Approved baseline and monitoring methodology AM0094

"Distribution of biomass based stove and/or heater for household or institutional use"

I. SOURCE, DEFINITIONS AND APPLICABILITY

Sources

This baseline and monitoring methodology is based on elements from the following proposed new methodology and approved baseline and monitoring methodology:

- NM0337 "Replacement of fossil fuel fired heaters with biomass residue fired heaters" prepared by Sindicatum Carbon Capital (Cayman) Limited and Milestone Biomass Energy Co Ltd;
- AM0086 "Installation of zero energy water purifier for safe drinking water application".

This methodology also refers to the latest approved versions of the following tools:

- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion;
- Tool to calculate baseline, project and/or leakage emissions from electricity consumption;
- Combined tool to identify the baseline scenario and demonstrate additionality.

For more information regarding the proposed new methodologies and the tools as well as their consideration by the Executive Board please refer to <http://cdm.unfccc.int/goto/MPappmeth>.

Selected approach from paragraph 48 of the CDM modalities and procedures

"Existing actual or historical emissions, as applicable".

Definitions

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

Baseline sample group (BSG). A group of consumers in the project area *i* which are surveyed prior to the start of the project activity to estimate baseline emissions.

Biomass based heater. A heater that uses biomass briquettes as fuel, applies biomass gasification technology and has an exhaust chimney. The heater is used for space heating directly or via a distribution network (e.g. water fed radiators, blown air or air pipes). The heater may have a secondary cooking function, such as water boiling. The types of heaters depend on size (heating for one room, one apartment or whole building) and the type of space heating means (i.e. radiative, water, oil etc).

Biomass based stove. A stove that uses biomass briquettes as fuel, biomass gasification technology and has an exhaust chimney. The stove is only used for cooking. The types of stove depend on size (e.g. for a family or for an institution) and whether it is closed or open.

Biomass briquettes. Mechanically compressed biomass residues produced in biomass briquetting factories.

Biomass. Non-fossilized and biodegradable organic material originating from plants, animals and microorganisms. This shall 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 residue. 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 (however, small fractions of inert inorganic material like soil or sands may be included).

Consumers. Households or small institutions such as hospitals, small family farms, schools etc. which uses stoves and/or heaters. Commercial entities are not included in this definition.

Project consumers. Consumers to whom biomass based stoves and/or heaters are supplied under the project activity.

Total project area (TPA). Total geographical area in which biomass based stoves and/or heaters are distributed under the project activity. The TPA is further stratified as project area *i* based on geo-climatic zones and socio-economic conditions.

Applicability

This methodology applies to project activities that directly invest (partially or fully) in and/or provide a subsidy for: (i) the distribution of biomass based stoves and/or heaters and (ii) the supply of biomass briquettes (e.g. transportation infrastructure, biomass briquetting factories etc.) in a project geographical area (TPA). The project activity has to consist of both components (i) and (ii).

The methodology is applicable under the following conditions:

- The biomass residues used to produce biomass briquettes are not stored for more than one year;
- The biomass residues used to produce biomass briquettes are not obtained from chemically processed biomass (e.g. through esterification, fermentation, hydrolysis, pyrolysis, bio- or chemical degradation etc.);
- The TPA is defined prior to the start of the project activity in the CDM-PDD and will not be changed later;
- If the project activity involves biomass based stoves, then in all the planned project area *i*, biomass constitutes not more than 10% of the fuel used for cooking purposes, on energy basis, prior to the start of the CDM project activity;[1]
- If the project activity involves biomass based heaters, then in all the planned project area *i*, biomass constitutes not more than 10% of the fuel used for space heating, on energy basis, prior to the start of the CDM project activity;[1]
- The biomass based stove or heater shall have a rated capacity not more than 150 kW thermal[2];
- The efficiency of the biomass based stove or heater is higher than or equal to that of the most efficient baseline stove or heater;

[1] This should be demonstrated by the project participants through a sample survey in the project area *i* as described below. The survey should be conducted within one year prior to the commissioning of the CDM project activity and the result of the survey should be presented at the validation. In case the CDM project activity starts after the validation, the survey should be conducted within one year prior to the start of the validation.

[2] This threshold is to limit the methodology to cases where the stove or heater is for household or small institutional use, but not for industrial use or district heating purpose.

- A contractual agreement between the project consumers and the project participants shall ensure that the project consumers do not claim any CERs from the use of stove and/or heater and biomass briquettes. The contractual agreement can be presented in the form of delivery notes for each stove and/or heater, receipts of the biomass briquettes delivery etc;
- If the manufacturer of the stoves and/or heaters is not a project participant and the project participant provides a subsidy for each stove and/or heater installed at the consumer's place, a contractual agreement between the manufacturer and the project participant shall ensure that the manufacturer does not claim any CERs from producing stoves and/or heaters;
- If the producer(s) of the biomass briquettes is not a project participant and project participant provides a subsidy for the biomass briquette supply, a contractual agreement between the producer(s) of the biomass briquettes and the project participant shall ensure that the producer(s) of the biomass briquettes does not claim any CERs from producing biomass briquettes;

In addition, the applicability conditions included in the tools referred to above apply.

