IPCC National GHGI Reporting and Guidelines for Energy, Waste Sectors –

Approaches to the data collection

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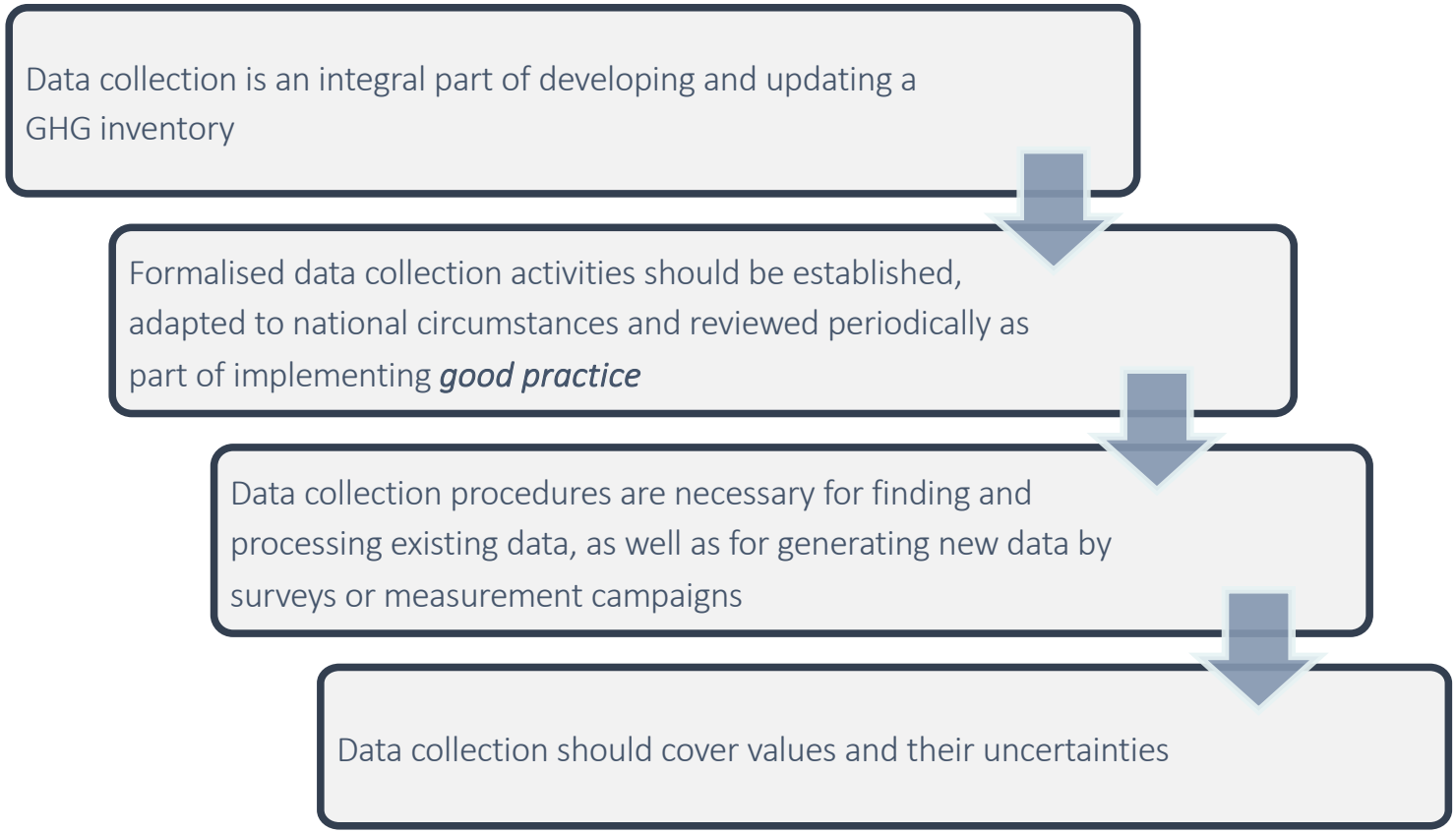
Approaches to Data Collection

Outline

- Why is data collection important in GHG compilation
- Data acquisition and confidentiality
- Collection of data
  - Sources of data
  - Collecting existing data
  - Generating new data
- Adapting data for inventory use
- Derivation or review of emission factors (EFs)
- Production or review of activity data (AD)
- Protocol for expert elicitation
- Summary

- Why is data collection important in GHG compilation



Reference: UNFCCC CGE Training material

Data acquisition: Dealing with restricted data and confidentiality

- It is good practice to engage data suppliers in the process of inventory compilation and improvement

- Data providers might restrict access to information because it is confidential, unpublished, or not yet finalized.

