Draft revision to the approved baseline and monitoring methodology ACM0003

"Emissions reduction through partial substitution of fossil fuels with alternative fuels or less carbon intensive fuels in cement manufacture"

I. SOURCE, DEFINITIONS AND APPLICABILITY

Source

This methodology is based on two cases "Replacement of Fossil Fuel by Palm Kernel Shell biomass in the production of Portland cement" NM0040, prepared by Lafarge Asia, and "Indocement's Sustainable cement Production Project" NM0048-rev, prepared by Indocement. For more information regarding the proposals and their consideration by the Executive Board please refer to cases NM0040 and NM0048-rev on http://cdm.unfccc.int/goto/MPappmeth.

This methodology also refers to the latest approved version of

- The "Combined tool to identify the baseline scenario and demonstrate additionality";
- The "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site";
- The "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion";
- The "Tool to calculate project emissions from electricity consumption;
- The baseline and monitoring methodology AM0042.

Selected approach from paragraph 48 of the CDM modalities and procedures

"Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment"

Definitions

For the purpose of this methodology, the following definitions apply:

- **Biomass.** Biomass is non-fossilized and biodegradable organic material originating from plants, animals and microorganisms. This shall also include products, by-products, residues and waste from agriculture, forestry and related industries as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes. Biomass also includes gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material.

- **Biomass residues.** *Biomass residues* are defined as *biomass* that is a by-product, residue or waste stream from agriculture, forestry and related industries. This shall not include municipal waste or other wastes that contain fossilized and/or non-biodegradable material (small fractions of inert inorganic material like soil or sands may be included).

- **Renewable biomass**. The latest approved definition by the EB applies.

- **Alternative fuels.** Alternative fuels include the following fuel types:

(a) Wastes originating from fossil sources, such as tires, plastics, textiles from polymers, or rubber; and/or
(b) Biomass residues; and/or
(c) Renewable biomass from a dedicated plantation.

- **Less carbon intensive fossil fuel**. A less carbon intensive fossil fuel is a fossil fuel type that has not been used in the project plant during the last three years prior to the start of the project activity and that has a lower CO_2 emission factor on a net calorific value basis (tCO_2/GJ) than any fossil fuel type that has been used in the project plant during the last three years prior to the start of the project activity.

Note that in case of solid biomass for all the calculations in this methodology, quantity of biomass refers to the *dry* weight of biomass.

Applicability

The methodology is applicable to the cement industry with the following conditions:

- Fossil fuel(s) used in cement manufacture are partially replaced by one or more less carbon intensive fossil fuel(s) and/or alternative fuels;
- A significant investment is required to enable the use of the alternative fuel(s) and/or the less carbon intensive fossil fuel(s);
- During the last three years prior to the start of the project activity, no alternative fuels have been used in the project plant;
- The CO_2 emissions reduction relates to CO_2 emissions generated from fuel combustion only and is unrelated to the CO_2 emissions from decarbonisation of raw materials (i.e. $CaCO_3$ and $MgCO_3$ bearing minerals);
- The methodology is applicable only for installed capacity (expressed in tons clinker/year) that exists by the time of validation of the project activity;

In case of project activities using biomass residues or renewable biomass, the following applicability conditions apply:

- The biomass is not chemically processed (e.g. esterification to produce biodiesel, production of alcohols from biomass, etc) prior to combustion in the project plant but it may be processed mechanically or be dried at the project site. Moreover, any preparation of the biomass, occurring before use in the project activity, does not cause other significant GHG emissions (such as, for example, methane emissions from anaerobic treatment of waste water or from char coal production).
- The biomass used by the project facility is stored under aerobic conditions.

In cases where renewable biomass from a dedicated plantation is used, the following applicability conditions apply:

- The site preparation at the dedicated plantation does not cause longer-term net emissions from soil carbon. Carbon stocks in soil organic matter, litter and deadwood can be expected to decrease more due to soil erosion and human intervention or increase less in the absence of the project activity;
- After harvest, regeneration will occur either by direct planting or natural sprouting;
- Grazing will not occur within the plantation;

- ~~No irrigation is undertaken for the biomass plantations;~~
- In the absence of the project activity, natural revegetation would not result in growth of a forest due to natural or human pressures;
- Prior to the implementation of the project activity, no fuel wood has been collected from the land area where the dedicated plantation will be established;
- For at least ten years before the implementation of the project activity, no forest was on the land where the dedicated plantation will be established;[1]
- If relevant, workers for any activities on the land prior to project implementation continue to be employed for the biomass plantation activity, i.e. no households are shifted from the project site;
- The land area where the dedicated plantation will be established is, prior to project implementation, will meet one of the following criteria:
  - a) Either being severely degraded and would in absence of the project activity have not been used for any other agricultural or forestry activity, or;
  - b) Has been used for agricultural purposes, provided the project participants can demonstrate that no natural forest exists in the host country.[2]

  If the land area is severely degraded, land degradation can be demonstrated using one or more of the following indicators:
  - (a) Vegetation degradation, e.g.,
    - crown cover of pre-existing trees has decreased in the recent past for reasons other than sustainable harvesting activities;
  - (b) Soil degradation, e.g.,
    - soil erosion has increased in the recent past;
    - soil organic matter content has decreased in the recent past.
  - (c) Anthropogenic influences, e.g.,
    - there is a recent history of loss of soil and vegetation due to anthropogenic actions; and
    - demonstration that there exist anthropogenic actions/activities that prevent possible occurrence of natural regeneration.

The applicability conditions outlined in the latest available version of the following tools have to be fulfilled as well:

- The “Combined tool to identify the baseline scenario and demonstrate additionality”;

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[1] This applicability condition is provided to avoid situations where the land-use is changed for the purpose of the CDM project activity some time before registering or starting the CDM project activity. For example, a forest could be deforested two years prior to formally establishing the CDM biomass plantation and starting the CDM project activity.

[2] This applicability condition addresses the issue that shifting agricultural production from the land area elsewhere may potentially result in deforestation. Natural forests include primary and secondary forests. Secondary forests are forest lands which have reverted to forests due to natural regeneration after a major disturbance such as fire, insect infestation, timber harvest or wind throw. To demonstrate that the no natural forests exist in the country, project participants may use forest statistics by the FAO or an official confirmation by the host country government. In case of countries that have natural forests, project participants are encouraged to request a revision to this methodology and to include methodological approaches that address the potential for increased deforestation as a result of shifting agricultural production from the project land area.

- The "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", if B2 is identified as the most plausible baseline scenario for the use of biomass residues;
- The "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion";
- The "Tool to calculate project emissions from electricity consumption;

Finally, this methodology is only applicable if F2 (the continuation of the current fuel mix) or F3 (a different fossil fuel mix portfolio) results to be the most plausible baseline scenario for the use of fuels in the cement plant and if one or several of the following scenarios, as explained in the "procedure for the selection of the most plausible baseline scenario and demonstration of additionality"**,** result to be the most plausible baseline scenario for the use of alternative fuels:

- For the fate of any wastes originating from fossil sources: scenarios W1 and/or W3.
- For the fate of any biomass residues: scenarios B1, B2 and/or B3.
- For the fate of any renewable biomass: scenario R1.

II. BASELINE METHODOLOGY

Project boundary

The physical project boundary covers all production processes related to clinker production, including on-site storage, and on-site transportation and drying of alternative fuels (if alternative fuels are used in the project activity). The project boundary includes also the vehicles used for transportation of alternative fuels to the project site. Where biomass residues are used, the project boundary includes the sites where the biomass residues would be dumped, left to decay or burnt in the absence of the project activity. Where renewable biomass is used in the project plant, the project boundary also includes the sites where the renewable biomass is cultivated. The emission sources and gases included in or excluded from the project boundary are described in Table 1.

