CLEAN DEVELOPMENT MECHANISM

CDM-SSCWG53-A04

Draft small-scale Methodology

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

Version 06.0

Sectoral scope(s): 13

COVER NOTE

1. Procedural background

1. The recommended revision of “AMS-III.AJ: Recovery and recycling of materials from solid waste” is based on the request for revision “SSC_723: Revision of AMS-III.AJ to include recovery and recycling of metals (i.e. aluminium and steel) from municipal solid wastes”.

2. Purpose

2. The purpose of the recommended revision of the “AMS-III.AJ: Recovery and recycling of materials from solid waste” is to broaden the applicability of the methodology to cover the recovery and recycling of aluminium and steel, thereby reducing CO_2 emissions by displacing the use of virgin raw materials to produce primary aluminium and steel.

3. Key issues and proposed solutions

3. Currently, the methodology contains provisions only to calculate the energy savings from the use of recycled plastic materials (such as HDPE, LDPE, PET and PP) and glass cullet to produce virgin plastic material and container glass. The proposed revision includes:

   (a) Provisions to cover the recycling/recovery of metals (aluminium and steel) associated with domestic appliances in the daily waste collection system, and it excludes collection of large devices such as refrigerators, vehicles;

   (b) Inclusion of an adjustment factor to account for the share of materials produced in non-Annex I countries.

4. Impacts

4. The proposed revision, if approved, will broaden the applicability of the methodology and facilitate the implementation of CDM project activities and component project activities (CPAs) in the waste recycling sector.

5. Subsequent work and timelines

5. The methodology is recommended by the Small-Scale Working Group (SSC WG) for consideration by the Board at its 90th meeting.

6. Recommendations to the Board

6. The Board may wish to approve the proposed revision to the small-scale methodology.

7. As part of the ongoing work to update the methodologies based on the latest published and scientific information, the SSC WG agreed to request a mandate from the Board to review and update the global default factors contained in the methodology AMS-III.AJ and AMS-III.BA "Recovery and recycling of materials from E-waste" with regard to the recycling of materials.

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1. Introduction

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

Table 1. Methodology key elements

Typical projects	The following materials which are recycled from municipal solid wastes (MSW) and processed into intermediate or finished products are covered in the methodology: • Plastics: HDPE, LDPE, PET and PP plastic materials; • ~~and/or c~~Container glass cullet; • Metals – Aluminium and Steel. ~~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: Reduction of production of HDPE, LDPE, PET, PP and container glass 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 in municipal solid waste (MSW)[1] to process them into intermediate or finished products, displacing the production of virgin materials in dedicated facilities, thereby resulting in avoidance of energy use. For paper and cardboard recycling, if the baseline scenario is the decay in a disposal site, the avoided methane emissions may be claimed.

3. The methodology covers the emissions associated with:

(a) Production of virgin pellets of plastics consisting of either high density polyethylene (HDPE), low density polyethylene (LDPE), Polyethylene Terephthalate (PET) or Polypropylene (PP). For the sake of this methodology, “plastic” means HDPE, LDPE, PET and PP, unless otherwise specified;

~~(b) Other materials such as 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;~~

(b) Production of container glass using virgin input (“container glass” hereafter) that is displaced by the recycled container glass (“container glass cullet” hereafter) due to the project activity;

[1] Non-hazardous waste materials suitable for deposition in a solid waste disposal site (SWDS), paper/cardboard refers to post-consumer wastes.

(c) Production of metals (i.e. aluminium and steel)[2] from mined ore or virgin raw materials that is displaced by the recycled metals due to the project activity.

2.2. Applicability

4. 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

5. 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.

6. 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, container glass cullet, paper and cardboard~~;

(c) Each type of recycled material is sold directly to a 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 materials ~~HDPE/LDPE/PET/PP product/s and container glass~~ from virgin inputs versus production from recycled plastic material and container glass cullet. 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

7. 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

[2] Other metals are not covered under this methodology

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, container glass cullet, 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 and container glass recycling, e~~Emission reductions can only be claimed for the difference in energy use for the production of finished ~~HDPE/LDPE/PET/PP~~ products ~~and container glass~~ from virgin inputs versus production from recycled materials ~~plastic material and container glass cullet~~. 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.