- Find solutions to overcome these concerns by:
  - explaining the intended use of the data,
  - agreeing, in writing, to the level at which it will be made public,
  - identifying the increased accuracy that can be gained through its use in inventories,
  - offering cooperation to derive mutually acceptable data sets,
  - and/or giving credit/acknowledgement in the inventory to the data provided.

Reference: UNFCCC CGE Training material

Gathering existing data: Possible sources of country-specific data

National	International	Other
• National statistics Agencies • Sectoral experts, stakeholder organisations • Other national experts • Reference libraries (National Libraries) • National Inventory Reports from Parties to the United Nations Framework Convention on Climate Change	• IPCC Emission Factor Database (EFDB) • International organisations publishing statistics e.g., United Nations, Eurostat or the International Energy Agency, OECD, FAO and the IMF (which maintains international activity as well as economic data) • Other international experts	• Scientific and technical articles in environmental books, journals and reports • Universities • Web search for organisations & specialists

Reference: UNFCCC CGE Training material

Collection of data: General guidance for gathering existing data – Important Steps

- **Begin with screening of available data**
  - Iterative process where details of available data are built up
  - Slow and requires questioning until final judgment about usefulness of a data set for the inventory can be made e.g. consider the original intent for data source

- **Refining data requirements**
  - Formal specification and data request (i.e. knowing what to ask for, from whom, and when)
  - Specifications include the following:

Reference: UNFCCC CGE Training material

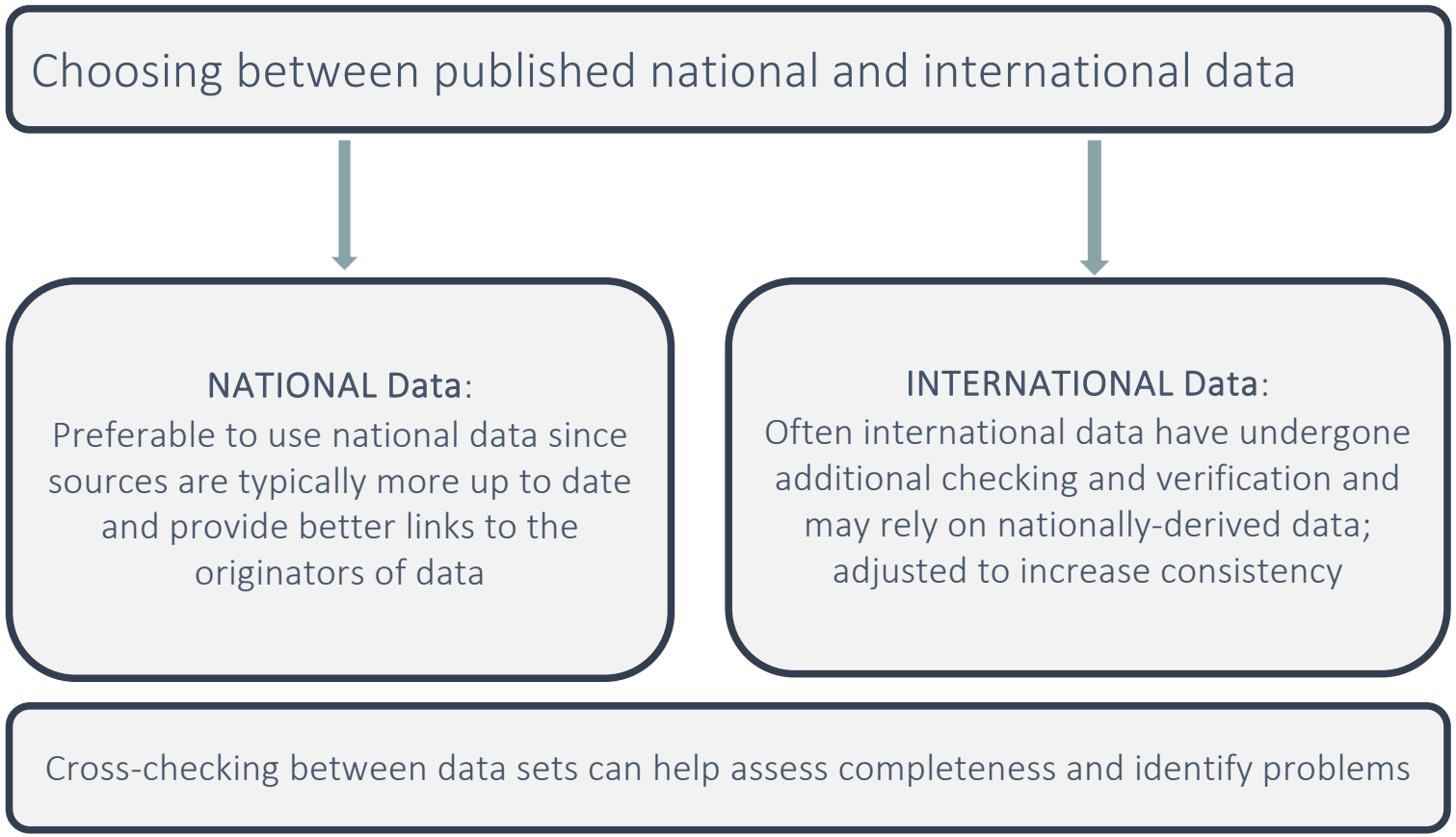
Collection of data: Refining data requirements (specifications)…

