# Workshop on Enhanced Transparency Framework under the Paris Agreement
# IPCC Software Energy Sector Demonstration
# Slides: Pacific Region

Venue: Crown Beach Resort & Spa, Rarotonga, Cook Islands
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# Outline

Step A: Set up Fuel Manager

Step B: Fuel Consumption Data

Step C: Fuel Consumption Emissions

Step C: Fuel Consumption Emissions – EFs

Step D: Fuel Combustion Emissions- Results

Comparing Sectoral and Reference Approaches (skip)

Access CRT Interface in Software
Create New CRT Data Set
Open CRTs
Open CRTs – Functionalities
Generate JSON

# 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.

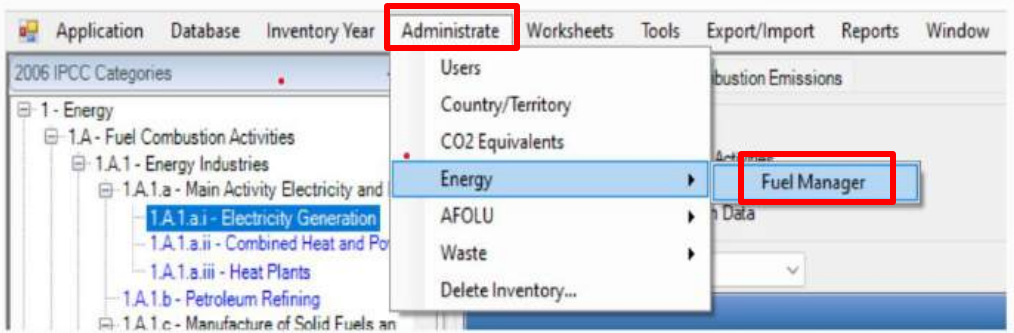
If you change parameters, data in worksheets automatically linked from the **Fuel Manager** are updated.

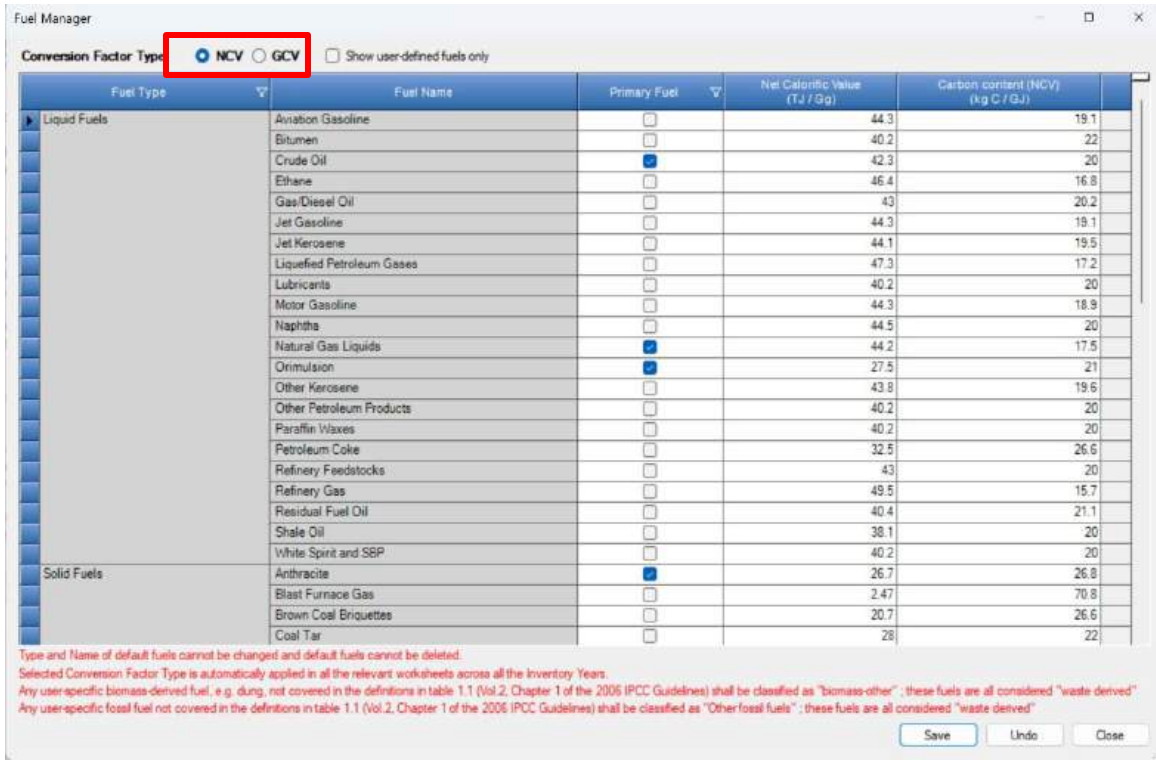
- Select **NCV (Net Calorific Value)** or **GCV (Gross Calorific Value)** as the Conversion Factor Type.

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.



