National Inventory Report preparation and MPGs reporting requirements

Paulo CORNEJO
CBIT-GSP Regional Coordinator for Spanish-speaking LAC
UNEP Copenhagen Climate Centre
paulo.cornejoguajardo@un.org

Reporting on the Paris Agreement

- The Paris Agreement establishes the ETF designed to build confidence that all countries are doing their part in this global effort.

- The rules for implementing the ETF are set out in the modalities, procedures and guidelines (MPGs) (CMA1, 2018) and in the guidance for operationalizing the MPGs (CMA3, 2021).

- The MPGs are based on a set of guiding principles and define the information to be submitted, temporary arrangements, technical experts review (TER) and the facilitative, multilateral consideration of progress process.

- The core element of ETF reporting are the Biennial Transparency Reports (BTRs), which replace the Biennial Update Reports (BURs) and are due to be submitted every two years starting in 2024.

Chapters of the MPGs

Chapter VIII
Facilitative, multilateral consideration of progress

Chapter VII
Technical expert review

Chapter VI
Information on financial, technology development and transfer and capacity-building support needed and received under Articles 9–11 of the Paris Agreement

Chapter 1
Introduction

Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement

(decision 18/CMA.1 and its annex)
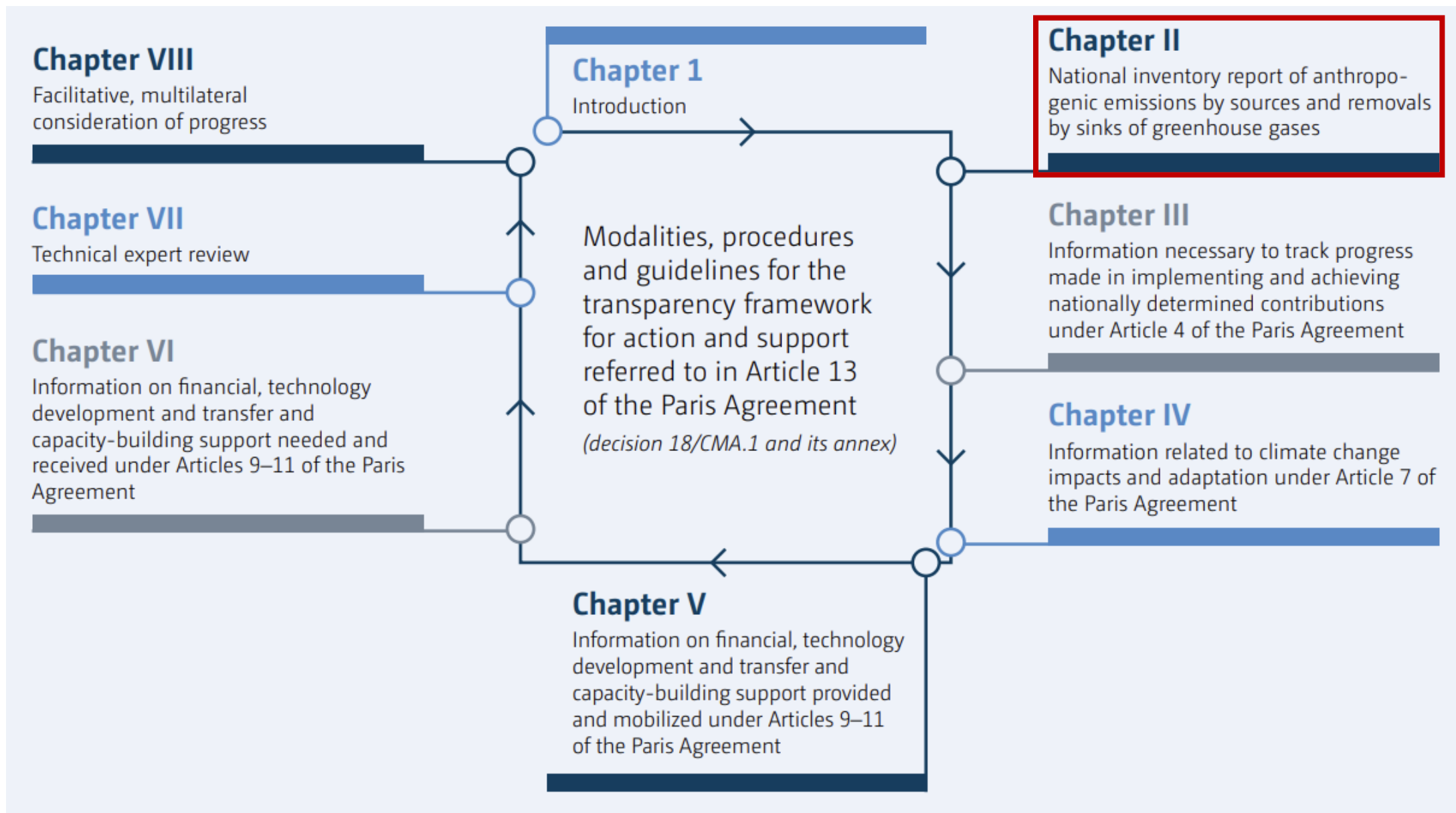
Chapter II
National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases

Chapter III
Information necessary to track progress made in implementing and achieving nationally determined contributions under Article 4 of the Paris Agreement

Chapter IV
Information related to climate change impacts and adaptation under Article 7 of the Paris Agreement

Chapter V
Information on financial, technology development and transfer and capacity-building support provided and mobilized under Articles 9–11 of the Paris Agreement

# National GHG Inventories

- National GHG Inventories (NGI) consist of an exhaustive account of each anthropogenic GHG released or absorbed in the atmosphere in a specific geographical area and period, generally corresponding to a calendar year.
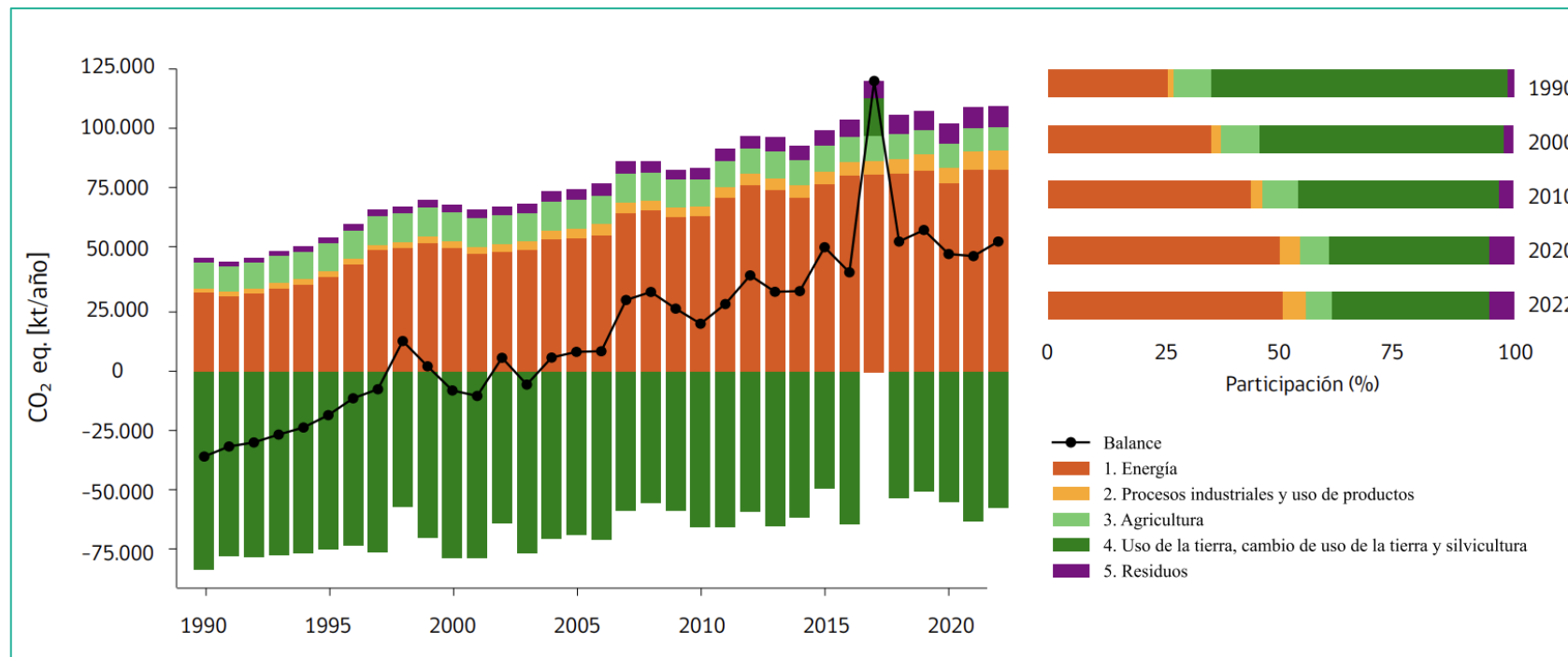
Benefits of National GHG Inventories

- Identify the economic sectors with the greatest contribution to climate change;

- Provide useful information for planning and evaluating economic development;

- Provide useful information to address other environmental problems;

- Identify gaps in national statistics;

- Promotes multidisciplinary collaboration between organizations;

- Assessment of mitigation actions, and guidelines for Long-term Low Emissions and Development Strategies (LT-LEDS); and

- Provide the basis for emissions trading schemes.
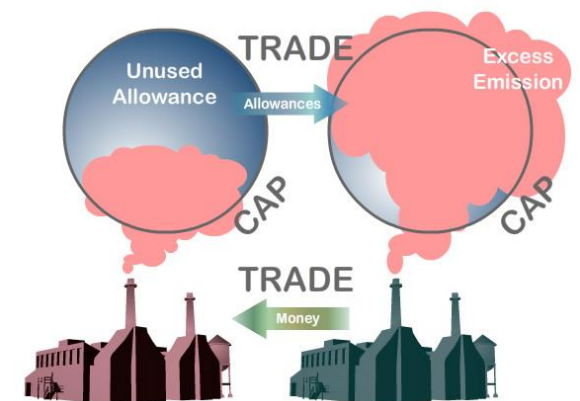
Reporting requirement for NGI under Paris Agreement

Article 13 of the Paris Agreement

National inventory report (NIR) of GHG emissions

7. **Each Party shall** regularly provide the following information:

(a) A **national inventory report** of anthropogenic emissions by sources and removals by sinks of greenhouse gases, prepared using good practice methodologies accepted by the IPCC and agreed upon by the Conference of the Parties serving as the meeting of the Parties to this Agreement;

Decision 18/CMA.1, Annex, Chapter II

National inventory document (NID) and Common reporting tables (CRT)

38.   Pursuant to Article 13, paragraph 7(a), of the Paris Agreement, **each Party shall** provide a **national inventory report** of anthropogenic emissions by sources and removals by sinks of GHGs. The NIR consists of a **national inventory document** and the **common reporting tables**. Each Party shall report the information referred to in paragraphs 39–46 below, recognizing the associated flexibilities provided for those developing country Parties that need them in the light of their capacities.