Part: 1	• Definition of the data set (e.g., time series, sectors and sub-sector detail, national coverage, requirements for uncertainty data, emission factors and/or activity data units), • Definition of the format (e.g., spreadsheet) and structure (e.g., what different tables are needed and their structure) of the data set
Part:2	• Description of any assumptions made regarding national coverage, the sectors included, representative year, technology/management level, and emission factors or uncertainty parameters • Identification of the routines and timescales for data collection activities (e.g., how often is the data set updated and what elements are updated),
Part:3	• Reference to documentation and QA/QC procedures, • Contact name and organisation, • Date of availability

Reference: UNFCCC CGE Training material

Collection of data: General guidance to gathering existing data

- National versus International data



Reference: UNFCCC CGE Training material

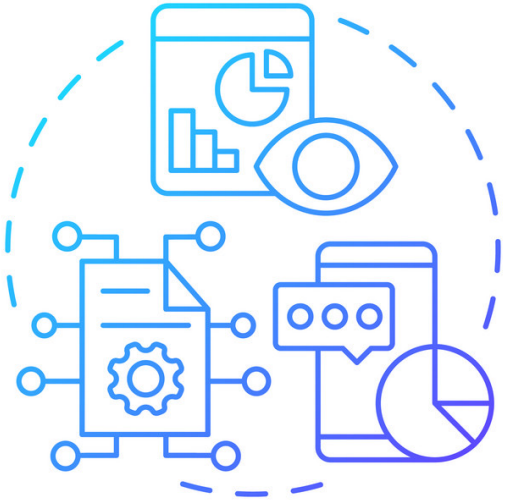
Using existing data

Gathering existing data is a critical step in developing a comprehensive Greenhouse Gas (GHG) inventory. It lays the foundation for accurate reporting and informed decision-making.

A diverse range of sources provides country-specific data, including National Statistics Agencies, sectoral experts, international organizations, and databases such as the IPCC Emission Factor Database

Initiating data collection begins with a screening process. This iterative approach involves building up details of available data, ensuring relevance to the inventory's objectives.

Selecting a data set is followed by refining data requirements. This step involves developing a formal specification and data request, ensuring efficient annual updating while complying with QA/QC requirements.



In cases where directly applicable data are unavailable, surrogate data become valuable.

Collection of data: General guidance to gathering existing data- Surrogate data

When to use and what is Surrogate data?

- In some cases, directly applicable data may be unavailable or have gaps (e.g., if survey and sampling programmes may be infrequent).
- surrogate data – alternative data that have a correlation with the data that they are replacing should be physically and statistically related to the facility emissions:

What is Good Practice?:

When using surrogate data to estimate emissions or removals, it is **good practice** for countries to perform the following steps:

1) Confirm and document the physical relationship between emissions/removals and the surrogate activity data.

2) Confirm and document a statistically significant correlation between emissions/removals and the surrogate activity data.

3) Using regression analysis, develop a country-specific factor relating emissions/removals to the surrogate data

Reference: UNFCCC CGE Training material

Collection of data: Generating new data

If representative emission factors, activity data or other estimation parameters do not exist, or cannot be estimated from existing sources.

