


IPCC's Guidelines and Tools for the National GHG Inventory

United Nations Statistical Commission

Towards the Global Set of Climate Change Statistics and Indicators - Virtual event

19 February 2021

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IPCC Plenary

IPCC Bureau

IPCC Executive Committee

IPCC Secretariat
(in Geneva, Switzerland)

Working Group I	Working Group II	Working Group III	Task Force on National Greenhouse Gas Inventories (TFI)
The Physical Science Basis	Climate Change Impacts, Adaptation and Vulnerability	Mitigation of Climate Change	
TSU (France/China)	TSU (Germany/South Africa)	TSU (UK/India)	TSU (Japan)

Authors, Contributors, Reviewers

Develop and refine the internationally-agreed methodology to estimate GHG emissions and removals at national level
Encourage the widespread use of this

What are National GHG Inventories?

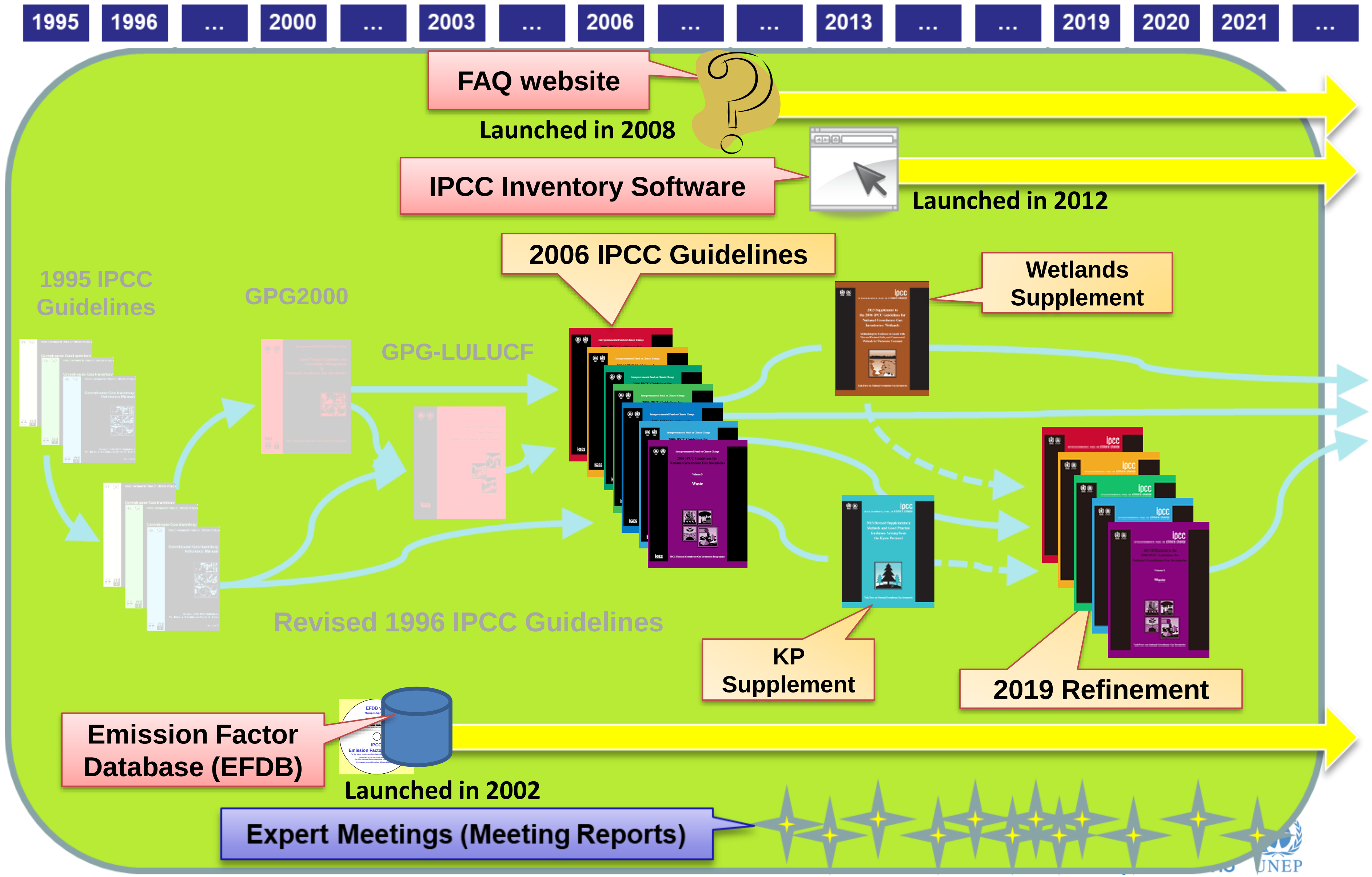
- **Time series of national statistics** of all emissions and removals of greenhouse gases (GHG) from given sources and sinks (i.e. GHG Inventory categories) from a defined territory in a specific period of time associated with human activities.