Decision 5/CMA.3

1. **Adopts**:

(a) The **common reporting tables** referred to in chapter II of the annex to decision 18/CMA.1 for the electronic reporting of the information in the NIR of anthropogenic emissions by sources and removals by sinks of GHG, as contained in annex I;

NIR components for reporting

FCCC/PA/CMA/2021/10/Add.2

Annex V*

Outline of the national inventory document, pursuant to the modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement[1]

[English only]

EXECUTIVE SUMMARY

ES.1. Background information on GHG inventories and climate change (e.g. as it pertains to the national context)

ES.2. Summary of trends related to national emissions and removals

ES.3. Overview of source and sink category emission estimates and trends

ES.4. Other information (e.g. indirect GHGs, precursor gases)

ES.5. Key category analysis (flexibility provided to those developing country Parties that need it in the light of their capacities as per para. 25 of the MPGs)

ES.6. Improvements introduced (related to a non-mandatory provision as per para. 7 of the MPGs, with flexibility provided to those developing country Parties that need it in the light of their capacities as per para. 7(c) of the MPGs)

Chapter 1: National circumstances, institutional arrangements and cross-cutting information

1.1. Background information on GHG inventories and climate change (e.g. as it pertains to the national context, to provide information to the general public)

1.2. A description of national circumstances and institutional arrangements

    1.2.1. National entity or national focal point

    1.2.2. Inventory preparation process

    1.2.3. Archiving of information

    1.2.4. Processes for official consideration and approval of inventory

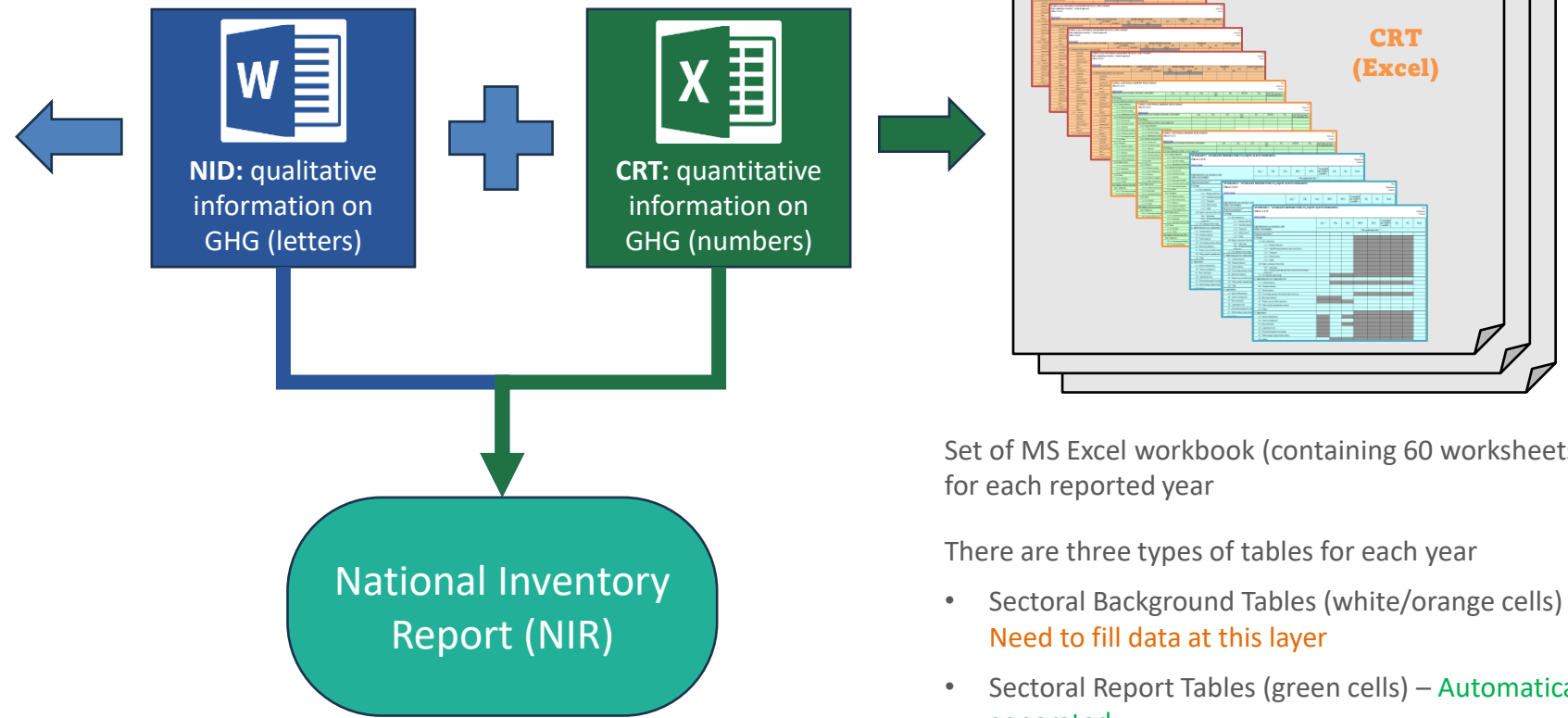1.3. Brief general description of methodologies (including tiers used) and data sources used

1.4. Brief description of key categories (flexibility provided to those developing country Parties that need it in the light of their capacities as per para. 25 of the MPGs)

1.5. Brief general description of QA/QC plan and implementation (related to non-mandatory provisions as per para. 35 of the MPGs, with flexibility provided to those developing country Parties that need it in the light of their capacities as per paras. 34–35 of the MPGs)

1.6. General uncertainty assessment, including data pertaining to the overall uncertainty of inventory totals (flexibility provided to those developing country Parties that need it in the light of their capacities as per para. 29 of the MPGs)

* The list of the acronyms and abbreviations used in this annex can be found at the end of the document.
[1] Use of the outline by Parties is as per para. 2 of decision 5/CMA.3.

NID: qualitative information on GHG (letters)

CRT: quantitative information on GHG (numbers)

National Inventory Report (NIR)

CRT (Excel)

Set of MS Excel workbook (containing 60 worksheets) for each reported year

There are three types of tables for each year

- Sectoral Background Tables (white/orange cells) – Need to fill data at this layer

- Sectoral Report Tables (green cells) – Automatically generated

- Summary Tables/Cross-sectoral Tables (blue cells) – Automatically generated

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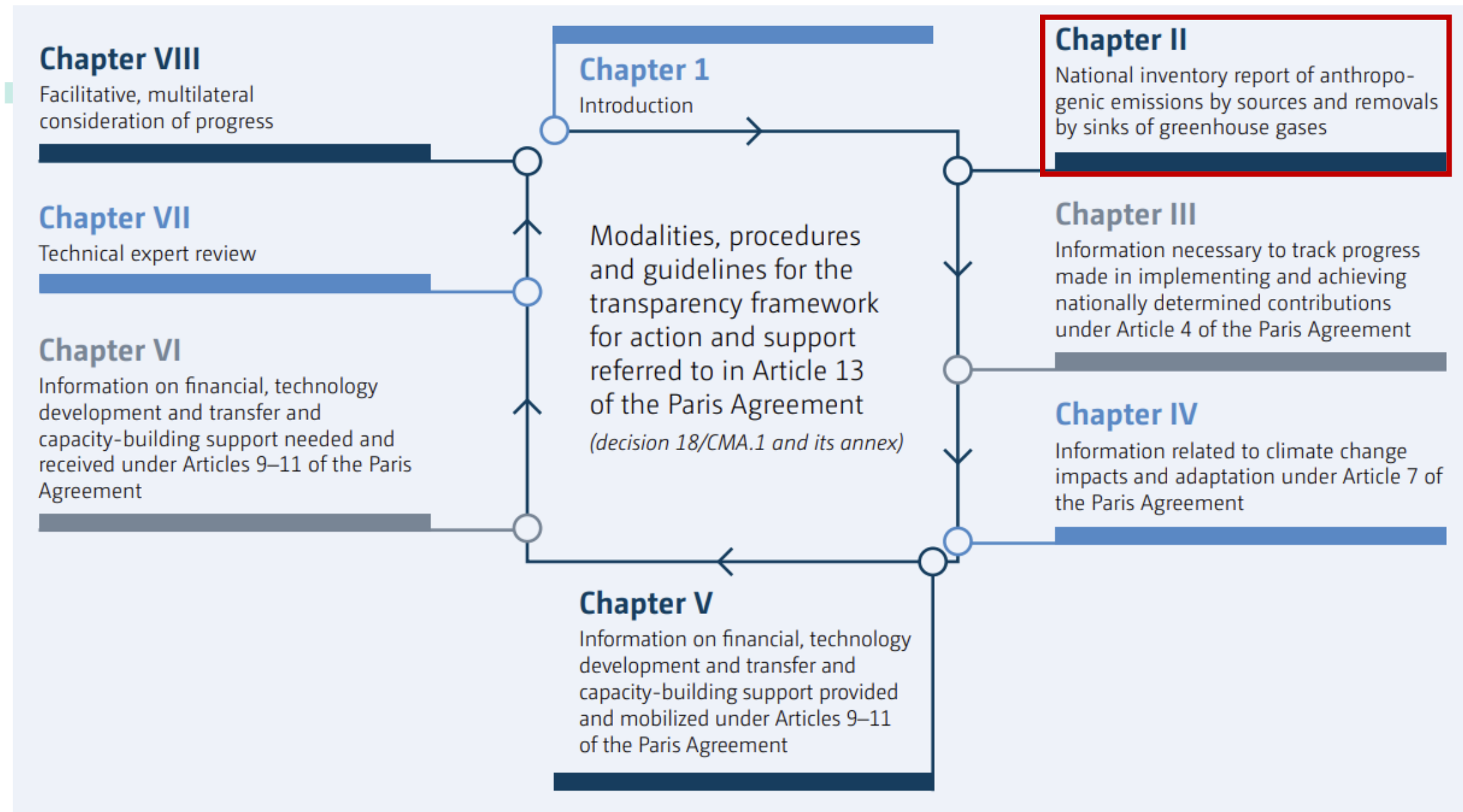
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Chapter II. National inventory report of anthropogenic emissions by sources and removals by sinks of GHG

A. Definitions (17)

B. National circumstances and institutional arrangements (18-19)

C. Methods

1. Methodologies, parameters and data (20-24)
2. Key category analysis (25)
3. Time-series consistency and recalculations (26-28)
4. Uncertainty assessment (29)
5. Assessment of completeness (30-33)
6. Quality assurance/quality control (34-36)

D. Metrics (37)

E. Reporting guidance (38)

1. Information on methods and cross-cutting elements (39-46)
2. Sectors and gases (47-56)
3. Time series (57-58)

A. Definitions

17. The definitions used for the principles of inventories shall be the definitions provided for in the 2006 IPCC Guidelines, Volume 1, Chapter 1, Section 1.4

Indicators of inventory quality are:

Transparency	There should be clear and sufficient documentation to enable individuals or groups other than the inventors to understand how the inventory was produced.
Completeness	Estimates should be declared for all relevant source and sink categories, and GHGs, across the country's entire territorial coverage.
Consistency	Estimates for different years, gases and categories should be made in such a way that differences between years and categories reflect actual differences in the emissions balance and should reflect actual annual fluctuations in emissions or removals, without being subject to changes resulting from methodological differences.
Comparability	Inventory should be reported in a way that allows comparison with inventories for other countries.
Accuracy	Should not contain excessive or insufficient estimates, to the extent that it can be judged. This means investing all the effort needed to eliminate bias in estimates.

Chapter II. National inventory report...

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B. National circumstances and institutional arrangements