Finally, this methodology is only applicable if the most plausible baseline scenario, as identified per the section "Selection of the baseline scenario and demonstration of additionality" hereunder, is:

- For the supply of biomass based stoves or heaters and biomass briquettes: Scenario P4 (No supply of biomass based stoves or heaters and biomass briquettes by the project participants); and
- For biomass residue use: Scenarios B1: to B8:, or any combination of those scenarios. For scenarios B4: to B8:, leakage emissions should be accounted for as per the procedures of the methodology.

II. BASELINE METHODOLOGY PROCEDURE

Project boundary

The **spatial extent** of the project boundary encompasses:

- Consumers in the TPA;
- Each of the project consumers where biomass based stoves or heaters are installed;
- Biomass briquetting factories;

The greenhouse gases included in or excluded from the project boundary are shown in Table 1.

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

Source		Gas	Included?	Justification / Explanation
Baseline	Fossil fuel combustion for heat generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
Project activity	Electricity consumption in the biomass briquetting factories	CO_2	Yes	May be an important emission source
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small
	Fossil fuel consumption in the biomass briquetting factories	CO_2	Yes	May be an important emission source
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small

Selection of the baseline scenario and demonstration of additionality

The selection of the baseline scenario and the demonstration of additionality should be conducted using the latest version of the "Combined tool to identify the baseline scenario and demonstrate additionality". The following additional guidance should be used when applying the tool.

When applying "Sub-step 1a" of the tool, alternative scenarios should include all realistic and credible alternatives to the project activity that are consistent with current laws and regulations of the host country.

For the supply of biomass based stoves or heaters and biomass briquettes, the alternative scenarios should include, but not be limited to, *inter alia*:

P1: The proposed project activity not undertaken as a CDM project activity;

P2: Distribution of biomass based stoves and/or heaters only;

P3: Supply of biomass briquettes only; and

P4: No supply of biomass based stoves or heaters and biomass briquettes by the project participants. The consumers continue to use their current heating or cooking technologies and fuels.

In case of alternative scenario P4, the current heating or cooking technologies and fuels used by the consumers shall be identified through a sample survey conducted with consumers in the TPA prior to the start of the CDM project activity. The survey determines the share of different types of stoves or heaters and types of fuels used to meet the heating or cooking energy demand, as observed historically through the survey.

For the use of biomass residues, the alternative scenarios should include, but not be limited to, *inter alia*:

B1: The biomass residues are dumped or left to decay mainly under 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 landfills which are deeper 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 it for energy purposes;

B4: The biomass residues are used for power or heat generation purposes (e.g. in power plants, industries);

B5: The biomass residues are used for household or institutional energy generation (e.g. direct use in stoves, making briquettes for stoves or heaters);

B6: The biomass residues are used for other energy purposes, such as the generation of biofuels;

B7: The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in processes (e.g. in the pulp and paper industry);

B8: Biomass residues are purchased from a market, or biomass residues retailers, or the primary source of the biomass residues and/or their fate in the absence of the project activity cannot be clearly identified.

When defining plausible and credible alternative scenarios for the use of biomass residues, the guidance below should be followed:

- The baseline scenario for the use of biomass residues should be separately identified for different categories of biomass residues, covering the whole amount of biomass residues supposed to be used in the project activity during the crediting period;
- A category of biomass residues is defined by three attributes: (1) its type (i.e. wheat straws, rice husks, sawdust, sugar cane bagasse, maize stalk etc.); (2) its source (e.g. produced on-site, obtained from an identified biomass residues producer, obtained from a biomass residues market, etc.); and (3) its fate in the absence of the project activity (Scenarios B above);
- Explain and document transparently in the CDM-PDD, using a table similar to Table 2, the quantities of each biomass residues categories used under the project activity and their baseline scenario.

