

National GHG Inventories: Scope & General Principles and 2006 IPCC Guidelines and relationship to earlier IPCC Guidelines

GHG Training Workshop

Morogoro, Tanzania

Sekai Ngarize

23-27 September 2024

Executed by:



Funded by:



copenhagen
climate centre

Implemented by:



What are national GHG inventories?

- Estimates of all emissions (and removals) of particular gases from given sources from a defined region in a specific period of time
- Here we are dealing with
 - Greenhouse Gases
 - National Estimates
 - Annual Estimates

Why?

- Scientific Understanding
 - Input to models
 - Understand link between environmental pollution and effects to sources of pollution
- Policy
 - Before any pollution problem can be efficiently controlled we need to know the sources and amounts emitted
 - To help develop cost-effective policy
 - To monitor progress towards policy goals
 - To inform the public

Why do we need inventory guidelines?

- Any international agreement to limit climate change must set emission limits/targets/aims and monitor progress in an open and transparent way
- Currently, most national emissions can only be estimated, not measured and so we need a consensus on the best way of doing this.
 - Cannot measure all sources (e.g. road transport would be impractical; Remote sensing techniques now emerging)
- To do this we need reliable, generally accepted methods and guidelines

How?

- Make estimates based on parameters associated with emission rates
 - CO₂ from fuel depends on carbon in fuel
 - CO₂ proportional to amount of fuel burnt
 - Changes on stocks of carbon in forests give emissions (or removals) of CO₂

$$E = EF \cdot AD$$

Where:

E = Emission

EF = Emission Factor

AD = Activity Data

Credibility

- As these are **estimates** we need to ensure they are **credible**
- **Verification**
 - Checking that the numbers are correct – that they reflect the true emissions
- **Validation**
 - Checking that the estimates are compiled correctly in the way they are supposed to be done
 - Needs standard methodologies and inventory management

Good Practice (1)

- Assists countries in producing inventories that are accurate in the sense of being neither over- nor underestimates so far as can be judged, and in which uncertainties are reduced as far as possible
 - Gives a way to manage uncertainties
 - Identifies main “KEY” categories to focus resources
 - Documentation provides transparency

Good Practice (2)

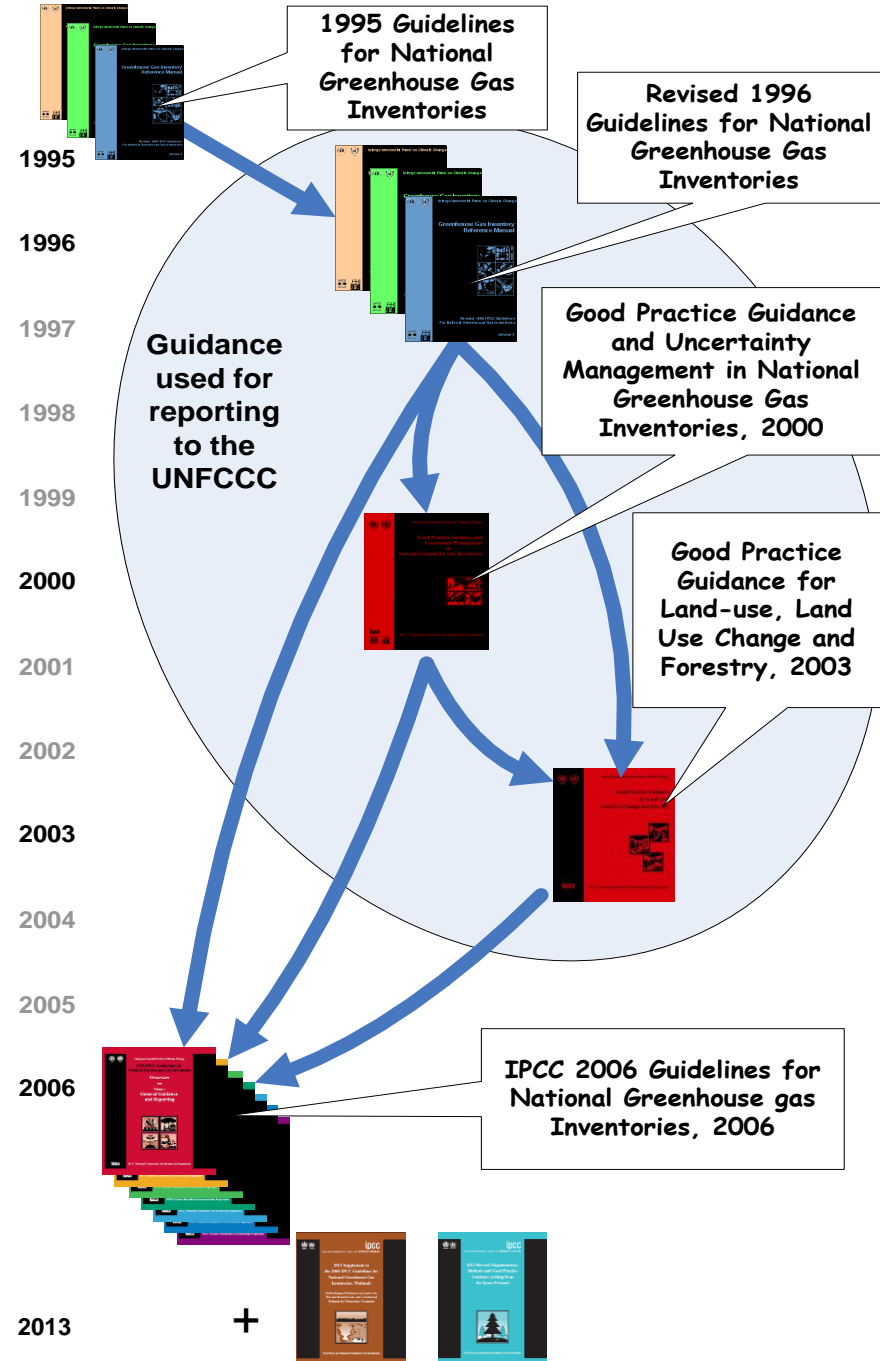
- IPCC Good Practice gives guidance on
 - Approaches to Data Collection
 - Uncertainty Evaluations
 - Key Category Analysis and Methodological Choice
 - Recalculations
 - Quality Control and Quality Assurance
 - Review
 - Documentation

