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

TYPE III - OTHER PROJECT ACTIVITIES

Project participants shall 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.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 other recyclable plastics such as polyethylene terephthalate (PET), Polypropylene (PP) etc, 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 and other plastics 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 materials e.g., HDPE, LDPE and other plastics 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, HDPE or other plastics 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. Such marketable commodities include sheets, flakes, chips etc.

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, HDPE or other type of plastics leaving the recycling facility (on a dry basis)[4];
- Emission reductions can only be claimed for the difference in energy use for the production of HDPE/LDPE/other plastics product/s from virgin inputs versus production from recycled material;

[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.

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

- The emission reductions under this methodology will accrue either to the recycling facility or the manufacturing facility[5]. 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 shall not~~ only one of them ~~can~~will 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 of the project activity, it is possible to demonstrate that the HDPE/LDPE/other finished products in the host country of the CDM project were manufactured using either in country HDPE/LDPE/other plastics type resin manufacturing facility or HDPE/LDPE/other plastics type resin imported from another non-annex I country. Optionally analysis may be limited to HDPE/LDPE/other plastics products where recycled materials have proven to be technically viable option;
- The solid wastes containing recyclable materials are procured locally from sources located within 200 km of the recycling facilities[6]. ~~Plastics already segregated from the rest of the waste and transported over 200 km distance are not eligible under this methodology;~~ If segregated plastics are transported over a distance of more than 200 km then this project emission source attributed to transportation shall be considered.
- ~~Processing/Manufacturing facility is located within 200 km from the Recycling facility.~~ If the Processing/Manufacturing facility is located over a distance more than 200km, the emissions from the transport of the material have to be included within the project emissions.

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.

[5] Manufacturing facilities can claim emission reductions in cases where~~n~~ there is an integrated recycling/manufacturing unit. ~~the classification and preparation takes place at their end and not at the recycling facility.~~

[6] Emissions related to transportation of solid wastes are ignored as they are likely to be small for short distances. ~~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.~~

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Baseline

4. Baseline emissions include emissions associated with energy consumption for the production of HDPE/LDPE/PET/other plastics pellets from virgin 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; a default specific energy consumption of 15 GJ/t for HDPE and LDPE shall be used;

(ii) It is assumed process energy for polymerization under high pressure is supplied with electricity; Default values of 3 GJ/t (0.83 MWh/t) and 6 GJ/t (1.67 MWh/t) for polymerization of HDPE and LDPE respectively shall be used;

(iii) The values for the specific energy usage related to the production of other types of plastics (other than HDPE/LDPE) should be based on publicly available data

~~(i)~~(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)*
$Q_{i,y}$	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 (ii or 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 or iii)*

$EF_{FF,CO2}$ 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 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)*
$EC_{i,,y}$	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, use 0.5 MWh/t (1.8 GJ/t)

9. Project ~~E~~emissions related to transport of recyclable material are calculated on the basis of distance and number of trips (or the average truck load)

$$PET_{i,y} = N_y \cdot AVD_y \cdot EF_{km,CO2,y} \quad \textbf{(3)}$$

Or

[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.~~

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$$PET_{i,y} = \frac{\sum_{k} BF_{T,y}}{TL_y} \cdot AVD_y \cdot EF_{km,CO2,y} \quad (4)$$

Where:

PET_{iy}	=	CO_2 emissions during the year *y* due to transport of the segregated plastic type i to the project plant (tCO_2/yr)
N_y	=	Number of truck trips during the year *y*
AVD_y	=	Average round trip distance (from and to) between the recyclable plastic supply sites and the site of the project plant during the year *y* (km)
$EF_{km,CO2,y}$	=	Average CO_2 emission factor for the trucks measured during the year *y* (tCO_2/km)
$BF_{T,y}$	=	Quantity of plastic that has been transported to the project site during the year *y* (tons of dry matter)
TL_y	=	Average truck load of the trucks used (tons) during the year *y*
i	=	Types of plastic used in the project plant and that have been transported to the project plant in year *y*

~~9.~~ 10. 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, 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

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

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

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, 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)

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$Q_{s,y}$ 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.~~ 11. 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:

ERy Emission reductions in year *y* (tCO_2e)

BEy Baseline emissions in year *y* (tCO_2e)

PEy Project emissions in year *y* (tCO_2e)

LEy Leakage emissions in year *y* (tCO_2e)

Monitoring

~~11.~~ 12. The following parameters shall be monitored and recorded during the crediting period.

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
1		Municipal solid waste	t	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	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/Manufacturing facility using production records[8]
3	EC_y	Electricity consumption	MWh	Continuous	Metering with calibrated equipment. Considering

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

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No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
		of the recycling facility in year *y*			the scattered nature of recycling operation, design values may be conservatively considered for some small drives, for which monitoring is not practically possible.
4	FC_y	Fossil fuel consumption of the recycling facility in year *y*	MJ		Weight or volume & density and calorific value
5	$\$_{i,y}$ 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.
6	$BF_{T,y}$	Quantity of Plastic that has been transported to the project site during the year *y*	t	Continuous	Direct weighing and recording of the weight, cross check with company records e.g., invoices
7	AVD_y	Average round trip distance (from and to) between plastic supply sites and the project site	Km	Continuous	Records by project participants on the origin of the supply of plastics
8	N_y	Number of truck trips for the transportation of segregated Plastics type i		Continuous	On-site measurements
9	TL_y	Average truck load of the trucks used for transportation	t	Continuously, aggregated annually	Determined by averaging the weights of each truck carrying plastics to the project plant

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No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
		of segregated Plastics type i			
10	$EF_{km,CO2,y}$	Average CO_2 emission factor for the trucks during the year *y*	tCO_2/km	At least annually	Calculate CO_2 emissions from fuel consumption by multiplying with appropriate net calorific values and CO_2 emission factors. For net calorific values and CO_2 emission factors, use reliable national default values or, if not available, (country-specific) IPCC default values.

Project activity under a programme of activities

~~12.~~ 13. Further guidance on leakage would be required to adapt this methodology for application to project activities under programme of activities.

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History of the document

Version	Date	Nature of revision
01	EB 53, Annex 15 26 March 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		