- By measurements
  - Representative sample
  - Suitable measurement method
  - Well-designed measurement program defines (Table 2.1, Vol 1 2006 GL):
    - Measurement objective
    - Methodology protocol
    - Measurement plan with clear instructions to the measurement personnel
    - Data processing and reporting procedures, and documentation

- Using models
  - Models can be used to generate data
  - Models are a means of data transformation

Reference: UNFCCC CGE Training material

Generating New Data

A Importance and Considerations for New Data Generation

Need for New Data

- New data may be required when representative emission factors or activity data are unavailable or cannot be estimated from existing sources.

Types of New Data Generation

- Measurement programs for industrial process or energy-related emissions.
- Sampling of fuels for carbon content.
- Land-use change and forestry sampling activities.
- New censuses or surveys for activity data.

Expertise and Resource Intensity

- New data generation requires appropriate expertise.
- Measurement programs should be conducted by competent organizations with calibrated equipment.
- Surveys and censuses are best handled by national statistical authorities.

Resource Optimization

- Activities are often resource-intensive.
- Considered when the category is key, and no other options exist.
- Optimize resources by extending existing programs rather than initiating entirely new ones.

Specific Details

- More specific guidelines for emission factor and activity data are outlined in respective chapters.
- Reference guidelines from official bodies, such as statistical offices and measurement standards committees.

Adapting data for inventory use

Aim: to ensure that the level of detail and coverage of the data, including sectors/process/abatement, match the location, land type, compound and years included

- Greenhouse gas inventories require consistent estimates across time series and between categories.
- Adapting data includes filling gaps if data are missing for one or more years or the data do not represent the year or national coverage required.

(Techniques to address gaps in data sets will be explained in detail in the other presentation “Time Series Consistency”.)

Reference: UNFCCC CGE Training material

Adapting data for inventory use - examples of approaches

Combining data sets numerically:

Presented with several potential datasets for the same estimates?

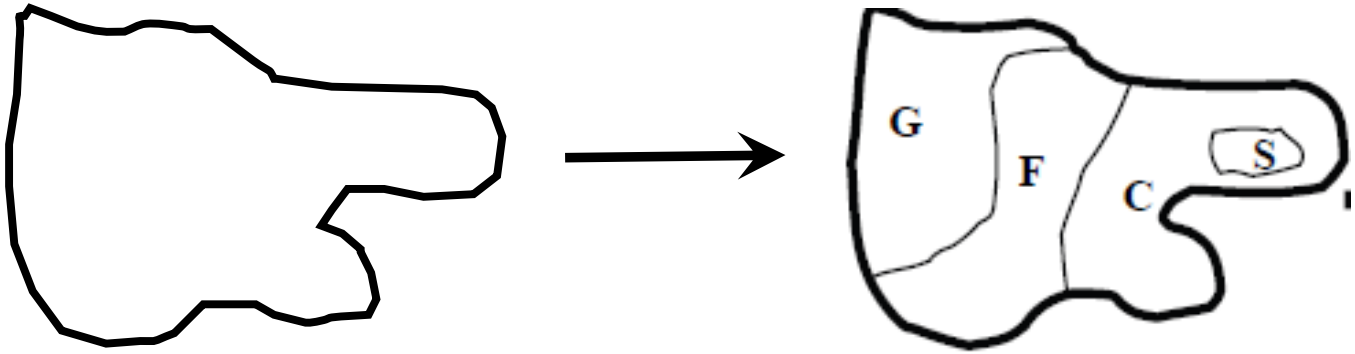
- Combination can be achieved by pooling the raw data and re-estimating the mean and 95% confidence limit
- Also possible to combine measurements of a single quantity made using different methods that produce results with different underlying probability distributions.
- Method could be more complex; sufficient to use expert judgment to average the results or identify more reliable data set

Reference: UNFCCC CGE Training material

Adapting data for inventory use

Data that are not homogenous?

- Inventory estimate should be stratified (subdivided) so that each stratum is homogeneous and the national total for the source category will then be the sum of the strata.



Reference: UNFCCC CGE Training material

Adapting data for inventory use

Empirical datasets contain outliers?

- Rule: lying more than 3x standard deviation
- But exercise caution: anomalous data may indicate some other set of circumstances that may need to be separately estimated (e.g. plant in start-up conditions; drainage leading to sudden release of CH_4 in rice field)

Multi-year averaging?

- Countries should report annual inventory estimates
- Avoid using multi-year averaging of data:
  - over- or under-estimates of emissions over time
  - increased uncertainty
  - reduced transparency, comparability, or time-series consistency of estimates

Reference: UNFCCC CGE Training material

Adapting data for inventory use

Non-calendar year data?