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

2.2.3. Applicability conditions for both cases i.e. Case A and Case B

8. 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 (HDPE, LDPE, PET, PP, steel aluminium, paper and cardboard and glass) were manufactured in the host country of the CDM project ~~were manufactured~~ using either virgin raw materials produced in country ~~plastic resin manufacturing facility~~ or virgin raw materials ~~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. ~~Similarly, for glass recycling it shall be demonstrated that the container glass production in the host country is supplied with raw materials originated in the country or imported from another non-Annex I country (ies).~~

9. As an alternative to the requirement stipulated in paragraph 8 above, the project proponents may choose to adjust the baseline emissions by using the baseline correction factor (Bi) as described under the baseline section below.

10. The recycling facility shall source its materials from MSW; materials from an unknown source are not eligible under this methodology. The project activity consists of separation of the recyclables from bulk MSW by means of manual or magnetic or mechanical separations. If the project activity involves the collection of wastes on a door to door basis, or collection at recipient's containers for the voluntary dispensing of wastes by the local community, all recyclables (paper, plastics, glass, etc.) processed by the recycling plant shall be collected together, selective collection of metals or any other wastes is excluded. 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.

11. In the specific case of metals, the methodology excludes collection of the scraps generated from the production process of primary/secondary/finished metal and materials or in the processing of the finished metal and materials into final products, and it covers only postconsumer obsolete wastes[6]. Project proponents shall provide evidence that the materials recycled under the project activity are recovered only from end-of-life-wastes and project activity does not divert waste from any historically existing informal or formal recycling activity.

12. The amount of fuel and electricity consumed by the recycling facility can be measured and recorded.

[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.

[6] Post-consumer obsolete wastes cover for example small domestic appliances in the daily waste collection system, and it excludes collection of large devices such as refrigerators, vehicles. This is because these devices are usually scrapped and not treated and disposed together with MSW as assumed by this methodology; further recycling/recovery of metals from such devices would potentially involve emissions due to physical leakage of refrigerants and accounting such emissions are not under the scope of this methodology.

13. Project proponents shall demonstrate that the properties of the materials produced from waste recycling are the same as those from virgin materials. For example, if the waste materials such as recycled plastic bottles are converted into building blocks or roof tiles, the emission reductions based on displacement of original virgin materials cannot be claimed under this methodology. For recycled materials, project proponents shall provide documentation proving that the properties of the materials produced are comparable according to standard testing methods for each material.

14. 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

15. The date of entry into force is the date of the publication of the EB 94 meeting report on 5 May 2017.

2.4. Applicability of Sectoral Scopes

16. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, application of sectoral scope 13 is mandatory.

3. Normative references

17. 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>.

18. This methodology also refers to the latest approved versions of the following approved methodology:

(a) "AMS-I.D.: "Grid connected renewable electricity generation";

4. Definitions

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

(a) **Mechanical Recycling** - physical/mechanical processes by which recyclable materials ~~that is plastic, container glass, paper and cardboard~~ are obtained from municipal solid waste by way of separation, cleaning and compaction/packing (for plastics and paper) or grinding (for container glass) 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 materials with hot water, drying, compacting, shredding or pelletizing;

(b) **Recycling facility** - facility(ies) where the recyclable fraction of the collected municipal solid waste are sorted, classified and prepared into marketable

commodities for processing/manufacturing in single or multiple locations.[7] 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 and associated emissions shall be monitored and accounted as project emissions. Similarly, the recycling of container glass cullet is an essential part of the project activity and associated emissions shall be accounted as project emissions. For steel and aluminium, the separation of these metals from extraneous non-metallic pieces present in the recycled wastes (e.g. plastics or glass) shall also take part at the recycling facility;

(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, i.e. production of recycled plastic resin or pellets and/or the glass manufacturing facility where the container glass cullet is melted;

(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.

5. Baseline methodology

5.1. Project boundary

20. 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;[8]

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

5.2. Baseline emissions

21. Baseline emissions include emissions include:

(a) For the production of plastic, associated with energy consumption for the production of plastic pellets from virgin plastic materials;

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

[8] 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.

