

# **2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories**

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**Task Force on National Greenhouse Gas Inventories**

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## Foreword

National greenhouse gas inventories are essential tools for countries to transparently report their anthropogenic emissions and removals of greenhouse gases. They provide a fundamental basis for mutual trust and confidence among countries that are needed for effective implementation of international agreements to address climate change. They are also essential tools in developing policies and in monitoring impact. They provide invaluable information for those developing policies related to climate change.

The Parties to the United Nations Framework Convention on Climate Change (UNFCCC) develop, periodically update and publish their national greenhouse gas inventories, using comparable methodologies to be agreed upon by the Conference of the Parties. The “comparable methodologies” agreed on are those produced by the Intergovernmental Panel on Climate Change (IPCC). Further, the Parties to the Paris Agreement decided in December 2018 that each Party shall use the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, and shall use any subsequent version or refinement of the IPCC guidelines agreed upon by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA).

The *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2019 Refinement)* has been produced by the IPCC Task Force on National Greenhouse Gas Inventories (TFI) and adopted/accepted by the IPCC at its 49<sup>th</sup> Session in May 2019. Its overall aim is to provide an updated and sound scientific basis for supporting the preparation and continuous improvement of national greenhouse gas inventories. It provides supplementary methodologies for sources and sinks of greenhouse gases where gaps have been identified, where new technologies and production processes have emerged requiring elaborated methodologies, or for sources and sinks that are not well covered by the *2006 IPCC Guidelines*. It also provides updated default values of emission factors and other parameters based on the latest available science. Wherever possible, it provides additional or alternative up-to-date information and guidance, as clarification or elaboration of existing guidance in the *2006 IPCC Guidelines*.

This report is the result of almost three years of work by over 280 scientists and experts from 47 countries. Its development has depended on the expertise, knowledge and co-operation of the Coordinating Lead Authors, Lead Authors, Review Editors and Contributing Authors. We wish to thank these authors for their commitment, time and efforts in preparing this report throughout all the drafting and reviewing stages of the IPCC process. We also wish to thank the governments and agencies that hosted the Lead Author meetings for this Methodology Report, namely: the Governments of Australia, Italy, Japan, Spain, and Zimbabwe; the Basque country government with the assistance of the Basque Center for Climate Change and the University of the Basque Country; and the Food and Agriculture Organization of the United Nations.

The steering group led by the TFI Co-Chairs Eduardo Calvo Buendia and Kiyoto Tanabe has guided the development of these guidelines, ensuring consistency across all the volumes and continuity with the *2006 IPCC Guidelines*. We would therefore wish to thank them for their considerable efforts in leading and guiding the report preparation, as well as the members of the TFI Bureau for their support. In addition, the TFI Technical Support Unit (TSU) worked extensively with the authors especially in the editing of the various drafts and preparing of the final version, and the IPCC Secretariat provided assistance and support in enabling this project to meet its tight deadlines. We thank them for their excellent work.



Petteri Taalas  
Secretary-General  
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Inger Andersen  
Executive Director  
United Nations Environment Programme

## Preface

The Task Force on National Greenhouse Gas Inventories (TFI) was established by the Intergovernmental Panel on Climate Change (IPCC) at its 14<sup>th</sup> Session (October 1998) to oversee the IPCC National Greenhouse Gas Inventories Programme.

The Bureau of the IPCC TFI (TFB) concluded at its 28<sup>th</sup> meeting in August 2014 that:

- The *2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines)* provide a technically sound methodological basis of national greenhouse gas inventories, and therefore fundamental revision is unnecessary.
- To maintain the scientific validity of the *2006 IPCC Guidelines*, certain refinements may be required, taking into account scientific and other technical advances that have matured sufficiently since 2006.

Following these conclusions by the TFB and approval by the IPCC at its 40<sup>th</sup> Session in October 2014, the TFI started a technical assessment of IPCC Inventory Guidelines through an on-line questionnaire survey and four expert meetings in 2015 and 2016. The technical assessment revealed that there had been abundant new scientific and empirical knowledge published since 2006 that the IPCC should take into account, particularly with respect to data for emission factor development for some categories and gases.

Based on the decision of the IPCC at its 43<sup>rd</sup> Session in April 2016, a Scoping Meeting was held in Minsk, Belarus, in August 2016, to prepare an outline of the Methodology Report to refine the *2006 IPCC Guidelines*.

The conclusions of this Scoping Meeting were submitted to the IPCC for consideration at its 44<sup>th</sup> Session in October 2016. At this session, IPCC decided to prepare a Methodology Report with the following title and format:

- The format should be one single Methodology Report comprising an Overview Chapter and five volumes following the format of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines)*.
- The title of the Methodology Report should be “2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories”.

Its overall aim was to provide an updated and sound scientific basis for supporting the preparation and continuous improvement of national greenhouse gas inventories.

The *2019 Refinement* does not revise the *2006 IPCC Guidelines*, but update, supplement and/or elaborate the *2006 IPCC Guidelines* where gaps or out-of-date science have been identified. It will not replace the *2006 IPCC Guidelines*. It should be used in conjunction with the *2006 IPCC Guidelines*.

