UNEP

Climate in Peril

A popular guide to the latest IPCC reports

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A climate neutral publication

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Climate in Peril

A popular guide to the latest IPCC reports

Disclaimer: This guide tries to remain faithful to the sense of the work of the IPCC and its Climate Change 2007 Synthesis Report of the Fourth Assessment, while simplifying the language and structure. The full responsibility for the accuracy of the content rests with the editors of this guide. Readers may remember the IPCC's helpful warning that "while the Synthesis Report is a largely self-contained document, it needs to be viewed in the context of the other volumes of *Climate Change 2007* and it is recommended that for further details the contributions of the three Working Groups be consulted, published in the volumes "Climate Change 2007 – The Physical Science Basis"; "Impacts, Adaptation and Vulnerability" and "Mitigation of Climate Change", as well as "Climate Change 2007 Synthesis Report".

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Foreword

In 2007 the Intergovernmental Panel on Climate Change (IPCC) shared the Nobel Peace Prize with former US Vice President Al Gore for their work to provide policy makers and the general public around the world with the best possible science base for understanding and combating the increasing threat from climate change. But as the messages from the scientists are becoming increasingly explicit, the gap between the need for action they project and the climate policy the world leaders put in place is steadily increasing.

One illustration is the trend in emissions of greenhouse gases. According to the IPCC global emissions would need to peak between 2000 and 2015 in order to limit the global temperature increase to between 2 and 2.4ºC compared to pre-industrial times. In 2007, when ideally the emissions should have peaked, the world instead experienced a new record in annual emission increase. For each day we fail to twist development towards a low-carbon society, the damage to the world's ecosystems become more severe, and the costs of mitigation and adaptation increases.

The main purpose of this short guide is to help bridging the gap between science and policy and to increase public awareness about the urgency of action to combat climate change and its impacts. This booklet is intended for those who do not have the time – and may not have the scientific expertise – to read the entire Synthesis Report from the IPCC.

Special thanks to Svein Tveitdal of Klima 2020 and former director of Grid-Arendal, for the initiative for this booklet and his valuable contribution to the content. We would also like to express our gratitude to the Swedish Environment Protection Agency and Earth-Print Ltd for additional financial support.

Arendal and Oslo, February 10, 2009

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How to Use This Guide

This guide, while it aims to present the substance and the sense of the IPCC's original Synthesis Report, is designed to be read as a narrative. So it tells the story in a simplified language while taking the liberty of shortening or enhancing specific parts where it appears useful and illustrating the text with additional graphics. You will always find the source of the data mentioned if it differs from the IPCC's own. The guide covers the six original topic headings as in the Summary for Policymakers but the order in which they are presented here differs from the IPCC publication. It starts by spelling out what the IPCC knows and what it considers as key questions.

Although the guide is intended for lay readers, not climate scientists, inevitably it uses some scientific terms. Readers will find a fuller explanation of some of them in the short Glossary at the end of the guide: they appear in the text in *italics*. In their assessment reports, the IPCC uses commonly used terms with a very specific meaning. In order to simplify the language, this guide abandon these specialized terms. *The IPCC also uses several terms which are likely to be self-explanatory: they include high agreement/medium agreement and high evidence/medium evidence*. The term *"agreement"* refers to agreement found within the scientific literature.

Introduction

In 2007 the Intergovernmental Panel on Climate Change published its Fourth Assessment Report (following earlier assessment reports in 1990, 1995 and 2001). The report – AR4 for short – consists of four volumes, published under the title *Climate Change 2007*. One volume was devoted to each of the IPCC's three Working Groups:

