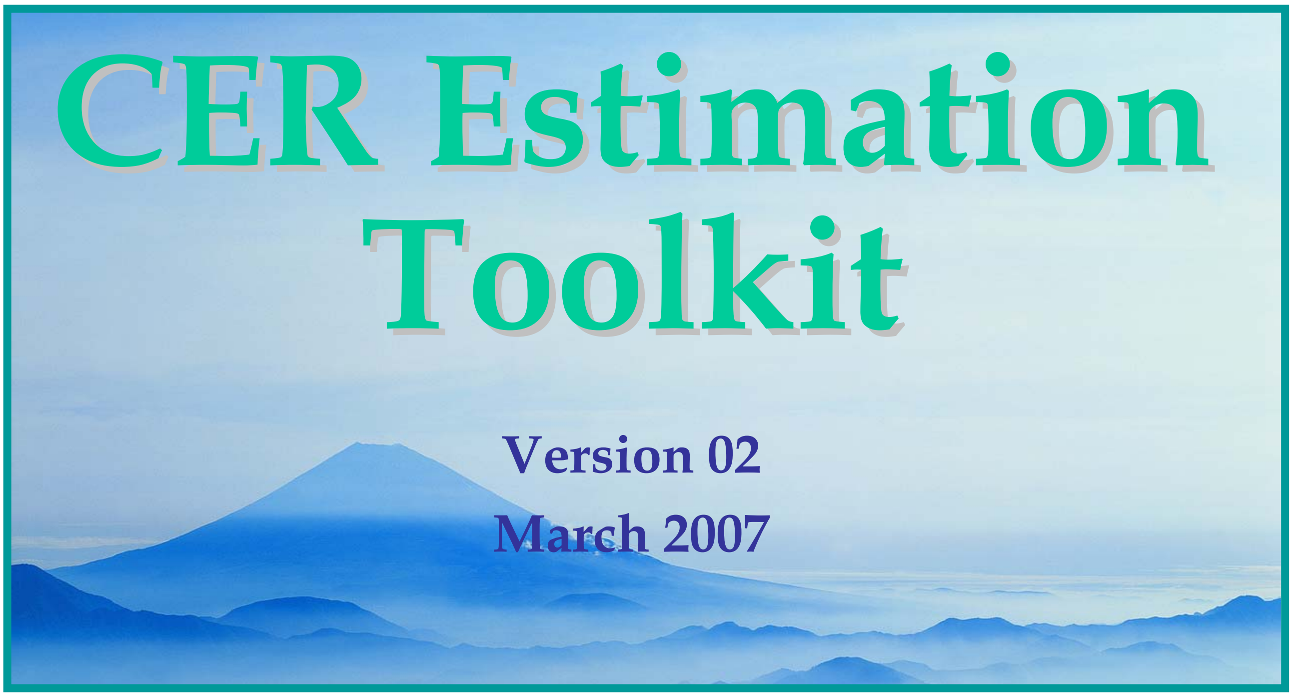
Ministry of the Environment, Japan

Global Environment Centre Foundation

CER Estimation Toolkit

Version 02

March 2007



A toolkit to assist the initial assessment of expected CER generation

Contents

The CER amounts shown in this toolkit have been calculated based on approved baseline methodologies, applying certain assumptions. It should be noted that this toolkit does not guarantee that the amount of CERs shown herein will be generated. The CER amounts are to be used only as indicative values. Revisions of approved methodologies can affect the CER amounts resulting from project activities.

As for the details of methodologies and exact calculation methods, please refer to the respective methodologies available on the website of the CDM website <http://cdm.unfccc.int/>.

1. Increasing the blend in cement production

Project activity:

Increase in the share of additives such as fly ash, gypsum, and slag (i.e. reduction in the share of clinker) in blended cement (hereinafter referred to as BC) production.

Baseline scenario:

The project cement plant would continue to produce BC. The baseline share of the clinker is determined using benchmark approach. Refer to “Box” in the next page for benchmark approach.

Applied methodology(ies):

ACM0005 “Consolidated Methodology for Increasing the Blend in Cement Production” (v.3)

Estimated annual CER generation

Unit: t-CO_2 equivalent

		Annual blended cement production(kt/yr)		
		1,000	2,000	3,000
Increased share(%)	10	90,000	180,000	270,000
	20	180,000	360,000	540,000
	30	270,000	540,000	810,000

Notes:

(1) Increased share(%) indicates the amount of increase in the percentage of additives in BC.

Increased share = ($B_{Blend,y}$ - $P_{Blend,y}$)/100

Where,

$B_{Blend,y}$: Baseline benchmark of share of clinker per tonne of BC updated for year y (tonne of clinker/tonne of BC)

$P_{Blend,y}$: Share of clinker per tonne of BC in project case in year y (tonne of clinker/tonne of BC)

(2) In the table above, the amount of CER is proportional to “increased share(%)” and “annual BC production (kt/yr)”. This is because simplified calculation method is applied (e.g. leakage due to the transportation of materials is neglected).

