

The IPCC Inventory Software

A Tool to Support the Enhanced Transparency Framework Implementation under the Paris Agreement

IPCC TFI TSU
UNFCCC SBs 5 June 2024



Transparency is critical to fighting Global Warming

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

Article 4

COMMITMENTS

1. All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall:

(a) Develop, periodically update, publish and make available to the Conference of the Parties, in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties;

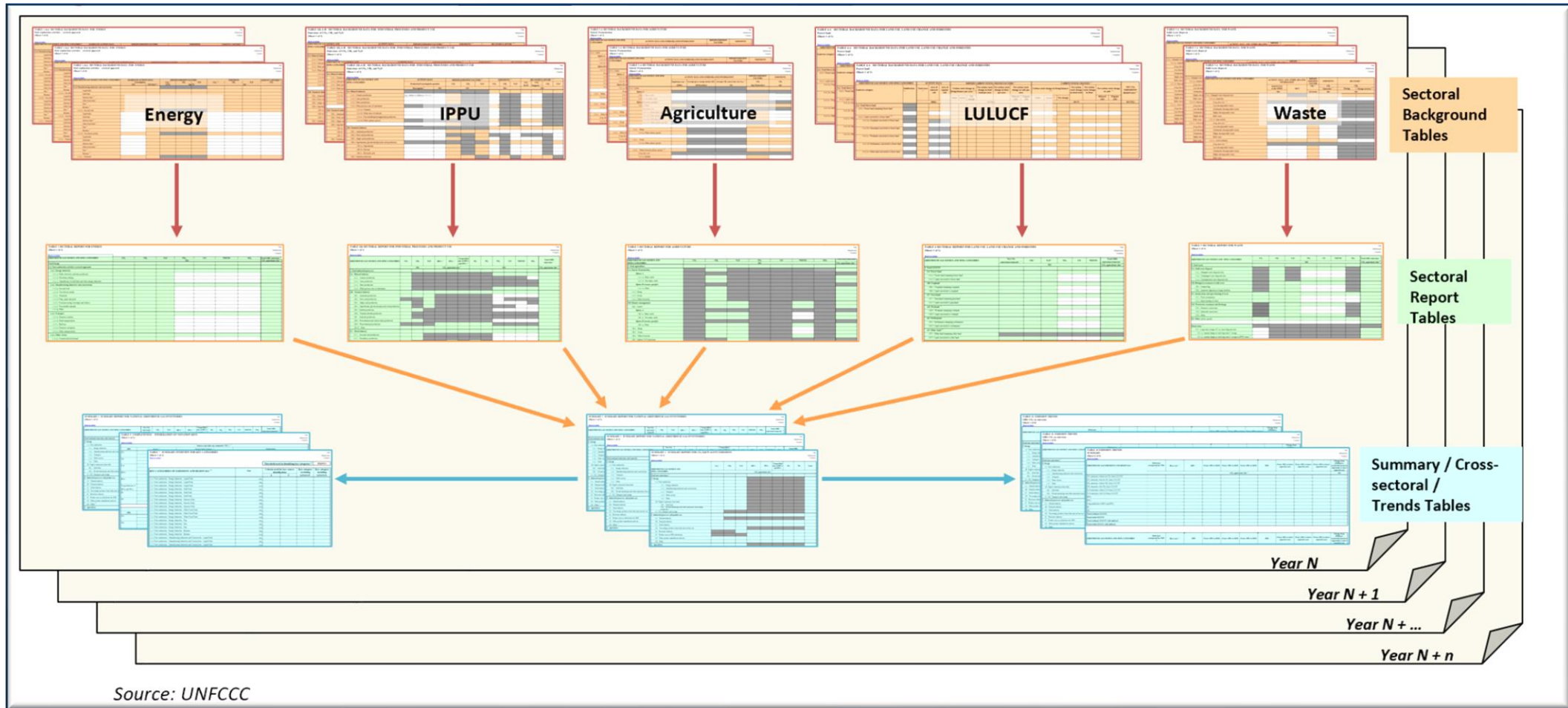
UNITED NATIONS
1992

IPCC supporting Transparency since its onset

IPCC's original authors (1991-1995) set out to produce:

- ✓ **Methodological guidance to prepare National GHG Inventories**
- ✓ **Software to facilitate use of those Guidelines**

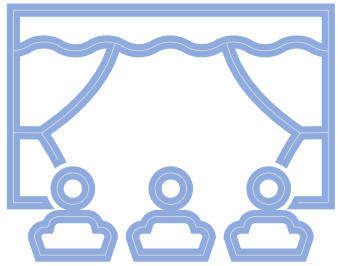
Transparency take a lot of efforts



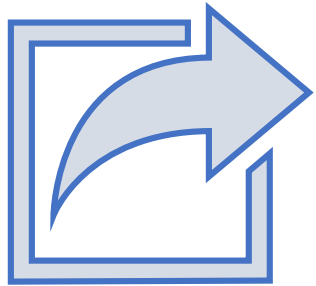
IPCC Inventory Software: Event Outline



Evolution and Features of the *Software*



Demonstration, including Interoperability with the UNFCCC ETF Reporting Tool



Moving Forward

Evolution and Features of the IPCC Inventory Software for NGHGI



The IPCC Inventory Software

Complete



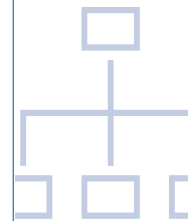
All IPCC methods (*all Tiers*)
and all IPCC approaches



All IPCC default data



Automatically implements
AR5 GWP100 values
(and allows any other user-specific metric
to be applied)



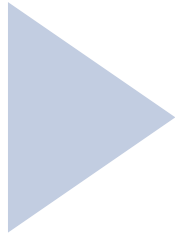
Cross-cutting elements
*Uncertainty Analysis - Key Category
Analysis*



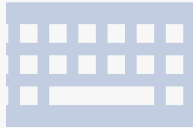
**All sectors and categories of the
National GHG Inventory**

The IPCC Inventory Software

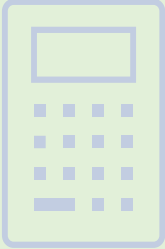
Easy to Use



Prepare an inventory using IPCC default methods with minimal efforts




All IPCC defaults at your fingertips



Avoids methodological and calculation errors



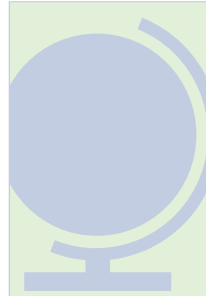
Data Managers facilitate data entry
(Fuels, Solid Waste, F-gases, Livestock, Land Representation, Land Use)



Have NGHGI estimates ready for Paris Agreement reporting

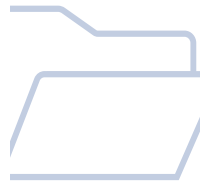
The IPCC Inventory Software

Fundamental for National GHG Inventory Preparation

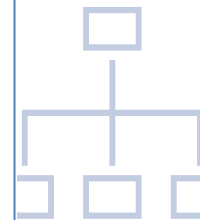


Adaptable to national circumstances

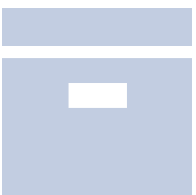
- Allows subnational level of reporting
- Use multiple tiers across inventory, even within a category
- Apply your own country-specific values wherever available



Organizing framework for data collection among national entities



Multiple experts in your country can work on different categories/sectors simultaneously

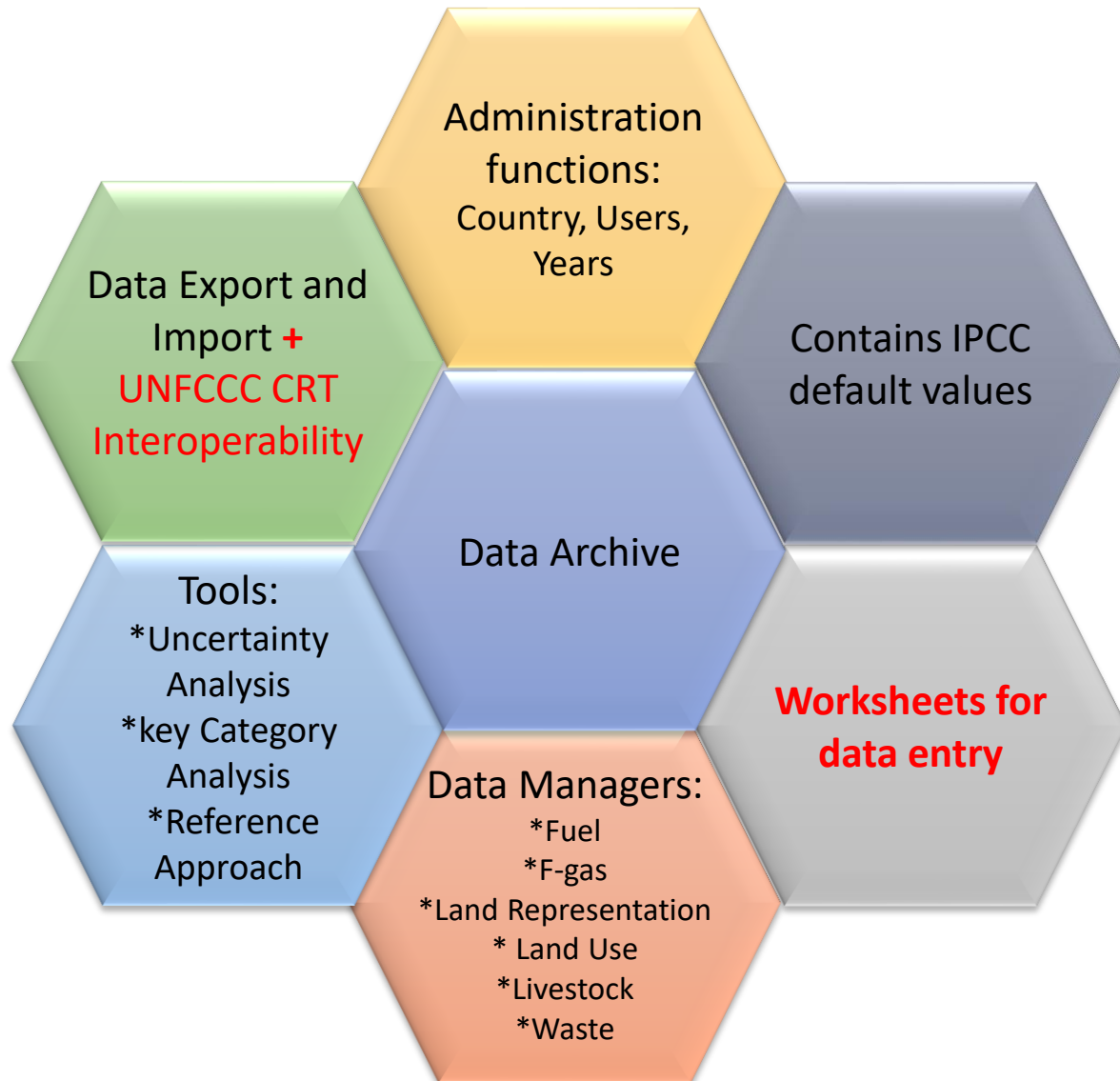


Establishes a single archive, in-country, to help you build for the future



Confidence that your inventory is consistent with the 2006 IPCC Guidelines & UNFCCC requirements

Architecture



- MSAccess (ACE OLEDB 12) for WindowsOS
- ACCDB file, *backup function*
- Microsoft .NET Framework 4.6.2
- Password protected
NEVER FORGET PASSWORD!

Example of a Worksheet

Categories

Data Entry & Calculation

IPCC Inventory Software - Pavel - [Worksheets]

Application Database Inventory Year Worksheets Reports Tools Export/Import Administration Window Help

2006 IPCC Categories

- 2.A.3 - Glass Production
- 2.A.4 - Other Process Uses of Carbonates
 - 2.A.4.a - Ceramics
 - 2.A.4.b - Other Uses of Soda Ash
 - 2.A.4.c - Non Metallurgical Magnesia Pro
 - 2.A.4.d - Other (please specify)
 - 2.A.5 - Other (please specify)
- 2.B - Chemical Industry
 - 2.B.1 - Ammonia Production
 - 2.B.2 - Nitric Acid Production
 - 2.B.3 - Adipic Acid Production
 - 2.B.4 - Caprolactam, Glyoxal and Glyoxylic A
 - 2.B.5 - Carbide Production
 - 2.B.6 - Titanium Dioxide Production
 - 2.B.7 - Soda Ash Production
 - 2.B.8 - Petrochemical and Carbon Black Pro
 - 2.B.8.a - Methanol
 - 2.B.8.b - Ethylene
 - 2.B.8.c - Ethylene Dichloride and Vinyl C
 - 2.B.8.d - Ethylene Oxide
 - 2.B.8.e - Acrylonitrile
 - 2.B.8.f - Carbon Black
 - 2.B.9 - Fluorochemical Production
 - 2.B.9.a - By-product emissions
 - 2.B.9.b - Fugitive Emissions
 - 2.B.10 - Other (Please specify)
- 2.C - Metal Industry
 - 2.C.1 - Iron and Steel Production
 - 2.C.2 - Ferroalloys Production
 - 2.C.3 - Aluminium production
 - 2.C.4 - Magnesium production
 - 2.C.5 - Lead Production
 - 2.C.6 - Zinc Production
 - 2.C.7 - Other (please specify)
- 2.D - Non-Energy Products from Fuels and Solv
 - 2.D.1 - Lubricant Use
 - 2.D.2 - Paraffin Wax Use
 - 2.D.3 - Solvent Use

Worksheet: Nitric Acid Production - Tier 1 | Nitric Acid Production - Tier 2 | Capture and storage or other reduction

Sector: Industrial Processes and Product Use
 Category: Chemical Industry
 Subcategory: 2.B.2 - Nitric Acid Production
 Sheet: N2O Emissions from Nitric Acid Production - Tier 2

Equation 3.6

Subdivision	Production process /technology	Nitric acid production from technology i (tonnes)	N2O emission factor for technology type i (kg N2O/tonne nitric acid produced)	Destruction factor for abatement technology type j (Fraction)	Abatement system utilisation factor for abatement technology type j (Fraction)	N2O Emissions (kg)	N2O Emissions (Gg)
	i,j	NAP _i	EF _i	DF _j	ASUF _j	E=NAP _i EF _i (1-DF _j)*ASUF _j	E/1000000
Facility #2	Medium pressure combustion plants	1,250	7	0.99	0.9	953.75	0.00095
Kanagawa	High pressure plants	10,000	9	0.5	1	45,000	0.045
	Plants with NSCRa (all processes)	1,000	2	0.5	1	1,000	0.001
Tokyo	Combined technology	5,000	2	0.5	1	5,000	0.005
	Plants with NSCRa (all processes)	1,000	2	0.6	1	800	0.0008
Total		18,250				52,753.75	0.05275

Uncertainties Time Series data entry...