- *Good Practice* to use calendar year (CY) data whenever available
- If not, use other types; but use consistently over time-series and document
- Data should be corrected where possible to represent CY

Regional inventory data?

- In some cases, regional data are more detailed and up-to-date than national data
- Can be used provided that:
  - Each regional component is compiled consistent with good practice QA/QC, choice of tiers, Time Series Consistency, and completeness
  - The approach to aggregate is transparent
  - The final inventory complies with good practice requirements

Reference: UNFCCC CGE Training material

Adapting data for inventory use

A Strategies for Addressing Data Gaps in Greenhouse Gas Inventories

Types of Data Gaps:

Filling Gaps in Periodic Data:

Examples: Infrequent surveys (e.g., national forest inventories).

Methods: Inference, splicing, extrapolation (Chapter 5: Time Series Consistency).

Time Series Revision:

Use of modeling and assumptions by statistical organizations for the most recent year.

Refinement in the following year with further data processing.

Integration of revised data into the inventory .

Incorporating Improved Data:

Challenges when recent data improvements are not suitable for earlier years.

Addressing inconsistencies in time series with detailed new data (e.g., emission factors for modern vs. older plants).

Stratification using expert judgment or surrogate data

Compensating for Deteriorating Data:

Use of splicing techniques for managing deteriorating data sets.

Deterioration due to changing priorities, economic restructuring, or diminishing resources.

Consideration of international data sources for relevant activity data.

Incomplete Coverage:

Usage of available data even when incomplete (e.g., measurements for a subset of plants or partial survey data).

Combination with other data sets for calculating national estimates.

Recommendations for expert judgment and data combination with considerations for time series consistency.

Adapting data for inventory use

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Emission factors and direct measurement of emissions

A IPCC Emission Factor Database

Introduction:

- The IPCC Emission Factor Database (EFDB) serves as a dynamic, web-based information exchange platform.
- It facilitates the sharing of emission factors and parameters crucial for greenhouse gas estimation at the national level.

Accessing the EFDB:

- The database is accessible online through the IPCC, IPCC-NGGIP, or directly at http://www.ipcc-nggip.iges.or.jp/EFDB/main.php.

Purpose and Design:

- The EFDB acts as a global forum for experts and researchers to communicate and share new emission factors and parameters.
- It aims to become a recognized library providing users with comprehensive information and technical references.

Inclusion Criteria (See Figure 2.2):

- **Robustness:** Value remains stable within accepted uncertainty upon repetition of the original measurement or modeling.
- **Applicability:** Clear understanding of source, technology mix, operating conditions, environmental factors, and abatement technologies.
- **Documentation:** Original technical reference information provided for evaluation of robustness and applicability.

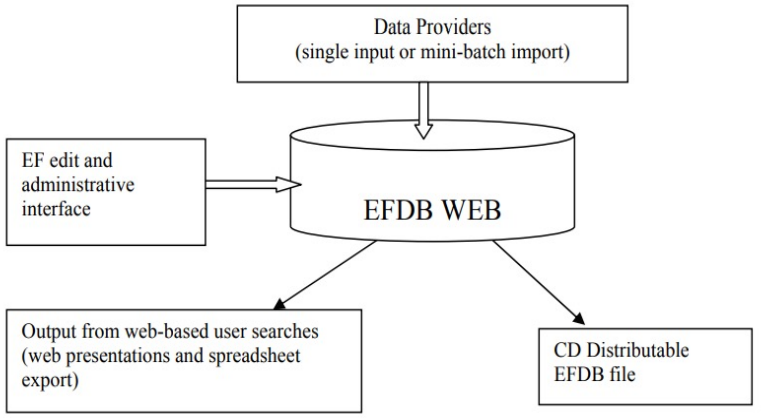
Contributions and Assessment:

- The EFDB invites worldwide experts and researchers to submit new emission factors and parameters.
- The Editorial Board evaluates proposals based on predefined quality criteria (robustness, applicability, documentation).
- Inclusion in the database is contingent upon meeting these quality standards.

User Responsibility:

- Users can judge the applicability of the emission factor or parameter for their inventory.
- The responsibility for appropriate use rests with the users.

Process for including data in the EFDB



How are EFs derived?

It is good practice to follow a stepwise approach to data collection by:

- Setting priorities
- Developing a strategy for accessing the data, and
- Collecting and processing data

The derivation or review of emission factors and other estimation parameters include use of:

Literature sources

Data obtained by measurements

Derived datasets

Reference: UNFCCC CGE Training material

How are EFs derived?