Table 2: Example of a table for biomass residue categories

Biomass residues category (*r*)	Biomass residues type	Biomass residues source	Fate of Biomass residues in the absence of the project activity
1	Rice husks	On-site production	Power or heat generation (B4:)
2	Wheat straws	On-site production	Dumped (B1:)
3	Rice husks	Off-site from an identified rice mill	Dumped (B1:)
4	Empty fruit bunches	Off-site from a retailer	Unidentified (B8:)

- For biomass residues categories for which scenarios B1:, B2: or B3: is deemed a plausible baseline alternative, project participants shall demonstrate that this is a realistic and credible alternative scenario. Project participants may choose one of the following procedures to demonstrate this:
    - Demonstrate that there is an abundant surplus of the type of biomass residue in the region of the project activity which is not utilized. For this purpose, demonstrate that the quantity of that type of biomass residues available in the region is at least 25% larger than the quantity of biomass residues of that type which is utilized in the region (e.g. for energy generation or as feedstock), including the project activity demand; or
    - Demonstrate for the sites from where biomass residues are sourced that 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 their use under the project activity. This approach is only applicable to biomass residues categories for which project participants can clearly identify the site from where the biomass residues are sourced.
- The scenarios B1:, B2: or B3: can only be regarded as a plausible baseline scenario for a certain category of biomass residues, if the project participants can demonstrate that at least one of the two approaches above is fulfilled. Otherwise, the baseline scenario for this particular biomass residues category should be considered as B8:, and a leakage penalty will be applied when calculating leakage emissions.

While applying "Step 3" of the tool (Investment Analysis), the following guidance should be followed:

- Alternative scenario P4 should be translated into a situation in which project participants do not undertake the investment in the project activity but seek an alternative investment that reflects a reasonable return in the financial markets (financial benchmark).

The "Step 4" of the tool (common practice analysis) need not to be conducted as this is already covered by the applicability conditions on the use of biomass as fuel for cooking or space heating.

Baseline emissions

Baseline emissions include CO_2 emissions from fossil fuels that would be burnt in the stoves or heaters in the absence of the CDM project activity. The baseline emissions depend on the types of stoves or heaters used, types of fuels burnt, amount of energy required for cooking or heating purposes and efficiency of the existing (baseline) stoves or heaters in the absence of the CDM project activity.

The methodology assumes that the share of different types of stoves or heaters used and types of fuels burnt prior to the implementation of the project activity would continue in the absence of the CDM project activity. The share of types of stoves or heaters and fuels are established by surveying a baseline sample group (BSG) of consumers in each of the project area *i* within the TPA. This baseline survey is conducted once prior to the implementation of the project activity in that project area. An example for a questionnaire for the survey of the BSG is provided in Appendix B.

The methodology further assumes that the amount of energy required in the baseline scenario and project scenario would be the same and this would be determined by monitoring the amount of energy provided by the biomass based (project) stoves or heaters in the project scenario.

With regard to the efficiency of the existing (baseline) stoves or heaters, the methodology provides two options for calculating the baseline emissions. The first option offers simpler but possibly more conservative approach, where the project participants can disregard the difference in the efficiency

between the baseline and project stoves or heaters. In the second option the project participants are required to determine the efficiency of the baseline and project stoves or heaters.

Baseline emissions are calculated following one of the options below:

Option 1

This option does not take into account the difference in the efficiency between the baseline and the project stoves or heaters.

$$BE_y = \sum_i \sum_j \left(EF_j \cdot p_{j,i} \cdot \sum_b \left(NCV_{b,y} \cdot \sum_k BF_{k,b,i,y} \right) \right) \quad \textbf{(1)}$$

Where:

BE_y = Baseline emissions in year y (tCO_2e)
$BF_{k,b,i,y}$ = Dry weight of biomass briquettes type b consumed by project consumer k in project area i in year y (ton)
$NCV_{b,y}$ = NCV of biomass briquettes type b in year y (TJ/ton)
$p_{j,i}$ = Proportion of fuel j (including biomass) used in the stoves or heaters in project area i in the baseline (Fraction)
EF_j = CO_2 emission factor of fuel j (tCO_2/TJ)

Option 2

This option takes into account the difference in the efficiency between the baseline and the project stoves or heaters.

$$BE_y = \sum_i \sum_j \left(EF_j \cdot p_{j,i} \cdot \sum_l \left(\frac{1}{\eta_{BL,l} \cdot p_{BL,l,i}} \right) \cdot \sum_p \left(\eta_{PJ,p,y} \cdot p_{PJ,p,i,y} \right) \cdot \sum_b \left(NCV_{b,y} \cdot \sum_k BF_{k,b,i,y} \right) \right) \quad \textbf{(2)}$$

Where:

BE_y = Baseline emissions in year y (tCO_2e)
$BF_{k,b,i,y}$ = Dry weight of biomass briquettes type b consumed by project consumer k in project area i in year y (ton)
$NCV_{b,y}$ = NCV of biomass briquettes type b in year y (TJ/ton)
$p_{PJ,p,i,y}$ = Proportion of project stove or heater type p in use in project area i in year y (Fraction)
$\eta_{PJ,p,y}$ = Efficiency of project stove or heater type p in year y (%)
$p_{BL,l,i}$ = Proportion of stove or heater type l used in project area i in the baseline (Fraction)
$\eta_{BL,l}$ = Efficiency of stove or heater type l used in the baseline (%)
$p_{j,i}$ = Proportion of fuel j (including biomass) used in the stoves or heaters in project area i in the baseline (Fraction)
EF_j = CO_2 emission factor of fuel j (tCO_2/TJ)

Determination of $\eta_{BL,l}$

Efficiency of stove or heater type l used in the baseline shall be determined following one of the options below (on the order of preference):

Option A

Efficiency of stove or heater type *l* used in the baseline shall be determined by an independent expert entity in the controlled environment (i.e. in the field or laboratory). The project participants shall document in the CDM-PDD whether the efficiency test was carried out in the field or in the laboratory and shall ensure that the efficiency test was carried out in the same control environment (field or laboratory) as in the case of efficiency of the new project stove or heater type *p* ($\eta_{PJ,p,0}$).

