CDM-MP77-A10

Draft Small-Scale Methodology

AMS-III.XX.: Efficient operation of public transportation

Version 02.0

Sectoral scope(s): 07

DRAFT

United Nations
Framework Convention on
Climate Change

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

COVER NOTE

1. Procedural background

1. The Executive Board of the clean development mechanism (CDM) (hereinafter referred to as the Board), at its one-hundredth meeting (EB 100 report, paragraph 43), while considering the draft new methodology "AMS.III.XX: Efficient Operation of Public Transportation", requested the Methodologies Panel (MP) to further work on the methodology in order to address potential uncertainties with regard to the baseline estimation (e.g. external factors not under the control of the project proponent that positively or negatively influence the calculated emission reduction). In doing so the MP shall take into account feedback provided by the Board and propose simplified but reliable methods for determining the emission reductions.

2. Purpose

2. The purpose is to address the concerns expressed by the Board's at its one-hundredth meeting, as outlined above.

3. Key issues and proposed solutions

3. In the method considered at the Board's one-hundredth meeting, baseline emissions were determined using historical data or data from a baseline campaign of operation of the baseline route including passenger-kilometres and the fuel and electricity consumed by the buses in the baseline route; project emissions were determined based on the amount of fuel and electricity monitored in the project scenario. However, this approach may not prevent a situation where the emissions changes that are not within the control of to the project from being counted, resulting in potential overestimation or underestimation of emission reductions.[1]

4. In order to address the issues explained above, the MP recommends to adjust the baseline emissions by a Baseline Adjustment Factor parameter (BAF_y). This factor represents changes observed during the crediting period not related to the project and that would affect the baseline (such as replacing the fleet of buses by more efficient vehicles, introducing new electric buses, etc., increasing congestion).

4. Impacts

5. The proposed new methodology will broaden the portfolio of methodological standards in the area of passenger transportation.

---

[1] For example, the replacement of the baseline vehicles by more efficient ones in the project scenario would result in an overestimation of emission reductions (calculated baseline emissions would too high), or the degradation of the pavement of the road in the project scenario leading to an underestimation of emission reductions (calculated baseline emissions would be too low).

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

5. Subsequent work and timelines

6. The methodology is recommended by the MP for consideration by the Board at its one-hundred-first meeting. No further work is envisaged.

6. Recommendations to the Board

7. The MP recommends that the Board adopt this draft methodology, to be made effective at the time of the Board's approval.

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

TABLE OF CONTENTS   **Page**

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

1. Introduction

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

Table 1. Methodology key elements

Typical projects	Implementation of measures to improve the operation of buses used for public transportation such as ITS (Intelligent Transportation Systems) and changes/improvements in bus routes, without reducing the level of service
Type of GHG emissions mitigation action	Energy efficiency: Reduction in the consumption of fossil fuels per passenger transported

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology applies to project activities that implement measures that improve the efficiency of operation of public transportation by buses, such as use of Intelligent Transportation System (ITS) measures and/or improvements in bus routes (e.g. re-design of routes, implementation of priority lanes that are not part of a Bus Rapid Transit (BRT) system, use of high quality pavement, construction of viaducts/tunnels, express service connecting only high demand stops during peak hours).

2.2. Applicability

3. The methodology is applicable to project activities that improve the operation of public transportation by buses by implementing one or more of the following measures (stand-alone or in combination) to one or more bus routes:

(a) Implementation of ITS measures to improve the operation of buses;

(b) Changes/improvements in bus routes that allow for a more efficient journey between the origin and final destination. The interventions can be:

(i) Re-design of bus routes;

(ii) Construction of viaducts, tunnels or other improvements for the purpose of improving the infra-structure of dedicated bus lanes that are not part of a BRT system, eliminating traffic lights or roundabouts and improving the traffic flow of buses;

(iii) Implementation of priority lanes for buses that are not part of a BRT system;

(iv) Implementation of an express service connecting high demand stops by reducing the number of intermediate stops during peak hours;

(v) Implementation of a bus queue jump lane;

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

(vi) ~~Introduction of higher-quality pavement in existing dedicated bus routes;~~

(vii) Rehabilitation of the pavement of the existing dedicated bus routes/lanes with high-quality pavement.

