

# Climate Change 2007

## Mitigation of Climate Change

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The Intergovernmental Panel on Climate Change (IPCC) was set up jointly by the World Meteorological Organization and the United Nations Environment Programme to provide an authoritative international statement of scientific understanding of climate change. The IPCC's periodic assessments of the causes, impacts and possible response strategies to climate change are the most comprehensive and up-to-date reports available on the subject, and form the standard reference for all concerned with climate change in academia, government and industry worldwide. Through three working groups, many hundreds of international experts assess climate change in this Fourth Assessment Report. The Report consists of three main volumes under the umbrella title *Climate Change 2007*, all available from Cambridge University Press:

*Climate Change 2007 – The Physical Science Basis*

Contribution of Working Group I to the Fourth Assessment Report of the IPCC  
(ISBN 978 0521 88009-1 Hardback; 978 0521 70596-7 Paperback)

*Climate Change 2007 – Impacts, Adaptation and Vulnerability*

Contribution of Working Group II to the Fourth Assessment Report of the IPCC  
(978 0521 88010-7 Hardback; 978 0521 70597-4 Paperback)

*Climate Change 2007 – Mitigation of Climate Change*

Contribution of Working Group III to the Fourth Assessment Report of the IPCC  
(978 0521 88011-4 Hardback; 978 0521 70598-1 Paperback)

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*Climate Change 2007 – Mitigation of Climate Change* aims to answer essentially five questions relevant to policymaking worldwide:

- What can we do to reduce or avoid the threats of climate change?
- What are the costs of these actions and how do they relate to the costs of inaction?
- How much time is available to realise the drastic reductions needed to stabilise greenhouse gas concentrations in the atmosphere?
- What are the policy actions that can overcome the barriers to implementation?
- How can climate mitigation policy be aligned with sustainable development policies?

This latest assessment of the IPCC provides a comprehensive, state-of-the-art and worldwide overview of scientific knowledge related to the mitigation of climate change. It includes a detailed assessment of costs and potentials of mitigation technologies and practices, implementation barriers, and policy options for the sectors: energy supply, transport, buildings, industry, agriculture, forestry and waste management. It links sustainable development policies with climate change practices. This volume will again be the standard reference for all those concerned with climate change, including students and researchers, analysts and decision-makers in governments and the private sector.

## From reviews of the Third Assessment Report – Climate Change 2001:

‘The detail is truly amazing ... invaluable works of reference ... no reference or science library should be without a set [of the IPCC volumes] ... unreservedly recommended to all readers.’

*Journal of Meteorology*

‘This well-edited set of three volumes will surely be the standard reference for nearly all arguments related with global warming and climate change in the next years. It should not be missing in the libraries of atmospheric and climate research institutes and those administrative and political institutions which have to deal with global change and sustainable development.’

*Meteorologische Zeitschrift*

‘... likely to remain a vital reference work until further research renders the details outdated by the time of the next survey ... another significant step forward in the understanding of the likely impacts of climate change on a global scale.’

*International Journal of Climatology*

‘The IPCC has conducted what is arguably the largest, most comprehensive and transparent study ever undertaken by mankind ... The result is a work of substance and authority, which only the foolish would deride.’

*Wind Engineering*

‘... the weight of evidence presented, the authority that IPCC commands and the breadth of view can hardly fail to impress and earn respect. Each of the volumes is essentially a remarkable work of reference, containing a plethora of information and copious bibliographies. There can be few natural scientists who will not want to have at least one of these volumes to hand on their bookshelves, at least until further research renders the details outdated by the time of the next survey.’

*The Holocene*

‘The subject is explored in great depth and should prove valuable to policy makers, researchers, analysts, and students.’

*American Meteorological Society*

## From reviews of the Second Assessment Report – Climate Change 1995:

‘... essential reading for anyone interested in global environmental change, either past, present or future. ... These volumes have a deservedly high reputation’

*Geological Magazine*

‘... a tremendous achievement of coordinating the contributions of well over a thousand individuals to produce an authoritative, state-of-the-art review which will be of great value to decision-makers and the scientific community at large ... an indispensable reference.’

*International Journal of Climatology*

‘... a wealth of clear, well-organized information that is all in one place ... there is much to applaud.’