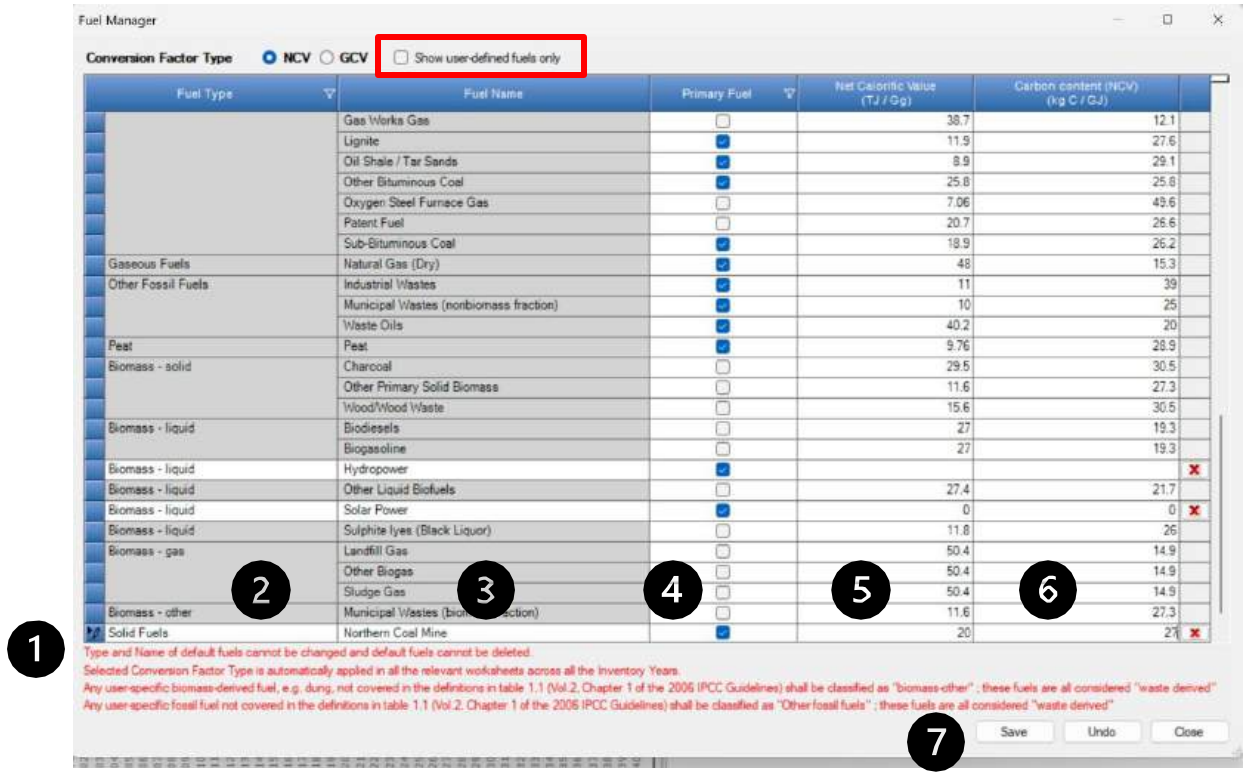



# Step A: Set-up Fuel Manager

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

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

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].

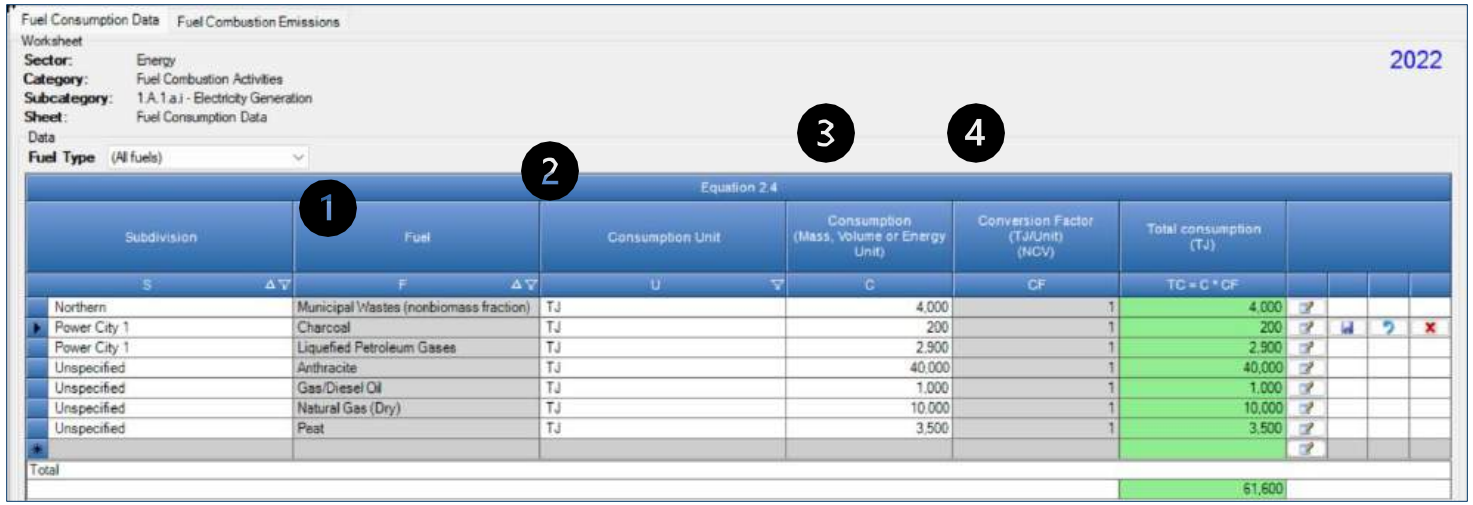
# Step B: Fuel Consumption Data

**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)
(N*ote 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, $m^3$). 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. $m^3$) the user shall enter the relevant conversion factor here.*

# 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 "⊞" 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.

# 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($CO_2$)|:** 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 $CO_2$ per TJ.

**4.** **Column |EF($CH_4$)|** and **Column |EF($N_2O$)|:** select from the drop-down menu the IPCC default value or enter the technology- type-specific value, in kg of $CH_4$ per TJ or kg of $N_2O$ per TJ, respectively.

# Step D: Fuel Combustion Emissions- Results

**1. To estimate the total $CO_2$ emitted into the atmosphere**, the amount of $CO_2$ **captured instead of emitted** into the atmosphere is to be entered in Gg $CO_2$ **in <u>Column |Z|</u>** 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
**Category:** Fuel Combustion Activities
**Subcategory:** 1.A.1.a.i - Electricity Generation
**Sheet:** Fuel Combustion Emissions

2022

Data
**Fuel Type** (All fuels)

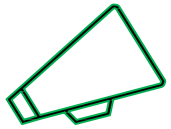
Equation 2.4

| 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 |

1

2



**Do you notice the error in the image?**

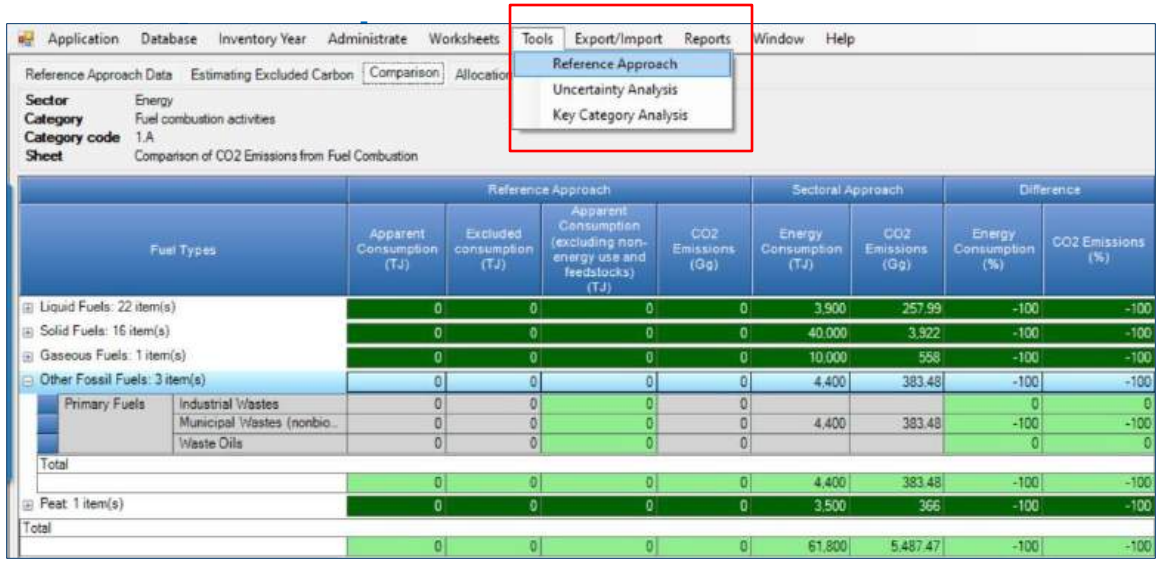
The *Software* has alerted you that the technology penetration rates are greater than 100%.

