CLEAN DEVELOPMENT MECHANISM

CDM-SSCWG49-A04

Draft Small-scale Methodology

AMS-III.AJ: Recovery and recycling of materials from solid wastes

Version 05.0 - Draft

Sectoral scope(s): 13

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. The Executive Board of clean development mechanism (CDM) (hereinafter referred as the Board) at sixty-eighth meeting mentioned that approved methodologies are eligible for application in a programme of activities (PoA) irrespective of whether it includes guidance on how to translate the relevant requirements into eligibility criteria.

2. The small-scale working group (SSC WG) previously reviewed PoA requirement in all Type I and Type II small-scale methodologies and noted that all these methodologies are applicable to PoA.

3. To continue working on this mandate the SSC WG further analysed Type-III small-scale methodologies and noted that further guidance on application for PoA is required in few Type-III small-scale methodologies.

2. Purpose

4. The proposed draft revision of the methodology is part of the on-going work by the SSC WG to make all methodologies applicable to PoAs following the Board's guidance mentioned above

3. Key issues and proposed solutions

5. The SSC WG noted that the issues related to leakage estimation were already addressed under the leakage section of the methodology and thus further guidance is not required in case of expanding this the methodology to PoA. The section providing guidance on PoA application is revised accordingly.

6. The SSC WG also agreed to clarify the requirements related to leakage emissions. No leakage calculation is required if it is demonstrated that paper and cardboard segregated in the recycling facility would otherwise have been deposited in a landfill without methane recovery or with methane recovery but without energy generation in the baseline scenario. Otherwise, leakage emissions resulting from lower production of energy from the baseline landfill shall be accounted .

4. Impacts

7. The revision to this methodology will enhance its usability for PoAs.

5. Subsequent work and timelines

8. The SSC WG requested that the secretariat make the draft revised methodology AMS-III.AJ publicly available for global stakeholder consultation. After receiving public inputs on the document, the SSC WG will continue working on the methodology, at its fiftieth meeting, for recommendation to the Board at a future meeting of the Board.

6. Recommendations to the Board

9. Not applicable (call for public input).

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1. Introduction

1. The following table describes the key elements of the methodology:

Table 1. Methodology key elements

Typical projects	HDPE, LDPE, PET and PP plastic materials are recycled from municipal solid wastes (MSw) and processed into intermediate or finished products (e.g. plastic bags)
Type of GHG emissions mitigation action	Energy efficiency. (a) Reduction of production of HDPE, LDPE, PET and PP from virgin materials, thus reducing related energy consumption

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology comprises activities for the recovery and recycling of materials[1] in municipal solid waste (MSW)[2] to process them into intermediate or finished products, that is plastic resin to displace the production of virgin plastic materials in dedicated facilities, thereby resulting in energy savings. For paper and cardboard recycling, if the baseline scenario is the decay in a disposal site, the avoided methane emissions may be claimed.

2.2. Applicability

3. The methodology is applicable in the following two cases:

2.2.1. Case A: Project activities that target the participation of the informal waste sector

4. In Case A, the recycling facility is operated by the informal sector. The recycling facility may also receive wastes collected by the formal waste sector (e.g. public collection system). Waste fractions that were already being recycled in the baseline by enterprises in the formal sector cannot be included in the calculations.

[1] In this present version, the methodology covers the emissions associated with the production of virgin high density polyethylene (HDPE), low density polyethylene (LDPE), Polyethylene Terephthalate (PET) and Polypropylene (PP). For the sake of this methodology, “plastic” means HDPE, LDPE, PET and PP, unless otherwise specified in this document. Other materials such as glass and metals found in solid wastes that are manufactured in industrial processes can be recycled, however the emissions associated with the production of virgin materials of these categories are not available in the present version. 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), paper/cardboard refers to post-consumer wastes.

