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

TYPE III - OTHER PROJECT ACTIVITIES

Project participants shall apply the general guidelines to small-scale (SSC) clean development mechanism (CDM), information on additionality (attachment A to appendix B) and general guidance on leakage in biomass project activities (attachment C to appendix B) provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> *mutatis mutandis*.

III.BD. GHG emission reduction due to supply of molten metal instead of ingots for aluminium castings

Technology/measure

1. This methodology comprises supply of molten aluminium metal/alloy from scrap aluminium recycling unit to casting units. In the absence of the project activity, the casting unit receives aluminium ingots from the recycling unit.[1]

2. Emission reductions under this methodology are on account of:

   (a) Energy savings due to avoidance of fossil fuel usage for re-melting the ingots at casting units;

   (b) Avoiding aluminium metal loss due to metal oxidation during re-melting of ingots at casting units.

3. For the purpose of this methodology, the following definitions apply.

   (a) Recycling facility: a facility, where aluminium scrap is processed to produce ingots of aluminium and/ or its alloys;

   (b) Casting Units: Facility(ies) that transform the aluminium or its alloy into intermediate or finished products through casting process.

4. The following conditions shall apply:

   (a) This methodology is applicable to existing facilities as well as new constructions (Greenfield facilities);

   (b) For facilities to qualify as existing, both the recycling unit and the casting units have a history of operation for at least three years prior to the start date of project activity and it shall be demonstrated that the baseline is the continuation of the existing practice i.e. casting units solely use ingots prior to the start date of the CDM project. The baseline emissions are established from the characteristics of the existing systems using data from the immediately prior three years. If any one of the units (recycling or casting) is a new construction it shall be considered as Greenfield;

[1] Aluminium casting is a process of casting aluminium or its alloy in a mould with or without application of pressure. In the process, molten metal is injected into a mould or dies either under gravity or under pressure. Upon cooling the metal takes the shape of the mould or dies and is removed from the mould.

(c) For Greenfield facilities, the baseline shall be determined using the relevant procedures prescribed in the "General Guidelines for SSC CDM methodologies";

(d) However, for Greenfield and existing facilities, if the estimated average annual emission reductions from the project activity is greater than 600 tCO_2 per installation (i.e. casting unit), then mandatory investment analysis is required for identification of the baseline and demonstration of additionality of the project. The investment analysis shall take into account all costs and benefits that result from the project activity;

(e) The hot metal transport between the recycling facility and casting unit is undertaken in closed ladle all through the crediting period;

(f) It is possible to directly measure and record the output of the recycling facility i.e. the quantity of molten aluminium metal or alloy supplied to the casting units;

(g) In order to avoid double counting of emission reductions, a contractual agreement between the recycling facility and casting unit shall indicate that only one of them will claim emission reductions;

(h) Production outputs in baseline and project scenario remain homogenous and within a range of ±10% with no change in installed capacity. The methodology is not applicable to project activities for retrofit of an existing facility to increase production outputs;

(i) It shall be demonstrated that the use of hot metal in the casting unit will not increase auxiliary consumptions. Any transportation related emissions is included as project emissions;

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

Project boundary

5. The project boundary includes the physical geographical site of the aluminium metal recycling unit and the associated aluminium casting facilities using the molten metal.

Baseline

6. The baseline scenario is the supply of aluminium ingots to the casting units from the aluminium metal recycling facilities. The aluminium recycling facilities in turn produce these ingots by processing the aluminium scrap. The processing of scrap involves its sorting, refining, melting and alloying. The molten aluminium alloy is converted to ingots before being supplied to the casting units.

7. Further, in the baseline scenario, the casting units melt the ingots using fossil fuel and/or electricity before being moulded. During the melting of ingots, some aluminium metal is lost because of oxidation.

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

III.BD. GHG emission reduction due to supply of molten metal instead of ingots for aluminium castings (cont)

8. Baseline GHG emissions are calculated as follows:

$$BE_y = BE_{fuel,y} + BE_{metal,y} \quad \textbf{(1)}$$

Where:

BE_y	Baseline emissions in the year *y* (tCO_2)
$BE_{fuel,y}$	Baseline emission in the year *y* due to use of fossil fuel/electricity for melting of aluminium ingots (tCO_2)
$BE_{metal,y}$	Baseline emission in the year *y* due to metal loss in oxidation during melting of aluminium ingots prior to casting (tCO_2)

9. For conservativeness, the emissions due to use of electricity in the baseline for melting of ingots (except where it is used as a main energy source for melting of metal) has been neglected. The emission due to the use of fossil fuel is calculated as follows:

$$BE_{fuel,y} = Q_y * \left[\{1.07 * (660 - T_{amb}) + 390\} / \eta_{furnace}\right] * EF_{fossilfuel} \quad \textbf{(2)}$$

Where:

Q_y	Quantity of molten aluminium alloy supplied in the year *y* to the casting unit (ton)
660	Melting temperature of aluminium. Use default value of 660°C[2]
T_{amb}	Ambient temperature (°C) Either of the following two values may be used: 1. Take $T_{amb,}$ as the highest temperature of the location during last one year prior to the implementation of the project activity as default value. 2. Take the ambient temperature T_{amb} = 100 °C as a default value
1.07	Average value of specific heat (MJ/ ton °C)of solid aluminium over a temperature range of 20 °C to 660 °C in the furnace shall be taken as 1.07 (MJ/ton °C)[2]
390	Latent heat of fusion of aluminium (MJ/ton)[2]

[2] Handbook of aluminium recycling by Christopher J. Schmitz. <http://books.google.co.in/books?id=WvT2OEf8DskC&lpg=PP1&pg=PP1>.