(b) For paper and cardboard the emissions associated with the anaerobic decay within a disposal site may be claimed;

(c) For the production of glass, emissions associated with the energy consumption for the production of virgin container glass corresponding to the preparation and mixing of raw materials before the melting stage.[9]

(d) For the production of metals, emissions associated with energy consumption for the production from virgin materials.

22. Baseline emissions shall be determined as:

$$BE_y = BE_{plastic,y} + BE_{glass,y} + BE_{paper,y} + BE_{Metal,y} \quad \text{Equation (1)}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2e)
$BE_{plastic,y}$	=	Baseline emissions in year *y* associated with the recycling of plastic (tCO_2e)
$BE_{glass,y}$	=	Baseline emissions in year *y* associated with the recycling of glass (tCO_2e)
$BE_{paper,y}$	=	Baseline emissions in year *y* associated with the recycling of paper (tCO_2e)
$BE_{Metal,i,y}$	=	Baseline emissions in year *y* associated with the recycling of metal i., i.e., Steel and/or Aluminium (tCO_2e)

23. Only the baseline emissions which would take place in non-Annex I countries shall be credited. Therefore, in the case where requirements stipulated under paragraph 8 cannot be met, the baseline emissions calculated for the total amount of recycled materials obtained in the project activity are adjusted by a correction factor *"Bi"*, calculated as the ratio of the production of the material *"i"* in non-Annex I countries and the total production of this material in the world. See the Table 2 below. These correction factors shall be updated at each renewal of the crediting period, and project participants shall use the values from the latest version of the methodology at renewal of the crediting period.

Table 2. Baseline correction factor for the share of production of metals, plastics and glass in non-Annex I countries

Metal/Plastic	Bi adjustment factor based on the share of the production in non-Annex I countries
Aluminium	0.63
Steel	0.65
ABS	0.54
HIPS	0.54

[9] Project proponent is encouraged to submit proposals to revise the methodology to include emissions avoided associated with the acquisition of raw materials and CO2 emissions avoided from the use of carbonated materials (such as limestone and soda) in the glass manufacturing process.

PET	0.54
HDPE	0.54
LDPE	0.54
PP	0.54
Glass	0.67

Source: For metals, U.S. Geological Survey, 2012[10]. For plastics, Plastics Europe, 2015[11]. For Glass http://www.glassforeurope.com/en/industry/global-market-structure.php

5.2.1. Baseline emissions for plastics recycling

24. 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.

25. Baseline emissions for the production of pellet type *i* from virgin inputs are calculated using equation (~~21~~):

$$BE_{plastic,y} = \sum_{i} \left[Q_{i,y} \times L_i \times B_i \times \left(SEC_{Bl,i} \times EF_{el,y} + SFC_{Bl,i} \times EF_{FF,CO2} \right) \right] \quad \text{Equation (2)}$$

Where:

$BE_{plastic,y}$ = Baseline emissions for plastics recycling in year *y* (tCO_2/year)

[10] U.S. Geological Survey, Mineral commodity summaries 2012, <http://minerals.usgs.gov/minerals/pubs/mcs/2012/mcs2012.pdf >

[11] Plastics Europe, Plastics the Facts 2015, < http://www.plasticseurope.org/cust/documentrequest.aspx?DocID=65435 >

i	=	Indices for material type *i* (*i = 1,2,3,4* 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 ~~17(c)~~24(c)
$EF_{el,y}$	=	Emission factor for grid electricity (tCO_2/MWh), determined in accordance with the provisions in AMS-I.D
B_i	=	Correction factor based on share of production in non-Annex I countries, as specified in Table 2 above. Apply a value of 1.0 when requirement stipulated under para 8 is met.
$SFC_{Bl,i}$	=	Specific fuel consumption for the production of virgin material type *i* (GJ/t), take value as specified in paragraph ~~17(a)~~24(a) and ~~17(b)~~24(b)
$EF_{FF,CO2}$	=	CO_2 emission factor for fossil fuel (tCO_2/GJ)

5.2.2. Baseline emissions for paper and cardboard ~~plastics~~ recycling

26. Baseline emissions for the anaerobic decay of paper and cardboard in the solid waste disposal site are calculated using the methodological tool “Emissions from solid waste disposal sites”.

