Draft VCS Methodology

M0299

REVISION TO *AMS-III.C. EMISSION REDUCTIONS BY ELECTRIC AND HYBRID VEHICLES*

Draft Version

24 April 2025

Sectoral Scope 7: Transport

This draft methodology was developed by Grutter Consulting AG.

CONTENTS

1 SUMMARY DESCRIPTION

Additionality and Crediting Method	
Additionality	Project/Activity Method
Crediting Baseline	Project Method
Mitigation Outcome	Reductions

CDM methodology *AMS-III.C. Emission reductions by electric and hybrid vehicles* quantifies GHG emission reductions from project activities that introduce new electric and/or hybrid vehicles that displace the use of fossil fuel vehicles in passenger and freight transportation.

This revision expands the scope of the methodology to include electric mobile machinery (EMM), such as building and construction machines. EMM includes both battery-electric mobile machinery and plug-in hybrid electric mobile machinery.

The methodology is globally applicable.

2 SOURCES

This methodology revision applies to CDM methodology *AMS-III.C Emission reductions by electric and hybrid vehicles*. Project proponents must use this methodology revision in conjunction with the most recent version of *AMS-III.C*.

3 DEFINITIONS

The definitions in *AMS-III.C* and the most recent version of the *VCS Program Definitions* apply to this methodology. In addition, the following definition applies.

Electric Mobile Machinery (EMM)
Equipment that operates on electric power and is not fixed to a specific site, allowing it to be moved either under its own propulsion or with assistance as required by engineering specifications or logistics. EMM must be self-propelled, except in cases where a self-propelled unit has had its drive carriage removed to secure the unit to a structure during operation. EMM includes both battery-electric mobile machinery or plug-in hybrid electric mobile machinery. For the avoidance of doubt, hybrid electric mobile machinery is not included under this methodology. Examples of EMM include, but are not limited to:

1) Construction machinery (e.g., excavators, road-building equipment)

2) Material handling equipment (e.g., forklifts, cargo-container handling equipment at ports such as cranes, reach stackers, tractor-trailers, straddle carriers)

3) Airport support equipment (e.g., pushback tractors, boarding stairs, belt and container loaders, luggage tugs)

Generators used for power generation do not qualify as mobile machinery under this methodology.

4 APPLICABILITY CONDITIONS

CDM methodology *AMS-III.C.* applies to project activities that introduce new electric and/or hybrid vehicles that displace the use of fossil fuel vehicles in passenger and freight transportation. This revision expands the scope of the methodology to include EMM. The methodology is globally applicable.

In all applicability conditions of *AMS-III.C.* the term "electric vehicles" must be replaced with "electric vehicles and mobile machinery."

Applicability conditions 7 and 10 must be replaced as follows:

7. The project participant must demonstrate that double counting of emission reductions does not occur following the rules and requirements in the latest version of the VCS Standard. Provisions to avoid double counting may include a contractual agreement with the end-user(s), maintenance of a comprehensive inventory of project vehicles, or unique identification of the vehicles owned by end-user(s). The steps undertaken to avoid double-counting must be documented in the Project Document.

10. The types of hybrid/electric vehicles and mobile machinery include, but are not limited to:

    1) Passenger and commercial vehicles (e.g., cars, buses, trucks, jeepneys, commuter vans, taxis)

    2) Two- and three-wheeled vehicles (e.g., motorcycles, tricycles)

    3) Electric Mobile Machinery (e.g., construction machinery)

5 PROJECT BOUNDARY

The project boundary must be determined following the procedure provided in the most version of *AMS-III.C.* The term "vehicles" must be read as "vehicles and mobile machinery."

6 BASELINE SCENARIO

The baseline scenario must be determined following the procedure provided in the most recent version of *AMS-III.C*. However, the term "vehicles" should be read as "vehicles and mobile machinery" in this section.

7 ADDITIONALITY

The additionality must be determined following the procedure provided in the most recent version of *AMS-III.C*. However, the term "vehicles" must be read as "vehicles and mobile machinery" in this section.

8 QUANTIFICATION REDUCTIONS AND REMOVALS

8.1 Baseline Emissions

Baseline emissions are determined in the same manner as outlined in AMS-III.C.