4. The project activity shall not reduce the number of passengers travelling on the affected bus route(s), as compared to the baseline. The number of passengers that are travelling during the crediting period are monitored and used for the purpose.

5. The applicability conditions included in the tools referred to below shall also apply.

6. The methodology is not applicable to buses operating on BRTs.

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

2.1. Entry into force

8. The date of entry into force is the date of the publication of the EB XX meeting report on DD Month YYYY.

2.2. Applicability of sectoral scopes

9. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, application of sectoral scope 07 is mandatory.

3. Normative references

10. The methodology also refers to the latest approved version of the following methodological tools, standards and guidelines:

(a) "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation";

(b) "TOOL07: Tool to calculate the emission factor for an electricity system";

(c) "TOOL11: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period";

(d) "TOOL21: Demonstration of additionality of small-scale project activities";

(e) "Standard: Sampling and surveys for CDM project activities and programme of activities";

(f) "Guideline: Sampling and surveys for CDM project activities and programmes of activities".

11. For more information regarding the approved methodologies and the tools as well as their consideration by the Executive Board (hereinafter referred to as the Board) of the clean development mechanism (CDM) please refer to <http://cdm.unfccc.int/goto/MPappmeth>.

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

4. Definitions

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

13. For the purpose of this methodology the following definitions apply:

(a) **Baseline route -** the route driven by buses before the implementation of the project. For project activities that involve the re-design of bus routes, the baseline route is the former bus route that was replaced by the project route. For project activities that implement other measures, the baseline route is the project route itself before the implementation of the measures;

(b) **Bus rapid transit (BRT) system -** is a bus-based urban or sub-urban passenger transit service system that uses dedicated bus lanes as trunk routes with busways and stations- often aligned to the center of the road-, off-board fare collection, and operates at high levels of performance, especially with regard to travel times and passenger carrying capacity;

(c) **High-quality pavement -** a pavement with a minimum thirty-year life span that can be of asphalt, jointed plain concrete pavement (JPCP) or continuously reinforced concrete pavement (CRCP);

(d) **Intelligent Transportation System (ITS) -** ITS is an operational system of technologies that, when combined and managed, improve the operating capabilities of the overall system (e.g. sensors installed in buses and in roads that detect buses approaching a crossroad and gives a traffic light priority for the buses);

(e) **Priority lane for buses -** lanes implemented on roads for the dedicated use of buses. These lanes can operate through the day or during peak-hours only. Differently from a BRT, these lanes do not serve as trunk routes;

(f) **Project route -** the route driven by buses after the implementation of the project. Depending on the type of measure implemented, the project route may be longer than, equal to or shorter than the baseline route;

(g) **Queue jump lane -** reserved bus lanes located at intersections with a dedicated traffic light that allow buses to move before other vehicles, avoiding long queues;

(h) **Viaduct** – a bridge that carries a road over another road or railway, in order to reduce disturbances to vehicle flow.

5. Baseline methodology

5.1. Project boundary

14. The project boundary includes the routes in which project changes/improvements and measures are applied.

15. CO_2 emissions from the buses (fossil fuel and/or electric) that operate in the baseline and project routes are included. N_2O and CH_4 emissions are excluded from the project boundary as the amount of these emissions is considered not significant.

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

5.2. Baseline scenario

16. The baseline scenario is assumed to be the continued operation of the buses in the baseline route(s) without the implementation of the project activity.

5.3. Demonstration of additionality

17. The project activity is additional if it is demonstrated, through the application of "TOOL21: Demonstration of additionality of small-scale project activities", that at least one barrier would prevent the implementation of the project.

