



**INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE**  
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# Issues relating to GHG, Sectors and Source Categories in IPCC Inventory Guidelines

**AWG5 - Kyoto Protocol**

**Bangkok, April 2008**



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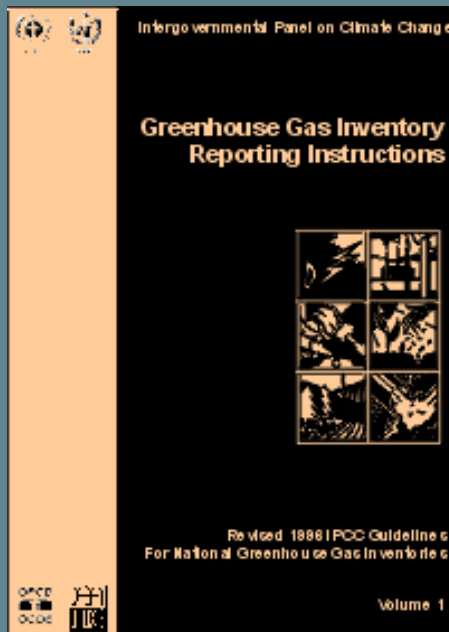
# *National Inventories of GHG*

- IPCC evolutionary approach for national inventories of GHGs
  - ✓ 1995 IPCC Guidelines for National Greenhouse Gas Inventories
  - ✓ Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories
  - ✓ Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (2000)
  - ✓ Good Practice Guidance for LULUCF (2003)
  - ✓ 2006 IPCC Guidelines (2006)

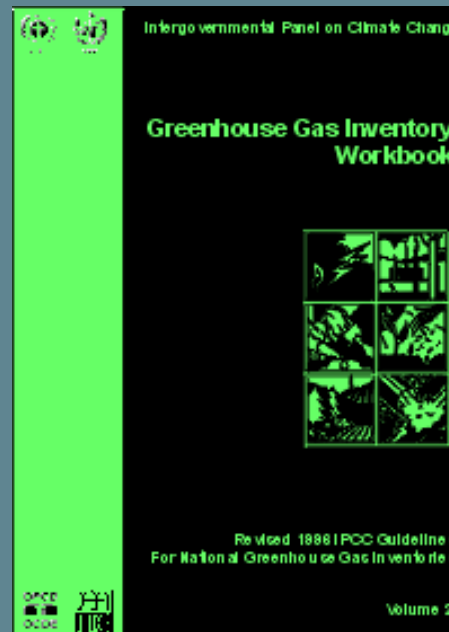
# “1995” and “Revised 1996” IPCC Guidelines for National Greenhouse Gas Inventories

<http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>

(cf. COP Decisions 4/CP.1, 9/CP.2, 10/CP.2, 2/CP.3 & 17/CP.8)

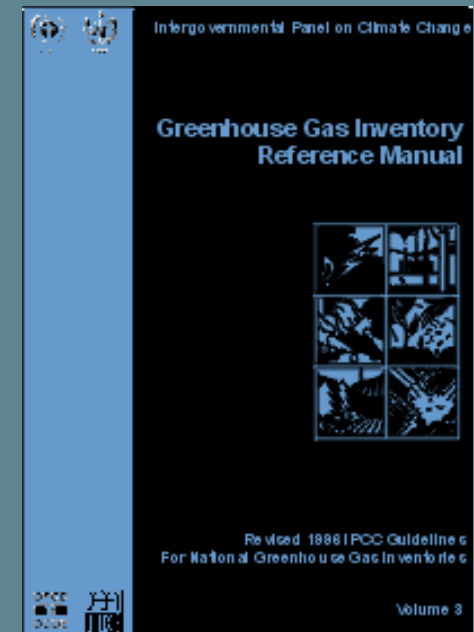


Volume 1  
Reporting  
Instructions



Volume 2  
Workbook  
+

IPCC Software



Volume 3  
Reference  
Manual



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# Revised 1996 IPCC Guidelines

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- Provide methodologies, default data and instructions for estimating emissions of all six GHG + ozone and aerosol precursors for the following sectors:
    - ✓ Energy
    - ✓ Industrial Processes
    - ✓ Solvent and Other Product Use
    - ✓ Agriculture
    - ✓ LUCF
    - ✓ Waste
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# IPPC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories

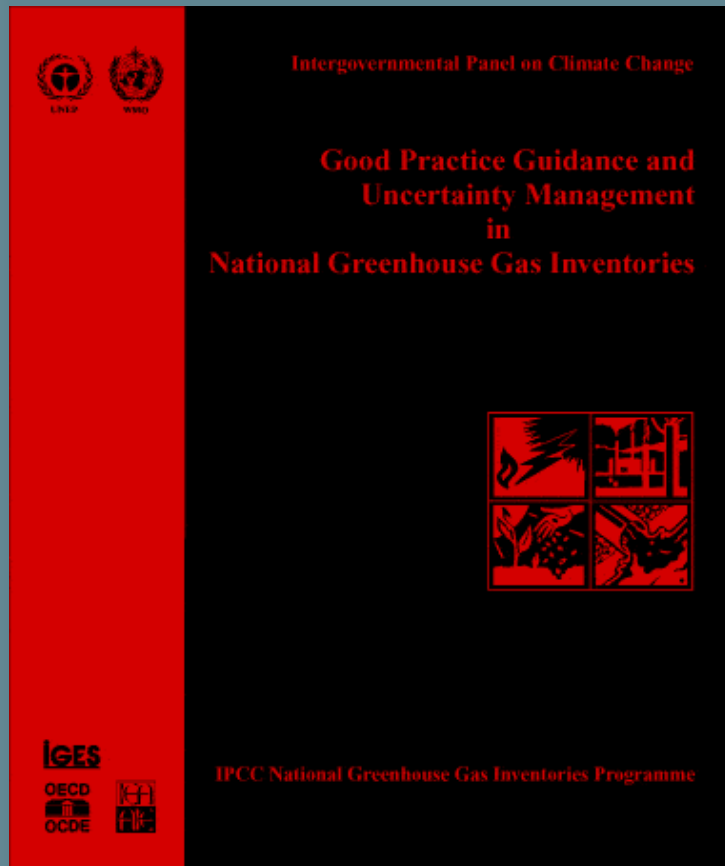
<http://www.ipcc-nggip.iges.or.jp/public/gp/english/> (All UN language versions)

**Complements the Revised 1996 IPCC Guidelines - Published in 2000**

Endorsed by SBSTA12 (June 2000)

**Other decisions include:** Dec.20/CMP.1

**For Non-Annex-I Parties:** Dec.17/CP.8 encourages its use.



Background Papers: IPCC Expert Meeting on Good Practice Guidance and Uncertainty Management in National GHG Inventories

Published in late 2002

<http://www.ipcc-nggip.iges.or.jp/public/gp/gpg-bgp.htm>



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## *IPCC GPG and Uncertainty Management*

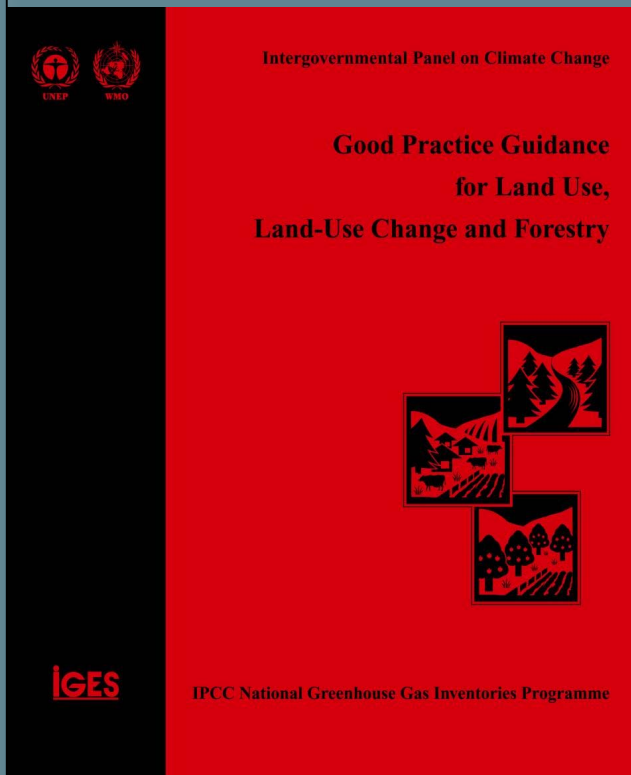
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- Consistent with the 1996 IPCC Guidelines
    - ✓ Covers all six GHGs
    - ✓ Sectors: Energy, Industrial Processes, Agriculture and Waste
    - ✓ Use of GWP is limited to
      - reporting results of the analysis of uncertainty
      - key category analysis
-

# IPCC Good Practice Guidance for Land use, Land-Use Change and Forestry

<http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>

- Actions by SBSTA at 19<sup>th</sup>, 20<sup>th</sup>, 21<sup>st</sup> sessions and  
[Dec. 13/CP.9](#) , [Dec. 15/CP.10](#), [Dec.17/CMP.1](#)



- Complements the Revised 1996 IPCC Guidelines for LULUCF sector.