# 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 $CO_2$ 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.

**Main menu → Tools → Reference**




| Fuel Types | Reference Approach: Apparent Consumption (TJ) | Excluded consumption (TJ) | Apparent Consumption (excluding non-energy use and feedstocks) (TJ) | CO2 Emissions (Gg) | Sectoral Approach: Energy Consumption (TJ) | CO2 Emissions (Gg) | Difference: Energy Consumption (%) | CO2 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 |
| Primary Fuels – Municipal Wastes (nonbio... | 0 | 0 | 0 | 0 | 4,400 | 383.48 | -100 | -100 |
| Primary Fuels – Waste Oils | 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 |

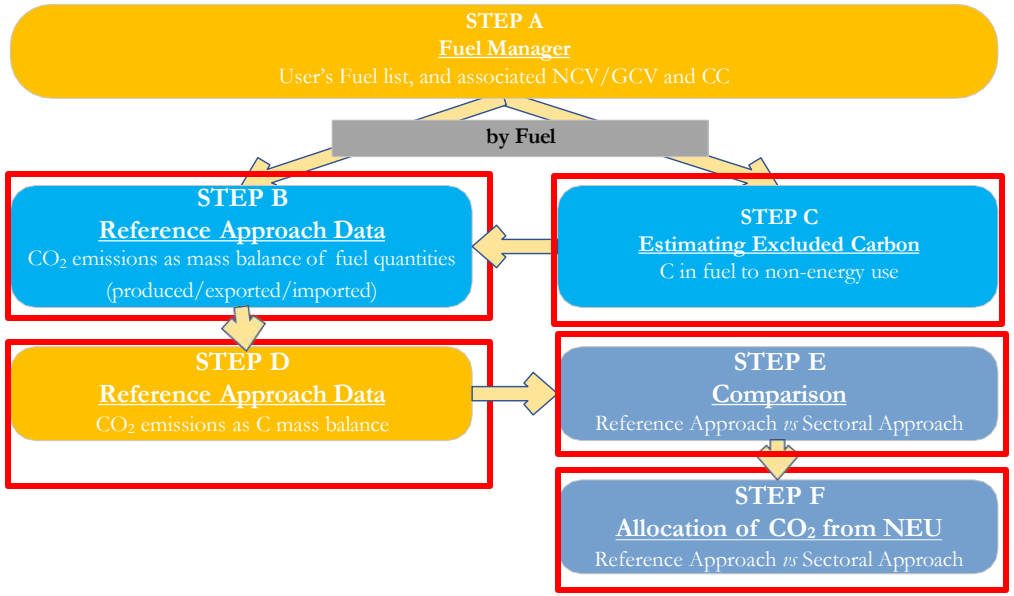
- The *Software* can calculate the Reference Approach and make a comparison between emissions estimated using the Reference and Sectoral Approaches.

- In the **Comparison tab** of the Reference Approach menu, the energy consumption and emissions from the data entered for electricity generation (under Sectoral Approach).

# Comparing Sectoral and Reference Approaches


The *Software* calculates $CO_2$ 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 $CO_2$ 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 $CO_2$ emissions from the Reference and Sectoral approaches.
- **Allocation of $CO_2$ from NEU** summarizes the total $CO_2$ excluded from the reference approach, by fuel. This worksheet allows for reporting the $CO_2$ 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:

1. **Column |Unit|:** select or enter manually the measurement unit used (e.g. Gg, TJ, $m^3$). (*see "+" sign to expand to the full fuel list)*

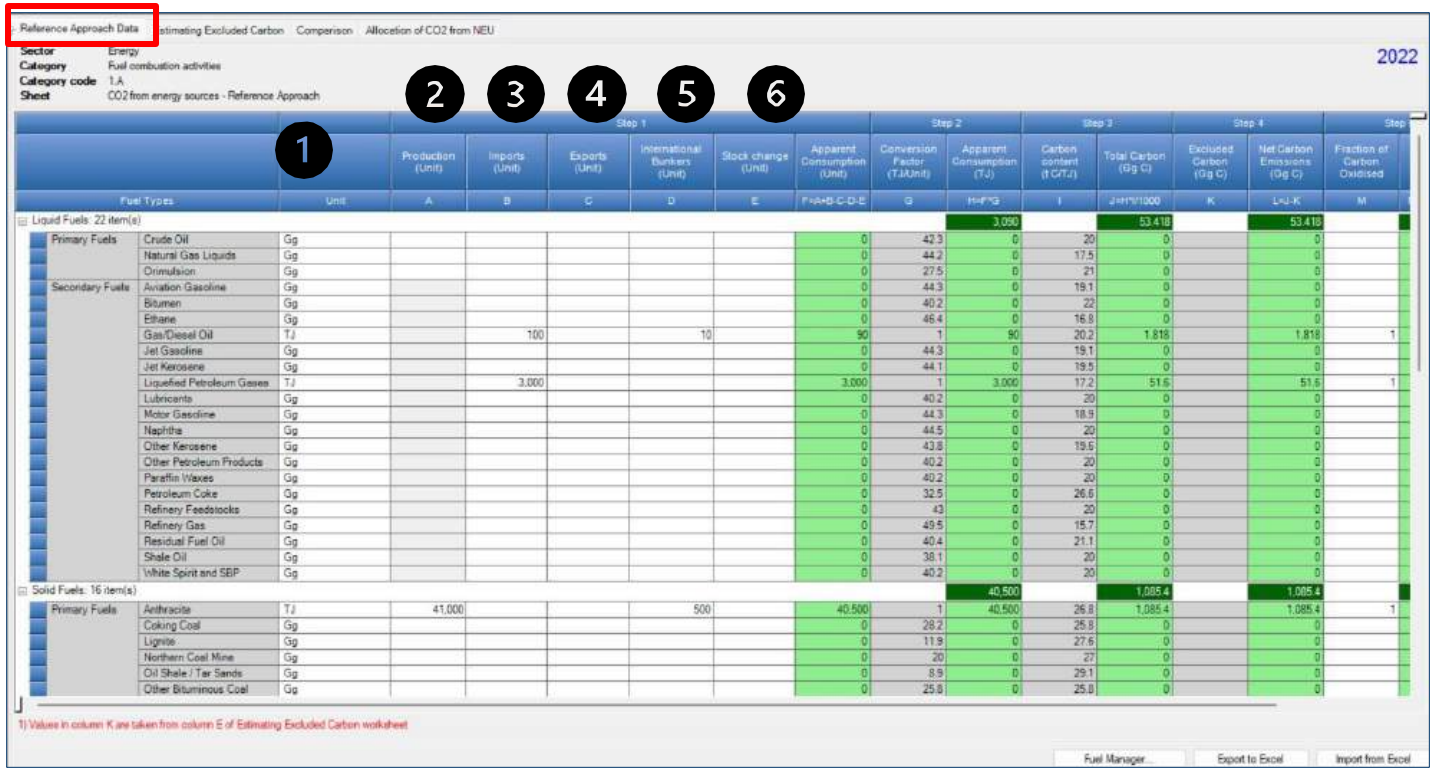
**2. Column |A|:** input the amount of production of the fuel (primary fuels only)