5.4. Baseline emissions

18. Baseline emissions are calculated as the amount of CO_2 emitted per passenger-kilometre transported in the absence of the measures (tCO2/pkm) in each baseline route *k-BL* included in the project boundary, following the equation below:

$$BE_y = \sum_k BAF_{k,y} \times P_{k,y} \times AVD_{k,y} \times EF_{CO2,PKM,k-BL}$$

Equation (1)

Where:

BE_y	=	Baseline emissions in year *y* (tCO2)
$BAF_{k,y}$	=	Baseline adjustment factor for route *k* in year y (fraction)
$P_{k,y}$	=	Total passengers transported by the buses in the project route *k* in year *y* (passengers)
$AVD_{k,y}$	=	Average distance travelled by the passengers in the project route *k* in year *y* (km). If the project route *k* is longer than the baseline route, this parameter is capped as the length of the baseline route
$EF_{CO2,PKM,k-BL}$	=	CO_2 emission factor per passenger-kilometre from the baseline route *k-BL* (tCO2/pkm)

19. The parameter $BAF_{k,y}$ represents changes observed in route *k* during the crediting period not related to the project activity that could affect the baseline (such as replacing the fleet of buses by more efficient vehicles, introducing new fuel efficient fossil fuel or electric buses), and is determined based on the equation below:

$$BAF_{k,y} = \frac{EF_{CO2,VKM,k,y}}{EF_{CO2,VKM,k,1}}$$

Equation (2)

Where:

$EF_{CO2,VKM,k,y}$	=	CO_2 emission factor per vehicle-kilometre in project route *k* in year *y* of the crediting period (tCO2/vkm), calculated using equation 6
$EF_{CO2,VKM,k,1}$	=	CO_2 emission factor per vehicle-kilometre in project route *k* observed for year 1 of the crediting period (tCO2/vkm), calculated using equation 6

20. The parameter $EF_{CO2,PKM,k-BL}$ can be determined either using historical data or through a baseline campaign. In both options, if fuel switching takes place during the crediting

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

period, the baseline emission factor shall be adjusted based on the fuel used in the project situation. [2]following requirements apply:

(a) The baseline emissions need to be adjusted in case there are circumstances such as historical trend of steadily increasing (or decreasing) operational efficiency in passenger-kilometre (for example due to exogenous increases in traffic congestion), changes in fuel type, significant change in maintenance practices and fleet replacement; and

(b) If fuel switching takes place during the crediting period, the baseline emission factor shall be adjusted based on the fuel used in the project situation.[3]

5.4.1. Option 1: Historical Data

21. Under this option, the emission factor is calculated using the most recent three years of historical data[4] based on the number of passenger-kilometres transported on each baseline route *k-BL*, type and quantity of fossil fuels consumed by the buses travelling in each baseline route *k-BL,* and quantity of electricity consumed by the buses travelling on the baseline route *k-BL* and CO_2 emission factor of the electric grid.

$$EF_{CO2,PKM,k-BL} = \frac{\sum_i\left(FC_{i,k-BL} \times NCV_i \times EF_{CO2,i}\right) + \frac{EC_{m,k-BL} \times EF_{grid,CO2}}{\left(1 - TDL_{grid,BL}\right)}}{PKM_{k-BL}}$$

Equation (3)

Where:

$EF_{CO2,PKM,k-BL}$ = CO_2 emission factor per passenger-kilometre from the baseline route *k-BL* that is replaced by the project route *k* (tCO₂/pkm)

$FC_{i,k-BL}$ = Total amount of fossil fuel type *i* consumed by the buses driving in the baseline route *k-BL* in the three years[4] prior to the start date of the project activity (mass or volume units)

NCV_i = Net calorific value of the fuel type *i* (GJ/mass or volume units)

$EF_{CO2,i}$ = CO_2 emission factor of the fuel type *i* (tCO2/GJ)

PKM_{k-BL} = Total passenger-kilometres transported in the baseline route *k-BL* by both electric and fossil-fuel buses in the three years[4] prior to the start date of the project activity (passenger-kilometres)

$EC_{m,k-BL}$ = Total electricity consumed by electric buses m driving on the baseline route *k-BL* in the three years[4] prior to the start date of the project activity (MWh)

$EF_{grid,CO2}$ = CO_2 emission factor of the electric grid that supplies electricity to the electric bus *m* (tCO₂/MWh)

---

[2] For example, if the buses switch from diesel to natural gas during the crediting period, the baseline emission factor is re-calculated on the basis of natural gas.