(3) If it is difficult to demonstrate that the additives used for the project activity are surplus, the amount of emission reductions needs to be discounted for the percentage of additives for which surplus availability is not substantiated.

(4) All the figures in the table above is calculated in accordance with ACM0005.

Assumptions and values used in emission calculations:

Baseline emissions	(i) CO_2 emissions due to clinker production ➢ CO_2 emissions per tonne of clinker is assumed to be 0.900 t-CO_2/tonne of clinker. This includes emissions from calcinations of calcium carbonate and magnesium carbonate, combustion of fossil fuels, and electricity use for clinker production. (ii) CO_2 emissions due to electricity consumption of BC grinding and preparation of additives ➢ CO_2 emission factor for BC grinding and preparation of additives is assumed to be 0.025 t-CO_2/tonne of BC.
Project emissions	(i) CO_2 emissions due to clinker production ➢ The same value as in the baseline scenario is applied for CO_2 emissions per tonne of clinker. (ii) CO_2 emissions due to electricity consumption of BC grinding and preparation of additives ➢ The same value as in the baseline scenario is applied for CO_2 emission factor for BC grinding and preparation of additives. (iii) Emissions due to fuel use for the transport of raw materials (e.g. limestone, gypsum), coal (or other fuels) and additives from offsite locations to the project plant. ➢ No emissions from this source is assumed. (iv) Emissions due to the diversion of additives from existing uses. ➢ No emissions from this source is assumed.
Common assumptions	(1) BCy (Annual BC production (tonne of BC/yr)) is common in baseline and project case.

Box: Baseline benchmark of share of clinker per tonne of BC (tonne of clinker/tonne of BC)

ACM0005 adopts benchmark approach to determine the share of clinker per tonne of BC in baseline scenario ($B_{Blend,y}$). This value needs to be determined as the lowest value among the following:

(i) The average (weighted by production) mass percentage of clinker for the 5 highest blend cement brands for the relevant cement type in the region; If the region comprises of less than 5 blend cement brands, the national market should be used as the default region; or

(ii) The production weighted average mass percentage of clinker in the top 20% (in terms of share of additives) of the total production of the BC type in the region. If 20% falls on part capacity of a plant, that plant is included in the calculations; or

(iii) The mass percentage of clinker in the relevant cement type produced in the proposed project activity plant before the implementation of the CDM project activity, if applicable (For Greenfield project activity this option may be excluded).

For reference, the range of the baseline benchmark of registered projects are shown in the table below. It should be noted this value varies depending on project countries/regions and project plants etc.

Ref	Project title	Host country	Baseline benchmark (tonne of clinker/tonne of BC)
0183	"Optimal Utilization of Clinker" project at Shree Cement Limited (SCL), Beawar, Rajasthan	India	0.666 - 0.712
0287	ACC Blended cement projects at New Wadi Plant, Tikaria Cement Plant, Chanda Cement Works, Kymore Cement Works, Lakheri Cement Works and Chaibasa Cement Works	India	0.606 - 0.733
0314	Optimal Utilization of Clinker in PPC manufacturing at Birla Corporation Limited, Raebareli Unit	India	0.678 - 0.727
0361	Optimum utilisation of clinker by PPC production at Binani Cement Limited, Rajasthan	India	0.701 - 0.746
0438	Optimum utilisation of clinker by production of Pozzolana Cement at UltraTech Cement Ltd. (UTCL), Andhra Pradesh	India	0.767 - 0.802
0473	Optimal utilization of clinker: Substitution of Clinker by Fly ash in Portland Pozzolana Cement blend at OCL, India	India	0.658 - 0.704

Note: Baseline benchmark value takes a range since it is updated annually.

2. Substitution of fossil fuels with alternative fuels in cement plant

Project activity :

Replace fossil fuels used in cement plant by alternative fuel such as wastes originating from fossil sources (e.g. tires, plastics) and biomass residues.

Baseline scenario:

The cement plant continues cement production using the existing technology, materials and fuel mix.

Applied methodology(ies):

ACM0003 “Emissions reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture**”** (v.4)

Estimated annual CER generation

Unit: t-CO_2 equivalent

			Quantity of alternative fuel (ton/yr)			
			5,000	10,000	15,000	20,000
Altanative fuel	Wastes originating from fossil sources	tire	6,759	13,518	20,277	27,036
		plastic	6,416	12,832	19,248	25,664
	Biomass residues		9,224	18,447	27,671	36,894

Notes:

(1) All the figures in the table above is calculated in accordance with ACM0003.
(2) Project participants should demonstrate that the amount of alternative fuels is 1.5 times the amount required to meet the consumption of all users consuming the same alternative fuels in order to apply ACM0003.
(3) In the table above, the amount of CER is proportional to “Quantity of alternative fuel (tonne/yr)“ because simplified calculation method is applied (e.g. leakage due to the transportation of alternative fuel is neglected).
(4) If it is possible to demonstrate that the biomass residues would be burned or decomposed anaerobically in landfills in the absence of the project, methane emission from the biomass residues can be considered in baseline emission.
(5) In case of the project which uses several types of alternative fuel, the total emission reductions can be calculated simply by adding up the emission reductions by each alternative fuel.