5. The following applicability conditions shall apply to project activities under this case:

   (a) The recycling facility may be an existing facility, or a newly implemented facility;

   (b) It is possible to directly measure and record the final output of the recycling facility, that is the weight of materials leaving the recycling facility (on a dry basis), segregated by type, such as LDPE, HDPE, PET, PP, Paper and cardboard;

   (c) Each type of recycled material is sold directly to processing/manufacturing facility, or to a chain of intermediary retailers that are able to transfer the materials to final identifiable processing/manufacturing facilities that process the segregated fractions;

   (d) The Project Design Document (PDD) shall explain the procedures such as contractual agreements proposed to eliminate double counting of emission reductions, for example due to the formal waste sector or the processing/manufacturing facility, or other parties possibly claiming credits for emission reductions. Similarly, through contractual agreement and other means such as survey/analysis undertaken by a third party, credible proof shall be 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 or disposal;

   (e) Emission reductions can be claimed for the difference in energy use for the production of HDPE/LDPE/PET/PP product/s from virgin inputs versus production from recycled plastic material. In the case of paper or cardboards, emission reductions due to the avoidance of methane formation in anaerobic decay may be claimed if the baseline scenario is the waste disposal in a disposal site without methane recovery.

2.2.2. Case B: Greenfield facility and/or capacity addition to existing facilities with formal sector participation

6. In Case B, the recycling facility is owned and operated by the formal waste sector. It may receive recyclable materials from the informal waste sector, but has no participation of the informal sector in its organization or management functions. The following applicability conditions shall apply under this case:

   (a) If the recycling facility is an existing activity, the average data on the amount of recycled materials from the previous three years of operation (a minimum of one year data would be required if the facility is less than three years old) shall be used for the estimation of the baseline recycling activity, and project activity shall consist of the increase of the recycling capacity above this level. If the recycling facility is newly implemented as a Greenfield activity, all recycled materials are eligible for the emission reduction calculation. However, in this case the project participants shall demonstrate that the materials recycled by the project activity are not diverted from other existing recycling facilities belonging to the formal sector, or, alternatively, that it is not a common practice in the region to recover and recycle these materials from municipal solid waste streams by means of formal businesses;

(b) It is possible to directly measure and record the final output of the recycling facility and the input to the final processing/manufacturing facilities, that is the weight of materials leaving the recycling facility and of those entering the processing/manufacturing facilities (on a dry basis),[3] segregated by type, such as LDPE, HDPE, PET, PP, Paper and cardboards;

(c) The recycled materials shall be sold directly to a processing/manufacturing facility, or to a chain of intermediary retailers that are able to transfer the recycled materials to a final identifiable processing/manufacturing facility;

(d) The PDD shall explain how procedures, such as contractual agreements, shall be put in place to eliminate double counting of emission reductions, for example potentially resulting from waste pickers, the recycling facility or the processing/manufacturing facility, or other parties possibly claiming credits for emissions reduction. Similarly through contractual agreement and other means, credible proof shall be 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 or disposal;

(e) For recycling of PET/PP, the project participants shall demonstrate the chemical equivalence of the recycled PET/PP to that of PET/PP made from virgin inputs by the comparison of intrinsic viscosities to ensure that the recycled PET/PP replaces virgin inputs;

(f) For plastics recycling, emission reductions can only be claimed for the difference in energy use for the production of HDPE/LDPE/PET/PP products from virgin inputs versus production from recycled plastic material. In the case of paper or cardboards, emissions reductions due to avoidance of methane formation in anaerobic decay may be claimed, if the baseline scenario is waste disposal in a disposal site without methane recovery.

2.2.3. Applicability conditions for both cases

7. In any of the above cases the project proponent shall be able to demonstrate, using three years[4] historic data (market data, official statistics etc.) prior to the start date[5] of the project activity, that the plastic finished products in the host country of the CDM project were manufactured using either in country plastic resin manufacturing facility or plastic resin imported from another non-Annex I country. This analysis may be limited to only those finished products where recycled materials have proven to be a technically viable option, that is those types of products that are expected to be the end products produced from materials recycled as part of the project activity.