2006 IPCC Guidelines

User notes

2.B.2 - Time Series

NITROUS OXIDE (N2O) Emissions (Gg CO2 Equivalents)

* Base year for assessment of uncertainty in trend: 1990

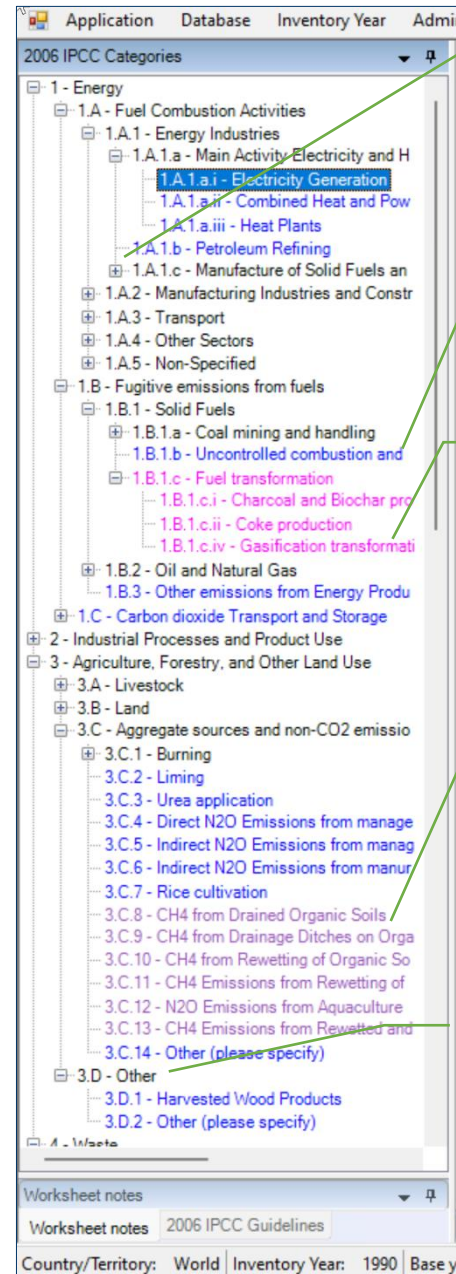
Gas: NITROUS OXIDE (N2O)

Country/Territory: Country X | Inventory Year: 1990 | Base year for assessment of uncertainty in trend: 1990 | CO2 Equivalents: AR4 GWPs (100 year time horizon) | Database file: (C:\Users\shermanau\Desktop\pavel\SOFT\IPPU SPEC\7 TESTING 282\Database_backup_282_IPPU_September.acddb)

2006 IPCC Categories Navigation Window (tree)

The worksheets relevant to the selected IPCC Category will be displayed in the main working area on the right.

Worksheets are available for all IPCC categories that are highlighted in blue, magenta and lilac.



Press to open a subcategory

Blue highlighted categories are from the 2006 IPCC Guidelines

Magenta highlighted categories are from the 2019 Refinement

Lilac highlighted categories are from the Wetlands Supplement

Clicking on the **Black** "Sector/ Sub-sector" level shows the CO₂e time series graph of the "Sector/ Sub-sector".

Example of a Worksheet

Worksheets

Sub-divisions

Default or User-defined process/technology

Default or User-defined EF & parameters

Estimates

Activity Data

Uncertainties

Time series

Notes

Subdivision	Production process / technology	Nitric acid production from technology i (tonnes)	N2O emission factor for technology type i (kg N2O/tonne nitric acid produced)	Destruction factor for abatement technology type j (Fraction)	Abatement system utilisation factor for abatement technology type j (Fraction)	N2O Emissions (kg)	N2O Emissions (Gg)
	i, j	NAPi	EFi	DFj	ASUFj	E=NAPi*EFi*(1-DFj)*ASUFj	E/1000000
Facility #2	Medium pressure combustion plants	1,250	7	0.99	0.9	953.75	0.00095
Kanagawa	High pressure plants	10,000	9	0.5	1	45,000	0.045
	Plants with NSCRs (all processes)	1,000	2	0.5	1	1,000	0.001
Tokyo	Combined technology	5,000	2	0.5	1	5,000	0.005
	Plants with NSCRs (all processes)	1,000	2	0.6	1	800	0.0008
Total		18,250				55,750	0.05575

Equation 3.6

Time Series

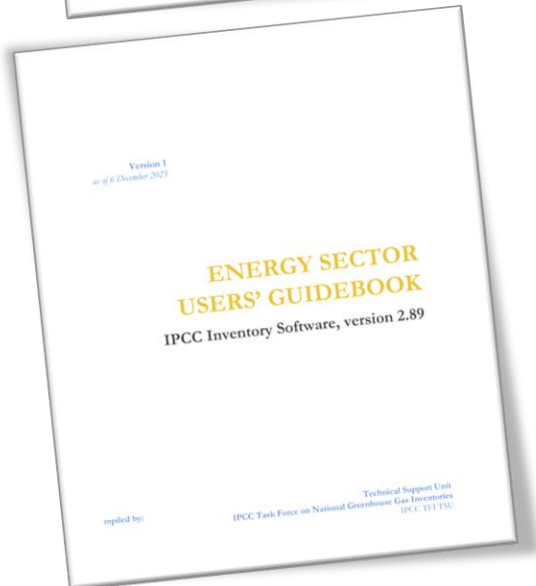
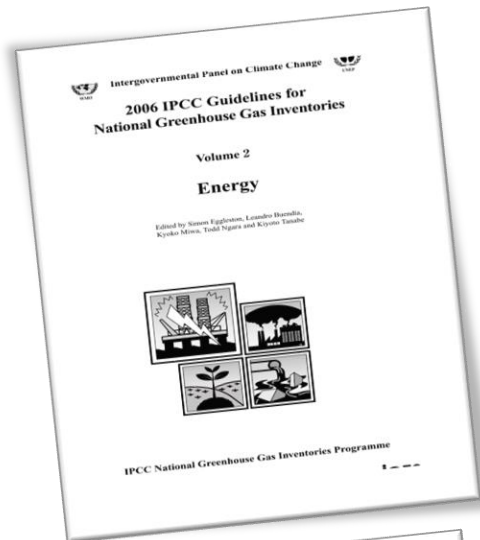
NITROUS OXIDE (N2O) Emissions (Gg CO2 Equivalents)

1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012

* Base year for assessment of uncertainty in trend: 1990

Gas NITROUS OXIDE (N2O)

Available resources



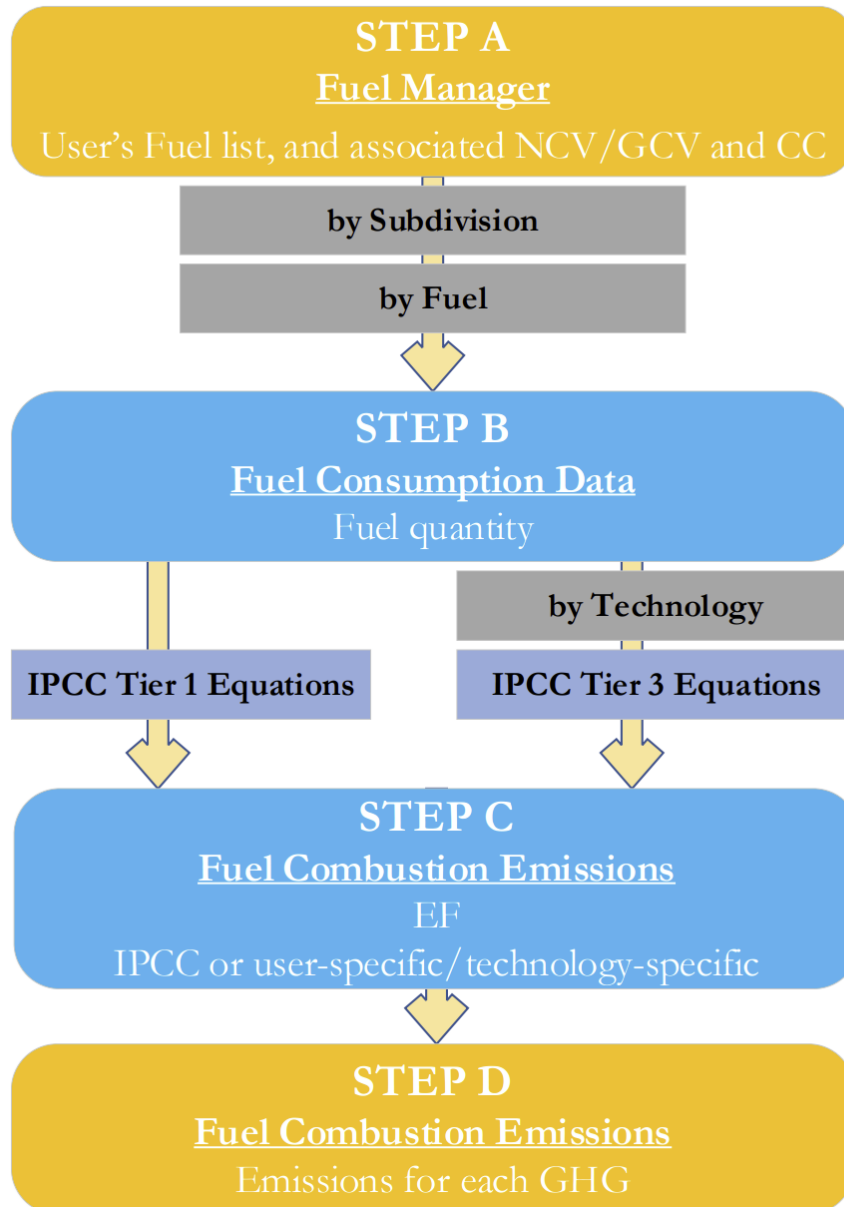
- ✓ **The 2006 IPCC Guidelines for National GHG Inventories**
 - The *Software* is a tremendous tool to prepare a GHG inventory, *although does not replace knowledge of the 2006 IPCC Guidelines.*

- ✓ **The *Software* Users' Guidebooks**
 - Integrated guides for the IPCC Guidelines & the *Software* :
 - Guides currently available for
 - General Software User Manual
 - Energy Sector
 - Livestock Categories 3.A.
 - Land Representation
 - UNFCCC Interoperability – CRT Export Quick Start Guide
 - Other sector-based Guidebooks under development

- ✓ **IPCC TFI TSU Support @ *ipcc-software@iges.or.jp***

Guidebook

Stationary combustion - flowchart



The Sector Guidebook is the place to start...

For each category, the Guidebook includes, *inter alia*, the following information:

- The relevant equations from the 2006 IPCC Guidelines
- A description of the relevant worksheets. For category 1.A.1.a.i this includes **Fuel Manager**, **Fuel Consumption Data** and **Fuel Consumption Emissions**
- A **User's Work Flowchart**
 - **Step A: Fuel Manager**
 - **Step B: Fuel Consumption Data**
 - **Step C: Fuel Combustion Emissions - EFs**
 - **Step D: Fuel Combustion Emissions - Results**
- Step-by-step guidance to input **activity data** and **emission factor** information
- **Results**

IPCC Inventory Software & Paris Agreement Reporting

International reporting requirements

- ✓ Countries to submit a Biennial Transparency Report (BTR), including the NGHGI and its CRTs (Common Reporting Tables).
- ✓ Reporting must follow the Modalities, Procedures and Guidelines (MPGs) (decision 18/CMA.1), and so be based on the 2006 IPCC Guidelines

IPCC Inventory Software as a Tool

- ✓ Decision 5/CMA.3 mandates the UNFCCC secretariat to develop reporting tools, including for CRTs.
- ✓ Decision 5/CMA.3 requests the UNFCCC secretariat to facilitate **interoperability with the IPCC Inventory Software** and invites the IPCC to cooperate

IPCC Inventory Software & Paris Agreement Reporting

IPCC Inventory Software

1. Prepare GHG Inventory in IPCC Software

- ✓ Estimate GHG emissions consistent with IPCC Guidelines
 - ✓ Reduce errors
- ✓ Supports national institutional arrangements



2. Review Visualized CRTs

- ✓ Review results; if necessary, go back to calculation worksheets
 - ✓ Finalize notation keys for reporting
- ✓ Incorporate information needed for reporting in the CRT, including flexibility, as applicable.



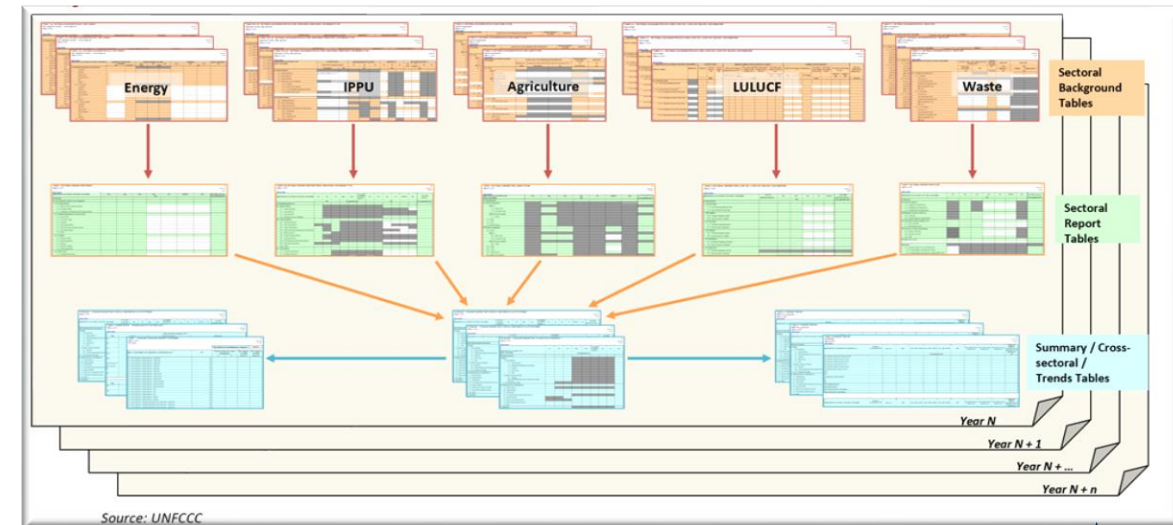
3. Produce JSON file

- ✓ Save file on your computer

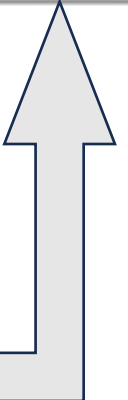


4. Upload file to UNFCCC ETF Reporting Tool

UNFCCC ETF Reporting Tool



Complete, Easy to Use, Fundamental
IPCC Inventory Software used to complete 60 tables
of the CRT for each year of the time series!