Table 1: Emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Emissions from fossil fuels displaced in the project plant ($BE_{FF,y}$)	CO_2	Yes	Main emission source
		CH_4	No	Minor source. Neglected for simplicity.
		N_2O	No	Minor source. Neglected for simplicity.
	Methane emissions avoided from preventing disposal or uncontrolled burning of biomass residues	CO_2	No	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Yes	Included if leakage can be ruled out.
		N_2O	No	Minor source

Project Activity	Emissions from the use of alternative fuels and/or less carbon intensive fossil fuels ($PE_{k,y}$)	CO_2	Yes	Main emission source
		CH_4	No	Minor source. Neglected for simplicity.
		N_2O	No	Minor source. Neglected for simplicity.
	Emissions from additional electricity and/or fossil fuel consumption as a result of the project activity ($PE_{FC,y}$ and $PE_{EC,y}$)	CO_2	Yes	Can be a significant emission source
		CH_4	No	Minor source. Neglected for simplicity.
		N_2O	No	Minor source. Neglected for simplicity.
	Emissions from combustion of fossil fuels for transportation of alternative fuels to the project plant ($PE_{T,y}$)	CO_2	Yes	Can be a significant emission source
		CH_4	No	Minor source. Neglected for simplicity.
		N_2O	No	Minor source. Neglected for simplicity.
	Emissions from the cultivation of renewable biomass at the dedicated plantation ($PE_{BC,y}$)	CO_2	Yes	Can be a significant emission source, e.g. from combustion of fossil fuels
		CH_4	Yes	Can be a significant emission source, e.g. in case of field burning of biomass
		N_2O	Yes	Can be a significant emission source, e.g. in the application of fertilizers

Procedure for the selection of the most plausible baseline scenario and demonstration of additionality

The baseline scenario is identified and additionality is assessed using the most recent approved version of the “Combined tool to identify the baseline scenario and demonstrate additionality”. This section highlights how specific sections of the tool are to be applied to this project context.

In applying step 1a of the tool, the alternatives to be analyzed for the fuel mix for cement manufacturing may include, inter alia:

F1 The proposed project activity not undertaken as a CDM project activity (i.e. use of alternative fuels and/or less carbon intensive fossil fuels).

F2 Continuation of current practice, i.e., a scenario in which the company continues cement production using the existing technology, materials and fuel mix.

F3 The continuation of using only fossil fuels and no alternative fuels, however, with a different fuel mix portfolio, taking into account relative prices of fuels available. The scenario(s) may be based on one fuel or a different mixes of fuels.

F4 The currently used fuels are partially substituted with alternative fuels and/or less carbon intensive fossil fuels other than those used in the CDM project activity and/or any other fuel types, without using the CDM. If relevant, develop different scenarios with different mixes of alternative fuels or less carbon intensive fuels and varying degrees of fuel-switch from traditional to alternative fuels or less carbon intensive fuels.

F5 The construction and operation of a new cement plant.

For each of these scenarios, project participants shall quantify the amount of fossil fuel(s) and alternative fuels that is expected to be used for clinker production during the crediting period.

If the project activity uses alternative fuels, project participants should determine what would happen to the alternative fuels in the absence of the project activity:

Where **wastes originating from fossil sources** are used as the alternative fuel, the alternatives to be analyzed may include, inter alia:

W1 Incineration of the waste in a waste incinerator without utilizing the energy from the incineration
W2 Incineration of the waste in a waste incinerator with use of the energy (e.g. for heat and/or electricity generation)
W3 Disposal of the waste at a managed or unmanaged landfill
W4 The use of the waste at other facilities, e.g. other cement plants or power plants, as a feedstock or for the generation of energy
W5 The recycling or reutilization of the waste
W6 The proposed project activity, not undertaken as a CDM project activity, i.e. the use of the waste in the project plant.

Where **biomass residues** are used as the alternative fuel, the alternatives to be analyzed may include, inter alia:

B1 The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.
B2 The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields.
B3 The biomass residues are burnt in an uncontrolled manner without utilizing them for energy purposes.
B4 The biomass residues are sold to other consumers in the market and used by these consumers, such as for heat and/or electricity generation, for the generation of biofuels, as feedstock in processes (e.g. the pulp and paper industry), as fertilizer, etc.
B5 The biomass residues are used for other purposes at the project site, such as for heat and/or electricity generation, for the generation of biofuels, as feedstock in processes (e.g. the pulp and paper industry), as fertilizer, etc.
B6 The proposed project activity, not undertaken as a CDM project activity, i.e. the use of the biomass residue in the project plant.

Where **renewable biomass** from a new dedicated plantation is used as the alternative fuel, the alternatives to be analyzed may include, inter alia:

R1 No establishment of a dedicated plantation and thus no generation of renewable biomass
R2 Establishment of a new dedicated plantation and sale of the renewable biomass from the plantation to other consumers in the market, which may use the renewable biomass for heat and/or electricity generation, for the generation of biofuels, as feedstock in processes (e.g. the pulp and paper industry), as fertilizer, etc.

R3 The proposed project activity, not undertaken as a CDM project activity, i.e. the establishment of a new dedicated plantation and use of the renewable biomass from that plantation in the project plant.

Where the project activity uses different types of wastes, biomass residues or renewable biomass, the baseline scenario should be identified for each type of waste, biomass residue or renewable biomass separately. Wastes, biomass residues or renewable biomass from different sources should be considered as a different type *k* of waste, biomass residue or renewable biomass. Similarly, wastes, biomass residues or renewable biomass with different uses in the absence of the project activity should be considered as a different type *k* of waste, biomass residues or renewable biomass.

Subsequently, all credible **combinations** of baseline scenarios should be identified and documented as part of step 1 of the tool. These combinations should be considered in applying the following steps of the tool.

Project participants should document transparently in the CDM-PDD:

- Which types and quantities of fuels have been used in the cement plant in the most recent three years prior to the start of the project activity;
- Which types and quantities of fossil fuels are supposed to be used under the project activity in the project plant and which of them are identified less carbon intensive fuels;
- For each waste type, biomass residue type and renewable biomass type that is to be used in the project plant under the project activity: the type, the source and available quantities.

This methodology is only applicable if F2 (the continuation of the current fuel mix) or F3 (a different fossil fuel mix portfolio) results to be the most plausible baseline scenario for the use of fuels in the cement plant. Moreover, the methodology is only applicable if one or several of the following scenarios result to be the most plausible baseline scenario for the use of alternative fuels:

- For the fate of any wastes: W1 and/or W3
- For the fate of any biomass residues: B1, B2 and/or B3
- For the fate of any renewable biomass: R1

Project emissions

Project emissions include project emissions from the use of alternative fuels and/or less carbon intensive fossil fuels ($PE_{k,y}$), project emissions from additional electricity and/or fossil fuel consumption as a result of the project activity ($PE_{EC,y}$ and $PE_{FC,y}$), project emissions from combustion of fossil fuels for transportation of alternative fuels to the project plant ($PE_{T,y}$), and, if applicable, project emissions from the cultivation of renewable biomass at the dedicated plantation ($PE_{BC,y}$):

$$PE_y = PE_{k,y} + PE_{FC,y} + PE_{EC,y} + PE_{T,y} + PE_{BC,y} \quad (1)$$

Where:

PE_y = Project emissions during the year *y* (tCO_2e)

$PE_{k,y}$ = Project emissions from combustion of alternative fuels and/or less carbon intensive fossil fuels in the project plant in year *y* (tCO_2)

$PE_{FC,y}$ = Project emissions from additional fossil fuel combustion as a result of the project activity in year *y* (tCO_2)

$PE_{EC,y}$ = Project emissions from additional electricity consumption as a result of the project activity in year y (tCO_2)

$PE_{T,y}$ = CO_2 emissions during the year y due to transport of alternative fuels to the project plant (tCO_2)

$PE_{BC,y}$ = Project emissions from the cultivation of renewable biomass at the dedicated plantation in year y (tCO_2e)

Project emissions are calculated in the following steps:

Step 1. Calculate project emissions from the use of alternative fuels and/or less carbon intensive fossil fuels
Step 2. Calculate project emissions from additional electricity and/or fossil fuel consumption as a result of the project activity
Step 3. Calculate project emissions from combustion of fossil fuels for transportation of alternative fuels to the project plant
Step 4. Calculate project emissions from the cultivation of renewable biomass at the dedicated plantation

Step 1. Calculate project emissions from the use of alternative fuels and/or less carbon intensive fossil fuels

Project emissions from the use of alternative fuels and/or less carbon intensive fossil fuels in the project plant are calculated as follows:

$$PE_{k,y} = \sum_{k} FC_{PJ,k,y} \times NCV_{k,y} \times EF_{CO2,k,y} \tag{2}$$

Where:

$PE_{k,y}$ = Project emissions from combustion of alternative fuels and/or less carbon intensive fossil fuels in the project plant in year y (tCO_2)

$FC_{PJ,k,y}$ = Quantity of alternative fuel or less carbon intensive fossil fuel type k used in the project plant in year y (tons)

$EF_{CO2,k,y}$ = Carbon dioxide emissions factor for alternative or less carbon intensive fossil fuels type k in year y (tCO_2/GJ)

$NCV_{k,y}$ = Net calorific value of the alternative or less carbon intensive fossil fuel type k in year y (GJ/tonne)

K = Alternative fuel types and less carbon intensive fossil fuel types used in the project plant in year y

Step 2. Calculate project emissions from additional electricity and/or fossil fuel consumption as a result of the project activity

The use of alternative fuels or less carbon intensive fossil fuels may result in additional fossil fuel and/or electricity consumption at the project site or off-site. This may include, inter alia, the following emission sources:

- Drying or mechanical treatment of the fuels;
- On-site transportation of the fuels;
- Flue gas treatment required as a result of the project activity.

