Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

TYPE III - OTHER PROJECT ACTIVITIES

Project participants must take into account the general guidance to the methodologies, information on additionality, abbreviations and general guidance on leakage provided at http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html.

III.E. Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment

Technology/measure

1. This project category comprises measures that avoid the production of methane from biomass or other organic matter that:

   (a) Would have otherwise been left to decay under clearly anaerobic conditions throughout the crediting period[1] in a solid waste disposal site without methane recovery, or

   (b) Is already deposited in a waste disposal site without methane recovery.

2. Due to the project activity, decay of the wastes of type referred to in paragraph 1(a) and/or 1(b) above is prevented through one of the following measures:

   (a) Controlled combustion.

   (b) Gasification to produce syngas/producer gas.

   (c) Mechanical/thermal treatment to produce refuse-derived fuel (RDF) or stabilized biomass (SB)[2]. An example of a mechanical/thermal treatment process is the pelletization of wood particles[3].

3. The produced RDF/SB shall be used for combustion either on site or off-site.

4. In the case of stockpiles of wastes baseline emission calculations as described in the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” shall be adjusted. Stockpiles can be characterised as waste disposal sites that consist of wastes of a homogenous nature with similar origin (e.g. rice husk, empty fruit bunches of oil palm, sawmill waste, etc.). Paragraph 22 provides specific instructions for the calculation of baseline emissions where the baseline is stockpiling of the waste.

~~1 Further work is undertaken to investigate to which extent and in which cases methane emissions may occur from stockpiling biomass residues. Subject to further insights on this issue the methodology may be revised.~~

[2] The thermal treatment process (dehydration) shall occur under controlled conditions (up to 300 degrees Celsius) and shall generate a stabilized biomass that would be used as fuel or raw material in other industrial processes. Stabilized biomass (SB) is defined as biomass adequately treated to prevent further degradation in the environment. Examples of SB are: pellets, briquettes and torrified wood chips.

[3] Pelletization is defined as the compression of wood particles into modules of solid fuel. The process includes thermal and mechanical pre-treatment of the raw material (e.g. saw dust). Pellets have moisture content of maximal 12%.

5. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.

6. Where in the baseline usually there is a reduction in the amount of waste through regular open burning or removal for other applications, the use of the "tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" shall be adjusted to take account of this burning or removal in order to estimate correctly the baseline emission.

7. The project activity does not recover or combust methane unlike AMS III.G. Nevertheless, the location and characteristics of the disposal site in the baseline condition shall be known, in such a way as to allow the estimation of its methane emissions.

8. If the project activity involves combustion, gasification or mechanical/thermal treatment of partially decayed waste mined (i.e. removed) from a solid waste disposal site in addition to freshly generated waste the project participants shall demonstrate that there is adequate capacity of the combustion, gasification or mechanical/thermal treatment facility to treat the newly generated wastes in addition to the partially decayed wastes removed from the disposal site. Alternately justifications for combusting, gasifying or mechanically/thermally treating the partially decayed wastes instead of the newly generated wastes shall be provided.

9. If the combustion facility, the produced syngas, producer gas or RDF/SB is used for heat and electricity generation within the project boundary, that component of the project activity shall use a corresponding methodology under type I project activities.

10. In case of RDF/SB production, project proponents shall provide evidence that no GHG emissions occur, other than biogenic CO_2, due to chemical reactions during the thermal treatment process for example limiting the temperature of thermal treatment to prevent the occurrence of pyrolysis and/or the stack gas analysis[4].

11. In case of gasification, the process shall ensure that all the syngas produced, which may contain non-CO_2 GHG, will be combusted and not released unburned to the atmosphere. Measures to avoid physical leakage of the syngas between the gasification and combustion sites shall also be adopted.

12. In case of RDF/SB processing, the produced RDF/SB should not be stored in such a manner as resulting in high moisture and low aeration favouring anaerobic decay. Project participants shall provide documentation showing that further handling and storage of the produced RDF/SB does not result in anaerobic conditions and do not lead to further absorption of moisture.

13. In case of RDF/SB processing, local regulations do not constrain the establishment of RDF/SB production plants/thermal treatment plants nor the use of RDF/SB as fuel or raw material.

14. During the mechanical/thermal treatment to produce RDF/SB no chemical or other additives shall be used.

[4] See also footnote 2.