The project participants shall use recognized provincial, national or international protocols/standards to determine the efficiency. For consistency and comparable outcomes, it shall be ensured that the same protocol/standard and conditions has been used to determine the efficiency of new project stove or heater type *p* ($\eta_{PJ,p,0}$) as well. In order to assure that the same standard is used, the project participants may use the standard for the determination of efficiency of fossil fuel stoves or heaters also for the determination of the efficiency of the biomass based stoves or heaters. Thus deviating from the official standard for the determination of the efficiency of the biomass based stoves or heaters is acceptable for the determination of efficiency of the biomass based stoves or heaters as long as the relevant provisions of the fossil fuel standard are considered.

The project participants shall carry out the determination of efficiency on three stoves or heaters that are representative for the considered stove or heater type. For each determination, three sample runs shall be carried out. The average of the nine results are taken as the efficiency for the considered stove or heater type.

In case of a stove, the project participants can follow the Controlled Cooking Test (CCT) protocol to determine the efficiency of the stove (available at <http://www.pciaonline.org/node/1050>).

Option B

The project participants can use this option only if they cannot perform option A above. The reason for choosing this option should be clearly documented in the CDM-PDD.

The efficiency of the stove or heater type *l* used in the baseline shall be determined as the highest efficiency value of stove or heater type *l* among the efficiency values provided by at least two manufacturers in the region. The project participants shall document in the CDM-PDD the standard/protocol which was followed to determine the efficiency. For consistency and comparable outcomes, it shall be ensured that the same protocol/standard and conditions has been used to determine the efficiency of new project stove or heater type *p* ($\eta_{PJ,p,0}$) as well.

***Determination of* $\eta_{PJ,p,y}$**

$$\eta_{PJ,p,y} = \eta_{PJ,p,0} \cdot \left(DF_{\eta}\right)^{y-1} \quad \textbf{(3)}$$

Where:

$\eta_{PJ,p,y}$ = Efficiency of project stove or heater type *p* in year *y* (%)
$\eta_{PJ,p,0}$ = Efficiency of new project stove or heater type *p* (%)
DF_{η} = Discount factor to account for efficiency loss of biomass based stove or heater per year of operation (Fraction)

Determination of $\eta_{PJ,p,0}$

The efficiency of new project stove or heater type *p*, shall be determined by an independent expert entity in the controlled environment (i.e. in the field or laboratory). The project participants shall document in the CDM-PDD whether the efficiency test was carried out in the field or in the laboratory and shall ensure that the efficiency test was carried out in the same control environment (field or laboratory) as in the case of efficiency of stove or heater type *l* used in the baseline ($\eta_{BL,l}$).

The project participants shall use recognized provincial, national or international protocols/standards to determine the efficiency. For consistency and comparable outcomes, it shall be ensured that the same protocol/standard and conditions has been used to determine the efficiency of stove or heater type *l* used in the baseline ($\eta_{BL,l}$) as well.

The project participants shall carry out the determination of efficiency on three stoves or heaters that are representative for the considered stove or heater type. For each determination, three sample runs shall be carried out. The average of the nine results are taken as the efficiency for the considered stove or heater type.

In case of stove, the project participants can follow the Controlled Cooking Test (CCT) protocol to determine the efficiency of the stove (available at <http://www.pciaonline.org/node/1050>).

Determination of $p_{BL,l,i}$, $p_{j,i}$, $B_{BL,cooking,i}$, $B_{BL,heating,i}$

These parameters are determined using data gathered by a sample survey conducted in each project area *i*.

Objective of the survey

(1) Determine proportions of stove or heater types and fuel types:

- Proportion of stove or heater type *l* used in project area *i* in the baseline ($p_{BL,l,i}$);
- Proportion of fuel *j* (including biomass) used in the stoves or heaters in project area *i* in the baseline ($p_{j,i}$)

(2) Determine the biomass penetration rate (i.e. percentage of biomass used as fuel for cooking or space heating prior to the start of the CDM project activity in project area *i* ($B_{BL,cooking,i}$ or $B_{BL,heating,i}$))

The survey shall be conducted via the following steps:

Step 1: Identification of the TPA;

Step 2: Stratification of consumers;

Step 3: Determination of the sample size of the BSG;

Step 4: Establishment of sampling database and a sampling plan;

Step 5: Implementation of the surveys.