This report was produced fully in accordance with the Appendix A to the Principles Governing IPCC Work: Procedures for the Preparation, Review, Acceptance, Adoption, Approval and Publication of IPCC Reports. More than 280 scientists and experts from 47 countries contributed for three years to development of this report. Completion of this report was not possible without the expertise, knowledge and co-operation of the Coordinating Lead Authors, Lead Authors, Review Editors and Contributing Authors as well as the overall guidance provided by the steering group<sup>1</sup>. We wish to thank these authors and experts for their commitment, time and efforts in preparing this report throughout all the drafting and reviewing stages of the IPCC process.

Lead Author meetings were held in 2017 and 2018 in Bilbao (Spain)<sup>2</sup>, Victoria Falls (Zimbabwe)<sup>3</sup>, Cairns (Australia)<sup>4</sup> and Rome (Italy)<sup>5</sup>. In addition, small meetings of authors were held in 2019 in Kyoto (Japan)<sup>6</sup>,

<sup>1</sup> The steering group consisted of TFI Co-Chairs and G. H. Sabin Guendehou, Bundit Limmeechokchai, Riitta Kristiina Pipatti, Yasna Rojas, Rob Sturgiss and Thomas Charles Wirth.

<sup>2</sup> Hosted by the government of Spain and the Basque country government with the assistance of the Basque Center for Climate Change and the University of the Basque Country.

<sup>3</sup> Hosted by the government of Zimbabwe.

<sup>4</sup> Hosted by the government of Australia.

<sup>5</sup> Hosted by the Food and Agriculture Organization of the United Nations and the government of Italy.

<sup>6</sup> Hosted by the government of Japan.

preparatory to the 49<sup>th</sup> Session of the IPCC where this report was adopted/accepted. We would therefore like to thank the host countries and agencies for organizing these meetings. We would also like to thank all governments that supported authors and reviewers, without their contributions, the production of this report might not have been possible.

Three reviews of these guidelines were made in 2017, 2018 and 2019. The first, an expert review, produced close to 5000 comments, the second, a combined governmental and expert review, resulted in over 4000 comments, while the third, government review, brought an additional almost 1600 comments. The efforts of the reviewers and their comments have contributed greatly to the quality of the final report and we wish to thank them accordingly. Furthermore, the Review Editors have ensured the appropriate consideration of all the comments received, so we would also like to thank them for their work.

In addition, the TFI Technical Support Unit (TSU: Head: Andrej Kranjc (until June 2019), Sandro Federici (from July 2019); Senior Programme Officer: Baasansuren Jamsranjav; Programme Officers: Maya Fukuda, Sekai Ngarize, Akira Osako, Yurii Pyrozhenko and Pavel Shermanau; IT Officer: Toru Matsumoto; and Administrative Officers: Koh Mikuni and Eriko Nakamura) has provided guidance and assistance as well as technical and organisational support for the project. They worked extensively with the authors especially in the editing of the various drafts and preparing of the final version, and we wish to congratulate them for their excellent work. We would also like to express our gratitude to the Government of Japan as well as the Institute for Global Environmental Strategies (IGES) for its generous support for the TSU, without which this report might not have been completed.

We would also like to thank the IPCC Secretariat (Jesbin Baidya, Laura Biagioni, Annie Courtin, Oksana Ekzarkho, Judith Ewa, Joelle Fernandez, Jonathan Lynn, Nina Peeva, Sophie Schlingemann, Mxolisi Shongwe and Werani Zabula) for their assistance and support in enabling this project to meet its tight deadlines.

Finally, we would like to thank IPCC Chair Hoesung Lee, IPCC Secretary Abdalah Mokssit, IPCC Deputy Secretary Kerstin Stendahl, and the TFB members: Fahmuddin Agus, Dominique Blain, Fatma Betül Demirok, Darío Gómez, Ghislain Hippolyte Sabin Guendehou, Bundit Limmeechokchai, Riitta Kristiina Pipatti, Yasna Rojas, Batouli Said Abdallah, Rob Sturgiss, Thomas Charles Wirth, and Irina Yesserkepova for their support.

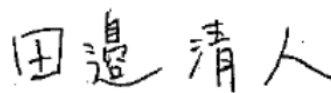


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## Dedication



**James Michael Penman**  
**(5 June 1950 – 8 September 2016)**

The *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories* of the Intergovernmental Panel on Climate Change (IPCC) is dedicated to the memory of James Michael Penman, an outstanding scientist with over thirty years of national and international experience in science, energy and environment.

Dr. Jim Penman was one of the first members of the Task Force Bureau, where he played a key role in the work of the Climate Panel's Task Force on National Greenhouse Gas Inventories. His soft, constructive and reasoned views in Task Force work were highly respected by all the Task Force Bureau members and experts who participated in Task Force activities.

He was the Interim Co-Chair of the Task Force Bureau's first session in 1999, and continued as a Bureau member till 2015. He co-chaired the project that produced the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* published in 2000. He was a member of the steering group that produced the IPCC's *Good Practice Guidance for Land Use, Land-Use Change and Forestry* published in 2003.

Jim was a member of the steering group that produced the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, which Annex I Parties to the UNFCCC use to estimate emission and removals of greenhouse gases in their national inventory submissions.

Jim was also one of the leading members of the group that led the production of the Climate Panel's latest Methodology Reports: the *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands* and the *2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol*.

He was awarded an OBE (Officer of the Most Excellent Order of the British Empire) in 2009 in recognition of his work on establishing the United Kingdom emissions mitigation evidence base, and in international negotiations. He is greatly missed by the scientific community both in the UK and internationally.