15. In case residual waste from controlled combustion, gasification or mechanical/thermal is stored under anaerobic conditions and/or delivered to a landfill emissions from the residual waste shall to be taken into account using the first order decay model (FOD) described in AMS III.G.

Boundary

16. The project boundary are the physical, geographical sites:

(a) Where the solid waste would have been disposed or is already deposited and the avoided methane emission occurs in absence of the proposed project activity.

(b) Where the treatment of biomass through controlled combustion, gasification or mechanical/thermal treatment takes place.

(c) Where the final residues of the combustion process will be deposited (this parcel is only relevant to controlled combustion activities).

(d) And in the itineraries between them, where the transportation of wastes and combustion residues and/or residues of gasification and mechanical/thermal treatment process occurs.

Project Activity Emissions

17. Project activity emissions consist of:

(a) CO_2 emissions related to the gasification and combustion of the non-biomass carbon content of the waste (plastics, rubber and fossil derived carbon) or RDF/SB and auxiliary fossil fuels used in the combustion, gasification or mechanical/thermal treatment facility,

(b) Incremental CO_2 emissions due to:

I. Incremental distances between the collection points to the project site as compared to the baseline disposal site.

II. Transportation of combustion residues and final waste from controlled burning to disposal site.

III. Transportation of RDF/SB from the mechanical/thermal treatment facility to the storage site within the project boundary.

IV. Transportation of RDF/SB to the sites of the end users (if some of the sites are unknown a conservative approach assuming transport emissions for a specific distance, for example a default of 250 km, shall be used).

(c) CO_2 emissions related to the fossil fuel and/or electricity consumed by the project activity facilities, including the equipment for air pollution control required by regulations. In case the project activity consumes grid-based electricity, the grid emission factor (tCO_2e/MWh) should be used, or it should be assumed that diesel generators would have provided a similar amount of electricity, calculated as described in category I.D.

$$PE_y = PE_{y,comb} + PE_{y,transp} + PE_{y,power} \quad \textbf{(1)}$$

Where:

PE_y	Project activity direct emissions in the year "y" (tCO_2e)
$PE_{y,comb}$	Emissions through combustion and gasification of non-biomass carbon of waste and RDF/SB in the year "y"(tCO_2e)
$PE_{y,transp}$	Emissions through incremental transportation in the year "y"(tCO_2e)
$PE_{y,power}$	Emissions through electricity or diesel consumption in the year "y"(tCO_2e)

18. The expected annual quantity (tonnes) and composition of the waste combusted, gasified or mechanically/thermally treated by the project activity during the crediting period shall be described in the project design document, including the biomass and non-biomass carbon content of the combusted or gasified waste and RDF/SB ($Q_{biomass}$ and $Q_{non\text{-}biomass}$).

The expected consumption of auxiliary fuel for the incineration, gasification, mechanical/thermal treatment process (Q_{fuel}) should also be reported in the project design document. CO_2 emissions from the combustion of the non-biomass (i.e., fossil) carbon content of the wastes and RDF/SB and from the auxiliary fossil fuel consumed will be estimated assuming the complete oxidation of carbon to CO_2 in the combustion.

$$PE_{y,comb} = Q_{y,non-biomass} * 44/12 + Q_{y,fuel} * EF_{y,fuel} \qquad \textbf{(2)}$$

Where:

$Q_{y,non\text{-}biomass}$	Non-biomass carbon of the waste and RDF/SB combusted/gasified in the year "y" (tonnes of carbon)
$Q_{y,fuel}$	Quantity of auxiliary fossil fuel used in the year "y" (tonnes)
$EF_{y,fuel}$	CO_2 emission factor for the combustion of the auxiliary fossil fuel (tonnes CO_2 per tonne fuel, according to latest IPCC Guidelines)

19. Project activity emissions from trucks for incremental collection activities will be estimated and considered as project activity emissions.

$$PE_{y,transp} = (Q_y / CT_y) * DAF_w * EF_{CO2} + (Q_{y,ash} / CT_{y,ash}) * DAF_{ash} * EF_{CO2} + (Q_{y,RDF/SB} / CT_{y,RDF/SB}) * DAF_{RDF/SB} * EF_{CO2} \qquad \textbf{(3)}$$