- GPG-LULUCF* provides supplementary methods and good practice guidance for estimating, measuring, monitoring and reporting on carbon stock changes and greenhouse gas emissions from LULUCF activities under Article 3, paragraphs 3 and 4, and Articles 6 and 12 of the Kyoto Protocol.



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# GPG for LULUCF

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- Land use representation
    - ✓ Forest land
    - ✓ Cropland
    - ✓ Grassland
    - ✓ Wetlands
    - ✓ Settlements
    - ✓ Other land
  - **Reporting categories in GPG can be traced back (mapped) to those of the Revised 1996 IPCC Guidelines**
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# GPG for LULUCF

## ➤ Greenhouse Gases

### ✓ CO<sub>2</sub>

- Living biomass, dead organic matter and carbon organic soil

### ✓ CH<sub>4</sub>

- Fire sub-category

### ✓ N<sub>2</sub>O

- Fire, soil organic matter mineralization, nitrogen inputs, cultivation of organic soils sub-categories

- ## ➤ Includes managed wetland (peatland and flooded lands), settlement remaining settlement, belowground biomass, drainage and rewetting of forest soils and natural disturbances (fires, storms, insects on managed land).



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## *GPG for LULUCF*

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- Provides guidance for estimation of human-induced activities agreed under Article 3.3 (deforestation, afforestation, reforestation) and Article 3.4 (forest management, cropland management, grassland management, revegetation) of the Kyoto Protocol.
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## GPG for LULUCF

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- Provides supplementary methods and *good practice* guidance specifically linked to (LULUCF) activities in the Kyoto Protocol
  - Provides *good practice* guidance for LULUCF projects hosted by Parties listed in Annex B (Article 6 projects) and afforestation / reforestation projects hosted by Parties not listed in Annex B of the Kyoto Protocol (Article 12, Clean Development Mechanism or CDM projects)
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## *Issues included in GPG LULUCF*

- **FACTORING OUT INDIRECT, NATURAL AND PRE-1990**
- For the purpose of accounting under the Kyoto Protocol for the first commitment period, “factoring out” has been addressed through the cap for carbon credits for forest management under Articles 3.4 and 6.
  - ✓ *“The “factoring out” issue is currently under consideration by the IPCC ... (2003)”*



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# Issues included

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## ➤ DISTURBANCES

- ✓ Include fire, windthrow, insects, droughts, flooding, ice storms, etc. Although disturbances

## ➤ INTERANNUAL VARIABILITY

- ✓ It is *good practice* to document whether the methods selected for the estimation of carbon stock changes and non-CO<sub>2</sub> greenhouse gas emissions are sensitive to interannual variability of environmental conditions during the commitment period, and to report how interannual variation was addressed in the inventory calculations.
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# 2006 IPCC Guidelines

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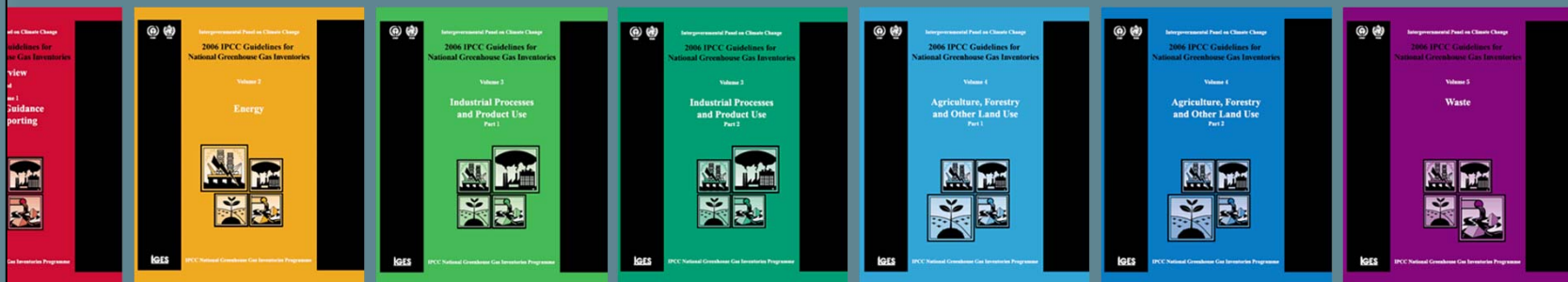
## ➤ FCCC/SBSTA/2002/13