Good Practice (3)

- Supports the development of inventories that are:
 - Transparent
 - Documented
 - Consistent over time
 - Complete
 - Comparable
 - Assessed for uncertainties
 - Subject to quality control and assurance
 - Efficient in the use of resources available to inventory agencies
 - In which uncertainties are gradually reduced as better information becomes available

Evolution

- Guidelines have evolved from 1996 to 2006
- Development of Good Practice Guidance (GPG) was a major step forward
 - Complete, consistent, comparable, transparent, and accurate inventories taking account of available resources
 - Major change was from 1996 LUCF to GPG LULUCF
- 2006 Guidelines [2.5 years work, 250 authors]
 - Have 4 sectors
 - Have improved methods and default data
 - Cover more greenhouse gases and methods
 - Integrate GPG
 - Require similar resources
 - Do not pre-empt accounting choices
 - The best globally applicable methods





+

IPCC Inventory Guidelines

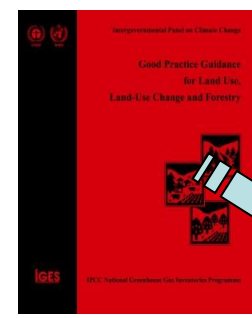
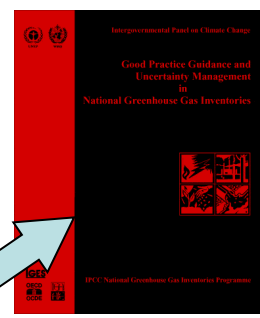
Non-Annex I Parties should use 1996 Guidelines. (Annex to Decision 17/CP.8)

Non-Annex I Parties are encouraged to use GPGs.

Annex I Parties must use from 2015
2006 IPCC Guidelines

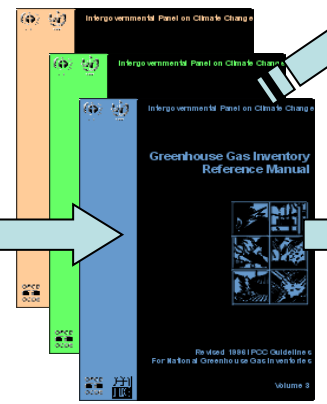
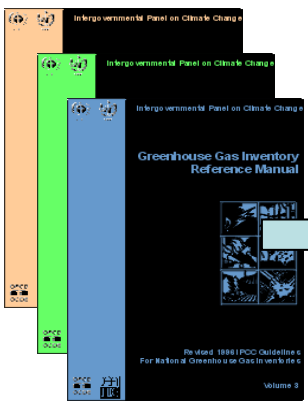
GPG2000 (non-LULUCF)

GPG2003 (LULUCF)



1995 IPCC Guidelines

Revised 1996 IPCC Guidelines



Actually, 2006 Guidelines are being used by more and more Non-Annex I Parties.