Step 1: Identification of the TPA

The project participants should determine the TPA where they would want to implement the project activity. This TPA should not be changed later. Examples of TPAs include: a state, a region, a province or a country.

Step 2: Stratification of consumers

The consumers within the TPA shall be stratified into the project area *i* consisting of different geo-climatic zones in order to reflect climatic effects and socio-economic conditions. Project area *i* are areas within the TPA that have similar climatic and socio-economic conditions[3]. Examples of project areas *i* include: villages, districts, towns etc. The distinct geographical boundary of each project area *i* should be clearly documented in the CDM-PDD.

Step 3: Determination of the sample size of the BSG

A survey of BSG in each project area *i* is required to be carried out to identify the types of stoves or heaters and types of fuels used by the consumers prior to the implementation of the project activity. The minimum sample size of the BSG ($n_{i,BSG}$) for each project area *i*, is determined by using the formula developed by Cochran (1977)[4] for a large or infinite population as given below. This formula should be applied by assuming x=0.01, y=0.99, z=1.96 (at 95% confidence interval) and e_1=0.01.

$$n_{i,BSG} = \frac{z^2 xy}{e^2} \quad \textbf{(4)}$$

Where:

$n_{i,BSG}$	=	Minimum sample size of the BSG for each project area *i*
x	=	Estimate of variance in the primary variables of interest in the survey (value 0.01)
y	=	1-x = 0.99
e	=	Precision level or acceptable margin of error (value 0.01)
z	=	z-value as the value of the standard variate at the given confidence level, to be obtained from the z-distribution table (value 1.96 at 95% confidence interval)

Note: Alternatively, a value of 380 should be used for $n_{i,BSG}$ which is the result of solving equation 4, as all the variables to determine this sample size are known. Note that this refers to the minimum number of consumers from which information should be collected. The project participants may choose a larger sample size to account for consumers for which no response can be collected.

Step 4: Establishment of sampling database and a sampling plan

The following information should be sought in order to develop a monitoring system database referred to as the Central Database System (CDS):

(a) A list of all project areas *i* including the name or number of the project area;

(b) A list of consumers included in the BSG;[5]

[3] Socio-economic differences should be in the form of rural or urban setting. A project area *i* should not include both rural and urban area, they should be in different project areas.

[4] Cochran W.G., (1977), Sampling Techniques, 3rd Edition, New York: John Wiley & Sons.

[5] Maintained as separate information; but may not be part of CDS.

(c) For consumers included in the BSG, the information according to sample survey questionnaires included in Appendix B respectively should be collected. Any additional information can also be collected on need basis;

(d) An extract of the database should be attached to the CDM-PDD;

(e) The information should be available for the crediting period plus two years.

Step 5: Implementation of the surveys

The survey is carried out by using the questionnaires as given in Appendix B of this methodology by visiting consumers in the BSG in each project area *i*.

One of the following survey principles shall be applied for all surveys:

Option I

(1) For each project area *i*, systematic random sampling should be followed to select samples. This should be done by selection of every k^{th} element from a sampling frame, where *k*, the sampling interval, would be calculated as:

$$k = \frac{\text{population size (N)}}{\text{sample size (n)}} \quad \textbf{(5)}$$

(2) The starting point of sampling for survey is randomly selected;

(3) Only persons over age 15 are interviewed.

Option II

(1) For each project area *i*, simple random sampling should be followed to select samples. The project participants will design and implement a sampling plan to sample the desired number of consumers such that each consumer has an equal probability of being selected;

(2) Only persons over age 15 are interviewed.

Project emissions

Project emissions include the sum of emissions from the biomass briquetting factories, including the use of heat/electricity.

Project emissions are calculated as follows:

$$PE_y = PE_{FC,y} + PE_{EC,y} \quad \textbf{(6)}$$

Where:

PE_y = Project emissions in year *y* (tCO_2e)
$PE_{FC,y}$ = Project emissions from fossil fuel combustion in year *y* (tCO_2e)
$PE_{EC,y}$ = Project emissions from electricity consumption in year *y* (tCO_2e)

Project emissions from fossil fuel consumption ($PE_{FC,y}$)

Project emissions from fossil fuel combustion in year *y* ($PE_{FC,y}$) are calculated using the latest approved version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", where

the sources *j* in the tool correspond to all sources of fossil fuel consumption by the project activity, including biomass briquetting factories. Fossil fuel consumption, if any, for electricity generation should be included in the project emissions from electricity consumption ($PE_{EC,y}$), as described below. All emission sources should be documented transparently in the CDM-PDD.