Project participants should identify in the CDM-PDD all relevant emission sources for additional fuel combustion and electricity generation and, if applicable, explain any changes in monitoring reports.

CO_2 emissions from on-site combustion of fossil fuels ($PE_{FC,y}$) should be calculated using the latest approved version of the “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”. For each fossil emission source *j*, the fuel consumption of each fuel type *i* ($FC_{i,j,y}$) should be monitored, consistent with the guidance in the tool.

CO_2 emissions from on-site electricity consumption ($PE_{EC,y}$) should be calculated using the latest approved version of the “Tool to calculate project emissions from electricity consumption”. Electricity consumption from each relevant source should be monitored and summed up to $EC_{PJ,y}$.

Step 3. Project emissions from combustion of fossil fuels for transportation of alternative fuels to the project plant

Project participants shall determine CO_2 emissions resulting from transportation of alternative fuels to the project plant. In many cases transportation is undertaken by vehicles. Project participants may choose between two different approaches to determine emissions: an approach based on distance and vehicle type (option 1) or on fuel consumption (option 2).

Option 1:

Emissions are calculated on the basis of distance and the number of trips (or the average truck load):

$$PE_{T,y} = N_y \cdot AVD_y \cdot EF_{km,CO2,y} \tag{3}$$

or

$$PE_{T,y} = \frac{\sum_k AF_{T,k,y}}{TL_y} \cdot AVD_y \cdot EF_{km,CO2,y} \tag{4}$$

Where:

$PE_{T,y}$ = CO_2 emissions during the year *y* due to transport of alternative fuels to the project plant (tCO_2/yr)

N_y = Number of truck trips during the year *y*

AVD_y = Average round trip distance (from and to) between the alternative fuel supply sites and the site of the project plant during the year *y* (km)

$EF_{km,CO2,y}$ = Average CO_2 emission factor for the trucks measured during the year *y* (tCO_2/km)

$AF_{T,k,y}$ = Quantity of alternative fuel type *k* that has been transported to the project site during the year *y* (mass or volume units)

TL_y = Average truck load of the trucks used (tons or liter)during the year *y*.

k = Types of alternative fuels used in the project plant and that have been transported to the project plant in year *y*

Option 2:

Emissions are calculated based on the actual quantity of fossil fuels consumed for transportation:

$$PE_{T,y} = \sum_{i} FC_{TR,i,y} \cdot NCV_{i,y} \cdot EF_{CO2,FF,i,y} \quad \textbf{(5)}$$

Where:

$PE_{T,y}$ = CO_2 emissions during the year *y* due to transport of alternative fuels to the project plant (tCO_2/yr)

$FC_{TR,i,y}$ = Fuel consumption of fuel type *i* in trucks for transportation of alternative fuels during the year *y* (mass or volume units)

$NCV_{i,y}$ = Net calorific value of fossil fuel type *i* (GJ / mass or volume unit)

$EF_{CO2,FF,i,y}$ = CO_2 emission factor for fossil fuel type *i* in year *y* (tCO_2/GJ)

i = Fossil fuel types used for transportation of alternative fuels to the project plant in year *y*

Step 4. Calculate project emissions from the cultivation of renewable biomass at the dedicated plantation

Where renewable biomass from a dedicated plantation is used as alternative fuel, project emissions from the cultivation of the renewable biomass ($PE_{BC,y}$) shall be calculated as:

$$PE_{BC,y} = PE_{FC,PL,y} + PE_{FP,y} + PE_{FA,y} + PE_{BB,y} + PE_{IR,y} \quad \textbf{(6)}$$

Where:

$PE_{BC,y}$ = Project emissions from the cultivation of renewable biomass at the dedicated plantation in year *y* (tCO_2e)

$PE_{FC,PL,y}$ = Project emissions related to fossil fuel consumption at the plantation during agricultural operations in year *y* (tCO_2/yr). This emission source should be calculated using the latest approved version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"

$PE_{FP,y}$ = Project emissions related to the production of synthetic fertilizer that is used at the dedicated plantation in year *y* (tCO_2e/yr). This emission source should be calculated using the procedures provided in the latest approved version of the baseline and monitoring methodology AM0042. In case of using organic fertilizers (compost), emissions from production of organic fertilizers are negligible and assumed to be zero.

$PE_{FA,y}$ = Project emissions related to the application of fertilizers at the plantation in year *y* (tCO_2e/yr). This emission source should be calculated using the procedures provided in the latest approved version of the baseline and monitoring methodology AM0042.

$PE_{BB,y}$ = Project emissions arising from field burning of biomass at the plantation site (tCO_2e/yr). This emission source should be calculated using the procedures provided in the latest approved version of the baseline and monitoring methodology AM0042. In case the land has been previously used for agriculture, it is conservatively assumed that all plantations (vegetation, trees, etc.) on the land prior to project implementation have been burnt and emissions are estimated accordingly using the same procedures provided in the latest approved version of the baseline and monitoring methodology AM0042.

$PE_{IR,y}$ = Project emissions from irrigation of the plantation should be estimated as per the procedure given in step 2 above. Emissions from fuel combustion due to irrigation ($PE_{FC,IR,y}$) are estimated as per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" while emissions from electricity consumption due to irrigation ($PE_{EC,IR,y}$) are estimated as per the "Tool to calculate project emissions from electricity consumption".

In case of conversion of land from crop land to forest land, soil carbon is likely to increase. Consistent with guidance by EB20, as contained in Annex 8 to the meeting report , the change in soil carbon is assumed to be zero and no CERs are claimed for such increase.

Baseline emissions

The project reduces CO_2 emissions by using alternative fuels and/or less carbon intensive fossil fuels in cement kilns. If applicable, the project may also reduce CH_4 emissions from preventing disposal or uncontrolled burning of biomass residues. Baseline emissions are calculated as follows:

$$BE_y = BE_{FF,y} + BE_{CH4,biomass,y} \tag{7}$$

Where:

BE_y = Baseline emissions in year *y* (tCO_2)

$BE_{FF,y}$ = Baseline emission from fossil fuels displaced by alternative fuels or less carbon intensive fossil fuels in year *y* (tCO_2)

$BE_{CH4,biomass,y}$ = Baseline methane emissions avoided during the year *y* from preventing disposal or uncontrolled burning of biomass residues (tCO_2e)

Baseline emissions are determined in the following steps:

Step 1. Estimate the project specific “fuel penalty”
Step 2. Calculate baseline emissions from the fossil fuels displaced by the alternative or less carbon intensive fuel(s)
Step 3. Calculate baseline emissions from decay, dumping or burning of biomass residues

Step 1. Estimate the project specific “fuel penalty”

A project specific fuel “penalty” is applied because the combustion of typically coarser biomass or other alternative fuels will reduce the heat transfer efficiency in the cement manufacturing process. The use of alternative fuels will therefore require a greater heat input to produce the same quantity and quality of cement clinker. The chemical content and ease of absorption into cement clinker of all fuel ashes also differs, and this also contributes to the need for a project specific “fuel penalty”.