18. Each Party should implement and maintain national inventory arrangements*, including institutional, legal and procedural arrangements for the continued estimation, compilation and timely reporting of NIR […]
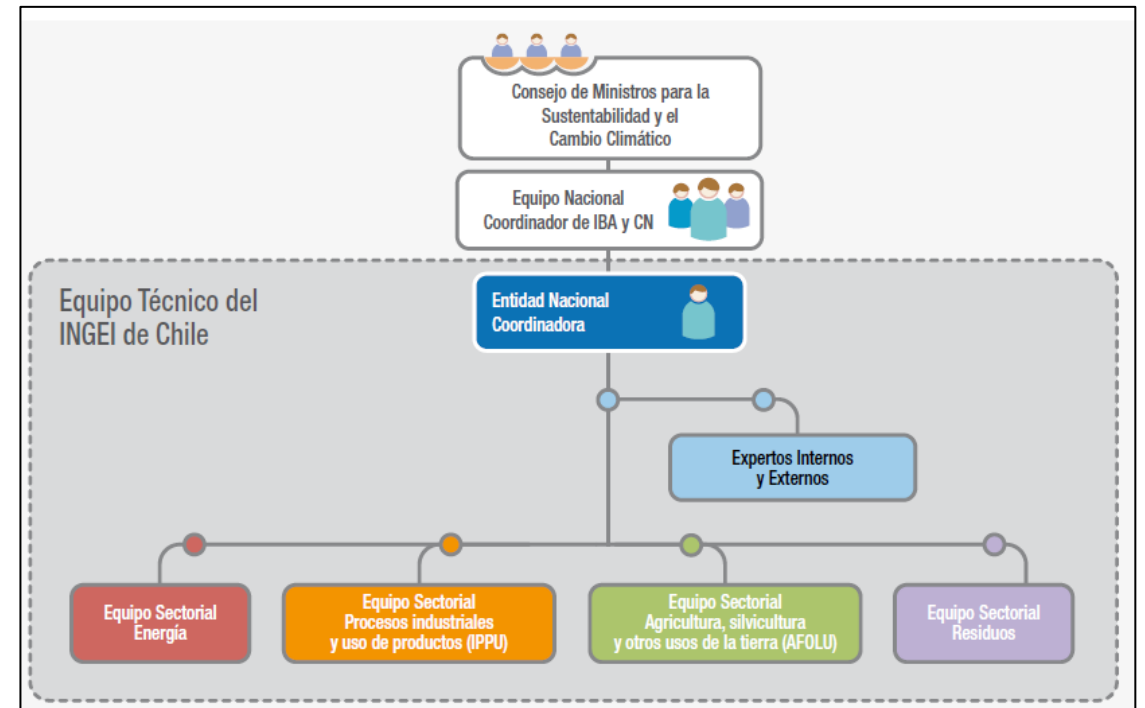
→ **Definition of the National Inventory System**
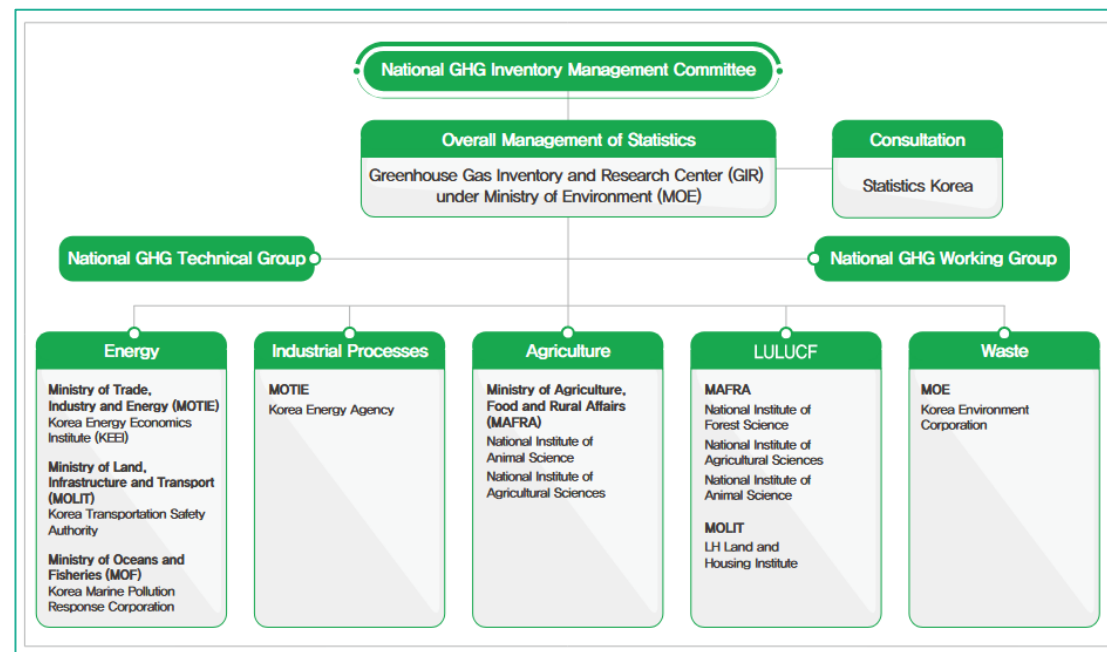
19. Each Party shall report on the following functions related to inventory planning, preparation and management:

(a) Its national entity or national focal point

(b) Its inventory preparation process

(c) Its archiving of all information for the reported time series

(d) Its processes for the official consideration and approval of the NGI

*Introduction to the national inventory arrangements

- It is considered good practice that countries improve the quality of NGI on a continuous basis.

- It is generally accepted that NGI are useful to users if they are updated on a regular basis.

- There should be improvement over time to provide increasingly useful information on national GHG trends and transparent reporting.

- Establishing sustainable national GHG inventory arrangements (National Inventory System) will help to continuously improve and regularly update national GHG inventories.

*Key elements of the national inventory arrangements

GHG inventory objectives

- A useful concept to help define NGI activities and outputs are a country's GHG inventory objectives and other decision-making needs for the GHG data.

- The identification of objectives will help define the NGI's data and expertise needs, roles and responsibilities, scope, and timeframes for the NGI compilation, reporting, and review processes.

CTF Table 9 →

TABLE 1.1 (NEW) AN ILLUSTRATIVE EXAMPLE STRUCTURE FOR CAPTURING AND SHARING INFORMATION ON THE OBJECTIVES OF THE NATIONAL GHG INVENTORY							
Objective[1]	Gases[2]	Sectors & categories[3]	Geographical resolution	Temporal resolution of estimates[4]	Time series span[5]	Reporting frequency[6]	Reporting formats[7]

1. List the objectives that the national GHG inventory supports.

2. Add gases included e.g. CO_2, CH_4, N_2O, fluorinated GHGs, other gases such as precursor pollutants.

3. Add sectors included Energy, IPPU, AFOLU, Waste, other sectors.

4. The temporal resolution is usually annual (e.g. 2010, 2011, 2012). Some GHG inventories have different durations spanning several years or sub-yearly (e.g. monthly data).

5. Indicate the start and end date of the time series.

6. How frequently is the data updated?

7. Highlight any specific reporting formats (e.g. table structures, schemas, variables needed for specific reporting).
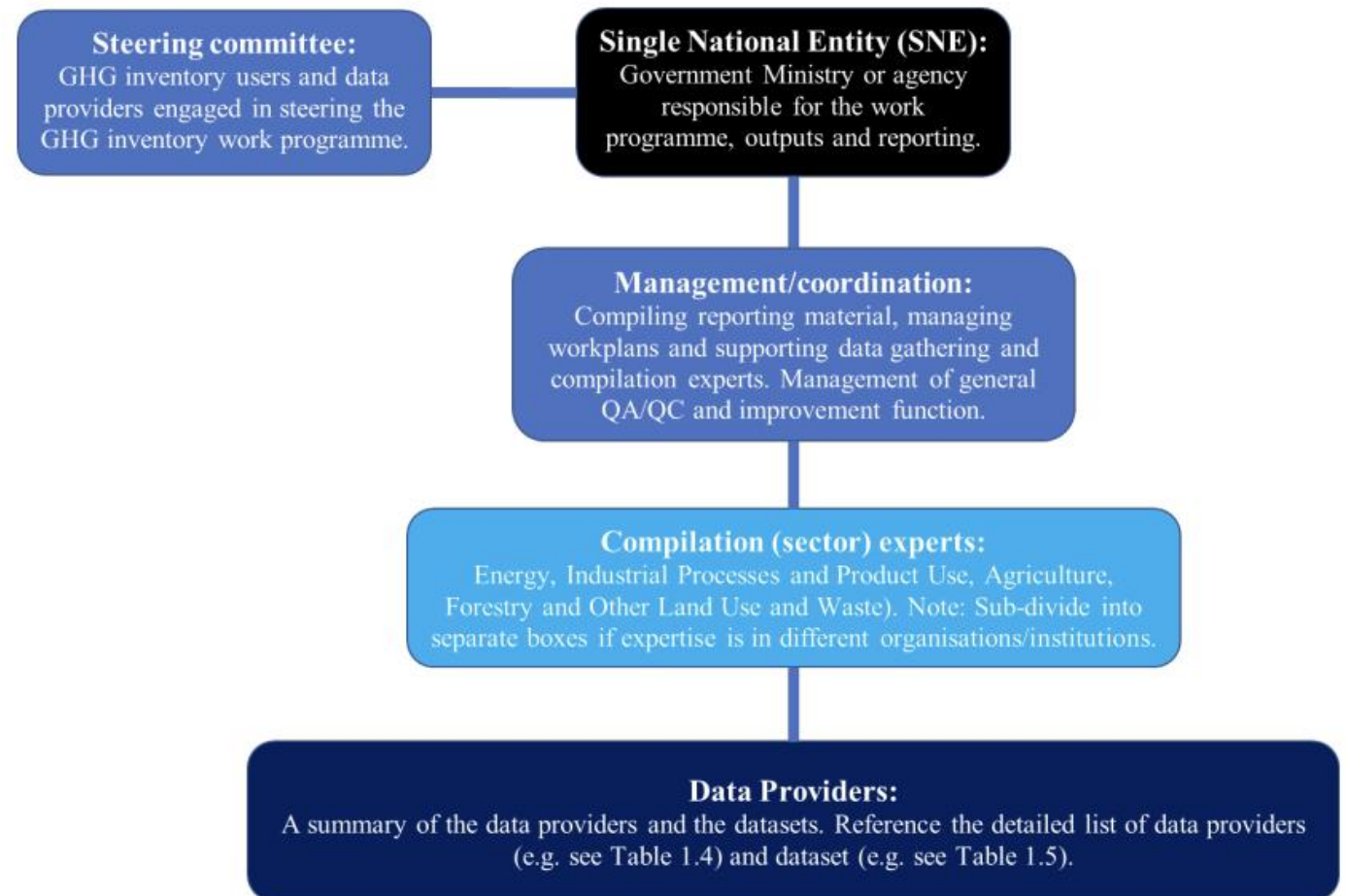
*Key elements of the national inventory arrangements
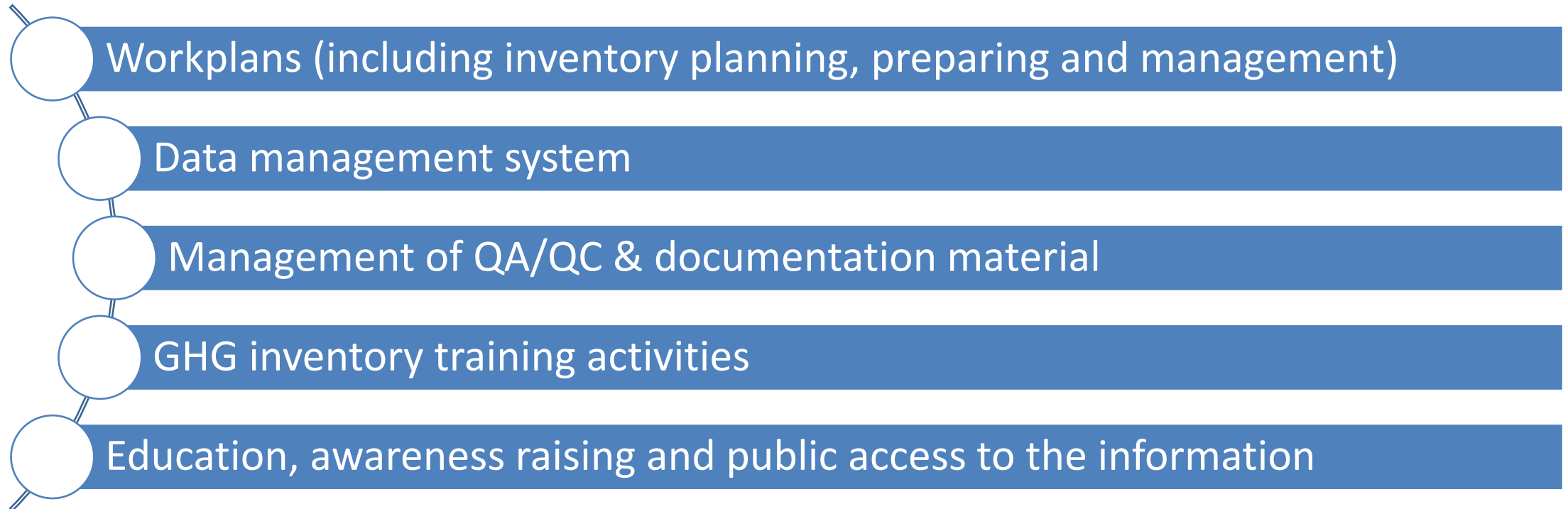
Structuring of institutional arrangements

- Clarifying the structure of institutional arrangements can help formalize and communicate the functional roles of organizations in the NGI compilation process.

- An illustrative structure provides an overview of the roles and responsibilities whether institutional arrangements are part of a larger statistical data gathering operation or a stand-alone and dedicated NGI activity.