- **National statistics**:
  - Anthropogenic Greenhouse Gases fluxes,
  - Occurring within a year, in a series across years
  - Across the entire National Territory

Why do we need inventory guidelines?

- Any international agreement to limit climate change must set emission limits/targets/goals and monitor progress in an open and transparent way
- Currently, **most emissions/removals can only be estimated at national scale, not measured**, and so consensus on the best way of doing this is needed
- To do this we need reliable, generally accepted methods and guidelines

IPCC Guidelines and supporting tools



IPCC Guidelines and Paris Agreement

- “Katowice Climate Package” to operationalize the PA. UNFCCC COP24/CMA.1, December 2018.
  - **Each Party shall use** the **2006 IPCC Guidelines**, and shall use any subsequent version or refinement of the IPCC guidelines agreed upon by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement (CMA).

Source: IISD/ENB

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How?

Infer emissions based on parameters (EF) associated with activities (AD). For example:

- ✓ Amount of fuel burnt (AD)
- ✓ Carbon content in fuel determines the amount of CO_2 emitted from a unit of fuel burnt (EF)
- ✓ CO_2 proportional to amount of fuel burnt (E)

$$E_{GHG} = AD \times EF_{GHG}$$

Where: E = Emission; AD = Activity Data; EF = Emission Factor

95% CI of AD, EF, and Estimates is to be calculated

Data Collection

- In establishing routine, formalised, data collection use should be made of existing **statistical organisations**…

  (e.g. , waste statistics for the estimation of methane emissions)

- It is ***good practice* to engage data suppliers** in the process of inventory compilation and improvement by involving in activities as:
  - …
  - Scientific or statistical workshops on the inventory inputs and outputs

- **Census** *vs* **Survey/Sampling**

- **Accuracy** & **Precision**

- **Uncertainty Analysis**
  - *Uncertainty in the mean vs Uncertainty in the individual*
  - *Standard error vs Standard deviation*