[3] For example, if the buses switch from diesel to natural gas during the crediting period, the baseline emission factor is re-calculated on the basis of natural gas.

[4] A minimum of one year of data can be used if three years of operational data are not available.

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

| $TDL_{grid,BL}$ | = | Average technical transmission and distribution losses for providing electricity to grid in the baseline (%) |

5.4.2. Option 2: Baseline Campaign

22. This option is only allowed if one full year of historical data is not available.

23. Under this option, the CO_2 emission factor per passenger-kilometre for the baseline route *k-BL* is calculated using Equation 2 above, where the parameters PKM_{k-BL}, $FC_{i,k-BL}$ and $EC_{m,k-BL}$ are determined through a survey following the latest version of the "Standard: Sampling and surveys for CDM project activities and programme of activities" and the "Guideline: Sampling and surveys for CDM project activities and programmes of activities".

24. The baseline campaign shall be conducted through an entire week that corresponds neither to a public holiday nor school vacations, and shall be representative of the typical demand for transport services, and the fuel consumption of the baseline route *k-BL* in the considered year[5].

5.5. Project emissions

25. Project emissions are the sum of the emissions from each project route *k* included in the project activity, and the emissions in each route *k* is calculated based on the amount of fuel and electricity consumed by the buses travelling in the route, as indicated in the ~~determined based on the amount of fuel and electricity consumed by the vehicles traveling in the project route, as indicated by the~~ equation below:

$$PE_y = \sum_k PE_{k,y} \sum_i \left(FC_{i,k,y} \times NCV_i \times EF_{CO2,i}\right) + \sum_m \left[EC_{m,pr,y} \times EF_{grid,CO2} \times \left(1 + TDL_{grid,y}\right)\right]$$

Equation (4)

Where:

| PE_y | = | Project emissions in year *y* (tCO₂) |
| $PE_{k,y}$ | = | Project emissions in project route *k* in year *y* (tCO₂) |

26. The emissions in each project route *k* is determined based on the equation below:

$$PE_{k,y} = \sum_i \left(FC_{i,k,y} \times NCV_i \times EF_{CO2,i}\right) + \frac{EC_{k,y} \times EF_{grid,CO2}}{1 - TDL_{grid,y}}$$

Equation (5)

Where:

$FC_{i,k,y}$	=	Total amount of fossil fuel type *i* consumed by the buses driving in project route *k* in year *y* (mass or volume units/year)
NCV_i	=	Net calorific value of fuel type *i* (GJ/mass or volume units)
$EF_{CO2,i}$	=	CO_2 emission factor of fuel type *i* (tCO₂/GJ)

---

[5] E.g. by taking into account road and weather conditions, traffic, as well as variations in occupancy and trip distances etc. related to e.g. school year, vacation period, weekends.

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

$EC_{m,k,y}$	=	Total amount of electricity consumed by all the electric buses m driving onin the project route -k in year -y (MWh/year)
$EF_{grid,CO2}$	=	CO_2 emission factor of the electric grid that supplies electricity to the electric buses m (tCO_2/MWh)
$TDL_{grid,y}$	=	Average technical transmission and distribution losses for providing electricity to grid in year y (%)

27. Parameter $EF_{CO2,VKM,k,y}$, required to determine the baseline adjustment factor in equation 2, is calculated for each project route k every year, by applying the equation below:

$$EF_{CO2,VKM,k,y} = \frac{PE_{k,y}}{VKM_{k,y}}$$

Equation (6)

Where:

$PE_{k,y}$	=	Project emissions in the project route k in year y (tCO_2e), determined based on equation 5
$EF_{CO2,VKM,k,y}$	=	CO_2 emission factor per vehicle-kilometre in project route k in year y (tCO_2/vkm)
$VKM_{k,y}$	=	Total vehicle-kilometres travelled by buses in project route k in year y (vkm)

28. Parameter $EF_{CO2,VKM,k,1}$, required to determine the baseline adjustment factor in equation 2, is determined by applying equation 6 for year 1 only.