8. The recycling facility shall source its materials from MSW; materials from an unknown source are not eligible under this methodology. As a consequence, wastes not pertaining to the identified baseline waste collection and destination stream that would not be delivered to the baseline disposal site and/or treatment plant (e.g. incineration) are not eligible.

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

[4] A minimum of one year data would be required if the facility is less than three years old.

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

9. Measures are limited to those that result in aggregate emission reductions of less than or equal to 60ktCO_2 equivalent annually.

2.3. Entry into force

10. Not applicable (call for public input).

3. Normative references

11. Project participants shall apply the "General guidelines for SSC CDM methodologies", "Guidelines on the demonstration of additionality of small-scale project activities" provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html>.

4. Definitions

12. The definitions contained in the Glossary of CDM terms shall apply:

(a) Mechanical Recycling - physical/mechanical processes by which recyclable materials that is plastic, paper and cardboard 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. In the case of plastics recycling, the process may be accomplished manually and/or using mechanical equipment including one or more of the following measures: washing of the separated plastic materials with hot water, drying, compacting, shredding or pelletizing;

(b) Recycling facility - facility (ies) where the recyclables in the municipal solid waste collected are sorted, classified and prepared into marketable commodities for processing/manufacturing in single or multiple locations.[6] In the case of plastics recycling, washing with hot water to clean the plastic to free it from extraneous materials is an essential part of this activity;

(c) Processing/Manufacturing facility - includes industrial processes to transform recyclable materials obtained from the recycling facility into intermediate or finished products that is plastic resin;

(d) Informal Waste Sector - individuals or a group of individuals who are involved in waste management activities, but are not formally registered or formally responsible for providing the waste management services. Newly established formalized organizations of such individuals, that is cooperatives, can also be considered as the informal sector for the purpose of this methodology;

(e) Formal Waste Sector - solid waste management activities planned, sponsored, financed, carried out or regulated and/or recognized by the local authorities or their agents, usually through contracts, licenses or concessions.

[6] The recycling facility includes final segregation of the waste types and no further segregation occurs in the Processing/Manufacturing facility.

5. Baseline methodology

5.1. Project boundary

13. The project boundary includes the physical geographical sites of:

    (a) Waste collection sites (e.g. door-to-door collection);

    (b) The recycling facility;

    (c) Processing/manufacturing facility;

    (d) Virgin material production;[7]

    (e) MSW disposal site or treatment plant in the baseline scenario.

5.2. Baseline emissions

14. Baseline emissions include emissions associated with energy consumption for the production of plastic pellets from virgin plastic materials. For paper and cardboard the emissions associated with the anaerobic decay within a disposal site may be claimed.

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

    (a) It is assumed that natural gas supplies the process energy required for the thermal cracking; a default specific energy consumption of 15 GJ/t shall be used for HDPE and LDPE or 11.6GJ/t for PP respectively;

    (b) For manufacturing of a 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;

    (c) It is assumed that process energy for polymerization is supplied with electricity. The following default values shall be used:

        (i) 0.83 MWh/t (3 GJ/t) and 1.67 MWh/t (6 GJ/t) for HDPE and LDPE;

        (ii) 1.11 MWh/t (4.0 GJ/t) for PET;

        (iii) 0.56 MWh/t (2.0 GJ/t) for PP;

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

[7] Virgin material production is included in the project boundary, even if it is not an identifiable site, because the emission factor for virgin material production for baseline calculation is based on the assumptions on the typical conditions for the virgin material production in the host country or in a non-Annex I country.