Revision/Update by the IPCC

Methodological approaches unchanged

➤ In General:

➤ Energy

- Based on carbon content of fuel
- Fugitive (leaks) use emission factors

➤ Industrial Processes

- Based on chemistry of process
- Some use mass balance of product used

➤ Land Use

- Stock changes \Rightarrow Emissions/Removals
 1. Inputs (e.g. growth) - outputs (e.g. decay, harvest)
 2. Total Stock at end minus Total stock at beginning

➤ Agriculture

- Based on understanding of processes

➤ Waste

- Tracks carbon (fossil & biogenic) in waste

GPG and Sectoral Guidance



- Good Practice inventories are defined as *“those that contain neither over- nor under-estimates so far as can be judged, and in which uncertainties are reduced as far as is practical”*
- GPG retains consistency with Revised 1996 Guidelines and is updated and expanded in the 2006 Guidelines
 - Approaches to Data Collection

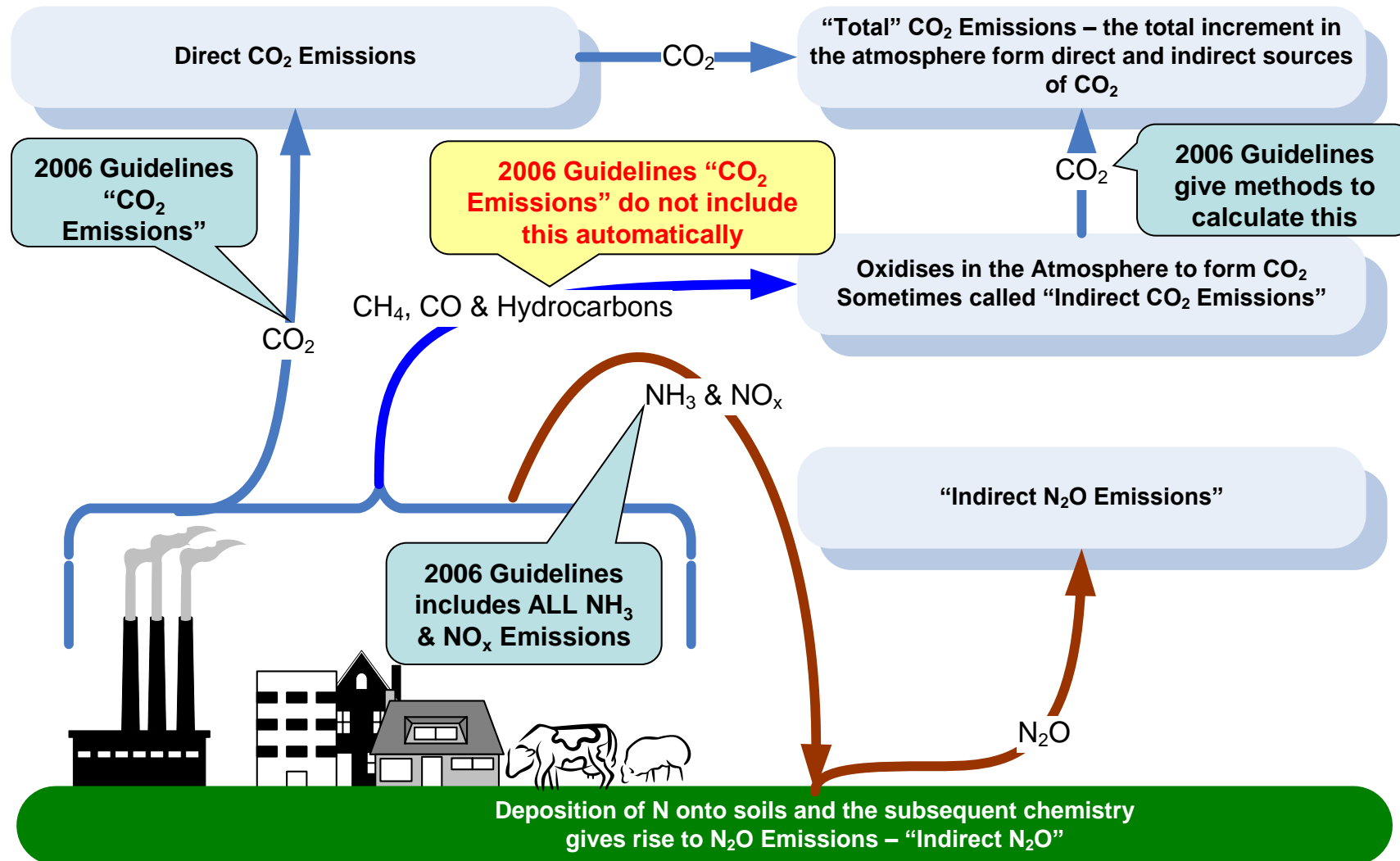
“New” gases in 2006 Guidelines

– Sources Identified in 2006 Guidelines

By-product & fugitive emissions

	Electronics Industries	Magnesium production	Halogenated Compounds Production	GWP in TAR	GWP in AR4
nitrogen trifluoride (NF ₃)	✓		✓	✓	✓
trifluoromethyl sulphur pentafluoride (SF ₅ CF ₃)			✓	✓	✓
halogenated ethers (e.g. C ₄ F ₉ OC ₂ H ₅ , CHF ₂ OCF ₂ OC ₂ F ₄ OCHF ₂ , CHF ₂ OCF ₂ OCHF ₂)	✓		✓	✓	✓
CF ₃ I, CH ₂ Br ₂ , CHCl ₃			✓	✓	✓
CH ₂ Cl ₂ , CH ₃ Cl			✓	✓	✓
C ₃ F ₇ C(O)C ₂ F ₅		✓	✓		
C ₄ F ₆ , C ₅ F ₈ , c-C ₄ F ₈ O	✓		✓		

Direct & Indirect Emissions: CO₂ and N₂O



Estimation of Actual Annual Emissions

- In the 1996 Guidelines and Good Practice Guidance for a few sources, the simplest methodology estimates a “potential emission” rather than the actual annual emission.
 - *This “potential emission” assumes all the emissions from an activity occur in the current year, ignoring the fact they will occur over many years (e.g. methane emissions from waste in landfills occurs over decades as the decay processes take place).*
- In the 2006 Guidelines, simple default methods estimate emissions when they occur, thus removing the need for potential emissions.