Project emissions from electricity consumption ($PE_{EC,y}$)

Project emissions from electricity consumption in year *y* ($PE_{EC,y}$) are calculated using the latest version of the "Tool to calculate baseline, project or leakage emissions from electricity consumption" where the electricity consumption sources *j* in the tool corresponds to all electricity consumption sources by the project activity, including biomass briquetting factories. All emission sources should be documented transparently in the CDM-PDD.

Leakage

The main potential source of leakage for this project activity is an increase in emissions from fossil fuel combustion or other sources due to diversion of biomass residues from other uses to the project activity. Changes in carbon stocks in the LULUCF sector are expected to be insignificant since this methodology is limited to biomass residues, as defined in the applicability conditions above. The baseline scenarios for biomass residues for which this potential leakage is relevant are B4:, B5:, B6:, B7: and B8:.

The actual leakage emissions in each of these cases may differ significantly. For that reason, a simplified approach is used in this methodology: it is assumed that an equivalent amount of fossil fuels, on energy basis, would be used if biomass residues are diverted from other users, no matter what the use of biomass residues would be in the baseline scenario.

Therefore, for the categories of biomass residues whose baseline scenario has been identified as B4:, B5:, B6:, B7: or B8:, project participants shall calculate leakage emissions as follows:

$$LE_y = EF_{CO2,LE} \cdot \sum_r BR_{B4/B8,r,y} \cdot NCV_{BR,r,y} \quad \textbf{(7)}$$

Where:

LE_y = Leakage emissions in year *y* (tCO_2e)

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

$BR_{B4/B8,r,y}$ = Quantity of biomass residues of category *r* used in the project activity in year *y*, for which the baseline scenario is B4:, B5:, B6:, B7: or B8: (tonnes on dry-basis)

$NCV_{BR,r,y}$ = Net calorific value of biomass residue of category *r* in year *y* (GJ/tonne on dry-basis)

The determination of $BR_{B4/B8,r,y}$ shall be based on the monitored amounts of biomass residues used to produce biomass briquettes included in the project boundary.

In the case that negative overall emission reductions arise in a year through application of the leakage emissions, CERs are not issued to project participants for the year concerned and in subsequent years, until emission reductions from subsequent years have compensated the quantity of negative emission reductions from the year concerned. For example, if negative emission reductions of 30 tCO_2e occur in the year t and positive emission reductions of 100 tCO_2e occur in the year t+1, only 70 CERs are issued for the year t+1.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(8)}$$

Where:
ER_y = Emission reductions in year y (tCO_2e)
BE_y = Baseline emissions in year y (tCO_2e)
PE_y = Project emissions in year y (tCO_2e)
LE_y = Leakage emissions in year y (tCO_2e)

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

This methodology is applicable to maximum one crediting period of 10 years.

Data and parameters not monitored

Data / Parameter:	$B_{BL,cooking,i}$
Data unit:	%
Description:	Percentage of biomass used as a fuel for cooking purposes, on energy basis, in project area *i*
Source of data:	Sample survey of consumers in project area *i*
Measurement procedures (if any):	-
Any comment:	This parameter is required in order to comply with the following applicability condition: • If the project activity involves stoves, then in all the each project area *i*, biomass constitutes less than or equal to 10% of the fuel used for cooking purposes, on energy basis, prior to the start of the CDM project activity

Data / Parameter:	$B_{BL,heating,i}$
Data unit:	%
Description:	Percentage of biomass used as a fuel for space heating purposes, on energy basis, in project area *i*
Source of data:	Sample survey of consumers in project area *i*
Measurement procedures (if any):	-
Any comment:	This parameter is required in order to comply with the following applicability condition: • If the project activity involves heaters, then in all the project area *i*, biomass constitutes less than or equal to 10% of the fuel used for space heating, on energy basis, prior to the start of the CDM project activity

Data / Parameter:	$p_{j,i}$
Data unit:	Fraction
Description:	Proportion of fuel *j* (including biomass) used in the stoves or heaters in project area *i* in the baseline
Source of data:	Sample survey of consumers in project area *i*
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	EF_j
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor of fuel *j*
Source of data:	Following default emission factors can be used: • Coal: 96 tCO_2/TJ • Kerosene: 71.5 tCO_2/TJ • Liquefied Petroleum Gas (LPG): 63.0 tCO_2/TJ • Biomass: 0 tCO_2/TJ For fuels other than listed above, the IPCC default values, at the lower limit of the confidence interval with a 95% confidence level, as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories, should be used
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	$p_{BL,l,i}$
Data unit:	Fraction
Description:	Proportion of stove or heater type *l* used in project area *i* in the baseline
Source of data:	Sample survey of consumers in project area *i*
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	DF_η
Data unit:	Fraction
Description:	Discount factor to account for efficiency loss of biomass based stoves or heaters per year of operation
Source of data:	Default value: 0.99
Measurement procedures (if any):	-
Any comment:	This assumes 1% efficiency loss per year

III. MONITORING METHODOLOGY

All monitoring should be attended to by appropriate and adequate personnel, as assessed by the project participants. All data collected as part of the monitoring should be archived electronically and be kept at least for two years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

In addition, the monitoring provisions in the tools referred to in this methodology apply.