This project specific fuel penalty (*FP_y*) should be determined as follows:

$$FP_y = P_{clinker,y} \times (SEC_{clinker,PJ,y} - SEC_{clinker,BL}) \tag{8}$$

Where:

FP_y = Fuel penalty in year *y* (GJ)

$P_{clinker,y}$ = Production of clinker in year *y* (tons)

$SEC_{clinker,PJ,y}$ = Specific energy consumption of the project plant in year *y* (GJ/t clinker)

$SEC_{clinker,BL}$ = Specific energy consumption of the project plant in the absence of the project activity (GJ/t clinker)

The specific energy consumption in the project is calculated based on the quantity of all fuels used in the project plant and the quantity of clinker produced in year *y*, as follows:

$$SEC_{clinker,PJ,y} = \frac{\sum_{i}\left(FC_{PJ,i,y} \times NCV_{i,y}\right) + \sum_{k}\left(FC_{PJ,k,y} \times NCV_{k,y}\right)}{P_{clinker,y}} \qquad \textbf{(9)}$$

Where:

$SEC_{clinker,PJ,y}$ = Specific energy consumption of the project plant in year *y* (GJ/t clinker)
$FC_{PJ,i,y}$ = Quantity of fossil fuel type *i* fired in the project plant in year *y* (tons)
$NCV_{i,y}$ = Net calorific value of the fossil fuel type *i* in year y (GJ/ton)
$FC_{PJ,k,y}$ = Quantity of alternative fuel or less carbon intensive fossil fuel type *k* used in the project plant in year *y* (tons)
$NCV_{k,y}$ = Net calorific value of the alternative or less carbon intensive fuel type *k* in year y (GJ/tonne)
$P_{clinker,y}$ = Production of clinker in year *y* (tons)
k = Alternative fuel types and less carbon intensive fossil fuel types used in the project plant in year *y*
i = Fossil fuel types used in the project plant in year *y* that are not less carbon intensive fossil fuel types

As a conservative approach, the specific energy consumption in the absence of the project activity should be calculated as the lowest annual ratio of fuel input per clinker production among the most recent three years prior to the start of the project activity, as follows:

$$SEC_{clinker,BL} = MIN\left[\frac{HG_{x}}{P_{clinker,x}}; \frac{HG_{x\text{-}1}}{P_{clinker,x\text{-}1}}; \frac{HG_{x-2}}{P_{clinker,x-2}}\right] \qquad \textbf{(10)}$$

with

$$HG_{x} = \sum_{i} FC_{i,x} \times NCV_{i} \qquad \textbf{(11)}$$

Where:

$SEC_{clinker,BL}$ = Specific energy consumption of the project plant in the absence of the project activity (GJ/t clinker)
HG_{x} = Heat generated from fuel combustion in the project plant in the historical year *x* (GJ)
$FC_{i,x}$ = Quantity of fossil fuel type *i* used in the project plant in year *x* (tons)
NCV_{i} = Net calorific value of the fossil fuel type *i* (GJ/ton)
$P_{clinker,x}$ = Production of clinker in year *x* (tons)
x = Year prior to the start of the project activity
i = Fossil fuel types used in the project plant in the last three years prior to the start of the project activity

Step 2. Calculate baseline emissions from the fossil fuels displaced by the alternative or less carbon intensive fuel(s)

Baseline emissions from displacement of fossil fuels are calculated as follows:

$$BE_{FF,y} = \left[\sum_{k} \left(FC_{PJ,k,y} \times NCV_{k,y} \right) - FP_{y} \right] \times EF_{CO2,BL,y} \quad \textbf{(12)}$$

Where:

$BE_{FF,y}$ = Baseline emission from fossil fuels displaced by alternative fuels or less carbon intensive fossil fuels in year *y* (tCO_2)

$FC_{PJ,k,y}$ = Quantity of alternative fuel or less carbon intensive fossil fuel type *k* used in the project plant in year *y* (tons)

$NCV_{k,y}$ = Net calorific value of the alternative or less carbon intensive fuel type *k* in year y (GJ/tonne)

FP_y = Fuel penalty in year *y* (GJ)

$EF_{CO2,BL,y}$ = Carbon dioxide emissions factor for the fossil fuels displaced by the use of alternative fuels or less carbon intensive fossil fuels in the project plant in year *y* (tCO_2/GJ)

k = Alternative fuel types and less carbon intensive fossil fuel types used in the project plant in year *y*

The baseline emissions factor ($EF_{CO2,BL,y}$) is estimated as the lowest of the following CO_2 emission factors:

A. The weighted average CO_2 emission factor for the fossil fuel(s) consumed during the most recent three years before the start of the project activity, calculated as follows:

$$EF_{BL,CO2,y} = \frac{\sum_{i} \left(FC_{i,x-2} + FC_{i,x-1} + FC_{i,x} \right) \times NCV_{i} \times EF_{CO2,FF,i}}{\sum_{i} \left(FC_{i,x-2} + FC_{i,x-1} + FC_{i,x} \right) \times NCV_{i}} \quad \textbf{(13)}$$

Where:

$EF_{CO2,BL,y}$ = Carbon dioxide emissions factor for the fossil fuels displaced by the use of alternative fuels or less carbon intensive fossil fuels in the project plant in year *y* (tCO_2/GJ)

$FC_{i,x}$ = Quantity of fossil fuel type *i* used in the project plant in year *x* (tons)

NCV_i = Net calorific value of the fossil fuel type *i* (GJ/ton)

$EF_{CO2,FF,i}$ CO_2 emission factor for fossil fuel type *i* (tCO_2/GJ)

x Year prior to the start of the project activity

i = Fossil fuel types used in the project plant in the last three years prior to the start of the project activity

B. the weighted average annual CO_2 emission factor of the fossil fuel(s) that are not less carbon intensive fossil fuels and that are used in the project plant in year *y*, calculated as follows:

$$EF_{BL,CO2,y} = \frac{\sum_i FC_{PJ,i,y} \times NCV_{i,y} \times EF_{CO2,FF,i,y}}{\sum_i FC_{PJ,i,y} \times NCV_i} \quad \textbf{(14)}$$

Where:

$EF_{CO2,BL,y}$ = Carbon dioxide emissions factor for the fossil fuels displaced by the use of alternative fuels or less carbon intensive fossil fuels in the project plant in year *y* (tCO_2/GJ)
$FC_{PJ,i,y}$ = Quantity of fossil fuel type *i* fired in the project plant in year *y* (tons)
$NCV_{i,y}$ = Net calorific value of the fossil fuel type *i* in year y (GJ/ton)
$EF_{CO2,FF,i,y}$ = Carbon dioxide emission factor for fossil fuel type *i* in year *y* (tCO_2/GJ)
i = Fossil fuel types used in the project plant in year *y* that are not less carbon intensive fossil fuel types

C. if F3 has been determined as the most likely baseline scenario: the weighted average annual CO_2 emission factor for the fossil fuel(s) that would have been consumed according to fuel mix determined in "Procedure for the selection of the most plausible baseline scenario" above, as follows:

$$EF_{BL,CO2,y} = \frac{\sum_i FC_{BL,F3,i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_i FC_{BL,F3,i,y} \times NCV_i} \quad \textbf{(15)}$$

Where:

$EF_{CO2,BL,y}$ = Carbon dioxide emissions factor for the fossil fuels displaced by the use of alternative fuels or less carbon intensive fossil fuels in the project plant in year *y* (tCO_2/GJ)
$FC_{BL,F3,i,y}$ = Quantity of fossil fuel type *i* that would in the absence of the project activity be used in the project plant according to the selected baseline scenario F3 in year *y* (tons)
$NCV_{i,y}$ = Net calorific value of the fossil fuel type *i* in year y (GJ/ton)
$EF_{CO2,i,y}$ = Carbon dioxide emission factor for fossil fuel type *i* in year *y* (tCO_2/GJ)
i = Fossil fuel types that are not less carbon intensive fossil fuel types and that would in the absence of the project activity be used in the project plant according to the selected baseline scenario F3 in year *y*

Step 3. Calculate baseline emissions from decay, dumping or burning of biomass residues

The calculation of baseline methane emissions from biomass residues dumped, left to decay or burnt in an uncontrolled manner without utilizing them for energy purposes depends on the applicable baseline scenario (B1, B2 or B3). If for a certain biomass residue type *k,* leakage can not be ruled out by using one of the approaches L_1, L_2 or L_3 outlined in the leakage section, then no baseline methane emissions can be claimed from decay, dumping or uncontrolled burning of that biomass quantity. Baseline emissions from decay, dumping or burning of biomass residues are calculated as follows:

$$BE_{CH4,biomass,y} = BE_{CH4,B1/B3,y} + BE_{CH4,B2,y} \quad \textbf{(16)}$$

Where:

$BE_{CH4,biomass,y}$ = Baseline methane emissions avoided during the year *y* from preventing disposal or uncontrolled burning of biomass residues (tCO_2e)

$BE_{CH4,B1/B3,y}$ = Baseline methane emissions avoided during the year *y* from aerobic decay and/or uncontrolled burning of biomass residues (tCO_2e)

$BE_{CH4,B2,y}$ = Baseline methane emissions avoided during the year *y* from anaerobic decay of biomass residues at a solid waste disposal site (tCO_2e)

Uncontrolled burning or aerobic decay of the biomass residues (cases B1 and B3)

If the most likely baseline scenario for the use of a biomass residue type *k*, used as alternative fuel in the project plant, is that the biomass residue would be dumped or left to decay under mainly aerobic conditions (B1) or burnt in an uncontrolled manner without utilizing them for energy purposes (B3), baseline emissions are calculated assuming, for both scenarios viz., natural decay and uncontrolled burning, that the biomass residues would be burnt in an uncontrolled manner.