IPCC Inventory Software in the ETF

- ✓ Estimates a **complete NGHGI** consistent with IPCC *Good Practice* and UNFCCC requirements in the format of UNFCCC CRTs
- ✓ Allows to compile explanatory information for CRT **Table 9**
- ✓ Allows to compile explanatory information for **flexibility**
- ✓ Allows to compile explanatory information on method and EF for CRT **Summary 3**
- ✓ Allows to compile all **official comments** for CRT
- ✓ Allows to compile **documentation boxes** and **additional information**
- ✓ Allows to designate information as **confidential**

All these at once, with a single Tool only

Live Demonstration



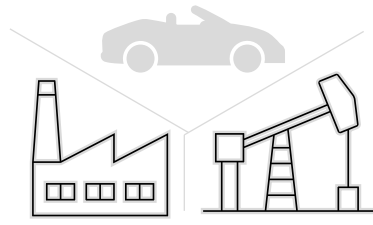
A Deeper Dive...entering Energy Sector data in the *Software*

Using national data or readily available international data sets

	Primary coal and peat	Coal and peat products	Primary Oil	Oil Products	Natural Gas	Boilers and waste	Nuclear	Electricity	Heat	Total energy	of which renewables
2021											
Primary production	...	38079	10258	17409	...	2315	...	64101	20244		
Imports	...	316	16364	1776	...	...	...	...	...	...	...
Exports	...	-33470	-369	...	...	-4242	...	-34512	-9	...	...
International marine bunkers
International aviation bunkers
Stock changes	...	1198	867	...	...	...	...	...	...	...	...
Total energy supply	...	6213	17918	13913	17488	...	...	21430	...	50212	20244
Statistical difference	...	-1230	...	...	...	...	...	...	...	-2000	2315
Transfers
Transformation	...	-1621	13075	-10422	-4780	...	...	9186	...	-10281	-4780
Electricity plants	...	-212	-208	-10342	...	...	...	9186	...	-6704	...
CHP plants
Heat plants
Coal waste
Bioenergy plants
Liquefaction plants
Gas waste
Boil furnaces	...	-418	406	...	...	...	...	...	...	289	...
NGL plants & gas blending	...	-1051	...	...	...	...	...	...	...	...	...
Oil refineries
Other transformation	...	-997	...	...	...	...	...	...	...	...	...
Energy industries own use	...	-1230	...	...	...	...	...	...	...	...	...
Losses

	All Coal	All Oil	Natural Gas	Primary biofuels / Waste	Charcoal	Electricity	Total energy	of which renewables
2021								
Final energy consumption	7175	7175
Manufacturing, const., mining	10915	10965
Iron and steel	487	29
Chemical and petrochemical
Non-ferrous metals
International marine bunkers	838	...
International aviation bunkers
Stock changes
Total energy supply	9990	17186
Statistical difference
Transfers
Transformation
Electricity plants
Charcoal plants
Other transformation
Energy industries own use
Losses
Total consumption
Final energy consumption
Manufacturing, const., mining
Transport, n.e.s.
Road
Domestic aviation
Domestic navigation
Other transport
Households
Other consumers
Non-energy use
Agriculture, forestry, fishing
Commerce and public services
Households
Other consumers
Non-energy use

Source: 2021 Energy Balances
<https://unstats.un.org/unsd/energystats/pubs/balance/>



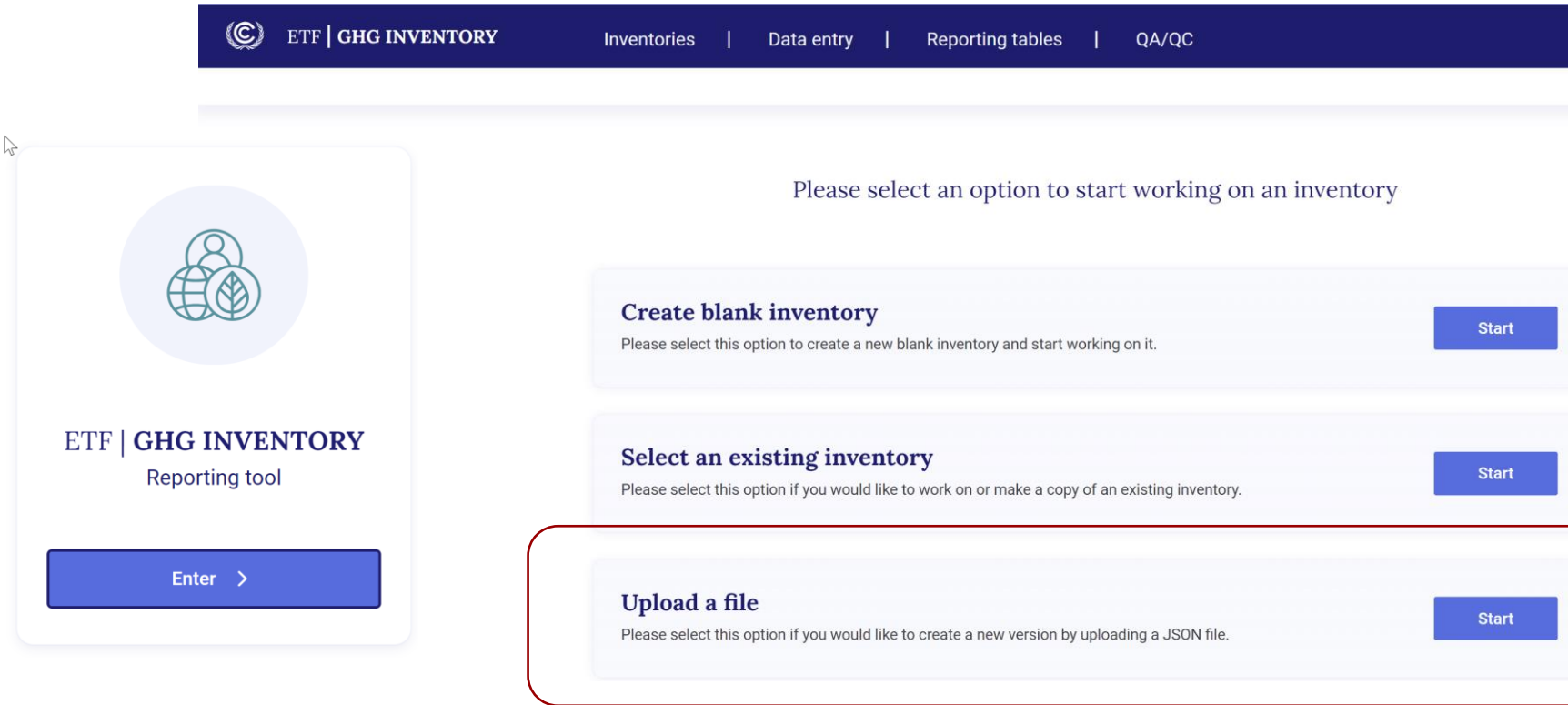
...and filling in relevant data for each category in the two worksheets below

The screenshot displays two worksheets from the IPCC software. The 'Fuel Consumption Data' worksheet shows a table with columns for Subdivision, Fuel, and Consumption Unit. The 'Fuel Combustion Emissions' worksheet shows a table with columns for Subdivision, Fuel, Total consumption, CO2 emissions, CH4 emissions, and N2O emissions. Both worksheets include dropdown menus for Sector, Category, Subcategory, Sheet, and Fuel Type.

...for most countries captures majority of emissions:

- fuel combustion responsible for ~70% of total emissions, excl. LULUCF
- Same worksheets allow countries to report Tier 2/3 methods for stationary combustion (~55% of total national emissions, excl LULUCF)

Import IPCC JSON file into ETF Reporting Tool



ETF | GHG INVENTORY

Inventories | Data entry | Reporting tables | QA/QC

Please select an option to start working on an inventory

Create blank inventory
Please select this option to create a new blank inventory and start working on it. [Start](#)

Select an existing inventory
Please select this option if you would like to work on or make a copy of an existing inventory. [Start](#)

Upload a file
Please select this option if you would like to create a new version by uploading a JSON file. [Start](#)

ETF | GHG INVENTORY
Reporting tool

Enter >

1. Select 'Upload a file'
2. Drag and drop or upload JSON file from previous step
3. You will be prompted to enter version settings:
 - Submission year
 - For developing countries, if you are applying flexibilities for time series/latest year
 - Sector-specific selections

Note: Screenshots subject to change in final version.

Quality Control Data Entry

ETF | GHG INVENTORY | Inventories | **Data entry** | Reporting tables | QA/QC

Version: XYZ-CRT-2025-V1.02 | Status: Started

Navigation tree Options

- Sectors/Totals
 - 1. Energy
 - 1.A. Fuel combustion activities (sectoral approach)
 - 1.A.1. Energy industries
 - 1.A.1.a. Public electricity and heat production
 - 1.A.1.b. Petroleum refining
 - Liquid fuels
 - Solid fuels**
 - Gaseous fuels
 - Other fossil fuels
 - Peat
 - Biomass
 - 1.A.1.c. Manufacture of solid fuels and other energy industries
 - 1.A.2. Manufacturing industries and construction
 - 1.A.3. Transport
 - 1.A.4. Other sectors
 - 1.A.5. Other (not specified elsewhere)
 - Information item
 - 1.A(b). CO₂ from fuel combustion activities (reference approach)
 - 1.A(c). Comparison of CO₂ emissions from fuel combustion
 - 1.A(d). Feedstocks, reductants and other non-energy use of fuels
 - 1.B. Fugitive emissions from fuels

1.A.1.b. Petroleum refining > Solid fuels

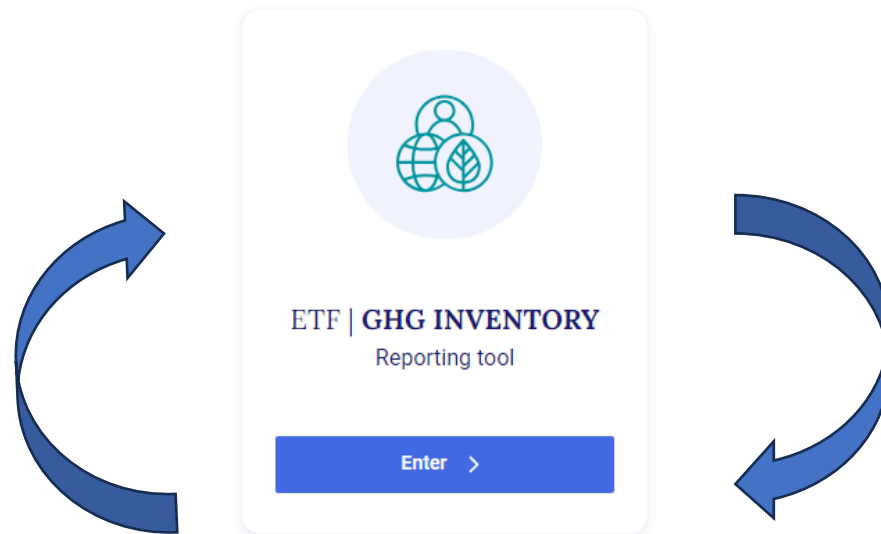
Expand all

ID	Description	Unit	1990
01	Fuel consumption	TJ	70,551.00
02	Calorific value		NCV
03	Method		
04	CO ₂		T1
05	CH ₄		T1
06	N ₂ O		T1
07	Emission factor information		
08	CO ₂		D
09	CH ₄		D
10	N ₂ O		D
11	Emissions		
12	CO ₂	kt	1,386.04
13	CH ₄	kt	0.01
14	N ₂ O	kt	0.02
15	Amount captured		
16	CO ₂	kt	-5.00
17	Implied emission factor		
18	CO ₂	t/TJ	19.72
19	CH ₄	kg/TJ	0.20
20	N ₂ O	kg/TJ	0.30
21	Documentation box		

Application version: d3871fd34e90ef87becce65a78defbfd | Metadata version: 1.19.6 | Last synchronised: 2023-11-30 17:48 (UTC+4)

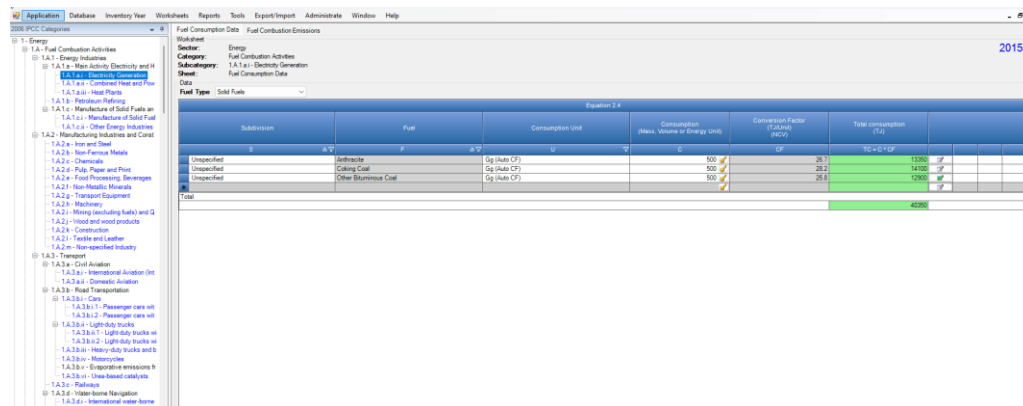
- Use of the IPCC JSON file is a means of data input into the ETF Reporting Tool. Users can check all data input grids and reporting tables in the ETF Reporting Tool.
- Users should quality control their imported IPCC data prior to submission.
- Note: The implied emission factors will be calculated here; they were not shown in the IPCC Inventory Software

Submit GHG Inventory to UNFCCC ...and start preparing for next submission



Remember: The ETF Reporting tool is the official tool TO BE USED for submission of data to the UNFCCC to meet reporting obligations under the Paris Agreement.

And... with the inventory you have created in the IPCC Inventory Software, you are well prepared to build on it for your next BTR GHG inventory submission.



The screenshot shows the IPCC Inventory Software interface for the year 2015. The left sidebar displays a hierarchical tree of categories, including 1.A. Fuel Combustion Activities, 1.A.1. Energy Industries, 1.A.1.a. Manufacturing Industries and Construction, 1.A.1.a.i. Iron and Steel, 1.A.1.a.ii. Chemicals, 1.A.1.a.iii. Other Energy Industries, 1.A.2. Manufacturing Industries and Construction, 1.A.2.a. Non-metallic Minerals, 1.A.2.b. Transport, 1.A.2.c. Other, 1.A.3. Transport, 1.A.3.a. Civil Aviation, 1.A.3.a.i. International Aviation, 1.A.3.a.ii. Domestic Aviation, 1.A.3.b. Road Transportation, 1.A.3.b.i. Cars, 1.A.3.b.ii. Light-duty trucks, 1.A.3.b.iii. Heavy-duty trucks and buses, 1.A.3.c. Railways, and 1.A.3.d. Waterborne Navigation.

