptions may be important for mitigation, adaptation, and vulnerability assessment).

#### *Use of numbers only (Skeleton)*

+ This can be interesting for sensitivity analysis

- Situations that need to be modelled by the adaptation, impact and vulnerability researchers cannot be captured by numbers only – it is crucial to understand the socio-economic drivers.

#### *Storylines*

+ These are needed in order to identify drivers and the context which is important for mitigation, adaptation, impact and vulnerability research and assessment; storylines also contribute to consistency within scenarios

- The merits can only be achieved if the storylines are transparent, with their driving forces (e.g. GDP, population, policies) quantified, and consistent with the past

#### *Baseline or Non-intervention scenarios*

+ Can be important for mitigation analysis if a comparison of outcomes between action and no-action is desired.

- Baselines are often prone to subjective definitions of one team. Assumptions need to be carefully judged.

#### *Mitigation and stabilization scenarios*

+ Important for informing decision makers and stakeholders about potential costs and technological requirements of reducing emissions, including uncertainties.

- It is important to have transparent and comparable scenarios

#### *Short term (20 – 30 years) and sectoral and regional disaggregated scenarios*

+ Short term, regionally disaggregated mitigation scenarios are needed for decision makers and adaptation, impact and vulnerability researchers. Climate modellers need them for the emissions of

less mixed gases with short lifetimes. It is more relevant for regional decision making and there will be a closer representation of the reality.

- There is need for consistency between long term and short term scenarios. The required technical capacity (including computer resources) and the data availability are higher, which might be difficult, furthermore, when one needs to downscale data, guidance should be provided, if required.

#### Long term (> 30 years) and aggregated regions and sectors

+ Long term scenarios are needed for describing technological strategies and possible effects of R&D. A long term horizon is needed for climate modelling. Global scenarios can also focus on main dynamics and may therefore be easier to communicate and it is easier to use a consistent approach.

- There is need for consistency between long term and short term scenarios; the long term scenarios are less useful for regional policies and decision makers and adaptation, impact and vulnerability researchers.

#### Climate change only scenarios

+ Easier to communicate, very long term scenarios may be possible

- Less policy relevant

#### Climate change integrated with other issues

+ Especially the linkages with air pollution, land-use and SD issues are important for mitigation, adaptation, impact and vulnerability researchers and decision makers, it presents a closer reflection of reality.

- It increases complexity; there is a lot of information at detailed level required,

#### Deterministic scenarios

+ Easy incorporation of a larger degree of complexity, especially in combination with the integration of other issues; therefore, it is also easier to communicate compared to probabilistic approaches, in combination with sensitivity analysis might be interesting

- Provides no indication of whether certain scenarios are considered more or less likely than others

#### Probabilistic scenarios

+ When meaningful likelihoods can be assigned, probabilistic approaches provide more information on uncertainty than deterministic scenarios.

- It is difficult to develop and maintain transparency, make use of expert judgments and there is a potential danger of misunderstanding these scenarios. In some cases knowledge may be insufficient to support likelihood judgments and therefore probabilities can be misleading.

### **3.9. Session 8 (break out): Discussing the options for the roles that IPCC could play in the development and assessment of new emission scenarios in the period after AR4**

The participants were grouped in the same composition as in session 6 and discussed the different roles as presented in Session 5. They addressed the following questions:

- What arguments could be listed in favour or against each of these roles light the importance of scenario aspects for different user groups (as identified in the previous section)?
- What would be the procedural implications of each of these roles?

### **3.10. Session 9: Feedback from break out groups: different options for IPCC**

The chairs of all break out groups presented their outcomes to the plenary, chaired by Ogunlade Davidson. Again, the breakout groups produced some independently similar results. All groups

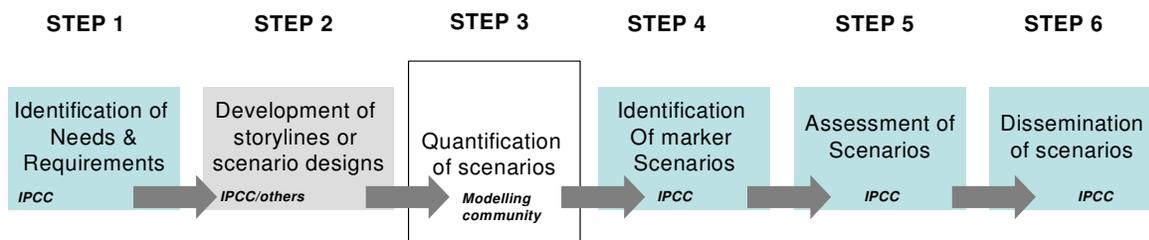
stated that IPCC should perform assessments of literature on emission scenarios. In addition, all groups agreed that IPCC should also do more than just that, namely provide some form of guidance or coordination for the scenario development work. Opinions varied on how intense this IPCC guidance/coordination should be. An issue that received a lot of attention was the degree of comparability of scenarios that would emerge in view of the use of these scenarios in a following IPCC assessment report. IPCC working group reports can be made consistent if they use the same scenarios to organise the assessments. Under option C, in which IPCC develops scenarios the coordination between the IPCC Working Groups would be easy and there would likely be comparable and consistent sets of scenarios. However, there could be a potential conflict of interest—i.e. IPCC both creating and assessing scenarios.

Option B in which IPCC has some coordinating or organizing role received most support. This option is not yet defined but it has the following advantages:

- Would provide potential for common or comparable assumptions and outputs.
- Comparability across scenarios would be made possible. This option could also include scenarios for adaptation at regional level.
- IPCC could develop a common set of storylines and then modellers would be free to follow their own interpretation.
- Could provide a common basis for future modelling and impact studies.

Some of the break-out groups presented a process description. One example:

- Step 1:* IPCC identifies the interests and needs for scenario designs either by consulting IPCC Governments, holding a meeting or workshop, or other steps.
- Step 2:* Development of underlying storylines or scenario design features is carried out by the emissions scenarios modelling community or IPCC, possibly requiring iteration with step 1.
- Step 3:* Quantitative emission scenarios would be developed by the modelling community. There may be a role here for IPCC in funding or ensuring developing country involvement.
- Step 4:* A limited number of characteristic or marker scenarios would be identified for use by the working groups in conjunction with Step 5.
- Step 5:* The IPCC would undertake an assessment of the full set of scenarios.
- Step 6:* Scenario results would be disseminated for use by research groups requiring cooperation between the IPCC and modelling groups.



Other groups presented some different ideas about the process.

An additional remark made was the idea that IPCC could also initiate a process to provide guidelines to develop national scenarios (as for Inventories) in order to make easier the task for assessing climate related scenarios, specially for Developing Countries.

#### 4. Conclusions and results of the meeting

#### **4.1. Concluding session**

In session 10 chaired by Bert Metz, Brian Fisher presented an overview of the conclusions and results of the meeting, these have been commented by the plenary and below a summary is given, including the comments by the participants.

**Objective 1:** Evaluating user needs and requirements: what are the future needs of governments, scientists, private sector and NGOs dealing with climate change with respect to new emission scenarios; to what extent have current and past IPCC scenario approaches fulfilled those needs?

The purposes of emission scenarios have been addressed earlier in an IPCC report in 1994<sup>1</sup>:

- 1: As input to evaluate the environmental/climatic consequences of “non-intervention”, i.e. no action to reduce greenhouse gas emissions.
- 2: As input to evaluating the environmental/climatic consequences of intervention to reduce greenhouse gas emissions
- 3: As input to examining the feasibility and costs of mitigating greenhouse gases from different regions and economic sectors, and over time. This purpose can include setting emission reduction targets and developing scenarios to reach these targets. It can also include examining the driving forces of emissions and sinks to identify which of these forces can be influenced by policies.
- 4: As input for negotiating possible emission reductions for different countries and geographic regions

Building on these results, the following additional purposes were introduced:

- 5: Inform discussions and decisions on stabilisation levels
- 6: Inform decisions on policy development and implementation by individual governments
- 7: Assist governments in communication about climate change issues
- 8: Inform integrated assessment and provide information to governments for the development of adaptation policy, research and assessment
- 9: Exploration of the uncertainties of climate change and mitigation and adaptation responses

**Objective 2:** Identifying what kind of scenarios could meet these user needs and requirements.

First it was shown that different terminologies were used to classify and describe scenario types. More discussion on terminologies might be needed.

The following characteristics of ‘good’ scenarios and their implementation in modelling has been given:

- Transparency in numbers and assumptions
- Comparability among scenario results
- Internal & temporally consistency within scenario families
- Scenarios that have credibility (i.e. cover a range of plausible range of futures) and legitimacy (i.e. involve key stakeholders in their development).
- Policy relevant
- Reproducible
- High availability and dissemination
- Easily communicated to the user-groups

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<sup>1</sup>Houghton, J.T., L.G. Meira Filho, J. Bruce, Hoesung Lee, B.A. Callander, E. Haites, N. Harris, K. Maskell, Climate Change 1994: Radiative forcing of climate change and an evaluation of the IPCC IS92 emission scenarios, Cambridge University Press, 1994

Table summarise the needs for different scenario types and designs. It was explicitly mentioned that the characteristics were not mutually excluding. It was for instance mentioned that trends during the next 25 – 30 years were better understood than trends over the longer term. A reference scenario for the shorter term might therefore be particularly useful for policy purposes. This can be followed by a longer term series of storylines or multiple baselines that would explore alternative futures.

Table I: Summary on requested types of scenarios

<i>Users have requested:</i>	<i>but....</i>
<b>Single baselines</b>	
<ul style="list-style-type: none"> <li>Reference scenario + variants; useful for ST, next 25 years</li> <li>For decision makers increases simplicity</li> </ul>	<ul style="list-style-type: none"> <li>Does not reflect the range of possible futures in the long term and therefore may be misleading</li> </ul>
<b>Multiple baselines</b>	
<ul style="list-style-type: none"> <li>For longer term analyses important to capture more of the socio-economic range and wide range of futures</li> <li>Uncertainty can be better incorporated</li> </ul>	<ul style="list-style-type: none"> <li>For GCM models no variations in results if range is not large</li> </ul>
<b>Storylines (+quantification)</b>	
<ul style="list-style-type: none"> <li>Important to increase consistency between emission scenarios and IAV (Impact, adaptation &amp; Vulnerability), particularly for longer time scales</li> </ul>	<ul style="list-style-type: none"> <li>Transparency in the quantification of underlying driving forces (e.g. GDP, population, policies) is required, especially for decision makers</li> <li>When you use storylines, base them on what has happened in the past</li> </ul>
<b>Baseline scenarios</b>	
<ul style="list-style-type: none"> <li>For non-intervention futures and climate risk.</li> <li>Basis for calculating mitigation costs</li> </ul>	<ul style="list-style-type: none"> <li>Baseline should include all relevant announced policies (e.g. baseline should include Kyoto and other established climate policy), this is difficult</li> </ul>
<b>Policy intervention scenarios</b>	
<ul style="list-style-type: none"> <li>Distinction between ST mitigation &amp; adaptation and LT stabilisation;</li> </ul>	<ul style="list-style-type: none"> <li>They need to be politically acceptable</li> <li>Is it useful to have 'representative' mitigation or stabilisation scenarios?</li> </ul>
<b>Short Term ( 20 – 30 years)</b>	
<ul style="list-style-type: none"> <li>Specific mitigation policy analysis</li> <li>More policy relevant compared to LT scenarios.</li> <li>Combined with regional and sectoral disaggregation</li> </ul>	<ul style="list-style-type: none"> <li>Data intensive and needs regular updating</li> <li>Needs to ensure continuity between ST and LT</li> </ul>
<b>Long Term ( &gt; 30 years)</b>	
<ul style="list-style-type: none"> <li>For understanding issues related to risk, technology development, avoided damage etc</li> </ul>	<ul style="list-style-type: none"> <li>Also relevant to short term policy decisions</li> </ul>
<b>Inclusion of more issues, not just GHG emissions</b>	
<ul style="list-style-type: none"> <li>Useful for assessment, address more questions.</li> <li>Important include LULUCF and air pollution, SD.</li> <li>May also be developed as building blocks</li> </ul>	<ul style="list-style-type: none"> <li>Specific questions may not be well addressed.</li> <li>It may be more difficult to communicate the outcomes – different audiences</li> </ul>
<b>Regionally and sectorally disaggregated</b>	
<ul style="list-style-type: none"> <li>Needed for IAV community and policy makers; e.g. for feedbacks mitigation and adaptation</li> </ul>	<ul style="list-style-type: none"> <li>Data and technical resources intensive (especially for DC)</li> <li>For downscaling and upscaling guidance is needed</li> <li>'Mappability' into larger regions important</li> </ul>
<b>Probabilistic</b>	
<ul style="list-style-type: none"> <li>Assessing effects of uncertainties in input on output;</li> </ul>	<ul style="list-style-type: none"> <li>Difficult if based on expert judgements</li> <li>Sensitivity analysis would be partial solution</li> </ul>

**Objective 3:** Discussing options for the role of IPCC with regard to development of new scenarios, with a view to provide recommendations to the 24th Session of the IPCC in September 2005 for consideration and decision.

