Draft methodological tool

"Tool to calculate project emissions from electricity consumption"

I. SCOPE, APPLICABILITY AND PARAMETERS

This tool provides procedures to estimate the project emissions associated with the consumption of electricity by the proposed CDM project activity. For example, the operation of plants (e.g. waste treatment plants, biofuel generation plants, etc) may involve the consumption of auxiliary electricity.

This tool is **not** applicable in cases where captive renewable power generation technologies installed at the project site supply the electricity consumed by the project activity.

This tool also refers to the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".

Parameters

This tool provides procedures to determine the following parameters:

Parameter	SI Unit	Description
$PE_{EC,y}$	tCO_2/yr	Project emissions from electricity consumption by the project activity during the year y

II. BASELINE METHODOLOGY PROCEDURE

Project emissions

Project emissions from electricity consumption ($PE_{EC,y}$) include CO_2 emissions from the combustion of fossil fuels at any power plants at the project site and, if applicable, at power plants connected physically to the electricity system (grid) from where the CDM project is consuming electricity. The tool provides procedures to calculate project emissions from electricity consumption for the following three cases:

Case A: **Electricity consumption from the grid.** The electricity consumed by the project activity is purchased from the grid. Either no captive power plant is installed at the project site or if any on-site captive power plant exits, it is not operating or it cannot provide electricity to the project activity.

Case B: **Electricity consumption from (an) off-grid captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the project activity site. The captive power plant(s) provide(s) electricity to the project activity. The captive power plant(s) is/are not connected to the electricity grid.

Case C: **Electricity consumption from the grid and (a) captive power plant(s).** One or more fossil fuel fired captive power plants are installed at the project activity site. The captive power plant(s) can provide electricity to the project activity. The captive power plant(s) is/are connected to the electricity grid.

Case A: Electricity consumption from the grid

Project emissions from consumption of electricity from the grid are calculated based on the power consumed by the project activity and the emission factor of the grid, adjusted for transmission losses, using the following formula:

$$PE_{EC,y} = EC_{PJ,y} * EF_{grid,y} * (1 + TDL_y) \quad \textbf{(1)}$$

Where:

$PE_{EC,y}$ are the project emissions from electricity consumption by the project activity during the year y (tCO_2 / yr);

$EC_{PJ,y}$ is the quantity of electricity consumed by the project activity during the year y (MWh);

$EF_{grid,y}$ is the emission factor for the grid in year y (tCO_2/MWh)

TDL_y are the average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site

Case B: Electricity consumption from an off-grid captive power plant

Project emissions from consumption of electricity from an off-grid captive power plant may be determined by using one of the following four options:

Option B1: Project emissions from consumption of electricity ($PE_{EC,y}$) are determined by calculating the CO_2 emissions from all fuel combustion in the captive power plant. These emissions should be calculated using the latest approved version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". This option provides an accurate estimate if all the power generated by the captive power plant is consumed by the proposed CDM project activity. In other cases, this option can also be used; however note that it may result in overestimation of project emissions.

Option B2: Project emissions from consumption of electricity ($PE_{EC,y}$) are calculated based on the electricity consumed by the project activity and the emission factor of the captive power plant, using the following formula:

$$PE_{EC,y} = EC_{PJ,y} * EF_{CP,y} \quad \textbf{(2)}$$

Where:

$PE_{EC,y}$ are the project emissions from electricity consumption by the project activity during the year y (tCO_2 / yr);

$EC_{PJ,y}$ is the quantity of electricity consumed by the project activity during the year y (MWh);

$EF_{CP,y}$ is the emission factor for the captive power plant(s) in year y (tCO_2/MWh);

The emission factor of the captive power plant(s) ($EF_{CP,y}$) is determined based on the CO_2 emissions from fuel combustion in the plant(s) and the electricity generation in the plant(s). In case of plants that co-generate heat and power (cogeneration plants), project participants may

- ignore, as a conservative assumption, the heat generation, or

- calculate an emissions credit for the co-product of heat. This credit is calculated by assuming that without cogeneration the heat would be generated in a boiler, using the same type of fossil fuel(s) that are used in the captive power plant. As a conservative approach, an efficiency of 100% is assumed for the boiler. Note that claiming this credit requires monitoring the heat generation of the captive power plant(s).