Approach (1): Using service units of project vehicles / mobile machinery

The baseline emissions are calculated based on the unit of service provided by the project electric vehicles (travelled distance) or EMM (hours of service) times the emission factor for the baseline vehicle / mobile machinery to provide the same unit of service as per the equation below:

$$BE_y = \sum_i EF_{BL,i} \times SU_{PJ,i,y} \times N_{PJ,i,y} \times 10^{-6} \quad \text{Equation (1)}$$

Where:

BE_y	= Total baseline emissions in year *y* (tCO_2)
$EF_{BL,I}$	= Emission factor for baseline vehicle / mobile machinery category *i* (gCO_2/km for vehicles and gCO_2/h for mobile machinery)
$SU_{PJ,i,y}$	= Services units of project vehicle / mobile machinery category *i* in the year *y* (average annual distance in km for vehicles and average operating hours for mobile machinery)
$N_{PJ,i,y}$	= Number of operational project vehicles / mobile machinery in category *i* in year *y*

Approach (2): Using the electricity used to charge the vehicles / mobile machinery

The baseline emissions are calculated by transforming the electricity charged to the vehicles / mobile machinery at the charging points into travelled distance / hours of operation and the emission factor for fossil fuels used by the baseline vehicles to perform the same service units.

$$BE_y = \sum_i EF_{BL,i} \times \frac{EC_{PJ,i,y}}{SEC_{PJ,i,y}} \times 10^{-6}$$ Equation (2)

Where:

BE_y = Total baseline emissions in year *y* (tCO_2)

$EF_{BL,I}$ = Emission factor for baseline vehicle category *i* (gCO_2/km for vehicles and gCO_2/h for mobile machinery)

$EC_{PJ,i,y}$ = Electricity consumed for charging project vehicles / mobile machinery category *i* in year *y* (kWh)

$SEC_{PJ,i,y}$ = Specific electricity consumption per unit of service of project vehicle / mobile machinery category *i* in year *y* (kWh/km for vehicles and kWh/h for mobile machinery)

The emission factor per unit of service for baseline vehicle / mobile machinery category i ($EF_{BL,km/h,i}$) shall be determined as follows:

$$EF_{BL,i} = SFC_{BL,i} \times NCV_i \times EFCO2_i \times IR^t \times 10^{-3}$$
Equation (3)

Where:

$EF_{BL,I}$ = Emission factor for baseline vehicle / mobile machinery category *i* (gCO_2/km for vehicles and gCO_2/h for mobile machinery)

$SFC_{BL,I}$ = Specific fuel consumption of baseline vehicle / mobile machinery category *i* (g/km for vehicles and g/h for mobile machinery)

NCV_i = Net calorific value of fossil fuel consumed by baseline vehicle / mobile machinery category *i* (MJ/kg)

$EFCO2_i$ = CO2 emission factor of fossil fuel consumed by baseline vehicle / mobile machinery category *i* (gCO_2/MJ)

IR^t = Technology improvement factor for baseline vehicle / mobile machinery in year *t*. The improvement rate is applied to each calendar year. The default value of the technology improvement factor for all baseline vehicle / mobile machinery categories is 0.99

t = Year counter for the annual improvement (dependent on age of data per vehicle / mobile machinery category)

Options for calculating the fuel efficiency of a vehicle / mobile machinery:

Option 1: Sample measurement

Measure the actual fuel consumption and corresponding units of service (distance travelled for vehicles and hours of operations for mobile machinery) of a sample of baseline vehicles / mobile machinery of the same vehicle / mobile machinery category operating in comparable

surroundings with a similar age or newer[1], and a comparable passenger or load carrying capacity with a maximum deviation of ±20% between the baseline and the project activity vehicles / mobile machinery. Sample vehicles shall be randomly chosen in accordance with the latest version of the "Guidelines for sampling and surveys for CDM project activities and programme of activities" using a 90 per cent confidence interval and +/- 10 per cent precision to determine the sample size. The lower bound of 90 per cent confidence interval shall be used as the Specific Fuel Consumption.

Option (2): Top 20 per cent

The specific fuel consumption for comparable vehicles / mobile machinery is estimated by using the specific fuel consumption of the top 20% of the vehicle / mobile machinery fleet from manufacturer's specifications for vehicles / mobile machinery in the project region.

Option (3): Using operational data

The vehicle / mobile machinery can be identified from the base case with comparable operating conditions[2] or in a similar area[3] and this vehicle / mobile machinery will not be replaced over the life of the project. The SFC value is determined from data of baseline vehicles / mobile machinery under comparable conditions. Historical data for at least 1 year is collected per vehicle / mobile machinery category. Otherwise, SFC can be obtained from manufacturer's specifications.