5.6. Leakage

29. No leakage needs to be accounted.

5.7. Emission Reductions

30. Emission reductions are calculated following the equation below:

$$ER_y = BE_y - PE_y$$

Equation (7)

Where:

| ER_y | = | Emission reductions in year y (tCO_2) |

5.8. Changes required for methodology implementation in 2nd and 3rd crediting periods

31. Project participants shall apply the latest approved version of "TOOL11: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period".

5.9. Data and parameters not monitored

32. In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

Data / Parameter table 1.

Data / Parameter:	$FC_{i,k\text{-}BL}$
Data unit:	Mass or volume units~~Tonnes~~
Description:	Total amount of fossil fuel type i consumed by the buses driving on the baseline route $k\text{-}BL$ in the three years[4] prior to the start date of the project activity
Source of data:	If Option 1 - Historical Data is selected, the data shall be the total fuel consumed prior to the start date of the project activity (3 years or minimum of 1 year) and shall be sourced from official statistics or from the bus operator.
	If Option 2 - Baseline Campaign is selected the data sourced shall be the total fuel consumed during the campaign.~~, extrapolated to yearly basis.~~
Measurement procedures (if any):	If Option 2 - Baseline Campaign is selected, the latest version of the "Standard: Sampling and surveys for CDM project activities and programme of activities" and the "Guideline: Sampling and surveys for CDM project activities and programmes of activities" shall be followed.
Any comment:	The information shall be cross-checked against fuel purchase receipts

Data / Parameter table 2.

Data / Parameter:	$EC_{\cancel{m,}k\text{-}BL}$
Data unit:	MWh
Description:	Total electricity consumed by the electric bus**es** ~~m~~ driving in the baseline route $k\text{-}BL$ in the three years[4] prior to the start date of the project activity
Source of data:	If Option 1 - Historical Data is selected, the data shall be the total electricity consumed prior to the start date of the project activity (3 years or minimum of 1 year) and shall be sourced from official statistics or from the bus operator.
	If Option 2 – Baseline Campaign is selected the data sourced shall be the total electricity consumed during the campaign.~~, extrapolated to yearly basis~~
Measurement procedures (if any):	If Option 2 – Baseline Campaign is selected, the latest version of the "Standard: Sampling and surveys for CDM project activities and programme of activities" and the "Guideline: Sampling and surveys for CDM project activities and programmes of activities" shall be followed.
Any comment:	The data source are electric charging records of the electricity charging station.
	The information shall be cross-checked against specific electricity consumption and distance travelled or against invoices from electricity charging station.

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

Data / Parameter table 3.

Data / Parameter:	PKM_{k-BL}
Data unit:	Passenger-kilometres
Description:	Total passenger-kilometres transported in the baseline route *k-BL* by both electric and fossil-fuel buses in in the three years[4] prior to the start date of the project activity
Source of data:	If Option 1 – Historical Data is selected, the data shall be the total number of passenger-kilometres travelling in the baseline route prior to the start date of the project activity (3 years or minimum of 1 year) and shall be sourced from official statistics or from the bus operator. If Option 2 – Baseline Campaign is selected the data sourced shall be the total passengers-kilometres transported during the campaign, extrapolated to yearly basis.
Measurement procedures (if any):	If Option 2 – Baseline Campaign is selected, the latest version of the "Standard: Sampling and surveys for CDM project activities and programme of activities" and the "Guideline: Sampling and surveys for CDM project activities and programmes of activities" shall be followed.
Any comment:	The information shall be cross-checked against electronic ticketing system or other official record. An alternative to determine this parameter based on historical data is by multiplying the number of passengers transported on both electric and fossil-fuel busses by the average distance travelled by each passenger. The passengers transported and the average distance travelled shall be determined based on electronic ticketing system or other official records or statistics. This parameter needs to be compared with the monitored passengers transported in the project activity in order to check the compliance with the requirements of paragraph 4.