Baseline emissions avoided from aerobic decay and/or uncontrolled burning of biomass residues are calculated as follows:

$$BE_{CH4,B1/B3,y} = GWP_{CH4} \cdot \sum_{k} FC_{PJ,k,y} \cdot NCV_{k,y} \cdot EF_{burning,CH4,k,y} \qquad \textbf{(17)}$$

Where:

$BE_{CH4,B1/B3,y}$ = Baseline methane emissions avoided during the year *y* from aerobic decay and/or uncontrolled burning of biomass residues (tCO_2e)

GWP_{CH4} = Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)

$FC_{PJ,k,y}$ = Quantity of alternative fuel or less carbon intensive fossil fuel type *k* used in the project plant in year *y* (tons)

$NCV_{k,y}$ = Net calorific value of the alternative or less carbon intensive fuel type *k* in year *y* (GJ/tonne)

$EF_{burning,CH4,k,y}$ = CH_4 emission factor for uncontrolled burning of the biomass residue type *k* during the year *y* (tCH_4/GJ)

k = Types of biomass residues used as alternative fuel in the project plant in year *y* for which the identified baseline scenario is B1 or B3 and for which leakage effects could be ruled out with one of the approaches L_1, L_2 or L_3 described in the leakage section

To determine the CH_4 emission factor, project participants may undertake measurements or use referenced default values. In the absence of more accurate information, it is recommended to use 0.0027 t CH_4 per ton of biomass as default value for the product of NCV_k and $EF_{burning,CH4,k,y}$.[3]

The uncertainty of the CH_4 emission factor is in many cases relatively high. In order to reflect this and for the purpose of providing conservative estimates of emission reductions, a conservativeness factor must be applied to the CH_4 emission factor. The level of the conservativeness factor depends on the uncertainty

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[3] 2006 IPCC Guidelines, Volume 4, Table 2.5, default value for agricultural residues.

range of the estimate for the CH_4 emission factor. The appropriate conservativeness factor from Table 2 below shall be chosen and multiplied with the estimate for the CH_4 emission factor. For example, if the default CH_4 emission factor of 0.0027 t CH_4/t biomass is used, the uncertainty can be deemed to be greater than 100%, resulting in a conservativeness factor of 0.73. Thus, in this case, an emission factor of 0.001971 t CH_4/t biomass should be used.

Table 2: Conservativeness factors

Estimated uncertainty range (%)	Assigned uncertainty band (%)	Conservativeness factor where lower values are more conservative
Less than or equal to 10	7	0.98
Greater than 10 and less than or equal to 30	20	0.94
Greater than 30 and less than or equal to 50	40	0.89
Greater than 50 and less than or equal to 100	75	0.82
Greater than 100	150	0.73

Anaerobic decay of the biomass residues (case B2)

If the most likely baseline scenario for the use of a biomass residue type *k*, used as alternative fuel in the project plant, is that the biomass residue would decay under clearly anaerobic conditions (case B2), project participants shall calculate baseline emissions using the latest approved version of the "*Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site*". The variable $BE_{CH4,SWDS,y}$ calculated by the tool is then corresponds to $BE_{CH4,B2,y}$ in this methodology. Use as waste quantities prevented from disposal ($W_{j,x}$) in the tool, those quantities of biomass residues ($BF_{PJ,k,y}$) for which B2 has been identified as the most plausible baseline scenario and for which leakage could be ruled out using one of the approaches L_1, L_2 or L_3 described in the leakage section.

Leakage

For this type of project activity, two leakage sources have to be considered:

- In case of project activities using biomass residues, the project activity may result in an increase in emissions from fossil fuel combustion or other sources due to diversion of biomass residues from other uses to the project plant as a result of the project activity;
- In case of project activities using (a) less carbon intensive fossil fuel(s), leakage may result from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary. This includes mainly fugitive CH_4 emissions and CO_2 emissions from associated fuel combustion and flaring.

Leakage emissions are calculated as follows:

$$LE_y = LE_{BR,y} + LE_{FF,upstream,y} \quad \textbf{(18)}$$

Where:

LE_y = Leakage emissions during the year *y* (tCO_2e/yr)
$LE_{BR,y}$ = Leakage emissions related to the use of biomass residues during the year *y* (tCO_2)
$LE_{FF,upstream,y}$ = Upstream leakage emissions from fossil fuel use in year *y* (tCO_2e)

Leakage emissions are calculated in two steps:

Step 1. Calculation of leakage emissions related to the use of biomass residues
Step 2. Calculation of upstream leakage emissions from fossil fuel use

Step 1. Calculation of leakage emissions related to the use of biomass residues

This step is only applicable if biomass residues are used in the project plant. In this case, project participants shall demonstrate that the use of the biomass residues does not result in increased fossil fuel consumption elsewhere. For this purpose, project participants shall assess as part of the monitoring the supply situation for the types of biomass residues used in the project plant. The following options may be used to demonstrate that the biomass residues used in the project plant did not increase fossil fuel consumption elsewhere:

L_1 Demonstrate that at the sites where the project activity is supplied from with biomass residues, the biomass residues have not been collected or utilized (e.g. as fuel, fertilizer or feedstock) but have been dumped and left to decay, land-filled or burnt without energy generation (e.g. field burning) prior to the implementation of the project activity. Demonstrate that this practice would continue in the absence of the CDM project activity, e.g. by showing that in the monitored period no market has emerged for the biomass residues considered or by showing that it would still not be feasible to utilize the biomass residues for any purposes (e.g. due to the remote location where the biomass residue is generated).

This approach is applicable to situations where project participants use only biomass residues from specific sites and do not purchase biomass residues from or sell biomass residues to a market.

L_2 Demonstrate that there is an abundant surplus of the biomass residue in the region of the project activity which is not utilized. For this purpose, demonstrate that the quantity of available biomass residue of type *k* in the region is at least 25% larger than the quantity of biomass residues of type *k* that are utilized (e.g. for energy generation or as feedstock), including the project plant.

L_3 Demonstrate that suppliers of the type of biomass residue in the region of the project activity are not able to sell all of their biomass residues. For this purpose, project participants shall demonstrate that the ultimate supplier of the biomass residue (who supplies the project) and a representative sample of suppliers of the same type of biomass residue in the region had a surplus of biomass residues (e.g. at the end of the period during which biomass residues are sold), which they could not sell and which is not utilized.

Where project participants wish to use approaches L_2 or L_3 to assess leakage effects, they shall clearly define the geographical boundary of the region and document it in the CDM-PDD. In defining the geographical boundary of the region, project participants should take the usual distances for biomass residue transports into account, i.e. if biomass residues are transported up to 50 km, the region may cover a radius of 50 km around the project activity. In any case, the region should cover a radius around the project activity of at least 20 km but not more than 200 km. Once defined, the region should not be changed during the crediting period(s).

Project participants shall apply a leakage penalty to the type of biomass residues k, for which project participants can not demonstrate with one of the approaches above that the use of the biomass does not result in leakage. The leakage penalty aims at adjusting emission reductions for leakage effects in a conservative manner, assuming that this quantity of biomass residue is substituted by the most carbon intensive fuel in the country.

If for a certain type of biomass residue *k* used in the project activity, leakage effects cannot be ruled out with one of the approaches above, leakage effects for the year *y* shall be calculated as follows:

$$LE_{BR,y} = EF_{CO2,LE} \cdot \sum_{k} FC_{PJ,k,y} \cdot NCV_{k,y} \tag{19}$$

Where:

$LE_{BR,y}$ = Leakage emissions during the year *y* (tCO_2/yr)

$EF_{CO2,LE}$ = CO_2 emission factor of the most carbon intensive fuel used in the country (tCO_2/GJ)

$FC_{PJ,k,y}$ = Quantity of biomass residue type *k* used in the project plant in year *y* (tons)

$NCV_{k,y}$ = Net calorific value of the biomass residue type *k* in year y (GJ/ton of dry matter)

k = Types of biomass residues for which leakage effects could not be ruled out with one of the approaches L_1, L_2 or L_3 above

Step 2. Calculation of upstream leakage emissions from fossil fuel use

Upstream leakage emission from fossil fuel use may result from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary. This includes mainly fugitive CH_4 emissions and CO_2 emissions from associated fuel combustion and flaring. In this methodology, the following leakage emission sources shall be considered:

- Fugitive CH_4 emissions associated with fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of (the) less carbon intensive fossil fuel(s) *k* used in the project plant and of the fossil fuel(s) *i* that would in the absence of the project activity be used.
- In the case LNG is used in the project plant: CO_2 emissions from fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression into a natural gas transmission or distribution system.