Figure 1.0 (New) Illustrative example of GHG inventory institutional arrangements structuring[5]

Steering committee: GHG inventory users and data providers engaged in steering the GHG inventory work programme.

Single National Entity (SNE): Government Ministry or agency responsible for the work programme, outputs and reporting.

Management/coordination: Compiling reporting material, managing workplans and supporting data gathering and compilation experts. Management of general QA/QC and improvement function.

Compilation (sector) experts: Energy, Industrial Processes and Product Use, Agriculture, Forestry and Other Land Use and Waste). Note: Sub-divide into separate boxes if expertise is in different organisations/institutions.

Data Providers: A summary of the data providers and the datasets. Reference the detailed list of data providers (e.g. see Table 1.4) and dataset (e.g. see Table 1.5).

*GHG inventory management tools

- The development of NGI management tools will help to ensure efficiency and transparency in the inventory compilation activities throughout the steps identified in the NGI compilation cycle.

Workplans (including inventory planning, preparing and management)

Data management system

Management of QA/QC & documentation material

GHG inventory training activities

Education, awareness raising and public access to the information

*Exercise. National GHG inventory objectives

- Form groups of five-eight experts and discuss on potential objectives for Grenada's inventory.

- Identify at least three new objectives beyond simply submitting the National Inventory Report (NIR) to the UNFCCC.

- Share your proposed objectives with your colleagues. Three groups will be randomly selected.

*Exercise. National GHG inventory arrangements

- Form groups of five-eight experts and discuss on roles and responsibilities of the Grenada's inventory.

- Identify the potential single national entity; inventory coordinator; compilation experts; data providers; and steering committee.

- Please, share your thoughts with your colleagues. Three groups will be randomly selected.

*Exercise. National GHG inventory management tools

- Form groups of five-eight experts and discuss on management tools for Grenada's inventory.

- Identify who would be in charge of preparing and managing the workplan; data management system; management of QA/QC & documentation material; GHG inventory training activities; and education, awareness raising and public access to the information.

- Please, share your thoughts with your colleagues. Three groups will be randomly selected.

Chapter II. National inventory report…

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**D. Metrics (37)**

E. Reporting guidance (38)

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1. Methodologies, parameters and data (1/2)

20. Each Party shall use the 2006 IPCC Guidelines [...]. Each Party is encouraged to use the 2013 Supplement: Wetlands.

21. Each Party shall use methods* from the IPCC guidelines [...]. Each Party should make every effort to use a recommended method (tier level) for key categories in accordance with those IPCC guidelines.

22. Each Party may use nationally appropriate methodologies if they better reflect its national circumstances and are consistent with the IPCC guidelines. In these cases, each Party shall transparently explain national methods, data and/or parameters selected.
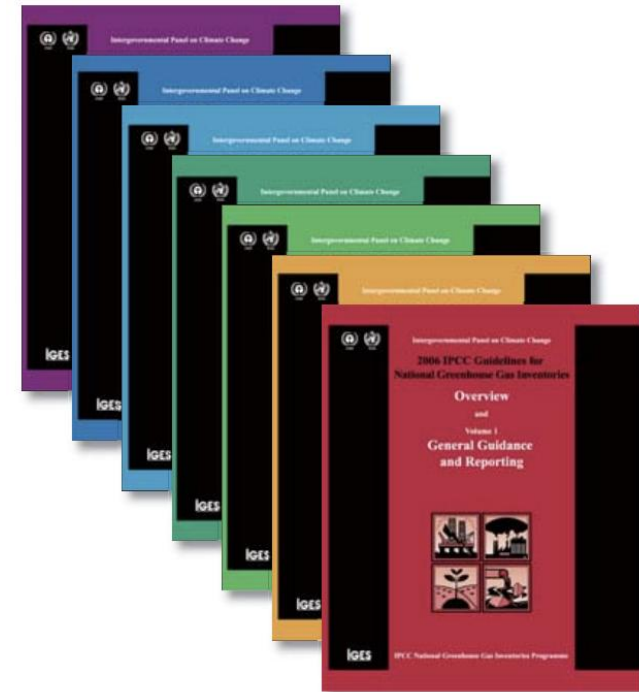
1. Methodologies, parameters and data (2/2)

23. A Party may be unable to adopt a higher tier method for a particular key category owing to lack of resources. In such cases, the Party may use a tier 1 approach, and shall clearly document why the methodological choice was not in line with the corresponding decision tree of the IPCC guidelines. The Party should prioritize for future improvement any key categories for which the good practice method elaborated in the IPCC guidelines […] cannot be used.

24. Each Party is encouraged to use country-specific and regional emission factors (EF) and activity data (AD), where available, or to propose plans to develop them, in accordance with the good practice elaborated in the IPCC guidelines […].

Figure 10.3   Decision tree for CH₄ emissions from Manure Management
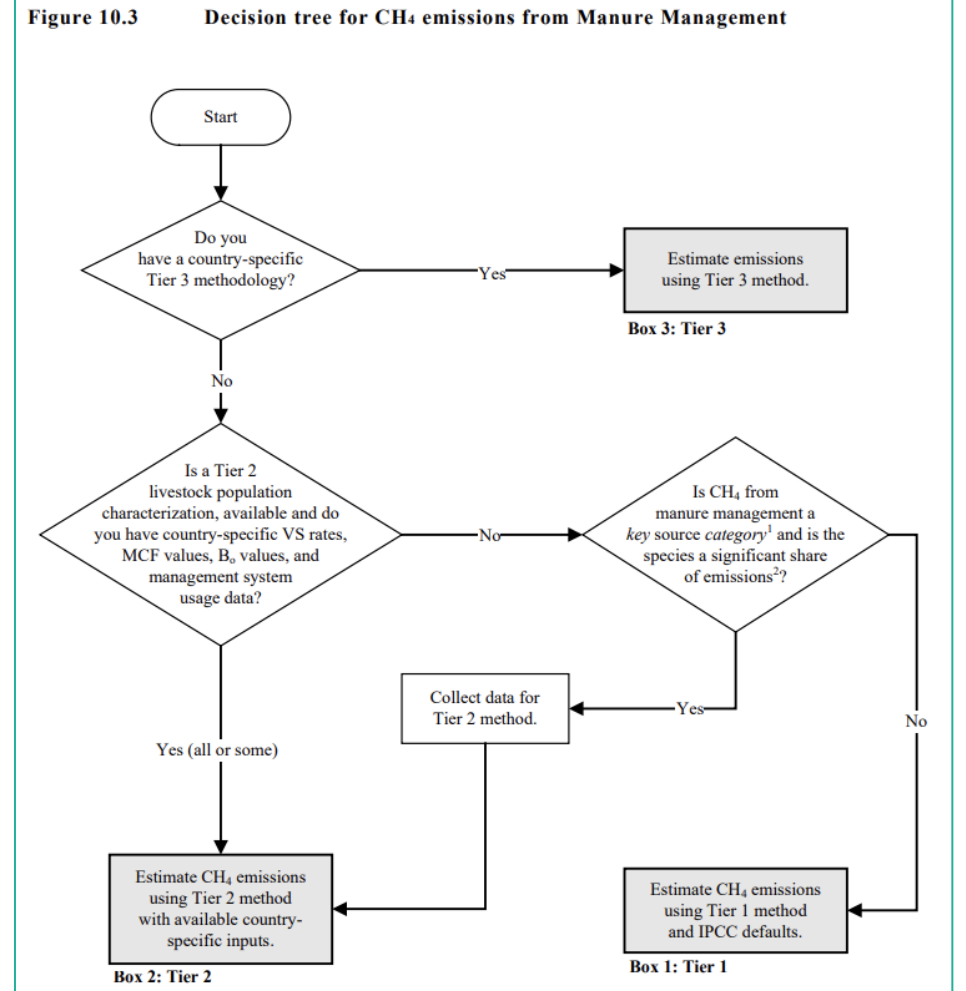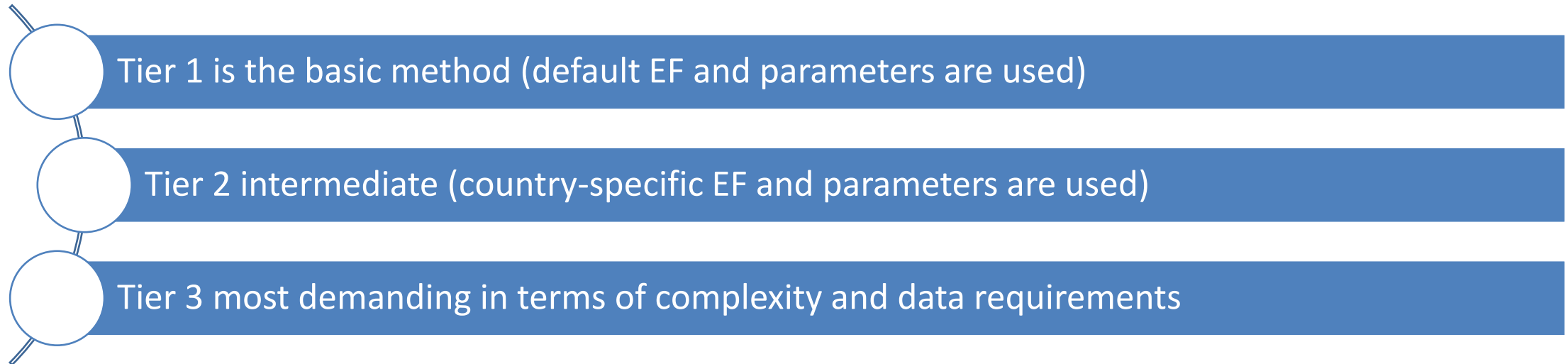
*Introduction to the estimation methods

- The most common simple methodological approach is to combine information on the extent to which a human activity takes place (called activity data or AD) with coefficients which quantify the emissions or removals per unit activity (called emission factors or EF).

- The basic equation is therefore:

$$Emissions = AD \cdot EF$$

- The basic equation can in some circumstances be modified to include other estimation parameters than emission factors.

*Tiers

- A tier represents a level of methodological complexity.

- Usually, three tiers are provided.

Tier 1 is the basic method (default EF and parameters are used)

Tier 2 intermediate (country-specific EF and parameters are used)

Tier 3 most demanding in terms of complexity and data requirements

- Tiers 2 and 3 are sometimes referred to as higher tier methods and are generally considered to be more accurate.

*In a very, very, very general methodological approach

IPCC sector	General methodological approach
Energy	• Based on carbon content of fuel • Fugitive (leaks) use emission factors
Industrial processes and product use (IPPU)	• Based on chemistry of process • Some use mass balance of product used
Agriculture	• Based on understanding of processes
Land use, land use change and forestry (LULUCF)	• Stock changes ⇒ Emissions/Removals • Inputs (e.g. growth) - outputs (e.g. decay, harvest) • Total stock at end minus total stock at beginning
Waste	• Tracks carbon (fossil & biogenic) in waste

*Energy sector

- The energy sector mainly comprises:

  - exploration and exploitation of primary energy sources,

  - conversion of primary energy sources into more useable energy forms in refineries and power plants,

  - transmission and distribution of fuels,

  - use of fuels in stationary and mobile applications.

- Emissions arise from these activities by combustion and as fugitive emissions or escape without combustion.