Data and parameters monitored

Data / Parameter:	TPA
Data unit:	-
Description:	TPA is defined prior to the project implementation and will not be changed later in year *y*
Source of data:	Distribution contract and/or records of project stoves and briquettes
Measurement procedures (if any):	Every year TPA should be checked and it should be ensured that it has not changed
Monitoring frequency:	Yearly
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$BF_{k,b,i,y}$
Data unit:	ton
Description:	Dry weight of biomass briquettes type *b* consumed by project consumer *k* in project area *i* in year *y*
Source of data:	On-site records by project participants
Measurement procedures (if any):	-
Monitoring frequency:	Daily, summed for a year
QA/QC procedures:	Cross checked with total production records from the biomass briquetting factories; also checked against theoretical maximum consumption by an individual consumer. This would be in the form of regular (e.g. daily or weekly) trend analysis of consumer level consumption data to screen out significant errors, particularly decimal place errors which might record the delivery of 10 tonnes of biomass instead of 1 tonne. Periodically (e.g. monthly or quarterly), the project participants would sum biomass briquettes consumption, calculate a mean and confidence intervals and then check outliers to see what is causing the discrepancy. Consumers who are using more than the stoves or heaters can physically consume shall be investigated. If a good reason as to why they are consuming more cannot be found, they should be excluded from the project activity
Any comment:	If required, change the wet weight to dry weight

Data / Parameter:	$NCV_{b,y}$
Data unit:	TJ/ton
Description:	NCV of biomass briquettes type *b* in year *y*
Source of data:	An independent laboratory
Measurement procedures (if any):	Measurements should be undertaken by the independent laboratory in line with national or international standards. The measurement should be based on dry biomass and there should be at least three samples for each measurement
Monitoring frequency:	Representative of each type of biomass briquettes produced and at least twice a year for each type of biomass briquettes *b*
QA/QC procedures:	If the measurement results for the samples differ significantly from each other (i.e. 95% confidence intervals do not overlap), conduct measurements on additional samples
Any comment:	-

Data / Parameter:	$p_{PJ,p,i,y}$
Data unit:	Fraction
Description:	Proportion of project stove or heater type *p* in use in project area *i* in year *y*
Source of data:	On-site records by project participants
Measurement procedures (if any):	
Monitoring frequency:	Yearly
QA/QC procedures:	-
Any comment:	For this parameter, the methodology assumes that the proportion of different types of stoves or heaters distributed will be same as the proportion of different types of stoves or heaters in use

Data / Parameter:	$BR_{B4/B8,r,y}$
Data unit:	tonnes of dry matter
Description:	Quantity of biomass residues of category *r* used in the project activity in year *y*, for which the baseline scenario is B4:, B5:, B6:, B7: or B8:
Source of data:	On-site measurements
Measurement procedures (if any):	Use weight meters. Adjust for the moisture content in order to determine the quantity of dry biomass
Monitoring frequency:	Data monitored continuously and aggregated as appropriate, to calculate emissions reductions
QA/QC procedures:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes
Any comment:	-

Data / Parameter:	$EF_{CO2,LE,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of the most carbon intensive fossil fuel used in the country in year *y*
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:	$NCV_{BR,r,y}$
Data unit:	GJ/tonnes of dry matter
Description:	Net calorific value of biomass residue of category *r* in year *y*
Source of data:	On-site measurements
Measurement procedures (if any):	Measurements shall be carried out at reputed laboratories and according to relevant international standards. Measure the NCV on dry-basis
Monitoring frequency:	At least every six months, taking at least three samples for each measurement.
QA/QC procedures:	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements. Ensure that the NCV is determined on the basis of dry biomass
Any comment:	-

IV. REFERENCES AND ANY OTHER INFORMATION

Not applicable.

Appendix A: Additional Guidance on Surveys

The results of the robust sample survey through questionnaires form the basis of the baseline emissions. While designing the sample survey and arriving at the baseline emissions, the following additional guidance and steps should be followed.