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

$$BE_y = \sum_i [Q_{i,y} \ x \ L_i \ x \ (SEC_{Bl,i} \ x \ EF_{el,y} + SFC_{Bl,i} \ x \ EF_{FF,CO2})] \qquad \text{Equation (1)}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2/y)
i	=	Indices for material type *i* (*i = 1,2,3* for HDPE, LDPE, PET and PP)
$Q_{i,y}$	=	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 15(c)
$EF_{el,y}$	=	Emission factor for grid electricity generation, as per the most recent version of the "Tool to calculate emission factor for an electricity system" (t CO_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 15(a) and 15(b)
$EF_{FF,CO2}$	=	CO_2 emission factor for fossil fuel (t CO_2/GJ)

17. Baseline emissions for the anaerobic decay of paper and cardboard in the solid waste disposal site are calculated using the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site".

5.3. Leakage

18. If it is demonstrated that ~~organic biogenic waste~~ paper and cardboard segregated in the recycling facility would otherwise have been deposited in a landfill without methane recovery or with methane recovery but without energy production in the baseline scenario, ~~or if the baseline scenario is the incineration of the wastes,~~ then no leakage calculation is required. Otherwise, leakage emissions resulting from lower production of energy from the baseline landfill shall be accounted.

5.4. Project activity emissions

19. Project emissions include emissions for energy use at recycling facility.[8] No project emissions need to be considered in the case of paper and cardboard. For project activities of Case B, project emissions are calculated using equation (2). The electricity and fuel energy consumption (EC_y, FC_y) shall be directly monitored.

$$PE_y = \sum_i Q_{i,j} \; x \; (EC_{i,y} \; x \; EF_{el,y} + FC_{i,y} \; x \; NCV_{FF} \; x \; EF_{FF,CO2}) \qquad \text{Equation (2)}$$

Where:

PE_y	=	Project emissions in year *y* (t CO_2/y)
i	=	Indices for plastic type *i (i = 1,2,3* for HDPE, LDPE, PET and PP)
$Q_{i,y}$	=	Quantity of plastic type *i* recycled in year *y* (t/y)
$EC_{i,y}$	=	Electricity consumption of the recycling facility apportioned to plastic type *i* (MWh/t) in year *y*
$FC_{i,y}$	=	Fuel consumption of the recycling facility apportioned to plastic type *i* (unit mass or volume/t) in year *y*
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

20. For Case A project activities, when project emissions are calculated using equation (2), the project emissions for electricity and fuel energy consumption (EC_y, FC_y) may be estimated based on the nameplate specific energy consumption of the equipment used and the average time of operation and level of service delivered,[9] or based on measurement campaigns of the energy consumption under typical operation conditions. Alternatively, the project emissions may be calculated using equation (3).

$$PE_y = \sum_i (Q_{i,y} \times SEC_{rec} \times EF_{el,y}) \qquad \text{Equation (3)}$$

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

[9] In case the nameplate energy consumption and/or service provided by the equipments used in the recycling facility in Case A are unknown, they may be estimated by a local expert in order to define a locally applicable emission factor for the recycling plant.

Where:

SEC_{rec} = Specific electricity consumption for the recycling of plastic type *i*, use 0.83 MWh/t (3 GJ/t) for HDPE/LDPE/PET/PP

21. Project emissions may be allocated to each mass unit of segregated material by market prices, that is 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.

22. The following formulas may be used to allocate project emissions to each mass unit of segregated material *s* by market prices

$$EC_{i,y} = EC_y \times \frac{Q_{i,y} \times \$_{i,y}}{\sum_s [Q_{s,y} \times \$_{s,y}]} \quad \text{Equation (4)}$$

$$FC_{i,y} = FC_y \times \frac{Q_{i,y} \times \$_{i,y}}{\sum_s [Q_{s,y} \times \$_{s,y}]} \quad \text{Equation (5)}$$

Where:

S = Indices for each of the segregated materials at the recycling facility with a market price including plastic 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 plastic type *i* in year *y*

$\$_{s,y}$ = Sale price of the segregated material type *s* in year *y*

5.5. Emission reductions

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

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (6)}$$

Where:

ER_y = Emission reductions in year *y* (t CO_2e)

BE_y = Baseline emissions in year *y* (t CO_2e)

PE_y = Project emissions in year *y* (t CO_2e)

LE_y = Leakage emissions in year *y* (t CO_2e)

6. Monitoring methodology

24. The following parameters as indicated in section 6.1 below shall be monitored and recorded during the crediting period. The applicable requirements specified in the "General guidelines for SSC CDM methodologies" are also an integral part of the monitoring guidelines specified below and therefore shall be referred to by the project participants:

6.1. Data and parameters monitored

Data / Parameter table 1.