Assumptions and values used in emission calculations:

Baseline emissions	(i) CO_2 emissions from the use of fossil fuels to be displaced by the alternative fuel - This value is calculated by multiplying the total actual heat of the alternative fuel (TJ/yr) by CO_2 emissions factor of the fossil fuel displaced (t- CO_2 /TJ). Moisture penalty is neglected for simplicity. - Heating value of each alternative fuel is assumed to be 0.033 TJ/tonne for tire, 0.042 TJ/tonne for plastic, and 19.5 TJ/tonne for biomass residues. -The fossil fuel displaced is assumed to be coal whose carbon emission factor is 94.6 t-CO_2 /TJ (= 25.8t-C/TJ) for simplicity. (ii) CH_4 emission from the biomass residues - No emissions from this source is assumed. Note that this emission can be taken into account only if it is demonstrated that the biomass residues would be burned or decomposed anaerobically in landfills in the absence of the project.
Project emissions	(i) CO_2 emissions from the use of alternative fuels - If the project uses waste originating from fossil sources, this emissions need to be considered. This value is calculated by multiplying the total weight of the alternative fuel (tonne/yr) by its CO_2 emissions factor (t- CO_2 /tonne). - CO_2 emission factor of each alternative fuel is assumed to be 1.77 t- CO_2 /tonne for tire and 2.69 t- CO_2 /tonne for plastic. Note: This emission does not need to be included in project emission if it can be clearly demonstrated that incineration of these alternative fuels without utilization for energy purposes is the dominant practice in the area(s) from which the alternative fuels in the project activity are sourced. (ii) GHG emissions that could be generated during the preparation of alternative fuels - No emissions from this source is assumed.
Common assumptions	- GHG emissions from transport of materials such as fossil fuel and alternative fuel is neglected.

3. Methane avoidance by anaerobic wastewater treatment

Project activity:

Methane avoidance by installation of an anaerobic wastewater treatment system.

Baseline scenario:

The existing waste water treatment system is an open lagoon system with an 'active' anaerobic conditions.

Applied methodology(ies):

AMS-III.H. “Methane Recovery in Wastewater Treatment” (v.4)

AM0013 “Avoided methane emissions from organic waste-water treatment” (v.4)

Estimated annual CER generation

Unit: t-CO_2 equivalent

		COD level (mg/L)			
		5,000 (0.005t/m^3)	10,000 (0.01t/m^3)	30,000 (0.03t/m^3)	50,000 (0.05t/m^3)
Wastewater volume (m^3/day)	65% treatment efficiency				
	1,000	2,841	6,507	21,170	35,833
	5,000	15,404	33,733	40,911	68,386
	10,000	31,108	27,174	82,123	137,072
	75% treatment efficiency				
	1,000	2,896	6,617	21,501	36,384
	5,000	15,680	34,284	51,214	85,557
	10,000	31,659	34,043	102,729	171,414
	85% treatment efficiency				
	1,000	2,951	6,727	21,831	36,936
	5,000	15,955	34,836	61,517	102,729
	10,000	32,211	40,911	123,334	205,757
	95% treatment efficiency				
	1,000	3,006	6,837	22,162	37,487
	5,000	16,231	35,387	71,820	119,900
	10,000	32,762	47,780	143,940	240,100

Notes:

(1) 1mg/L is about the same as 1ppm. The unit for COD level used in the methodologies is t/m^3.
(2) Treatment efficiency = [COD removed by the treatment system (mg/L)] / [COD entering the system (mg/L)]
(3) Annual operating days of the project facility is assumed here as 250 days.
(4) According to the decision of COP/MOP2, AMS-III.H is applicable to projects with annual emission reductions lower than 60,000 t-CO_2 equivalent.
(5) An average ambient temperature of 30 degrees Celsius is being assumed in applying AM0013.
(6) AMS-III.H has been applied to the values in shaded cells

Assumptions and values used in emission calculations:

	AMS III.H	AM0013
Baseline emissions	(i) The case of introduction of methane recovery and combustion unit to an existing anaerobic wastewater or sludge treatment (corresponds to 7. (b) of the methodology) is assumed. (ii) Methane emissions from untreated wastewater ➢$B_{0,ww}$(maximum methane producing capacity):0.21 kg-CH_4/kg .COD (IPCC lower value) ➢ $MCF_{ww,treatment}$ (methane conversion factor): 0.8 (IPCC lower value for "Anaerobic deep lagoon") (iii) Methane emissions from sludge ➢ It is assumed that sludge generated by the baseline treatment system is to be controlled combusted, disposed in a landfill with methane recovery, or used for soil application. No methane emissions would occur from the decay of the final sludge.	(i) Lagoon baseline emissions ➢B_0(maximum methane producing capacity):0.21 kg-CH_4/kg COD (IPCC lower value) ➢MCF (monthly methane conversion factor) is calculated based on the following assumptions: (a) Depth of sludge pit : deeper than 5m (b) Ambient temperature: 30 degrees Celsius, which lead to ft =1. (c) AD (a factor to reflect the effect of effluent from the lagoons in the baseline): 1 (d) MCF=0.623 has been applied (calculated based on above assumptions). ・*Note that the value of MCF varies with the ambient temperature. For example, MCF=0.408 at 25℃.* (ii) Electricity baseline emissions ➢No electricity consumption in the baseline scenario is assumed.
Project emissions	(i) Emissions from heat and electricity use due to the project activity ➢Project electricity consumption of 1.5MWh/day and carbon emission factor of 0.8 t-CO_2/MWh is assumed. (ii) Methane emissions through inefficiency of the wastewater treatment and presence of degradable organic carbon in treated wastewater. ➢$B_{0,ww}$: 0.21 kg-CH_4/kg .COD (IPCC default value) ➢$MCF_{ww,final}$: 0.1 (IPCC higher value for "Aerobic treatment, well managed") (iii) Methane emissions from the decay of the final sludge generated by the treatment systems. ➢It is assumed that sludge generated by the treatment system is to be controlled combusted, disposed in a landfill with methane recovery, or used for soil application. No methane emissions would occur from the decay of the final sludge. (iv) Methane fugitive emissions through inefficiencies in capture and flare systems. ➢CFE_{ww}(capture and flare efficiency of the methane recovery and combustion equipment in the wastewater treatment): 0.9 (default value for enclosed flare) ➢$MCF_{ww,treatment}$: 1.0 (IPCC higher value for "Anaerobic digester without methane recovery") (v) Methane emissions resulting from dissolved methane in the treated wastewater effluent. ➢$[CH_4]_{y,ww,treated}$ (dissolved methane content in the treated wastewater): 0.0001 t/m³ (suggested default value)	(i) Emissions from heat and electricity use due to the project activity Project electricity consumption of 1.5MWh/day and carbon emission factor of 0.8 t-CO_2/MWh is assumed. (ii) Methane emissions from lagoons ➢The same values for B0, MCF as in the baseline scenario are applied. (iii) Emissions from land application of sludge ➢No land application of sludge is assumed. (iv) Physical leakage from biodigesters ➢IPCC default value (15% of total biogas production) is applied. ➢Methane production potential is used instead of biogas production and % of biogas that is methane. (v) Stack emissions from the flare or energy generation ➢Methane production potential is used instead of biogas production and % of biogas that is methane. ➢Flare efficiency of 90% (default value for enclosed flare) is assumed. (vi) Emissions from wastewater removed in the dewatering process ➢No emissions from wastewater removed in the dewatering process is assumed.
Common assumptions	(1) Annual operating days of the project facility: 250 days (2) Global Warming Potential of CH_4:21	

4. Landfill Gas Recovery and Flaring

Project activity:
Methane capture at landfill and its flaring.

Baseline scenario:
Methane in landfill gas would be emitted through anaerobic decay of organic wastes at landfill site.

Applied methodologies:
AMS-III.G. "Landfill Methane Recovery" (v.4)
ACM0001 "Consolidated methodology for landfill gas project activities" (v.4)

Estimated annual CER generation

Unit: t-CO_2 equivalent

South-Eastern Asia

		Landfill Management Level								
		1. Managed			2. Unmanaged (Deep)			3. Unmanaged (Shallow)		
		1st year	7th year	Average of 1st-7th year	1st year	7th year	Average of 1st-7th year	1st year	7th year	Average of 1st-7th year
Population whose waste is disposed at landfill site (,000 cap.)	100	10,519	3,990	6,527	8,415	3,192	5,222	4,208	1,596	2,611
	300	31,558	11,969	19,581	25,246	9,575	15,665	12,623	4,787	7,832
	1,000	105,193	39,896	65,271	84,155	31,916	52,217	42,077	15,958	26,108
	3,000	315,580	119,687	195,812	252,464	95,749	156,650	126,232	47,875	78,325
	10,000	1,051,933	398,956	652,706	841,546	319,165	522,165	420,773	159,582	261,083

Easten Europe

		1st year	7th year	Average of 1st-7th year	1st year	7th year	Average of 1st-7th year	1st year	7th year	Average of 1st-7th year
Population whose waste is disposed at landfill site (,000 cap.)	100	14,444	11,010	12,658	11,555	8,808	10,127	5,778	4,404	5,063
	300	43,332	33,031	37,975	34,666	26,425	30,380	17,333	13,212	15,190
	1,000	144,440	110,103	126,582	115,552	88,082	101,266	57,776	44,041	50,633
	3,000	433,319	330,309	379,747	346,655	264,247	303,797	173,328	132,124	151,899
	10,000	1,444,397	1,101,029	1,265,822	1,155,517	880,823	1,012,658	577,759	440,412	506,329