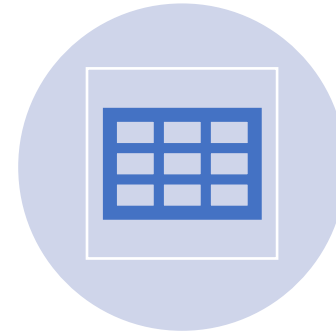
Subdivision	Fuel	Consumption Unit	Consumption (Mass, Million of Energy Units)	Conversion Factor (IPCC, IPCC)	Total consumption (Gt)
Unspecified	Anthracite	GJ (Auto CF)	600	26.7	16020
Unspecified	Calor Gas	GJ (Auto CF)	500	26.2	13100
Unspecified	Other Bituminous Coal	GJ (Auto CF)	600	26.5	15900
Total					45020

Thus... helping build a sustainable GHG inventory system.

Some final thoughts on this example



You can now estimate GHG emissions/removals for all categories, using any method available in the 2006 IPCC Guidelines.



The exact set of worksheets presented in this example are used to estimate GHG emissions from many categories in the energy sector.



The broad approach (using the worksheets and the Guidebooks) is applicable across the *Software*.



The Energy Guidebook, as well as Guidebooks for data managers in the AFOLU sector and Interoperability, are available. Guidebook for waste will be ready by June followed by IPPU.

Moving Forward



Ongoing work

○ Paris Agreement requirements

- Interoperability with UNFCCC reporting tool for Common Reporting Tables (*Decision 5/CMA.3*), Testing

○ Other

- Testing
- Export/Import functionality: time series, individual subdivisions for categories
- Uncertainty Analysis
- Guidebooks
- Other supporting material, as
 - ✓ step-by-step exercises on implementation of IPCC default methodologies
 - ✓ Land representation tools (add-on, excel-based datasheet)

Download & Use

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



- Version 2.91 of the IPCC Inventory Software comes with two alternative installation packages: **32 bit vs 64bit**.
- Please support by using it and reporting any findings to: ipcc-software@iges.or.jp

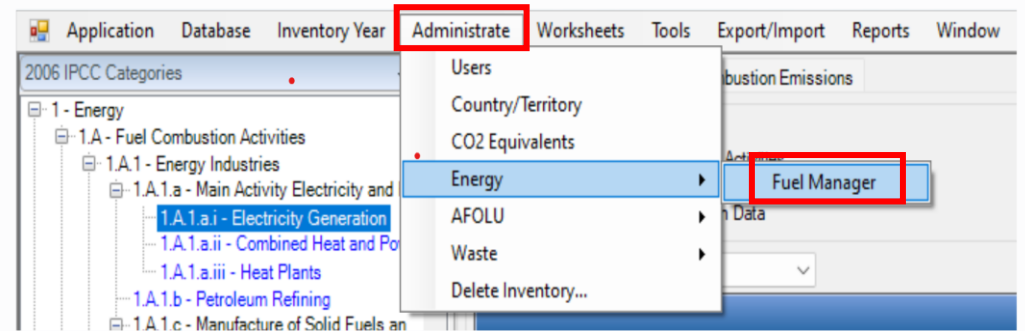
Slides Supporting Demonstration




Step A: Set-up Fuel Manager

The **Fuel Manager** contains the following for each fuel:
-- name, carbon content and calorific value.

- Access **Fuel Manager** from main menu or any category level worksheet before you start a GHG Inventory, can modify **Fuel Manager** later.

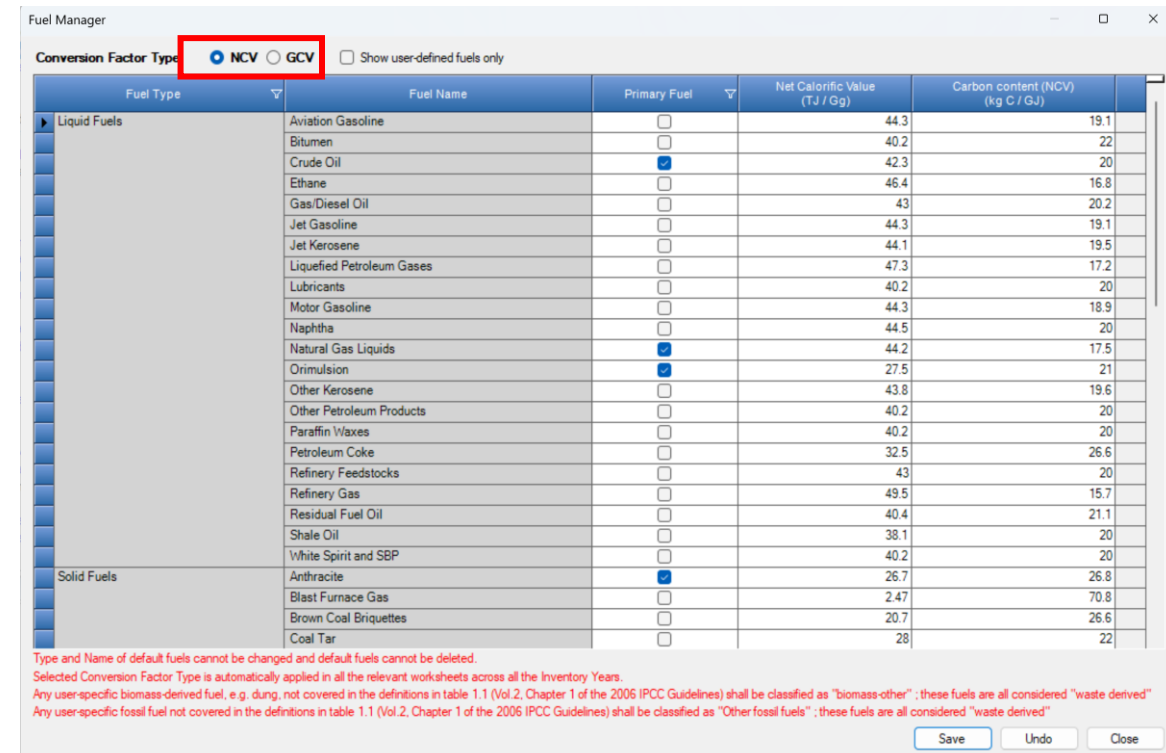


 If you change parameters, data in worksheets automatically linked from the **Fuel Manager** are updated.

- Select **NCV (Net Calorific Value)** or **GCV (Gross Calorific Value)** as the Conversion Factor Type.

Note that:

- For each IPCC default fuel, when NCV is selected, the Calorific Value and Carbon Content are pre-filled with IPCC default values, may overwrite with user-specific values.
- For GCV, no IPCC default values are available, requires data to be entered by the user.


 A screenshot of the 'Fuel Manager' dialog box. The 'Conversion Factor Type' is set to 'NCV' (Net Calorific Value). Below is a table of default fuels with columns for Fuel Type, Fuel Name, Primary Fuel, Net Calorific Value (TJ / Gg), and Carbon content (NCV) (kg C / GJ).

Fuel Type	Fuel Name	Primary Fuel	Net Calorific Value (TJ / Gg)	Carbon content (NCV) (kg C / GJ)
Liquid Fuels	Aviation Gasoline	<input type="checkbox"/>	44.3	19.1
	Bitumen	<input type="checkbox"/>	40.2	22
	Crude Oil	<input checked="" type="checkbox"/>	42.3	20
	Ethane	<input type="checkbox"/>	46.4	16.8
	Gas/Diesel Oil	<input type="checkbox"/>	43	20.2
	Jet Gasoline	<input type="checkbox"/>	44.3	19.1
	Jet Kerosene	<input type="checkbox"/>	44.1	19.5
	Liquefied Petroleum Gases	<input type="checkbox"/>	47.3	17.2
	Lubricants	<input type="checkbox"/>	40.2	20
	Motor Gasoline	<input type="checkbox"/>	44.3	18.9
	Naphtha	<input type="checkbox"/>	44.5	20
	Natural Gas Liquids	<input checked="" type="checkbox"/>	44.2	17.5
	Orimulsion	<input checked="" type="checkbox"/>	27.5	21
	Other Kerosene	<input type="checkbox"/>	43.8	19.6
	Other Petroleum Products	<input type="checkbox"/>	40.2	20
	Paraffin Waxes	<input type="checkbox"/>	40.2	20
	Petroleum Coke	<input type="checkbox"/>	32.5	26.6
	Refinery Feedstocks	<input type="checkbox"/>	43	20
Refinery Gas	<input type="checkbox"/>	49.5	15.7	
Residual Fuel Oil	<input type="checkbox"/>	40.4	21.1	
Shale Oil	<input type="checkbox"/>	38.1	20	
White Spirit and SBP	<input type="checkbox"/>	40.2	20	
Solid Fuels	Anthracite	<input checked="" type="checkbox"/>	26.7	26.8
	Blast Furnace Gas	<input type="checkbox"/>	2.47	70.8
	Brown Coal Briquettes	<input type="checkbox"/>	20.7	26.6
	Coal Tar	<input type="checkbox"/>	28	22

Type and Name of default fuels cannot be changed and default fuels cannot be deleted.
Selected Conversion Factor Type is automatically applied in all the relevant worksheets across all the Inventory Years.
Any user-specific biomass-derived fuel, e.g. dung, not covered in the definitions in table 1.1 (Vol.2, Chapter 1 of the 2006 IPCC Guidelines) shall be classified as "biomass-other"; these fuels are all considered "waste derived".
Any user-specific fossil fuel not covered in the definitions in table 1.1 (Vol.2, Chapter 1 of the 2006 IPCC Guidelines) shall be classified as "Other fossil fuels"; these fuels are all considered "waste derived".

Save Undo Close

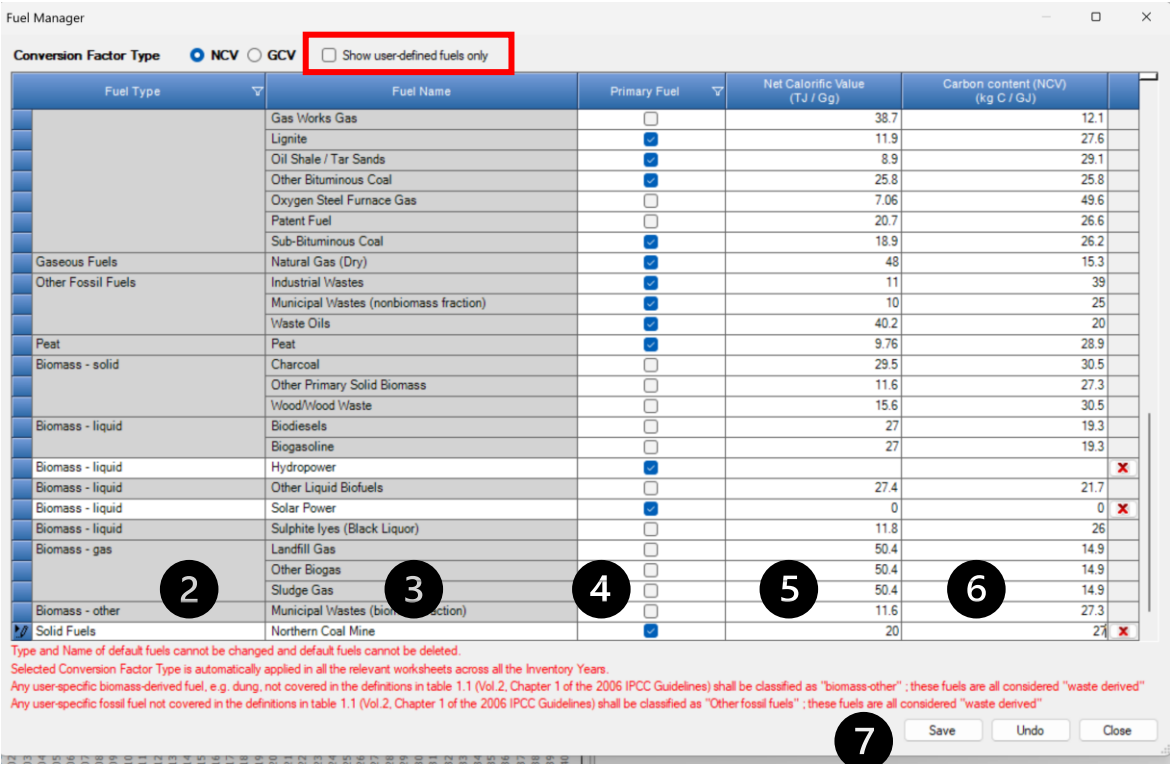
Step A: Set-up Fuel Manager

For each new (user-specific) fuel entry the following steps apply:

1. Click on the **asterisk** in the bottom-most row to add the user-specific fuel.
2. Select **fuel type** from the drop-down menu.
3. Enter specific **fuel name**.
4. Indicate (checkbox) if a **primary fuel** or not.
5. Enter its **calorific value** in TJ/Gg, (either NCV or GCV according to the selection made for entire Fuel Manager).
6. Enter **carbon content** in kg C/GJ.
7. **Save**

[To single out user-defined fuels only, the corresponding box on the window's top border shall be marked].

Example: New fuel type: Northern Coal Mine, primary fuel, NCV=20 and CC=27



Fuel Type	Fuel Name	Primary Fuel	Net Calorific Value (TJ / Gg)	Carbon content (NCV) (kg C / GJ)
	Gas Works Gas	<input type="checkbox"/>	38.7	12.1
	Lignite	<input checked="" type="checkbox"/>	11.9	27.6
	Oil Shale / Tar Sands	<input checked="" type="checkbox"/>	8.9	29.1
	Other Bituminous Coal	<input checked="" type="checkbox"/>	25.8	25.8
	Oxygen Steel Furnace Gas	<input type="checkbox"/>	7.06	49.6
	Patent Fuel	<input type="checkbox"/>	20.7	26.6
	Sub-Bituminous Coal	<input checked="" type="checkbox"/>	18.9	26.2
Gaseous Fuels	Natural Gas (Dry)	<input checked="" type="checkbox"/>	48	15.3
Other Fossil Fuels	Industrial Wastes	<input checked="" type="checkbox"/>	11	39
	Municipal Wastes (nonbiomass fraction)	<input checked="" type="checkbox"/>	10	25
	Waste Oils	<input checked="" type="checkbox"/>	40.2	20
Peat	Peat	<input checked="" type="checkbox"/>	9.76	28.9
Biomass - solid	Charcoal	<input type="checkbox"/>	29.5	30.5
	Other Primary Solid Biomass	<input type="checkbox"/>	11.6	27.3
	Wood/Wood Waste	<input type="checkbox"/>	15.6	30.5
Biomass - liquid	Biodiesels	<input type="checkbox"/>	27	19.3
	Biogasoline	<input type="checkbox"/>	27	19.3
Biomass - liquid	Hydropower	<input checked="" type="checkbox"/>		
Biomass - liquid	Other Liquid Biofuels	<input type="checkbox"/>	27.4	21.7
Biomass - liquid	Solar Power	<input checked="" type="checkbox"/>	0	0
Biomass - liquid	Sulphite lyes (Black Liquor)	<input type="checkbox"/>	11.8	26
Biomass - gas	Landfill Gas	<input type="checkbox"/>	50.4	14.9
	Other Biogas	<input type="checkbox"/>	50.4	14.9
	Sludge Gas	<input type="checkbox"/>	50.4	14.9
Biomass - other	Municipal Wastes (biomass fraction)	<input type="checkbox"/>	11.6	27.3
Solid Fuels	Northern Coal Mine	<input checked="" type="checkbox"/>	20	27

NCV GCV Show user-defined fuels only

Type and Name of default fuels cannot be changed and default fuels cannot be deleted.
 Selected Conversion Factor Type is automatically applied in all the relevant worksheets across all the Inventory Years.
 Any user-specific biomass-derived fuel, e.g. dung, not covered in the definitions in table 1.1 (Vol.2, Chapter 1 of the 2006 IPCC Guidelines) shall be classified as "biomass-other"; these fuels are all considered "waste derived"
 Any user-specific fossil fuel not covered in the definitions in table 1.1 (Vol.2, Chapter 1 of the 2006 IPCC Guidelines) shall be classified as "Other fossil fuels"; these fuels are all considered "waste derived"

Save Undo Close

Step B: Fuel Consumption Data

Then, compile worksheet **Fuel Consumption Data** either with a single row of data for the entire category or with subnational aggregations.