*Environment International*

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*Edited by*

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**Bert Metz**

Co-chair Working Group III  
Netherlands Environmental  
Assessment Agency

**Ogunlade Davidson**

Co-chair Working Group III  
University of Sierra Leone

**Peter Bosch**

**Rutu Dave**

**Leo Meyer**

Technical Support Unit IPCC Working Group III  
Netherlands Environmental Assessment Agency

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Contribution of Working Group III  
to the Fourth Assessment Report of the  
Intergovernmental Panel on Climate Change

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Solar PV screen and high voltage power line. © (FREELENS Pool) Tack / Still Pictures

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## Foreword

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“Climate Change 2007 – Mitigation of Climate Change”, the third volume of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), provides an in-depth analysis of the costs and benefits of different approaches to mitigating and avoiding climate change.

In the first two volumes of the “Climate Change 2007” Assessment Report, the IPCC analyses the physical science basis of climate change and the expected consequences for natural and human systems. The third volume of the report presents an analysis of costs, policies and technologies that could be used to limit and/or prevent emissions of greenhouse gases, along with a range of activities to remove these gases from the atmosphere. It recognizes that a portfolio of adaptation and mitigation actions is required to reduce the risks of climate change. It also has broadened the assessment to include the relationship between sustainable development and climate change mitigation.

At regular intervals of five or six years, the IPCC presents comprehensive scientific reports on climate change that assess the existing scientific, technical and socioeconomic literature. The rigorous multi-stage review process of the reports, the broad and geographically-balanced participation of experts from all relevant fields of knowledge and the thousands of comments taken into account guarantee a transparent and unbiased result.

As an intergovernmental body established by the World Meteorological Organization and the United Nations Environment Programme, the IPCC has the responsibility of providing policymakers with objective scientific and technical findings that are policy relevant but not policy prescriptive. This is especially evident in the Mitigation report, which presents tools that governments can consider and implement in their domestic policies and measures in the framework of international agreements.

Hundreds of authors contributed to the preparation of this report. They come from different backgrounds and possess a wide range of expertise, from emissions modelling to economics, from policies to technologies. They all dedicated a large part of their valuable time to the preparation of the report. We would like to thank them all, in particular the 168 Coordinating Lead Authors and Lead Authors most closely engaged in the process.

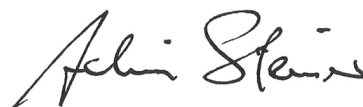
The preparation of an IPCC Assessment Report is a complex and absorbing process. We would like to express our gratitude to the Technical Support Unit for its massive organizational efforts. We would also like to thank the IPCC Secretariat for its dedication to the efficient completion of the report.

We express our appreciation to the Government of the Netherlands, which hosted the Technical Support Unit; the Government of Thailand, which hosted the plenary session for the approval of the report; the Governments of China, Germany, New Zealand and Peru, which hosted the Lead Authors’ meetings; and to all the countries that contributed to IPCC work through financial and logistic support.

We wish to sincerely thank Dr Rajendra K. Pachauri, Chairman of the IPCC, for his steady and discreet guidance and to express our deep gratitude to Drs Ogunlade Davidson and Bert Metz, Co-Chairs of Working Group III, who successfully led their team with positive, efficient and constructive direction.



M. Jarraud  
Secretary General  
World Meteorological Organization



A. Steiner  
Executive Director  
United Nations Environment Programme



## Preface

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The Fourth Assessment Report of IPCC Working Group III, “Mitigation of Climate Change”, aims to answer essentially five questions relevant to policymakers worldwide:

- What can we do to reduce or avoid climate change?
- What are the costs of these actions and how do they relate to the costs of inaction?
- How much time is available to realise the drastic reductions needed to stabilise greenhouse gas concentrations in the atmosphere?
- What are the policy actions that can overcome the barriers to implementation?
- How can climate mitigation policy be aligned with sustainable development policies?

A description of mitigation options for the various societal sectors that contribute to emissions forms the core of this report. Seven chapters cover mitigation options in energy supply, transport, buildings, industry, agriculture, forestry and waste management, with one additional chapter dealing with the cross-sectoral issues. The authors have provided the reader with an up-to-date overview of the characteristics of the various sectors, the mitigation measures that could be employed, the costs and specific barriers, and the policy implementation issues. In addition, estimates are given of the overall mitigation potential and costs per sector, and for the world as a whole. The report combines information from bottom-up technological studies with results of top-down modelling exercises. Mitigation measures for the short term are placed in the long-term perspective of realising stabilisation of global average temperatures. This provides policy-relevant information on the relation between the stringency of stabilisation targets and the timing and amount of mitigation necessary. Policies and measures to achieve mitigation action, both at national and international levels, are covered in chapter 13; this is additional to what is included in the sector chapters. The link between climate change mitigation, adaptation and sustainable development has been further elaborated in the relevant chapters of the report, with one chapter presenting an overview of the connections between sustainable development and climate change mitigation.