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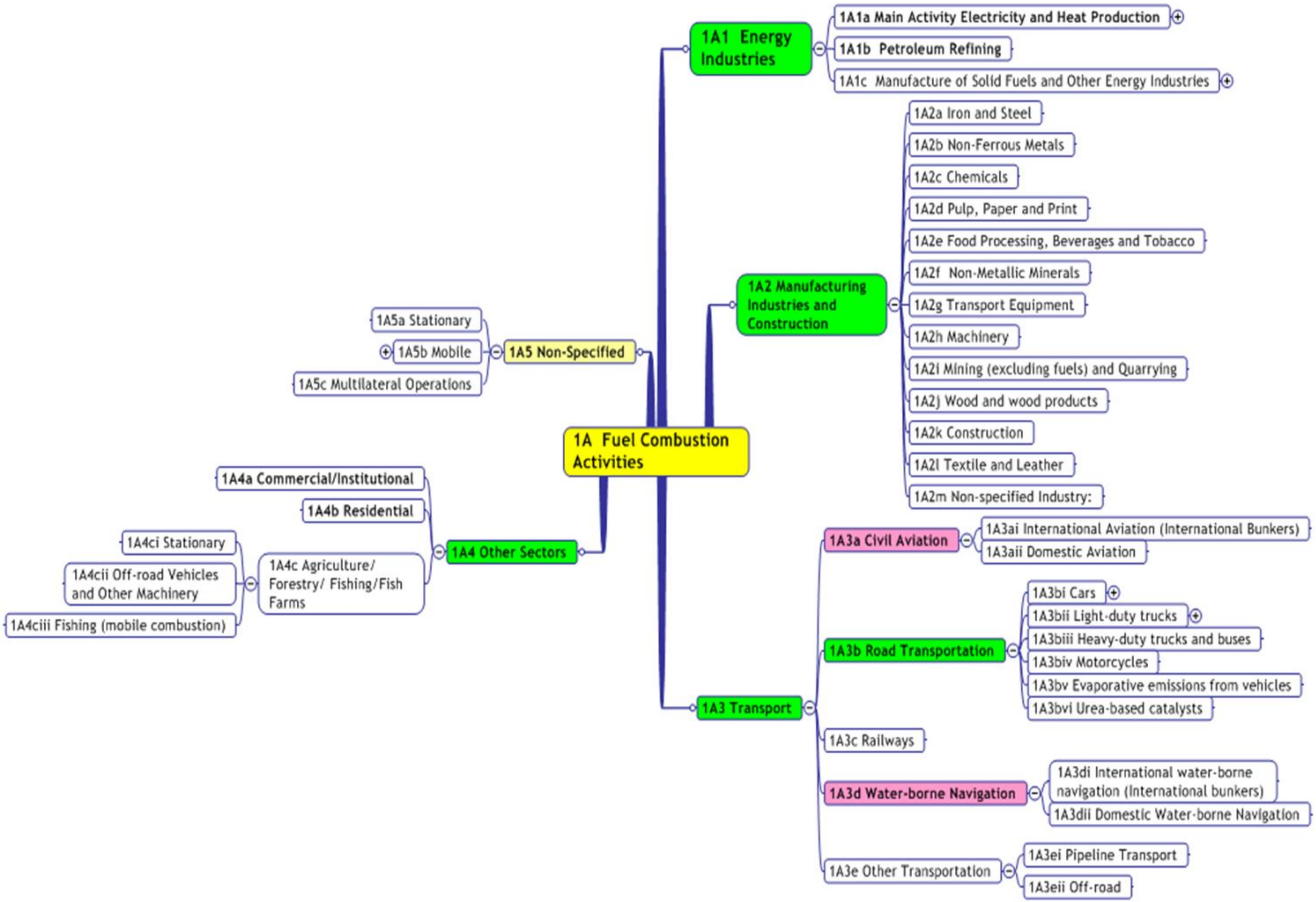
Focus on Fuel Combustion activities



Fuel Combustion – Activity Data [Gg (TJ)]

- For each source category, **fuel consumption/sales** of fuel:
  - ✓ LIQUID FOSSIL FUELS *(Crude oil and petroleum products)*
  - ✓ SOLID FOSSIL FUELS *(Coal and coal products)*
  - ✓ GAS FOSSIL FUELS *(Natural Gas)*
  - ✓ OTHER FOSSIL FUELS *(e.g. waste)*
  - ✓ PEAT *(CO_2 adds to the Energy sector total)*
  - ✓ BIOMASS *(bioliquid, biosolid and biogas fuels, waste bio-fraction; CO_2 does NOT add to the Energy sector total)*
- In statistics data on fuels consumption/sale are in physical units, e.g. in tonnes or cubic metres

Fuel Combustion – Net Calorific Value [TJ/Gg]

- To convert AD to energy units requires calorific values.
- IPCC Guidelines use the **net calorific values** (NCVs), expressed in SI units.
- Some statistical offices use gross calorific values (GCVs).

  The difference between NCV and GCV is the latent heat of vaporisation of the water produced during fuel combustion.
- Calorific value is fuel specific and thus independent of combustion technology.