In project activities where baseline vehicles / mobile machinery include non-standard vehicles / mobile machinery for which manufacturer's data is not available, the specific fuel consumption may be determined using one of the following two options:

1) Measure the actual fuel consumption and corresponding service unit of a sample of baseline vehicles / mobile machinery operating in conditions with a similar age or newer, a similar or smaller engine size, a similar or lower passenger/goods load capacity, and other relevant factors to distinguish vehicles / mobile machinery with different fuel consumption rates. Sample vehicles / mobile machinery shall be randomly chosen in accordance with the latest version of the "Guidelines for sampling and surveys for CDM project activities and programme of activities" using a 90 per cent confidence interval and a 10 per cent precision to determine the sample size. The lower bound of 90 per cent confidence interval shall be used as the specific fuel consumption;

2) Use a specific fuel consumption value from peer-reviewed literature source or report authored by a nationally/internationally recognized independent third party or a research institute under the condition that the specific fuel consumption value for

[1] If the baseline vehicle / mobile machinery sample is older than project vehicles the technology improvement factor IR^t can instead be applied

2 Comparable conditions refers to usage types e.g. usage of construction machinery in a quarry.

[3] Comparable areas are primarily urban or inter-urban for vehicles

baseline vehicles / mobile machinery was derived with characteristics leading to similar or lower emissions as compared to the baseline vehicles / mobile machinery, for example use specific fuel consumption values for vehicles / mobile machinery of a similar age or newer, a similar or smaller engine size, a similar or lower passenger/goods load capacity, and other relevant factors to distinguish vehicles / mobile machinery with different fuel consumption rate.

Option (4): Using data from a control group

If no specific baseline vehicle / mobile machinery can be identified or appropriate operational data is not available, then specific fuel consumption should be obtained through a statistically significant control group or existing statistics that are regularly updated. Such a control group or the source of data must shall have similar or conservative characteristics with respect to vehicle / mobile machinery age (equal or newer), and operating conditions. The choice of such control group will be, in order of preference:

1) Fleet of the same company operating simultaneously with the project activity;
2) Fleet of company with similar operations operating simultaneously with the project activity;
3) Host country statistics;
4) IPCC or other international data.

Under this option specific fuel consumption is monitored throughout the project crediting period thus gradual efficiency improvements of the fleet or gradual deterioration of driving conditions would automatically be incorporated into the project efficiency levels. The technology improvement factor IRT must in case of using this option not be applied in equation (3) to determine emission factor for baseline vehicles.

Option (5): Existing statistics

If none of the above options apply due to lack of data, other public available existing statistics could be used as industry default values, such as host country statistics (released by transportation department or other authorities), IPCC or other international data

8.2 Project Emissions

Project emissions include the electricity and fossil fuel consumption associated with the operation of project vehicles / mobile machinery and shall be calculated as follows:

Electricity emissions

$$PEE_y = \sum_i EC_{PJ,i,y} \times GEF_y$$ Equation (4)

Where:

PEE_y = Total project emissions from electricity usage in year *y* (tCO_2)

$EC_{PJ,i,y}$ = Electricity consumed by project vehicle / mobile machinery category *i* in year *y* (MWh)
GEF_y = Grid emission factor in year y (tCO_2/MWh)
Electricity consumed by project vehicles / mobile machinery can be based on total consumption statistics or through the following equation:

$$EC_{PJ,i,y} = SEC_{PJ,i,y} \times SU_{PJ,i,y} \times N_{PJ,i,y} \times 10^{-3} \quad \text{Equation (5)}$$

Where:
$EC_{PJ,i,y}$ = Electricity consumed by project vehicle / mobile machinery category *i* in year *y* (MWh)
$SEC_{PJ,i,y}$ = Specific electricity consumption factor for project vehicle / mobile machinery category *i* in year *y* (kWh/km for vehicles and kWh/h for mobile machinery)
$SU_{PJ,i,y}$ = Services units of project vehicle / mobile machinery category *i* in year *y* (average annual distance in km for vehicles and average operating hours for mobile machinery)
$N_{PJ,i,y}$ = Number of operational project vehicles / mobile machinery in category *i* in year *y*

The grid emission factor is established as:

$$GEF_y = \frac{EF_{elec,y}}{(1-TDL_y)} \quad \text{Equation (6)}$$

Where:
GEF_y = Grid emission factor in year *y* (tCO_2/MWh)
$EF_{elec,y}$ = Emission factor for electricity consumption in year *y* (tCO_2/MWh)
TDL_y = Average technical transmission and distribution losses for providing electricity in the year *y*

Fossil fuel emissions

$$PEF_y = \sum_i FC_{PJ,i,y} \times NCV_i \times EFCO2_i \times 10^{-6} \quad \text{Equation (7)}$$

Where:
PEF_y = Total project emissions from fossil fuel usage in year *y* (tCO_2)
$FC_{PJ,i,y}$ = Fossil fuel consumed by project vehicle / mobile machinery category *i* in year *y* (kg)
NCV_i = Net calorific value of fossil fuel consumed by project vehicle/ mobile machinery category *i* (MJ/kg)
EFCO2i = CO2 emission factor of fossil fuel consumed by project vehicle / mobile machinery category i (gCO2/MJ)