1. Literature sources

- A useful approach for gathering and selecting from among a variety of possible data
- Maybe time-consuming because many lead to old data
- Should be fully documented to be transparent
- It is *good practice*, for countries to use their own, peer-reviewed, published literature because this should provide the most accurate representation of their country's practices and activities.
- If no country-specific peer-reviewed studies available, the inventory compiler can use IPCC default factors and Tier 1 methods as indicated by the decision trees in Volumes 2 to 5, or Tier 2 methods with data from Emission Factor Database (EFDB), or other literature values

Reference: UNFCCC CGE Training material

Table 2.2 , Vol 1, 2006 GL Potential sources of literature data		
Literature Type	**Where to find it**	**Comments**
IPCC Guidelines	IPCC website	Provide agreed default factors for Tier 1 methods but may not be representative of national circumstances.
IPCC Emission Factor Database (EFDB)	IPCC website	Described in more detail below. May not be representative of processes in your country or appropriate for *key category*estimates.
EMEP/EEA Emission Inventory Guidebook (Formerly EMEP/CORINAIR)	EEA (European Environment Agency website)	Useful defaults or for cross-checking. May not be representative of processes in your country or appropriate for *key category*estimates.
International Emission Factor Databases: USEPA	USEPA website	Useful defaults or for cross-checking. May not be representative of processes in your country or appropriate for *key category*estimates.
Country-specific data from international or national peer reviewed journals	National reference libraries, environmental press, environmental news journals	Reliable if representative. Can take time to be published.
National testing facilities (e.g., road traffic testing facilities)	National laboratories	Reliable. Need to make sure the factors are representative and that standard methods are used.

Reference: UNFCCC CGE Training material

How are EFs derived?

2. Data obtained by measurements (applies concepts presented in 2006 GL, Volume 1, Section 2.2.2 to assess quality of measurement data)

- Emissions can be determined directly (e.g., using continuous emission monitoring systems) or calculated
- Require a well-designed measurement program
- Require suitable and well-documented measurement methods

Reference: UNFCCC CGE Training material

How are EFs derived?

2. **Data obtained by measurements** (applies concepts presented in Volume 1, Section 2.2.2 to assess quality of measurement data)

- Use instruments with known performance characteristics (i.e. regularly calibrated, maintained, and inspected) or perform relative accuracy audits against established standard reference methods
- Be representative of the sector-specific activity or practice and appropriate for national circumstances
- Not double-count or omit the emissions data that are intended to be measured

Reference: UNFCCC CGE Training material

How are Activity Data produced?

It is good practice to follow a stepwise approach to data collection by:

- Setting priorities
- Developing a strategy for accessing the data, and
- Collecting and processing data

The production or review of activity data include use of:

Information on specialized data sources

Surveys and censuses

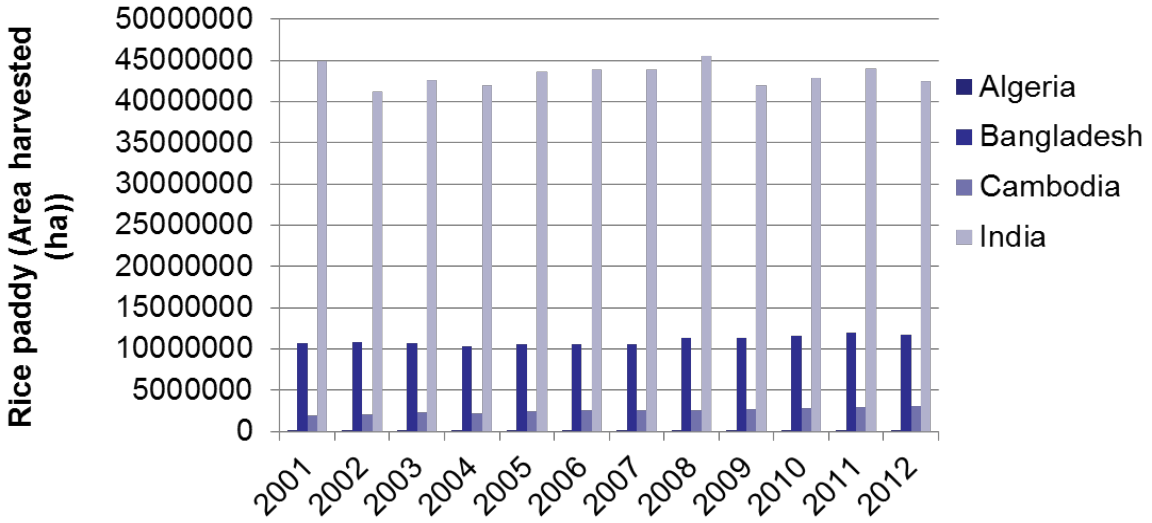
Measurement related data, where appropriate

Reference: UNFCCC CGE Training material

How are Activity Data produced?

