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

TYPE III - OTHER PROJECT ACTIVITIES

Project participants shall apply~~take into account~~ the general guidelines to SSC CDM ~~guidance to the~~ methodologies, information on additionality~~,~~ and abbreviations ~~and general guidance on leakage~~ provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html>.

III.AJ. Recovery and recycling of materials from solid wastes

Technology/measure

1. This methodology comprises activities for recovery and recycling of high density polyethylene (HDPE), ~~and~~ low density polyethylene (LDPE) and Polyethylene Terephthalate (PET) materials[1] in municipal solid wastes[2] to process them into intermediate or finished products e.g. plastic resin to displace production of virgin ~~HDPE and LDPE~~plastic materials in dedicated facilities thereby resulting energy savings and emission reduction.

For the purpose of this methodology the following definitions apply:

Mechanical Recycling: physical/mechanical processes by which recyclable plastic materials e.g. HDPE, ~~and~~ LDPE ~~plasties~~ and PET are obtained from municipal solid waste by way of separation, cleaning and compaction/packing for further processing in order to produce intermediate/finished products to substitute virgin raw materials in an industrial production chain. The process may be accomplished manually and/or using mechanical equipment including one or more of the following measures: washing of the separated LDPE, ~~and~~ HDPE and PET plastic materials with hot water, drying, compaction, shredding and pelletizing.

Recycling facility: facility (ies) where the recyclables in the municipal solid waste collected are sorted, classified and prepared[3] into marketable commodities for processing/manufacturing in single or multiple locations.

Processing/Manufacturing facility: includes industrial processes to transform recyclable materials obtained from recycling facility into intermediate or finished products e.g. plastic resin.

The methodology is applicable under the following conditions:

- It is possible to directly measure and record the final output of the recycling facility i.e. the weight of LDPE, ~~and~~ HDPE and PET materials~~plastics~~ leaving the recycling facility (on a dry basis);[4]

[1] Other materials such as glass, paper found in solid wastes that are manufactured in industrial processes can be potentially recycled, project proponents are encouraged to submit a revision of this methodology to include additional materials proposing conservative default values for specific energy consumption for the production from virgin raw materials.

[2] Non hazardous waste materials suitable for deposition in a solid waste disposal site (SWDS).

[3] Washing with hot water to clean the plastics to free it from extraneous materials is an essential part of this activity.

[4] If multiple processes or facilities are involved consider the final weight of the clean and dry material.

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

III.AJ. Recovery and recycling of materials from solid wastes (cont)

- For recycling of PET, the project participants shall prove the chemical equivalence of the recycled PET to that of PET made from virgin inputs by the comparison of intrinsic viscosities to ensure that the recycled PET replaces virgin inputs;
- Emission reductions can only be claimed for the difference in energy use for the production of HDPE/LDPE/PET plastic product/s from virgin inputs versus production from recycled plastic material;
- The emission reductions under this methodology will accrue either to the recycling facility or to the processing/manufacturing facility. In order to avoid double counting of emission reductions, a contractual agreement between the recycling facility and processing/manufacturing facility shall indicate that ~~the latter~~ only one of them will ~~shall not~~ claim emission reductions. Similarly through contractual agreement and other means, credible proof is provided to show that the materials supplied from the recycling facility are used for processing/manufacturing and not for other purposes such as a source of fuel;
- Using three years historic data (market data, official statistics etc.) prior to the start date[5] of the project activity, it is possible to demonstrate that the HDPE/LDPE/PET finished products in the host country of the CDM project were manufactured using either in country HDPE/LDPE/PET resin manufacturing facility or HDPE/LDPE/PET resin imported from another non-annex I country. Optionally analysis may be limited to HDPE/LDPE/PET products where recycled materials have proven to be technically viable option;
- Plastics already segregated from the rest of the solid waste from an unknown sources are not eligible under this methodology, i.e. recycling facility shall source its materials from an area where a system for municipal solid waste collection, management and disposal is in place;
- The solid wastes containing recyclable materials are procured locally from sources located within 200 km of the recycling facilities.[6] However this restriction on transport distance shall not apply to segregated plastics ~~Plastics already segregated from the rest of the waste and~~ transported within the host country ~~distance are not eligible under this methodology~~;
- ~~Processing/Manufacturing facility is located within 200 km from the Recycling facility.~~
- The project participants shall demonstrate that it is not common practice in the region to recover the plastics from solid waste disposal sites (landfills) and process them into recycled pellets;

[5] As per the definition of start date provided in paragraph 67, EB 41.