- ✓ Invites the IPCC to revise the Revised 1996 IPCC Guidelines, taking into account the relevant work under the Convention and the KP
    - Built upon the 1996 GLs, GPGs, inventory expert's experience
    - Evolutionary approach wherever scientific and technical knowledge had improved
-

## 2006 IPCC Guidelines

2,000 pages. Adopted by IPCC 25 (Mauritius, April 2006)

- ✓ Revision of the Revised 1996GLs was completed in April 2006. <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm>
- ✓ SBSTA 30 (June 2009) to consider its implementation.





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# Volume Structure

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





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# 2006 IPCC Guidelines

- Estimation methods and complete coverage of all direct GHGs for which GWP values are available in the IPCC TAR
  - ✓ CO<sub>2</sub> ; CH<sub>4</sub> ; N<sub>2</sub>O
  - ✓ HFCs (HFC-23, HFC134a, HFC152a)
  - ✓ PFCs (CF<sub>4</sub>, C<sub>2</sub>F<sub>6</sub>, C<sub>3</sub>F<sub>8</sub>, C<sub>4</sub>F<sub>10</sub>, C<sub>5</sub>F<sub>12</sub>)
  - ✓ SF<sub>6</sub>
- nitrogen trifluoride (NF<sub>3</sub>)
- trifluoromethyl sulphur pentafluoride (SF<sub>5</sub>CF<sub>3</sub>)
- halogenated ethers (e.g. C<sub>4</sub>F<sub>9</sub>OC<sub>2</sub>H<sub>5</sub>, CHF<sub>2</sub>OCF<sub>2</sub>OC<sub>2</sub>F<sub>4</sub>OCHF<sub>2</sub>, CHF<sub>2</sub>OCF<sub>2</sub>OCHF<sub>2</sub> )
- other halocarbons not covered by the Montreal Protocol (e.g. CF<sub>3</sub>I, CH<sub>2</sub>Br<sub>2</sub>, CHCl<sub>3</sub>, CH<sub>3</sub>Cl, CH<sub>2</sub>Cl<sub>2</sub>).



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# 2006 IPCC Guidelines

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- Estimation methods for some direct GHG for which GWP values were not available from the IPCC at the time of the writing
    - ✓ Countries unable to incorporate these gases in key category analysis or to include them in national total GWP weighted emissions
    - ✓ Provide estimates in mass units using methods in the GLs
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# 2006 Guidelines

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## ✓ Energy

- Overview of the CCS system
    - provides emission estimation methods for CO<sub>2</sub> capture, CO<sub>2</sub> transport, CO<sub>2</sub> injection and underground CO<sub>2</sub> storage.
  - Methane from abandoned coal mines
  - Uncontrolled combustion of coal added
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# 2006 Guidelines

- ✓ Industrial Processes and Product Use
  - Additional methods for new categories and new gases
    - Production of lead, zinc, titanium dioxide, petrochemicals, and liquid crystal display manufacturing
    - New gases in the IPCC TAR
      - »  $\text{NF}_3$ ,  $\text{SF}_5\text{CF}_3$ , and halogenated ethers
  - Non-energy uses of fossil fuels
    - Reported under the Industrial Processes and Product Use (IPPU)



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# Additional Notes on IPPU Sources

- A wide variety of industries and products
  - ✓ Electronics industry
    - semiconductor manufacturing, TFT flat panel display manufacturing, etc.
  - ✓ Product uses as ODS substitutes
    - refrigeration and air conditioning, foam blowing agents, fire protection, etc.
  - ✓ Other product manufacture and use
    - electrical equipment, medical applications, propellant for pressure and aerosol products, etc.
- New sources (new industries, new products) may emerge in the future.