Thus, upstream leakage emissions from fossil fuel use are calculated as follows:

$$LE_{FF,upstream,y} = LE_{CH4,y} + LE_{LNG,CO2,y} \tag{20}$$

Where:

$LE_{FF,upstream,y}$ = Upstream leakage emissions from fossil fuel use in year *y* (tCO_2e)

$LE_{CH4,y}$ = Leakage emissions due to fugitive upstream CH_4 emissions in the year *y* ($t\ CO_2e$)

$LE_{LNG,CO2,y}$ = Leakage emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year *y* ($t\ CO_2e$)

Fugitive methane emissions

For the purpose of determining fugitive methane emissions associated with the production – and in case of natural gas, the transportation and distribution of the fuels – project participants should use the following equation:

$$LE_{CH4,y} = \left[\sum_{k} \left(FC_{PJ,k,y} \cdot NCV_{k,y} \cdot EF_{k,upstream,CH4} \right) - \sum_{i} FC_{BL,i,y} \cdot NCV_{i,y} \cdot EF_{i,upstream,CH4} \right] \cdot GWP_{CH4} \quad \textbf{(21)}$$

Where:

$LE_{CH4,y}$ = Leakage emissions due to fugitive upstream CH_4 emissions in the year *y* (t CO_2e)
$FC_{PJ,k,y}$ = Quantity of less carbon intensive fossil fuel type *k* used in the project plant in year *y* (mass or volume unit)
$FC_{BL,i,y}$ = Quantity of fossil fuel type *i* displaced in the project plant as a result of the project activity in year *y* (mass or volume unit)
$NCV_{k,y}$ = Net calorific value of less carbon intensive fossil fuel type *k* in year y (GJ/mass or volume unit)
$NCV_{i,y}$ = Net calorific value of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{k,upstream,CH4}$ = Emission factor for upstream fugitive methane emissions from production, transportation and distribution of less carbon intensive fuel type *k* (t CH_4 / GJ)
$EF_{i,upstream,CH4}$ = Emission factor for upstream fugitive methane emissions from production, transportation and distribution of fossil fuel type *i* (t CH_4 / GJ)
GWP_{CH4} = Global warming potential of methane valid for the relevant commitment period
k = Less carbon intensive fossil fuel types used in the project plant in year *y*
i = Fossil fuel types displaced in the project plant as a result of the use of alternative fuels or less carbon intensive fossil fuels under the project activity

The quantities and types of fossil fuels *i* that are displaced as a result of the project activity ($FC_{BL,i,y}$) should be determined consistent with the guidance above on the determination of the baseline CO_2 emission factor ($EF_{CO2,BL,y}$), as follows:

$$FC_{BL,i,y} \times NCV_{i,y} = S_{i,y} \times \sum_{k} FC_{PJ,k,y} \times NCV_{k,y} \quad \textbf{(22)}$$

Where:

$FC_{BL,i,y}$ = Quantity of fossil fuel type *i* displaced in the project plant as a result of the project activity in year *y* (mass or volume unit)
$NCV_{i,y}$ = Net calorific value of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$S_{i,y}$ = Share of fossil fuel type *i* (on an energy basis) in the fossil fuel mix that is displaced in the project plant as a result of the use of alternative fuels or less carbon intensive fossil fuels under the project activity, determined consistently with the determination of $EF_{CO2,BL,y}$
$FC_{PJ,k,y}$ = Quantity of less carbon intensive fossil fuel type *k* used in the project plant in year *y* (mass or volume unit)
$NCV_{k,y}$ = Net calorific value of less carbon intensive fossil fuel type *k* in year y (GJ/mass or volume unit)
i = Fossil fuel types displaced in the project plant as a result of the use of alternative fuels or less carbon intensive fossil fuels under the project activity
k = Less carbon intensive fossil fuel types used in the project plant in year y

Where reliable and accurate national data on fugitive CH_4 emissions associated with the production, and in case of natural gas, the transportation and distribution of the fuels is available, project participants should use this data to determine average emission factors by dividing the total quantity of CH_4 emissions by the quantity of fuel produced or supplied respectively.[4] Where such data is not available, project participants may use the default values provided in **Table 3** below. In case of natural gas, the natural gas emission factor for the location of the project should be used, except in cases where it can be shown that the relevant system element (gas production and/or processing/transmission/distribution) is predominantly of recent vintage and built and operated to international standards, in which case the US/Canada values may be used.

Note that the emission factor for fugitive upstream emissions for natural gas should include fugitive emissions from production, processing, transport and distribution of natural gas, as indicated in the **Table 3** below. Note further that in case of coal the emission factor is provided based on a mass unit and needs to be converted in an energy unit, taking into account the net calorific value of the coal.

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[4] GHG inventory data reported to the UNFCCC as part of national communications can be used where country-specific approaches (and not IPCC Tier 1 default values) have been used to estimate emissions.

Table 3: Default emission factors for fugitive CH_4 upstream emissions

Activity	Unit	Default emission factor	Reference for the underlying emission factor range in Volume 3 of the *1996 Revised IPCC Guidelines*
Coal			
Underground mining	t CH4 / kt coal	13.4	Equations 1 and 4, p. 1.105 and 1.110
Surface mining	t CH4 / kt coal	0.8	Equations 2 and 4, p.1.108 and 1.110
Oil			
Production	t CH4 / PJ	2.5	Tables 1-60 to 1-64, p. 1.129 - 1.131
Transport, refining and storage	t CH4 / PJ	1.6	Tables 1-60 to 1-64, p. 1.129 - 1.131
Total	t CH4 / PJ	4.1	
Natural gas			
USA and Canada			
Production	t CH4 / PJ	72	Table 1-60, p. 1.129
Processing, transport and distribution	t CH4 / PJ	88	Table 1-60, p. 1.129
Total	t CH4 / PJ	160	
Eastern Europe and former USSR			
Production	t CH4 / PJ	393	Table 1-61, p. 1.129
Processing, transport and distribution	t CH4 / PJ	528	Table 1-61, p. 1.129
Total	t CH4 / PJ	921	
Western Europe			
Production	t CH4 / PJ	21	Table 1-62, p. 1.130
Processing, transport and distribution	t CH4 / PJ	85	Table 1-62, p. 1.130
Total	t CH4 / PJ	105	
Other oil exporting countries / Rest of world			
Production	t CH4 / PJ	68	Table 1-63 and 1-64, p. 1.130 and 1.131
Processing, transport and distribution	t CH4 / PJ	228	Table 1-63 and 1-64, p. 1.130 and 1.131
Total	t CH4 / PJ	296	

Note: The emission factors in this table have been derived from IPCC default Tier 1 emission factors provided in Volume 3 of the 1996 Revised IPCC Guidelines, by calculating the average of the provided default emission factor range.

CO_2 emissions from LNG

Where applicable, CO_2 emissions from fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system ($LE_{LNG,CO2,y}$) should be estimated by multiplying the quantity of natural gas used in the project with an appropriate emission factor, as follows:

$$LE_{LNG,CO2,y} = FC_{PJ,NG,y} \times NCV_{NG,y} \times EF_{CO2,upstream,LNG} \quad \textbf{(23)}$$

Where:

$LE_{LNG,CO2,y}$ = Leakage emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year *y* (t CO_2e)

$FC_{PJ,NG,y}$ = Quantity of natural gas used in the project plant in the year *y* (m^3)

$NCV_{NG,y}$ = Net calorific values of natural gas in the project plant in year *y* (GJ/m^3)

$EF_{CO2,upstream,LNG}$ = Emission factor for upstream CO_2 emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system (t CO_2/GJ)

Where reliable and accurate data on upstream CO_2 emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system is available, project participants should use this data to determine an average emission factor. Where such data is not available, project participants may assume a default value of 6 t CO_2/TJ as a rough approximation.[5]

Where total net leakage effects from upstream emissions are negative ($LE_{FF,upstream,y} < 0$), project participants should assume $LE_{FF,upstream,y} = 0$.

Emission Reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(24)}$$

Where:

ER_y = Emission reductions during the year *y* (tCO_2/yr)
BE_y = Baseline emissions during the year *y* (tCO_2e/yr)
PE_y = Project emissions during the year *y* (tCO_2e/yr)
LE_y = Leakage emissions during the year *y* (tCO_2e/yr)

Changes required for methodology implementation in 2^{nd} and 3^{rd} crediting periods

At the renewal of the crediting period, project participants should evaluate whether the project activity continues not to be the baseline scenario, i.e. whether it would have been implemented in the absence of the project activity. The procedure outlined under baseline scenario selection and demonstration of additionality above should be used for that purpose. Furthermore, all relevant data contained under "Data and parameters not monitored" should be updated.