Then, for each subdivision in Column |S| data are entered row by row as follows:

1. Column |F|: select each fuel used from the drop-down menu (one row for each fuel)
(Note that fuels shown in the dropdown are those listed in the Fuel Manager. User can filter fuels shown in the “Fuel Type” bar at the top)

2. Column |U|: enter unit of fuel consumption data (e.g. Gg, TJ, m³). To enter a user-specific unit (e.g. m³) select Gg (Manual CF) from the dropdown menu and overwrite Gg with the user-specific unit.

3. Column |C|: enter corresponding amount of fuel consumed.

4. Column |CF|: enter conversion factor to convert the consumption unit to an energy unit (TJ). Note that where Gg of fuel are entered, the NCV/GCV is automatically sourced from the Fuel Manager; while if the consumption unit is TJ the Software compiles the conversion factor with the value 1. Where other units are applied (e.g. m³) the user shall enter the relevant conversion factor here.

Fuel Consumption Data Fuel Combustion Emissions

Worksheet: Energy 2022

Sector: Fuel Combustion Activities

Subcategory: 1.A.1.a.i - Electricity Generation

Sheet: Fuel Consumption Data

Data

Fuel Type: (All fuels)

Equation 2.4

Subdivision	Fuel	Consumption Unit	Consumption (Mass, Volume or Energy Unit)	Conversion Factor (TJ/Unit) (NCV)	Total consumption (TJ)
S	F	U	C	CF	TC = C * CF
Northern	Municipal Wastes (nonbiomass fraction)	TJ	4,000	1	4,000
Power City 1	Charcoal	TJ	200	1	200
Power City 1	Liquefied Petroleum Gases	TJ	2,900	1	2,900
Unspecified	Anthracite	TJ	40,000	1	40,000
Unspecified	Gas/Diesel Oil	TJ	1,000	1	1,000
Unspecified	Natural Gas (Dry)	TJ	10,000	1	10,000
Unspecified	Peat	TJ	3,500	1	3,500
Total					61,600

Step C: Fuel Consumption Emissions

Then, the **Fuel Combustion Emissions** worksheet is pre-filled by the *Software* with rows corresponding to the number of subdivision/fuel combinations entered in worksheet **Fuel Consumption Data**.

1. For each row, users click the symbol “田” on the left of the row to open a drop-down table where EF values are to be compiled.

2. Drop-down table can be filled: either with a single row of data, this is the case for IPCC default method; or with several rows, one row for each technology type, this is the case for IPCC Tier 3 method.

3. Again the “Fuel Type” bar available to enter data for each fuel one by one.

The screenshot displays the 'Fuel Combustion Emissions' worksheet for the year 2022. The 'Sector' is Energy, 'Category' is Fuel Combustion Activities, and 'Subcategory' is 1.A.1.a.i - Electricity Generation. The 'Sheet' is Fuel Combustion Emissions. A drop-down menu for 'Fuel Type' is open, showing options like (All fuels), Liquid Fuels, Solid Fuels, Gaseous Fuels, Other Fossil Fuels, Peat, Biomass - solid, Biomass - liquid, Biomass - gas, Biomass - other, and Unspecified. The main table shows data for various fuels and technologies, with columns for Fuel, Total consumption (TJ), CO2 Emissions (Gg CO2), CH4 Emissions (Gg CH4), and N2O Emissions (Gg N2O). A second table below shows technology-specific data with columns for Type of Technology, Technology penetration (%), Consumption (TJ), CO2 Emission Factor (kg CO2/TJ), Amount Captured (Gg CO2), CO2 Emissions (Gg CO2), CH4 Emission Factor (kg CH4/TJ), CH4 Emissions (Gg CH4), N2O Emission Factor (kg N2O/TJ), and N2O Emissions (Gg N2O). The 'Technology 3' row is highlighted.

Fuel	Total consumption (TJ)	CO2 Emissions (Gg CO2)	CH4 Emissions (Gg CH4)	N2O Emissions (Gg N2O)
Municipal Wastes (nonbiomass fraction)	4,000	0	0	0
Charcoal	200	17.4	0.02	0.0004
Liquefied Petroleum Gases	2,900	177.99	0.00145	0.000029
Anthracite	40,000	3,922	0.76	0.096
Gas/Diesel Oil	1,000	80	0.003	0.0006
Natural Gas (Dry)	10,000	558	0.01	0.001
Peat	3,500	366	0.0035	0.00525

Type of Technology	Technology penetration (%)	Consumption (TJ)	CO2 Emission Factor (kg CO2/TJ)	Amount Captured (Gg CO2)	CO2 Emissions (Gg CO2)	CH4 Emission Factor (kg CH4/TJ)	CH4 Emissions (Gg CH4)	N2O Emission Factor (kg N2O/TJ)	N2O Emissions (Gg N2O)
T	P	C=TC*(P/100)	EF(CO2)	Z	CO2=C*EF (CO2)/10*6-Z	EF(CH4)	CH4=C*EF (CH4)/10*6	EF(N2O)	N2O=C*EF (N2O)/10*6
Technology 3	100	3,500	106,000	5	366	1	0.0035	1.5	0.00525

Step C: Fuel Consumption Emissions - EFs

Compile each row as follows:

1. **Column [T]:** enter technology type. Where the IPCC default method is applied, the notation “unspecified” is selected.
2. **Column [P]:** enter technology penetration rate (%) associated with each technology type. The technology penetration rate apportions the total fuel consumed in the subdivision among technology types. Where the IPCC default method is applied, the value 100 is automatically entered by the Software. (For each fuel in each subdivision, summing up technology penetration rates shall = 100%)

3. **Column [EF(CO₂)]:** select from the drop-down menu the IPCC default value or, for user-specific fuels entered in the **Fuel Manager**, the value calculated by the Software as the carbon content multiplied by 44/12; otherwise enter the technology-type-specific value, in kg of CO₂ per TJ.

4. **Column [EF(CH₄)]** and **Column [EF(N₂O)]:** select from the drop-down menu the IPCC default value or enter the technology-type-specific value, in kg of CH₄ per TJ or kg of N₂O per TJ, respectively.

Fuel Consumption Data Fuel Combustion Emissions

Worksheet: Energy 2022

Sector: Fuel Combustion Activities

Category: 1.A.1.a) - Electricity Generation

Subcategory: Fuel Combustion Emissions

Sheet: Fuel Combustion Emissions

Data

Fuel Type: (All fuels)

Subdivision		Fuel	Total consumption (TJ)	CO ₂ Emissions (Gg CO ₂)	CH ₄ Emissions (Gg CH ₄)	N ₂ O Emissions (Gg N ₂ O)
S	F	TC	CO ₂	CH ₄	N ₂ O	
Northern	Municipal Wastes (nonbiomass fraction)	4,000	0	0	0	
Power City 1	Charcoal	200	17.4	0.02	0.0004	
Power City 1	Liquefied Petroleum Gases	2,900	177.99	0.00145	0.000029	

Type of Technology	Technology penetration (%)	Consumption (TJ)	CO ₂		CH ₄		N ₂ O		
			CO ₂ Emission Factor (kg CO ₂ /TJ)	Amount Captured (Gg CO ₂)	CH ₄ Emission Factor (kg CH ₄ /TJ)	CH ₄ Emissions (Gg CH ₄)	N ₂ O Emission Factor (kg N ₂ O/TJ)	N ₂ O Emissions (Gg N ₂ O)	
T	P	C=TC*(P/100)	EF(CO ₂)	Z	CO ₂ =C*EF (CO ₂)/10 ⁶ -Z	EF(CH ₄)	CH ₄ =C*EF (CH ₄)/10 ⁶	EF(N ₂ O)	N ₂ O=C*EF (N ₂ O)/10 ⁶
Technology 4	100	2,900	63,100	5	177.99	0.5	0.00145	0.01	0.000029
Total		2,900			177.99		0.00145		0.000029

Step D: Fuel Combustion Emissions- Results

1. To estimate the total CO₂ emitted into the atmosphere, the amount of CO₂ captured instead of emitted into the atmosphere is to be entered in Gg CO₂ in **Column |Z|** of worksheet **Fuel Combustion Emissions**.
2. Then, for each GHG, emissions from each source are calculated by the *Software*, in mass unit (Gg). Total emissions from each source of stationary combustion is the sum of all emissions from combustion of all fuels listed in all subdivisions.

Fuel Consumption Data Fuel Combustion Emissions

Worksheet

Sector: Energy 2022

Category: Fuel Combustion Activities

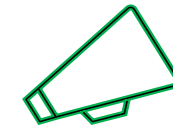
Subcategory: 1.A.1.a.i - Electricity Generation

Sheet: Fuel Combustion Emissions

Data

Fuel Type: (All fuels)

Subdivision		Fuel	Total consumption (TJ)	CO2 Emissions (Gg CO2)	CH4 Emissions (Gg CH4)	N2O Emissions (Gg N2O)			
S		F	TC	CO2	CH4	N2O			
Northern		Municipal Wastes (nonbiomass fraction)	4,000	383.48	0.132	0.0176			
Technology		CO2	CH4	N2O					
Type of Technology	Technology penetration (%)	Consumption (TJ)	CO2 Emission Factor (kg CO2/TJ)	Amount Captured (Gg CO2)	CO2 Emissions (Gg CO2)	CH4 Emission Factor (kg CH4/TJ)	CH4 Emissions (Gg CH4)	N2O Emission Factor (kg N2O/TJ)	N2O Emissions (Gg N2O)
T	P	C=TC*(P/100)	EF(CO2)	Z	CO2=C*EF(CO2)/10 ⁶ *Z	EF(CH4)	CH4=C*EF(CH4)/10 ⁶	EF(N2O)	N2O=C*EF(N2O)/10 ⁶
Technology 1	60	2,400	91,700	10	210.08	30	0.072	4	0.0096
Technology 2	50	2,000	91,700	10	173.4	30	0.06	4	0.008
Total		4,400			383.48		0.132		0.0176



Do you notice the error in the image?

The *Software* has alerted you that the technology penetration rates are greater than 100%.

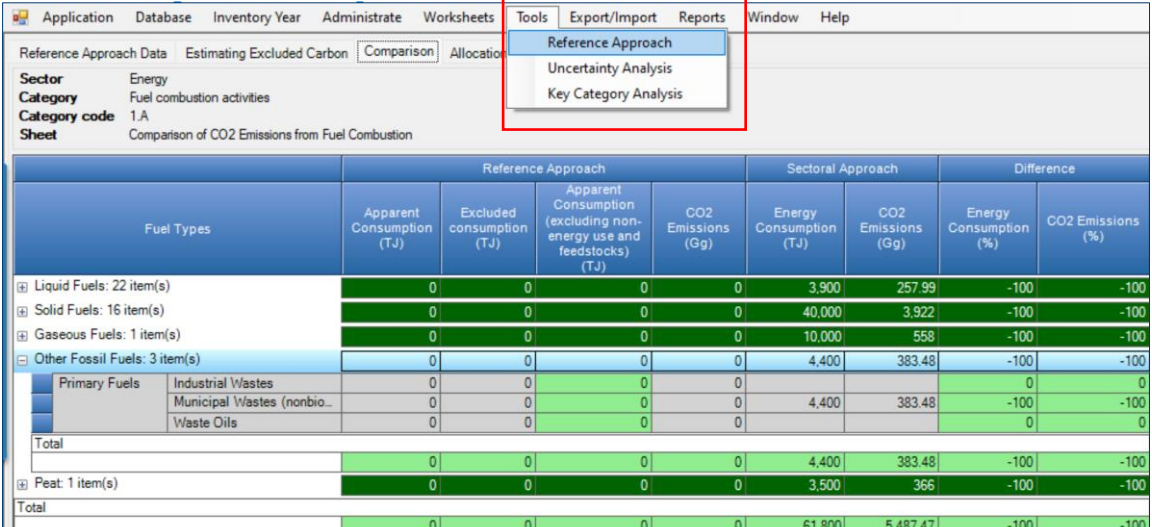
Comparing Sectoral and Reference Approaches

- You have just estimated GHG emissions from electricity generation – this estimation methodology is based on sectoral consumption, and part of the **Sectoral Approach**.

- The **Reference Approach** is designed to calculate CO₂ emissions from fuel combustion, starting from high-level energy supply data. This approach does not distinguish between different source categories within the energy sector and only estimates total emissions from source category 1.A Fuel Combustion.

- The *Software* can calculate the Reference Approach and make a comparison between emissions estimated using the Reference and Sectoral Approaches.
- In the **Comparison tab** of the Reference Approach menu, the energy consumption and emissions from the data entered for electricity generation (under Sectoral Approach).

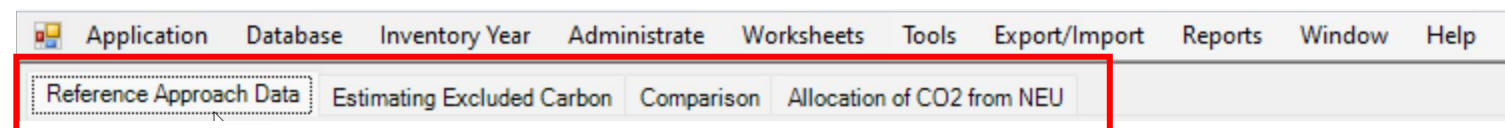
Main menu → Tools → Reference



The screenshot shows the software interface with the 'Tools' menu open, highlighting the 'Reference Approach' option. Below the menu, a table compares the Reference Approach and Sectoral Approach for CO₂ emissions from fuel combustion.