Data / Parameter table 4.

Data / Parameter:	$TDL_{grid,BL}$
Data unit:	%
Description:	Average technical transmission and distribution losses for providing electricity to grid in the baseline (%)
Source of data:	As per "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
Measurement procedures (if any):	As per "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
Any comment:	-

6. Monitoring Methodology

33. In addition to the parameters listed in the tables below, the provisions on data and parameters monitored in the tools referred to in this methodology apply.

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

Data / Parameter table 1.

Data / Parameter:	$P_{k,y}$
Data unit:	Passengers
Description:	Total passengers transported in the project route k in year y
Source of data:	Project system operator, based on electronic ticketing system or any other official records
Measurement procedures (if any):	
Monitoring frequency:	Measured at the entry point of passengers on the buses travelling on the project route k. Data to be consolidated annually
QA/QC procedures:	-
Any comment:	If this parameter is determined based on sampling, the latest version of the "Standard: Sampling and surveys for CDM project activities and programme of activities" and the "Guideline: Sampling and surveys for CDM project activities and programmes of activities" shall be followed. This parameter needs to be compared with the passengers transported in the baseline route in order to check the compliance with the requirements of paragraph 4

Data / Parameter table 2.

Data / Parameter:	$AVD_{k,y}$
Data unit:	km
Description:	Average distance travelled by passengers in the project route k
Source of data:	Survey
Measurement procedures (if any):	Survey of the project passengers in year 1 and 4 of the first crediting period to determine~~asking about~~ the entry and exit bus stops on the project routes k through face-to-face interviews or by using other appropriate survey modes (e.g. using GPS data)
Monitoring frequency:	Year 1 and Year 4 of the crediting period
QA/QC procedures:	-
Any comment:	If the project route is longer than the baseline route, this parameter is capped as the length of the baseline route

Data / Parameter table 3.

Data / Parameter:	$FC_{i,k,y}$
Data unit:	Mass or volume units of fuel
Description:	Total amount of fossil fuel type i consumed by the buses driving in the project route k in year y
Source of data:	Operator of the bus
Measurement procedures (if any):	Based on fuelling station reports
Monitoring frequency:	Measured when the buses are refuelling the tank.
QA/QC procedures:	The amount of fuel consumed shall be cross-checked against purchase receipts

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

Any comment:	-

Data / Parameter table 4.

Data / Parameter:	NCV_i
Data unit:	GJ/mass or volume units
Description:	Net calorific value of the fuel type i
Source of data:	In order of preference: (a) Provided in invoices from the fuel supplier; (b) Measured using a sample of fuel stations, if (a) is not available; (c) Regional or national default values, if (a) is not available and only applicable for liquid fuels; (d) IPCC default values[6]
Measurement procedures (if any):	For (a) and (b): measurements shall be undertaken in line with national or international fuel standards

Monitoring frequency:	For (a) and (b): the NCV shall be obtained for each fuel delivery, from which weighted average annual values shall be calculated.
	
	For (c): review the appropriateness of the values annually.
	
	For (d): any future revision of the IPCC Guidelines shall be taken into account

QA/QC procedures:	Verify if the values under (a), (b) and (c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range, collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in (a), (b) or (c) shall have ISO17025 accreditation or justify that they can comply with similar quality standards
Any comment:	-

Data / Parameter table 5.

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tCO_2e/GJ
Description:	CO_2 emission factor of the fuel type i

---

[6] Use the lower bound of the 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

Source of data:	In order of preference: (a) Provided in invoices from the fuel supplier; (b) Measured using a sample of fuel stations, if (a) is not available; (c) Regional or national default values, if (a) is not available and only applicable for liquid fuels; (d) IPCC default values[7]

Measurement procedures (if any):	For (a) and (b): measurements shall be undertaken in line with national or international fuel standards.
	