1. Information on specialized data sources

- Use data from such bodies as National Statistical Agencies, and national regulatory authorities
- National and international statistics
- Other sources of specialized literature (UN statistics, US Geological Survey, etc.)



Source: FAOSTAT 2013

Reference: UNFCCC CGE Training material

How are Activity Data produced?

2. Survey and Census Information

- Provide the best agricultural, production and energy statistics for GHG inventories
- Generally these data are compiled by national statistical agencies or relevant ministries for national policy purposes or to comply with international demand for data

Survey data:

- Derived from sampling and do not include real data for the whole population
- Representativeness and methods for developing the population estimate require careful review

Census data:

- Based on a complete count of the whole population
- Limited in detail and can be costly and time consuming

Reference: UNFCCC CGE Training material

How are Activity Data produced?

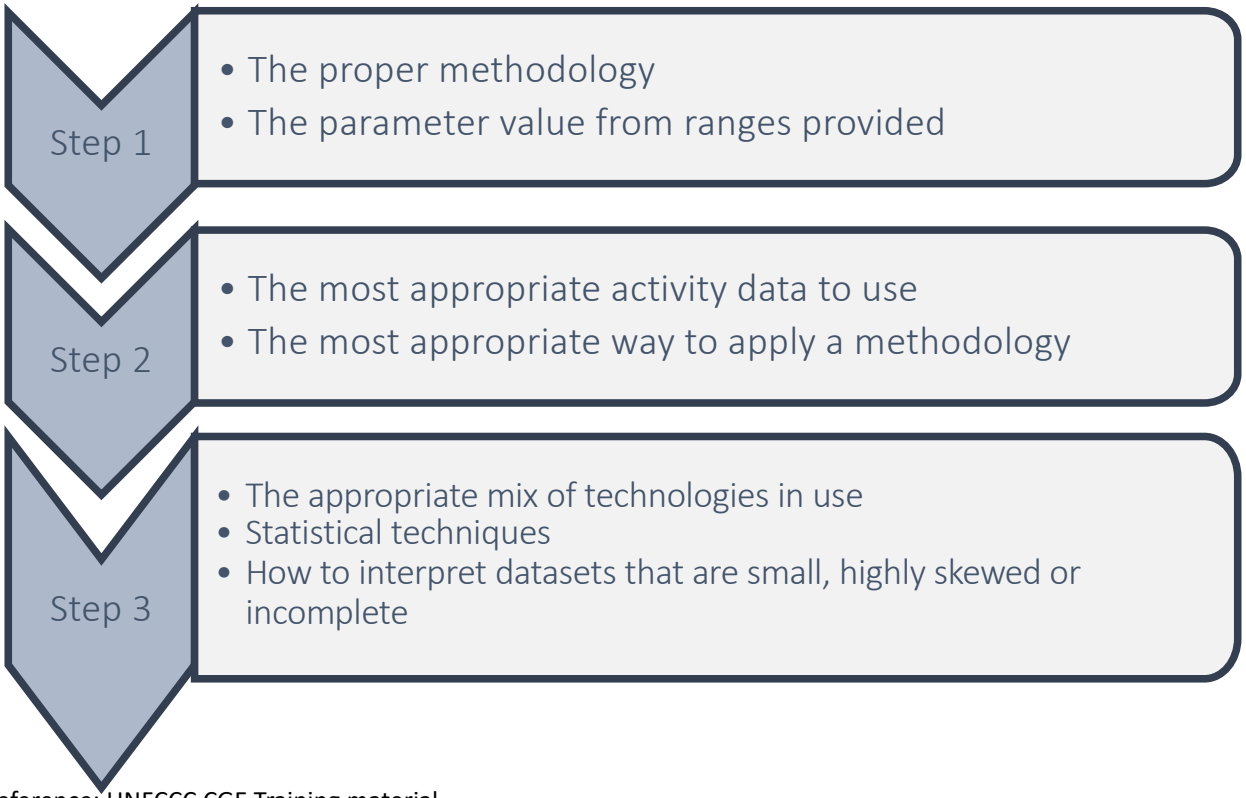
2. Survey and Census Information

- Energy surveys: The best way to avoid double-counting is to compile energy balances according to the basic principles, concepts and methods developed at the international level.
- Industry surveys: Standardised lists of industrial commodities have been established at international level, and countries are encouraged to adopt these lists for collecting harmonized statistics.
- Agriculture surveys & censuses: The FAO promotes and provides guidance on national censuses of agriculture.
- Forest surveys: The FAO also provides support national forest assessments including on the sampling design, intensity, plot configuration and variables to collect.
- Waste surveys: Volume and composition of industrial waste that they produce each year is generally estimated. However, the volume of production is directly proportional. Municipal waste can be estimated by weighing vehicles before and after collection.

Reference: UNFCCC CGE Training material

Why is Eliciting expert judgment important?

- Aim to be as representative as possible in order to reduce possible bias and increase accuracy.
- Use of expert judgment may be needed when determining:



Reference: UNFCCC CGE Training material

Eliciting expert judgment?