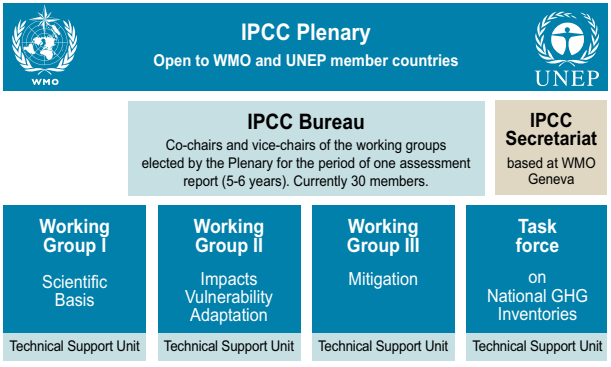
Working Group I (WG I) assesses the physical scientific aspects of the climate system and climate change;
Working Group II (WG II) assesses the vulnerability of socio-economic and natural systems to climate change, negative and positive consequences, and options for adapting to it; and
Working Group III (WG III) assesses options for mitigating climate change through limiting or preventing greenhouse gas emissions and enhancing activities that are working to remove them from the atmosphere.

The fourth volume that completed AR4 is the Synthesis Report. It summarizes the findings of the other three volumes and specifically addresses issues of concern to policymakers, and draws as well on other IPCC reports. Its range of policy-relevant questions is structured around six topic headings:

1. Observed changes in climate, and the effects of past changes
2. Natural and human causes of climate change and their relation to observed changes
3. Projected future climate change and its impacts
4. Options to adapt to climate change and to mitigate it; what responses are possible by 2030
5. The long-term perspective; how fast and how deep greenhouse gas cuts will need to be to limit global temperature increases to a given level; why climate concerns are intensifying
6. Robust findings and key uncertainties.

The IPCC is a scientific intergovernmental body set up by the World Meteorological Organization (WMO) and by the United Nations Environment Programme (UNEP) in 1988. It was established to provide decision-makers and others interested in climate change with an objective source of information. The IPCC does not conduct any research. Its role is to assess on a comprehensive, objective and transparent basis the latest scientific, technical and socio-economic literature relevant to the understanding of the risk of human-induced climate change, its observed and projected impacts and options for adaptation and mitigation. IPCC reports should be neutral with respect to policy, although they need to deal objectively with policy relevant scientific, technical and socio-economic factors. They should aim to reflect a range of views, expertise and wide geographical coverage. The IPCC continues to be a major source of information for the negotiations under the UNFCCC (United Nations' Framework Convention on Climate Change).

How the IPCC is organized



Robust findings and key uncertainties

Robust findings

Observed changes in climate, their effects and their causes	➡ Warming is un ambiguous, as demonstrated by observations such as: - rises in global average air and sea temperatures and average sea levels, - widespread melting of snow and ice; ➡ Observed changes in many biological and physical systems are consistent with warming: - many natural systems on all continents and oceans are affected; ➡ 70% growth of greenhouse gas emissions in terms of the global warming potential between 1970 and 2004; ➡ Concentrations of methane (CH_4), carbon dioxide (CO_2) and nitrous oxide (N_2O) are now far higher than their natural range over many thousands of years before industrialization (1750); ➡ Most of the warming over the last 50 years is "very likely" to have been caused by anthropogenic increases in greenhouse gases.
Causes and projections of future climate changes and their impacts	➡ Global GHG emissions will continue to grow over decades unless there are new policies to reduce climate change and to promote sustainable development. ➡ Warming of about 0.2°C a decade is projected for the next two decades (several IPCC scenarios). ➡ Changes this century would "very likely" be larger than in the 20th. ➡ Greater warming over land than sea, and more in the high latitudes of the northern hemisphere. ➡ The more the planet warms, the less CO_2 it can absorb naturally. ➡ Warming and rising sea levels would continue for centuries, even if GHG emissions were reduced and concentrations stabilized, due to feedbacks and the time-lag between cause and effect. ➡ If GHG levels in the atmosphere double compared with pre-industrial levels, it is “very unlikely” that average global temperatures will increase less than 1.5°C compared with that period.
Responses to climate change	➡ Some planned adaptation to climate change is occurring, but much more is needed to reduce vulnerability. ➡ Long term unmitigated climate change will "likely" exceed the capacity of people and the natural world to adapt. ➡ Many technologies to mitigate climate change are already available or likely to be so by 2030. But incentives and research are needed to improve performance and cut cost. ➡ The economic mitigation potential, at costs from below zero to US$100 per tonne of CO_2 eq, is enough to offset the projected growth of global emissions or to cut them to below their current levels by 2030. ➡ Prompt mitigation can buy time to stabilize emissions and to reduce, delay or avoid impacts. Sustainable development and appropriate policy-making in sectors not apparently linked to climate help to stabilize emissions. Delayed emissions reductions rincrease the risk of more severe climate change impacts.