Four different options for the future roles of IPCC with regard to new emission scenarios were identified. All options include a full assessment of available (emission) scenarios as published in the peer reviewed scientific literature. The options are listed with an increasing level of coordination by IPCC:

**A:** IPCC completes assessment of the available literature on scenarios only

**B1** IPCC identifies a "Wish list" of issues that need to be included in the input and/or output of scenarios; subsequently, independent modellers develop scenarios; these scenarios are assessed by IPCC.

**B2:** IPCC coordinates a process where common narrative and input and output parameters are jointly produced by scenario/ modelling groups; results are produced independently.

**C:** IPCC develops new scenarios under full IPCC control and produces an 'IPCC product' ('SRES +')

Options B1 and B2 received most support from the participants.

In Table II, the strengths and weaknesses of the different options are presented as identified by the Workshop.

Table II: summary of options for future role of IPCC, strength, weakness and how to address the weakness

Option	Strength	Weakness	How to address weakness
A	<ul style="list-style-type: none"> <li>IPCC and modellers independent;</li> <li>Assessment of scenarios can begin earlier</li> </ul>	<ul style="list-style-type: none"> <li>No guarantee that scenarios meeting user needs will be developed. Without standard scenario set.</li> <li>Few countries included</li> </ul>	<ul style="list-style-type: none"> <li>Strengthen assessment and choice of 'representative' results</li> </ul>
B1	<ul style="list-style-type: none"> <li>IPCC and modellers mostly independent</li> </ul>	<ul style="list-style-type: none"> <li>Results may not be directly comparable</li> <li>DC participation not guaranteed</li> </ul>	<ul style="list-style-type: none"> <li>Frequent dialogue among modelling groups</li> <li>Finance DC work</li> </ul>
B2	<ul style="list-style-type: none"> <li>Better comparability and consistency</li> <li>Useful for difference analysis</li> </ul>	<ul style="list-style-type: none"> <li>DC Participation</li> <li>Less independence modellers</li> </ul>	<ul style="list-style-type: none"> <li>Finance DC work</li> <li>Open process, reviews</li> </ul>
C	<ul style="list-style-type: none"> <li>Comparable, consistent and easy coordination across WGs</li> <li>Approved by IPCC Plenary</li> </ul>	<ul style="list-style-type: none"> <li>More risk of self-serving literature</li> <li>Time consuming process</li> </ul>	<ul style="list-style-type: none"> <li>Open process, reviews with independent teams</li> </ul>

**Process:**

From the break-out group session it became clear that there are different modalities of possible processes, as far as the different steps and the timing are concerned. For both the B1 and B2

options, two different modalities are possible. Several process steps were proposed by the breakout groups. No further discussion of the processes and the pros and cons of the processes has taken place in the last plenary session. Below is the WGIII co-chairs summary of different processes that have been proposed in break out sessions. It reflects two options.

Option 1: A process in which the development of scenarios and the use of scenarios in climate modelling, impact, adaptation and mitigation studies is done by the research community, after initial guidance/coordination by IPCC. This would then be followed by an IPCC assessment of the literature (in AR5), including identification of “representative scenarios”.

Option 2: A process in which after the development of scenarios by the research community (after initial IPCC guidance/coordination) would first be assessed by IPCC (in a Special Report), before the result of this assessment (in the forum of e.g. “representative scenarios”) would be issued by the research community to produce climate modelling, impact, adaptation and mitigation studies, that would therefore be assessed (in AR5)

Option 2 would require a substantially larger timeline, but would probably lead to more homogeneity in the literature that is to be assessed later. Option 1 would be quicker, but the comparability of the “representative scenarios” emerging from the assessment would depend more on the initial guidance/coordination.

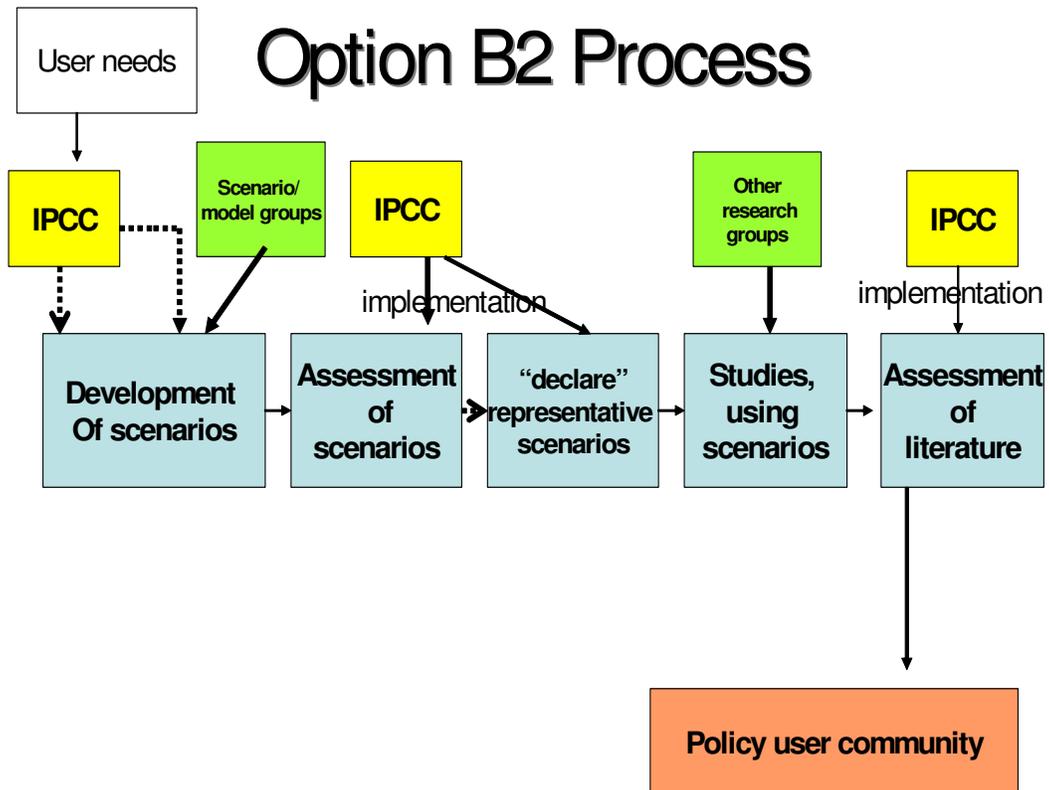
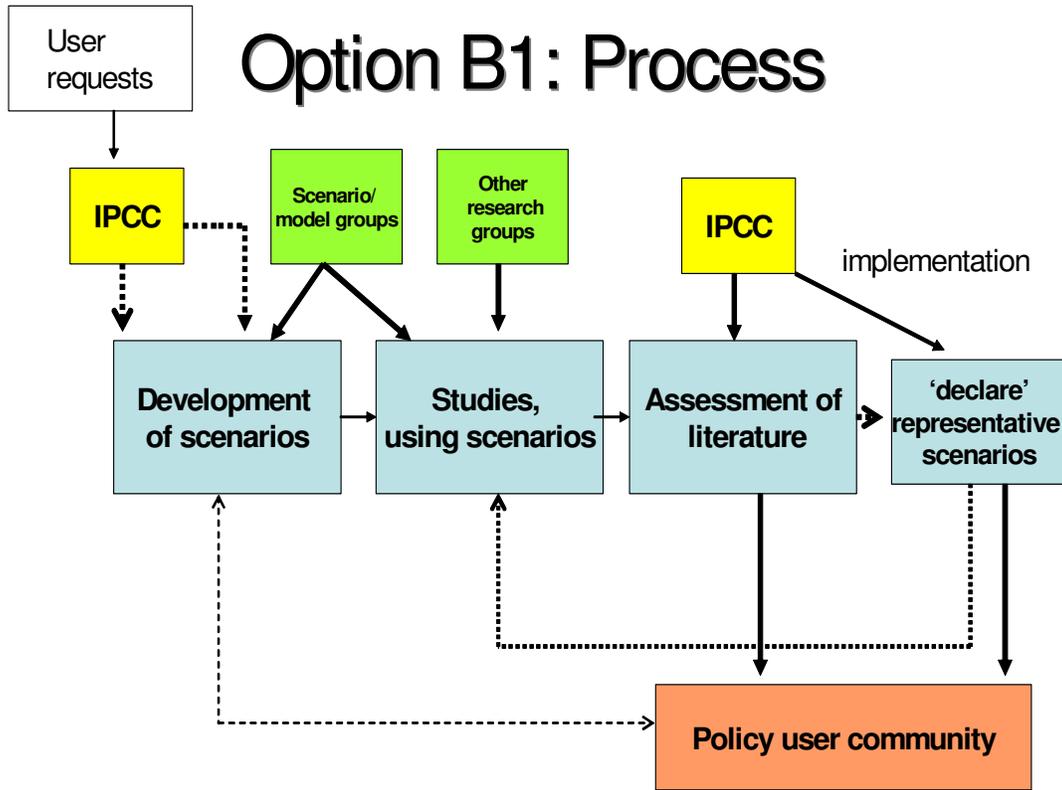
The processes are pictured In Annex I.

#### ***4.2 Main conclusion***

The Workshop identified many different types of scenarios and a wide variety of scenario user needs and requirements of policy makers, the scientific community, NGOs and private sector. It was agreed that there is no single approach to scenario development that could satisfy all user needs, and that particular scenario types involve tradeoffs between meeting various needs. For example, there are conflicting needs for simplicity on the one hand and regional and temporal detail on the other.

Pros and cons of various future roles of IPCC were identified. All agreed that in the period after AR4, IPCC should continue assessing literature in emission scenarios. There was also discussion on the role of IPCC with regard to the genesis of new scenarios for the period after the AR4. Benefits and drawbacks were presented and argued. The vast majority of the workshop participants preferred IPCC to facilitate or coordinate the development of new emission scenarios by the scientific community, rather than IPCC developing new scenario itself, as was done in the past. More discussion is needed to clearly specify any level of involvement beyond the standard assessment role of IPCC. A key trade-off identified is that a stronger IPCC coordination is more likely to produce a common and consistent set of scenarios that can be used in assessments across IPCC working groups, but a dominant coordination role of IPCC could be perceived as a potential conflict of interest with IPCC both generating and assessing scenarios.

Annex I: Presentation of two examples of process



## Annex II

Programme IPCC Workshop on new emission scenarios  
29 June – 1 July 2005  
Laxenburg

### Goals and deliverables

The objective of the workshop is to investigate the possible roles that IPCC could play in the development and assessment of new emission scenarios in the period after AR4. The workshop should achieve the objective by:

- (i) Evaluating user needs and requirements: what are the future needs of governments, scientists, private sector and NGOs dealing with climate change with respect to new emission scenarios; to what extent have current and past IPCC scenario approaches fulfilled those needs? To this end, IPCC will ask these user communities for submissions well in advance of the workshop.
- (ii) Identifying what kind of scenarios could meet these user needs and requirements.
- (iii) Discussing options for the role of IPCC with regard to development of new scenarios, with a view to provide recommendations to the 24<sup>th</sup> Session of the IPCC in September 2005 for consideration and decision.

## Day 1: Wednesday 29 June

8:30 am	<b>Registration</b>	Registration desk Plenary Room
9:00 am	<b>Official opening :</b> <i>Leen Hordijk</i> , Director IIASA, Welcome words on behalf of host <i>Dr. Pachauri</i> , Chairman IPCC, opening on behalf of IPCC <i>Bert Metz</i> , IPCC, co-chair Working Group III, Background and objectives of the meeting <i>Bert Bolin</i> : key note presentation on background of use of scenarios	
9:50 am	<b>Session 1: Historical IPCC scenarios; IS92, the “95”overview, SRES and TAR</b> <i>Nebojsa Nakicenovic</i> : Historical overview of IPCC scenarios. How and to what extent have previous generations of scenarios fulfilled user requirements. Discussion on opening session and Session 1 (15 min)	
10:25 am	<b>Coffee break</b>	
10:55 am	<b>Session 2: Evaluating user needs and requirements and overview of submissions</b> <b>Chair</b> <i>Brian Fisher</i> : <i>Leo Meyer</i> : summary of submissions on user needs and requirements, how scenarios are used, have they fulfilled their needs and what types of scenarios are required. Panel discussion on the use of scenarios by different user groups <i>Martin Manning</i> : the climate system and climate modeling perspective <i>Tim Carter</i> : the impact and adaptation perspective <i>Jiang Kejun</i> : the mitigation and emission perspective Discussion (30 min)  <i>Jim Penman</i> : the policy perspective <i>Brian Flannery</i> : the private sector perspective <i>Jennifer Morgan</i> : the NGO perspective Discussion (30 min).	
12:45	<b>Lunch</b>	
2:15 pm	<b>Session 3: Overview of scenario aspects; what types are most effective for what purposes (1)?</b> <b>Chair:</b> <i>Arnulf Grübler</i> <i>Ferenc Toth</i> : Overview of different methodological aspects of scenarios; what types of	

scenarios fulfill what user requirements, including aspects of scale and time horizon.