In case where none of the captive power plants is a cogeneration plant or where project participants choose to ignore the heat generation, the emission factor of the captive power plant(s) is calculated as follows:

$$EF_{CP,y} = \frac{\sum_k \sum_i FC_{k,i,y} \times COEF_{i,y}}{\sum_k EG_{k,y}} \quad \textbf{(3)}$$

Where:

$EF_{CP,y}$	is the emission factor for the captive power plant(s) in year y (tCO_2/MWh);
$FC_{k,i,y}$	is the quantity of fossil fuel type i fired in the captive power plant k in year y (mass or volume unit);
$COEF_{i,y}$	is the CO_2 emission coefficient for fuel type i in year y (tCO_2 / mass or volume unit)
$EG_{k,y}$	is the quantity of electricity generated in captive power plant k in year y (MWh)
K	are the fossil fuel fired captive power plants installed at the project site in year y
I	are the fossil fuel types fired in captive power plant k in year y

$COEF_{i,y}$ should be calculated according to the procedures provided in the latest approved version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".

In case project participants wish to make an allocation of the CO_2 emissions between the electricity and heat generation in cogeneration plants, the emission factor of the captive power plant(s) is calculated as follows:

$$EF_{CP,y} = \frac{\sum_k \left[\sum_i \left(FC_{k,i,y} \times NCV_i \right) - HG_{k,y} \right] \times EF_{CO2,k}}{\sum_k EG_{CP,k,y}} \quad \textbf{(4)}$$

In case the captive power plant uses one single fuel:
$EF_{CO2,k} = EF_{CO2,i}$

In case the captive power plant uses multiple fuels:

$$EF_{CO2,k} = \frac{\sum_i FC_{k,i,y} \times NCV_i \times EF_{CO2,i}}{\sum_i FC_{k,i,y} \times NCV_i} \quad \textbf{(5)}$$

Where:

$EF_{CP,y}$	is the emission factor for the captive power plant(s) in year y (tCO_2/MWh);
$FC_{k,i,y}$	is the quantity of fossil fuel type i fired in the captive power plant k in year y (mass or volume unit);
NCV_i	is the net calorific value of fuel type i (GJ / mass or volume unit)
$EF_{CO2,i}$	is the CO_2 emission factor of fuel type i (tCO_2 / GJ)
$HG_{k,y}$	is the quantity of heat co-generated in captive power plant k in year y (GJ)
$EG_{k,y}$	is the quantity of electricity generated in captive power plant k in year y (MWh)
k	are the fossil fuel fired captive power plants installed at the project site in year y
i	are the fossil fuel types fired in captive power plant k in year y

Option B3: Project emissions from consumption of electricity ($PE_{EC,y}$) are determined based on electricity consumed by the project activity and a conservative default emission factor for the captive power plant of 1.3 tCO_2/MWh, as follows:

$$\mathrm{PE}_{\mathrm{EC,y}} = \mathrm{EC}_{\mathrm{PJ,y}} * 1.3\ \mathrm{tCO}_2 / \mathrm{MWh} \quad \textbf{(6)}$$

Where:

$PE_{EC,y}$	are the project emissions from electricity consumption by the project activity during the year y (tCO_2 / yr);
$EC_{PJ,y}$	is the quantity of electricity consumed by the project activity during the year y (MWh);

Option B4: Project emissions from consumption of electricity ($PE_{EC,y}$) are determined based on the rated capacity of the captive power plant(s), assuming, as a very conservative simplification, an emission factor of 1.3 tCO_2/MWh and an operation of 8,760 hours per year at the rated capacity, as follows:

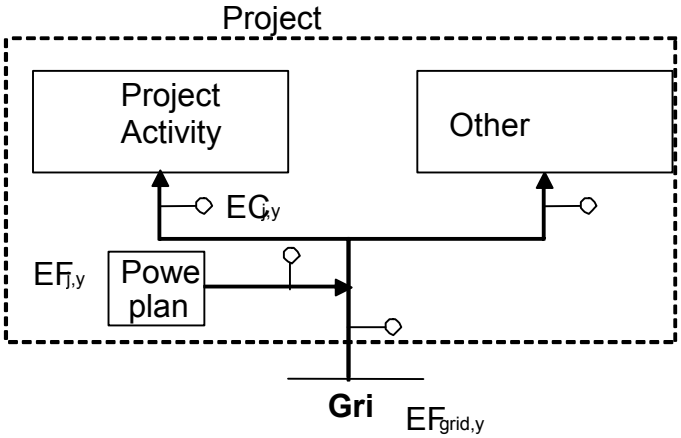
$$\mathrm{PE}_{\mathrm{EC,y}} = 11{,}400 \frac{\mathrm{tCO}_2}{\mathrm{MW}} * \mathrm{PP}_{\mathrm{CP}} \quad \textbf{(7)}$$

Where:

$PE_{EC,y}$	are the project emissions from electricity consumption by the project activity during the year y (tCO_2 / yr);
$PP_{CP,y}$	is the rated capacity of the captive power plant(s) (MW).

Note that this option does not require monitoring any parameters.

Case C: Electricity consumption from the grid and (a) captive power plant(s)



Project emissions may be determined using one of the following two options:

Option C1: Project emissions are calculated based on the power consumed by the project activity and the maximum value of the emission factor of the captive power plant and the emission factor of the grid, including transmission and distribution losses, using the following formula:

$$PE_{EC,y} = EC_{PJ,y} \times MAX\left(EF_{CP,y}\,;\, EF_{grid,y} \times \left(1 + TDL_y\right)\right) \quad \textbf{(8)}$$

Where:

$PE_{EC,y}$ are the project emissions from electricity consumption by the project activity during the year y (tCO_2 / yr);

$EC_{PJ,y}$ is the quantity of electricity consumed by the project activity during the year y (MWh);

$EF_{CP,y}$ is the emission factor for the captive power plant(s) in year y (tCO_2/MWh), determined according to the approach described in option B2 above;

$EF_{grid,y}$ is the emission factor for the grid in year y (tCO_2/MWh);

TDL_y are the average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site

Option C2: Project emissions are calculated based on the power consumed by the project activity and a conservative default emission factor for grid electricity of 1.3 tCO_2/MWh and taking into account transmission and distribution losses, using the following formula:

$$PE_{EC,y} = EC_{PJ,y} \times 1.3\ tCO_2 / MWh \times \left(1 + TDL_y\right) \quad \textbf{(9)}$$

Where:

$PE_{EC,y}$ are the project emissions from electricity consumption by the project activity during the year y (tCO_2 / yr);

$EC_{PJ,y}$ is the quantity of electricity consumed by the project activity during the year y (MWh);

TDL_y are the average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site

Parameters not monitored

Data / Parameter:	**PP_i**
Data unit:	MW
Description:	Rated capacity of power plant *i*
Source of data:	Name plate capacity of the captive power plant, manufacturer's specifications or catalogue references
Measurement procedures (if any):	-
Any comment:	In case of uncertainty a conservative value should be chosen

III. MONITORING METHODOLOGY PROCEDURE

Monitoring procedures

Describe and specify in the CDM-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).

All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. 100% of the data should be monitored if not indicated differently in the comments in the tables below.

Data and parameters monitored

Data / Parameter:	**$EC_{PJ,y}$**
Data unit:	MWh
Description:	Onsite consumption of electricity provided by the grid and/or captive power plant(s) and attributable to the project activity during the year *y*
Source of data:	Onsite measurements
Measurement procedures (if any):	Use electricity meters
Monitoring frequency:	Continuously, aggregated at least annually
QA/QC procedures:	Cross check measurement results with invoices for purchased electricity if relevant.
Any comment:	Applicable for all cases except where option B4 is used.