Key uncertainties

Observed changes in climate, their effects and their causes

- Limited climate data coverage in some regions.
- Analysing and monitoring changes in extreme events, for example droughts, tropical cyclones, extreme temperatures and intense precipitation (rain, sleet and snow), is harder than identifying climatic averages, because longer and more detailed records are needed.
- Difficult to determine the effects of climate change on people and some natural systems, because they may adapt to the changes and because other unconnected causes may be exerting an influence.
- Hard to be sure, at scales smaller than an entire continent, whether natural or human causes are influencing temperatures because (for example) pollution and changes in land use may be responsible.
- There is still uncertainty about the scale of CO_2 emissions due to changes in landuse, and the scale of methane emissions from individual sources.

Causes and projections of future climate changes and their impacts

- It is uncertain how much warming will result in the long term from any particular level of GHG concentrations, and therefore,
- it is uncertain what level - and pace - of emissions cuts will be needed to ensure a specific level of GHG concentrations.
- Estimates vary widely for the impacts of aerosols and the strength of feedbacks, particularly clouds, heat absorption by the oceans, and the carbon cycle.
- Possible future changes in the Greenland and Antarctic ice sheets are a major source of uncertainty about rising sea levels
- Projections of climate change impacts beyond about 2050 are heavily dependent on scenarios and models.

Responses to climate change

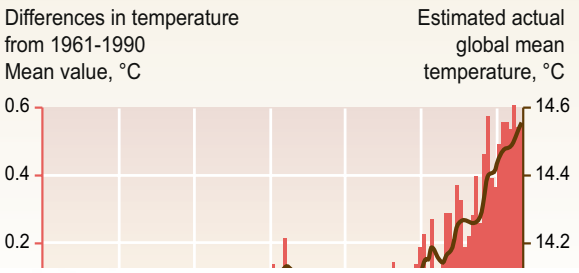
- Limited understanding of how development planners factor climate into their decisions.
- Effective adaptation steps are highly specific to different political, financial and geographical circumstances, making it hard to appreciate their limitations and costs.
- Estimating mitigation costs and potentials depends on assumptions about future socio-economic growth, technological change and consumption patterns.
- Not enough is known about how policies unrelated to climate will affect emissions.

Present changes, causes and observed impacts

Observed changes in climate and their effects

Warming of the climate system is beyond argument, as shown by observations of increases in global average air and ocean temperatures, the widespread melting of snow and ice, and rising global average sea levels. In the following paragraphs, some of the most striking changes that are already taking place are described and illustrated.

Trends in global average surface temperature



Temperature rise

Of the last 12 years (1995–2006), 11 are among the 12 warmest since records began in 1850. The warming trend over the previous century was reported as 0.6ºC in the IPCC's Third Assessment Report (TAR) published six years earlier in 2001: it is now 0.74ºC. The temperature increase is widespread across the world but is most marked in the northern Polar Regions. Warming of the climate system has been detected on the Earth's surface and up in the atmosphere, as well as in the upper few hundred metres of the oceans. The land has warmed faster than the seas.

Average Northern Hemisphere temperatures after 1950 have been higher than during any other 50-year

Temperature change 1970-2004