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# 2006 Guidelines

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- ✓ Agriculture, Forestry and Other Land Use (AFOLU)
    - Integration between agriculture and land use, land-use change and forestry
    - Managed land as a proxy to anthropogenic emissions by sources and removals by sinks
    - CO<sub>2</sub> emissions and removals associated with terrestrial carbon stocks in settlements
    - Harvested wood products (HWP)
    - Emissions from managed wetlands
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# AFOLU

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- Description of alternative methods to estimate and report C stock changes associated with harvested wood products
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# 2006 Guidelines

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## ✓ Waste

- Methodology for landfills improved. The previous method (potential emissions from waste deposited in that year) is replaced by a first order decay that estimates emission in that year.
  - Carbon accumulation in landfills is estimated and can be used with the HWP estimations in the AFOLU sector.
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# 2006 Guidelines

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- ✓ Relevant to all sectors
    - CO<sub>2</sub> resulting from emission of other gases
    - Consistent treatment of nitrogen (N) deposition
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# Coverage

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The same principles as IPCC 96 Guidelines, plus notably:

- Methods for all GHGs with available GWP values
  - Methods for additional gases that could be used as substitutes for which GPGs not yet available
  - Methods for possibly significant sources which were not contained in earlier GLs or GPGs,
  - Clarified carbon dioxide capture and storage
-



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## However, basic approaches unchanged

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- Basic approaches unchanged from 1996, GPGs (2000 1nd 2003) to 2006 GLs
  - Methodological improvements due to improved scientific and technical knowledge
  - New and improved default values
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# Guidelines have evolved

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- Main sectors reduced from 6 to 4
  - Good Practice Guidance has evolved and became central
  - Land use and Agriculture sectors have been merged into AFOLU
  - Methods for more gases and sources contained
-



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# Global Warming Potential - GWP

- **AR4 – Working Group I**
  - ✓ **GWP or other emission metrics provide a tool that can be used to implement comprehensive and cost-effective policies in a decentralised manner so that multi-gas emitters can compose mitigation measures, according to a specified emission constraint.**
- **Adequacy of GWP concept has been widely debated since its introduction**
- **Remains as the recommended metric to compare future climate impacts of emissions of long-lived climate gases**
- **Serious limitations to the use of global mean GWPs to assess the possible climate impacts of short lived species and compare those with the impacts of the long-lived climate gases**



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# ADDITIONAL SLIDES

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# AFOLU

- CO<sub>2</sub> emissions and removals resulting from C stock changes in biomass, dead organic matter and mineral
- soils, for all managed lands;
- • CO<sub>2</sub> and non-CO<sub>2</sub> emissions from fire on all managed land;
- • N<sub>2</sub>O emissions from all managed soils;
- • CO<sub>2</sub> emissions associated with liming and urea application to managed soils;
- • CH<sub>4</sub> emissions from rice cultivation;
- • CO<sub>2</sub> and N<sub>2</sub>O emissions from cultivated organic soils;
- • CO<sub>2</sub> and N<sub>2</sub>O emissions from managed wetlands (with a basis for methodological development for CH<sub>4</sub> emissions from flooded land in an Appendix 3);
- • CH<sub>4</sub> emission from livestock (enteric fermentation);
- • CH<sub>4</sub> and N<sub>2</sub>O emissions from manure management systems; and
- • C stock change associated with harvested wood products.



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# HWP

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- Several different approaches for reporting the storage of carbon in wood products and its subsequent release as CO<sub>2</sub>
  - No preference to any approach and no attempt prejudice whether these, or any other approach, should be used to account for this storage and emission.
  - Alternative approaches differ in how they allocate the *HWP Contribution* between wood producing and consuming countries, and what processes (atmospheric fluxes or stock changes) they focus on.
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# HWP

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- Stock-Change approach
  - Atmospheric Flow approach
  - Production Approach.
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# HWP

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- The time carbon is held in products varies depending on the product and its uses.
    - ✓ fuelwood and mill residue may be burned in the year of harvest
    - ✓ many types of paper are likely to have a use life in uses less than 5 years which may include recycling of paper
    - ✓ sawnwood or panels used in buildings may be held for decades to over 100 years
    - ✓ discarded HWP can be deposited in solid waste disposal sites (SWDS) where they may persist for long periods of time.
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# HWP

- IPCC 1996 GLs default assumption was that inputs to the HWP reservoir equals outputs. Since the only significant output is oxidation, this means that the amount of oxidation equals the harvest, where the oxidation includes oxidation of some of the wood harvested in the current year and oxidation of some of the HWP placed in use in prior years.
- Given that inputs do not in general equal outputs and that carbon can remain stored in HWP for extended periods of time, this storage time needs to be taken into account when providing guidelines for estimating the contribution of HWP to AFOLU CO<sub>2</sub> emissions/ removals.