Data / Parameter:	**Municipal solid waste**
Data unit:	t/y
Description:	Quantity of municipal solid waste collected at the recycling facility
Source of data:	-
Measurement procedures (if any):	Quantity
Monitoring frequency:	Yearly
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 2.

Data / Parameter:	$Q_{s,y}$ and $Q_{i,y}$
Data unit:	t/y
Description:	Quantity of each of the segregated materials leaving the recycling facility with a market price, including plastic type *i* and other marketable items such as organics, glass etc.
Source of data:	-

Measurement procedures (if any):	Direct weighing and recording of the weight, cross checked with company records that is invoices that are backed with receipt of payments. For the case of plastic type *i* in Case B, cross-check with the mass of product(s) used at the processing/ manufacturing facility using production records[10]
Monitoring frequency:	Recorded at the time of sending each consignment from recycling facility to processing/ manufacturing facility or other customers
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 3.

Data / Parameter:	EC_y
Data unit:	MWh
Description:	Electricity consumption of the recycling facility in year *y*
Source of data:	-
Measurement procedures (if any):	Metering with calibrated equipment. As an alternative option, for the project activity where monitoring is not possible, default values based on specification of equipment may be conservatively considered
Monitoring frequency:	Continuous
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 4.

Data / Parameter:	FC_y
Data unit:	MJ
Description:	Fossil fuel consumption of the recycling facility in year *y*
Source of data:	-
Measurement procedures (if any):	Weight or volume & density and calorific value
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

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

Data / Parameter table 5.

Data / Parameter:	$\$_{i,y}$ and $\$_{s,y}$
Data unit:	$
Description:	Sale price of plastic type *i* or material *s* in year *y*
Source of data:	-
Measurement procedures (if any):	Cross check with sale invoices/receipts
Monitoring frequency:	As per paragraph 22
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 6.

Data / Parameter:	**Intrinsic Viscosity**
Data unit:	decilitres/gram (dL/g)
Description:	Intrinsic Viscosity of PET/PP
Source of data:	-
Measurement procedures (if any):	Test method for determining Intrinsic viscosity is as per ASTM D 4603 "Standard test method for determining Viscosity of Polyethylene Terephthalate" for PET and as per "Plastics - Determination of the viscosity of polymers in dilute solution using capillary viscometers; EN ISO 1628-3:2010)" for PP
Monitoring frequency:	Every batch of Polymerisation
QA/QC procedures:	-
Any comment:	-

6.2. Project activity under a programme of activities

25. ~~Further guidance on leakage would be required to adapt this methodology for application to project activities under programme of activities.~~ The methodology is applicable to a programme of activities. No additional leakage estimations are necessary other than that indicated under the leakage section above.

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Document information

Version	*Date*	*Description*
Draft 05.0	19 October 2015	SSCWG 49, Annex 04 A call for public input will be issued on this draft revised methodology. Revision to provide guidance for application of the methodology under programme of activities.
04.0	23 November 2012	EB 70, Annex 28 The revision includes inclusion of Polypropylene (PP).
03	15 July 2011	EB 62, Annex 10 The revision includes: • Inclusion of accounting avoided methane emissions for recycling of paper and cardboard; • Inclusion of simplified requirements such as the use of default values for project emissions for the informal waste sector; and • Elimination of project emissions associated with energy use at processing/manufacturing facility.
02	18 February 2011	EB 59, Annex 3 Inclusion of Polyethylene Terephthalate (PET). .
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