**3. Column |B|:** input the amount of imported fuel

**4. Column |C|:** input the amount of exported fuel

**5. Column |D|:** input the amount of fuel used for international bunkers, if applicable

**6. 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*



# 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. $m^3$) the user shall enter relevant conversion unit here.*

# Step C. Estimating Excluded Carbon

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

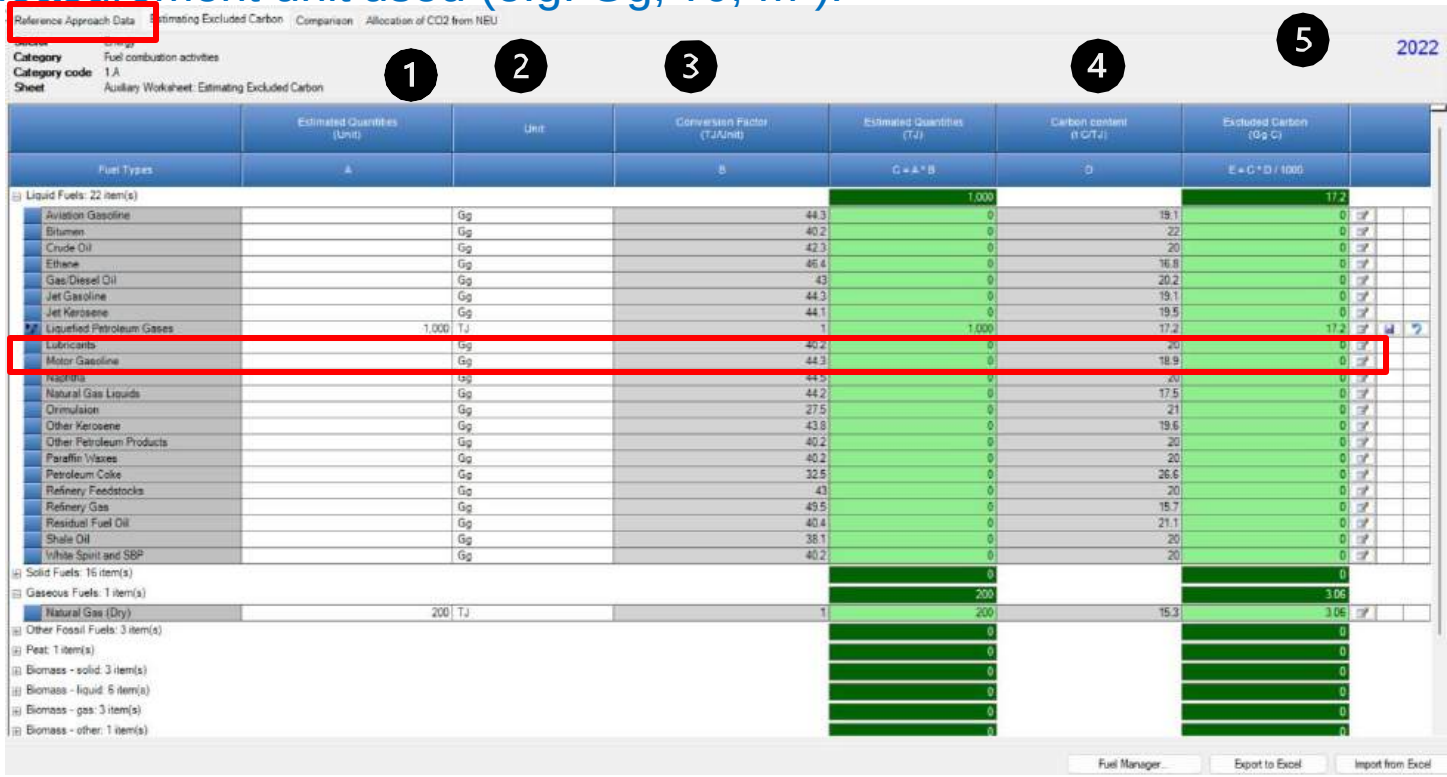
1. **Column |A|**: enter the estimated quantity of the fuel not used for combustion purposes (e.g. natural gas used as a feedstock for ammonia production, or coking coal used in the iron and steel industry).

**2. Column |Unit|:** select or enter manually the measurement unit used (e.g. Gg, TJ, $m^3$).

**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.



# Step D. Reference Approach Data Tab

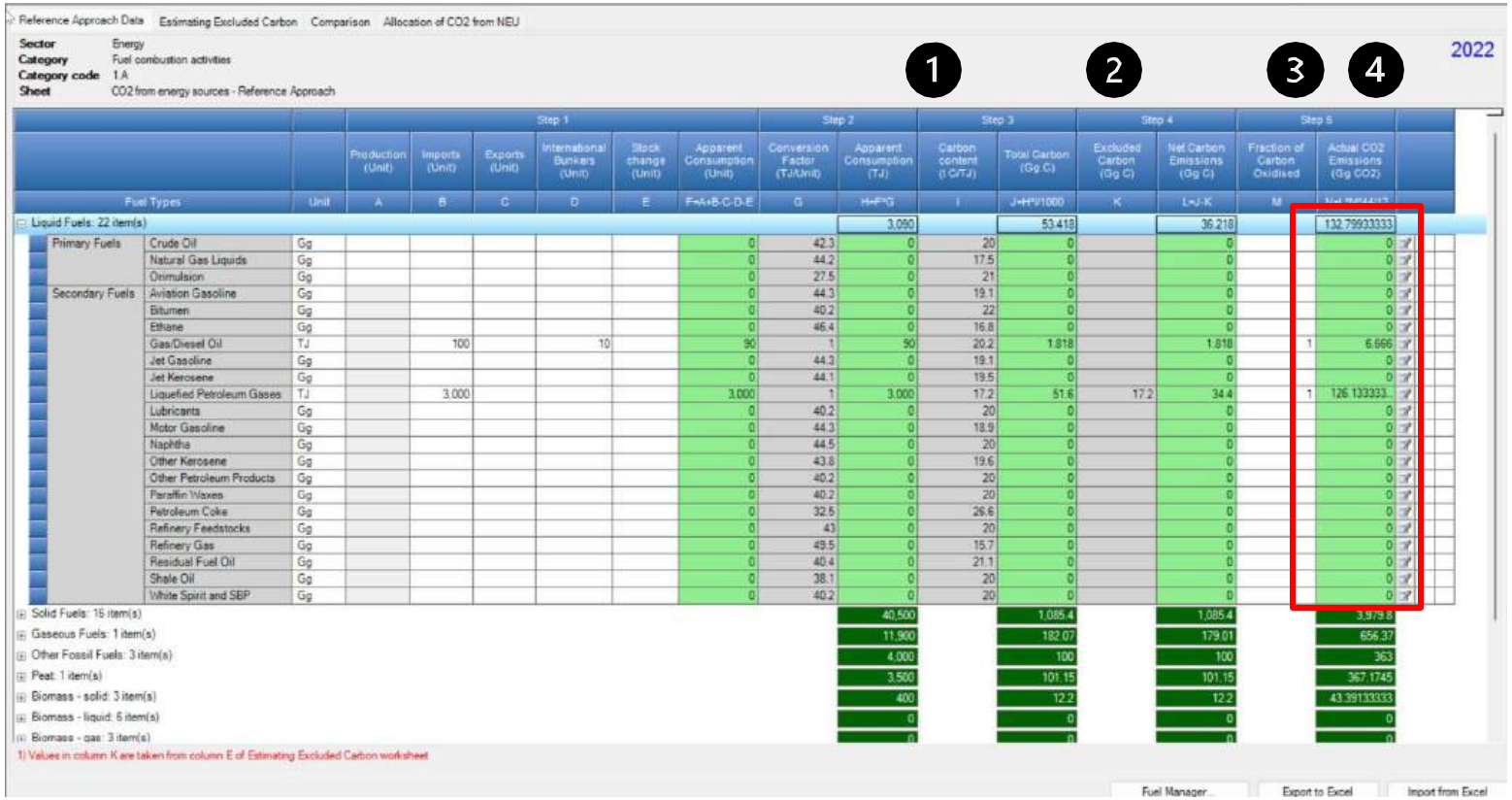
Input of EFs for the Reference Approach requires the following steps:

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 $CO_2$ emissions following the Reference Approach



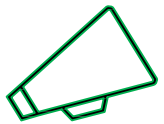

**Recall:** gray shading means that data contained in that cell are automatically pooled from somewhere else.

# Step E. Comparison

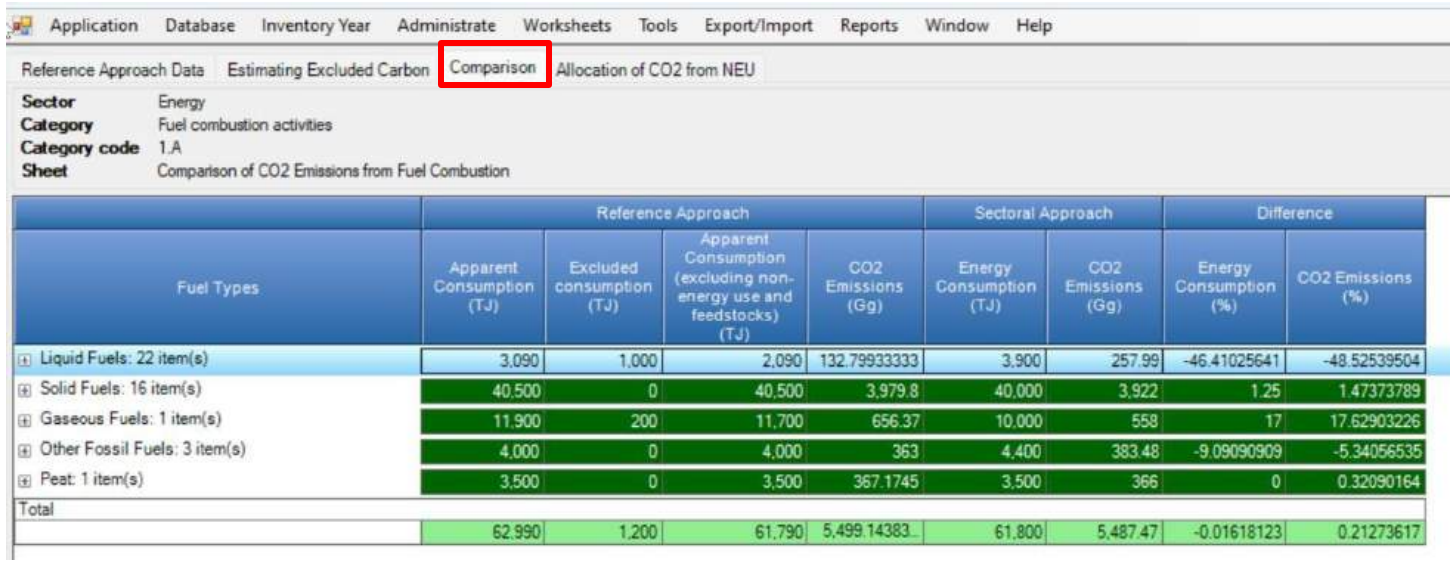
The *Software* provides results of $CO_2$ estimations under the Reference and Sectoral approaches and performs a comparison between the two approaches by each fuel, fuel type and total for the NGHGI
For each fuel, enter following information:

- Worksheet **Comparison** presents the results for the **Reference Approach**, as well as main AD (apparent consumption). This worksheet also summarizes the main AD and $CO_2$ 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 $CO_2$ 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.