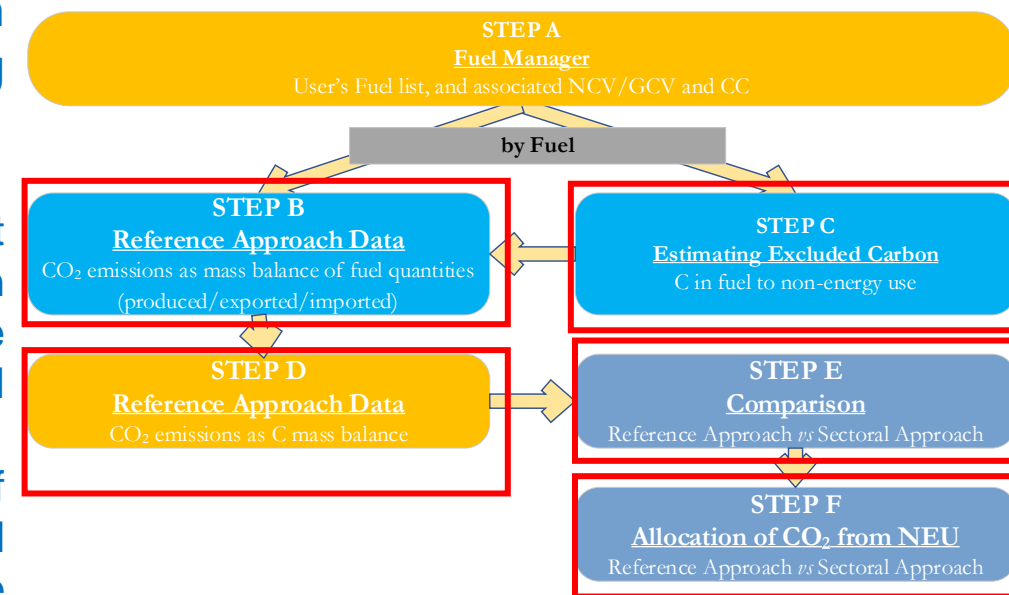
Fuel Types	Reference Approach				Sectoral Approach		Difference	
	Apparent Consumption (TJ)	Excluded consumption (TJ)	Apparent Consumption (excluding non-energy use and feedstocks) (TJ)	CO ₂ Emissions (Gg)	Energy Consumption (TJ)	CO ₂ Emissions (Gg)	Energy Consumption (%)	CO ₂ Emissions (%)
☑ Liquid Fuels: 22 item(s)	0	0	0	0	3,900	257.99	-100	-100
☑ Solid Fuels: 16 item(s)	0	0	0	0	40,000	3,922	-100	-100
☑ Gaseous Fuels: 1 item(s)	0	0	0	0	10,000	558	-100	-100
☑ Other Fossil Fuels: 3 item(s)	0	0	0	0	4,400	383.48	-100	-100
Primary Fuels								
Industrial Wastes	0	0	0	0	0	0	0	0
Municipal Wastes (nonbio...)	0	0	0	0	4,400	383.48	-100	-100
Waste Oils	0	0	0	0	0	0	0	0
Total	0	0	0	0	4,400	383.48	-100	-100
☑ Peat: 1 item(s)	0	0	0	0	3,500	366	-100	-100
Total	0	0	0	0	61,800	5,487.47	-100	-100

Comparing Sectoral and Reference Approaches



The *Software* calculates CO₂ emissions from fuel combustion categories for the top-down reference approach using the following worksheets:

- **Fuel Manager:** information on *carbon content* and *calorific value*
- **Reference Approach Data:** for each fuel type calculates apparent consumption; uses data *calorific value* and *carbon content* (filled in automatically from the **Fuel Manager**), the excluded carbon, and the fraction oxidized. From this information the worksheet calculates actual CO₂ emissions.
- **Estimating Excluded Carbon:** contains for specific fuels the amount of the total estimated quantity of carbon which does not lead to fuel combustion emissions, calculates the amount of carbon that shall be excluded from the emissions.
- **Comparison:** Compares summary information on total estimated AD and CO₂ emissions from the Reference and Sectoral approaches.
- **Allocation of CO₂ from NEU** summarizes the total CO₂ excluded from the reference approach, by fuel. This worksheet allows for reporting the CO₂ emissions from NEU reported elsewhere in the NGHGI, identifying in which category they are reported.



Step B. Reference Approach Data

We have already explored the Fuel Manager, so here we start with Step B. Reference Approach Data. For each fuel, enter the following information:

- Column [Unit]:** select or enter manually the measurement unit used (e.g. Gg, TJ, m³). (see “+” sign to expand to the full fuel list)
- Column [A]:** input the amount of production of the fuel (primary fuels only)
- Column [B]:** input the amount of imported fuel
- Column [C]:** input the amount of exported fuel
- Column [D]:** input the amount of fuel used for international bunkers, if applicable
- Column [E]:** input the amount of stock change. Note that an increase in stocks is a positive stock change which withdraws supply from consumption. A stock reduction is a negative stock change which, when subtracted in the equation, causes an increase in apparent consumption

Reference Approach Data		Estimating Excluded Carbon													Comparison	Allocation of CO2 from NEU	2022
Sector	Energy																
Category	Fuel combustion activities																
Category code	1.A																
Sheet	CO2 from energy sources - Reference Approach																
		1	2	3	4	5	6	Step 1		Step 2		Step 3		Step 4		Step 5	
		Production (Unit)	Imports (Unit)	Exports (Unit)	International Bunkers (Unit)	Stock change (Unit)	Apparent Consumption (Unit)	Conversion Factor (TJ/Unit)	Apparent Consumption (TJ)	Carbon content (t CO ₂ /TJ)	Total Carbon (Gg C)	Excluded Carbon (Gg C)	Net Carbon Emissions (Gg C)	Fraction of Carbon Oxidised			
Fuel Types		Unit	A	B	C	D	E	F=A+B-C-D-E	G	H=F*G	I	J=H*1000	K	L=J-K	M		
Liquid Fuels: 22 item(s)																	
Primary Fuels	Crude Oil	Gg						0	42.3	0	3,090	53,418		53,418			
	Natural Gas Liquids	Gg						0	44.2	0	20	0		0			
	Orimulsion	Gg						0	27.5	0	21	0		0			
Secondary Fuels	Aviation Gasoline	Gg						0	44.3	0	19.1	0		0			
	Bitumen	Gg						0	40.2	0	22	0		0			
	Ethane	Gg						0	46.4	0	16.8	0		0			
	Gas/Diesel Oil	TJ		100		10		90	1	90	20.2	1,818		1,818	1		
	Jet Gasoline	Gg						0	44.3	0	19.1	0		0			
	Jet Kerosene	Gg						0	44.1	0	19.5	0		0			
	Liquefied Petroleum Gases	TJ		3,000				3,000	1	3,000	17.2	51.6		51.6	1		
	Lubricants	Gg						0	40.2	0	20	0		0			
	Motor Gasoline	Gg						0	44.3	0	18.9	0		0			
	Naphtha	Gg						0	44.5	0	20	0		0			
	Other Kerosene	Gg						0	43.8	0	19.6	0		0			
	Other Petroleum Products	Gg						0	40.2	0	20	0		0			
	Paraffin Waxes	Gg						0	40.2	0	20	0		0			
	Petroleum Coke	Gg						0	32.5	0	26.6	0		0			
	Refinery Feedstocks	Gg						0	43	0	20	0		0			
	Refinery Gas	Gg						0	49.5	0	15.7	0		0			
	Residual Fuel Oil	Gg						0	40.4	0	21.1	0		0			
	Shale Oil	Gg						0	38.1	0	20	0		0			
	White Spirit and SBP	Gg						0	40.2	0	20	0		0			
Solid Fuels: 16 item(s)																	
Primary Fuels	Anthracite	TJ	41,000			500		40,500	1	40,500	26.8	1,085.4		1,085.4	1		
	Coking Coal	Gg						0	28.2	0	25.8	0		0			
	Lignite	Gg						0	11.9	0	27.6	0		0			
	Northern Coal Mine	Gg						0	20	0	27	0		0			
	Oil Shale / Tar Sands	Gg						0	8.9	0	29.1	0		0			
	Other Bituminous Coal	Gg						0	25.8	0	25.8	0		0			

1) Values in column K are taken from column E of Estimating Excluded Carbon worksheet

Step B. Reference Approach Data

For each fuel, enter the following information (*continued*):

7. **Column [F]:** the *Software* estimates the amount of apparent consumption of the fuel.

8. **Column [G]:** conversion factor in (TJ/Unit) is filled automatically from the Fuel Manager.

Note that where Gg of fuel are converted to TJ, the NCV/GCV is sourced from the Fuel Manager and compiled by the Software as a conversion factor; while if the consumption unit is TJ, the Software compiles the conversion factor cell with the value 1. Where other units are applied (e.g. m³) the user shall enter relevant conversion unit here.

		Step 1					Step 2		Step 3		Step 4		Step		
		Production (Unit)	Imports (Unit)	Exports (Unit)	International Bunkers (Unit)	Stock change (Unit)	Apparent Consumption (Unit)	Conversion Factor (TJ/Unit)	Apparent Consumption (TJ)	Carbon content (t C/TJ)	Total Carbon (Gg C)	Excluded Carbon (Gg C)	Net Carbon Emissions (Gg C)	Fraction of Carbon Oxidised	
Fuel Types		Unit	A	B	C	D	E	F=A+B-C-D-E	G	H=F*G	I	J=H*V1000	K	L=J-K	M
Liquid Fuels: 22 item(s)										3,090		53,418		53,418	
Primary Fuels	Crude Oil	Gg					0	42.3	0	20	0	0	0	0	
	Natural Gas Liquids	Gg					0	44.2	0	17.5	0	0	0	0	
	Orimulsion	Gg					0	27.5	0	21	0	0	0	0	
Secondary Fuels	Aviation Gasoline	Gg					0	44.3	0	19.1	0	0	0	0	
	Bitumen	Gg					0	40.2	0	22	0	0	0	0	
	Ethane	Gg					0	46.4	0	16.8	0	0	0	0	
	Gas/Diesel Oil	TJ		100		10	90	1	90	20.2	1,818	0	1,818	1	
	Jet Gasoline	Gg					0	44.3	0	19.1	0	0	0	0	
	Jet Kerosene	Gg					0	44.1	0	19.5	0	0	0	0	
	Liquefied Petroleum Gases	TJ		3,000			3,000	1	3,000	17.2	51.6	0	51.6	1	
	Lubricants	Gg					0	40.2	0	20	0	0	0	0	
	Motor Gasoline	Gg					0	44.3	0	18.9	0	0	0	0	
	Naphtha	Gg					0	44.5	0	20	0	0	0	0	
	Other Kerosene	Gg					0	43.8	0	19.6	0	0	0	0	
	Other Petroleum Products	Gg					0	40.2	0	20	0	0	0	0	
	Paraffin Waxes	Gg					0	40.2	0	20	0	0	0	0	
	Petroleum Coke	Gg					0	32.5	0	26.6	0	0	0	0	
	Refinery Feedstocks	Gg					0	43	0	20	0	0	0	0	
	Refinery Gas	Gg					0	49.5	0	15.7	0	0	0	0	
	Residual Fuel Oil	Gg					0	40.4	0	21.1	0	0	0	0	
	Shale Oil	Gg					0	38.1	0	20	0	0	0	0	
	White Spirit and SBP	Gg					0	40.2	0	20	0	0	0	0	
Solid Fuels: 16 item(s)										40,500		1,085.4		1,085.4	
Primary Fuels	Anthracite	TJ	41,000			500	40,500	1	40,500	26.8	1,085.4	0	1,085.4	1	
	Coking Coal	Gg					0	28.2	0	25.8	0	0	0	0	
	Lignite	Gg					0	11.9	0	27.6	0	0	0	0	
	Northern Coal Mine	Gg					0	20	0	27	0	0	0	0	
	Oil Shale / Tar Sands	Gg					0	8.9	0	29.1	0	0	0	0	
	Other Bituminous Coal	Gg					0	25.8	0	25.8	0	0	0	0	

1) Values in column K are taken from column E of Estimating Excluded Carbon worksheet

Step C. Estimating Excluded Carbon

For each fuel in the Column |Fuel Types|, enter the following information:

1. **Column |A|**: enter the estimated quantity of the fuel not used for combustion purposes (e.g. natural gas used as a feedstock for ammonia production, or coking coal used in the iron and steel industry).

2. **Column |Unit|**: select or enter manually the measurement unit used (e.g. Gg, TJ, m³).

3. **Column |B|**: conversion factor in TJ/Unit is filled automatically from the Fuel Manager.

4. **Column |D|**: carbon content is filled automatically from the Fuel Manager in t C/TJ.

5. Excluded carbon in **Column |E|** is then automatically included in **Column |K|** of the **Reference Approach Data** tab.

Fuel Types	Estimated Quantities (Unit)	Unit	Conversion Factor (TJ/Unit)	Estimated Quantities (TJ)	Carbon content (t C/TJ)	Excluded Carbon (Gg C)
	A		B	C = A * B	D	E = C * D / 1000
Liquid Fuels: 22 item(s)						
Aviation Gasoline		Gg	44.3	0	19.1	0
Bitumen		Gg	40.2	0	22	0
Crude Oil		Gg	42.3	0	20	0
Ethane		Gg	46.4	0	16.8	0
Gas/Diesel Oil		Gg	43	0	20.2	0
Jet Gasoline		Gg	44.3	0	19.1	0
Jet Kerosene		Gg	44.1	0	19.5	0
Liquefied Petroleum Gases	1,000	TJ	1	1,000	17.2	17.2
Lubricants		Gg	40.2	0	20	0
Motor Gasoline		Gg	44.3	0	18.9	0
Naphtena		Gg	44.3	0	20	0
Natural Gas Liquids		Gg	44.2	0	17.5	0
Orimulsion		Gg	27.5	0	21	0
Other Kerosene		Gg	43.8	0	19.6	0
Other Petroleum Products		Gg	40.2	0	20	0
Paraffin Waxes		Gg	40.2	0	20	0
Petroleum Coke		Gg	32.5	0	26.6	0
Refinery Feedstocks		Gg	43	0	20	0
Refinery Gas		Gg	49.5	0	15.7	0
Residual Fuel Oil		Gg	40.4	0	21.1	0
Shale Oil		Gg	38.1	0	20	0
White Spirit and SBP		Gg	40.2	0	20	0
Solid Fuels: 16 item(s)						
Gaseous Fuels: 1 item(s)						
Natural Gas (Dry)	200	TJ	1	200	15.3	3.06
Other Fossil Fuels: 3 item(s)						
Peat: 1 item(s)						
Biomass - solid: 3 item(s)						
Biomass - liquid: 6 item(s)						
Biomass - gas: 3 item(s)						
Biomass - other: 1 item(s)						

Step D. Reference Approach Data Tab

Input of EFs for the Reference Approach requires the following steps:

1. **Column [I]:** carbon content is filled automatically from the Fuel Manager in t C/TJ.
2. Excluded carbon in **Column [K]** is taken automatically from the **Excluded Carbon** worksheet

3. **Column [M]:** enter fraction of oxidized carbon.