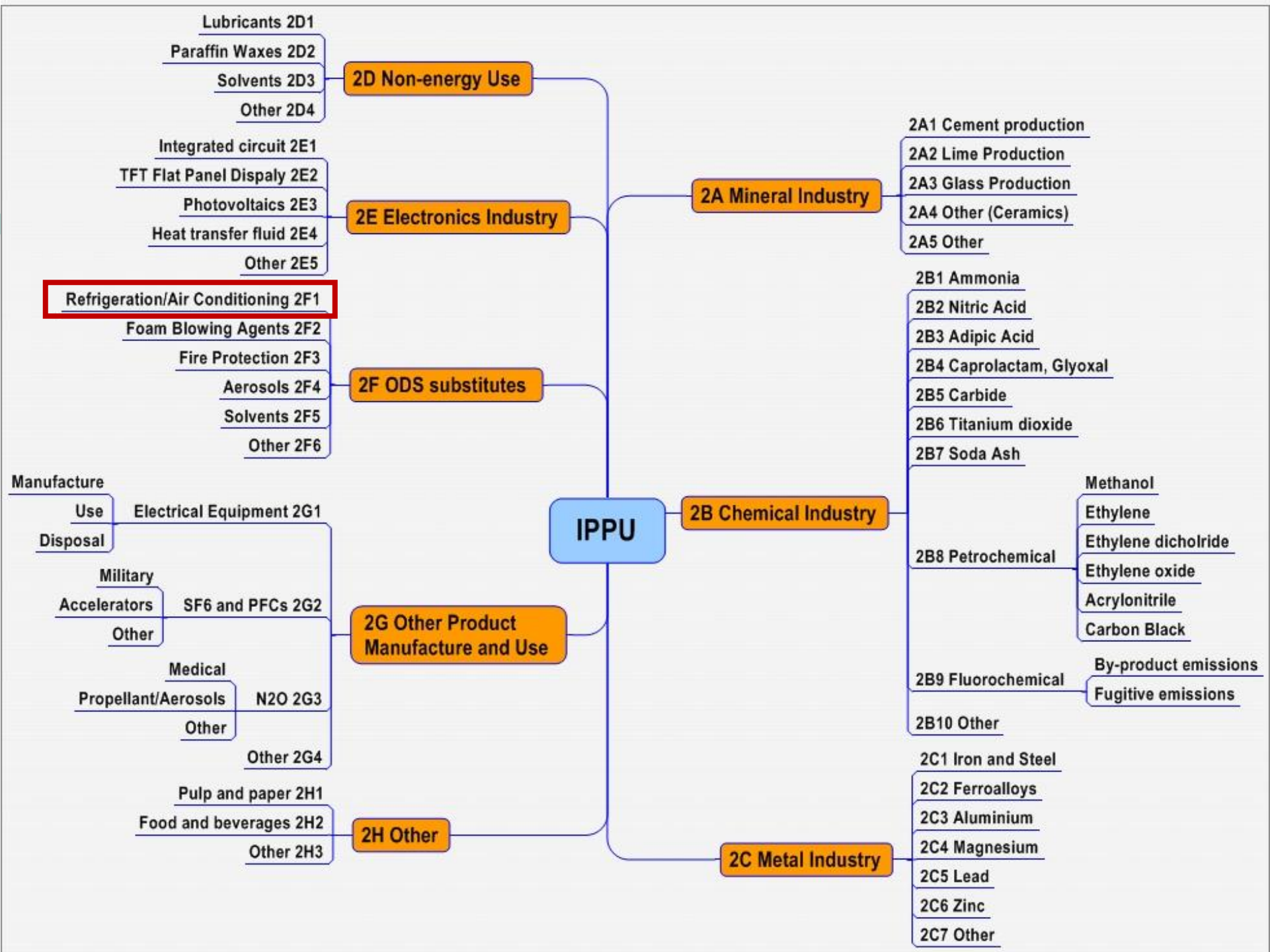THERMAL POWER PLANT

*Energy sector: categories
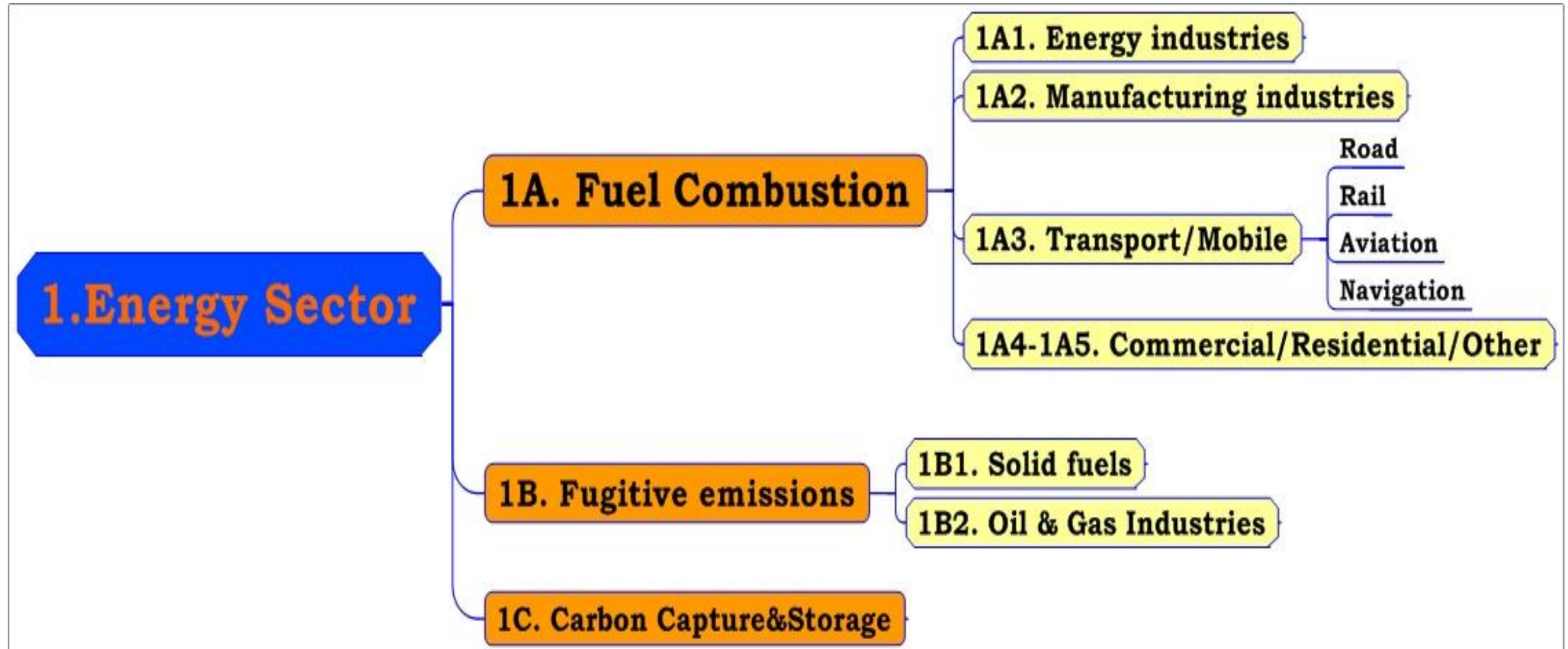
*Energy sector: methodological issues

- **Biomass:** CO_2 emissions from biomass combustion are not included in the national total. They are reported separately (information item). Non-CO_2 emissions are reported in the national total

- **International bunker:** Domestic emissions included in National Total. International emissions reported separately as "Bunker Fuels". Domestic trips are journeys between points in one country. International trips are between countries.

- **Excluded carbon/fuels in other sectors:** Waste incineration without energy recovery → Waste. Use of fossil fuels as a feedstock in the industrial sector (e.g., coke in Iron&Steel) → IPPU. Biomass fires or open burning → AFOLU

- **Reference approach** is a top-down approach, using a country's energy supply data to calculate the emissions of CO_2 from fuel combustion. Reference approach is used for checking (CO_2).

*IPPU sector

- The IPPU sector includes:

    - Industrial processes that chemically or physically transform materials releasing GHG

    - Product use: GHGs are used in products such as refrigerators, foams or aerosol cans

    - A wide variety of gases: CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3.

- Not IPPU:

    - Emissions from fuel combustion in industrial sector for energy purposes (e.g., fuel used in cement production) → Energy sector

    - Fugitive emissions in oil/gas industries → Energy sector

   - Solvents & other products incineration without energy recovery → Waste sector

*IP

Lubricants 2D1	
Paraffin Waxes 2D2	
Solvents 2D3	**2D Non-energy Use**
Other 2D4	
Integrated circuit 2E1	
TFT Flat Panel Dispaly 2E2	
Photovoltaics 2E3	**2E Electronics Industry**
Heat transfer fluid 2E4	
Other 2E5	

Refrigeration/Air Conditioning 2F1

Foam Blowing Agents 2F2	
Fire Protection 2F3	
Aerosols 2F4	**2F ODS substitutes**
Solvents 2F5	
Other 2F6	

IPPU

2A Mineral Industry
- 2A1 Cement production
- 2A2 Lime Production
- 2A3 Glass Production
- 2A4 Other (Ceramics)
- 2A5 Other

2B Chemical Industry
- 2B1 Ammonia
- 2B2 Nitric Acid
- 2B3 Adipic Acid
- 2B4 Caprolactam, Glyoxal
- 2B5 Carbide
- 2B6 Titanium dioxide
- 2B7 Soda Ash
- 2B8 Petrochemical
  - Methanol
  - Ethylene
  - Ethylene dicholride
  - Ethylene oxide
  - Acrylonitrile
  - Carbon Black
- 2B9 Fluorochemical
  - By-product emissions
  - Fugitive emissions
- 2B10 Other

Manufacture
Use
Disposal — Electrical Equipment 2G1

Military
Accelerators — SF6 and PFCs 2G2
Other

2G Other Product Manufacture and Use

Medical
Propellant/Aerosols — N2O 2G3
Other

Other 2G4

Pulp and paper 2H1	
Food and beverages 2H2	**2H Other**
Other 2H3	

2C Metal Industry
- 2C1 Iron and Steel
- 2C2 Ferroalloys
- 2C3 Aluminium
- 2C4 Magnesium
- 2C5 Lead
- 2C6 Zinc
- 2C7 Other

*AFOLU sector (or Agriculture and LULUCF sectors)

The AFOLU sector includes:

- CO_2 emissions and removals resulting from C stock changes in biomass, dead organic matter and mineral soils, for all managed lands (FL, CL, GL, WL, SL, OL);

- CO_2 and non-CO_2 emissions from fire on all managed land;

- N_2O emissions from all managed soils;

- CO_2 emissions associated with liming and urea application to managed soils;

- CH_4 emissions from rice cultivation;

- CO_2 and N_2O emissions from cultivated organic soils;

- CH_4 emission from livestock (enteric fermentation);

- CH_4 and N_2O emissions from manure management systems; and

- C stock change associated with harvested wood products (HWP).

*AFOLU sector: sources and removals of GHG
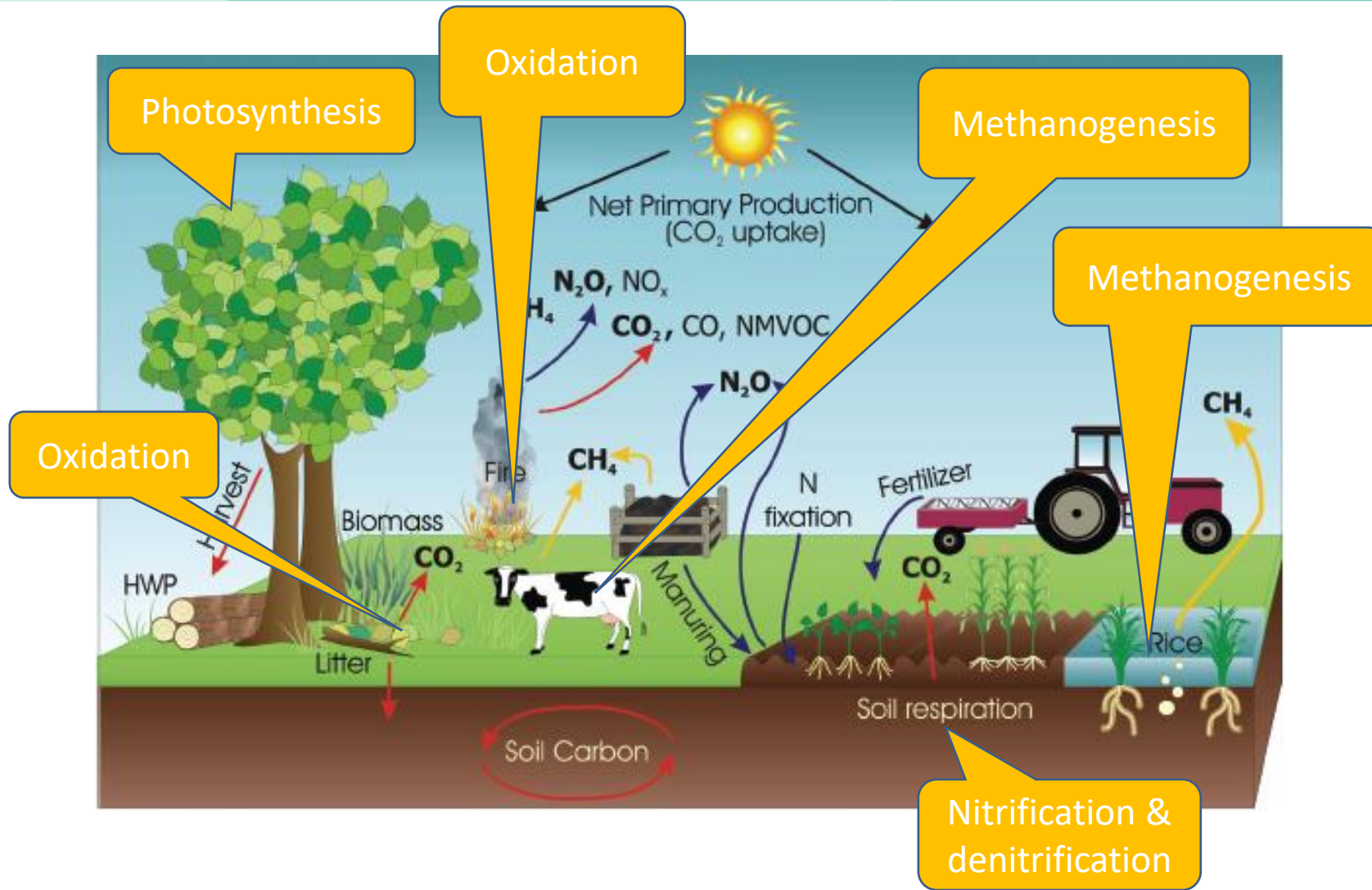
*Waste sector