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



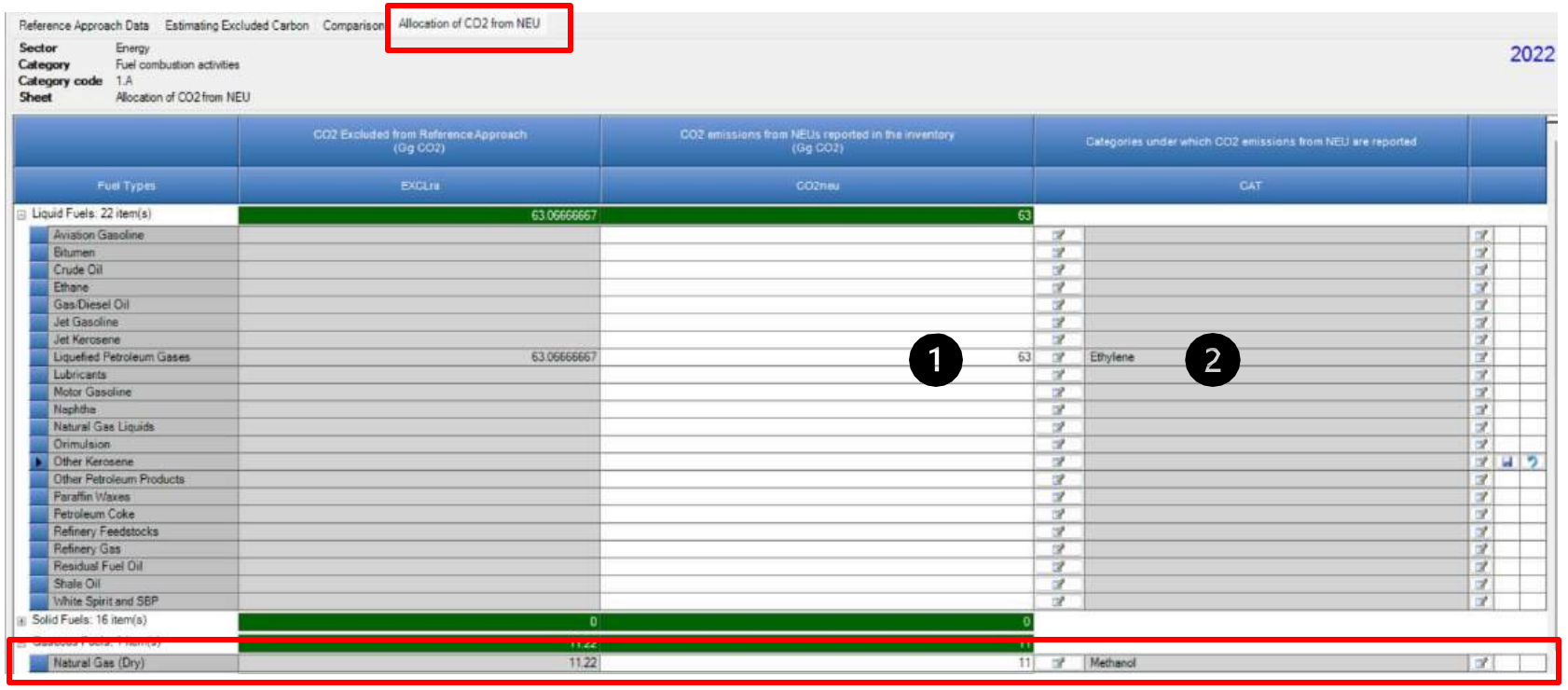

| Fuel Types | Reference Approach | | | | Sectoral Approach | | Difference | |
|---|---|---|---|---|---|---|---|---|
| | Apparent Consumption (TJ) | Excluded consumption (TJ) | Apparent Consumption (excluding non-energy use and feedstocks) (TJ) | CO2 Emissions (Gg) | Energy Consumption (TJ) | CO2 Emissions (Gg) | Energy Consumption (%) | CO2 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 |

# Step F. Allocation of $CO_2$ from NEU

For each relevant fuel in Column |Fuel Types| that is used for NEU and for which $CO_2$ emissions from the use of that fuel are reported elsewhere, enter the following information:

1. Column |CO2neu|: enter the quantity of $CO_2$ emissions from NEU that is reported elsewhere in the NGHGI, in $GgCO_2$ (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 $CO_2$ emissions are reported.



# Allocation of $CO_2$ 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.

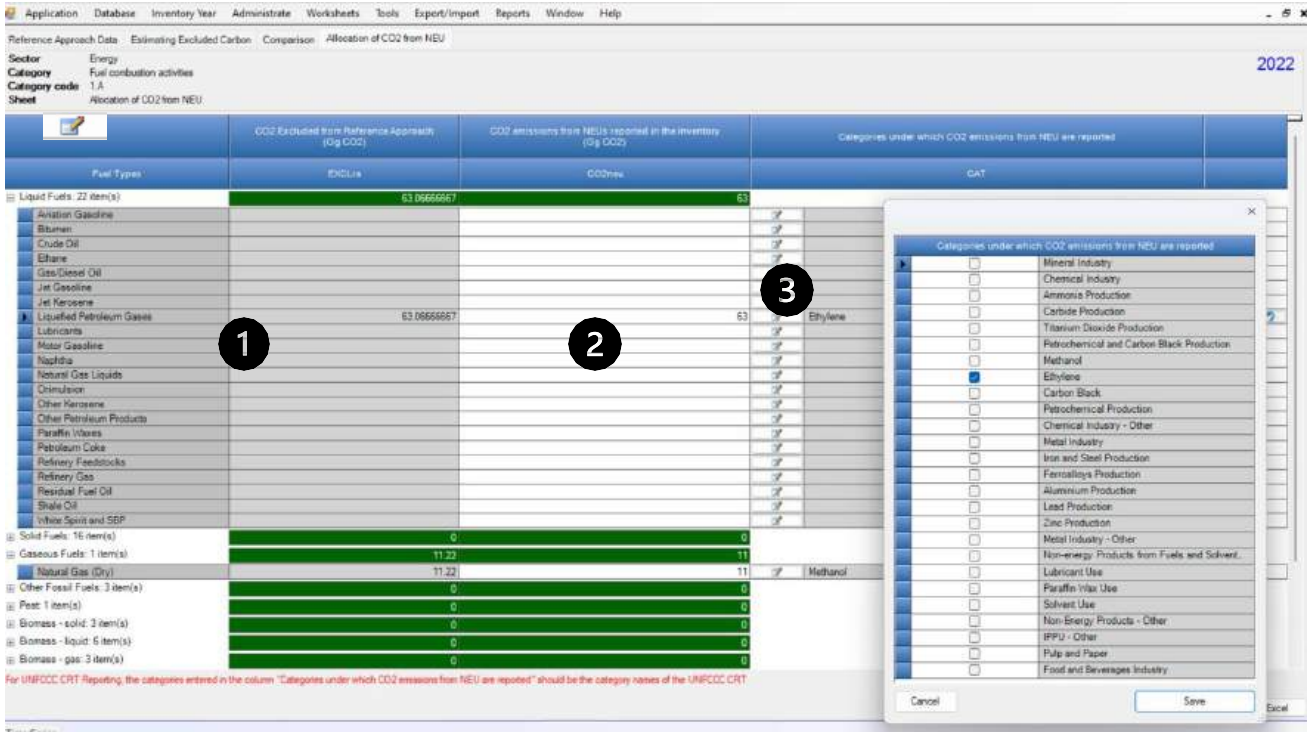
- One possible reason, could be that there is double counting of the natural gas used for combustion in the energy sector, and that used as a feedstock for the petrochemical industry (and thus reported in the IPPU sector). Recall, in the Estimating Excluded Carbon worksheet, we estimated 1,000 TJ were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

- In this tab "Allocation of $CO_2$ from Non-energy use" you can indicate where this LPG was used.