[6] Emissions related to transportation of solid wastes are ignored as they are likely to be small for short distances. For plastics sourced from outside the host country this methodology is not applicable. ~~When the wastes are transported over larger distances consideration of this source may be necessary and a request for revision of this methodology would be required.~~

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

III.AJ. Recovery and recycling of materials from solid wastes (cont)

- For recycling of PET, the project participants shall demonstrate that Pellets obtained from recycled PET are used to produce the same final product (e.g. bottles) as the one with the virgin pellets.

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

Boundary

3. The project boundary is the physical geographical sites of:

- The recycling facility;
- Processing/manufacturing facility;
- Virgin material production.

Baseline

4. Baseline emissions include emissions associated with energy consumption for the production of HDPE/LDPE/PET pellets from virgin plastic materials.

5. Baseline emissions for the production of pellet *i* from virgin inputs are calculated as below making conservative assumptions:

(i) It is assumed that natural gas supplies the process energy required for the thermal cracking to produce ethylene for HDPE and LDPE manufacturing; a default specific energy consumption of 15 GJ/t shall be used;

(ii) For manufacturing of an unit mass of PET, the baseline emissions for production of the monomers Mono Ethylene Glycol (MEG) and Purified Terepthalic Acid (PTA) are conservatively estimated as the energy demand for the production of the same mass of ethylene through thermal cracking; a default specific energy consumption of 15 GJ/t may be used;

(iii) It is assumed process energy for polymerization ~~under high pressure~~ is supplied with electricity. The following d~~D~~efault values shall be used:

- 0.83 MWh/t (3 GJ/t) and 1.67 MWh/t (6 GJ/t) for HDPE and LDPE;
- 1.11 MWh/t (4.0 GJ/t) for PET;

(iv) The remaining steps of virgin pellet production (melting and shaping, pelletizing, compounding) require relatively negligible amounts of energy and hence ignored.

6. Baseline emissions for the production of pellet type *i* from virgin inputs are calculated using equation (1).

$$BE_y = \sum_i [Q_{i,y} * L_i * (SEC_{Bl,i} * EF_{el,y} + SFC_{Bl,i} * EF_{FF,CO2})] \quad \textbf{(1)}$$

Where:

BE_y	Baseline emissions in year *y* (tCO_2/y)
i	Indices for material type *i (i = 1,2,3* for HDPE, LDPE and PET)
$Q_{i,y}$	Quantity of plastic type *i* recycled in year *y* (t/y)
L_i	Net to gross adjustment factor to cover degradation in material quality and material loss in the production process of the final product using the recycled material (use 0.75)
$SEC_{Bl,i}$	Specific electricity consumption for the production of virgin material type *i* (MWh/t), take value specified in paragraph 5 (iii)
$EF_{el,y}$	Emission factor for grid electricity generation, as per the most recent version of "Tool to calculate emission factor for an electricity system" (tCO_2/MWh). If the virgin material is sourced from more than one non-Annex 1 countries, the weighted average of the grid emission factors shall be used, using market data from the last three years prior to the project start date
$SFC_{Bl,i}$	Specific fuel consumption for the production of virgin material type *i* (GJ/t), take value as specified in paragraph 5 (i) and (ii)
$EF_{FF,CO2}$	CO_2 emission factor for fossil fuel (tCO_2/GJ)

Leakage

7. If it is demonstrated that organic waste segregated in the recycling facility would have been deposited in a landfill in the baseline without methane recovery, then no leakage calculation is required.

Project activity emissions

8. Project emissions include emissions for energy use at recycling facility[7] and processing/manufacturing facility.

$$PE_y = \sum_i [(EC_{i,y} * EF_{el} + FC_{i,y} * NCV_{FF} * EF_{FF,CO2}) + (Q_{i,y} * SEC_{proc} * EF_{el,y})] \quad \textbf{(2)}$$

Where:

PE_y	Project emissions in year *y* (tCO_2/y)
i	Indices for plastic type *i (i = 1,2,3* for HDPE, LDPE and PET)

[7] Emissions associated with transportation of recyclable materials and transportation for further processing/manufacturing under the project activity are considered as equivalent to the corresponding emissions for the virgin materials and therefore ignored in this methodology.