*Richard Moss:* Dealing with uncertainty and use of probabilistic scenarios

*Shukla:* Maintaining consistency in drivers (storylines approach, possible alternatives)

*Emilio la Rovere:* Relation between baseline scenarios and policy intervention scenarios and the construction of standard response scenarios (stabilization)

Discussion (45 min)

4:00 pm

**Coffee break**

4:30 pm

**Session 4: Overview of scenario aspects; what types are most effective for what purposes (2)?**

**Chair:** *Gilberto Gallopin*

*Ron Prinn:* Integration of GHG emission scenarios including probabilities, observational tests, and feedbacks with other issues (e.g. economic development, air pollution, ozone and aerosol precursors)

*Dale Rothman:* GHG emissions in integrated environmental and sustainability scenarios

*Laura Cozzi:* Regionally, economically or sectorally disaggregated short and medium-term scenarios

Discussion on session 3 and 4 issues: (60 min)

6:15 pm

**Closure**

6:30 pm

**Social Event kindly hosted by Austrian Government**

## Day 2: Thursday 30 June

Plenary Room

9:00 am

### **Session 5: Introducing the options for the roles that IPCC could play in the development and assessment of new emission scenarios in the period after AR4**

**Chair:** *Pierre Boileau*

*Leo Meyer*;: Summary of submissions

Panel discussion on merits and limitations of different options for the role IPCC could play in the development and assessment of new emission scenarios.

Panel members:

*Bill Hare,*

*Mustafa Babiker,*

*John Weyant,*

*Francisco de la Chesnaye,*

*David Warrilow,*

*Shikegi Kobayashi*

*Javier García.*

Discussion (*35 min*)

10:20 am

### **Instructions on the Break Out Groups**

Break Out Rooms

10:25 am

### **Session 6: (break out): Evaluation of scenario aspects that meet user requirements. Following questions are addressed and linked with the user requirements**

- Merits and practical limitations of different kinds of scenarios
- Exploration of how user requirement can be addressed with different types of scenarios
- What sort of outputs do users find most useful, and in what format?

The participants will be grouped in 4 groups, organized along user groups: 1) Scientific users climate system, vulnerability and adaptation 2) Scientific users mitigation 3) and 4) Government, Private sector and NGOs This should result in 4 equal sized groups

Break out group Chairs:

1) *Cynthia Rosenzweig*

2) *Eberhard Jochem*

3) *Leena Srivastava*

4) *Ian Carruthers*

12:30 pm

### **Lunch**

2:00 pm

### **Continuation of Session 6.**

Plenary room

3:00 pm **Session 7: Evaluation of feedback from break out groups**  
**Chair:** *Holger Rogner*

4:30 pm **Coffee break**

Break Out Rooms

5:00 pm **Session 8 (break out): Discussing the options for the roles that IPCC could play in the development and assessment of new emission scenarios in the period after AR4**

- What arguments could be listed in favour or against each of these roles light the importance of scenario aspects for different user groups (as identified in the previous section)?
- What would be the procedural implications of each of these roles?

The participants are grouped by the same groups as before

**Chairs of the break-out groups:**

- 1) *Eduardo Calvo*
- 2) *Jae Edmonds*
- 3) *David Warrilow*
- 4) *Jean-Pascal van Ypersele*

6:30 pm **Closure**

## Day 3: Friday 1 July

Break Out Rooms

9:00 am **Session 8 (break out): Continuation of discussing the options for the roles that IPCC could play in the development and assessment of new emission scenarios in the period after AR4**

- What arguments could be listed in favour or against each of these roles?
- What would be the procedural implications of each of these roles?

The participants are grouped by the same groups as Day 2

10:30 am **Coffee break**

Plenary Room

11:00 pm **Session 9: Feedback from break out groups: different options for IPCC**  
**Chair:** *Ogunlade Davidson*, Co-chair IPCC WGIII

12:30 pm **Lunch**

2:00 pm **Session 10: Conclusions and closure:**

**Chair:** *Bert Metz*

*Brian Fisher:* Overview of conclusions

- Conclusions on most important user needs/requirements
- Conclusions on requirements for scenario types and aspects
- Conclusions on Possible future role for IPCC (options + findings)

Discussion (*60 min*).

3:50 **Concluding words:** *Dr. Pachauri*, chair IPCC

4:00 pm **Closure**

## Annex III

### Overview of all Submissions of Views for the IPCC Workshop on New Emission Scenarios

The IPCC Secretary requested (1 March 2005), governments and international organizations to submit their views on the following questions:

- (i) What are your future needs with respect to new emission scenarios; to what extent have current and past IPCC scenario approaches fulfilled those needs?
- (ii) What kind of scenarios could meet your future needs and requirements?
- (iii) What possible roles could IPCC play in the development of new scenarios, in light of the outcomes of the discussion on objectives (i) and (ii)? Options may include:
  - a. No specific role, other than assessing existing scenario literature,
  - b. Organize a process with the scientific community in developing new scenarios (driven by the modellers),
  - c. Develop new scenarios, as was the case with IS92 and SRES scenarios.

This request was done in order to obtain a broad range of views from the main ‘clients’ of IPCC, being the governments that are members to the Panel, as input to the discussions at the workshop. This Annex provides the submitted views as received by IPCC.

#### Table of Content

Albania.....	2
Austria.....	3
Azerbaijan .....	5
Canada.....	6
Chile.....	8
China .....	10
Denmark.....	11
France.....	13
Germany.....	15
Japan.....	17
Madagascar .....	19
Malawi .....	20
Mexico .....	21
The Netherlands .....	22
New Zealand .....	24
Panama.....	27
Sweden.....	28
TGICA .....	29
United Kingdom.....	35
United States of America .....	38
Uzbekistan.....	41
Worldbank.....	42

## Albania

### ALBANIA proposal Some ideas for the IPCC-WGIII Workshop on New Emission Scenarios

Within the framework of the project *Enabling Albania to prepare its First National Communication to the CoP of the UNFCCC*, in Vulnerability & Adaptation Assessment activity, are prepared the climate change scenarios for Albania by using the MAGICC/SCENGEN software, developed by CRU/UEA.

To estimate the global changes, MAGICC is run by using the mid- range IS92a emission scenario as the reference scenario *SRESA1*, *SRESA2*, *SRESB1* and *SRESB2* as policy scenarios. To develop a mean pattern of future climate change, GCM experiments: HadCM2, UKTR, ECHAM4, CSIRO-TR, UIUC-EQ, GFDLLO are considered and a composite pattern is constructed.

As **main outputs** during this activity we may order:

- SRESA2 (high climate sensitivity) as more optimistic.
- need for finer resolution of outputs
- need for regional scenarios is stressed
- in this stage of work was very difficult to deal with uncertainties

Referring to the objectives of the IPCC-WGIII Workshop on New Emission Scenarios we may distinguish the need to develop:

- short and medium scenarios, as more realistic
- regionally, economically disaggregated scenarios
- coverage of the socioeconomic drivers behind both emission and V&A scenarios
- relation of climate scenarios with climate implication models/scenarios

We think that IPCC will play an important role in the development of regional scenarios (driven by modelers) involving the experts from developing countries and countries with economies in transition.

Prepared by:

**Eglantina Bruci**  
Institute of Hydrometrology of Albania

**Austria**

**Submission by Austria  
on  
Main issues to be discussed at the IPCC-WGIII Workshop on New Emission Scenarios  
29 June – 1 July 2005, Laxenburg, Austria**

**General comments**

Austria welcomes the opportunity to provide its views on relevant issues to be discussed at the workshop. Austria sees a strong need to start a process that results in new emission scenarios to be available for the fifth assessment report. However, Austria also feels that in the assessment report(s) a general description of the role of such emission scenarios and the identification of decisions of significant impact on future emissions should be included. Policy makers should not blame emission scenarios for resulting in unwanted (high) emissions but the (political) decisions that may contribute to such development.

**Specific comments**

Austria would like to put forward the following preliminary views with regard to the questions identified in the letter from 1 March.

- (i) *What are your future needs with respect to new emission scenarios; to what extent have current and past IPCC scenario approaches fulfilled those needs?*

Austria expects that the fifth assessment report will build on new emission scenarios. All the new scenarios should be consistent with the most recent scenarios developed by other agencies, e.g. the IEA (energy scenarios), the UN (population scenarios). Austria does not expect probabilities for the new scenarios because it would be beyond the scope of the IPCC to try to assess the political will of stakeholders in the next 100 years.

- (ii) *What kind of scenarios could meet your future needs and requirements?*

Future emission scenarios should reflect the full range of possible futures. There should be a range of

1. business as usual scenarios
2. of mitigation scenarios
3. stabilization scenarios.

The key factors that result in different emissions should be identified in order to better understand the world that is linked to each of those scenarios. Past IPCC scenarios did highlight some of the key parameters (e.g. population, energy consumption, energy split) but maybe not all – e.g. with regard to technology development (e.g. rate of market penetration, investments needed). It might also be helpful to split the global figures into regions in order to better assess the feasibility of the assumptions. For large countries (US, EU, China, India) even a country split might be appropriate. The methodological description should be provided as an annex and all background material should be made available, e.g. via a CD-rom in order to allow for an in-depth review. It might be useful to develop a format to help such review process. Any assumptions made by the experts of the IPCC need to be made

transparent and justification of them should be included. The format of such justification (“expert judgement”) could build on the format required in preparation of emission inventories.

*(iii) What possible roles could IPCC play in the development of new scenarios, in light of the outcomes of the discussion on objectives (i) and (ii)?*

Future emission scenarios should be based on those published in peer reviewed literature. The IPCC will have to review those scenarios in order to check that all information to understand the scenarios is available, ask authors to provide missing information, start a process to get a full description of the scenario and bring those scenarios into a comparable format.

However, if the scenarios, having been published in the peer reviewed literature, do not deliver all the scenarios identified under i) and ii) it is proposed that the IPCC organizes a process with the scientific community in developing in addition those that have not been published in the literature but should be made available to the 5<sup>th</sup> assessment report.

If no team in the scientific community is willing to co-operate with the IPCC in developing the missing scenarios the IPCC should also have the mandate to develop new scenarios, as was the case with the IS92 and SRES scenarios.

## **Azerbaijan**

### **AZERBAIJAN**

Submission on IPCC Workshop on New Emissions Scenarios in Laxemburg, Austria, June 29-July 1 2005.

There is a need in Regional Emissions Scenarios.

As Azerbaijan is situated in the join point of the existing models for Europe and Asia and there are some uncertainties in selecting in using those models.

Considering the fact what economy of Azerbaijan has developed and chanced for last 10 years it would more useful and helpful to consider accelerating social-economic development in the country with transition economic like Azerbaijan.

In the process of preparing the Initial National Communication not all the aspects of social-economical scenarios were used. In the nearest future we are planning to fulfill that point in the preparing Second National Communication.

It would be useful to decision makers to have both the short and the long term perspectives in developing scenarios.

The IPCC as an organ plays an important role in these issues.

## CANADA

### VIEWS ON THE DEVELOPMENT OF FUTURE GREENHOUSE GAS EMISSIONS SCENARIOS

As requested by the Chair of the Intergovernmental Panel on Climate Change (IPCC), Canada is pleased to submit its views on the second meeting on the development of emissions scenarios, a workshop to be held 29 June – 1 July, 2005 in Laxenburg, Austria. Canada welcomes the opportunity to present its views on the main issues to be discussed at the workshop by addressing the questions (in italics below) posed by Renate Christ, on behalf of the Chair of the IPCC.

*(i) What are your future needs with respect to new emission scenarios; to what extent have current and past IPCC scenario approaches fulfilled those needs?*

Canada, and all countries, will need reliable, internationally consistent, comparable and detailed long-term scenarios of greenhouse gas (GHG) concentrations and emissions. These will enhance our collective understanding of the global emissions picture, as well as support international discussions on energy and climate-change related matters. In addition, they will almost surely be of use to Canada's research and NGO communities.

Previous scenarios—including the Special Report on Emissions Scenarios (SRES)—have been found to be very useful within government and the research community. In particular, senior government officials have looked to these scenarios in addressing issues related to stabilizing GHG emissions.

To meet Canada's upcoming modelling and analytical requirements, upcoming scenarios should have:

- Key variables made explicit (regarding population, productivity, energy efficiency improvement, etc.) and comparable across scenarios. The key variables should have some discussion of alternative parameter values, to provide a range or reveal differences of opinion where possible.
- Sectoral detail for major GHG-emitting sectors (agriculture, oil and gas extraction, coal mining, electric power generation, non-hydro renewables, refineries, iron & steel, aluminum and/or other non-ferrous smelting, industrial chemicals, cement, glass, transportation, households).
- Regional detail at an economically meaningful level—the SRES met this requirement.
- Explicit discussion of prospective demand and technological futures under the various scenarios (e.g. travel demand per person, vehicle efficiencies, energy conversion efficiencies, etc.) where possible.
- Regard for regional air quality issues, both in developing scenarios and in providing data on regional energy/non-GHG emissions where possible.

*(ii) What kind of scenarios could meet your future needs and requirements?*

Canada will need multiple scenarios, at least one consistent with aggressive GHG-mitigation policies (e.g. stabilization at various levels) and at least one consistent with less aggressive

policies. Among other things, such scenarios allow Canada (and other countries) to understand the full implications and possible options available in regards to the various levels of effort required to move from current pathways to alternative.