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# HWP Variables

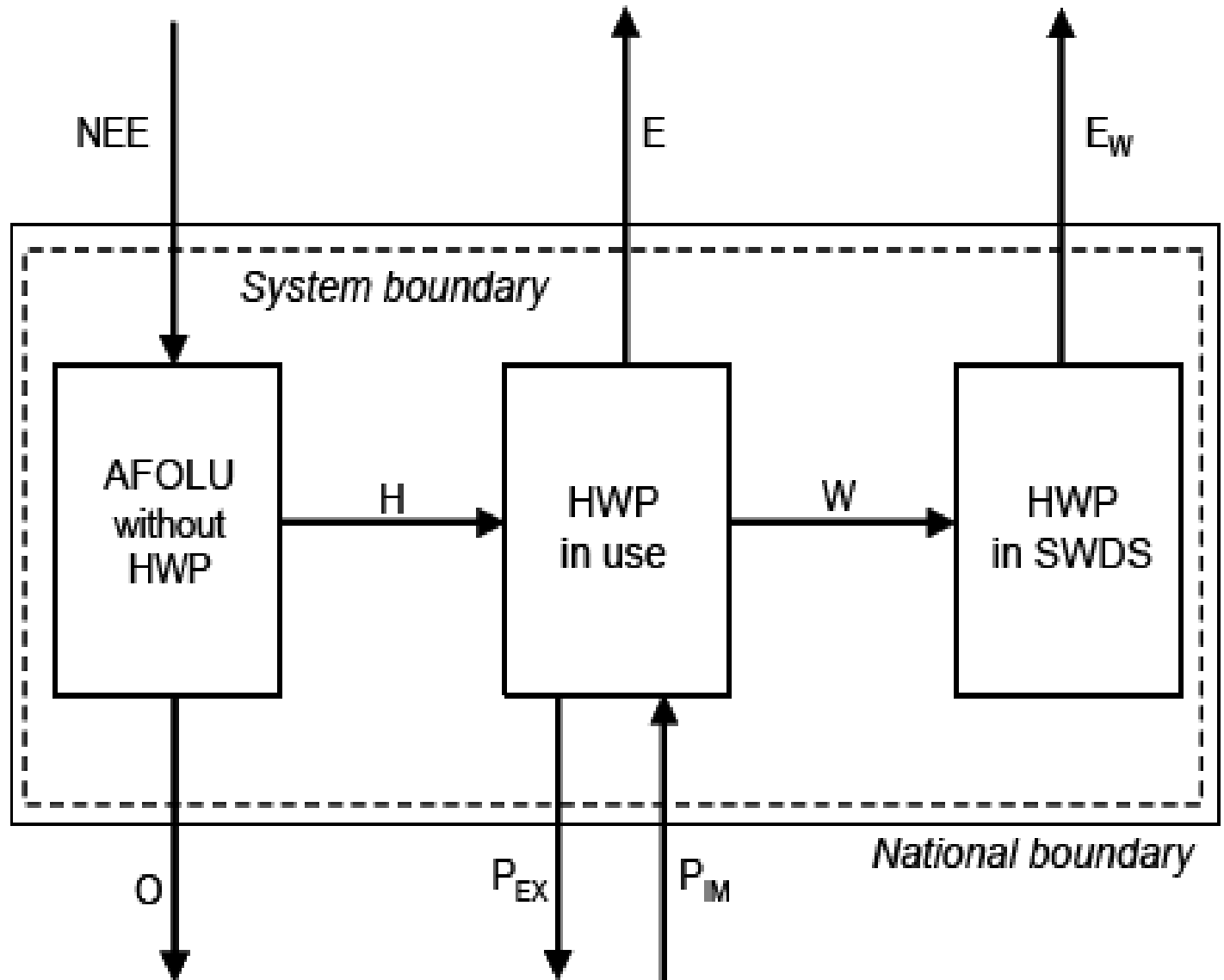
- Annual change in carbon stock in HWP in the reporting country, including HWP stocks from both domestic harvest and imports (Gg of carbon per year)
- 2. Annual change in carbon stock in HWP made from wood harvested in the reporting country including annual change in carbon stock in HWP exported to other countries (Gg of carbon per year)
- 3. Annual imports of all types of wood and paper material to the reporting country (Gg of carbon per year)
- 4. Annual exports of all types of wood and paper material from the reporting country (Gg of carbon per year)
- 5. Annual harvest for wood products in the reporting country (Gg of carbon per year).