Fuel Combustion – EF [kg/TJ]

- Default assumption is that all carbon contained in the fuel is oxidised to CO_2 *(this in practice includes the indirect CO_2 emissions caused by the subsequent oxidation in atmosphere of non-CO_2 carbon emissions)*. Thus,
  - ✓ CO_2 EFs are based on the **C-content of the fossil fuel**
  - ✓ Since independent of combustion technology, same fuel-specific default CO_2 EF is applicable to all combustion processes
- CH_4 and N_2O emissions are strongly dependent on the technology applied in both stationary and mobile combustions, thus EFs vary accordingly

2006 IPCC Guidelines: Reference Approach

- The Reference Approach is based on the principle of mass conservation, and it is used for CO_2 only.
- C brought into a national economy in the form of a fuel, it is either released into the atmosphere as GHG, or it is diverted *(e.g., increased fuel stocks, feedstocks, stored in products, left unutilised in ash)* and does not enter the atmosphere.
- It is *good practice* <u>to apply both</u> a sectoral approach and the reference approach to estimate a country's CO_2 emissions from fuel combustion and <u>to compare the results</u> of these two independent estimates. Significant <u>differences may indicate possible problems</u> with AD, NCVs, carbon content, excluded carbon calculation, etc

Energy Balance
CO_2 Estimation
Reference Approach (QC)

$$E=\Sigma_{allfuels}[(ApparentConsumption_{fuel} - ExcludedCarbon_{fuel}) \times COF_{fuel}] \times 44/12$$

- ✓ ApparentConsumption =
Production(primary fuels) + Imports – Exports - International bunkers – Stock change (in CC)
- ✓ ExcludedCarbon = CC in feedstocks and non-energy use excluded from combustion
- ✓ COF = C oxidised fraction. By default = 1 (complete oxidation). Lower values used to count for C retained indefinitely in ash or soot
- ✓ CC = Carbon Content

Excluded Carbon/Non-Energy Use of Fuels

TABLE 1.2
TYPES OF USE AND EXAMPLES OF FUELS USED FOR NON-ENERGY APPLICATIONS

Type of use	Example of fuel types	Product/process	Chapter
Feedstock	natural gas, oils, coal	ammonia	3.2
	naphtha, natural gas, ethane, propane, butane, gas oil, fuel oils	methanol, olefins (ethylene, propylene), carbon black	3.9
Reductant	petroleum coke	carbides	3.6
	coal, petroleum coke	titanium dioxide	3.7
	metallurgical cokes, pulverised coal, natural gas	iron and steel (primary)	4.2
	metallurgical cokes	ferroalloys	4.3
	petroleum coke, pitch (anodes)	aluminium [1]	4.4
	metallurgical coke, coal	lead	4.6
	metallurgical coke, coal	zinc	4.7
Non-energy product	lubricants	lubricating properties	5.2
	paraffin waxes	misc. (e.g., candles, coating)	5.3
	bitumen (asphalt)	road paving and roofing	5.4
	white spirit[2], some aromatics	as solvent (paint, dry cleaning)	5.5