*(iii) What possible roles could IPCC play in the development of new scenarios, in light of the outcomes of the discussion on objectives (i) and (ii)? Options may include: a. No specific role, other than assessing existing scenario literature, b. Organize a process with the scientific community in developing new scenarios (driven by the modelers), c. Develop new scenarios, as was the case with IS92 and SRES scenarios.*

Canada believes that the IPCC should lead the development of scenarios, using options b. or c. above. While there are efforts currently undertaken elsewhere to generate scenarios, many of them are not mutually comparable, or involve different sets of assumptions or modelling frameworks that are not easily compared.

The IPCC is particularly well placed to produce or organize the development of scenarios. Furthermore, the IPCC or IPCC officials have already engaged to various extents many of the authors who are or will be producing scenarios in the open literature. This process of engagement should continue, keeping in mind that a transparent and open process becomes particularly important in addressing concerns about bias.

In Canada's view, the choice between options b. and c. should be guided by:

- The ability to reflect simultaneously expert opinions on development, technology, scientific, economic and population issues.
- Transparency and broad exposure, allowing for comments and review before final publication.
- Timeliness, both in producing as current an outlook as possible, and in capturing as efficiently as possible the various authors' contributions and views.

A detailed, agreed-upon, and up-to-date set of scenarios would be of great value indeed. Differences of opinion can be reflected in the discussion of the various parameters and other assumptions that accompany the presentation of the scenarios.

Canada looks forward to participating in upcoming events that contribute to the development of emissions scenarios.

## Chile

### VIEWS OF CHILE ON THE IPCC WORKSHOP ON EMISSIONS SCENARIOS

#### General Comment:

Emissions Scenarios is an aggregated tool for the assessment of future scenarios. In general terms, for Latin American countries, emission scenarios currently defined are too global, and therefore they are not useful for policymakers to take decisions on environmental management.

New efforts are needed in order to produce emissions scenarios that are suitable for decision making for countries of a small scale, in terms of their burden of emissions. If the present methodologies do not enable this kind of issue on emissions scenarios, at least some methodological features allowing particular countries to make deeper approaches on emissions scenarios, over the basis of scenarios given by IPCC are needed.

#### Particular comments

1. The Urbanization process is a very important one, especially in the developing world, including Latin America. There are important trends in developing countries, causing changes in patterns of general way of living. Little by little, people leaves farm-related jobs to establish themselves in cities, mainly in the suburbs. This trend will put important pressures on emissions, linked to land use, mobility patterns and energy consumption. These trends must be taken in account for the assessment of future scenarios. Additionally, energy consumption rates growth has proved quicker in developing countries than in OECD ones. This fact, and how these rates will evolve in the future, must be taken into account for future scenarios.
2. Some changes on emissions are due to social and management modifications rather than technological ones. Urban planing systems or general transport frameworks in big cities, affecting the behavior of people, are good examples. There is a need to include in future scenarios such kind of changes where there are high possibilities of its application. Cases of implementation of Transmillenium transport project in Bogotá, Colombia, or Transantiago transport project, in Santiago, Chile, are good examples that, maybe in the next future, will be applied in other big cities of Latin America.
3. In general terms, global emission scenarios are built upon emissions factors valid for developed countries. In the context of developing emission inventories, for both global and local pollutants, some developing countries have developed local factors, more representative of local conditions. These factors, when available, should be preferred for emissions in the developing world. An assessment of the suitability of using these factors must be done in order to improve future emissions scenarios.
4. More efforts are needed to improve the spatial and temporal resolutions for definition of future scenarios. Countries should go further with their work in specific scenarios. Development of capabilities to build local scenarios is important to link the development of scenarios with decision making.
5. There is a strong need to develop indicators that allow comparing different scenarios. Such indicators will be useful to advice policy makers in developing climate-oriented policies.

6. New scenarios could include methodological features that allow particular countries to develop its own scenarios, upon the basis of the global ones.
7. It would be desirable to develop an interactive system that allows countries to “put” its emissions inventories and scenarios, when available, in a global shared system. This system could enable a strong cooperation between countries and investigators on emission inventories and emission scenarios.

## **China**

### **China's views on the IPCC Workshop on New Emissions Scenarios**

According to the letter from the Secretary of the IPCC dated on 1 March 2005, we put forward the following views on the main issues to be discussed at the IPCC Workshop on New Emissions Scenarios.

Generally speaking, the development of emission scenarios is a kind of very difficult and time-exhausted effort with significant uncertainty. On the one hand, the current and past IPCC scenarios have reflected our understanding of climate change science and socio-economic situations. In particular, SRES was the wonderful work done by many distinguished scientists over the world. So far it hasn't been fully utilized. We should continue to make good use of these scenarios. On the other hand, as time passes, many factors, especially socio-economic factors have changed a lot. The current and past scenarios are not enough for determining the dangerous level of climate change. Therefore, it is suggested to further improve current scenarios and gradually develop new emission scenarios after AR4.

Considering the complexity and difficulties of the development of new emission scenarios, it is suggested that experts should begin to collect relevant information in order to develop more reasonable new scenarios. New emissions should consider special development needs of developing countries. In addition, due to unexpected technology advance, it is suggested new scenarios had better have smaller time frame.

As regard to the possible role that IPCC could play, it is suggested that IPCC could organize a process with the scientific community in developing new scenarios. In this way, it could ensure more participants, more subjective, open and transparency.

**Denmark**

IPCC Working Group III Technical Support Unit  
ipcc3tsu@rivm.nl

Climate and environmental support

In your reply, please refer to File No.

File no. M:

Ref.:

JGu/AJ

Date April 11, 2005

Concerning. Workshop on scenarios 29 June 1 July 2005

**Dear Sirs**

We appreciate the opportunity to submit our views on the future needs with respect to new emission scenarios. The Climate and Environmental Support unit of the Danish Environmental Protection Agency is the key advisor to the Danish Government on issues related to climate policy.

We have found the earlier scenario work of the Panel extremely useful. It simplifies the work of policy advisors to have a reasonable set of well reviewed and representative scenarios and creates coherence in the international work. The SRES scenarios have been run by several GCM-model groups and also feeds further into regional models and work on impacts and adaptation.

The most present need now is probably not to revise the SRES scenarios, but rather to have a review of stabilisation scenarios, ie scenarios which leads to stabilisation of the GHG-concentrations and of global climate, at various levels. We believe the effort should concentrate on scenarios that avoids dangerous levels, such as by staying below 2 degrees average global temperature compared to the preindustrial situation. For each level of stabilised climate change, it would be useful to have access to several scenarios, based on varying assumptions about the earth-system (climate sensitivity, Carbon-cycle etc) and based on various assumptions about technologies and socioeconomic and other driving factors. The scenarios should be explicit in terms of technologies, energy-sources end energy demand, and should have data for selected points in time such as 2020, 2050 and 2100 and beyond and should be reasonably detailed

Miljøministeriet  
Miljøstyrelsen  
Strandgade 29  
DK-1401 Copenhagen K  
Denmark

Phone: +45 32 66 01 00  
Fax: +45 32 66 01 00  
Telex: 31209 miljøe dk  
mst@mst.dk  
www.mst.dk

geographically so that regions, or even countries, can study the scenarios and see their implications for the local development of infrastructure, energy systems etc.

We believe the scenarios should be made by independent modeling groups, but the Panel should take on a coordinating role, such as specifying required output from the modelling, without which analysis and synthesis of results across models and scenarios would be difficult. Also reporting of costs should be harmonized, so that comparison of costs implied by the various scenarios can be made, which could feed into the international discussion on how to achieve the ultimate objective of the convention in an economically efficient way.

Policy-makers needs some reasonable explicit scenarios to get an idea of the changes in energy systems etc that are involved in achieving stabilisation. And as an input to the national and international discussion on policies that might effect those changes.

We believe such scenarios would also be extremely useful for businesses with a stake in the future changing markets, such as energy suppliers, manufacturers of technologies, international investment and lending institutions etc.

An idea that might be explored, is to involve local modelers in a coordinated global scenario-building exercise, such as was done under the WEC decades ago. This kind of exercise would probably be too demanding for the IPCC to organize itself, but the Panel could invite other organisations to initiate such work.

Besides being useful for policymaking in the mitigation area, the availability of credible, consistent stabilisation scenarios would also be very useful for the work on adaptation strategies, and considerations on the relation between adaptation and mitigation. Selection of a suitable set of “marker” stabilisation scenarios, for which also GCM-runs were made, would meet a need in such national work.



**France**

PREMIER MINISTRE

MINISTÈRE DE L'ÉCOLOGIE ET DU DÉVELOPPEMENT DURABLE

Délégation interministérielle  
au développement durable

Paris, le 19 avril 2005

Observatoire national sur les  
effets du réchauffement climatique

*Le Directeur*

**Madame Renate Christ**  
**Secrétaire du GIEC**  
**Organisation météorologique mondiale**  
**2 bis, avenue de la Paix**  
**CH 1211 Genève 2**

**Subject : IPCC emission scenarios workshop, Laxenburg, 29 June-1 July 2005**

**Ref : your message dated f 2 March 2005**

Madam ,

In response to your message quoted in reference, we have the pleasure to submit for the participation of 4 persons from France, whose forms are in the same message or have already been sent to you : Ms Catherine Liousse, Mr Jean-Charles Hourcade, Mr Minh Ha Duong and Mr Marc Gillet.

We would like also to make a few preliminary comments on the issues proposed to be discussed in the meeting.

The question of GHG and aerosols emissions and absorption scenarios is critical for the presentation and understanding of IPCC assessments, and should be treated with the greatest attention and the greatest

openness, so that the policymakers may have a vision of the whole range of possible future climates. There is presently much activity in this field in the scientific community, which results should be taken into account in the IPCC work and probably lead to a range of new scenarios for the following assessment report.

The role of the IPCC is to help policymakers to better understand the variety of approaches of the scientific community, through a well structured presentation, covering the range of results and of drivers. We believe that the SRES have greatly helped in clarifying the presentation of scenarios. However, many questions remain unanswered, which IPCC might look into in the coming months. We would appreciate more insight in the following subjects:

- Many economic and social mechanisms of utmost importance need to be better taken into account, such as the debt of developing countries and the financial constraints for the growth, the economy of petroleum and fossil fuels in general, possible rebound effects produced by the development of transport economy, the role of demography and its links with economy.
- A better description of the material content of the economy and of exchanges would also be appreciated, as presentations are too often limited to monetary analysis, usually in terms of GNP.
- Some efforts for better taking into account the effects of policies and measures.

We appreciate that the IPCC proposes in the future reference emissions scenarios more clearly linked to the possible political action. Such scenarios should not include only optimal situations, but might also analyze the consequences of possible crisis independent of climate policy, such as have happened in the field of petroleum supply.

Such work will need additional and long term implication of IPCC with the scientific community working in this field, which we would certainly favor.

We will be happy to add possibly new inputs during the workshop, and we are looking forward to discuss this most important subject with the colleagues and delegates of other countries.

Yours sincerely,

Marc Gillet

## Germany

### German views on new Emission scenarios

#### Referring to letter from Secretariat No. 7711-05/IPCC/WG3 March 2005

The government of Germany welcomes the opportunity to express views on the issues to be discussed at the workshop on the development of new emission scenarios.

#### General Comments

#### Future needs with respect to new emission scenarios – to what extent have current and past IPCC scenario approaches fulfilled those needs?

The development of IPCC emission scenarios has been useful in the past as a common basis for the analysis of possible climate change, its impacts, and options to mitigate climate change.

The SRES scenarios (developed between 1996 and 2000) are now being used widely for climate change analyses, including impact analyses, as well as mitigation analyses, e.g. for the AR4. For the Fifth Assessment Report (to be published in 2012), there will be a need for new emission scenarios, based on an evaluation of the SRES scenarios and other scenarios in the literature, in the light of more recent analyses and observed trends in driving forces for emissions.

As in the past (IS92a, SRES), it is useful to develop emission scenarios that assume no additional climate policy, as a basis to analyse the implications for climate change and its impacts of a development without any additional future climate policy and as a reference for the analysis of mitigation scenarios relevant for Art. 2 FCCC. In order to operationalise Art. 2, there is a need to analyse the climate change implications and its impacts of different mitigation scenarios related to different levels of climate change. Therefore, it would be useful to develop a range of mitigation scenarios in addition to these baseline scenarios.

#### Scenarios that could meet future needs and requirements

Germany thinks that a comprehensive review of the SRES scenarios and of other scenarios in the literature is necessary in order to draw conclusions for the development of new scenarios.

As the assessment in the IPCC AR4 of new literature since SRES will also cover literature on emission scenarios that include climate feedbacks, it would be useful to address this question at the Laxenburg workshop.

The approach used in the SRES scenarios of looking at different possible development pathways (“storylines”) with consistent assumptions about different driving forces (population, economic development, technology development) is considered to be useful. The role of technology development and factors that drive technology development should be addressed in particular.

#### Possible roles of the IPCC in the development of new scenarios

The experience in the past shows that it is useful for the IPCC to develop new scenarios, as has been done in the past with IS92 and SRES scenarios. This is important to provide a set of common baseline scenarios both for climate modelling and impacts research as well as for the development of mitigation

scenarios to address questions related to Art. 2 FCCC, so that comparability of results of climate change, impacts, and mitigation scenarios is improved. The development should be based on a thorough review and assessment of SRES scenarios as well as of scenarios developed since the publication of the SRES scenarios. Experience and expertise of practitioners with energy and emission scenarios should be taken into account appropriately.