	For (a): if fuel suppliers provide the NCV value and the CO_2 emission factor on the invoices and these two values are based on measurements for this specific fuel, this CO_2 factor shall be used. If another source for the CO_2 emission factor is used or no CO_2 emission factor is provided, options (b), (c) or (d) shall be used

Monitoring frequency:	For (a) and (b): the CO_2 emission factor shall be obtained for each fuel delivery, from which weighted average annual values shall be calculated.
	
	For (c): review the appropriateness of the values annually.
	
	For (d): any future revision of the IPCC Guidelines shall be taken into account

QA/QC procedures:	-
Any comment:	-

Data / Parameter table 6.

Data / Parameter:	$EC_{\overline{m}k,y}$
Data unit:	kWh
Description:	Total amount of electricity consumed by the electric buses ~~m~~ driving in the project route k in year y
Source of data:	Electric charging records at the electricity charging station
Measurement procedures (if any):	As per the latest version of "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation". When applying the tool, requirements for $EC_{PJ,grid,y}$ specified in the tool shall apply to electricity consumed form the grid
Monitoring frequency:	Measured when the buses are recharged.
QA/QC procedures:	As per "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
Any comment:	The data source are the electric charging records ~~of~~ at the electricity charging station. The information shall be cross-checked against specific electricity consumption and distance travelled or against invoices from electricity charging station.

---

[7] Use the lower bound of the 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

Data / Parameter table 7.

Data / Parameter:	$EF_{grid,CO2}$
Data unit:	tCO2e/MWh
Description:	CO_2 emission factor of the electric grid that supplies electricity to the electric bus m
Source of data:	Determined following the steps from the "TOOL07: Tool to calculate the emission factor for an electricity system"
Measurement procedures (if any):	As per the "TOOL07: Tool to calculate the emission factor for an electricity system"
QA/QC procedures:	As per the "TOOL07: Tool to calculate the emission factor for an electricity system"
Any comment:	Applicable if the monitoring option selected is ex-post

Data / Parameter table 8.

Data / Parameter:	$TDL_{grid,y}$
Data unit:	%
Description:	Average technical transmission and distribution losses for providing electricity to the grid in year y
Source of data:	As per "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
Measurement procedures (if any):	As per "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
Monitoring frequency:	As per "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
QA/QC procedures:	As per "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation"
Any comment:	-

Data / Parameter table 9.

Data / Parameter:	$EF_{CO2,VKM,k,y}$
Data unit:	tCO_2/vkm
Description:	CO_2 emission factor per vehicle-kilometre in project route k in year y
Source of data:	Calculated
Measurement procedures (if any):	-
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

CDM-MP77-A10
Draft Small-Scale Methodology: AMS-III.XX.: Efficient operation of public transportation
Version 02.0
Sectoral scope(s): 07

Data / Parameter table 10.

Data / Parameter:	$VKM_{k,y}$
Data unit:	vkm
Description:	Total vehicle-kilometres travelled in project route k by both electric and fossil-fuel buses in year y
Source of data:	Bus operator, based on the odometer of the buses travelling in the project route k.
Measurement procedures (if any):	-
Monitoring frequency:	Distance travelled by each bus shall be measured continuously and recorded daily by the bus operator.
QA/QC procedures:	The odometer of each bus travelling in project route k shall be recorded at the start and at the end of each day for cross-checking.
Any comment:	The total distance travelled can be cross-checked by multiplying the number of trips that each bus travelled in project route k by the length of the route.

- - - - -

Document information

Version	Date	Description
02.0	18 October 2018	MP 77, Annex 10
		To be considered by the Board at EB 101. This version incorporates the input and guidance provided by the Board (EB100).
01.0	20 June 2018	MP 76, Annex 7 To be considered by the Board at EB100. The draft version of this document (CDM-MP74-A02) was available for public input from 24 October to 7 November 2017. It received no inputs.

Decision Class: Regulatory
Document Type: Standard
Business Function: Methodology
Keywords: simplified methodologies, transport, type (iii) projects, urban