1. Also used in secondary steel production (in electric arc furnaces) (see Chapter 4.2).

2. Also known as mineral turpentine, petroleum spirits, industrial spirit ('SBP').

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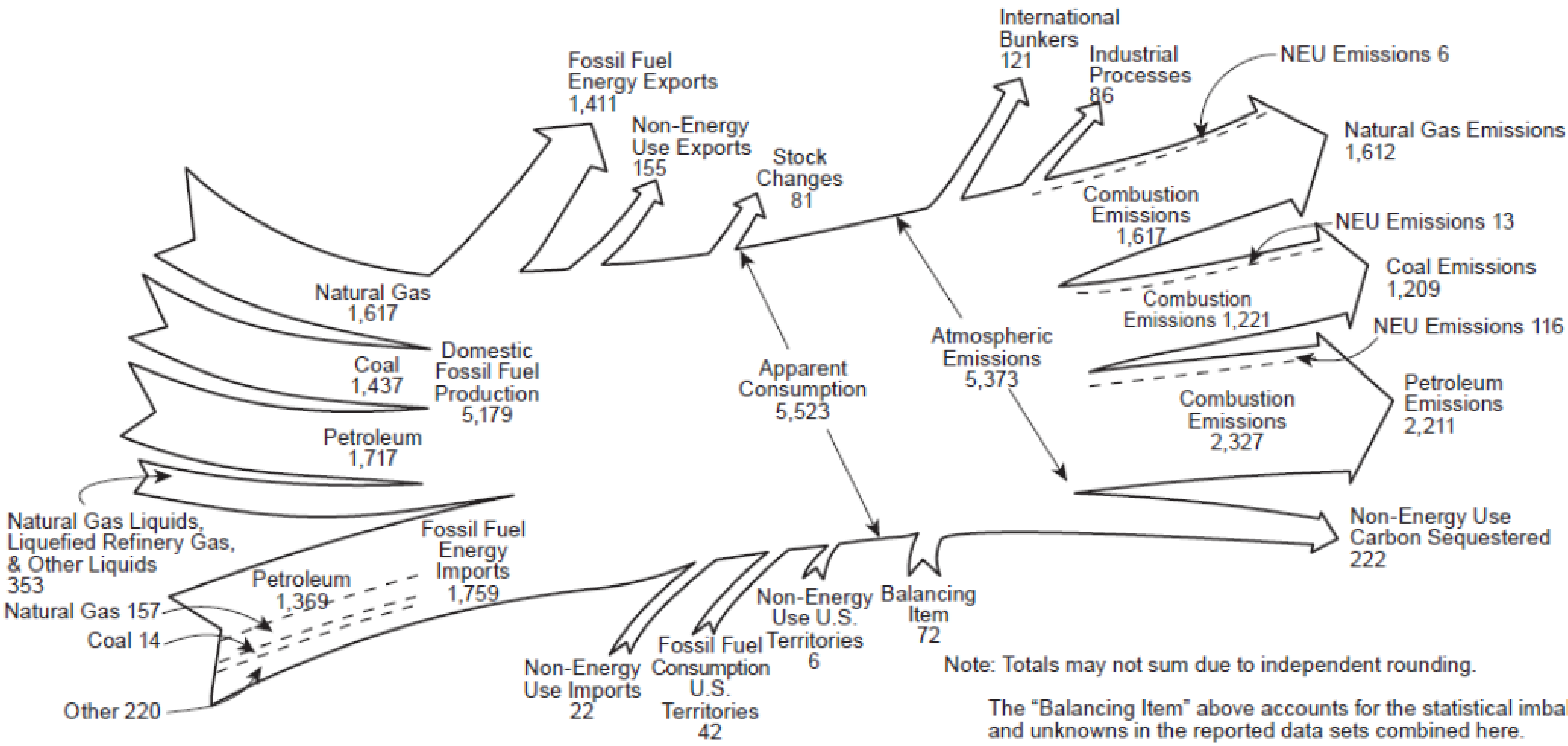
US Carbon Flow 2018

Figure 3-2: 2018 U.S. Fossil Carbon Flows (MMT CO_2 Eq.)



Note: Totals may not sum due to independent rounding.

The "Balancing Item" above accounts for the statistical imbalances and unknowns in the reported data sets combined here.

NEU = Non-Energy Use

Note: Tracking Carbon in Fuel (!!)

Source: US NIR 2019

Various Tools – Supporting Materials

- Emission Factor Database (EFDB)