Where:

Q_y	Quantity of waste combusted, gasified or mechanically/thermally treated in the year "y" (tonnes)
CT_y	Average truck capacity for waste transportation (tonnes/truck)
DAF_w	Average incremental distance for waste transportation (km/truck)

EF_{CO2}	CO_2 emission factor from fuel use due to transportation (tCO_2/km, IPCC default values or local values)
$Q_{y,ash}$	Quantity of combustion and gasification residues and residues from mechanical/thermal treatment produced in the year "y" (tonnes)
$CT_{y,ash}$	Average truck capacity for residues transportation (tonnes/truck)
DAF_{ash}	Average distance for residues transportation (km/truck)
$Q_{y,RDF/SB}$	Quantity of RDF/SB produced in the year "y" (tonnes)
$CT_{y,RDF/SB}$	Average truck capacity for RDF/SB transportation (tonnes/truck)
$DAF_{RDF/SB}$	Aggregate average distance for RDF/SB transportation to the storage in the production site as well as to the end user sites (km/truck)

20. If the project activity includes wastewater release, which are treated anaerobically or released untreated, methane emission shall be considered as project emissions and estimated using the provisions of AMS III.H.

Baseline

21. The baseline scenario is the situation where, in the absence of the project activity, organic waste matter is left to decay within the project boundary and methane is emitted to the atmosphere. The yearly baseline emissions are the amount of methane that would have been emitted from the decay of the cumulative quantity of the waste diverted or removed from the disposal site, to date, by the project activity, calculated as the methane generation potential using the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site". ~~the first order decay model (FOD) described in AMS III.G~~.

22. In the case of stockpiles of waste the baseline emission calculations as described in the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" shall be adjusted. It is recognised that biomass waste disposal practices and the final fate of the disposed waste in stockpiles is highly region and waste specific, therefore the quantity of waste taken as input for the calculations and MCF and k values shall be chosen conservatively.

In determining the amount of waste prevented from disposal in the SWDS ($W_{i,x}$) as input in formula 1 in the Tool, the percentage of the biomass that is combusted in the project activity and which would have been dumped in a stockpile in the baseline situation and also would have remained in the stockpile for a sufficient period of time to decay shall be determined. A quantitative analysis shall be carried out using the following options (in the order of priorities):

1) Project specific waste disposal data from at least 3 years prior to the implementation of the project activity;

2) A control group;

3) Official data sources.

The following factors shall be taken into account in this analysis:

1) Parts of the biomass may be taken from the stockpile for various reasons. Examples are that the biomass: a) may be used as a fuel; b) incinerated to use the ashes as fertilizer; c) directly applied to land as fertilizer (mulching); d) composted; e) or used as a raw material (e.g. panel board production). The various uses shall be analysed and quantified to show what percentage of biomass would have remained in the stockpile.

2) There may be restrictions for leaving the biomass in a stockpile indefinitely. Examples are restrictions concerning land surface used for stockpiling or height of the stockpile.

These two factors shall be quantified and $W_{i,x}$, shall be adjusted accordingly, as the model in the Tool assumes that the waste would have remained at the disposal site for sufficient time to fully decay.

Due to the high uncertainty in the estimation of methane emissions from stockpiles, conservative assumptions shall be made for the MCF and k values given in the Tool. As piles have a large surface area to volume ratio anaerobic conditions are not ensured like in the case of SWDS. In addition the homogenous nature of the waste in stockpiles result in a different decay rate compared to normal SWDS that contain mixed wastes. For the purpose of this methodology, project participants shall use an MCF value of 0.28[5]. This is the MCF value for an unmanaged shallow SWDS minus the 30% uncertainty range as specified in 2006 IPCC Guidelines for National Greenhouse Gas Inventories. The k value for the relevant waste type must be the lower value from the range provided for the Boreal and Temperate Climate Zone as listed in Table 3.3 in Chapter 3, volume 5 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

23. In the case of project activities combusting, gasifying or mechanically/thermally treating only freshly generated wastes, the baseline emissions at any year “y” during the crediting period is calculated using the amount and composition of wastes combusted, gasified or mechanically/thermally treated since the beginning of the project activity (year “x=1”) up to the year “y”, using the first order decay model as referred to in the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site” ~~in AMS III.G~~. Baseline emissions shall exclude methane emissions that would have to be removed to comply with national or local safety requirement or legal regulations.