5.2.3. Baseline emissions for glass recycling

27. Baseline emissions for the production of container glass from virgin inputs are calculated through the following conservative assumptions:

(a) Container glass cullet will displace only the preparation and mixing of raw materials before the melting stage;

(b) The only source of energy consumed by the preparation and mixing of raw materials is electricity – no fossil-fuels are used;

(c) The default value for SEC (specific electricity consumption) of 0.026 MWh/t_{glass} shall be used;

(d) The remaining steps of container glass production are not considered because the use of container glass cullet does not avoid melting and the subsequent steps of the glass manufacturing process (i.e. forming and post-forming);

28. Baseline emissions for the production of container glass from virgin inputs are calculated using following equation:

$$BE_{glass,y} = \sum_i [Q_{glass,y} \times L_{glass} \times B_i \times SEC_{Bl,glass} \times EF_{el,y}]$$ Equation (3)

Where:

$BE_{glass,y}$	=	Baseline emissions in year *y* (tCO_2/y)
$Q_{glass,y}$	=	Quantity of glass cullet recycled by the project activity in year *y* (t/y)
L_{glass}	=	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 0.88)
$SEC_{Bl,glass}$	=	Specific electricity consumption for the production of raw materials displaced by the glass recycling (MWh/t), take value as specified in paragraph ~~20(c)~~27(c).

5.2.4. Baseline emissions for metals recycling

29. Baseline emissions for the production of primary steel and aluminium from virgin inputs are calculated using the specific emission factors indicated in Table 3 below. These values shall be updated at each renewal of the crediting period, in accordance with the latest version of the methodology.

Table 3. Specific CO_2 emission factor for production of metals

Metal	Specific CO_2e emission factor for production of metals (tCO_2/t)
Aluminium	5.1
Steel	1.2

30. Baseline emissions for the production of metal type *i* from virgin inputs are calculated using equation (4):

$$BE_{metal,y} = \sum_i [Q_{i,y} \times B_i \times SE_i]$$ Equation (4)

Where:

$BE_{metal,y}$	=	Baseline emissions for metals recycling in year *y* (tCO_2/year)
i	=	Metal type (i.e. Steel or Aluminium)
$Q_{i,y}$	=	Quantity of metal type *i* (Steel or Aluminium) recycled and sent to a processing or manufacturing facility in year *y* (t/y)
SE_i	=	Specific CO_2e emission factor for production of metal i (tCO_2/t), take value specified in Table 3above

5.3. Leakage

31. If it is demonstrated that organic biogenic waste segregated in the recycling facility would otherwise have been deposited in a landfill without methane recovery in the baseline scenario, or if the baseline scenario is the incineration of the wastes, then no leakage calculation is required.

5.4. Project activity emissions

32. Project emissions include emissions for energy use at recycling facility[12] and emissions associated with the use of the recycled material in the manufacturing facility. 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 (5). The electricity and fuel energy consumption (EC_y, FC_y) shall be directly monitored.

$$PE_y = \sum_i \{Q_{i,y} \times [(EC_{i,y} + SEC_{P,i}) \times EF_{el,y} + FC_{i,y} \times NCV_{FF} \times EF_{FF,CO2}]\} \quad \text{Equation (5)}$$

Where:

PE_y	=	Project emissions in year *y* (t CO_2/y)
i	=	Materialplastic type – plastics (HDPE, LDPE, PET and PP), or container glass cullet, aluminium or steel.
$Q_{i,y}$	=	Quantity of materialplastic type or container glass cullet recycled in year *y* (t/y)
$EC_{i,y}$	=	Electricity consumption of the recycling facility apportioned to material plastic type *i* or container glass cullet (MWh/t) in year *y*
$SEC_{P,i}$	=	Energy consumption factor for processing of recycled material i in the processing/manufacturing facility (MWh/t). Use 0.66 for aluminium. Use 0.9 for steel. Use 0 for plastics and glass[12].
$FC_{i,y}$	=	Fuel consumption of the recycling facility apportioned to material plastic type *i* or container glass cullet (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

33. For Case A project activities, when project emissions are calculated using equation (5), the project emissions for electricity and fuel energy consumption (EC_y, FC_y) may be