- The Waste sector includes CO_2, CH_4 and N_2O emissions from following categories:

  - Solid waste disposal

  - Biological treatment of solid waste

  - Incineration and open burning of waste

  - Wastewater treatment and discharge

- Typically, CH_4 emissions from solid waste disposal sites are the largest source in the Waste sector.

- Biogenic CO_2 emissions are not included in the Waste sector.

- All GHG emissions from waste-to-energy should be estimated and reported under the Energy sector.

*Example. GHG emissions from stationary combustion

2.3.1.1   TIER 1 APPROACH

Applying a Tier 1 emission estimate requires the following for each source category and fuel:

- Data on the amount of fuel combusted in the source category

- A default emission factor

Emission factors come from the default values provided together with associated uncertainty range in Section 2.3.2.1. The following equation is used:

EQUATION 2.1

GREENHOUSE GAS EMISSIONS FROM STATIONARY COMBUSTION

$$Emissions_{GHG, fuel} = Fuel\ Consumption_{fuel} \bullet Emission\ Factor_{GHG, fuel}$$

Where:

$Emissions_{GHG, fuel}$ = emissions of a given GHG by type of fuel (kg GHG)

$Fuel\ Consumption_{fuel}$ = amount of fuel combusted (TJ)

$Emission\ Factor_{GHG, fuel}$ = default emission factor of a given GHG by type of fuel (kg gas/TJ). For CO_2, it includes the carbon oxidation factor, assumed to be 1.

*Example. CH$_4$ emissions from enteric fermentation

EQUATION 10.19
ENTERIC FERMENTATION EMISSIONS FROM A LIVESTOCK CATEGORY

$$Emissions = EF_{(T)} \bullet \left(\frac{N_{(T)}}{10^6} \right)$$

Where:

Emissions = methane emissions from Enteric Fermentation, Gg CH$_4$ yr^{-1}

$EF_{(T)}$ = emission factor for the defined livestock population, kg CH$_4$ head^{-1} yr^{-1}

$N_{(T)}$ = the number of head of livestock species / category T in the country

T = species/category of livestock

*Exercise. GHG emissions from energy generation (1.A.1.a)

- Step 1: Download All Worksheets of the 2006 IPCC Guidelines.

- Step 2: Open file "1_Energy".

- Step 3: Open file "AD_Energy". We sent it this morning.

- Step 4: Complete column A in file "1_Energy" using activity data from file "AD_Energy".

- Step 5: Complete column B in file "1_Energy" using default net calorific values from Table 1.2 for each fuel type.

- Step 6: Complete columns D, F and H using default emissions factors from Table 2.2 for each fuel type and gases.

- Step 7: Estimate GHG emissions un columns E, G and I in the file "1_Energy".

*Exercise. CH$_4$ emissions from enteric fermentation (3.A)

- Step 1: Download All Worksheets of the 2006 IPCC Guidelines.

- Step 2: Open file "3A1_Enteric Fermentation".

- Step 3: Open file "AD_Livestock". We sent it this morning.

- Step 4: Complete column B in file "3A1_Enteric Fermentation" using activity data from file "AD_Livestock".

- Step 5: Complete column C in file "3A1_Enteric Fermentation" using default emissions factors from Table 10.10 and 10.11 for each animal category.

- Step 6: Estimate CH$_4$ emissions from enteric fermentation in columns D in the file "3A1_Enteric Fermentation".

- EXTRA: Complete column E in file "3A1_Enteric Fermentation" including default emissions factors from Table 10.14 and 10.15 for each animal category in an average temperature of 26°C. Then, estimate CH$_4$ from manure management in column F for each animal category.

2. Key category analysis

25. Each Party shall identify key categories* for:

a) the starting year and the latest reporting year [...],

b) including and excluding LULUCF categories,

c) using approach 1*,

d) for both level and trend assessment,

by implementing a key category analysis consistent with the IPCC guidelines [...];

Parties that need **flexibility** [...] have the flexibility to instead identify key categories using a threshold no lower than 85 per cent in place of the 95 per cent threshold defined in the IPCC guidelines [...], allowing a focus on improving fewer categories and prioritizing resources

*Key category analysis

- The concept of key category is used to identify the categories that have a significant influence on a country's total inventory in terms of the absolute level of emissions and removals, the trend in emissions and removals, or uncertainty in emissions and removals.

- Key categories should be the priority for countries during inventory resource allocation for data collection, compilation, quality assurance/quality control and reporting.

- In general, more detailed higher tier methods should be selected for key categories.

*How to define key categories

1. Disaggregate categories to the lowest possible level:

- to sub-category (e.g., to a fuel type – liquid, gaseous, solid)

- to individual gas (use GWP).

2. Apply two approaches:

- Approach 1 – Level and Trend Assessment (key categories - 95% cumulative effect)

- Approach 2 – Level/Trend + Uncertainty Assessment (key categories - 90% cumulative effect)

*Approach 1 to identify key categories (level assessment)

Table 4.2 presents a spreadsheet that can be used for the level assessment. An example of the use of the spreadsheet is given in Section 4.5.

TABLE 4.2
SPREADSHEET FOR THE APPROACH 1 ANALYSIS – LEVEL ASSESSMENT

A	B	C	D	E	F	G
IPCC Category Code	IPCC Category	Greenhouse Gas	Latest Year Estimate $E_{x,t}$ [in CO_2-equivalent units]	Absolute Value of Latest Year Estimate $\|E_{x,t}\|$	Level Assessment $L_{x,t}$	Cumulative Total of Column F
Total				$\sum_y \|E_{y,t}\|$	1	

*Example of level assessment

A	B	C	D
Code	Category	GHG	Emission/ Removal
1A1	Fuel Combustion Activities - Energy Industries: Solid	CO_2	10,000
1A1	Fuel Combustion Activities - Energy Industries: Liquid	CO_2	200
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Solid	CO_2	1,300
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Gas	CO_2	123
1A3a	Fuel Combustion Activities - Transport - Civil Aviation	CO_2	5,502
3A2	Manure Management	CH_4	543
3B1a	Forest Land Remaining Forest Land	CO_2	-2,345
3B1b	Land Converted to Forest Land	CO_2	879

- Inputs to Columns A-D will be available from the inventory.

- The total of Column D presents the net emissions and removals.

*Example of level assessment

A	B	C	D	E
Code	Category	GHG	Emission/ Removal	Absolute
1A1	Fuel Combustion Activities - Energy Industries: Solid	CO_2	10,000	10,000
1A1	Fuel Combustion Activities - Energy Industries: Liquid	CO_2	200	200
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Solid	CO_2	1,300	1,300
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Gas	CO_2	123	123
1A3a	Fuel Combustion Activities - Transport - Civil Aviation	CO_2	5,502	5,502
3A2	Manure Management	CH_4	543	543
3B1a	Forest Land Remaining Forest Land	CO_2	-2,345	2,345
3B1b	Land Converted to Forest Land	CO_2	879	879
				20,892

- In Column E, absolute values are taken from each value in Column D.

- The sum of all entries in Column E is entered in the total line of Column E

*Example of level assessment

A	B	C	D	E	F
Code	Category	GHG	Emission/ Removal	Absolute	Level
1A1	Fuel Combustion Activities - Energy Industries: Solid	CO_2	10,000	10,000	47.9%
1A1	Fuel Combustion Activities - Energy Industries: Liquid	CO_2	200	200	1.0%
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Solid	CO_2	1,300	1,300	6.2%
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Gas	CO_2	123	123	0.6%
1A3a	Fuel Combustion Activities - Transport - Civil Aviation	CO_2	5,502	5,502	26.3%
3A2	Manure Management	CH_4	543	543	2.6%
3B1a	Forest Land Remaining Forest Land	CO_2	-2,345	2,345	11.2%
3B1b	Land Converted to Forest Land	CO_2	879	879	4.2%
				20,892	

- In Column F, the level assessment is computed according to Equation 4.1.

*Example of level assessment

A	B	C	D	E	F
Code	Category	GHG	Emission/ Removal	Absolute	Level
1A1	Fuel Combustion Activities - Energy Industries: Solid	CO_2	10,000	10,000	47.9%
1A3a	Fuel Combustion Activities - Transport - Civil Aviation	CO_2	5,502	5,502	26.3%
3B1a	Forest Land Remaining Forest Land	CO_2	-2,345	2,345	11.2%
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Solid	CO_2	1,300	1,300	6.2%
3B1b	Land Converted to Forest Land	CO_2	879	879	4.2%
3A2	Manure Management	CH_4	543	543	2.6%
1A1	Fuel Combustion Activities - Energy Industries: Liquid	CO_2	200	200	1.0%
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Gas	CO_2	123	123	0.6%
				20,892	

- Once the entries in Column F are computed, the categories in the table should be sorted in descending order of magnitude according to Column F

*Example of level assessment

A	B	C	D	E	F	G
Code	Category	GHG	Emission/ Removal	Absolute	Level	Cumulative
1A1	Fuel Combustion Activities - Energy Industries: Solid	CO_2	10,000	10,000	47.9%	47.9%
1A3a	Fuel Combustion Activities - Transport - Civil Aviation	CO_2	5,502	5,502	26.3%	74.2%
3B1a	Forest Land Remaining Forest Land	CO_2	-2,345	2,345	11.2%	85.4%
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Solid	CO_2	1,300	1,300	6.2%	91.6%
3B1b	Land Converted to Forest Land	CO_2	879	879	4.2%	95.8%
3A2	Manure Management	CH_4	543	543	2.6%	98.4%
1A1	Fuel Combustion Activities - Energy Industries: Liquid	CO_2	200	200	1.0%	99.4%
1A2	Fuel Combustion Activities - Manufacturing Industries and Construction: Gas	CO_2	123	123	0.6%	100.0%
				20,892		

- After this step, the cumulative total summed in Column F can be calculated into Column G.

- Key categories are those that, when summed together in descending order of magnitude, add up to 95 percent of the total in Column G

*Exercise. Key category – level assessment

- Use the file "Exercise_KCA" to estimate the key categories by applying the Approach 1 level assessment.

- How many categories account for 95% of the total?

- How many categories account for 85% of the total? (Flexibility)

3. Time-series consistency and recalculations

26. To ensure time-series consistency, each Party should use the same methods and a consistent approach to underlying AD and EF for each reported year.

27. Each Party should use surrogate data, extrapolation, interpolation and other methods consistent with splicing techniques contained in the IPCC guidelines [...] to estimate missing emission values resulting from lack of AD, EF or other parameters in order to ensure a consistent time series.

28. Each Party shall perform recalculations [...], ensuring that changes in emission trends are not introduced as a result of changes in methods or assumptions across the time series.