$$BE_y = BE_{CH4,SWDS,y} \sout{- MD_{reg,y}} * GWP\_CH_4 \quad \textbf{(4)}$$

Where:

BE_y Baseline emissions at year “y” during crediting period (tCO_2e)

$BE_{CH4,SWDS,y}$ Yearly Methane Generation Potential of the wastes diverted to be disposed in the landfill from the beginning of the project (x=1) up to the year “y”, calculated according to the

[5] Project proponents are encouraged to submit procedures to accurately assess the values for k and MCF in the case of stockpiles as a revision to this methodology for EB approval.

"Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" ~~AMS III.G~~ (tCO_2e).

~~$MD_{reg,y}$ Methane that would be destroyed or removed in the year "y" for safety or legal regulation~~

GWP_CH_4 Global Warming Potential for methane (value of 21)

24. In the case of project activities that combust, gasify or mechanically/thermally treat wastes that have partially decayed in a disposal site, the calculation of the yearly methane generation potential of the wastes combusted, gasified or mechanically/thermally treated from the project beginning (x=1) up to the year "y" will consider the age of the wastes at the start of the project. One of the following options may be used:

(a) Estimate the mean age of the wastes contained in the disposal site in the beginning of the project activity ("ā"). It may be estimated as the weighted average age considering the yearly amount of wastes deposited in the SWDS since its beginning of operation up to the year prior to the start of the project:

$$\bar{a} = \frac{1 \cdot A_1 + 2 \cdot A_2 + 3 \cdot A_3 + ... + a \cdot A_a}{A_1 + A_2 + A_3 + ... + A_a} = \frac{\sum_{a=1}^{a\max} A_a \cdot a}{\sum_{a=1}^{a\max} A_a} \quad \textbf{(5)}$$

Where:

ā Weighted mean age of the wastes present in the SWDS prior to the project start

a Years before project start, starting in the first year of waste disposal (a=1) up to the maximal age of the wastes contained in the SWDS at the project start (a=amax.)

A_a Total amount of waste deposited in the SWDS in each year "a". It shall be obtained from recorded data of waste disposals, or estimated according to the level of the activity that generated the wastes (for example, considering the amount of wood processed by a sawmill in each year "a", and estimating the amount of wastes generated and disposed in the SWDS in that year)

If the yearly amount of waste deposited in the SWDS cannot be estimated, then an arithmetic mean age may be used (ā = 0.5 * amax). By using this option, the baseline emissions at any year "y" during the crediting period are calculated using the same formula as provided in the last paragraph, nevertheless, the exponential term for the First Order Decay Model "exp [$-k_j$.(y-x)]" will be corrected for the mean age, and will be substituted by "exp[$-k_j$.(y-x+ā)]".

(b) Calculate the yearly methane generation potential of the SWDS as described in the Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", ~~AMS III.G~~ considering the total amount and composition of wastes deposited since its start of operation. The methane generation potential of the wastes removed to be combusted, gasified or mechanically/thermally treated up to the year "y" in the crediting period will be estimated as proportional to the mass fraction of these wastes, relative to the initial amount:

$$BE_y = \frac{\sum_{x=1}^{y} A_x}{A} BE_{CH4,SWDS,y} * GWP\_CH4 \quad \textbf{(6)}$$

[$MD_{reg,y}$ removed from the formula]

Where:

A_x	Amount of wastes removed to be combusted, gasified or mechanically/thermally treated in the year “x” (tonnes)
A	Total amount of wastes present in the SWDS at the beginning of the project activity (tonnes)
$BE_{CH4,SWDS,y}$	Yearly methane generation potential of the SWDS at the year “y”, considering all the wastes deposited in it since its beginning of operation, and without considering any removal of wastes by the project activity.