  https://www.ipcc-nggip.iges.or.jp/EFDB/

- IPCC Inventory Software

  https://www.ipcc-nggip.iges.or.jp/software/index.html

- Primer for 2006 IPCC Guidelines

  https://www.ipcc-nggip.iges.or.jp/support/support.html

- Reports of Expert Meetings

  https://www.ipcc-nggip.iges.or.jp/meeting/meeting.html

- Frequently Asked Questions

  https://www.ipcc-nggip.iges.or.jp/meeting/meeting.html

EFDB

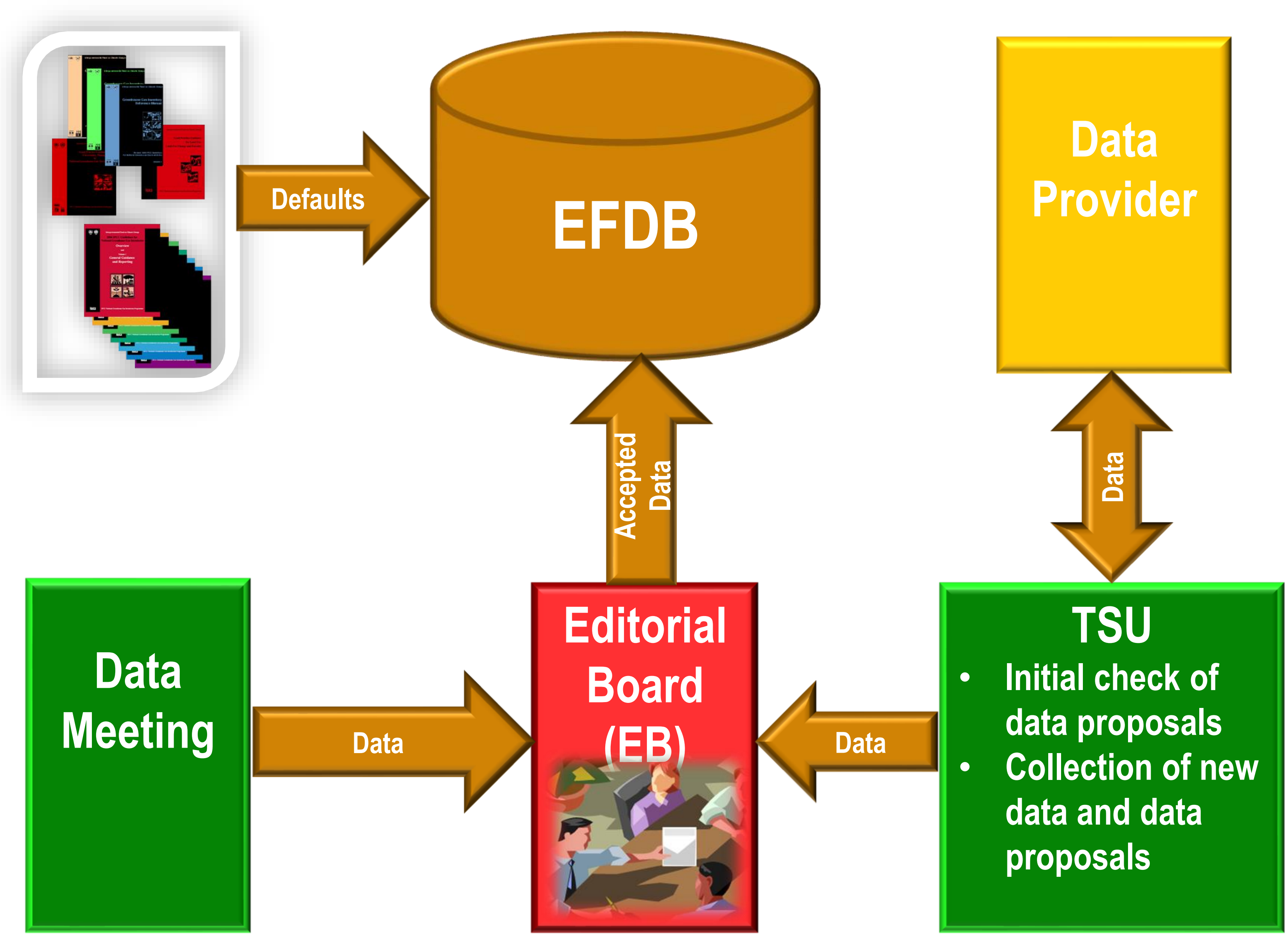
- Library of emission factors and other parameters *(with background documentation and technical references)* that can be used for estimation of GHG emissions and removals in Inventories

- Data collected:
  - Default values from IPCC Guidelines
  - Data from peer-reviewed papers
  - Data from other publications (e.g., national reports)