An open process for the development of the scenarios such as has been applied for the development of the SRES scenarios should be followed again, so that a wide range of scientific perspectives and interactions between regions and sectors can be taken into account and input and feedback from a wide community of experts and practitioners can be used.

## Japan

Japan's views on the main issues to be discussed at the IPCC-WGIII Workshop on New Emission Scenarios

/04/2005

### **(i) What are your future needs with respect to new emission scenarios; to what extent have current and past IPCC scenario approaches fulfilled those needs?**

Japan recognizes that the SRES scenarios developed by the IPCC have contributed much to the climate policy making processes in Japan and international organizations.

SRES scenarios have contributed to enlarging the perspective of policy making agencies and other stakeholders in Japan. They enabled a shift toward appreciation of (i) longer term implications, (ii) dynamic linkages among various decision variables and impacts, and (iii) multiple future possibilities. They helped in highlighting the collective potential of various stakeholders to influence future development path. By drawing long-term perspectives, these scenarios helped to widen the scope of the national environmental planning and energy policy planning processes. SRES scenarios have been also used in various materials by government agencies to raise awareness of various stakeholders about climate issues.

SRES also triggered development of country level scenarios by NGOs and governmental agencies. These country level scenarios looked at both climate change and other domestic environmental issues due to future emissions of GHGs. For instance, Ministry of the Environment published a white paper on waste management sector, covering three scenarios up to 2030. Although many of these national scenarios had short to medium-term horizon, SRES provided a global and long-term context to them, as indicated by extensive reference to SRES by these studies. This exercise stimulated several policy discussions in Japan.

Based on these experiences, Japan expects that new emission scenarios will contribute significantly to enhancing policy making processes and public awareness of global warming issue, in particular relating to the discussion on medium and long term policy toward the ultimate goal of UNFCCC.

New emission scenarios will also be critical for scientific community for assessment of climate change, its impacts, mitigation, and adaptation.

### **(ii) What kind of scenarios could meet your future needs and requirements?**

Based on the experiences up to TAR, it is clear that the long term emission scenarios are basis for the assessment of the future climate change, its impacts and mitigation/adaptation policies. National governments or other stakeholders, in turn, can develop detailed short to medium-term scenarios based on such scenarios. Therefore, emission scenarios should be scientifically robust and developed in a transparent manner, allowing sufficient inputs from various stakeholders from both developed and developing countries. Discontinuities of emissions of GHGs at year 2000 between past data and future predictions should be considered more carefully.

In addition, it will be useful if scenarios include regional and sectoral disaggregation to the extent possible by modeling approaches, taking into account the CO<sub>2</sub> reduction potential of each region and/or sector covered. From this viewpoint, disaggregated baseline/reference emission scenarios should be prepared with a view to providing a good basis for policy maker to take mitigation measures suitable for a certain specific sector and to assess their effects thereafter.

As for baseline/reference scenarios, they need to reflect any foreseeable structural changes in aspect of resource, technology, economy and society, projected in the next 50 years. From the same

viewpoint, baseline/reference scenarios should be updated taking into account such changes and advances of climate researches which have occurred over last 10 years.

Concerning Mitigation/stabilization scenarios, they need to be developed based on new baseline/reference scenarios considering new technological developments and other possibilities to meet the goal of UNFCCC. Such scenarios will be even more useful for the policy process if scenarios cover both mitigation and adaptation measures so that the effect of the measures to be taken can be identified and assessed subsequently.

Feedbacks among mitigation, climate impacts and adaptation are likely to influence socio-economic driving forces of greenhouse gas emissions. New scenarios are required to incorporate such feedbacks.

**(iii) What possible roles could IPCC play in the development of new scenarios, in light of the outcomes of the discussion on objective (i) and (ii)? Options may include:**

- a. No specific role, other than assessing existing scenario literature,**
- b. Organize a process with the scientific community in developing new scenarios (driven by the modelers),**
- c. Develop new scenarios, as was the case with IS92 and SRES scenarios**

Japan thinks option c would be most appropriate, as IPCC has developed solid procedures to ensure scientific robustness and transparency.

We also recognize, however, some concern that IPCC process is time consuming and not very efficient. Accordingly, it is important for the IPCC to fully cooperate with existing scientific fora, including modelers community, in developing new scenarios to carry out the work effectively. From this perspective, option b might be the alternative to be pursued.

MADAGASCAR

IPCC workshop on New Emissions Scenarios

Nirivololona RAHOLIJAO  
Research Service  
National Meteorological Office

In year 2002, Madagascar National Meteorological Office was in charge of the elaboration of the Climate Change Scenarios for Madagascar as part of the Vulnerability and Adaptation Study in the framework of the first national communication to UNFCCC.

The climate scenarios were built from the climate scenarios generator software MAGICC/SCENGEN( Hulme,M. et al., 2000) which use as input nineteen pre-defined emission scenarios. Three emission scenarios were selected for this study:

-two scenarios from the first scenarios developed by the IPCC, the IS92 scenarios: IS92a(reference scenario) and IS92c(policy scenario).

-one scenario from the Special Report on Emissions Scenarios, SRES(Nakicenovic et al, 2000): SRES98a.

Future changes in climate are based on model projections with these scenarios. Assumptions associated with emissions scenarios are one of the the source of uncertainties in future climate change. As emission scenarios user for vulnerability, impacts and adaptation assessment, we submit the following points of view:

- i) New emission scenarios should take into account more national (or at least regional) dimensions. Current and past IPCC scenarios approaches have not fulfilled these needs since they were produced for a global scale consideration. Impacts studies are undertaken at much finer spatial scale.
- ii) New emission scenarios should consider:
  - Regional/national population growth rate
  - Regional/national GDP growth rate
  - Regional/national climate policies and environmental policies
  - Regional/national observed GHG emissions trend
  - Short, medium and long-time projections
  - Climate initiatives such as the implementation of the Kyoto Protocol and the Montreal Protocol
- iii) IPCC could organize a process with the scientific and socio-economic communities in developing new scenarios.

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**MALAWI Views on Issues to be Discussed at the IPCC Workshop on New Emissions Scenarios in Luxemburg, Austria**

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**(i) Future needs include:**

Use of locally derived emission factors to estimate gas emissions from all the sectors. This is especially the case where default values were used in estimating gas emissions. However, so far so good, although with increasing human population pressures on limited land resource base, and increasing agricultural expansion to marginal areas, faster and more accurate methods are required for estimating emissions in the future.

**(ii) Scenarios that would meet future needs**

An improvement in the predicting ability of past scenarios, through the use of locally derived emission factors, would meet most immediate future needs. However, there is still need to consider other scenarios in the future. For example, in the agriculture sector:

- The assumption that net emission of CO<sub>2</sub> is zero when determining GHGs in field, burning of crop residues and the burning of savannas, needs further testing. There is need to determine the sink-source relationship, especially for major crops that produce a lot of residues, so as to ensure that emissions are indeed zero.
- There is need to develop local default values for some parameters that were used in the present calculations. This includes determining crop to residue ratios, carbon to nitrogen ratios, nitrogen fractions, dry matter fractions, leaching and volatilization values of nitrogen sources in different soil types.
- There is need to determine emission factors for different crops, livestock species and soil types under local (Malawi) conditions.

**(iii) The role of IPCC**

This would include:

- Hands on computer simulation modeling;
  - Developing and/or modifying computer models to suit local conditions;
  - Training on various methodologies for determining model input data (or model parameters).
-

## **Mexico**

Views from Mexico.

Mexico has devoted great attention to the environment, reason by which the environmental item is one included in the Political Agenda. The Federal Government has asked the University Program of Energy to carry on a prospective study of scenarios of emissions to year 2030.

The main activities were:

Elaboration of summaries of the environmental in relation to the emissions by the energy sector.

International evaluation of the present situation in the matter of emissions by the different economic sectors.

In this last point the scenarios of the IPCC were analyzed which was of great relevance to de define carrying events and drivers of the future.

Estimation of the parameters required by our model.

We proposed three scenarios.

We organized working groups to analyze the different scenarios and to retrofit the proposed scenarios.

## **The Netherlands**

### **The Netherlands views on the main issues to be discussed in the IPCC Emissions Scenarios meeting to be held from 29 June – 1 July 2005 in Laxenburg, Austria**

The Netherlands is happy to submit its views on the IPCC Emissions Scenarios meeting in Laxenburg, Austria, as requested in your letter, reference: 7711-05/IPCC/WG3. The Netherlands also nominates experts from the different user communities to attend the meeting as requested.

Your letter formulates three specific questions that we have used to structure this submission.

- (i) What are your future needs with respect to new emission scenarios; to what extent have current and past IPCC scenario approaches fulfilled those needs?
- (ii) What kind of scenarios could meet your future needs and requirements?

*These first two questions are answered jointly below.*

The Netherlands wishes to stress that emission scenarios should be as realistic as possible to be of practical use and to receive maximal acceptance. Greenhouse gas emissions are closely connected to the source and magnitude development in energy production in different parts of the world. Furthermore changes in greenhouse gas emissions stem from land use (including forestry) that are subject to change in surface area and technology application. To assist integrated consideration of these land use policies, energy policies and climate change policies the Netherlands consider the development of closely linked or integrated scenarios of importance. In this respect future fuel prices merit more attention. Scenarios which integrate aspects of the supply of energy in the future (energy prices, oil, natural gas, coal) will possibly make climate policy more attractive. New scenarios for 2030 developed by IIASA indicate that the current IPCC emissions scenarios underestimate the effect of planned (or even already implemented) air pollution policy measures, which strongly reduce future emissions. Because climate and air quality are increasingly connected in policy making there is a need for consistent scenarios including different time horizons: 2030 (as this is the time horizon for air quality policy makers) as well as 2050 and 2100 (for climate policy). This includes the interaction between ozone depletion and climate change as indicated in IPCCs Special Report.

Furthermore scenarios are desirable which show the effect of CO<sub>2</sub> trade on trade balance and terms of trade, scenarios which show learning aspects of new technology and scenarios which integrate effects of climate change on world economy.

Currently global and regional emissions scenarios co-exist. The IPCC emission scenarios are used primarily at an international level, whereas locally national and/or regional scenarios are being used (for example in European negotiations and national policy making). It is desirable to have available global scenarios that have sufficient detail to be applicable on a regional scale. At a European level this is attempted with the RAINS-model supplemented with greenhouse gases (GAINS).

It would be worthwhile to attempt to attach probabilities to different scenarios, despite conceptual difficulties.

(iii) What possible roles could IPCC play in the development of new scenarios, in light of the outcomes of the discussion on objectives (i) and (ii)?

One could argue that IPCC has no active role to play in developing emission scenarios. It is the task of the research community to independently develop scenarios out of scientific principles. IPCC merely assesses scientific knowledge on the basis of existing literature. However, from a practical viewpoint it is helpful if IPCC stimulates the development of sets of high quality scenarios so as to facilitate comparability of different model runs.

IPCC could also play a role in improving consistency between emissions scenarios and efforts outside a strict climate context (e.g. IEA scenarios for future energy consumption), as well as with economic development (such as scenarios developed by WB, OECD and others).

The Netherlands therefore sees no objection in IPCC developing scenarios provided this is being done in close collaboration with existing scientific organisations, notably WCRP, IGBP and IHDP.

The Netherlands is pleased to nominate the following experts for contributing to the IPCC Emissions Scenarios meeting:

Ms. E. Trines, independent expert

Mr. J. Vis, representative Non Governmental Organizations

Mr. E. Schmersal, Netherlands Ministry of Housing, Spatial Planning and the Environment

Mr. T. van Noije, Royal Netherlands Meteorological Institute

Brief curricula vitae of the nominees have been annexed to this submission.

## New Zealand

### The role of the IPCC in developing and assessing future emission scenarios

The New Zealand government welcomes the invitation by the IPCC to provide its views on:

- future needs with respect to new emission scenarios, and the extent to which current and past scenarios have met those needs,
- the types of scenarios that would fulfil those needs, and
- the role that the IPCC could play in the development of new scenarios.

### Future needs with respect to emission scenarios and extent to which current and past scenarios have met those needs, and the types of scenarios that would fulfil those needs

Non-mitigation scenarios: Past and current non-mitigation scenarios have provided essential input to climate models to estimate a plausible range of future climate change to 2100 in the absence of targeted mitigation measures. Non-mitigation scenarios will continue to be essential information for governments, since they act as baselines against which governments can determine the climatic and socio-economic effect of mitigation policies and broader development goals.

Stabilisation scenarios: Stabilisation scenarios have been useful mainly in providing a long-term view of the climate system, and to provide information on both the timing and magnitude of emission reductions that need to be undertaken to allow stabilisation of greenhouse gas concentrations in the atmosphere at various possible levels, consistent with Article 2 of the Framework Convention on Climate Change. Stabilisation scenarios, their long-term climatic implications and impacts and adaptation options, and the magnitude, costs and timing of mitigation measures, will continue to provide essential information for policymakers, and the information associated with stabilisation scenarios across all 3 IPCC Working Groups should be updated regularly.