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# STOCK-CHANGE APPROACH

## ATMOSPHERE



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# ATMOSPHERIC FLOW APPROACH

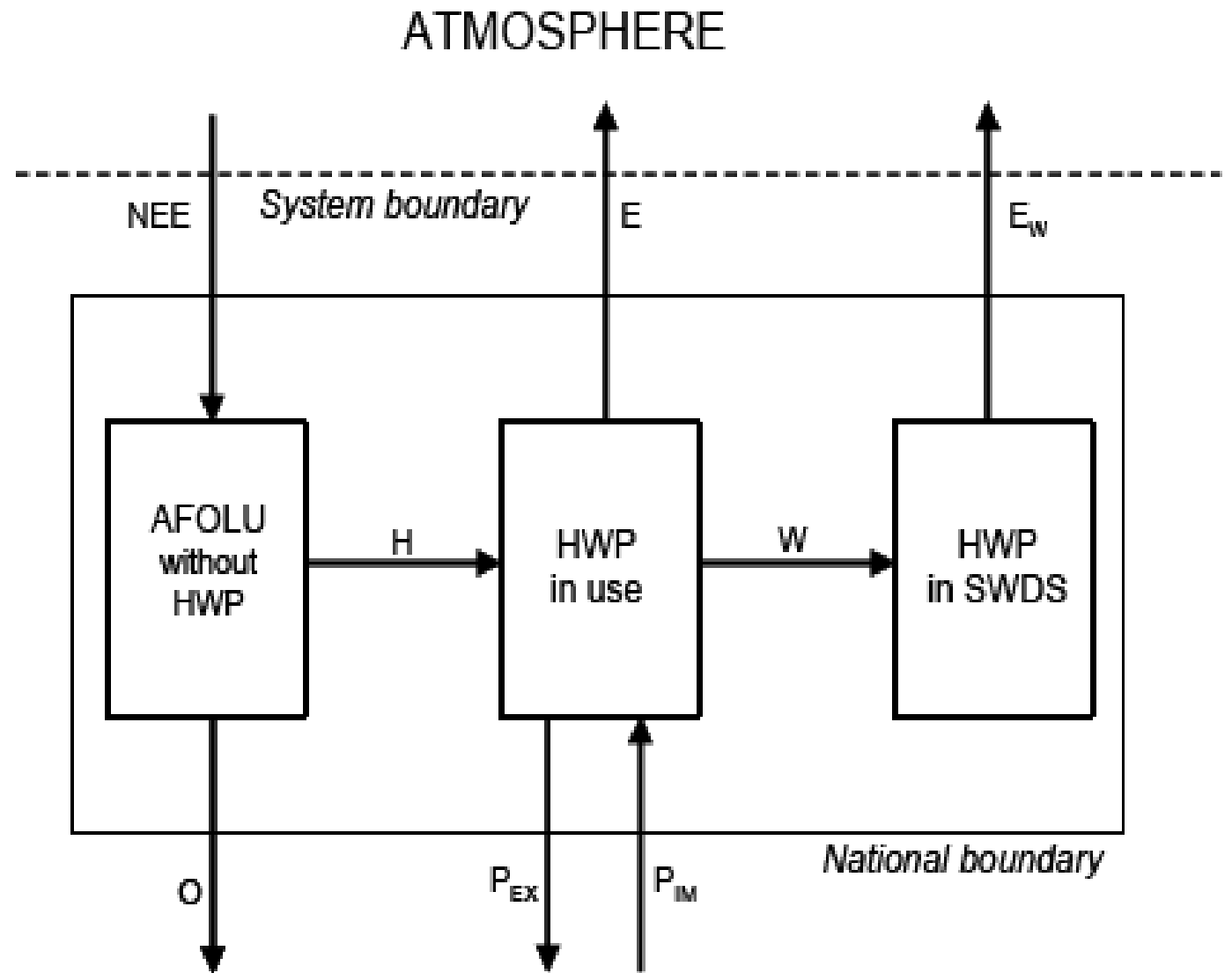


Figure 12.A.2 System boundary of the Atmospheric Flow Approach.