South America

		1st year	7th year	Average of 1st-7th year	1st year	7th year	Average of 1st-7th year	1st year	7th year	Average of 1st-7th year
Population whose waste is disposed at landfill site (,000 cap.)	100	8,743	4,430	6,328	6,994	3,544	5,063	3,497	1,772	2,531
	300	26,229	13,289	18,985	20,983	10,631	15,188	10,491	5,316	7,594
	1,000	87,429	44,298	63,285	69,943	35,438	50,628	34,972	17,719	25,314
	3,000	262,287	132,893	189,854	209,830	106,314	151,883	104,915	53,157	75,941
	10,000	874,290	442,976	632,846	699,432	354,381	506,276	349,716	177,190	253,138

Notes:

(1) The project activity is assumed to recover and flare methane in landfill gas collected at closed solid waste disposal site which has received wastes during 10 years.
(2) The following waste components and waste generation rates are applied, that are provided in "2006 IPCC Guidelines for National GHG Inventory" as regional defaults:

Region	Composition rate by %					Generation rate (t/cap/yr)	Fraction of MSW disposed to SWDS
	Food waste	Paper/cardboard	Wood	Textiles	Other		
South-Eastern Asia	43.5	12.9	9.9	2.7	16.3	0.27	0.59
Eastern Europe	30.1	21.8	7.5	4.7	14.6	0.38	0.90
South America	44.9	17.1	4.7	2.6	13.0	0.26	0.54

Source: 2006 IPCC Guidelines for National GHG Inventory
Note: "Other" is considered to consist of "Garden and park waste and other (non-food) putrescibles"

(3) Landfill management level is determined as follows:
"Managed" sites have controlled placement of waste (i.e. waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include some of the following: cover material, mechanical compacting or leveling of waste.
"Unmanaged (Deep)" sites have sufficient depth of MSW, Municipal Solid Waste (>=5m) for anaerobic degradation.
"Unmanaged (Shallow)" sites do not have sufficient depth of MSW, Municipal Solid Waste (<=5m) for anaerobic degradation. The project in host country is encouraged to adopt 0.4, unless there is any documented data that indicates managed landfill practices in the host country.
(4) Since ACM0001 does not specify the method to calculate the methane emission, this Toolkit applies "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site", as an authorized method to calculate the methane emission from landfill site.
(5) According to the decision of COP/MOP2, AMS-III.G is applicable to projects with annual emission reductions lower than 60,000 t-CO_2 equivalent and is applied to the values in **shaded cells**

AMS III.G

Baseline emissions

(i) Yearly methane generation potential

➢ It is assumed that the baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere, and the baseline emissions excludes methane emissions that would have to be removed to comply with national or local safety requirement or legal regulations.

➢The assumptions for the calculation is the same as "Methane emissions that would have been destroyed/combusted by the project" of ACM0001.

(ii) Methane emissions that would be captured and destroyed to comply with national or local safety requirement or legal regulations

➢No methane is assumed to be destroyed/combusted (by national or local safety requirement or legal regulations) in the absence of the project.

Project emissions

(i) Emissions related to the power used by the project activity facilities

➢No emissions related to the power used by the project activity facilities are assumed.

ACM0001

Emission reduction

(i) Methane emissions that would have been destroyed/combusted by the project

➢It is assumed that the baseline is the atmosphere release of the gas and the baseline methodology considers that some of the methane generated by the landfill may be captured and destroyed to comply with regulations or contractual requirements, or to address safety and odour concerns.

(a) OX: 0 (no oxidation of methane in the covering layers.)

(b) f: 0 (no methane is captured and flared in the absence of the project)

(c) DOCf: 0.5 (2006 IPCC default value)

(d) F (Fraction of methane in the landfill gas): 0.5 (Default).

(e) Default values of k and DOC are shown below. As a representative climatic condition, k and DOC values for Tropical (wet), Boreal and Temperate (dry) and Boreal and Temperate (wet) are applied to South-Eastern Asia, Eastern Europe and Southern America, respectively.

Waste type	Decay-rate (k)			DOC (% wet waste)
	Boreal and Temperature (MAT<=20oC)		Tropical (MAT>20oC)	
	Dry (MAP/PET<1)	Wet (MAP/PET>1)	Wet (MAP>1000mm)	
Pulp, paper, cardboard (other than sludge)	0.04	0.06	0.07	40
Texitiles				24
Other (non-food) organic putrescibles garden and park waste	0.05	0.10	0.17	20
Food, food waste, beverages and tabacco (other than sludge)	0.06	0.19	0.40	15
Wood, wood products and straw	0.02	0.03	0.04	43

MAT – mean annual temperature, MAP – Mean annual precipitation, PET – potential evapotranspiration.
MAP/PET is the ratio between the mean annual precipitation and the potential evapotranspiration.

(ii) Methane emissions that would have been destroyed/combusted in the absence of the project

➢No methane is assumed to be destroyed/combusted (by regulations or contractual requirements, or to address safety and odour concerns) in the absence of the project.

(iii) Emissions from flaring of the residual gas stream

➢It is assumed that flaring efficiency is 90%, as a default value, and 10% of the methane in landfill gas is released.

(iv) Emissions from electricity to be exported by the project

➢No electricity is assumed to be exported by the project.