$EF_{fossilfuel}$ CO_2 emission factor ($tonCO_2/MJ$) of the fossil fuel which would have been consumed at the casting unit to which the molten metal is being supplied. For the purpose of determining the fuel, it is to be considered that the fuel used at the recycling facility and the casting unit is the same.

Emissions factor of fossil fuels can be determined using the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". In the case of electricity, emission factor can be determined using the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

$\eta_{furnace}$ Efficiency of the furnace at the casting unit to which the molten metal is being supplied (fraction)

Efficiency of the melting furnace ($\eta_{furnace}$)

10. Regarding the efficiency of the melting furnace ($\eta_{furnace}$) , the highest of the following two shall be used to determine the conservative value:

(a) The rated efficiency given by the manufacturer; or

(b) The efficiency value as listed in Table 1 below. The table provides the maximum efficiency value available for a particular type of melting furnace/process.

Table 1: Efficiency of Melting Furnace

Melting furnace/process	Efficiency, $\eta_{furnace}$ (%)
Reverberatory furnace, no recuperation	32
Reverberatory furnace, with recuperation	53
Closed well furnace, no recuperation	40
Closed well furnace, with recuperation	50
Rotary drum furnace fixed axis	40
Tilt able rotary drum furnace	53

Source: Handbook of Aluminium recycling By Christopher J. Schmitz[2]

11. For conservativeness, equation (2) above does not account for GHG emission associated with superheating the molten aluminium beyond its melting point.

12. Baseline GHG emission in year *y* due to metal loss during melting of aluminium ingots is calculated as follows:

$$BE_{metal,y} = (\beta \times Q_y \times EF_{AP} \times EF_{CO2,grid,y}) / 100 \quad \textbf{(3)}$$

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

III.BD. GHG emission reduction due to supply of molten metal instead of ingots for aluminium castings (cont)

Where:

$BE_{metal,y}$	Baseline GHG emission in year *y* due to metal loss during melting of aluminium ingots (tCO_2)
Q_y	Quantity of molten aluminium alloy supplied in year *y* to the casting units (ton)
β	Percentage loss of aluminium due to oxidation during the process of re-melting of ingots
EF_{AP}	Emission factor for primary aluminium production from virgin inputs Conservative default value of 7.3 MWh (electricity)/tonne molten aluminium alloy can be applied if the host country is net exporter of aluminium. This shall be demonstrated for each crediting year using credible official documented evidence (e.g., from government and/or from industrial association). Otherwise, the emission factor shall be discounted using baseline correction factor of 0.63.[3] These values 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.
$EF_{CO2,grid,y}$	The emissions associated with grid electricity consumption should be calculated in accordance with the procedures of AMS-I.D (tCO_2/MWh)

Melting loss (β)

13. The value of oxidation loss (β) is chosen as minimum between the two:

(a) Value of 4[4]%

(b) Value determined by carrying out a survey of the casting units in and around the project region. The survey shall at least include ten facilities.

14. The selected default value shall be used for the crediting period and updated at renewal of crediting period.

Project activity emissions

15. The project emissions (PE_y) on account of use of any fossil fuel/electricity consumption associated with transportation of molten metal between recycling facility and casting units and also any incremental auxiliary consumption for the use of the hot metal in casting unit. Relevant tools such as the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and/or the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" shall be used.

Leakage

[3] See Table 1, AMS-III.BA "Recovery and recycling of materials from E-waste"

[4] US Department of Energy, Office of Scientific & Technical Information on "Reduction of Oxidative Melt Loss of Aluminium And Its Alloys".

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

III.BD. GHG emission reduction due to supply of molten metal instead of ingots for aluminium castings (cont)

16. If the energy generating equipment is transferred from another activity leakage is to be considered.

Emission reductions

17. Emission reductions on annual basis (*ERy*) are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(4)}$$

Where:

ER_y	Emission reductions in year *y* (tCO_2/y)
PE_y	Project emissions in year *y* (tCO_2/y)
LE_y	Leakage emissions in year *y* (tCO_2/y)

Monitoring

18. Relevant parameters shall be monitored as indicated in the table below. The applicable requirements specified in the "General Guidelines to SSC CDM methodologies". (e.g. calibration requirements, sampling requirements) are also an integral part of the monitoring guidelines specified below and therefore shall be referred.

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

III.BD. GHG emission reduction due to supply of molten metal instead of ingots for aluminium castings (cont)

Table 2: Parameters for monitoring during the crediting period

No.	Parameter	Description	Unit	Monitoring/ recording frequency	Measurement methods and procedures
1.	Q_y	Quantity of molten aluminium alloy supplied in the year y to the casting unit	tons	On a continuous basis	Invoice of supply of Aluminium alloy, material dispatch and receipt records. The basis of this data will be direct measurement at the point of transfer of molten metal. The weigh bridge/scale shall be calibrated annually
2.	β	Percentage of aluminium metal loss due to melting of ingots	fraction	Once for every crediting period	Value for oxidation loss shall be determined based on survey of the aluminium die-casting units in the area/region prior to the implementation of the project activity. This shall include data obtained by the relevant industry and trade associations

19. The monitoring shall also include availability of closed ladle furnaces annually.

Project activity under a programme of activities

20. The project activity is not applicable to PoA.

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History of the document

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