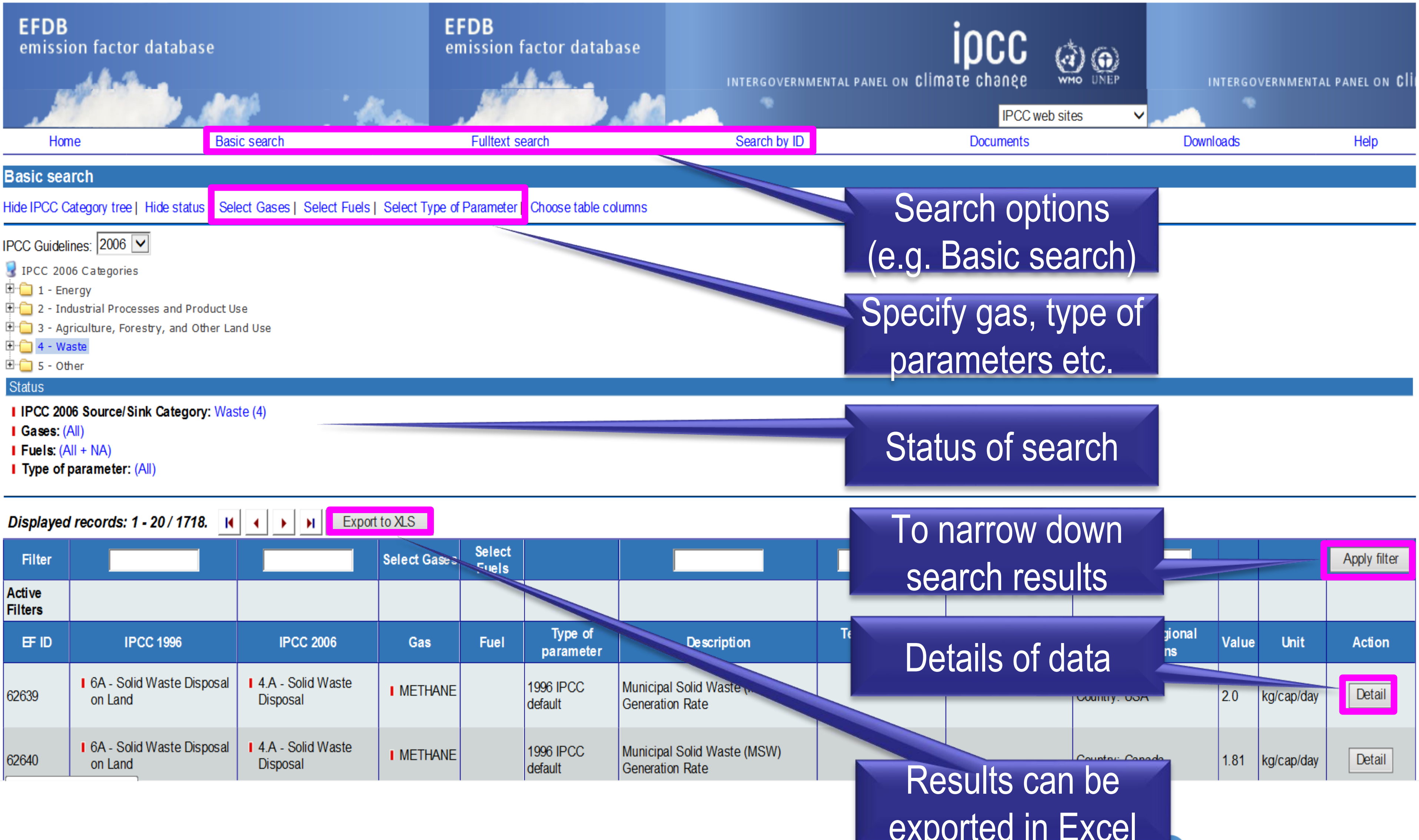
- It evolves across time

The EFDB is not intended for authorization of use of specific EFs by countries and it has not been subject to formal IPCC review processes

It serves as a library where inventory compilers can find EFs suitable to their countries by their own judgement.


Defaults
EFDB
Data Provider
Accepted Data
Data
Data Meeting
Data
Editorial Board (EB)
Data
TSU
• Initial check of data proposals
• Collection of new data and data proposals