In some cases, an appropriate protocol is especially important. For example, to fill gaps in the available data, to select data from a range of possible values or make judgments about uncertainty ranges.

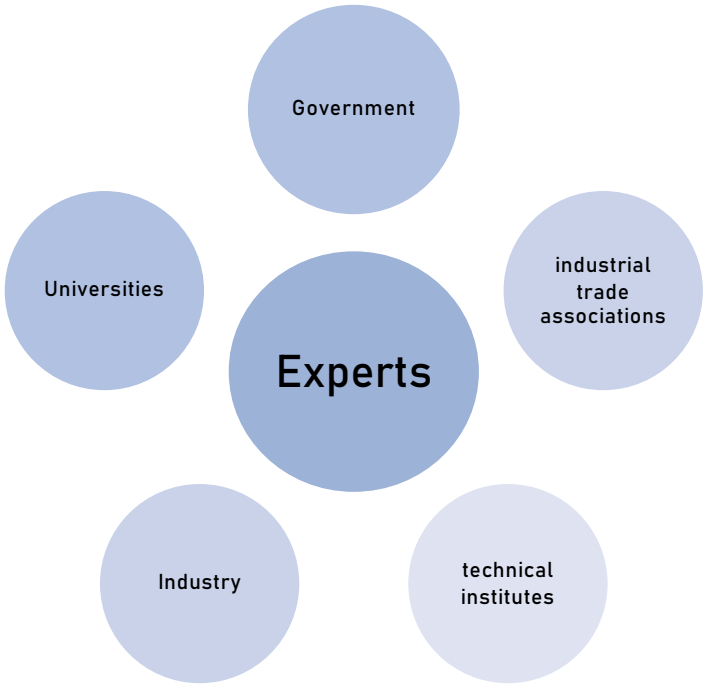
- Motivating: establish a rapport; describe the context
- Structuring: define the quantities for which judgements are to be sought (e.g. the year and country, the source/sink category, the structure of the inventory model, etc).
- Conditioning: work with the expert to identify and record all relevant data, models, and theory relating to the formulation of the judgements.
- Encoding: encoding is the process of converting an expert's judgement regarding uncertainty into a quantitative PDF (see Vol 1. Chapter 3).
- Verification: analyze the expert's response and provide the expert with feedback. Is what has been encoded really what the expert meant? Are there inconsistencies in the expert's judgement?

Reference: UNFCCC CGE Training material

Expert judgement

Expert judgment, a fundamental component of inventory development, refers to the well-informed conclusions and selections made by subject-matter experts. It acts as a pillar for managing information gaps and making important choices.

Expert judgment forms the basis of all inventory development efforts. Sector specialists play a crucial role in providing insights and filling gaps in data where necessary.



Assist

- selecting methodologies
- parameter values
- activity data
- ensuring a comprehensive approach

Summary of presentation – Key messages

- IPCC Guidance provides advice on approaches to data collection (Chapter 2, Vol 1, 2006 GL)
- It is good practice to have a formalized data collection process adapted to national circumstances
- Need to follow data collection procedures for collection of new and existing data
- Good practice for Inventory compilers to follow methodological approaches for data collection as listed in the IPCC guidelines
- Advice on emission factors focuses on understanding and generating measured data as well as finding and using default factors
- Advice on activity data focuses on generating and using new census& survey data as well as use of existing national and International data sets
- Guidance on adapting data for inventory use,
- The need for maintaining QA/QC records during every stage of data collection
- Protocol for expert elicitation

Reference: UNFCCC CGE Training material

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