Data / parameter:	**$EF_{grid,y}$**
Data unit:	TCO_2/MWh
Description:	Emission factor for the grid in year *y*
Source of data:	Choose one of the following options: • Calculate the combined margin emission factor, using the procedures in the latest approved version of the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002); • Use a conservative default value of 1.3 tCO_2/MWh.
Measurement procedures (if any):	-
Monitoring frequency:	Follow procedures as described in ACM0002
QA/QC procedures:	Follow procedures as described in ACM0002
Any comment:	Only applicable if case A applies or option C1 is used

Data / parameter:	**TDL_y**
Data unit:	-
Description:	Average technical transmission and distribution losses in the grid in year *y* for the voltage level at which electricity is obtained from the grid at the project site
Source of data:	Choose one of the following options: a) Use recent, accurate and reliable data available within the host country; b) Use a default value of 20%
Measurement procedures (if any):	For a): TDL_y should be estimated for the distribution and transmission networks of the electricity grid of the same voltage as the connection where the proposed CDM project activity is connected to. The technical distribution losses should not contain other types of grid losses (e.g. commercial losses/theft). The distribution losses can either be calculated by the project participants or be based on references from utilities, network operators or other official documentation.
Monitoring frequency:	
QA/QC procedures:	In the absence of data from the relevant year, most recent figures should be used, but not older than 5 years.
Any comment:	Applicable for cases A and C Technical distribution losses do not contain other types of grid losses (e.g. commercial losses/theft).

Data / parameter:	**$FC_{k,i,y}$**
Data unit:	Mass or (normalized) volume unit per year (in m^3, ton or l)
Description:	Quantity of fossil fuel type *i* fired in the captive power plant *k* in year *y*
Source of data:	Onsite measurements
Measurement procedures (if any):	Use weight or volume meters
Monitoring frequency:	Continuously
QA/QC procedures:	The consistency of metered fuel consumption quantities should be cross-checked with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	Only applicable if option B2 or C1 are used.

Data / Parameter:	**$EG_{k,y}$**
Data unit:	MWh
Description:	the total net amount of electricity produced by captive power plant *k*
Source of data:	Onsite measurements
Measurement procedures (if any):	Use electricity meters.
Monitoring frequency:	Continuously, aggregated at least annually
QA/QC procedures:	Cross check measurement results with records for sold electricity where relevant.
Any comment:	Only applicable if option B2 or C1 are used.

Data / parameter:	**$HG_{k,y}$**
Data unit:	GJ
Description:	is the quantity of heat co-generated in captive power plant *k* in year *y* (GJ)
Source of data:	Onsite measurements
Monitoring frequency:	Use meters
Measurement procedures (if any):	Heat generation is determined as the difference of the enthalpy of the steam or hot water generated minus the enthalpy of the feed-water and any condensate return. The respective enthalpies should be determined based on the mass (or volume) flows, the temperatures and, in case of superheated steam, the pressure. Steam tables or appropriate thermodynamic equations may be used to calculate the enthalpy as a function of temperature and pressure.
QA/QC procedures:	Cross check measurement results with records for sold heat and the other energy measurements where relevant.
Any comment:	Only applicable if option B2 or C1 are used and if project participants wish to account for emission credits from heat generation in the cogeneration plant.

<table>
<tr><td>Data / parameter:</td><td>NCV_i</td></tr>
<tr><td>Data unit:</td><td>GJ / mass or volume unit</td></tr>
<tr><td>Description:</td><td>Net calorific value of fuel type i</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 project participants</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 Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a) is not available</td></tr>
</table></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>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>QA/QC procedures:</td><td>Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 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 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>Only applicable if option B2 or C1 are used</td></tr>
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<table>
<tr><td>Data / parameter:</td><td>$EF_{CO2,i}$</td></tr>
<tr><td>Data unit:</td><td>tC / mass or volume unit</td></tr>
<tr><td>Description:</td><td>CO_2 emission factor of fuel type i</td></tr>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:
<table>
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<tr><td>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a) is not available</td></tr>
</table></td></tr>
<tr><td>Monitoring frequency:</td><td>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</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.
For a): If the fuel supplier does provide the NCV value and the CO_2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO_2 factor should be used. If another source for the CO_2 emission factor is used or no CO_2 emission factor is provided, options b), c) or d) should be used.</td></tr>
<tr><td>QA/QC procedures:</td><td></td></tr>
<tr><td>Any comment:</td><td>Only applicable if option B2 or C1 are used.</td></tr>
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