1. $CO_2$ is automatically populated from "**Estimating Excluded carbon"**

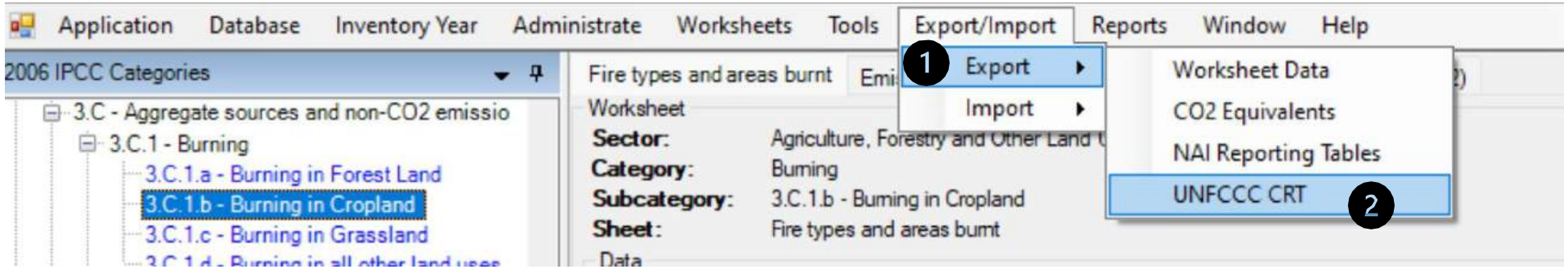
2. **Enter the $CO_2$ emissions reported elsewhere**

3. **To select the category(ies)** where reported select  and check appropriate category(ies) in the dropdown. This information will be used the UNFCCC ETF Reporting Tool