Web application



https://www.ipcc-nggip.iges.or.jp/EFDB/main.php

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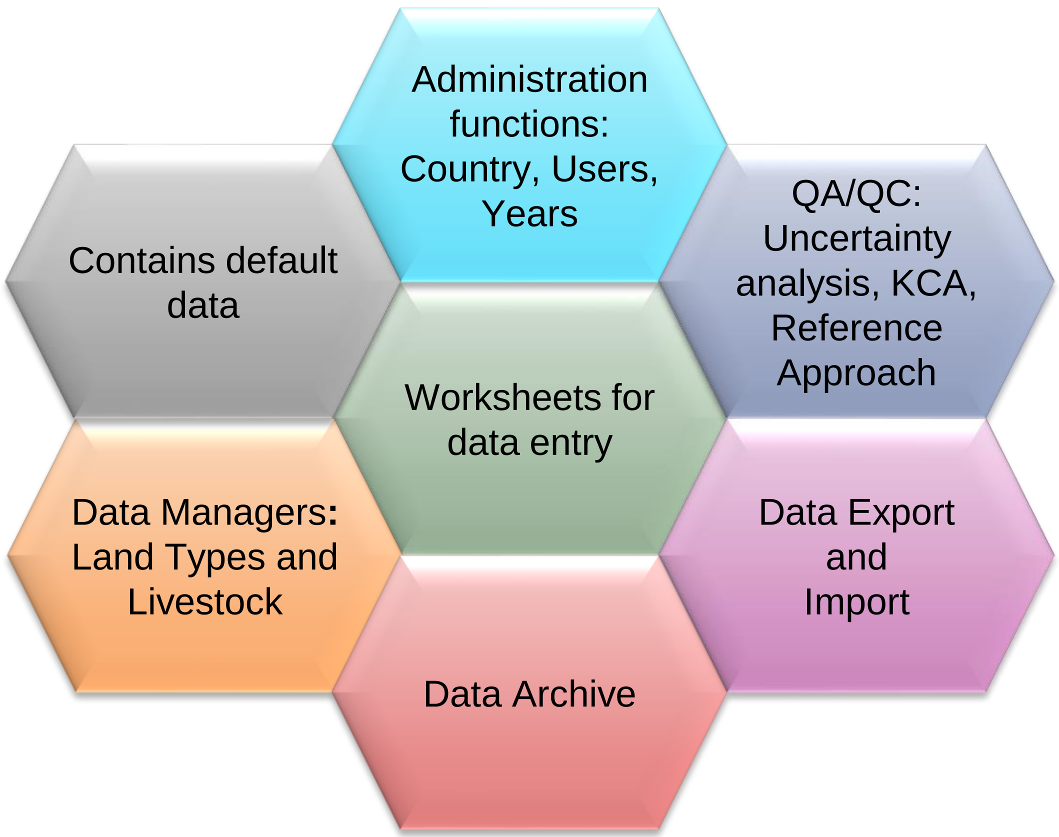
IPCC Inventory Software



https://www.ipcc-nggip.iges.or.jp/software/index.html

Data Quality & Data Gaps

Data quality (chapter 2 Volume 1 IPCC Guidelines) is to be checked as:

- Completeness (territory, population, calendar year)
- Uncertainty (2.5 & 97.5% percentile, PDF's shape)
- Method for data collection
- Time series completeness and consistency

Data availability gaps are identified as

- Entire time series missing:
  - ✓designing a new data collection system
  - ✓as interim expert judgment is allowed
- Data missing in the time series (chapter 5 Volume 1 IPCC Guidelines) :
  - ✓Splicing techniques as: overlap, surrogate data, interpolation/extrapolation

Conclusions

- Quality and completeness of the inventories depend on the underlying activity data produced primarily by national statistical offices, as well as other relevant institutions, including the national climate reporting authorities to the UNFCCC.

- Close working arrangements with existing systems will make best use of national expertise, minimize duplication, and increase efficiency.

- It is important to engage both data producers and users at an early stage to ensure clear understanding and assessment of the quality of data collected as well as of the availability of data needed.

- Cooperation between inventory compilers and data collectors is key to enhance national data statistics to ensure full correspondence with inventories requirements.

Questions

- Is your National GHG Inventory part of the National statistical System?

- Is your national statistical office working in cooperation with your National GHG Inventory in assessing its data needs?

- Is your national statistical system integrating emerging data needs for estimating GHG emissions and removals from human activities? *(new variables to be monitored/ changes in the data collection procedure for relevant variables)*

Thank you

https://www.ipcc-nggip.iges.or.jp/index.html

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