विद्युत मंत्रालय
MINISTRY OF
POWER

सत्यमेव जयते

METHODOLOGICAL TOOL

BM-T-002

Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion

---

Publication Date: 27 March 2025

Version 1.0

Table of Contents

1. Introduction

1. This tool provides procedures to calculate emissions associated with the fossil fuels combustion.

2. Definitions

2. The definitions contained in the Detailed Procedure for Offset Mechanism under CCTS shall apply.

3. Scope & Applicability

3.1. Scope and Applicability

3. This tool provides procedures to calculate project and/or leakage CO_2 emissions from the combustion of fossil fuels. It can be used in cases where CO_2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties. Methodologies using this tool should specify to which combustion process j this tool is being applied.

4. Parameters

4. This tool provides procedures to determine the following parameters:

Parameter	SI Unit	Description
$\boldsymbol{PE_{FC,j,y}}$	tCO_2/yr	CO_2 emissions from fossil fuel combustion in process *j* during the year *y*

5. Procedure

5.1. Baseline methodology procedure

6. CO_2 emissions from fossil fuel combustion in process *j* are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$$PE_{FC,j,y}=\Sigma FC_{i,j,y}\times COEF_{i,yi} \qquad \text{Equation (1)}$$

Where:

$PE_{FC,j,y}$ = CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr)

FCi,j,y = Quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr)

$COEF_{i,y}$ = CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit)

i = Fuel types combusted in process j during the year y

5. The CO_2 emission coefficient $COEF_{i,y}$ can be calculated using one of the following two Options, depending on the availability of data on the fossil fuel type *i*, as follows:

6. (a) Option A: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type *i*, using the following approach:

If $FC_{i,j,y}$ is measured in a mass unit:

$COEF_{i,y}$=$w_{C,i,y}$×44/12 Equation (2)

If FCi,j,y is measured in a volume unit:

$COEF_{i,y}$=$w_{C,i,y}$×$\rho_{i,y}$×44/12 Equation (3)

Where:

$COEF_{i,y}$ = CO_2 emission coefficient of fuel type i (tCO_2/mass or volume unit);

$w_{C,i,y}$ = Weighted average mass fraction of carbon in fuel type i in year y (tC/mass unit of the fuel)

$\rho_{i,y}$ = Weighted average density of fuel type i in year y (mass unit/volume unit of the fuel)

i = Fuel types combusted in process j during the year y

(b) Option B: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO_2 emission factor of the fuel type i, as follows:

$COEF_{i,y}$=$NCV_{i,y}$×$EF_{CO2,i,y}$ Equation (4)

Where:

$COEF_{i,y}$ = CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit)

$NCV_{i,y}$ = Weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit)

$EF_{CO2,i,y}$ = Weighted average CO_2 emission factor of fuel type i in year y (tCO_2/GJ)

i = Fuel types combusted in process j during the year y

7. Option A should be the preferred approach, if the necessary data is available.

5.2. Monitoring methodology procedure

5.2.1. Monitoring procedures

8. Describe and specify in the ICM-PDD all monitoring procedures, including the type of measurement instrumentation used, the responsibilities for monitoring and QA/QC procedures that will be applied. Where the methodology provides different options (e.g. use of default values or on-site measurements), specify which option will be used. Meters should be installed, maintained and calibrated according to equipment manufacturer instructions and be in line with national standards, or, if these are not available, international standards (e.g. IEC, ISO).

5.2.1.1. Data and parameters monitored

Data / Parameter table 1.

Data / parameter:	***FC$_{i,j,y}$***
Data unit:	Mass or volume unit per year (e.g. ton/yr or m^3/yr)
Description:	Quantity of fuel type *i* combusted in process *j* during the year *y*
Source of data:	Onsite measurements

Measurement procedures (if any):	• Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezo electronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions
Monitoring frequency:	Continuously
QA/QC procedures:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the ICM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records
Any comment:	Project activities where end users of the subsystems or measures are households/communities/small and medium enterprises (SMEs), faced with data gaps due to meter failure or other reasons unforeseen, may estimate the quantity of fuel, using one of the following options, provided the gap period does not exceed 30 consecutive days within six consecutive months: • The purchased fuel/energy invoices/bills, where the purchased fuel can be identified specifically for the ICM project; • The energy produced by the equipment, adjusted by efficiency. Efficiency of the equipment is determined using the 'Methodological tool: Determining the baseline efficiency of thermal or electric energy generation systems', and energy produced is measured directly or calculated based on operation hours; • The highest value of the parameter for the same calendar period of the previous years; • The fuel consumption of a representative sample of the first batch of project devices. It may be assumed that the fuel consumption measured in a representative sample of the first batch of project devices apply to all subsequent batches.

Data / Parameter table 2.