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

III.AJ. Recovery and recycling of materials from solid wastes (cont)

$EC_{i,y}$	Electricity consumption of the recycling facility apportioned to the plastic type *i* (MWh/t) in year *y*, see below
$FC_{i,y}$	Fuel consumption of the recycling facility apportioned to the plastic type *i* (unit mass or volume/t) in year *y*, see below
NCV_{FF}	Net calorific value of the fossil fuel consumed in the recycling facility in year *y* (GJ/unit mass or volume)
$EF_{FF,CO2}$	CO_2 emission factor of the fossil fuel consumed at the recycling facility (tCO_2/GJ), use local or national values, or IPCC default values
SEC_{proc}	Specific electricity consumption for the processing/manufacturing of plastic type *i*, use 0.5 MWh/t (1.8 GJ/t) for HDPE or LDPE. For PET, use 0.65 MWh/t (2.34 GJ/t). PET melts at relatively higher temperature. However, for the project activity where the processing/manufacturing facility is under the control of the project proponent, electricity consumption shall be monitored and the higher of the monitored value and 0.65 MWh/t shall be used

9. The electricity and fuel energy consumption of the recycling facility (EC_y , FC_y) shall be based on ~~monitoring of~~ energy consumption of the recycling facility. The project emissions shall be allocated to each mass unit of segregated material by market prices, i.e. apportioning the emissions proportional to the market prices of plastics, metals, organics, glass and paper etc. The market prices may be either monitored *ex post* or be determined once for the crediting period. This rule can be applied only if transparent and reliable information on market prices is available. Alternatively, as a conservative approach, all project emissions shall be allocated to recycled plastic.

Following formulas may be used to allocate project emissions to each mass unit of segregated material *s* by market prices

$$EC_{i,y} = EC_y \times \frac{Q_{i,y} * \$_{i,y}}{\sum_s [Q_{s,y} * \$_{s,y}]} \quad \textbf{(3)}$$

$$FC_{i,y} = FC_y \times \frac{Q_{i,y} * \$_{i,y}}{\sum_s [Q_{s,y} * \$_{s,y}]} \quad \textbf{(4)}$$

Where:

s	Indices for each of the segregated materials at the recycling facility with a market price including plastics type *i* and other marketable items such as organics and glass
EC_y	Total electricity consumption of the recycling facility in year *y* (MWh/y)

FC_y	Total fossil fuel consumption of the recycling facility in year *y* (unit mass or volume/y)
$Q_{s,y}$	Quantity of material type *s* segregated in the recycling facility in year *y* (t/y)
$\$_{i,y}$	Sale price of the plastic type *i* in year *y*
$\$_{s,y}$	Sale price of the segregated material type *s* in year *y*

Emission reductions

10. The emission reductions achieved by the project activity shall be determined as the difference between the baseline emissions and the project emissions and leakage.

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(5)}$$

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)

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

III.AJ. Recovery and recycling of materials from solid wastes (cont)

Monitoring

11. The following parameters shall be monitored and recorded during the crediting period. The applicable requirements specified in the "General guidelines to SSC methodologies" are also an integral part of the monitoring guidelines specified below and therefore shall be referred by the project participants:

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
1		Municipal solid waste	t/y	yearly	Quantity and distance of transportation
2	$Q_{s,y}$ and $Q_{i,y}$	Quantity of each of the segregated materials leaving the recycling facility with a market price including plastics type *i* and other marketable items such as organics, glass etc.	t/y	Recording at the time of sending each consignment from recycling facility to processing/ manufacturing facility or other customers	Direct weighing and recording of the weight, cross check with company records e.g. invoices. For the case of plastics type *i*, cross-check with the mass of product(s) used at Processing/Manufact uring facility using production records[8]
3	EC_y	Electricity consumption of the recycling facility in year *y*	MWh	Continuous	Metering with calibrated equipment. As alternative option, for the project activity where the monitoring is not possible, default values based on specification of equipments may be conservatively considered

[8] This is to ensure that the recycled HDPE and LDPE are further utilized and substitute virgin raw materials.

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

III.AJ. Recovery and recycling of materials from solid wastes (cont)

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
4		Electricity consumption of the processing/manufacturing facility in year *y*	MWh	Continuous	Applicable only for the project activity where the processing/manufacturing facility is under the control of the project proponent. Metering with calibrated equipment. Electricity consumption shall be monitored and the higher of the monitored value and default 0.65 MWh/t shall be used for PET
45	FC_y	Fossil fuel consumption of the recycling facility in year *y*	MJ		Weight or volume & density and calorific value
~~5~~6	$\$_{i,y}$ and $\$_{s,y}$	Sale price of plastic type *i* or material *s* in year *y*	$	As per paragraph 9	Cross check with sale invoices/receipts
7		Intrinsic Viscosity of PET	decilitres /gram (dL/g)	Every batch of Polymerisation	Test method for determining Intrinsic viscosity is as per ASTM D 4603 "Standard test method for determining Viscosity of Polyethylene Terephthalate"

Project activity under a programme of activities

12. Further guidance on leakage would be required to adapt this methodology for application to project activities under programme of activities.

- - - - -

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

III.AJ. Recovery and recycling of materials from solid wastes (cont)

History of the document

Version	Date	Nature of revision
02	EB 59, Annex # 18 February 2011	Inclusion of PET.
01	EB 53, Annex 15 26 March 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		