AMS-I.D./Version 13
Scope: 1
25 Feb. 2008

	1st year	7th year	Average of 1st-7th year
Your Emission Reduction is	#DIV/0! tCO2e/year	#DIV/0! tCO2e/year	#DIV/0! tCO2e/year

Remark:

calculation result

to be calculated

to be filled

I.D. 'Grid connected renewable electricity generation'

Technology/measure

1. This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.

2. If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel[1], the capacity of the entire unit shall not exceed the limit of 15MW.

3. Combined heat and power (co-generation) systems are not eligible under this category.

4. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[2] from the existing units.

5. Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.

AMS-III.E./Version 15
Scope: 13
25 Feb. 2008

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 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)[1]. An example of a mechanical/thermal treatment process is the pelletization of wood particles[2].

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.

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[3].

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.

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.

Basic Assumption

This spreadsheet assmes the project activity to install new biomass power generator and utilize "renewable biomass", which would be otherwise disposed at the landfill site in anaerobic condition, to supply electricity to the grid.

Project emission (PE) #DIV/0! tCO2e/year

$PE_y = PE_{y,comb} + PE_{y,transp} + PE_{y,power}$ **(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)

PE_y,comb 0 tCO2e/year

$PE_{y,comb} = Q_{y,non\text{-}biomass} * 44/12 + Q_{y,fuel} * EF_{y,fuel}$ **(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)	0 t-C
$Q_{y,fuel}$	Quantity of auxiliary fossil fuel used in the year "y" (tonnes)	t/year
$EF_{y,fuel}$	CO_2 emission factor for the combustion of the auxiliary fossil fuel (tonnes CO_2 per tonne fuel, according to latest IPCC Guidelines)	3.18 t-CO2/t

Diesel oil

43.33 TJ/1000 t

20.2 t-C/TJ

0.99 (fraction of carbon oxidized)

PE_y,transp #DIV/0! tCO2e/year

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

Where:

Q_y	Quantity of waste combusted, gasified or mechanically/thermally treated in the year "y" (tonnes)		t/year
CT_y	Average truck capacity for waste transportation (tonnes/truck)		t/truck
DAF_w	Average incremental distance for waste transportation (km/truck)		km/truck
EF_{CO2}	CO_2 emission factor from fuel use due to transportation (tCO_2/km, IPCC default values or local values)	1.097	kgCO2/km
		IPCC 2006: US Heavy Duty Diesel Vehicles (Uncontrolled)	
$Q_{y,ash}$	Quantity of combustion and gasification residues and residues from mechanical/thermal treatment produced in the year "y" (tonnes)	NA	t/year
$CT_{y,ash}$	Average truck capacity for residues transportation (tonnes/truck)	NA	t/truck
DAF_{ash}	Average distance for residues transportation (km/truck)	NA	km/truck
$Q_{y,RDF/SB}$	Quantity of RDF/SB produced in the year "y" (tonnes)	NA	t/year
$CT_{y,RDF/SB}$	Average truck capacity for RDF/SB transportation (tonnes/truck)	NA	t/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)	NA	km/truck

PE_y,power 0 tCO2e/year

It is assumed that the project activity would not consume electricity generated from fossil-fuel and/or supplied from the grid.

Baseline emission (BE)	1st year	7th year	Average of 1st-7th year
	0 tCO2e/year	0 tCO2e/year	0 tCO2e/year

$BE_y = BE_{CH4,SWDS,y}$

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

BE_power,y	CO2 emissions that would otherwise occur at the fossil fuel power plants of the grid, which the project activity would supply electricity, to generate the electricity to be replaced by the project activity.

BE_CH4,SWDS,y	1st year	7th year	Average of 1st-7th year
	0 tCO2e/year	0 tCO2e/year	0 tCO2e/year

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j(y-x)} \cdot \left(1-e^{-k_j}\right)$$

quoted from the Tool

φ	=	Model correction factor to account for model uncertainties (0.9)	0.9
f	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner	0
GWP_{CH4}	=	Global Warming Potential (GWP) of methane, valid for the relevant commitment period	21
OX	=	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)	0
F	=	Fraction of methane in the SWDS gas (volume fraction) (0.5)	0.5
DOC_f	=	Fraction of degradable organic carbon (DOC) that can decompose	0.5
MCF	=	Methane correction factor	
$W_{j,x}$	=	Amount of organic waste type *j* prevented from disposal in the SWDS in the year *x* (tons)	*see below*
DOC_j	=	Fraction of degradable organic carbon (by weight) in the waste type *j*	*see "Tool-SSC"*
k_j	=	Decay rate for the waste type *j*	*see "Tool-SSC"*
j	=	Waste type category (index)	-
x	=	Year during the crediting period: x runs from the first year of the first crediting period (x = 1) to the year y for which avoided emissions are calculated (x = y)	-
y	=	Year for which methane emissions are calculated	-

quoted from the AMS III.G

5. The estimation of the methane emission potential of a solid waste disposal site ($BE_{CH4,SWDS,y}$, in tCO_2e) shall be undertaken using the "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", found on the CDM website[1]. The tool may be used:

- With the factor "f=0.0" assuming that no methane is captured and flared.
- With the definition of year x as 'the year since the landfill started receiving wastes, x runs from the first year of landfill operation (x=1) to the year for which emissions are calculated (x=y)'.

The amount of waste type "j" deposited in each year "x" ($W_{j,x}$) shall be determined by sampling (as specified in the tool), in the case wastes are generated during the crediting period. Alternatively, for existing SWDS, if the pre-existing amount and composition of the wastes in the landfill are unknown, they can be estimated by using parameters related to the attended population or industrial activity, or by comparison with other landfills with similar conditions in regional or national levels.

W_j,x t/yr

Biomass composition rate (%)

%-weight	wood	
%-weight	paper	
%-weight	food	
%-weight	textile	
%-weight	garden	

BE_power,y		0	tCO2e/year
	0	MWh/year	: Electricity to be supplied to the grid from the project activity
		MW	: Generation capacity of the project activity
		hours/year	: Operation hour of the project activity
		tCO2e/MWh	: CO2 emission factor of the grid per 1 MWh