(v) Emissions from fossil fuel used to generate thermal/mechanical energy

➢No emissions from fossil fuel consumption are assumed.

Common assumptions

(1) Annual operating days of the project facility: 365 days
(2) Global Warming Potential of CH_4:21

5. Methane Avoidance through Composting

Project activity:
Methane avoidance from anaerobic decay of organic wastes at landfill

Baseline scenario:
Methane would be emitted through anaerobic decay of organic wastes at solid waste disposal sites without methane recovery.

Applied methodology(ies):
AMS-III.F. “Avoidance of methane production from biomass decay through composting” (v.3)
AM0025 “Avoided emissions from organic waste through alternative waste treatment processes” (v.6)

Estimated annual CER generation

Unit: t-CO_2 equivalent

		Landfill Management Level								
		1. Managed			2. Unmanaged (Deep)			3. Unmanaged (Shallow)		
South-Eastern Asia		1st year	7th year	Average of 1st-7th year	1st year	7th year	Average of 1st-7th year	1st year	7th year	Average of 1st-7th year
Volume of waste to be composted (wet, ton/day)	10	706	2,632	1,851	559	2,099	1,475	265	1,035	723
	30	2,119	7,895	5,554	1,678	6,298	4,426	795	3,105	2,169
	100	7,065	26,315	18,514	5,593	20,993	14,752	2,650	10,350	7,229
	300	20,691	78,441	55,037	16,553	62,753	44,029	7,950	31,050	21,688
	1,000	68,969	261,470	183,456	55,175	209,176	146,764	27,588	104,588	73,382
Easten Europe										
Volume of waste to be composted (wet, ton/day)	10	167	1,175	690	128	934	546	49	452	259
	30	502	3,525	2,071	384	2,802	1,639	148	1,357	776
	100	1,674	11,749	6,904	1,280	9,341	5,464	493	4,524	2,586
	300	5,021	35,248	20,711	3,841	28,023	16,393	1,480	13,571	7,757
	1,000	15,056	115,815	67,359	12,045	92,652	53,887	4,441	40,714	23,270
South America										
Volume of waste to be composted (wet, ton/day)	10	403	2,073	1,326	316	1,652	1,055	144	812	513
	30	1,208	6,218	3,979	949	4,957	3,165	431	2,435	1,539
	100	4,028	20,728	13,262	3,164	16,524	10,551	1,435	8,115	5,129
	300	11,581	61,681	39,282	9,492	49,572	31,653	4,306	24,346	15,386
	1,000	38,603	205,603	130,941	30,882	164,482	104,753	15,441	82,241	52,376

Notes:

(1) The following waste components are applied, that are provided in "2006 IPCC Guidelines for National GHG Inventory" as regional defaults:

Region	Food waste	Paper/cardboard	Wood	Textiles	Other
South-Eastern Asia	43.5	12.9	9.9	2.7	16.3
Eastern Europe	30.1	21.8	7.5	4.7	14.6
South America	44.9	17.1	4.7	2.6	13.0

Source: 2006 IPCC Guidelines for National GHG Inventory
Note: "Other" is considered to consist of "Garden and park waste and other (non-food) putrescibles"

(2) Landfill management level is determined as follows:
"Managed" sites have controlled placement of waste (i.e. waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include some of the following: cover material, mechanical compacting or leveling of waste.
"Unmanaged (Deep)" sites have sufficient depth of MSW, Municipal Solid Waste (>=5m) for anaerobic degradation.
"Unmanaged (Shallow)" sites do not have sufficient depth of MSW, Municipal Solid Waste (<=5m) for anaerobic degradation. The project in host country is encouraged to adopt 0.4, unless there is any documented data that indicates managed landfill practices in the host country.
(3) According to the decision of COP/MOP2, AMS-III.F is applicable to projects with annual emission reductions lower than 60,000 t-CO_2 equivalent and is applied to the values in **shaded cells**

Baseline emissions

AMS III.F

(i) Yearly methane generation potential of the solid waste composted by the project

➢ It is assumed that the baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere, and the baseline emissions excludes methane emissions that would have to be removed to comply with national or local safety requirement or legal regulations.

➢The assumptions for the calculation is the same as "Yearly methane generation potential" of AM 0025.

(ii) Methane emissions that would have to be captured and combusted to comply with prevailing regulations

➢No methane is assumed to be destroyed/combusted (by national or local safety requirement or legal regulations) in the absence of the project.

(iii) Methane emission potential of wastewater

➢No methane is assumed since co-composting wastewater is not included in the project activity.

AM0025

(i) Methane produced by in the landfill in the absence of the project activity

➢It is assumed that no methane would have been destroyed/combusted in the absence of the project.

(a) OX: 0 (no oxidation of methane in the covering layers.)

(b) f: 0 (no methane is captured and flared in the absence of the project)

(c) DOCf: 0.5 (2006 IPCC default value)

(d) F (Fraction of methane in the landfill gas): 0.5 (Default).