One shortcoming of stabilisation scenarios is that they have tended to focus on stabilisation of CO<sub>2</sub> only. This has led to confusion about the total radiative forcing associated with specific targets and the long-term climate effects, as well as the mitigation costs and timing. Future stabilisation scenarios should work with multi-gas approaches, and clearly link stabilisation concentrations to the radiative forcing exerted by the total mix of gases.

Policy scenarios: A third class of scenarios is needed but has not received systematic treatment by the IPCC. These are 'partial' mitigation policy scenarios that are most reflective of the real world. Given the entry into force of the Kyoto Protocol, the assumption of the SRES scenarios that no specific greenhouse gas mitigation action is taken is clearly no longer valid.

Future scenario work by the IPCC should therefore include 'partial mitigation' scenarios that describe the effect of various policies that aim to reduce greenhouse gas emissions but that are not in themselves determined by a particular stabilisation goal. An assessment of such partial policy scenarios would be essential for policymakers to understand the relative climatic effect, avoided damages, costs, technology and timing options, and implications for sustainable development for a range of regional and sectoral mitigation approaches.

The development and assessment of scenarios that evaluate the effect of specific policy approaches would be best to be comprehensive and inclusive of a wide range of approaches being discussed in the academic literature.

### **The role of the IPCC in developing future scenarios**

Over the last two years there have been questions raised by expert commentators about aspects of some of the economic methodologies underlying the IPCC projections. In assessing future scenarios, the IPCC should take explicit note of economic methodologies used in their production. New Zealand encourages the IPCC to review the widest possible range of comments on scenarios produced in the expert literature. This would include taking note of comments made by institutions such as the Economics Department of the OECD.

A disproportionate amount of recent media attention on emission scenarios has focused on supposed discrepancies in economic metrics and assumptions used in producing scenarios. A robust IPCC-organised discussion on the proper choice of economic metrics and the proper explanation of economic assumptions would be beneficial to the future production of scenarios. Such a discussion would be strengthened by the participation of a broad range of economics, policy, and development climate change experts.

Special Report on Emissions Scenarios: We consider it important that the IPCC produce a Special Report on Emission Scenarios, based on an assessment of the available literature, to provide guidance to the authors of the 5th Assessment Report. Such a Special Report would need to be started with very high priority in the next assessment cycle to ensure its results are available to the authors before the end of 2010. Failure by the IPCC to provide consistent and timely guidance on emission scenarios would likely lead to inconsistencies in the contributions of the three Working Groups to the 5th Assessment Report.

Non-mitigation scenarios: We believe the IPCC remains an essential body to assess available scenario literature with regard to non-mitigation scenarios, and to ensure that underlying assumptions are subjected to expert scrutiny and are made transparent. To ensure this goal can be achieved, it may be important for an IPCC expert meeting to clearly set out the parameters and assumptions that individual scenarios need to provide information on so that they can be consistently assessed and compared with each other.

We do not see benefit in the IPCC either becoming involved in a prescriptive approach to developing new non-mitigation scenario literature by external groups, or to develop new scenarios itself.

Stabilisation scenarios: With regard to stabilisation scenarios, the IPCC should produce clear guidance to modelling groups about the relevant relationships between radiative forcing, lifetimes of greenhouse gases, and atmospheric concentrations, to achieve a consistent metric for comparison of different stabilisation scenarios and the mix of greenhouse gas concentrations. As long as a wide range of possible stabilisation targets is maintained (e.g. from 450 to 1000ppm CO<sub>2</sub>-equivalent), this approach would not be policy-prescriptive even if the information required would be prescriptive for individual modelling groups. We do not see benefit in the IPCC developing its own stabilisation scenarios.

Partial policy scenarios: One of the most important and challenging tasks for the IPCC will be the development and assessment of partial or transitional scenarios as suggested above, that is, scenarios

that apply mitigation policies only at the regional or sectoral level and that are not determined in themselves to achieve stabilisation of greenhouse gas concentrations.

To this end, the IPCC should undertake a stocktake through a series of expert meetings, of the current policy scenarios available in the literature, and group those scenarios into a limited number of approaches. The scenarios under each of those approaches could then be evaluated for their likely effects on:

- global climate system in the near and long term,
- avoided damages from the impacts of climate change,
- mitigation technology options
- timing of mitigation and implications for long-term greenhouse gas concentrations
- mitigation costs
- co-benefits and integration with sustainable development objectives.

We suggest that a Special Report by the IPCC on such a set of mitigation policies would be very helpful for governments and policymakers. Governments would need to determine the total scope of the report and against which criteria the various policy sets are evaluated, but it would be essential that the scenarios are inclusive of a wide range of hypothetical options to ensure the IPCC does not prejudge the interests of the policy community.

## **Panama**

Submission of views from Panama;

We are grateful to the IPCC for the objective and comprehensive assessment of social and economical information on climate change research and mitigation and adaptation measurements. Nevertheless, the emissions and concentrations of GHGs and aerosols as well as the response of climatic system are subject of the very high level of uncertainty.

Moreover there are certain antagonisms in the methodology when at the very high uncertainty of the assessments the determinative methods are used. In this respect, it is much more correct to be consecutive and wider apply the probabilistic approaches. It is particularly important for long-term perspective of events developments. On our opinion, it will reflect the modern level of understanding of climatic events development.

We also consider that the IPCC could follow the way of assessments integrations where all the interaction aspects can be taken into consideration instead of following the way of increasing the options of events developments, which have no deficiencies.

The aim is to reduce the uncertainties of existing assessments.

In this aspect there would be of interest the assessments considering both social-economic and natural factors, which are the certain phase of GHGs concentration increase can play a decisive role (e.g. the world ocean).

Effective also could be established of appropriate working groups of experts, the practice of which in our opinion proved to correct and is extremely effective.

## Sweden

Sweden

Issues that could be discussed:

Underlying assumptions regarding the pace and distribution of development, specially technical and economic development. We would like to see more in depth elaboration on emissions on sulphur, soot, particles etc. how the development looks like for every single subject.

Specified stabilisation scenarios. Emission scenarios has to be coupled to the carbon cycle, the sulphur cycle etc. We need more information on the relation between emissions, atmospheric concentrations of greenhouse gases and the relation to temperature. The uncertainty in vulnerability – we would need the information where the lowest limit is for an impact/event to happen.

We would like to see the IPCC as a free and assessing body. However, if IPCC could initiate a process where the scientific community takes on the work in close collaboration with stakeholders dealing with emission reporting an prognosis, without scarifying its integrity, that would be a way forward.

Best regards

Marianne Lilliesköld  
Swedish IPCC Focal Point  
Swedish Environmental Protection Agency  
Research Secretariat  
SE 106 48 Stockholm  
Phone: + 46 8 698 12 69  
Fax: + 46 8 698 16 64  
[www.naturvardsverket.se](http://www.naturvardsverket.se)



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# INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



UNEP

Task Group on Data and Scenario Support for Impact and Climate Analysis (TGICA)

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## TGICA

### **TGICA Submission on IPCC Scenarios Workshop IIASA, Laxenburg, Austria, June 29 – July 1 2005**

#### **1. Introduction**

The Task Group on Data and Scenario Support for Impacts and Climate Analysis (TGICA) was established by the IPCC in 1996 to facilitate wide availability of climate change related data and scenarios to enable research and sharing of information across the three IPCC working groups. This includes, for example, information on: anthropogenic influences on climate; climatological baselines and observations; emissions scenarios; climate scenarios; and information and scenarios on other environmental, technological, and socio-economic factors relevant to impacts, adaptation, vulnerability, and mitigation research. The TGICA coordinates a Data Distribution Centre (DDC) which provides these and other materials (e.g., technical guidelines on use of scenarios). The Group also identifies information needs in support of IPCC work, facilitates research on climate impacts, adaptation, and mitigation, and makes related recommendations on cross-cutting issues. The TGICA is composed of approximately 20 members known through their peer reviewed publications and works from the following areas of research: climatology; climate modeling (both global and regional); physical, social, and economic impacts; adaptation; emissions modeling; and integrated assessment.

This submission was prepared in response to the letter requesting input from the IPCC Secretary. It was drafted during the 10th Meeting of the TGICA, in Sao Paulo, Brazil from 19- 21 April 2005 (see attached participant list). It addresses the first two issues on which input was requested, namely needs and requirements of (potential) user communities, and characteristics of scenarios that could meet those requirements. In offering these comments, TGICA draws upon its experience of interacting with researchers and analysts who use scenarios and related information in their research, as well as lead authors who apply scenarios in the process of preparing contributions to IPCC assessments. We do not address the third issue raised in the request for submissions, the possible future roles IPCC could play in the development of scenarios.

#### **2. Past use of scenarios**

TGICA has observed the important role that scenarios have played in previous IPCC assessments, and more broadly in research on climate change, its impacts, and response options. Specifically, past sets of IPCC scenarios have:

- Provided a framework for IPCC WGs to put their assessments in a joint perspective, e.g. impacts consistent with climate change; climate change consistent with socioeconomic drivers; vulnerability and adaptation consistent with socio-economic drivers; land-use and land-use change consistent with emissions and mitigation on the one hand, and impacts, adaptation, and vulnerability on the other.

- Provided a mechanism by which WGs can coordinate their treatment of cross cutting issues and other linkages.
- Encouraged comparability of studies for assessment by the IPCC by providing a framework of common assumptions around which independent researchers can voluntarily and informally coordinate their work.

It bears emphasizing that these multiple uses (and integrating across them) are best supported if scenario development is approached as more than preparation of *emissions* scenarios, but as development of scenarios that also support projection of climate change and analysis of impacts, adaptation, and mitigation at different scales. It is important to keep all of these analytic, research, and assessment purposes in mind when scenarios are developed, or it is likely that important information requirements will not be met.

Below we reflect on the lessons learned in assisting the IPCC community. This includes issues where discussion continues, as well as identification of needs and requirements crucial for successful scenario development and analysis.

### 3. Unresolved issues

The use of earlier sets of IPCC scenarios has met with several persistent issues that call for serious consideration in any future scenario exercise:

- Specificity of storyline and derived assumptions
- Connectivity to smaller scales
- The use of scenarios to manage uncertainty

**Specificity.** There is a tradeoff between specificity and the ease with which agreement can be reached on the plausibility of a scenario. With higher levels of specificity, it becomes easier for user groups to undertake in-depth analyses. Thus some analysts would prefer if a certain scenario specified the existence of an international agreement on emissions limitations that is enforced from a certain year onwards. But the more specific the chain of events in a scenario, the more likely it is that users will disagree about the plausibility of that chain of events. More generic storylines that don't describe specific developments but that indicate "high-levels of co-operation on environmental issues" are easier to agree on and provide analysts flexibility in making their own detailed assumptions, but at a cost of developing comparable analysis without additional coordination.

**Connectivity to smaller scales.** This issue has two components: what kind of quantitative information can be provided and the scale at which the information is provided. Over time, TGICA has experienced that many questions and problems arise when users of global scenario information wish to nest smaller scale analyses within the larger scale scenario in a consistent fashion. For analysis at smaller scales, it is highly desirable to have quantitative information on the background scenarios. Needs and requirements for this purpose include:

- Multiple baselines to test robustness of policy alternatives
- Information on the international policy environment, e.g. agreements on trade,
- international environmental treaties and conventions
- Land-use and land-use change scenarios including markets for land-based mitigation options (bio-energy, C-plantations)
- International markets for fossil fuels, metals, etc.
- Technology, e.g. mitigation technology development: performance, cost, potentials
- (e.g. solar, hydrogen, carbon sequestration and storage)

However, this information is often required at a level of precision and/or geographic scale that is finer than the integrated assessment tools used to develop the global scenarios can credibly provide.

**Uncertainty.** The tension between individual realizations associated with a storyline and probabilistic approaches to arrive at a best guess and a distribution around it has led to extensive and an as yet unresolved debate. In particular, the debate centers around whether to assign likelihoods to “what-if” scenarios that fall within a range framed by a distribution of emissions. The TGICA has developed a proposal that aims to take on that discussion for consideration in future work that may be useful regardless of what decision is taken on the TGICA Input to IPCC Scenario Workshop 21 April 2005 role of IPCC in development of future scenarios. This proposal is described in the last section of this document.

#### **4. Needs and requirements**

The needs and requirements for future work on scenarios are structured in a chain linking driving forces, emissions, climate change, impacts-adaptation-vulnerability, and integration.

##### **4.1 Socio-economic scenarios and emissions**

- Scenarios should identify coherent sets of drivers of emissions: population, GDP, energy use, land-use, technology, governance, trade, resources (fossil fuels, metals) and other factors.
- The storyline/quantification practice developed within SRES, preceded by and adopted by other similar global assessments (Shell, UNEP-GEO, MA) has proven valuable and should be retained in future work.
- Emissions trajectories should provide full coverage of sources, sectors, gases, regions (GHGs, pollutants, aerosols, ozone precursors, etc.) for evaluation by climate models. The trajectories should also include “reference” baselines as well as intervention scenarios.