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[5] This value has been derived on data published for North American LNG systems. "Barclay, M. and N. Denton, 2005. Selecting offshore LNG process. http://www.fwc.com/publications/tech_papers/files/LNJ091105p34-36.pdf (10th April 2006)".

Data and parameters not monitored

As applicable, all the provisions regarding data and parameters not monitored as contained in the tools referred to in this methodology shall be followed. In addition, in cases where renewable biomass from a dedicated plantation is used in the project plant, the applicable provisions on data and parameters not monitored in AM0042 related to the calculation of $PE_{FP,y}$, $PE_{FA,y}$ and $PE_{BB,y}$ apply.

Parameter:	**$FC_{i,x}$, $FC_{i,x-1}$ and $FC_{i,x-2}$**
Data unit:	Mass or volume units
Description:	Quantity of fossil fuel of type *i* used in the project plant in year *x*, *x-1* and *x-2* where *x* is the year prior to the start of the project activity and *i* are the fossil fuel types used in the project plant in the last three years prior to the start of the project activity
Source of data:	Three years data from fuel consumption data logs at the project site
Measurement procedures (if any):	Use mass or volume meters. 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 CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.
Any comment:	

Parameter:	**$FC_{BL,F3,i,y}$**
Data unit:	Mass or volume unit
Description:	Quantity of fossil fuel type *i* that would in the absence of the project activity be used in the project plant according to the selected baseline scenario F3 in year *y*
Source of data:	Baseline scenario determination
Measurement procedures (if any):	-
Any comment:	Only applicable if F3 has been determined as the most likely baseline scenario

Parameter:	**$P_{clinker,x}$, $P_{clinker,x-1}$ and $P_{clinker,x-2}$**
Data unit:	tons
Description:	Production of clinker in year *x*, *x-1* and *x-2* where *x* is the year prior to the start of the project activity
Source of data:	Three years data from production data logs at the project site
Measurement procedures (if any):	Use appropriate mass meters
Any comment:	

Parameter:	**NCV_i**
Data unit:	GJ/mass or volume units
Description:	Net calorific value of fossil fuel type *i* where *i* are the fossil fuel types used in the project plant in the last three years prior to the start of the project activity

<table>
<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.</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 lower 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>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>Any comment:</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>
</table>

Parameter:	**$EF_{CO2,FF,i}$**
Data unit:	tCO_2/GJ
Description:	Weighted average CO_2 emission factor for fossil fuel type *i* where *i* are the fossil fuel types used in the project plant in the last three years prior to the start of the project activity
Source of data:	The following data sources may be used: (see table below)
Measurement procedures (if any):	For a) and b): Measurements should be undertaken in line with national or international fuel standards.
Any comment:	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.

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 project participants	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).
d) IPCC default values at the lower 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	If a) is not available

III. MONITORING METHODOLOGY

The monitoring procedures are described in the tables below. As applicable, all the monitoring provisions contained in the tools referred to in this methodology shall be followed. In addition, in cases where renewable biomass from a dedicated plantation is used in the project plant, the applicable monitoring provisions in AM0042 related to the calculation of $PE_{FP,y}$, $PE_{FA,y}$ and $PE_{BB,y}$ apply.

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. All meters and instruments should be calibrated regularly as per industry practices.

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:	**$FC_{PJ,k,y}$, $FC_{PJ,i,y}$ and $FC_{PJ,NG,y}$**
Data unit:	Mass or volume units
Description:	Quantity of alternative fuel or less carbon intensive fossil fuel of type *k* ($FC_{PJ,k,y}$), fossil fuel of type *i* ($FC_{PJ,i,y}$), including any natural gas ($FC_{PJ,NG,y}$), used in the project plant in year *y*
Source of data:	Measurements
Measurement procedures (if any):	Use mass or volume meters. 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 CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.
Monitoring frequency:	Recorded continuously and aggregated at least annually.
QA/QC procedures:	According to ISO 9000 or similar quality systems
Any comment:	

Data / parameter:	**$EF_{CO2,k,y}$ and $EF_{CO2,FF,i,y}$**
Data unit:	tCO_2/GJ
Description:	Weighted average CO_2 emission factor for alternative or less carbon intensive fuels of type *k* ($EF_{CO2,k,y}$) and for fossil fuel of type *i* ($EF_{CO2,FF,i}$) in year *y*
Source of data:	For fossil fuels and for wastes originating from fossil sources for which W3 has been identified as the most likely baseline scenario, the following data sources should be used:
Measurement procedures (if any):	For a) and b): Measurements should be undertaken in line with national or international fuel standards.

Data source	**Conditions for using the data source**
e) Values provided by the fuel supplier in invoices	This is the preferred source.
f) Measurements by the project participants	If a) is not available
g) 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).
h) IPCC default values at the upper/lower limit[6] 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	If a) is not available

$EF_{CO2,k,y}$ is zero for the following alternative fuels:
- Wastes originating from fossil sources where W1 has been identified as the most plausible baseline scenario;
- Biomass residues;
- Renewable biomass.[7]

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[6] To be conservative, choose the upper limit where project emissions are calculated and the lower limit where baseline emissions are calculated.

[7] In case of waste originating from fossil sources and baseline scenario W1, the waste would also be combusted in the absence of the project activity, without displacing any fossil fuels. In case of biomass residues it is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector and that the biomass residues are available in surplus. If this condition is not met any more during the crediting period, CO_2 emissions are taken into account by applying a leakage penalty (see leakage section). In case of renewable biomass, emissions from the cultivation of the biomass are estimated separately ($PE_{BC,y}$).

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
QA/QC procedures:	According to ISO 9000 or similar quality systems
Any comment:	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.

Data / parameter:	**$NCV_{k,y}$, $NCV_{i,y}$ and $NCV_{NG,y}$**
Data unit:	GJ/mass or volume units
Description:	Weighted average net calorific value of the alternative or less carbon intensive fuel types *k* ($NCV_{k,y}$), fossil fuel types *i* ($NCV_{i,y}$), including natural gas ($NCV_{NG,y}$), 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 project participants	If a) is not available
c) Regional or national default values	If a) is not available These sources can only be used for liquid fossil fuels and should be based on well documented, reliable sources (such as national energy balances).
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	If a) is not available This source may only be used for fossil fuels.

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 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
QA/QC procedures:	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.
Any comment:	-

Data / Parameter:	$PE_{FC,y}$
Data unit:	tCO_2
Description:	Project emissions from additional fossil fuel combustion as a result of the project activity in year *y*
Source of data:	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".
Measurement procedures (if any):	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".
Monitoring frequency:	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".
QA/QC procedures:	As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".
Any comment	-

Data / Parameter:	$PE_{EC,y}$
Data unit:	tCO_2
Description:	Project emissions from additional electricity consumption as a result of the project activity in year *y*.
Source of data:	As per the "Tool to calculate project emissions from electricity consumption".
Measurement procedures (if any):	As per the "Tool to calculate project emissions from electricity consumption".
Monitoring frequency:	As per the "Tool to calculate project emissions from electricity consumption".
QA/QC procedures:	As per the "Tool to calculate project emissions from electricity consumption".
Any comment:	-

Data / Parameter:	**$BE_{CH4,B2,y}$**
Data unit:	tCO_2
Description:	Baseline methane emissions avoided during the year *y* from preventing disposal of biomass residues at a solid waste disposal site during the period from the start of the project activity to the end of the year *y*
Source of data:	As per the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”.
Measurement procedures (if any):	As per the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”.
Monitoring frequency:	As per the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”.
QA/QC procedures:	As per the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”.
Any comment:	-

Data / Parameter:	**N_y**
Data unit:	-
Description:	Number of truck trips during the year *y*
Source of data:	Transportation data logs.
Measurement procedures (if any):	-
Monitoring frequency:	Continuously
QA/QC procedures:	Check consistency of the number of truck trips with the quantity of biomass combusted, e.g. by the relation with previous years.
Any comment:	Applicable if option 1 is chosen to estimate CO_2 emissions from transportation. Project participants have to monitor either this parameter or the average truck load TL_y.