Note if no information on this factor is available, the value "1" shall be entered to proceed with calculations

4. Software estimate CO₂ emissions following the Reference Approach

Reference Approach Data Estimating Excluded Carbon Comparison Allocation of CO2 from NEU

Sector: Energy
Category: Fuel combustion activities
Category code: 1.A
Sheet: CO2 from energy sources - Reference Approach

2022

Fuel Types	Unit	Step 1					Step 2		Step 3		Step 4		Step 5		
		Production (Unit)	Imports (Unit)	Exports (Unit)	International Bunkers (Unit)	Stock change (Unit)	Apparent Consumption (Unit)	Conversion Factor (TJ/Unit)	Apparent Consumption (TJ)	Carbon content (t C/TJ)	Total Carbon (Gg C)	Excluded Carbon (Gg C)	Net Carbon Emissions (Gg C)	Fraction of Carbon Oxidised	Actual CO2 Emissions (Gg CO2)
		A	B	C	D	E	F=A+B-C-D-E	G	H=F*G	I	J=H*1000	K	L=J-K	M	N=J*M*1000
Liquid Fuels: 22 item(s)															
Primary Fuels	Gg								3,090		53,418		36,218		132,799,333.33
Crude Oil	Gg						0	42.3	0	20	0		0		0
Natural Gas Liquids	Gg						0	44.2	0	17.5	0		0		0
Orimulsion	Gg						0	27.5	0	21	0		0		0
Secondary Fuels	Gg						0	44.3	0	19.1	0		0		0
Aviation Gasoline	Gg						0	40.2	0	22	0		0		0
Bitumen	Gg						0	46.4	0	16.8	0		0		0
Ethane	Gg						0	46.4	0	16.8	0		0		0
Gas/Diesel Oil	TJ		100		10		90	1	90	20.2	1,818		1,818	1	6,666
Jet Gasoline	Gg						0	44.3	0	19.1	0		0		0
Jet Kerosene	Gg						0	44.1	0	19.5	0		0		0
Liquefied Petroleum Gases	TJ		3,000				3,000	1	3,000	17.2	51.6	17.2	34.4	1	126,133,333.33
Lubricants	Gg						0	40.2	0	20	0		0		0
Motor Gasoline	Gg						0	44.3	0	18.9	0		0		0
Naphtha	Gg						0	44.5	0	20	0		0		0
Other Kerosene	Gg						0	43.8	0	19.6	0		0		0
Other Petroleum Products	Gg						0	40.2	0	20	0		0		0
Paraffin Waxes	Gg						0	40.2	0	20	0		0		0
Petroleum Coke	Gg						0	32.5	0	26.6	0		0		0
Refinery Feedstocks	Gg						0	43	0	20	0		0		0
Refinery Gas	Gg						0	49.5	0	15.7	0		0		0
Residual Fuel Oil	Gg						0	40.4	0	21.1	0		0		0
Shale Oil	Gg						0	38.1	0	20	0		0		0
White Spirit and SBP	Gg						0	40.2	0	20	0		0		0
Solid Fuels: 16 item(s)															
								40,500			1,085.4		1,085.4		3,979.8
Gaseous Fuels: 1 item(s)															
								11,900			182.07		179.01		656.37
Other Fossil Fuels: 3 item(s)															
								4,000			100		100		363
Peat: 1 item(s)															
								3,500			101.15		101.15		367,174.5
Biomass - solid: 3 item(s)															
								400			12.2		12.2		43,391,333.33
Biomass - liquid: 6 item(s)															
								0			0		0		0
Biomass - gas: 3 item(s)															
								0			0		0		0

1) Values in column K are taken from column E of Estimating Excluded Carbon worksheet



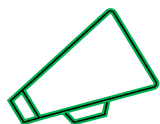
Recall: gray shading means that data contained in that cell are automatically pooled from somewhere else.

Step E. Comparison

The *Software* provides results of CO₂ estimations under the Reference and Sectoral approaches and performs a comparison between the two approaches by each fuel, fuel type and total for the NGHGI. For each fuel, enter following information:

- Worksheet **Comparison** presents the results for the **Reference Approach**, as well as main AD (apparent consumption). This worksheet also summarizes the main AD and CO₂ emissions calculated under the **Sectoral Approach**, by fuel type. In the Columns [**Difference**], the *Software* provides the comparative difference between the Reference and Sectoral approaches in terms of energy consumption and CO₂ emissions.
- The [2006 IPCC Guidelines, Section 6.8](#), provide possible reasons for a gap between the two approaches, (expected to be less than 5%). For higher percent differences, reporting programs typically require users to provide a clear explanation and justification.

Fuel Types	Reference Approach				Sectoral Approach		Difference	
	Apparent Consumption (TJ)	Excluded consumption (TJ)	Apparent Consumption (excluding non-energy use and feedstocks) (TJ)	CO ₂ Emissions (Gg)	Energy Consumption (TJ)	CO ₂ Emissions (Gg)	Energy Consumption (%)	CO ₂ Emissions (%)
☑ Liquid Fuels: 22 item(s)	3,090	1,000	2,090	132.79933333	3,900	257.99	-46.41025641	-48.52539504
☑ Solid Fuels: 16 item(s)	40,500	0	40,500	3,979.8	40,000	3,922	1.25	1.47373789
☑ Gaseous Fuels: 1 item(s)	11,900	200	11,700	656.37	10,000	558	17	17.62903226
☑ Other Fossil Fuels: 3 item(s)	4,000	0	4,000	363	4,400	383.48	-9.09090909	-5.34056535
☑ Peat: 1 item(s)	3,500	0	3,500	367.1745	3,500	366	0	0.32090164
Total	62,990	1,200	61,790	5,499.14383	61,800	5,487.47	-0.01618123	0.21273617



In this example, which reason might you provide for the sectoral approach being greater than the reference approach for liquid fuels?

Step F. Allocation of CO₂ from NEU

For each relevant fuel in Column |Fuel Types| that is used for NEU and for which CO₂ emissions from the use of that fuel are reported elsewhere, enter the following information:

1. Column |CO₂neu|: enter the quantity of CO₂ emissions from NEU that is reported elsewhere in the NGHGI, in GgCO₂ (e.g. CO₂ emissions from the liquified petroleum gases used in petrochemical production).

2. Column |CAT|: for each relevant fuel, click on the editing box in the left-hand side of the column and select one or more categories of the inventory where these CO₂ emissions are reported.

Reference Approach Data				Estimating Excluded Carbon		Comparison		Allocation of CO ₂ from NEU	
Sector	Energy								
Category	Fuel combustion activities								
Category code	1.A								
Sheet	Allocation of CO ₂ from NEU								
		CO ₂ Excluded from Reference Approach (Gg CO ₂)			CO ₂ emissions from NEUs reported in the inventory (Gg CO ₂)				
Fuel Types		EXCLra			CO ₂ neu	Categories under which CO ₂ emissions from NEU are reported			
						CAT			
Liquid Fuels: 22 item(s)		63.06666667			63				
Aviation Gasoline									
Bitumen									
Crude Oil									
Ethane									
Gas/Diesel Oil									
Jet Gasoline									
Jet Kerosene									
Liquefied Petroleum Gases		63.06666667			63	Ethylene			
Lubricants									
Motor Gasoline									
Naphtha									
Natural Gas Liquids									
Orimulsion									
Other Kerosene									
Other Petroleum Products									
Paraffin Waxes									
Petroleum Coke									
Refinery Feedstocks									
Refinery Gas									
Residual Fuel Oil									
Shale Oil									
White Spirit and SBP									
Solid Fuels: 16 item(s)		0			0				
Gaseous Fuels: 1 item(s)		11.22			11				
Natural Gas (Dry)		11.22			11	Methanol			

Allocation of CO₂ from Non-energy use

In the **Comparison slide**, the apparent consumption in the Reference approach was **higher than** energy consumption in the Sectoral Approach for gaseous fuels.

- One possible reason, could be that there is double counting of the natural gas used for combustion in the energy sector, and that used as a feedstock for the petrochemical industry (and thus reported in the IPPU sector). Recall, in the Estimating Excluded Carbon worksheet, we estimated 1,000 TJ were excluded?

- In this tab “Allocation of CO₂ from Non-energy use” you can indicate where this LPG was used.

- CO₂ is automatically populated from “**Estimating Excluded carbon**”
- Enter the CO₂ emissions reported elsewhere
- To select the category(ies) where reported select and check appropriate category(ies)

The screenshot shows the 'Allocation of CO₂ from NEU' worksheet in the UNFCCC Reporting Tool. The interface includes a menu bar (Application, Database, Inventory Year, Administrate, Worksheets, Tools, Export/Import, Reports, Window, Help) and a toolbar. The main data table is titled 'Allocation of CO₂ from NEU' and has the following columns: 'Fuel Types', 'CO₂ Excluded from Reference Approach (Gg CO₂)', 'CO₂ emissions from NEUs reported in the inventory (Gg CO₂)', and 'Categories under which CO₂ emissions from NEU are reported'. The table is filtered for 'Sector: Energy', 'Category: Fuel combustion activities', 'Category code: 1.A', and 'Sheet: Allocation of CO₂ from NEU'. The year is set to 2022. The table shows data for 'Liquefied Petroleum Gases' with a value of 63 in the 'CO₂ emissions from NEUs reported in the inventory' column. A dropdown menu is open, showing a list of categories with checkboxes. Three numbered callouts (1, 2, 3) highlight specific areas: 1 points to the 'Liquefied Petroleum Gases' row, 2 points to the 'CO₂ emissions from NEUs reported in the inventory' column, and 3 points to the 'Ethylene' category in the dropdown menu.

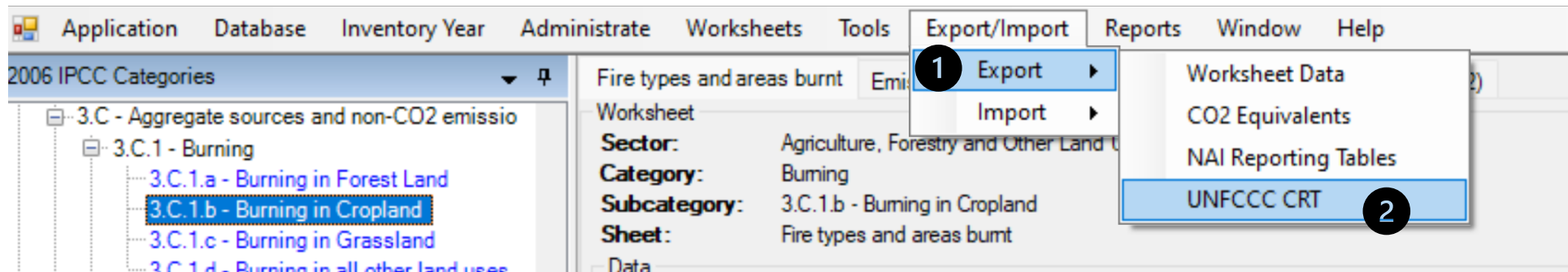
Fuel Types	CO ₂ Excluded from Reference Approach (Gg CO ₂)	CO ₂ emissions from NEUs reported in the inventory (Gg CO ₂)	Categories under which CO ₂ emissions from NEU are reported
	EXCLra	CO2neu	CAT
Liquid Fuels: 22 item(s)	63 0666667	63	
Aviation Gasoline			
Bitumen			
Crude Oil			
Ethane			
Gas/Diesel Oil			
Jet Gasoline			
Jet Kerosene			
Liquefied Petroleum Gases	63 0666667	63	Ethylene
Lubricants			
Motor Gasoline			
Naphtha			
Natural Gas Liquids			
Orinulsion			
Other Kerosene			
Other Petroleum Products			
Paraffin Waxes			
Petroleum Coke			
Refinery Feedstocks			
Refinery Gas			
Residual Fuel Oil			
Shale Oil			
White Spirit and SBP			
Solid Fuels: 16 item(s)	0	0	
Gaseous Fuels: 1 item(s)	11.22	11	Methanol
Natural Gas (Dry)	11.22	11	
Other Fossil Fuels: 3 item(s)	0	0	
Peat: 1 item(s)	0	0	
Biomass - solid: 3 item(s)	0	0	
Biomass - liquid: 6 item(s)	0	0	
Biomass - gas: 3 item(s)	0	0	

For UNFCCC CRT Reporting, the categories entered in the column "Categories under which CO₂ emissions from NEU are reported" should be the category names of the UNFCCC CRT

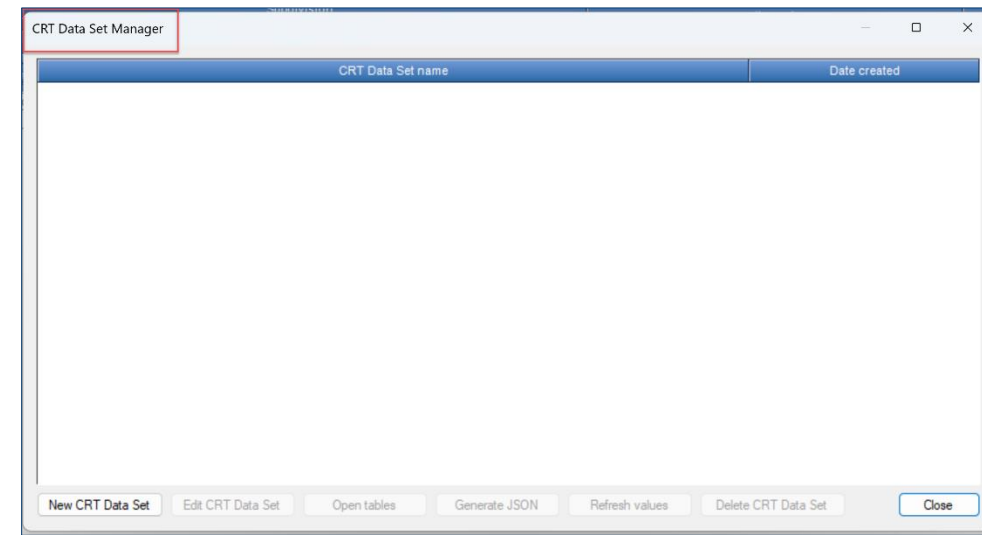
in the dropdown. This information will be used the UNFCCC ETF Reporting Tool