##### **4.2 Scenarios for climate simulation**

- In order to facilitate intercomparison and diagnosis of climate model development, any new scenario set should include at least one scenario that has the equivalent forcing of a scenario in the previous set (at least as well mixed GHGs are concerned).
- Emissions scenarios should include cases which lead to a sufficiently high signal-to-noise ratio in the climate models.
- Multiple emissions scenarios for climate simulations should be sufficiently different to yield different outcomes from the simulation.
- The representation of the reactive gases and local air pollutants needs to be improved.
- Geographic distribution of short-lived gases is required as input.

##### **4.3 Impacts-adaptation-vulnerability**

- Extended storylines should provide qualitative detail to facilitate regional, country and local analysis of sensitivity, adaptive capacity, and vulnerability.
- Global-scale scenarios should be constructed to support downscaling (at country, region and grid scale) of population, GDP, and other scenario characteristics affecting adaptive capacity and vulnerability, as well as development of consistent scenarios of land-use (agriculture,

timber, biomass, C-plantations) local pollutants, and downscaled climate (core variables, extremes, variability).

- A traceable account of how global scenario information is aggregated should be carefully maintained so that the information can be accurately disaggregated again for impacts/vulnerability analysis.
- Climate scenarios constructed from climate models data should include trends in means, changes in variability and extreme events, and abrupt and irreversible changes. Appropriate sets of indicators and formats should be developed through cooperation between the impacts and climate modeling communities.

#### **4.4 Integration across research and user communities**

To integrate across the research communities and provide information required by user communities that will in turn generate input for assessment by the IPCC, any efforts to develop scenarios for use after AR4 should encompass:

- A set (or multiple sets) of consistent scenarios, rooted in storylines/narratives and providing input and background for assessments at smaller scale levels
- Active involvement of representatives of user communities throughout the scenario development process to enhance commitment and acceptance
- An open process to solicit input, comments and feedback from the broader research and user communities
- Suitable (IA) model frameworks with adequate LULUCF functionality
- Extensions beyond SRES (revisions/updates, downscaling, additional indicators and information)
- The issue of uncertainty management (see proposal below)

#### **5. Proposal for evaluation of uncertainty in the scenario literature**

Whatever decision is reached about whether the IPCC will develop new scenarios, a useful first step activity (conducted as an antecedent to a scenario development process) is a thoughtful statistical analysis of two classes of scenarios: 1) reference cases; and 2) stabilization cases.

What is meant by “reference case” would need to be carefully defined in light of the entry into force of the Kyoto Protocol, but the general sense of this term is scenarios that are constructed to illustrate what might happen in the event that (additional) climate policies are not undertaken. The analysis would include characterization of the frequency distribution of different emissions and concentration levels which capture some fraction (e.g., 2/3) of the range in the published literature. Perhaps even more important, this would also include analysis of distributions of important input/driving variables. The result of the exercise would be a careful description of the frequency distribution of the future range in emissions and concentrations with an analysis of the distribution of leading driving forces that could be used as a baseline characterization for a variety of analytical (and potentially decision making) purposes.

The evaluation of concentration stabilization cases would be organized by stabilization level, e.g., 350, 550, 750, etc. Just as for the reference cases, there are a number of definitional issues to be addressed carefully (e.g., what is being stabilized in multi-gas scenarios, what to do about aerosols, etc.) for the work to be meaningful. For each agreed level, the process would report on the frequency distributions of input assumptions for key variables that produce the stabilization level. This could include characteristics of technologies assumed in the scenarios, as well as demographic, economic, and other

characteristics. The result of this activity would be rigorous analysis of distributions of key input parameters for each stabilization level that would help illuminate the issues associated with attaining these different stabilization levels and that could serve as baselines for additional analysis.

**TGICA 10, List of Participants****Members**

Jose A. Marengo (Co-Chair)  
 CPTEC-INPE  
 Brazil

Hugh M Pitcher  
 Joint Global Change Research Institute  
 USA

Richard H. Moss (Co-Chair)  
 US Climate Change Science Program and  
 Joint Global Change Research Institute  
 USA

Bernard Seguin  
 Unité Agroclim  
 France

Ayman F Abou Hadid  
 Ain Shams University  
 Union of Producers and Exporters of  
 Horticultural Crops  
 Egypt

Serguei M. Semenov  
 Institute of Global Climate and Ecology,  
 Russia

Xuejie Gao  
 China Meteorological Administration  
 China

Knut H. Alfsen  
 Statistics Norway  
 Norway

**Ex Officio**  
 Tahl Kestin  
 WGI Technical Support Unit  
 USA

Brad Bass  
 Environment Canada  
 Canada

Michael Lautenschlager  
 Deutsches Klima Rechenzentrum  
 (Germany)

Timothy Carter  
 Finnish Environment Institute  
 Finland

Jean Palutikof  
 WG II Technical Support Unit  
 United Kingdom

Bruce C. Hewitson  
 University of Cape Town  
 South Africa

David Viner  
 Climatic Research Unit (UK)

Tom Kram  
 National Institute of Public Health  
 And the Environment (MNP-RIVM)  
 The Netherlands

Xiaoshi Xing  
 CIESIN (US)

Rodel D. Lasco  
 World Agroforestry Centre (ICRAF)  
 Philippines

**Guest**  
 Daniel Pabon  
 Universidad Nacional de Colombia  
 Columbia

John Mitchell  
 Met Office  
 United Kingdom

Anthony (Tony) Nyong  
 University of Jos  
 Nigeria

## **United Kingdom**

### **UK submission on IPCC Emission Scenarios**

Future needs with respect to new emission scenarios and the extent to which current and past IPCC scenarios have fulfilled the needs of Governments

#### **Summary**

A range of scenarios and approaches is required to meet the needs of governments. An ability to distinguish between business as usual and with policy scenarios will be important. Some indication of likelihood is also essential. Stabilisation scenarios will be needed, together with an indication of options to achieve them. IPCC should initiate a facilitative process with other organisations through which new scenarios are developed. IPCC's primary role should be to act as an assessment body and to ensure consistency in the scenario development process.

#### **1. The needs of governments**

Governments in general need scenarios that will help them to assess the risks and costs of climate change, the effects of mitigation and adaptation policies on these risks and costs, and the options for mitigation and adaptation and their related costs. They need clarity in underlying assumptions and uncertainties, and a coherent and comprehensive approach to scenario development that recognises the practical needs of governments.

#### **2. Scope of the scenarios**

The IPCC should consider a wide range of scenarios and approaches to scenario building. This should range from the traditional "what if" approaches to more probabilistic methods. A clear distinction between interventionist and non-interventionist scenarios will be essential to inform the debate concerning the impact of policies on the response to climate change, and it should be very clear how interventionist and non-interventionist scenarios differ from and relate to one another. The set of scenarios should also include a group that defines pathways to greenhouse gas stabilisation at different levels.

All scenarios should be accompanied by a full consideration of underlying assumptions and derived quantities of interests, including estimates of costs and benefits. Consideration of options and associated costs for achieving interventionist scenarios should be provided.

To help in risk assessment Governments need some indication of the likelihood of different scenarios, particularly with regard to the set without policy intervention. It will be important to explore different ways of expressing and computing probabilistic scenarios, but a consistent approach will be essential, with clear links to underlying drivers such as population, economic growth and technology dynamics.

#### **3. Practical needs**

The ways in which scenarios are currently used should influence development of the next set. In practical terms it would be good to identify a few "marker" scenarios that would be widely used by GCM and impacts modellers and provide baselines for intercomparisons. This would reflect current experience in which users take one or two scenarios from the SRES and use those as illustrative cases, rather than using all the scenarios. Given this, it may be useful to identify which two or three scenarios are likely to be most commonly used, for instance,

scenarios demonstrating typical high and low growth. In a probabilistic approach these could for example be 5 and 95 percentile scenarios. Additionally It would be useful to set a marker stabilisation target for the mitigation scenarios (such as 550ppm CO<sub>2</sub> equivalent).

#### **4. Factors to be included in scenarios**

Scenarios will need to incorporate a comprehensive treatment of influences on climate. This will include analysis of greenhouse gases, aerosol, tropospheric and stratospheric ozone precursors, natural emissions, and land use changes, as well as sinks and corresponding emissions.

The socio-economic assumptions underlying the scenarios will need careful consideration. The socio-economic assumptions in particular should be carefully justified and consistently applied, ensuring a coherent and authoritative approach that commands widespread support among economists. The differences between total costs of BAU and mitigation scenarios should be clearly defined.

The impacts of both natural and socio-economic feedbacks will need to be addressed. Some socio-economic feedbacks and direct climate feedbacks could perhaps be complicated to include in scenarios, but do require some consideration due to their potentially significant impact on emissions (for instance of methane from hydrates).

#### **5. Timescales**

There is some need for the new scenarios to cover different time-scales; the 2100 end date is still relevant for many cases, but longer term scenarios would also provide useful information, particularly for stabilisation pathways. In addition, improved model intercomparisons would be enabled if scenarios with longer timescales are available, halting the current practice of extrapolating the scenarios beyond 2100 in various ways and inhibiting comparison of like with like beyond that date.

New scenarios will of course need to be consistent with historical emissions, and it would be useful to consider historical emissions from as early a date as practically possible, for instance the early 1900s. There will need to be some measure of continuity with the existing SRES scenarios to ensure that new analyses can build on work that has been performed so far.

#### **6. Output**

Previous scenarios provided only limited information on regional scales, which would be valuable when considering the impacts of aerosol in particular. Therefore it would be advantageous if future scenarios could provide greater regional disaggregation of emissions and other output.

On logistics, the output of the scenarios should be appropriate for application in driving GCMs, and governments would certainly find it useful if a database of relevant outputs could be provided for easy application of the associated information in a policy context.

#### **7. Role of IPCC in developing scenarios**

The primary role of the IPCC should be to ensure consistency in the scenarios, without being prescriptive, and to make sure that the end result is a common set of emission scenario information. In view of these objectives IPCC should initiate a facilitative process with other

organisations through which new scenarios are developed. The IPCC should then be active in contributing to that process in terms of ensuring coherence and consistency. Scenario development will be most successful if user needs are provided as input on a regular basis. The IPCC is well placed to do this by ensuring that the scientists are guided by a body that has an overview of requirements. The details of the involvement of the IPCC will require further elaboration but should be motivated by considerations such as these.

### **8. Timing**

The IPCC should make every effort to agree the scenarios in time to ensure their availability in time for use in the Fifth Assessment Report. This suggests the need to prepare a special report on scenarios by about 2009/10. Optimal timing will need to be considered: premature development of scenarios could undermine the AR4 but an extended delay could prevent sufficient opportunities for new model studies to use the new scenarios prior to the AR5.

## **United States of America**

### **United States Government views on the main issues to be discussed at the IPCC Emission Scenarios Workshop in Laxenburg, Austria, 29 June - 1 July 2005.**

1. The United States Government believes that scenarios have played and will continue to play an important role as a framework for discussion of the potential impacts, costs, and policy choices related to greenhouse gas emissions and changes to the radiative balance of the atmosphere. They are important as research tools for testing ideas and as comparison tools for projecting the consequences of different socio-economic and development assumptions, technological advancements, or possible courses of action into alternative sets of future conditions. Scenarios also are useful in gaining an understanding of the range of scientific uncertainties in the climate system and for helping to prioritize which are most important. Because the relevant timescale for emissions scenarios is so long, their outputs are inherently uncertain. Scenarios are best used for bounding problems and generating policy insights rather than prescribing particular solutions.

Therefore, to be most useful scenarios should be: (1) updated, as needed, to incorporate the best available initial conditions, the most recent economic, population, technological data, and the latest developments in scenario modeling; (2) designed to address pressing climate change issues and provide insights to researchers and policymakers; and (3) well tested and documented, so as to improve user understanding of driving forces and uncertainties, distinguishing between questions that can be resolved over time and those that will remain unknowable for decades or more.

2. Users of scenarios can be found in all segments of the U.S. science, technology, and policy community. What this vast and differentiated community will need or require in the future is best defined by the demands of the community itself. Their needs and requirements will drive model and scenario development in the directions that are most productive. For example, the Stanford University's Energy Modeling Forum has organized an international scenario study group with the objective of developing new climate stabilization scenarios to meet the needs of the broader climate analytic community. The U.S. Climate Change Science Program (CCSP) is another example of a scenario development process that includes many segments of the climate analytic community supported by the United States Government. The final EMF and CCSP scenario products will be available for assessment by the time of the AR5 as will other scenario development efforts not formally associated with the IPCC. The United States Government does not believe that an IPCC-led effort to direct the work of the modelers towards any specific scenario types, defined development pathways, or modeling methodologies would improve on the dynamic of the marketplace.

The United States Government expects that useful new scenarios will be structured around two main areas: (1) reference or "business-as-usual" scenarios; and (2) stabilization scenarios. In each area, it will continue to be important to evaluate the possible future range of emissions, climate change, and impacts from both a probabilistic and a deterministic or "storyline" perspective.