(e) Default values of k and DOC are shown below. As a representative climatic condition, k and DOC values for Tropical (wet), Boreal and Temperate (dry) and Boreal and Temperate (wet) are applied to South-Eastern Asia, Eastern Europe and Southern America, respectively.

Waste type	Decay-rate (k)			DOC (% wet waste)
	Boreal and Temperature (MAT<=20oC)		Tropical (MAT>20oC)	
	Dry (MAP/PET<1)	Wet (MAP/PET>1)	Wet (MAP>1000mm)	
Pulp, paper, cardboard (other than sludge)	0.04	0.06	0.07	40
Texitiles				24
Other (non-food) organic putrescibles garden and park waste	0.05	0.10	0.17	20
Food, food waste, beverages and tabacco (other than sludge)	0.06	0.19	0.40	15
Wood, wood products and straw	0.02	0.03	0.04	43

MAT – mean annual temperature, MAP – Mean annual precipitation, PET – potential evapotranspiration. MAP/PET is the ratio between the mean annual precipitation and the potential evapotranspiration.

(ii) Methane that would be destroyed in the absence of the project activity

➢No methane is assumed to be destroyed/combusted (by national or local safety requirement or legal regulations) in the absence of the project.

(iii) Emissions from electricity/thermal energy to be generated/exported by the project

➢No electricity/thermal energy is assumed to be generated/exported by the project.

Project emissions

AMS III.F

(i) Emissions from incremental transportation

➢No incremental emissions from the transportation are assumed.

(ii) Emissions from electricity or diesel consumption

➢It is assumed as same as (i) and (ii) of AM 0025.

AM0025

(i) Emissions from electricity consumption on-site

(ii) Emissions due to fuel consumption on-site

➢It is assumed that 5 kW/t-MSW of electricity and 1.5 liter/t-MSW of diesel fuel would be consumed and the emission factors for the electricity and the diesel fuel would be 0.8 kg-CO2/kWh and 2.72 kg-CO2/liter, respectively.

(iii) Emissions during the composting process

➢It is assumed that N_2O would be emitted at the rate of 0.043 kg-N_2O / t-compost and the compost would amount 35% of MSW in weight.

(iv) Emissions from the anaerobic digestion process

➢No emissions from composting through anaerobic conditions are assumed.

Common assumptions

(1) Annual operating days of the project facility: 365 days
(2) Global Warming Potential of CH_4:21, N_2O: 310

6. Electricity generation from biomass residues

Project activity:

Grid-connected and biomass residue fired electricity generation project

Baseline scenario:

For power generation: The generation of power in grid-connected power plants
For heat generation: The generation of heat in boilers using the same type of biomass residues
For the use of biomass: The biomass residues are dumped or left to decay under mainly aerobic conditions, or burnt in an uncontrolled manner without utilizing it for energy purposes.

Applied methodology(ies):

ACM0006 “Consolidated Methodology for Grid-connected Electricity Generation from Biomass Residues” (v.4)

Estimated annual CER generation

Unit: t-CO_2 equivalent

		Gross Electric Power Output (MW)					
		5	10	15	20	25	30
Grid Emission Factor (tCO_2/MWh)	0.100	10,265	13,348	16,432	19,515	22,599	25,682
	0.200	13,348	19,515	25,682	31,849	38,016	44,184
	0.300	16,432	25,682	34,933	44,184	53,434	62,685
	0.400	19,515	31,849	44,184	56,518	68,852	81,186
	0.500	22,599	38,016	53,434	68,852	84,269	99,687
	0.600	25,682	44,184	62,685	81,186	99,687	118,188
	0.700	28,766	50,351	71,935	93,520	115,104	136,689
	0.800	31,849	56,518	81,186	105,854	130,522	155,190
	0.900	34,933	62,685	90,436	118,188	145,940	173,691
	1.000	38,016	68,852	99,687	130,522	161,357	192,192

Notes:

(1) All the figures in the table above is calculated in accordance with ACM0006.

Assumptions and values used in emission calculations:

Baseline emissions	**(i) CH_4 emissions due to aerobic decay or uncontrolled burning of biomass residues** ➢ It is assumed that the biomass residues are either dumped or left to decay under mainly aerobic conditions, or burnt in an uncontrolled manner without utilizing it for energy purposes. ➢Biomass used by the project activity: 100,000 dry tonne/year ➢ Biomass net calorific value: 19.5 TJ/10^3tonne ➢ Biomass methane emission factor in agriculture or forestry: 300 kg-CH_4/TJ (according to the IPCC Guidelines) ➢ Conservativeness factor for the correction of the methane emission factor: 0.73 *(see the following note)* **(ii) Emission reductions due to displacement of electricity** ➢ Grid emission factor: *set as a parameter in the previous page (t-CO_2/MWh)* ➢ Gross electric power output: *set as a parameter in the previous page (MW)* ➢ Internal electric power consumption of the power plant: 12% of the electric power output ➢ Average load factor: 80%
Project emissions	**(i) CO_2 emissions from biomass transportation to the power plant** ➢ Biomass used by the project activity: 100,000 dry tonne/year ➢ Biomass average humidity: 20 % ➢ Approximate load for 1 trip: 30 tonne/truck ➢ Average distance to the power plant: 100 km ➢ Emission factor for heavy truck transportation: 1.011 kg-CO_2/km (according to the IPCC Guidelines) **(ii) CO_2 emissions from diesel combustion in the power boiler** ➢ Fossil fuel (diesel) used in the power boiler: 100 tonne/year ➢ Fossil fuel (diesel) net calorific value: 43.33 TJ/10^3tonne (according to the IPCC Guidelines) ➢ Fossil fuel carbon content: 20.2 t-C/TJ (according to the IPCC Guidelines) ➢ Fraction of carbon oxidized: 0.99 (according to the IPCC Guidelines) **(iii) CH_4 emissions from biomass combustion in the power boiler** ➢ Biomass burned in the power boiler: 100,000 dry tonne/year ➢ Biomass net calorific value: 19.5 TJ/10^3 tonne ➢ Biomass methane emission factor in industrial stoker boiler: 15 kg-CH_4/TJ (according to the IPCC Guidelines) ➢ Conservativeness factor for the correction of the methane emission factor: 1.02 *(see the following note)*
Common assumptions	(1) Global Warming Potential of CH_4: 21

Notes:

(1) According to the ACM0006, project participants shall select the appropriate conservativeness factor from the tables below and shall multiply the estimate for the CH_4 emission factor with the conservativeness factor.

Methane emissions from biomass combustion in the power boiler

Estimated uncertainty range (%)	Assigned uncertainty band (%)	Conservativeness factor where higher values are more conservative
Less than or equal to 10	7	1.02
Greater than 10 and less than or equal to 30	20	1.06
Greater than 30 and less than or equal to 50	40	1.12
Greater than 50 and less than or equal to 100	75	1.21
Greater than 100	150	1.37

Methane emissions from biomass combustion in agriculture or forestry

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

7. Electricity generation from waste heat recovery

Project activity:

Case (1) Introducing a waste heat recovery and an electricity generation system at an industrial plant

Case (2) Introducing a coke dry quenching (CDQ) heat recovery equipment and an electricity generation system in a coking plant

Baseline scenario:

Purchase of grid electricity (the generation of power in grid-connected power plants).

Applied methodology(ies):

ACM0004 "Consolidated baseline methodology for waste gas and/or heat and/or pressure for power generation" (v.2)

Estimated annual CER generation

Case (1) Introducing a waste heat recovery and an electricity generation system at an industrial plant

Unit: t-CO_2 equivalent

		Gross Electric Power Output (MW)		
		10	30	50
Grid Emission Factor (tCO_2/MWh)	0.400	23,652	70,956	118,260
	0.600	35,478	106,434	177,390
	0.800	47,304	141,912	236,520
	1.000	59,130	177,390	295,650

Case (2) Introducing CDQ in a coking plant

Unit: t-CO_2 equivalent

		Annual Coke Production ('000 ton)		
		500	1,000	1,500
Grid Emission Factor (tCO_2/MWh)	0.400	27,000	54,000	81,000
	0.600	40,500	81,000	121,500
	0.800	54,000	108,000	162,000
	1.000	67,500	135,000	202,500

Notes:

(1) Case (2) is a specific case of Case (1). It is separately presented since the relationship between coke production level and emission reduction is relatively clear.

Assumptions and values used in emission calculations:

Baseline emissions	**Emission reductions due to displacement of electricity** ➢The baseline scenario for electricity generation is assumed to be grid power supply. The Emissions Factor for displaced electricity is to be calculated as in ACM0002. ➢Grid emission factor: *set as a parameter in the previous page (t-CO_2/MWh)* ➢Gross electric power output: *set as a parameter in the previous page (MW)* ➢ Internal electric power consumption of the power plant: 10% of the electric power output for both cases ➢Average load factor: 75%
Project emissions	**Emissions from firing auxiliary fuels for generation startup, in emergencies, or to provide additional heat gain before entering the Waste Heat Recovery Boiler.** ➢ For both cases, it is assumed that no auxiliary fuels are fired. In case of projects requiring firing of auxiliary fuels, emissions from such fuels must be counted as project emissions.
Note	➢ For Case (2) (CDQ) emission reduction calculation, 0.5 t-steam/t-coke and 300 kWh/t-steam is assumed. Source: “Technology transfer handbook for countermeasures of global warming. FY 2004 Research Report”, p. 77, the New Energy and Industrial Technology Development Organization (NEDO) [report only available in Japanese]

Ministry of the Environment
Government of Japan

Climate Change Policy Division
Global Environment Bureau
Ministry of the Environment, Japan
1-2-2, Kasumigaseki, Chiyoda-ku,
Tokyo, 100-8975 Japan
URL: http://www.env.go.jp/

GEC Global Environment Centre Foundation

Global Environment Centre Foundation (GEC)
2-110, Ryokuchi-koen, Tsurumi-ku,
Osaka, 538-0036 Japan
URL: http://gec.jp/