[12] 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.

estimated based on the nameplate specific energy consumption of the equipment used and the average time of operation and level of service delivered[13], or based on measurement campaigns of the energy consumption under typical operation conditions. Alternatively, the project emissions from plastic recycling may be calculated using equation (6).

$$PE_y = \sum_i \left(Q_{i,y} \times SEC_{rec} \times EF_{el,y}\right)$$ Equation (6)

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

34. If the recycling plant is claiming emission reductions for only part of recycled materials (e.g. only for plastics and not for metals), ~~P~~project emissions may be allocated to each mass unit of segregated material by gross sales revenues ~~market prices~~, that is apportioning the emissions proportional to the market prices of plastics, metals, organics, glass and paper etc. and their respective throughput. The market prices are the average prices of recycled materials paid by processing units/retailers to the recycling plants, 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 material~~plastic~~.

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

$$EC_y = EC_y \times \frac{Q_{i,y} \times \$_{i,y}}{\sum_s \left(Q_{s,y} \times \$_{s,y}\right)}$$ Equation (7)

$$FC_y = FC_y \times \frac{Q_{i,y} \times \$_{i,y}}{\sum_s \left(Q_{s,y} \times \$_{s,y}\right)}$$ Equation (8)

Where:

S	=	Material segregated at the recycling facility with a market price, including plastic and other marketable items such as organics ~~and glass~~
EC_y	=	Total electricity consumption of the recycling facility in year *y* (MWh/y)
EC_{yi}	=	Total electricity consumption of the recycling facility in year *y* (MWh/y) apportioned to product i
FC_y	=	Total fossil fuel consumption of the recycling facility in year *y* (unit mass or volume/y)

[13] In case the nameplate energy consumption and/or service provided by the equipment 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.

$Q_{s,y}$	=	Quantity of material type *s* segregated in the recycling facility in year *y* (t/y)
$\$_{i,y}$	=	Sale price of plastic type *i* or container glass in year *y*
$\$_{s,y}$	=	Sale price of the segregated material type *s* in year *y*

5.5. Emission reductions

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

$$ER_y = \left(BE_{plastic,y} + BE_{glass,y} + BE_{paper,y}\right)BE_{,y} - PE_y - L_y \quad \text{Equation (9)}$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2e)
$BE_{plastic,y}$	=	Baseline emissions in year *y* associated with the recycling of plastic (t CO_2e)
$BE_{glass,y}$	=	Baseline emissions in year *y* associated with the recycling of glass (t CO_2e)
$BE_{paper,y}$	=	Baseline emissions in year *y* associated with the recycling of paper (t CO_2e)
PE_y	=	Project emissions in year *y* (t CO_2e)
L_y	=	Leakage emissions in year *y* (t CO_2e)

6. Monitoring methodology

37. 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:	$Q_{s,y}$, $Q_{i,y}$ *and* Q_{glass}
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, container glass cullet, metals etc.
Source of data:	-
Measurement procedures (if any):	Direct weighing and recording of the weight, cross checked with company's records that is invoiceds ~~that are~~ and backed ~~with~~ by 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[14].
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:	-

[14] 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 $_{s,y}*
Data unit:	~~$~~Local currency or USD
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~~34
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

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

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Document information

Version	*Date*	*Description*
06.0	3 April 2017	SSCWG 53, Annex 04 To be considered by the Board at EB 94. Revision to broaden the applicability of recovery and recycling of metals (aluminium and steel) from municipal solid wastes.
05.2	12 August 2016	Editorial revision to correct the year in paragraph 11.
05.1	5 August 2016	Editorial revision to include information on mandatory and conditional sectoral scopes under section 2.4, paragraph 12.
05.0	22 July 2016	EB 90, Annex 14

Version	*Date*	*Description*
		Revision to broaden the applicability of container glass.
04.0	23 November 2012	EB 70, Annex 28 The revision includes inclusion of Polypropylene (PP).
03.0	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.
02.0	18 February 2011	EB 59, Annex 3 Inclusion of Polyethylene Terephthalate (PET).
01.0	26 March 2010	EB 53, Annex 15 Initial adoption.

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