Fossil consumed by project vehicle or mobile machinery can be based on total consumption statistics or through the following equation:

$$FC_{PJ,i,y} = SFC_{PJ,i,y} \times SU_{PJ,i,y} \times N_{PJ,i,y} \times 10^{-3} \quad \text{Equation (8)}$$

Where:

$FC_{PJ,i,y}$ = Fossil fuel consumed by project vehicle / mobile machinery category *i* in year *y* (kg)
$SFC_{PJ,i,y}$ = Specific fuel consumption factor for project vehicle / mobile machinery category *i* in year *y* (vehicles g/km and mobile machinery g/h)
$SU_{PJ,i,y}$ = Services units of project vehicle / mobile machinery category *i* in year *y* (vehicle in km and mobile machinery in h)
$N_{PJ,i,y}$ = Number of operational project vehicle / mobile machinery in category *i* in year *y*

Total project emissions

$$PE_y = PEE_y + PEF_y \quad \text{Equation (9)}$$

Where:
PE_y = Total project emissions in year *y* (tCO_2)
PEE_y = Total project emissions from electricity usage in year *y* (tCO_2)
PEF_y = Total project emissions from fossil fuel usage in year *y* (tCO_2)

8.3 Leakage Emissions

No change from AMS-III.C.

8.4 Net Reductions and Removals

No change from AMS-III.C.

9 MONITORING

Project proponents must follow the monitoring procedures of the latest version of AMS-III.C and apply the changes indicated in this section.

9.1 Data and Parameters Available at Validation

This refers to the parameters NCV, EFCO2 and IR. Project proponents must follow the procedure provided in the latest version of AMS-III.C.

9.2 Data and Parameters Monitored

Project proponents must follow the procedure provided in the latest version of AMS-III.C and apply the changes indicated in this section. Changes are relative to inclusion of mobile machinery for the following parameters

Data/Parameter 1:

Data / Parameter:	$SU_{PJ,l,y}$
Data unit:	Vehicles: kilometer mobile machinery: hours
Description:	Services units of project vehicle / mobile machinery category *i* in the year *y*
Source of data:	Measurement
Measurement procedures (if any):	Measure the annual service units by the project vehicles / mobile machinery through: Option (A): monitoring of all vehicles / mobile machinery units or Option (B): representative sample survey of vehicles / mobile machinery for each vehicle / mobile machinery category. Sample units shall be chosen in accordance with the latest version of the "Guidelines for sampling and surveys for CDM project activities and programme of activities" using a 90 per cent confidence interval and +/- 10 per cent precision to determine the sample size. The lower bound of 90 per cent confidence interval shall be used as the annual service units
Any comment:	-

Data / Parameter table 1.

Data / Parameter:	$SEC_{PJ,l,y}$
Data unit:	Vehicles: kWh/km Mobile machinery: kWh/h
Description:	Specific electricity consumption per unit of service of project vehicle / mobile machinery category *i* in year *y*
Source of data:	Measurement
Measurement procedures (if any):	Measure the specific electricity consumption through: Option (A): monitor electricity consumption of all project vehicles / mobile machinery or Option (B): measure the specific electricity consumed for a representative sample of each vehicle / mobile machinery category. Sample vehicles / mobile machinery shall be chosen in accordance with the latest version of the "Guidelines for sampling and surveys for CDM project activities and programme of activities" using a 90 per cent confidence interval and +/- 10 per cent precision to determine the sample size. The upper bound of 90 per cent confidence interval shall be used for the specific electricity consumed. Cross-checked against vehicle specifications of specific energy consumption provided by the manufacturers and use the highest of the two values.
Any comment:	-

Data / Parameter table 2.

Data / Parameter:	**$SFC_{PJ,i,y}$**
Data unit:	Vehicles: g/km Mobile machinery: g/h
Description:	Specific fuel consumption factor for project vehicle/ mobile machinery category *i* in year *y*
Source of data:	Measurement
Measurement procedures (if any):	Measure the specific fossil fuel consumption through: Option (A): monitor consumption of all project vehicles / mobile machinery or Option (B): measure the specific fossil fuels consumed for a representative sample of each vehicle / mobile machinery category. Sample vehicles / mobile machinery shall be chosen in accordance with the latest version of the "Guidelines for sampling and surveys for CDM project activities and programme of activities" using a 90 per cent confidence interval and +/- 10 per cent precision to determine the sample size. The upper bound of 90 per cent confidence interval shall be used for the specific fuel consumed. Cross-checked against vehicle specifications of specific fuel consumption provided by the manufacturers and use the highest of the two values
Any comment:	-

Data parameters 6, 7, 8 and 9 replace the term "vehicle(s)" with the term "vehicle(s) / mobile machinery"

9.3 Description of the Monitoring Plan

All monitoring requirements of the most recent version of *AMS-III.C.* must be followed.