Data / parameter:	$w_{C,i,y}$
Data unit:	tC/mass unit of the fuel
Description:	Weighted average mass fraction of carbon in fuel type *i* in year *y*
Source of data:	The following data sources may be used if the relevant conditions apply:

	Data Source / **Conditions for using the data source** a) Values provided by the fuel supplier in invoices — This is the preferred source b) Measurements by the non-obligated entity — If a) is not available
Measurement procedures (if any):	Measurements should be undertaken in line with national or international fuel standards
Monitoring frequency:	The mass fraction of carbon should be obtained for each fuel delivery, from which weighted average annual values should be calculated
QA/QC procedures:	Verify if the values under (a) and (b) are within the uncertainty range of the product of the IPCC default values IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in (b) should have ISO17025 accreditation or justify that they can comply with similar quality standards
Any comment:	Applicable where Option A is used

Data/Parameter table 3.

Data / parameter:	$\rho_{i,y}$
Data unit:	Mass unit/volume unit
Description:	Weighted average density of fuel type *i* in year *y*
Source of data:	The following data sources may be used if the relevant conditions apply: **Data Source** / **Conditions for using the data source** (a) Values provided by the fuel supplier in invoices — This is the preferred source (b) Measurements by the non-obligated entity — If (a) is not available (c) Regional or national default values — If (a) is not available. These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances)
Measurement procedures (if any):	Measurements should be undertaken in line with national or international fuel standards
Monitoring frequency:	The density of the fuel should be obtained for each fuel delivery, from which weighted average annual values should be calculated
QA/QC procedures:	-
Any comment:	Applicable where Option A is used and where $FCi_{j,y}$ is measured in a volume unit. Preferably the same data source should be used for $w_{C,i,y}$ and $\rho_{i,y}$

Data/Parameter table 4.

Data / parameter:	$NCV_{i,y}$
Data unit:	GJ per mass or volume unit (e.g. GJ/m³, GJ/ton)
Description:	Weighted average net calorific value of fuel type *i* in year *y*
Source of data:	The following data sources may be used if the relevant conditions apply:

<table>
<tr><td></td><td>
<table>
<tr><th>Data Source</th><th>Conditions for using the data source</th></tr>
<tr><td>(a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source if the carbon fraction of the fuel is not provided (Option A)</td></tr>
<tr><td>(b) Measurements by the non-obligated entity</td><td>If (a) is not available</td></tr>
<tr><td>(c) Regional or national default values</td><td>If (a) is not available
These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances)</td></tr>
<tr><td>(d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in IPCC Guidelines on National GHG Inventories</td><td>If (a) is not available</td></tr>
</table>
</td></tr>
<tr><td>Measurement procedures (if any):</td><td>For (a) and (b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
<tr><td>Monitoring frequency:</td><td>For (a) and (b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated.
For (c): Review appropriateness of the values annually.
For (d): Any future revision of the IPCC Guidelines should be taken into account</td></tr>
<tr><td>QA/QC procedures:</td><td>Verify if the values under (a), (b) and (c) are within the uncertainty range of the IPCC default values. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in (a), (b) or (c) should have ISO17025 accreditation or justify that they can comply with similar quality standards</td></tr>
<tr><td>Any comment:</td><td>Applicable where Option B is used</td></tr>
</table>

Data/Parameter table 5.

<table>
<tr><th>Data / parameter:</th><td>EF_{CO2,i,y}</td></tr>
<tr><td>Data unit:</td><td>tCO_2/GJ</td></tr>
<tr><td>Description:</td><td>Weighted average CO_2 emission factor of fuel type i in year y</td></tr>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data Source</th><th>Conditions for using the data source</th></tr>
<tr><td>(a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source if the carbon fraction of the fuel is not provided (Option A)</td></tr>
<tr><td>(b) Measurements by the non-obligated entity</td><td>If (a) is not available</td></tr>
<tr><td>(c) Regional or national default values</td><td>If (a) is not available
These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances)</td></tr>
</table>
</td></tr>
</table>

	(d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in IPCC Guidelines on National GHG Inventories	If (a) is not available
Measurement procedures (if any):	For (a) and (b): Measurements should be undertaken in line with national or international fuel standards	

Monitoring frequency:	For (a) and (b): The CO_2 emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.
	For (c): Review appropriateness of the values annually.
	For (d): Any future revision of the IPCC Guidelines should be taken into account	

Any comment:	Applicable where option B is used. For (a): If the fuel supplier does provide the NCV value and the CO2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO2 factor should be used. If another source for the CO2 emission factor is used or no CO2 emission factor is provided, Options (b), (c) or (d) should be used	

Revision/Changes in the Document

Version	*Date*	*Description*
1.0	27 March 2025	Initial Adoption