Both reference and stabilization scenarios should take advantage of the latest data and model developments, including updated cost and performance information on mitigation technologies. In addition, since the SRES, there have been many important developments in scenario work in the areas of non-CO<sub>2</sub> GHGs, land use and forestry emission and sinks, and emissions of radiatively important non-GHGs such as black and organic carbon, and analysis of uncertainty, among other issues. For comparison, reference and stabilization scenarios should be characterized in terms of population trajectories, economic growth by sector, primary energy contributions, land-

use and land-use change, key technological changes affecting those, and the resulting emissions trajectories over time.

New reference scenarios would help to show the range of emissions and potential climate change given the assumption of no specific greenhouse gas control policies and representing plausible values for critical drivers such as global population growth, technological change, and economic growth. New stabilization scenarios would then be needed to span a range of GHG concentrations and temperature change above pre-industrial levels. It is important that objectives in these scenarios be defined in terms of metrics that allow for cost-effective tradeoffs between GHGs.

3. The United States Government believes that IPCC should have no specific role in commissioning or directing scenario development. While it may have been important a decade ago for IPCC to organize and seed the work that ultimately led to the scenario assessments described in the TAR, the community engaged in scenario development is now much larger and is attracting specialists from fields outside of the core IPCC disciplines that are needed to improve the soundness of the models. This is clearly evident from community modeling efforts such as the ENSEMBLES Project and the Innovation Modeling Comparison Project in Europe, the Asian-Pacific Integrated Modeling consortia coordinated by the National Institute of Environmental Studies in Japan, and the Energy Modeling Forum organized by Stanford University, as well as the multitude of original scenarios generated and published in the scientific literature that is not part of any IPCC-organized process.

Future IPCC assessment activities should work with this community in the same way that they have worked with climate scientists in the past: engage the best people that the field has to offer as authors and reviewers of the state of the science. The IPCC also should follow for AR5 the current experience of AR4 where IPCC authors are in the process of assessing the available literature published after the development and publication of the SRES. IPCC should not try to push the field in any pre-determined direction.

Beyond its assessment responsibilities, the IPCC could play an important but limited role in support of the modeling community's effort to develop new scenarios by AR5. To be more specific, the IPCC could:

1. Prepare a Technical Paper evaluating the needs and requirements of governments, scientists, industry, and NGOs in assessing potential climate change with respect to new emission scenarios;
2. Organize a Workshop or Expert Meeting to solicit input from governments, scientists, industry, and NGOs on their needs and useful approaches for scenario development prior to the start any major new scenarios development activities.
3. Organize Workshops or Expert Meetings to help foster communication between and coordination across user and developer groups in ongoing scenarios modeling efforts. IPCC involvement in these meetings might be especially useful to gain support for the participation of experts from developing countries.
4. Provide simple guidance and formats for researchers to facilitate clear reporting of results and key assumptions that could aid in assessments in the future. This guidance should not be prescriptive of methods and should be entirely voluntary for potential users.
5. During the assessment of the scenario literature that is conducted as part of the AR5, perform statistical analysis of scenarios in the literature and describe the range of emissions for both reference and stabilization scenarios. This should include analysis of the major sources of variance across scenarios.

For all of the above options, the United States Government believes that the IPCC should not develop new scenarios, as was the case with the 1990, IS92 and SRES scenarios, but may support a process with the scientific community in the development of new scenarios that is driven by science itself. The post-SRES experience clearly demonstrates that: (1) the international modeling community is sufficiently capable of developing high-quality and state-of-the art scenarios on its own; (2) the current role of the IPCC in AR4 –of solely assessing the scenario literature– is proving effective; and (3) there is no evidence that the needs and requirements of governments, scientists, industry, NGOs, and the IPCC are not being met by scenario development efforts that are independent of the IPCC.

## **Uzbekistan**

FAX 5 April 2005

Subject: Submission of Uzbekistan of views of the main issues of IPCC workshop on new emission scenarios 29 June – 1 July 2005, Laxenburg, Austria

(i) *Objective 1*

The development of emission scenarios for 2010 – 2020

(ii) *Objective 2*

The regionally, economically or sectorally disaggregated scenarios with identification of main factors impacted to relevant sectors

(iii) *Objective 3*

The development of new scenarios as was done with IPCC IS92 and IPCC SRES scenarios with assessment of trust worthy for 2010 – 2020.

## **Worldbank**

To whom it may concern,

As a follow up to Ms. Laura Tlaiyes' letter to Dr. Renate Christ, dated April 21, 2005, regarding our views on the main issues to be discussed in Austria in late June, we have the following input to report:

The World Bank is mostly interested in how energy markets may evolve in developing countries, how energy technologies (production and use) may evolve, including their costs, the implications of developing countries assuming carbon emissions reductions obligations, and how the carbon market may evolve.

Therefore, the IPCC new scenarios need to take into account revised population projections, the storyline team should have more financial experts, and the most useful scenarios are those that incorporate different climate policy assumptions (both OECD and developing countries) - different assumptions should be made regarding the evolution of different energy technologies (e.g., carbon capture and storage) and the international carbon market. In addition, the storylines should NOT be written by the modellers, rather by a group of development and energy experts who are not confined by what can be modelled.

We hope you find this information useful. Please let us know of any questions.

Best,

Elisson  
202-473-1067



**Annex IV**

**IPCC WORKSHOP ON NEW EMISSION SCENARIOS  
29 June – 1 July 2005**

**List of participants**

Mr. Anthony **Adegbulugbe**  
Centre for Energy Research and Development  
Nigeria

Mr. Aysar Ahmed **Al-Tayeb**  
Environmental Consultant  
Saudi Arabia

Mr. Michail **Antonovskyi**  
Institute for Global Climate and Ecology  
Russia

Mr. Mustafa **Babiker**  
Arab Planning Institute Kuwait

Mr. Philip **Bagnoli**  
OECD  
France

Mr. Jiri **Balajka**  
ECOSYS  
Slovak Republic

Mr. Brad **Bass**  
Adaptation and Impacts Research Group  
Meteorological Service of Canada  
Canada

Mr. Gerardo **Bazan** Navarette  
National Autonomous University of Mexico  
(UNAM)  
Mexico

Ms. Outi **Berghäll**  
Ministry of the Environment  
Finland

Mr. Ulrich **Berner**  
Federal Ministry of Economics and Labour  
Germany

Mr. Pierre **Boileau**  
Environment Canada  
Canada

Mr. Bert **Bolin**  
Chairman Emeritus of the IPCC  
Sweden

Mr. Prithviraj **Booneedy**  
Mauritius Meteorological Service  
Mauritius

Mr. Richard **Bradley**  
IEA/OECD  
France

Mr. Eduardo **Calvo**  
IRENA  
Peru

Mr. Ian **Carruthers**  
Australian Greenhouse Office  
Australia



## INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



Mr. Tim **Carter**  
Finnish Environment Institute (SKYE)  
Finland

Ms. Wenying **Chen**  
Tsinghua University, Beijing  
China

Ms. Renate **Christ**  
Secretary of IPCC  
IPCC

Ms. Laura **Cozzi**  
IEA  
France

Mr. Ogun **Davidson**  
Co-chair WGIII  
IPCC-WGIII

Mr. Mauro Meirelles **de O. Santos**  
Ministry of Science and Technology - MCT  
Brazil

Mr. Francisco **Delachesnaye**  
U.S. Environmental Protection Agency  
USA

Ms. Nicole **Dellero**  
ICC  
France

Mr. James **Edmonds**  
Pacific Northwest National Laboratory  
USA

Mr. Brian **Fisher**  
Australian Bureau of Agricultural  
and Resource Economics  
Australia

Mr. Brian **Flannery**  
Exxon Mobil Corporation  
USA

Mr. Ronald **Flippi**  
Ministry of Housing, Spatial Planning  
and the Environment  
Netherlands

Mr Gilberto **Gallopin**  
Regional Adviser on Environmental Policies  
Division of Environment and Human Settlements  
United Nations  
Chile

Mr. Javier **García**  
Environmental National Commission  
Chile

Mr. Amit **Garg**  
UNEP-Risoe Centre on Energy, Environment  
and Sustainable Development  
Denmark

Mr. Amadou Thierno **Gaye**  
Laboratory of Atmospheric Physics  
Senegal

Ms. Elena **Georgopoulou**  
National Observatory of Athens  
Greece

Mr. Marc **Gillet**  
Ministère de l'écologie  
et du développement durable  
France

Mr. Koffi **Gnronfoun** Kodjovi  
Ministere de l'environnement  
et des ressources forestieres (MERF)  
Togo

Mr. Arnulf **Grübler**  
IIASA  
Austria

Mr. Jesper **Gundermann**  
Danish Environmental Protection Agency  
Denmark



## INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



Mr. William **Hare**  
Greenpeace International/PIK  
Netherlands/Germany

Ms. Monique **Hoogwijk**  
TSU WGIII  
IPCC-WGIII

Mr. Leen **Hordijk**  
IIASA  
Austria

Ms. Jinhe **Jiang**  
Chinese Academy of Social Sciences  
China

Mr. Kejun **Jiang**  
Energy Research Institute  
China

Mr. Eberhard **Jochem**  
Fraunhofer Institute Systems  
and Innovation Research (Fh-ISI)  
Germany

Ms. Mikiko **Kainuma**  
National Institute for Environmental Studies  
Japan

Ms. Lucka **Kajfez Bogataj**  
Biotechnical Faculty, University of Ljubljana  
Slovenia

Mr. Tiit **Kallaste**  
Stockholm Environment Institute, Tallinn Centre  
SEI-Tallinn  
Estonia

Mr. Abdulhamid **Kayumov**  
Agency on Hydrometeorology  
Tajikistan

Mr. Shigeki **Kobayashi**  
Toyota R&D Labs. Inc.  
Japan

Mr. Tom **Kram**  
Netherlands Environmental  
Assessment Agency (MNP)  
Netherlands

Mr. Emilio **La Rovere**  
Institute for Research and Graduate Studies  
of Engineering, Federal University  
of Rio de Janeiro - COPPE/UFRJ  
Brazil

Mr. Erda **Lin**  
Chinese Academy of Agricultural Sciences  
China

Mr. Juan Federico **Llanes-Regueiro**  
University of Havana  
Cuba

Mr. Martin **Manning**  
Head TSU WGI  
IPCC-WGI

Mr. El-Sayed **Mansour**  
Ministry of State for Environmental Affairs  
Egyptian Environmental Affairs Agency (EEAA)  
Egypt

Mr. Kenneth **Martchek**  
Alcoa Inc  
USA

Mr. Koki **Maruyama**  
Central Institute of Electric  
Power Industry (CRIEPI)  
Japan

Mr Ben **Matthews**  
Louvain Catholic University  
Belgium

Mr. Mohammad **Mazraati**  
Organisation of Petroleum Exporting Countries  
Austria



## INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



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ICC  
United Kingdom

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Central Lab. for Agricultural Climate (CLAC)  
Egypt

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IPCC-WGIII

Mr. Leo **Meyer**  
Head TSU WGIII  
IPCC-WGIII

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WWF  
Germany

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Tokyo University of Science  
Japan

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US Climate Change Science Program  
University of Maryland  
USA

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IIASA  
Austria

Mr. Sten **Nilsson**  
IIASA  
Austria

Ms. Raholijao **Nirivololona**  
Direction Generale de la Meteorologie  
Madagascar

Mr. Brian **O'Neill**  
IIASA  
Austria

Ms. Balgis **Osman** Elasha  
Higher Council for Environment  
and Natural Resources  
Sudan

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IPCC Chair  
IPCC

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Head TSU WGII  
IPCC

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Canada

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DEFRA  
United Kingdom

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UNFCCC  
Germany

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USA

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Ministry for Nature and Environment  
Mongolia

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Umweltbundesamt  
Austria

Mr. Nurmohamed **Riad**  
University of Suriname  
Suriname

Mr. Keywan **Riahi**  
IIASA  
Austria



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IAEA  
Austria

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Swiss Agency for the Environment, Forest  
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Switzerland

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NASA Goddard Institute of Space Studies  
USA

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Macaulay Institute  
United Kingdom

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Ministry of Agriculture  
Malawi

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Max Planck Institute for Meteorology  
Germany

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Asian Institute of Technology  
Thailand

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TERI  
India

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Central Research Institute of Electric Power  
Industry (CRIEPI)  
Japan

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Director of Prognosis Bureau  
of the National Hydrometeorological Department  
Republic of Azerbaijan

Mr. Ferenc **Toth**  
IAEA

Austria  
Ms. Eveline **Trines**  
Treeness Consult  
Netherlands

Mr. Jean-Pascal **van Ypersele**  
Institut d'astronomie et de géophysique  
Belgium

Ms. María Virginia **Vilariño**  
BCSD  
Argentina

Mr. Jasper **Vis**  
The Netherlands Society for Nature  
and Environment (Stichting Natuur en Milieu)  
Netherlands

Ms Rachel **Warren**  
University of East Anglia  
UK

Mr. David **Warrilow**  
Defra  
United Kingdom

Mr. Martin **Weiß**  
Federal Environmental Agency  
Germany

Mr. John **Weyant**  
Stanford University  
USA

Mr. Azman **Zainal** Abidin  
Malaysian Energy Centre  
Malaysia

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Ms. Katalin Dávid  
Ms. Nina Drinkovic  
Ms. Sanja Drinkovic  
Ms. Holmes Hummel  
Ms. Shilpa Rao