Access CRT Interface in Software

1. Navigate to Main Menu and select “Export/Import”
2. Select “Export” and “UNFCCC CRT”

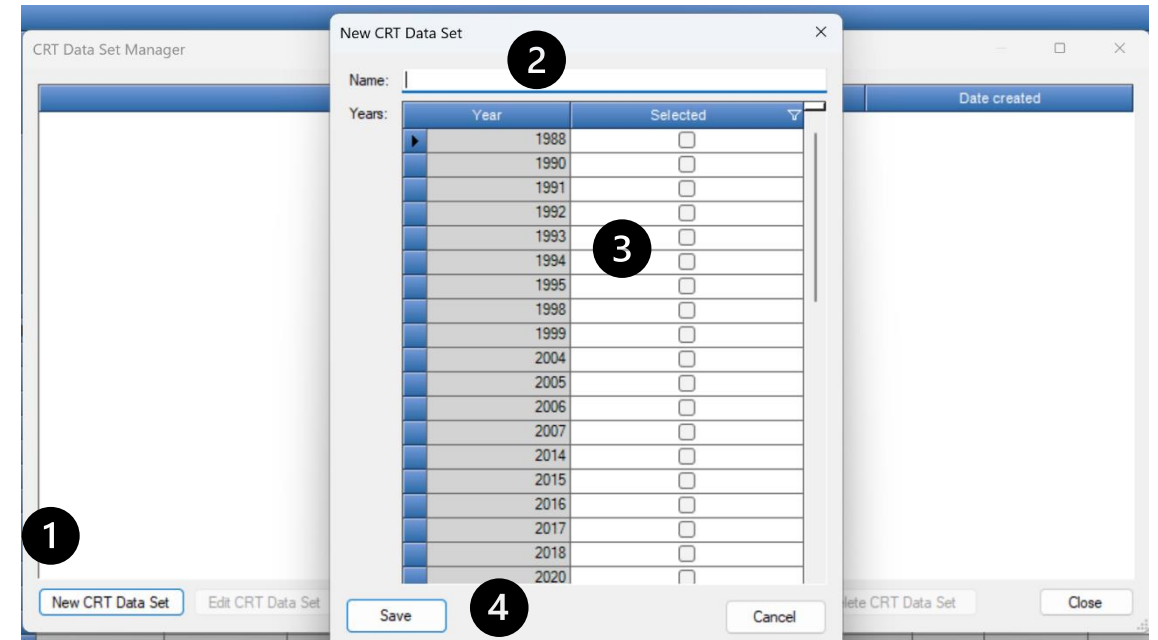
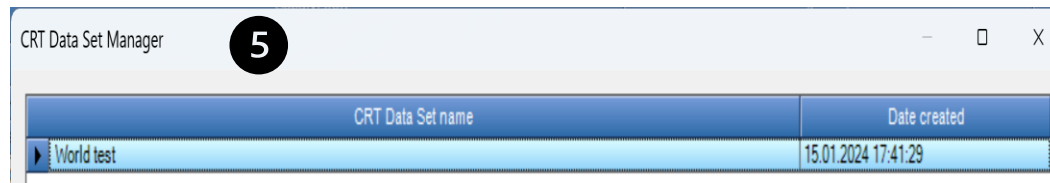


- This opens the CRT Data Set Manager interface



Create New CRT Data Set

1. **Select New CRT Data Set:** This action button opens a screen where properties of the new CRT Data Set are specified, managed and exported to JSON independently.
2. **Name** – Enter name of new CRT Data Set
3. **Years** – Select years to include in your data set
4. **Save** – Select Save
5. A new data set is created



NOTES:

- The list of years for selection will include only those years that you have created in the *Software*
- You may save in the JSON a subset of years you have in your CRT data set

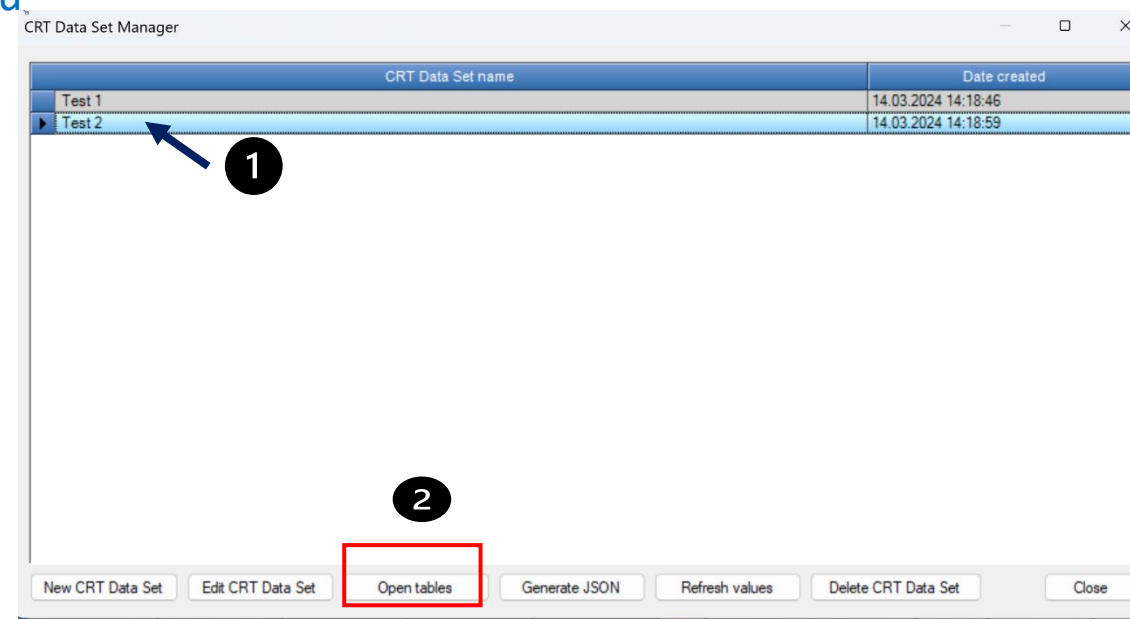
Open CRTs

- **Open Tables** is an interface that visualizes the CRT and allows you to review, manage and finalize the data for the CRT across sectors and years for your selected CRT Data Set

1. Highlight the **CRT Data Set** you want to review

2. Select **Open Tables**

- This action button opens a screen containing CRT for the currently selected CRT Data Set.
- This screen will open in a mode that allows you to switch between the visualized CRT and other *Software* screens (e.g. Worksheets). Only one visualized CRT for one CRT Data Set can be open at a time.



Recall, to access this screen navigate to the **Main Menu** and select **Export/Import / Export / UNFCCC CRT**

Open CRTs - Functionalities

- In Open Tables, you can separately visualize each table for each sector and each year and provide additional information that will be needed for your submission in the UNFCCC ETF Reporting Tool.
- In the visualized CRT, you may:
 - **Review** your data, including data aggregations
 - **Change notation keys**
 - **Provide explanations for use of the notation keys “IE” (included elsewhere) and “NE” (not estimated) for CRT table 9**
 - Provide information on the **method and EFs used**, for Summary 3 of the CRT
 - Designate information as confidential (notation key “C”)
 - Draft **“Official” comments**
 - Provide information for **documentation boxes**
 - Review **CRT footnotes**
 - Review **IPCC Inventory Software Notes**

Application Database Inventory Year Administrate Worksheets Tools Export/Import Reports Window Help

Sector: Energy Year: 1990 Refresh values

Table1: Table1.A(a) Table1.A(a)2 Table1.A(a)3 Table1.A(a)4 Table1.A(b) Table1.A(c) Table1.A(d) Table1.B.1 Table1.B.2 Table1.C Table1.D

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel combustion activities - sectoral approach (Sheet: 1 of 4)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	AGGREGATE ACTIVITY DATA			IMPLIED EMISSION FACTORS			EMISSIONS			AMOUNT CAPTURED	Information for Summary 3 CRT						
	Consumption (TJ)	INDUSTRY		CO2 (t/TJ)	CH4 (t/TJ)	N2O (t/TJ)	CO2 (kt)	CH4 (kt)	N2O (kt)		CO2	CH4	N2O	Method	EF	Method	EF
1.A. Fuel combustion	3912675.4						269105.35743214	87187.42812678	164346.8226314								
Liquid fuels	1506201.3						147811.44835483	5193.95019574	2032.67502264								
Solid fuels	410746.36						23688.3608317	6.49478348	1.21619424								
Gaseous fuels (5)	1079360						72214.06032673	81550.3170149	162869.4226764								
Other fossil fuels (7)	279254.4						14920.3058165	10.7655396	2.1427326								
Peat (8)	124927.04						12611.19104	2.26377248	0.18678056								
Biomass (3)	521196.3						99702.2788826	123.6222606	41.2582747								
1.A.1. Energy industries	470378.94						34439.27833333	2.290196	0.244696								
Liquid fuels	9500						6771.872	0.25412	0.049142								
Solid fuels	106413.84						10784.10733333	0.10914	0.15987								
Gaseous fuels (5)	105400						3262.44	0.1554	0.07854								
Other fossil fuels (7)	35710						3521.341	0.1731	0.14308								
Peat (8)	49736						5010.016	0.049736	0.074604								
Biomass (3)	32140						2976.2	1.6537	0.06206								
1.A.1.a. Public electricity and heat production (9)	131350						11984.016	0.1748	0.18399								
Liquid fuels	17400						1195.34	0.0464	0.00899								
Solid fuels	60000						6057	0.06	0.09								
Gaseous fuels (5)	22800						1220.2	0.023	0.0022								
Other fossil fuels (7)	15750						1921.475	0.4725	0.063								
Peat (8)	14000						1470	0.014	0.021								
Biomass (3)	2200						236.4	0.1	0.0088								
1.A.1.a.i. Electricity generation	61600						5452.89	0.2194	0.08394								
Liquid fuels	3900	NCV					247.09	0.0059	0.00089								
Solid fuels	40000	NCV					3927	0.04	0.06								
Gaseous fuels (5)	10000	NCV					556	0.01	0.001								
Other fossil fuels (7)	4000	NCV					356.8	0.12	0.016								
Peat (8)	3500	NCV					366	0.0035	0.00625								
Biomass (3)	200	NCV					17.4	0.04	0.0008								
1.A.1.a.ii. Combined heat and power generation	2450						1814.075	0.084	0.0348								
Liquid fuels	4500	NCV					293.55	0.0135	0.0027								
Solid fuels	8000	NCV					851	0.008	0.012								

Legend

IPCC Inventory Software notes

Note: Minimum level of aggregation is needed to protect confidential business and military information, where it would identify particular entity/entities' confidential data.

Note: 1. Party may collapse rows below 1.A.1.b and 1.A.1.c up to the 1.A.1.b and 1.A.1.c level when all the data must be aggregated to protect confidential business and military information; and this data can be used to identify particular entity(ies). The rows will be expanded for display purposes. An explanation of why this has been applied will be provided in the documentation box.

Note: All footnotes for this table are given at the end of the table (sheet 4).

Note: For the coverage of fuel categories, refer to the 2006 IPCC Guidelines (vol. 2, chap. 1.A.1.1, p.1.11). If some derived gases (e.g. gas works, gas, coke oven gas, blast furnace gas) are considered, Parties should provide information on the allocation of these derived gases under the above fuel categories (liquid, solid, gaseous, biomass and other fuels) in the HD (see also documentation box at the end of sheet 4 of this table).

To implement the second note, users can mark values mapped in this CRT with the notation key "C". Note that Totals calculated in orange cells won't change because of the input of "C".

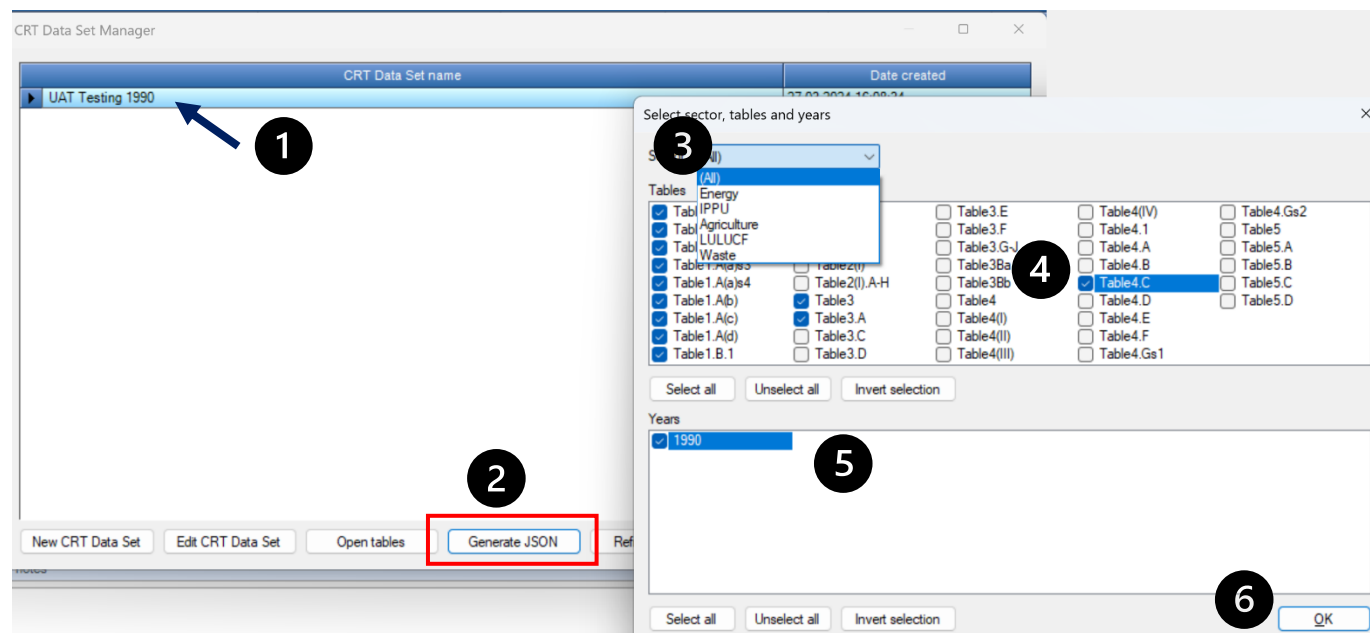
Orange cells above that contain no information (i.e. are blank) will be calculated automatically by the UNFCCC reporting tool. No action by the user is required.

* In "1.A.1.c - Manufacture of solid fuels - Solid fuels - Consumption" cell, activity data from worksheet "Fuel consumption Data" of the inventory category in the IPCC Inventory Software are mapped, as are some process inputs from coke production in category 2.C.1. Users that estimate GHG emissions from coke production in iron and steel should ensure the energy content (TJ) of all process inputs from category 2.C.1 are included. If necessary, the user should revise the activity data to include the total fuel consumed for the category, including the energy content of all process inputs to coke production in iron and steel.

Generate JSON

- Selecting this button allows you to generate a JSON file for export and subsequent upload to the UNFCCC ETF Reporting Tool.
- All tables of the CRT that belong to the selected CRT Data Set and settings selected below, will be serialized into the JSON file for selected years.

1. **Highlight** the **CRT Data Set** for which you want to generate a JSON file.
2. **Select Generate JSON**
3. **Select Sector(s)** you would like to include in the JSON file. You may include one, multiple, or all sectors
4. **Select specific table(s) of the CRT** you would like to include in the JSON file.
5. **Select the Year(s)** you want to include in the JSON file. You may, but do not have to, include all years that are in your CRT Data Set.
6. **Select “OK”**



Notes:



Recall, to access this screen navigate to the **Main Menu** and select **Export/Import / Export / UNFCCC CRT**

- At the time of drafting, the F gas tables of the IPPU sector are not yet available for export in JSON format.

Generate JSON

Save the JSON file to your computer. This is the file you can then upload to the ETF Reporting Tool