- The removal of potential emission estimates also allows the emission reductions of abatement techniques to be properly estimated and ensures that the Tier 1 methods are compatible with higher tier methods. The areas where this occurred are:
 - *Actual emissions of fluorinated compounds*
 - *Methane from landfills*

“New” Guidance in 2006 Guidelines

Fuel Combustion

- CO₂ -Transport and Storage
- Urea-based Catalysts (Road Transport)

Fugitive Emissions from Fuels

- Abandoned Underground Mines

Mineral Industry

- Glass Production
- Ceramics
- Non Metallurgical Magnesia Production

Chemical Industry

- Caprolactam, Glyoxal & Glyoxylic Acid
- Titanium Dioxide Production
- Petrochemical and Carbon Black Production

Metal Industry

- Lead Production
- Zinc Production

Electronics Industries

- Integrated Circuit or Semiconductor
- TFT Flat Panel Display
- Photovoltaics
- Heat Transfer Fluid

Other Product Manufacture and Use

- Electrical Equipment
- Military Applications
- Accelerators
- Medical Applications
- Propellant for Pressure and Aerosol Products

Substitutes for Ozone Depleting Substances

Land Use

- Complete, consistent treatment of fires
- Liming
- Settlements remaining Settlements
- Some wetlands categories
- Urea Application
- Indirect N₂O Emissions from Manure
- Harvested Wood Products

Waste

- Open Burning of Waste
- Biological Treatment of Solid Waste

Other

- Indirect N₂O Emissions from the Atmospheric Deposition of N (excluding agriculture)

New Methodology Reports

- The TFI has developed two additional methodology reports in response to the invitations from UNFCCC:
 - 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands (***Wetlands Supplement***)
 - To fill gaps in the coverage of wetlands and organic soils in the 2006 IPCC Guidelines
 - 2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol (***KP Supplement***)
 - To update and augment the existing Chapter 4 of the GPG- LULUCF
- The ***Wetlands Supplement*** and ***KP Supplement*** were adopted/accepted by the IPCC Plenary at its 37th Session (IPCC 37) in Batumi, Georgia, 14-18 October 2013, and published on the TFI website in February 2014.
- ***Wetlands Supplement***