Linear Interpolation

Linear Extrapolation in AFOLU
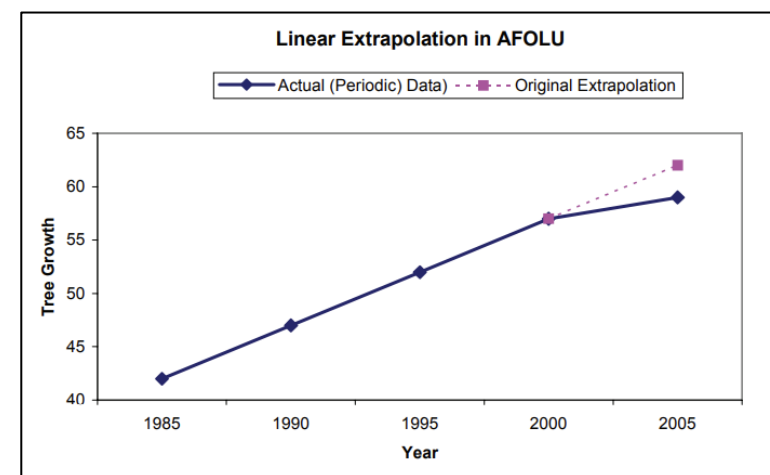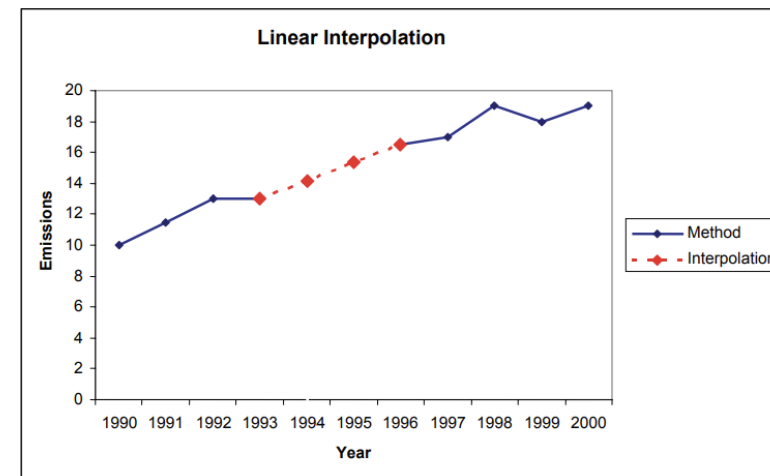
*Splicing techniques

- Splicing refers to the combining of more than one method to form a complete time series.

- Several splicing techniques are available if it is not possible to use the same method or data source in all years (overlap, surrogate data, extrapolation, interpolation).

- Each technique can be appropriate in certain situations, as determined by considerations such as data availability and the nature of the methodological modification.

- Selecting a technique requires an evaluation of the specific circumstances, and a determination of the best option for the particular case.

- It is good practice to perform the splicing using more than one technique before making a final decision and to document why a particular method was chosen.

*Example of interpolation technique

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GHG emission source x	3,800	3,920	4,030	4,135	4,235				4,655	4,770	4,880	4,975

Step 1. Determine whether any factors might have affected the activities that give rise to emissions for the emission category of interest. This step is important to ensure that the interpolation method is not applied in cases where the activity was prohibited for certain years of the time series (e.g. due to legislation prohibiting certain activities, disruptions such as conflicts/economic performance, etc.).

Step 2. Analyze data and assess applicability and type of interpolation technique desired. This exercise can be achieved by fitting a trend line on the data and assessing the value of R^2 (the regression coefficient). The closer to unity the regression coefficient is, the more appropriate the interpolation methodology is. In the example above, fitting a linear trend line is more appropriate as the time series is linear.

*Example of interpolation technique

Step 3. Calculate difference in GHG emissions between last year before the gap and first year after the gap:

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GHG emission source x	3,800	3,920	4,030	4,135	4,235				4,655	4,770	4,880	4,975

4,655 (2007) – 4,235 (2003) = 420

Step 4. Calculate the length of the gap: 2007 – 2003 = 4 years.

Step 5. Calculate average change in emissions per gap year = 420/4 = 105 Gg CO_2.

Step 6. Calculate total emissions for gap year by adding the average change per year.

*Example of interpolation technique

Step 7. Use results obtained in step 6 to calculate the missing emissions data in the time series:

- year 2004: $4{,}235 + 105 = 4{,}340$ Gg CO_2

- year 2005: $4{,}340 + 105 = 4{,}445$ Gg CO_2

- year 2006: $4{,}445 + 105 = 4{,}550$ Gg CO_2

Step 8. Transparently report results:

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GHG emission source x	3,800	3,920	4,030	4,135	4,235	4,340	4,445	4,550	4,655	4,770	4,880	4,975

*Exercise: Applying interpolation technique

- Please review the file "Exercise_Interpolation" and fill in any missing information using interpolation.

- Step 1. Calculate difference in data between last year before the gap and first year after the gap.

- Step 2. Calculate the length of the gap.

- Step 3. Calculate average change in emissions per gap year.

- Step 4. Calculate total emissions for gap year by adding the average change per year.

- Step 5. Use results obtained in step 4 to calculate the missing emissions data in the time series.

4. Uncertainty assessment

29. Each Party shall quantitatively estimate and qualitatively discuss the uncertainty of the emission and removal estimates for all source and sink categories, including inventory totals, for at least the starting year and the latest reporting year of the inventory time series [...]. Each Party shall also estimate the trend uncertainty of emission and removal estimates for all source and sink categories, including totals, between the starting year and the latest reporting year of the inventory time series [...], using at least approach 1, as provided in the IPCC guidelines [...];

Table 1.5. The ten sources with the largest uncertainty contributions in the Swedish inventory for 2022, excluding LULUCF (Contribution to level approach 2).

IPCC Source Category	GHG	Year 2022 emissions or removals (kt CO$_2$-eq.)	Combined uncertainty (%)	Relative contribution to variance in year 2022 (%)
3 D a 1 Inorganic N fertilizers	N2O	769.78	80.2	18.63
3 D a 6 Cultivation of organic soils (i.e. histosols)	N2O	604.36	85.1	12.96
1 A 1 a Public Electricity and Heat Production:Other Fuels	CO2	3 101.18	15.7	11.54
3 A 1 Non-dairy cattle	CH4	1 619.62	25.5	8.34
3 D b 1 Atmospheric deposition	N2O	83.52	400.5	5.48
2 F 1 Refrigeration and air conditioning	HFCs	785.82	38.4	4.46
3 D a 4 Crop residues applied to soils	N2O	360.22	82.5	4.32
3 B Indirect N2O emissions	N2O	72.50	400.5	4.13
5 A 1 Managed waste disposal sites	CH4	509.09	55.9	3.96
3 A 1 Dairy cattle	CH4	1 240.85	20.6	3.20
Total				**77%**

Parties that need **flexibility** [...] have the flexibility to instead provide, at a minimum, a qualitative discussion of uncertainty for key categories, using the IPCC guidelines [...], where quantitative input data are unavailable to quantitatively estimate uncertainties, and are encouraged to provide a quantitative estimate of uncertainty for all source and sink categories of the GHG inventory.

5. Assessment of completeness (1/2)

30. Each Party should indicate the sources and sinks (categories, pools and gases) that are not considered in the NGI report but for which estimation methods are included in the IPCC guidelines […] and explain the reasons for such exclusion.

31. Each Party shall use notation keys where numerical data are not available when completing CRT, indicating the reasons why emissions from sources and removals by sinks and associated data for specific sectors, categories and subcategories or gases are not reported.

Notation Key	Definition	Explanation
NE	Not estimated	Emissions and/or removals occur but have not been estimated or reported, but for which a corresponding activity may occur within a Party.
IE	Included elsewhere	Emissions and/or removals for this activity or category are estimated and included in the NGI but not presented separately for this category. The category where these emissions and removals are included should be indicated.
C	Confidential information	Emissions and/or removals are aggregated and included elsewhere in the NGI because reporting at a disaggregated level could lead to the disclosure of confidential information
NA	Not applicable	The activity or category exists but relevant emissions and removals are considered never to occur. Such cells are normally shaded in the CRT.
NO	Not occurring	An activity or process does not exist within a country.

*Exercise. Identify notation keys used in NIRs

- Step 1: Access any NIR submissions included/as part of the 1BTR.

- Step 2: Identify the notation keys used by countries.

- Step 3: Share your findings and thoughts with your colleagues.

5. Assessment of completeness (2/2)

32. Each Party may use the notation key "NE" when the estimates would be insignificant in terms of level according to the following considerations:

The likely level of emissions is below 0.05 % of the national total GHG emissions, excluding LULUCF, or 500 kt CO_2 eq, whichever is lower. The total national aggregate of estimated emissions for all gases from categories considered insignificant shall remain below 0.1 % of the national total GHG emissions, excluding LULUCF. Parties should use approximated AD and default IPCC EF to derive a likely level of emissions for the respective category.

Parties have the **flexibility** to instead consider emissions insignificant if the likely level of emissions is below 0.1 % of the national total GHG emissions, excluding LULUCF, or 1,000 kt CO_2 eq, whichever is lower. The total national aggregate of estimated emissions for all gases from categories considered insignificant, in this case, shall remain below 0.2 % of the national total GHG emissions, excluding LULUCF.

33. Once emissions or removals have been estimated for a category and if they continue to occur, each Party shall report them in subsequent submissions.

6. Quality assurance/quality control

34. Each Party shall elaborate an inventory QA/QC plan [...], including information on the inventory agency responsible for implementing QA/QC.

> Parties that need **flexibility** [...] are instead encouraged to elaborate an inventory QA/QC plan [...], including information on the inventory agency responsible for implementing QA/QC.

35. Each Party shall implement and provide information on general inventory QC procedures in accordance with its QA/QC plan and the IPCC guidelines [...].

> Parties that need **flexibility** [...] are instead encouraged to implement and provide information on general inventory QC procedures in accordance with its QA/QC plan [...].

In addition, Parties should apply category-specific QC procedures [...] for key categories and for those individual categories in which significant methodological changes and/or data revisions have occurred. In addition, Parties should implement QA procedures by conducting a basic expert peer review of their inventories [...].

36. Each Party should compare the national estimates of CO_2 emissions from fuel combustion with those obtained using the reference approach [...] and report the results of this comparison in its NIR.

Chapter II. National inventory report...

A. Definitions (17)

B. National circumstances and institutional arrangements (18-19)

C. Methods

1. Methodologies, parameters and data (20-24)
2. Key category analysis (25)
3. Time-series consistency and recalculations (26-28)
4. Uncertainty assessment (29)
5. Assessment of completeness (30-33)
6. Quality assurance/quality control (34-36)

D. Metrics (37)

E. Reporting guidance (38)

1. Information on methods and cross-cutting elements (39-46)
2. Sectors and gases (47-56)
3. Time series (57-58)

D. Metrics

37. Each Party shall use the 100-year time-horizon GWP values from the IPCC AR5 […], to report aggregate emissions and removals of GHGs, expressed in CO_2 eq. Each Party may in addition also use other metrics (e.g. global temperature potential) to report supplemental information […]. In such cases, the Party shall provide in the NID information on the values of the metrics used and the IPCC AR they were sourced from.

IPCC Global Warming Potential (GWP) values relative to CO_2

Common chemical name or industrial designation	Chemical formula	GWP values for 100-year time horizon		
		Fourth Assessment Report (AR4)	Fifth Assessment Report (AR5)	Sixth Assessment Report (AR6)
Major Greenhouse Gases				
Carbon dioxide	CO_2	1	1	1
Methane – non-fossil	CH_4	25	28	27.0
Methane – fossil	CH_4	N/A	30	29.8
Nitrous oxide	N_2O	298	265	273
Nitrogen trifluoride	NF_3	17,200	16,100	17,400
Sulfur hexafluoride	SF_6	22,800	23,500	24,300

Chapter II. National inventory report…

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D. Metrics (37)

E. Reporting guidance (38)

1. Information on methods and cross-cutting elements (39-46)
2. Sectors and gases (47-56)
3. Time series (57-58)

*Final exercise on inventory reporting requirements

Based on the provisions of the MPG, use "Table NIR-E: Reporting Guidance" in the file "02. BTR checklist_NIR" to determine:

- Whether the data is available or can be produced (Yes/No/NA).