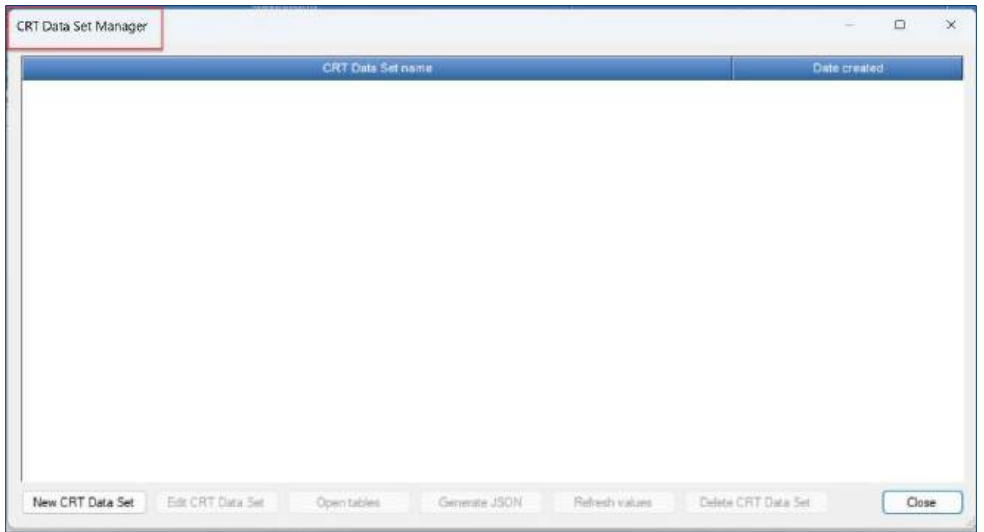


# Access CRT Interface in Software

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

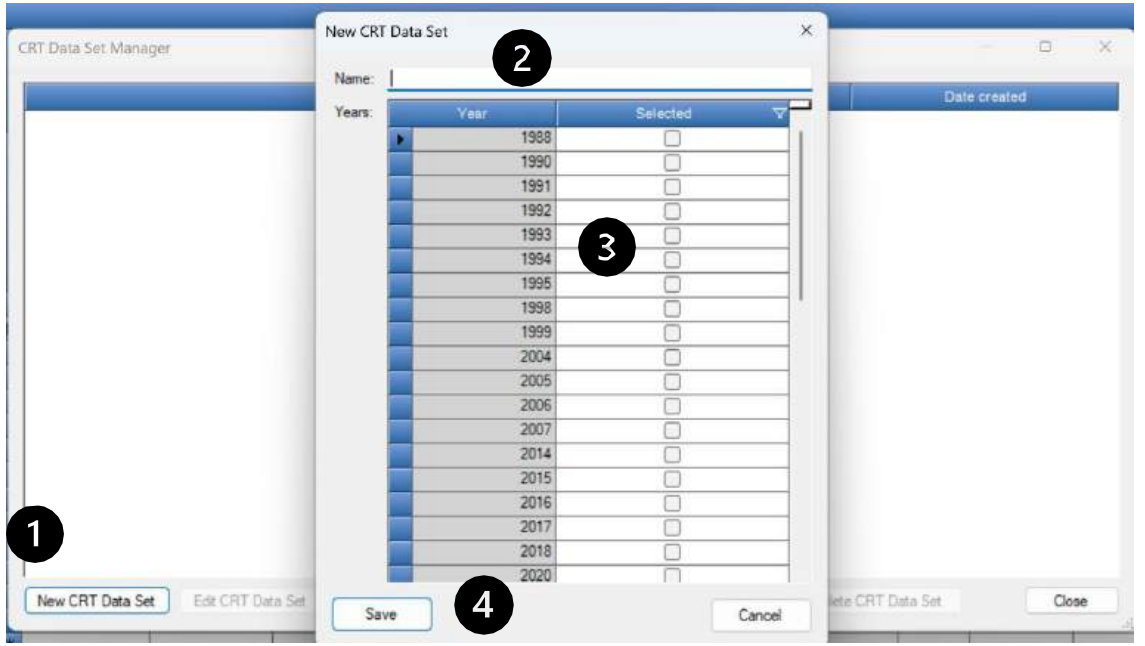



- This opens the **CRT Data Set Manager** interface



# 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

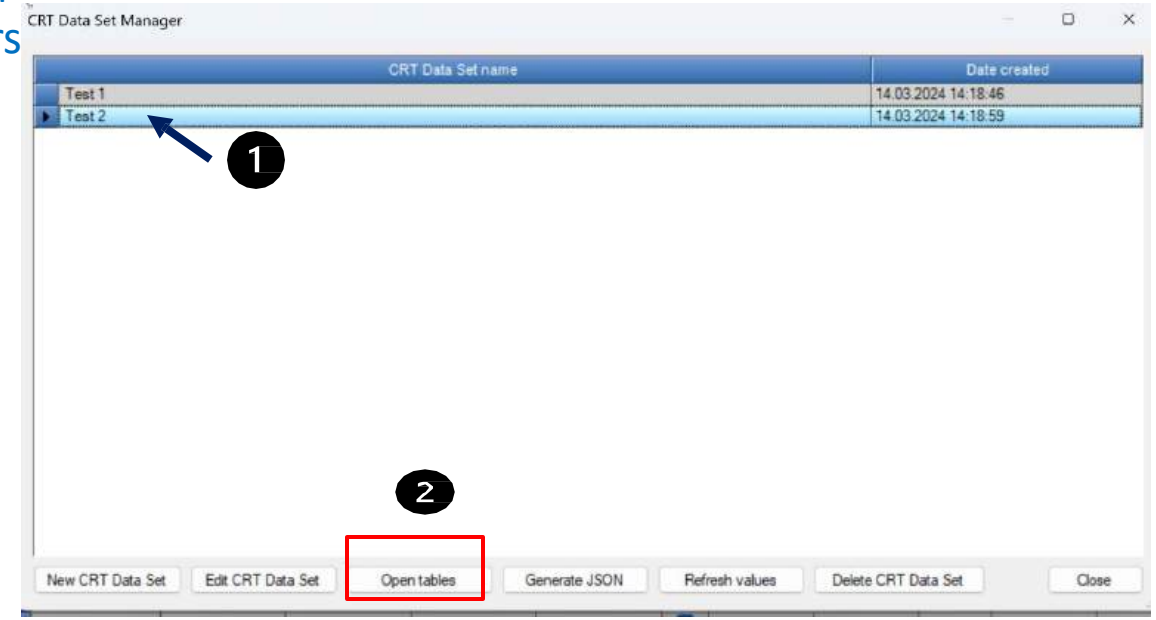




**NOTES:**

- 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**

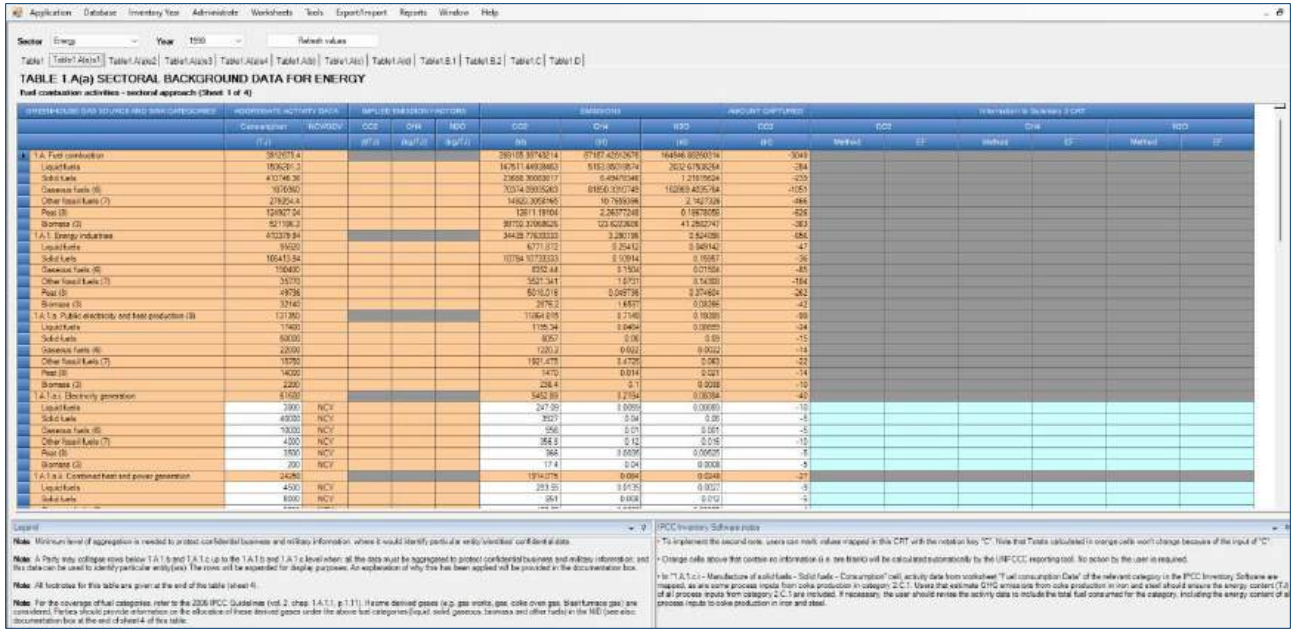
- This action button opens a screen containing CRT for the currently selected CRT Data Set.

- 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

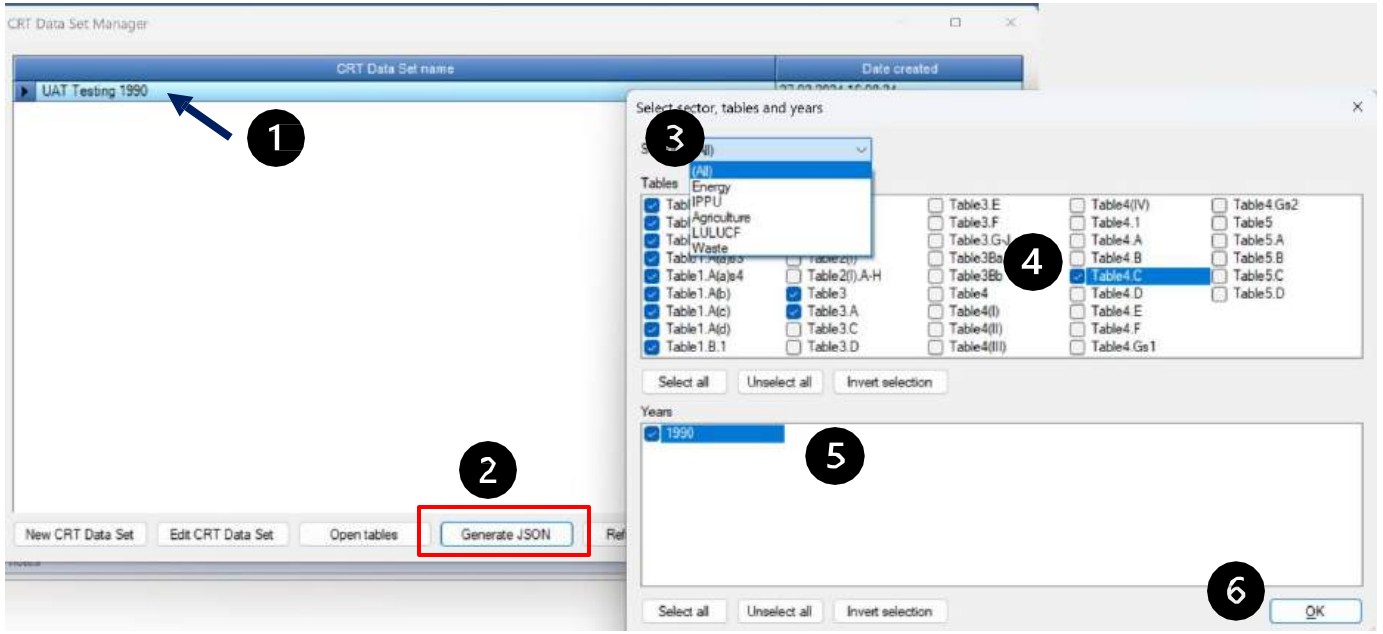
- In Open Tables, you can separately visualize each table for each sector and each year and provide additional information that will be needed for your submission in the UNFCCC ETF Reporting Tool.
- In the visualized CRT, you may:
  - **Review** your data, includingdata aggregations
  - **Change notation 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**



# 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