(c) Estimate the quantity and the age distribution of the wastes removed each year “x” during the crediting period[6], and calculate the methane generation potential of these wastes in the year “y”. For example, in the year x=2 of the project activity, the amount “A_2” was removed to be combusted, gasified or mechanically/thermally treated, and this amount can be divided into “$A_{2,n}$” parts, each part belonging to the age “n”. In the year “y” the methane generation potential of the portions removed from the SWDS may be estimated as:

$$BE_y = \sum_{n=n\min}^{n\max} BE_{CH4,SWDS,y,n} * GWP\_CH4 \quad \textbf{(7)}$$

[6] Age distribution is the discrete partitioning of the waste by age (i.e., the number of years since it was generated and deposited at the site). The estimation of the age of the portions of waste being removed from the disposal site and combusted, gasified or mechanically/thermally treated each year may be done by topographical modelling of the wastes present in the relevant sections of the disposal site. This approach should include segregation of the wastes into even-age layers or volumetric blocks based on historical or constructive data (design of the disposal site). This information on quantity, composition, and age may be based on (a) historical records of the yearly mass and composition of waste deposited in the section of the disposal site where waste is being removed for combustion, gasification or mechanical/thermal treatment; or (b) historical production data for cases in which the waste at the site is dominated by relatively homogeneous industrial waste materials (e.g., waste by-products from sawmills or finished wood product manufacturing). Option (b) that uses historical industrial production data should apply the following steps. Step1: Estimate the total mass of waste at the disposal site in the section where it is to be removed based on the section’s volume and the average density of the waste. Step 2: Apportion the mass of waste in this section into waste types and ages using historical records on the output of products produced in a given year from the industrial facility and factors for the average mass of waste by-products produced per unit of each product.

[$MD_{reg,y}$ removed from the formula]

Where:

$BE_{CH4,SWDS,y,n}$	Yearly methane generation potential of the wastes removed since the beginning of the project activity "x=1" up to the year "y" during the crediting period, segregated according to its age "n" at the time of removal (tCO2e). It is calculated using the tool referred to in III-G, substituting the exponential term for the First Order Decay Model "exp [-k_j.(y-x)]" by "exp[-k_j.(y-x+n)]".

Leakage

25. If the controlled combustion, gasification or mechanical/thermal treatment technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects at the site of the other activity are to be considered.

26. In case of RDF/SB production, project proponents shall demonstrate that the produced RDF/SB is not subject to anaerobic conditions before its combustion end-use resulting in methane emissions. If the produced RDF/SB is not used in captive facilities but sold to consumers outside the project boundary as a fuel, a default 5% of the baseline emissions shall be deducted as leakage to account for these potential methane emissions, unless project proponents can prove otherwise (e.g. by demonstrating that potential risks of methane emissions from RDF/SB are avoided through measures such as appropriate packaging, by showing that monitored moisture content of the RDF/SB is under 12% or by the use of standards that ensure that characteristics of the RDF/SB during the entire lifecycle of the product is not conducive for methane production).

Monitoring

27. The emission reduction achieved by the project activity will be measured as the difference between the baseline emission and the sum of the project emission and leakage.

$$ER_y = BE_y - \left(PE_y + Leakage_y\right) \quad \textbf{(8)}$$

Where:

ER_y	Emission reduction in the year "y" (tCO_2e)

28. The amount of waste combusted, gasified or mechanically/thermally treated by the project activity in each year (Q_y) shall be measured and recorded, as well as its composition through representative sampling, to provide information for estimating the baseline emissions. The quantity of auxiliary fuel used ($Q_{,fuel}$) and the non-biomass carbon content of the waste or RDF/SB combusted ($Q_{,non-biomass}$) shall be measured, the latter by sampling. The total quantity of combustion and gasification residues and residues from mechanical/thermal treatment ($Q_{y,ash}$) and the average truck capacity (CT_y) shall be measured. The electricity consumption and/or generation shall be measured. The distance for transporting the waste in the baseline and the project scenario and the distance for transporting the produced RDF/SB (km/truck) shall also be recorded.

In the case of project activities processing newly generated biomass wastes, the project participants shall demonstrate annually, through the assessment of common practices at proximate waste disposal sites, ~~that~~ what percentage of the amount of waste combusted, gasified or mechanically/thermally treated in the project activity facilities would have been disposed in a solid waste disposal site without methane recovery in the absence of the project activity and ~~it~~ would decay anaerobically in the disposal site throughout the crediting period.

Project activity under a programme of activities

The following conditions apply for use of this methodology in a project activity under a programme of activities:

29. In case the project activity involves the replacement of equipment, and the leakage effect of the use of the replaced equipment in another activity is neglected, because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. For this purpose scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.

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