- Whether there are any capacity constraints or flexibility provision to be applied.

- Whether there are any areas for improvement and the corresponding time frame.

E. Reporting guidance

38. [...] Each Party shall provide a NIR of anthropogenic emissions by sources and removals by sinks of GHGs. The NIR consists of a national inventory document and the common reporting tables [...].

1. Information on methods and cross-cutting elements (1/2)

Each Party shall:

39. Report methods used, including the rationale for the choice of methods [...], and the descriptions, assumptions, references and sources of information used for the EF and AD used [...].

40. Provide information on the category and gas, and the methodologies, EF and AD used at the most disaggregated level [...] including related data references for reported emission and removal estimates for any country-specific category and gas [...].

41. Describe the key categories, including information on the approach used for their identification, and information on the level of disaggregation used [...].

42. Report the individual and cumulative percentage contributions from key categories, for both level and trend [...].

NA

43. Report recalculations for the starting year […] and all subsequent years of the inventory time series, together with explanatory information and justifications for recalculations with an indication of relevant changes and their impact on the emission trends […].

44. Report the results of the uncertainty analysis as well as methods used, underlying assumptions, as applicable, and trends, at least for the starting year and the latest reporting year of the inventory time series […].

45. Report information on the reasons for lack of completeness, including information on any methodological or data gaps […].

46. Report the QA/QC plan and information on QA/QC procedures already implemented or to be implemented in the future […].

2. Sectors and gases (1/4)

47. Each Party shall report estimates of emissions and removals for all categories, gases and carbon pools considered in the NGI throughout the reported period on a gas by-gas basis in units of mass at the most disaggregated level [...], using the CRT, including a descriptive summary and figures underlying emission trends, with emissions by sources listed separately from removals by sinks, except in cases where it may be technically impossible to separate information on emissions and removals in the LULUCF sector, and noting that a minimum level of aggregation is needed to protect confidential business and military information.

48. Each Party shall report seven gases: CO_2, CH_4, N_2O, HFCs, PFCs, SF_6 and NF_3;

Parties that need **flexibility** [...] have the flexibility to instead report at least three gases (CO_2, CH_4 and N_2O) as well as any of the additional four gases (HFCs, PFCs, SF_6 and NF_3) that are included in the Party's NDC [...], are covered by an activity under Article 6, or have been previously reported.

2. Sectors and gases (2/4)

49. Each Party reporting HFCs, PFCs, SF_6 and NF_3 shall report actual emissions of the gases, providing disaggregated data by chemical and category in units of mass and in CO_2 eq.

50. Each Party shall report the following sectors: energy, IPPU, agriculture, LULUCF and waste [...].

51. Each Party should provide information on the following precursor gases: CO, NO_x, NMVOC and SO_x.
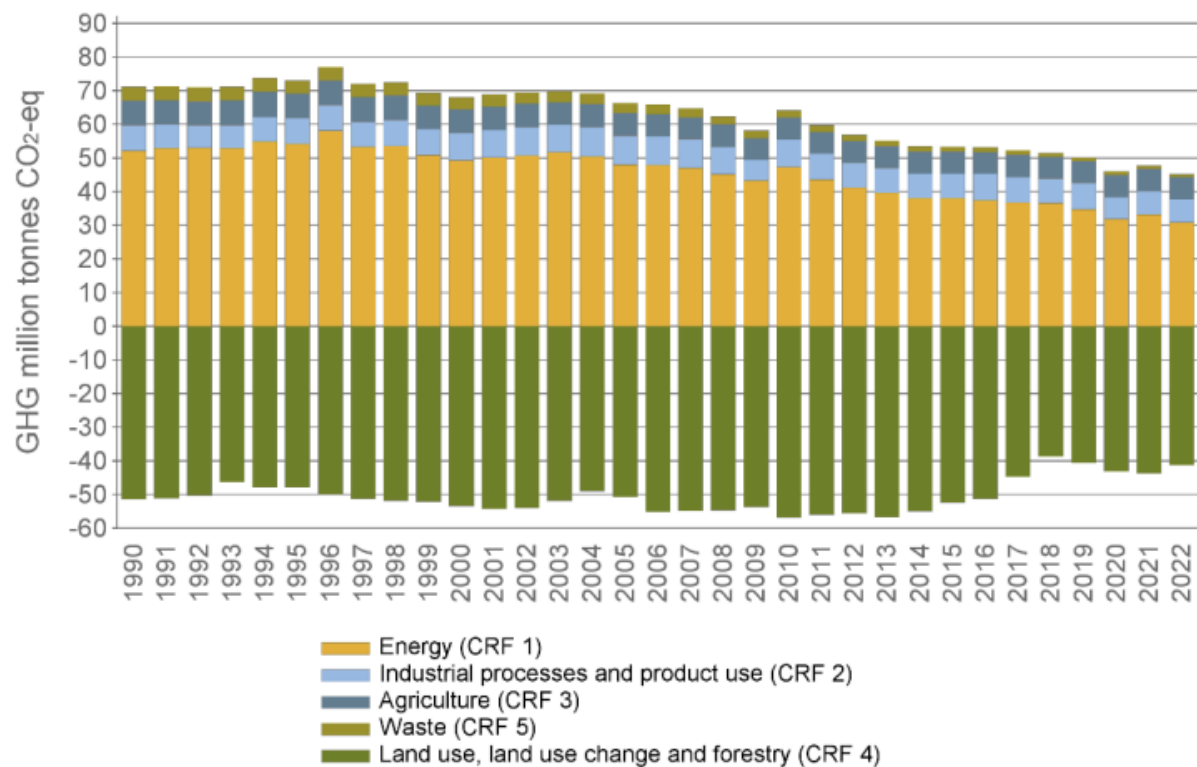

Energy (CRF 1)
Industrial processes and product use (CRF 2)
Agriculture (CRF 3)
Waste (CRF 5)
Land use, land use change and forestry (CRF 4)

Figure 2.1. Total emissions and removals of greenhouse gases calculated as CO_2-eq. from Land use, land use change and forestry (LULUCF, CRT 4) and the other sectors (CRT 1, 2, 3 and 5), 1990-2022.

2. Sectors and gases (3/4)

52. Each Party may report indirect CO_2 from the atmospheric oxidation of CH_4, CO and NMVOCs. For Parties that decide to report indirect CO_2, the national totals shall be presented with and without indirect CO_2. Each Party should report indirect N_2O emissions from sources other than those in the agriculture and LULUCF sectors as a memo item. Those estimates of indirect N_2O shall not be included in national totals. Parties may provide information on other substances that have an impact on climate.

53. Each Party should report international aviation and marine bunker fuel emissions as two separate entries and should not include such emissions in national totals but report them distinctly, if disaggregated data are available, making every effort to both apply and report according to the method contained in the IPCC guidelines [...] for separating domestic and international emissions.

2. Sectors and gases (4/4)

54. Each Party should clearly indicate how feedstocks and non-energy use of fuels have been accounted for in the inventory, under the energy or IPPU sector […].

55. In the case of a Party addressing the emissions and subsequent removals from natural disturbances on managed lands in its NGI, that Party shall report information on the approach taken, and how it is consistent with IPCC guidance, as appropriate, and shall indicate if the estimates are indicated in national totals.

56. In the case of a Party using an approach to reporting emissions and removals from harvested wood products (HWP) in accordance with IPCC guidance other than the production approach, that Party shall also provide supplementary information on emissions and removals from HWP estimated using the production approach.

3. Time series

57. Each Party shall report a consistent annual time series starting from 1990;

Parties that need **flexibility** […] have the flexibility to instead report data covering, at a minimum, the reference year/period for its NDC […] and, in addition, a consistent annual time series from at least 2020 onwards.

58. For each Party, the latest reporting year shall be no more than two years prior to the submission of its NIR;

Parties that need **flexibility** […] have the flexibility to instead have their latest reporting year as three years prior to the submission of their NIR.
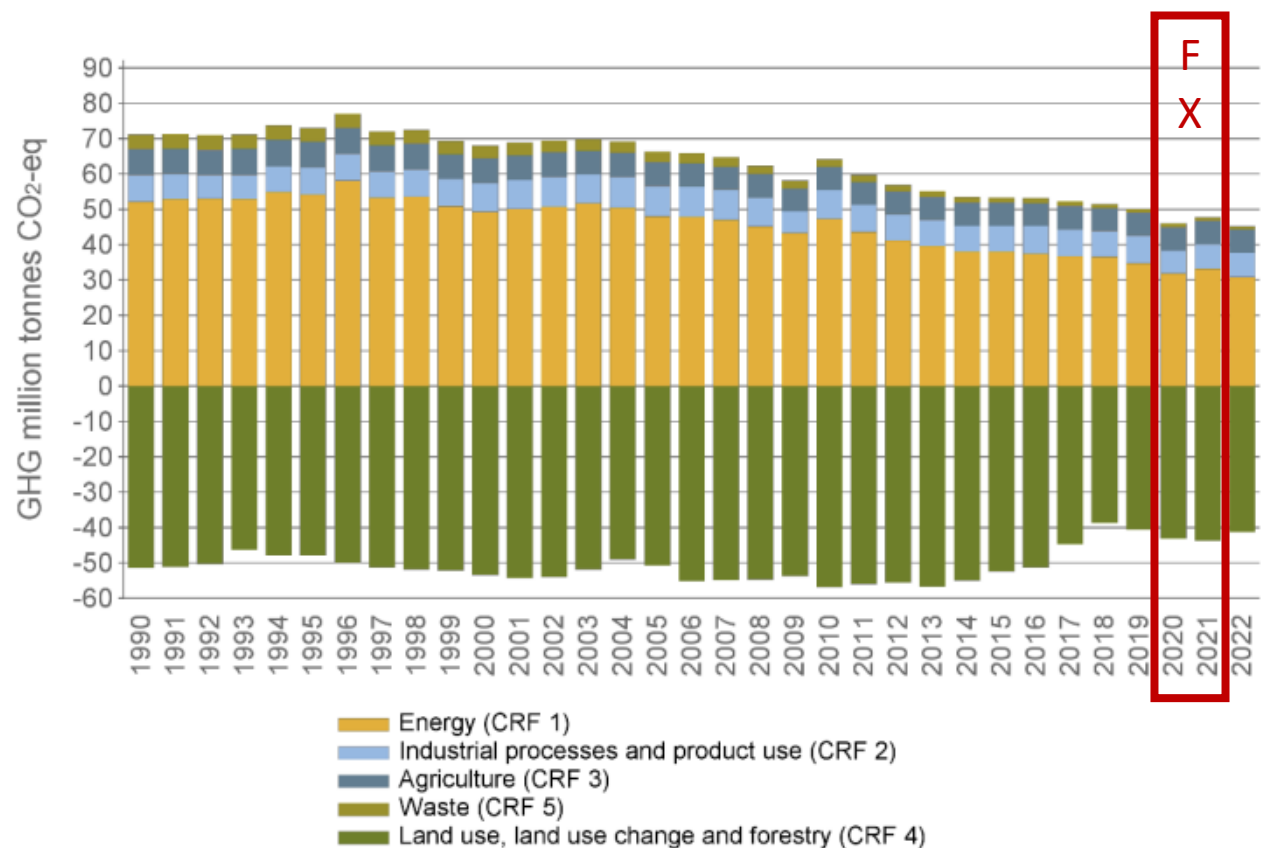

Figure 2.1. Total emissions and removals of greenhouse gases calculated as CO_2-eq. from Land use, land use change and forestry (LULUCF, CRT 4) and the other sectors (CRT 1, 2, 3 and 5), 1990-2022.

*Flexibility

SUMMARY TABLE ON THE USE OF FLEXIBILITY PROVISIONS

Back to Index

MPG flexibility provision	Year	Sector	Category	Gas	Description of the application of flexibility	Clarification of capacity constraint	Timeframe for improvement	Progress made in addressing areas of improvement

Note: This table is used on a voluntary basis.

Thank you for your attention

Paulo CORNEJO
CBIT-GSP Regional Coordinator for Spanish-speaking LAC
UNEP Copenhagen Climate Centre
paulo.cornejoguajardo@un.org