## PRODUCTION APPROACH

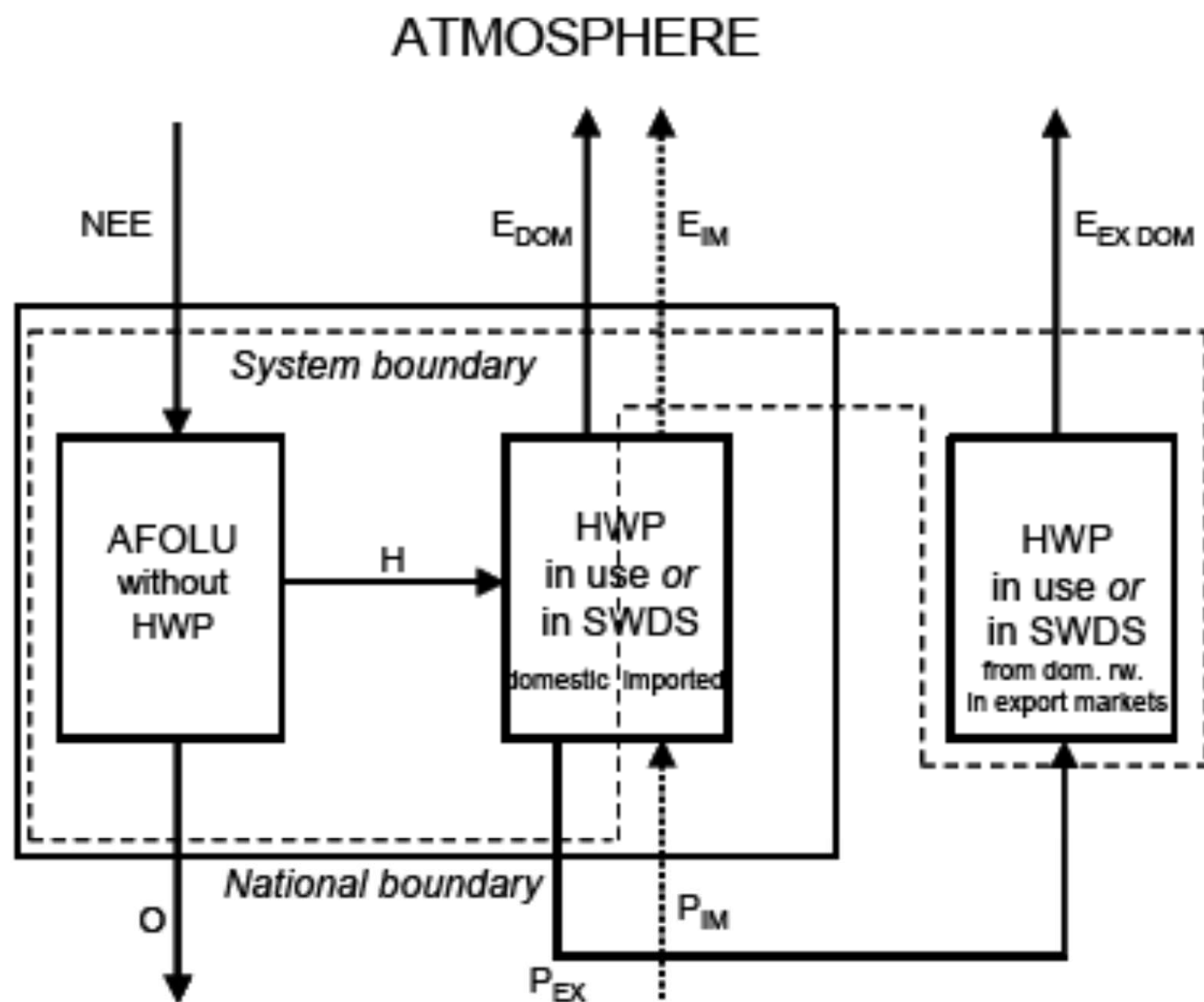


Figure 12.A.3 System boundary of the Production Approach.