### *The process*

After two scoping meetings to establish possible content, the formal assessment production process got underway in 2003 with the approval of the report outline by the IPCC at the Panel’s 21st session. Soon after this, an author team of 168 lead authors (55 from developing countries, 5 from EIT countries and 108 from OECD countries) and 85 contributing authors was formed by the Working Group III Bureau, based on nominations from governments and international organisations. Thirty-six per cent of the lead authors came from developing countries and countries with economies in transition. The IPCC review procedure was followed, in which drafts produced by the authors were subject to two reviews. Thousands of comments from a total of 485 expert reviewers, and governments and international organisations were processed. The processing into new drafts was overseen by two review editors per chapter, who ensured that all substantive comments received appropriate consideration.

The Summary for Policymakers was approved line by line, and the main report and Technical Summary were accepted at the 9th session of the IPCC Working Group III held in Bangkok, Thailand from 30 April to 4 May 2007.

### *Acknowledgements*

Production of this report was a major enterprise, in which many people all around the world delivered a wide variety of contributions. This input could not have been made without the generous support from the governments and institutions involved, which enabled the authors, review editors and reviewers to participate in this process. To them, our thanks.

We are particularly grateful to the governments of Germany, Peru, China and New Zealand, who, in collaboration with local institutions, hosted the crucial lead author meetings in Leipzig (October 2004), Lima (June 2005), Beijing (February 2006) and Christchurch (October 2006).

Various countries and institutions supported expert meetings and stakeholder consultations that have contributed to the depth and scope of the report, namely:

- Adaptation, mitigation and sustainable development in La Réunion (supported by the government of France)
- Emissions scenarios in Washington DC (supported by the US Government)
- Input by industry representatives in Tokyo (supported by the Japanese government) and Cape Town, South Africa (co-sponsored by Eskom), and
- Input from environmental NGOs, intergovernmental organisations, research organisations and members of the International Energy Agency and its technology network in Paris (in cooperation with the IEA).

Throughout the process, the Working Group III Bureau – consisting of Ramón Pichs Madruga (Cuba), R.T.M. Sutamiardja (Indonesia), Hans Larsen (Denmark), (up to May 2005), Olav Hohmeyer (Germany, from June 2005), Eduardo Calvo (Peru), Ziad H. Abu-Ghararah (Saudi Arabia, up to September 2005), and Taha M. Zatari (Saudi Arabia, after September 2005), Ismail A.R. Elgizouli (Sudan) – delivered constructive support and continuous encouragement.

The success of this report is, however, fully based on the expertise and enthusiasm of the author team for which we are grateful. We would also like to express our appreciation of the expert reviewer inputs. Without their comments, the report would not have achieved its current quality level. Our review editors had a similar critical role in supporting the author team in dealing with the comments.

The assessment process was supported by the Technical Support Unit, financed by the government of the Netherlands. The following persons provided support, advice and coordination: Leo Meyer, Peter Bosch, Rutu Dave, Monique Hoogwijk, Thelma van den Brink, Anita Meier, Sander Brinkman, Heleen de Coninck, Bertjan Heij, David de

Jager, John Kessels, Eveline Trines, Manuela Loos (editing support), Martin Middelburg (layout), Rob Puijk (webmaster), Ruth de Wijs (coordination of copyediting), Marilyn Anderson (index) and many more from the secretariats of MNP and ECN in the Netherlands.

Finally, we would like to thank the IPCC secretariat in Geneva in the persons of Renate Christ (Secretary of the IPCC), Jian Liu, Carola Saibante, Rudie Bourgeois, Annie Courtin and Joelle Fernandez for their continuous support throughout the process.

Bert Metz  
Ogunlade Davidson

Co-chairs, IPCC Working Group III

This report is dedicated to

**Gerhard Petschel-Held, Germany**

**Lead Author in Chapter 12**

Gerhard Petschel-Held died unexpectedly on September 9, 2005, at the age of 41 years. He worked at the Potsdam Institute for Climate Impact Research as head of the department Integrated Systems Analysis. He was an excellent scientist and a wonderful person to work with.

Based on his scientific credentials and his capacity to integrate, Gerhard Petschel-Held played a key role in several international research networks. He believed strongly in the communication of scientific knowledge to a wider public, and to improve the world with the help of science.