Data / Parameter:	**AVD_y**
Data unit:	km
Description:	Average round trip distance (from and to) between the alternative fuel supply sites and the site of the project plant during the year *y*
Source of data:	Transportation data logs.
Measurement procedures (if any):	-
Monitoring frequency:	Continuously
QA/QC procedures:	Check consistency of distance records provided by the truckers by comparing recorded distances with other information from other sources (e.g. maps).
Any comment:	Applicable if option 1 is chosen to estimate CO_2 emissions from transportation. If alternative fuels are supplied from different sites, this parameter should correspond to the mean value of km traveled by trucks that supply the alternative fuels to the plant

Data / Parameter:	**$EF_{km,CO2,y}$**
Data unit:	tCO_2/km
Description:	Average CO_2 emission factor for the trucks measured during the year *y*
Source of data:	Conduct sample measurements of the fuel type, fuel consumption and distance traveled for all truck types. Calculate CO_2 emissions from fuel consumption by multiplying with appropriate net calorific values and CO_2 emission factors. For net calorific values and CO_2 emission factors, use reliable national default values or, if not available, (country-specific) IPCC default values. Alternatively, choose emission factors applicable for the truck types used from the literature in a conservative manner (i.e. the higher end within a plausible range).
Measurement procedures (if any):	-
Monitoring frequency:	At least annually
QA/QC procedures:	Cross-check measurement results with emission factors referred to in the literature.
Any comment:	Applicable if option 1 is chosen to estimate CO_2 emissions from transportation.

Data / Parameter:	**$AF_{T,k,y}$**
Data unit:	Mass or volume units
Description:	Quantity of alternative fuel type *k* that has been transported to the project site during the year *y*.
Source of data:	Measurements by project participants
Measurement procedures (if any):	Use mass or volume meters 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 CDM project, the monitored quantities should also be cross-checked with available purchase invoices from the financial records.
Monitoring frequency:	Recorded continuously and reported monthly and adjusted according to stock change.
QA/QC procedures:	According to ISO 9000 or similar quality systems.
Any comment:	-

Data / Parameter:	**TL_y**
Data unit:	Mass or volume units
Description:	Average truck load of the trucks used during the year *y*
Source of data:	Transportation data logs.
Measurement procedures (if any):	-
Monitoring frequency:	Continuously
QA/QC procedures:	-
Any comment:	Applicable if option 1 is chosen to estimate CO_2 emissions from transportation. Project participants have to monitor either the number of truck trips N_y or this parameter.

Data / parameter:	**$FC_{TR,i,y}$**
Data unit:	Mass or volume units
Description:	Fuel consumption of fuel type *i* in trucks for transportation of alternative fuels during the year *y*.
Source of data:	Fuel purchase receipts or fuel consumptions meters in the trucks
Measurement procedures (if any):	-
Monitoring frequency:	Continuously, aggregated annually
QA/QC procedures:	Cross-checked the resulting CO_2 emissions for plausibility with a simple calculation based on the distance approach (option 1).
Any comment:	-

Data / Parameter:	**$P_{clinker,y}$**
Data unit:	tons
Description:	Production of clinker in year *y*
Source of data:	Production data logs at the project site.
Measurement procedures (if any):	Weighing feeders
Monitoring frequency:	Recorded/calculated and reported monthly
QA/QC procedures:	According to ISO 9000 or similar quality systems
Any comment:	-

Data / Parameter:	**$EF_{CO2,BL,y}$**
Data unit:	tCO_2/GJ
Description:	Carbon dioxide emissions factor for the fossil fuels displaced by the use of alternative fuels or less carbon intensive fossil fuels in the project plant
Source of data:	Calculated as follows as the lowest of the following CO_2 emission factors: - The weighted average annual CO_2 emission factor for the fossil fuel(s) consumed and monitored ex ante during the most recent three years before the start of the project activity; - The weighted average annual CO_2 emission factor of the fossil fuel(s) consumed in the project plant in year *y* that are not less carbon intensive fossil fuels, - If F2 has been determined as the most likely baseline scenario: the weighted average annual CO_2 emission factor for the fossil fuel(s) that would have been consumed according to fuel mix determined in “Procedure for the selection of the most plausible baseline scenario” above.
Measurement procedures (if any):	-
Monitoring frequency:	Continuously, aggregated at least annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	**$EF_{CO2,LE}$**
Data unit:	tCO_2/GJ
Description:	Carbon dioxide emission factor of the most carbon intensive fuel used in the country
Source of data:	Identify the most carbon intensive fuel type from the national communication, other literature sources (e.g. IEA). Possibly consult with the national agency responsible for the national communication / GHG inventory. If available, use national default values for the CO_2 emission factor. Otherwise, IPCC default values may be used.
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	**$FC_{BL,i,y}$**
Data unit:	Mass or volume unit
Description:	Quantity of fossil fuel type *i* displaced in the project plant as a result of the project activity in year y
Source of data:	The quantities and types of fossil fuels *i* that are displaced as a result of the project activity ($FC_{BL,i,y}$) should be determined consistent with the guidance above on the determination of the baseline CO_2 emission factor ($EF_{CO2,BL,y}$).
Measurement procedures (if any):	-
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	**$EF_{k,upstream,CH4}$ and $EF_{i,upstream,CH4}$**
Data unit:	tCH_4/GJ
Description:	Emission factor for upstream fugitive methane emissions from production, transportation and distribution of less carbon intensive fuel type *k* ($EF_{k,upstream,CH4}$) and of fossil fuel type *i* ($EF_{i,upstream,CH4}$).
Source of data:	See below.
Measurement procedures (if any):	Where reliable and accurate national data on fugitive CH_4 emissions associated with the production, transportation and distribution of the fuels is available, project participants should use this data to determine average emission factors by dividing the total quantity of CH_4 emissions by the quantity of fuel produced or supplied respectively. Where such data is not available, project participants may use the default values provided in **Table 3** in this methodology. In case of natural gas, the natural gas emission factor for the location of the project should be used, except in cases where it can be shown that the relevant system element (gas production and/or processing/transmission/distribution) is predominantly of recent vintage and built and operated to international standards, in which case the US/Canada values may be used. Note that the emission factor for fugitive upstream emissions for natural gas should include fugitive emissions from production, processing, transport and distribution of natural gas, as indicated in the **Table 3** in this methodology. Note further that in case of coal the emission factor is provided based on a mass unit and needs to be converted in an energy unit, taking into account the net calorific value of the coal.
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	**$EF_{CO2,upstream,LNG}$**
Data unit:	tCO_2/GJ
Description:	Emission factor for upstream CO_2 emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system.
Source of data:	See below.
Measurement procedures (if any):	Where reliable and accurate data on upstream CO_2 emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system is available, project participants should use this data to determine an average emission factor. Where such data is not available, project participants may assume a default value of 6 t CO_2/TJ as a rough approximation.
Monitoring frequency:	Annually
QA/QC procedures:	-
Any comment:	-

Data / parameter:	**-**
Data unit:	-
Description:	Demonstration that the biomass residue type *k* from a specific source would continue not to be collected or utilized, e.g. by an assessment whether a market has emerged for that type of biomass residue (if yes, leakage is assumed not be ruled out) or by showing that it would still not be feasible to utilize the biomass residues for any purposes.
Source of data:	Information from the site where the biomass is generated
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	Monitoring of this parameter is applicable if approach L_1 is used to rule out leakage

Data / parameter:	**-**
Data unit:	Tons
Description:	Quantity of biomass residues of type *k* that are utilized (e.g. for energy generation or as feedstock) in the defined geographical region
Source of data:	Surveys or statistics
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	Monitoring of this parameter is applicable if approach L_2 is used to rule out

	leakage

Data / parameter:	**-**
Data unit:	Tons
Description:	Quantity of available biomass residues of type *k* in the region
Source of data:	Surveys or statistics
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	Monitoring of this parameter is applicable if approach L_2 is used to rule out leakage

Data / parameter:	**-**
Data unit:	
Description:	Availability of a surplus of biomass residue type *k* (which can not be sold or utilized) at the ultimate supplier to the project and a representative sample of other suppliers in the defined geographical region.
Source of data:	Surveys
Measurement procedures (if any):	
Monitoring frequency:	Annually
QA/QC procedures:	
Any comment:	Monitoring of this parameter is applicable if approach L_3 is used to rule out leakage

Data / parameter:	**$EF_{burning,CH4,k,y}$**
Data unit:	tCH_4/GJ
Description:	CH_4 emission factor for uncontrolled burning of the biomass residue type *k* during the year *y*
Source of data:	Undertake measurements or use referenced and reliable default values (e.g. IPCC)
Measurement procedures (if any):	
Monitoring frequency:	Review of default values: annually Measurements: once at the start of the project activity
QA/QC procedures:	Cross-check the results of any measurements with IPCC default values. If there is a significant difference, check the measurement method and increase the number of measurements in order to verify the results.
Any comment:	Monitoring of this parameter for project emissions is only required if CH_4 emissions from biomass combustion are included in the project boundary. Note that a conservative factor shall be applied, as specified in the baseline methodology.