<http://www.ipcc-nggip.iges.or.jp/public/wetlands/index.html>

- ***KP Supplement***

<http://www.ipcc-nggip.iges.or.jp/public/kpsg/index.html>

2019 Refinement to the 2006 IPCC Guidelines (1)

➤ TFB at its 26th Meeting in Ottawa (28-29 August 2014) concluded that:

- 2006 IPCC Guidelines provide a technically sound methodological basis of national greenhouse gas inventories; however,
- to maintain their scientific validity, certain refinements may be required, taking into account scientific and other technical advances that have matured sufficiently since 2006.

2019 Refinement to the 2006 IPCC Guidelines (3)

➤ **Completed in May 2019.**

➤ **Aim:**

- to provide an updated and sound scientific basis for supporting the preparation and continuous improvement of national GHG inventories;
- not to 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.

➤ **Format and Structure:**

- Same as the 2006 IPCC Guidelines (= Overview Chapter and 5 Volumes) so as to make it easier for inventory compilers to use the 2019 Refinement in conjunction with the 2006 IPCC Guidelines.

The 2019 Refinement will not replace the 2006 IPCC Guidelines. It should be used in conjunction with the 2006 IPCC Guidelines.

Various Tools – Supporting Materials

- **Emission Factor Database (EFDB)**

<http://www.ipcc-nggip.iges.or.jp/EFDB/>

- **IPCC Inventory Software**

<http://www.ipcc-nggip.iges.or.jp/software/index.html>

- **Primer for 2006 IPCC Guidelines**

<http://www.ipcc-nggip.iges.or.jp/support/support.html>

- **Reports of Expert Meetings**

<http://www.ipcc-nggip.iges.or.jp/meeting/meeting.html>

Various Tools – FAQ Website

- Answers to frequently asked questions (FAQs) such as:
 - Q1-3-2: “What is the difference between accuracy and precision? Does uncertainty assessment relate to both?”
 - Q2-10: “According to the IPCC Guidelines CO₂ Emissions from the combustion of biomass are reported as zero in the Energy sector. Do the IPCC Guidelines consider biomass used for energy to be carbon neutral?”
- ❖ Continuously updated
 - For example, a new set of Q&As on the use of 2006 Guidelines in other areas has been recently added following a relevant expert meeting.

<http://www.ipcc-nggip.iges.or.jp/faq/faq.html>

Methodologies for Estimating GHG Inventories and Enhanced Transparency Framework- ETF

- In the context of the ETF inventories submitted by Parties as part of their BTRs must meet the requirements established by the MPGs.
- According to the UNFCCC reporting guidelines and the MPGs, the methods to estimate GHG emissions and removals shall be those of the 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for national GHG inventories, but Parties may use the IPCC 2019 Refinement to the 2006 IPCC Guidelines on a voluntary basis (Decision 5/CMA.3).
- The 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines) provide methodologies for estimating national inventories of anthropogenic emissions by sources and removals by sinks of greenhouse gases.



There are **five volumes** of the 2006 guidelines:

- 1 General Guidance and Reporting
- 2 Energy
- 3 Industrial Processes and Product Use
- 4 Agriculture, Forestry and Other Land Use
- 5 Waste

Summary

- ✓ Emission inventories have several uses.
 - They help understand problems and are a key to policy development as well as reporting and monitoring progress towards targets.
- ✓ They are estimates and cannot be completely measured.
- ✓ Inventory management and “good practice” is as important as the emission estimation itself.
- ✓ The same basic methodological approaches are used from 1996 Guidelines, through GPG 2000 & GPG LULUCF to 2006 Guidelines.
- ✓ The 2006 Guidelines maintain, with improvements, the methods of earlier guidelines and integrate GPG.
- ✓ The 2006 Guidelines provide improved guidance in some areas, more and improved default data.
 - Wider coverage of gases
 - Additional sources covered
 - All estimates are now of actual annual emissions (“potential” emissions not needed)
 - Categories simplified and clarified in some areas
- ✓ The 2006 Guidelines do not pre-empt accounting choices
 - all the information needed is retained.
- ✓ The ETF and use of the IPCC 2006 Guidelines

Thank you!

sngarize47@gmail.com