Sr. No.	Steps	Relevance for methodology
1.	Identify the research objectives	The main objective of the sample survey is the identification of percentage of biomass used for cooking or heating (biomass penetration rate), share of different types of stoves or heaters, share of different types of fuels prior to the implementation of the project activity in project area *i*
2.	Identify and characterize target audience	The target audience should include consumers present in the project area *i* as defined by the project participants
3.	Design a sampling plan	The sampling plan should be devised to ascertain that the sample population is representative of the total population in the project area *i*. The sample size is decided as per the Step 3 above. The systematic random sampling or simple random sampling plan should be adopted as discussed in the Step 5 above
4.	Design and preparation of the questionnaire	The proposed methodology suggests sampling be conducted for BSG only. A comprehensive questionnaire (sample format is given in Appendix B) should be developed which should be further linked to the BSG data for the purpose of monitoring
5.	Use questionnaire, analyze results and write report	The questionnaire designed should then be used to collect data/information of sample group and the available results should be analyzed and reported

Appendix B: Sample format for survey questionnaire for Baseline Sample Group (BSG)

Questionnaire: An objective questionnaire should be designed as per guidance provided in this appendix.

Methodology of conducting the BSG survey:

(a) Population: Total number of consumers in the project area *i*;

(b) Sampling Frame: Electoral register, government approved census / directory or equivalent available government information;

(c) Sampling Unit: A consumer;

(d) Mode of data collection: Personal in home survey;

(e) Sampling Method: Systematic random sampling or simple random sampling;

(f) Sample Size: The sample size is determined using Cochran formula for categorical and dichotomous variables in case of large or infinite population;

(g) Sampling Plan:

(1) The entire population is divided into different project areas *i*. The stratification of project areas *i* is carried out as per methodology;

(2) Survey principles are followed as per Step 5 (implementation of the surveys) above.

(h) Select the sample: Carry out office and fieldwork necessary for the selection of the sample.

I. CONSUMER PROFILE							
Date of survey							
Name:					**Gender:**	Male	Female
Address:					**Age:**		
Nearest landmark							
Type of consumer:		Household:	☐	Small institution:	☐		
Guidance: This information is only used to capture demographic pattern and will not be directly used for analysis of baseline emission.							

II. FUEL USED FOR COOKING OR SPACE HEATING PRIOR TO THE START OF THE CDM PROJECT ACTIVITY IN PROJECT AREA *i*			
(1)	**Type of fuels used for cooking**	LPG Piped gas Coal Biomass (including its type)	Kerosene Electricity Others (please specify):_____
Guidance: It should include all the fuel types that were used for cooking in the last year.			
(2)	**Amount of fuels used for cooking**	LPG: _____ kg or cylinders /year Piped gas: _____ m^3 or MW/year Coal: _____ kg/year Biomass: _____ kg/year	Kerosene: _____ Liters/year Electricity: _____ KWh or unit /year Others:_____: _____ ___/year
Guidance: The measurement unit of the amount of fuel used for cooking depends on the types of fuel. Also, in many cases, local people might not be able to give the amount in terms of kg or m^3. This very much depends on the local practice of measurement. The project participants should include such local measurement unit in the questionnaire. In some cases, the measurement unit could also be in terms of money. Furthermore, depending on the local situation, the project participants should also provide default NCV values of possible fuel types so that the surveyor can immediately convert amount of fuel used (mass or volume unit) to amount of energy (MJ or GJ per year). The weight of biomass should also be converted to dry weight of biomass.			
(3)	**Type of fuels used for space heating**	LPG Piped gas Coal Biomass (including its type)	Kerosene Electricity Others (please specify):_____
Guidance: It should include all the fuel types that were used for space heating in the last year.			
(4)	**Amount of fuels used for space heating**	LPG: _____ kg or cylinders /year Piped gas: _____ m^3 or MW/year Coal: _____ kg/year Biomass: _____ kg/year	Kerosene: _____ Liters/year Electricity: _____ KWh or unit /year Others:_____: _____ ___/year
Guidance: The measurement unit of the amount of fuel used for space heating depends on the types of fuel. Also, in many cases, local people might not be able to give the amount in terms of kg or m^3. This very much depends on the local practice of measurement. The project participants should include such local measurement unit in the questionnaire. In some cases, the measurement unit could also be in terms of money. Furthermore, depending on the local situation, the project participants should also provide default NCV values of possible fuel types so that the surveyor can immediately convert amount of fuel used (mass or volume unit) to amount of energy (MJ or GJ per year). The weight of biomass should also be converted to dry weight of biomass.			

III. TYPES OF STOVE OR HEATER USED PRIOR TO THE START OF THE CDM PROJECT ACTIVITY IN PROJECT AREA *i*		
(5)	**Type of current stove**	_____ _____ _____
Guidance: If there are more than one type of stove used by the consumer, then list all of them. However, here the primary stove (which is used most of the time) is the most relevant one. In case, the secondary stove (if present) is used less than 10% of the time, this type of stove should not be listed above.		
(6)	**Type of current heater**	_____ _____ _____
Guidance: If there are more than one type of heater used by the consumer, then list all of them. However, here the primary heater (which is used most of the time) is the most relevant one. In case, the secondary heater (if present) is used less than 10% of the time, this type of heater should not be listed above.		
Surveyed by…….. Date……		

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History of the document

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