



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 SSC CDM methodologies and information on additionality (attachment A to Appendix B) provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> *mutatis mutandis*.

III.S. Introduction of low-emission vehicles/technologies to commercial vehicle fleets

Technology/measure

1. This methodology is for project activities introducing low-greenhouse gas emitting vehicles for commercial passenger (including public transportation), material and freight transport, operating on a number of identified fixed routes with comparable conditions.¹ Retrofitting of existing vehicles (e.g. switching from high greenhouse gas intensive to low greenhouse gas intensive fossil fuel) is also included in the methodology.

2. Types of low-emission vehicles to be introduced include but not limited to:
 - Compressed natural gas (CNG) vehicles;
 - Electric vehicles;
 - Liquid petroleum gas (LPG) vehicles;
 - Hybrid vehicles with electrical and internal combustion motive systems.
3. Types of vehicles covered by the methodology include but not limited to:
 - Buses, jeepneys, commuter vans and tricycles for public transport;
 - Trucks for freight transport, waste collection or other services with regular routes.
4. Project participants must demonstrate that:
 - The project activity is unlikely to change the level of service provided on each route before the project activity;²
 - ~~There is no significant change in tariff discernible from their natural trend, which could lead to change in patterns of vehicle use;~~
 - The project activity does not include measures to bring about a modal switch (e.g. shift from bus transport to underground train system) in transport.
5. Project participants shall identify the following parameters:
 - The fixed routes along which the vehicles operate;
 - The distances and characteristics³ of those routes;

¹ Comparable routes are routes with similar traffic conditions and terrain in the same city or region (e.g. traffic density of the route and average speed of vehicles).

² That is by showing that the frequency of operations is not decreased by the project activity, the characteristics of the travel route - distance, start and end points and the route itself and/or that the capacity introduced by the project activity is sufficient to service the level of passenger/freight transport previously provided.

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

III.S. Introduction of low-emission vehicles to commercial vehicle fleets (cont)

- The level of service on each route, for example the average/total number of passengers or tonnage transported and the average distance the passengers or freight was transported on that route on an annual basis;
 - The vehicles that are in use on that each fixed route before and after project implementation.
6. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO₂ equivalent annually.

Boundary

7. The project boundary includes the following:
- Fleet to which low emission vehicles are introduced;
 - The geographical area covering the fixed physical routes along which these vehicles operate (start to end point);
 - Auxiliary facilities such as fuelling stations, workshops and service stations that are visited by the vehicles in the fleet.

The conditions which govern the operation of the fleet (e.g. tariffs, regulations) should be homogeneous within the project boundary.

Baseline

8. The first step to determine the baseline emissions is to calculate a baseline emission factor per passenger or per tonne of goods per kilometre for the baseline vehicle (BEF_i). The baseline emission factor is determined by dividing the emissions from the total annual distance travelled by each baseline vehicle before the project begins (D_i) by the total annual passengers or volume of goods transported by each baseline vehicle (P_i) times the annual average distance of transportation per person or tonne before the project begins.

$$BEF_i = \frac{\sum_j \sum_l D_i * \eta_{BLV_i} * NCV_j * EF_{CO_2,j}}{P_i * dp_i} \quad (1)$$

Where:

- BEF_i Baseline emission factor per passenger or ton of goods per kilometre for the baseline vehicle i (tCO₂/passenger km or tCO₂/ton km)
- P_i Total annual passengers or tons of goods transported by each baseline vehicle i (passengers or tons)
- dp_i The annual average distance of transportation per person or tonne of freight by each baseline vehicle i (km)

³ That is the following route characteristics may be identified: distance, type of road, average speed, traffic density, patterns of traffic, urban or inter-city routes.



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

III.S. Introduction of low-emission vehicles to commercial vehicle fleets (cont)

D_i	Total annual distance travelled by each baseline vehicle i (km)
η_{BLV_i}	Fuel efficiency of baseline vehicle i (qty of fuel/km, see paragraph 12)
NCV_j	Net calorific value of fuel j (MJ/Unit qty of fuel)
$EF_{CO_2,j}$	CO ₂ emission factor of fuel used by baseline vehicle (tCO ₂ /MJ energy content of fuel, country specific data or IPCC default value)

9. In the baseline calculations the remaining lifetime of the vehicles replaced shall be taken into account in accordance to the guidance provided by the CDM Executive Board (the Board) (EB 22, annex 2).

10. If electricity is used by the vehicles, the associated emissions shall be estimated in accordance with paragraphs of category AMS-I.D as per the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”.

11. The total baseline emissions are calculated on an annual basis using the monitored data as below.

$$BE_y = \sum P_{i,y,k} \times BEF_i \times dp_{i,y} \quad (2)$$

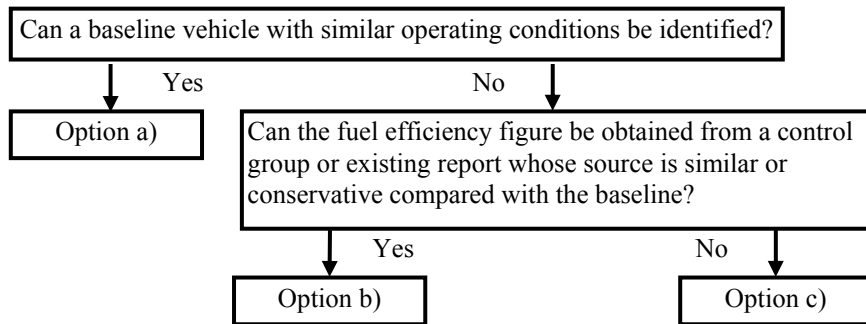
Where:

$P_{i,y,k}$	Total annual passengers or tons of goods transported by each project vehicle i in year y on route k taking into account provisions of paragraph 20
BE_y	Total baseline emissions in year y (tCO ₂ /yr)
$dp_{i,y}$	Annual average distance of transportation per passenger or tonne of goods by project vehicle i in year y (km) taking into account the provisions of paragraph 20

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

III.S. Introduction of low-emission vehicles to commercial vehicle fleets (cont)

12. The baseline vehicle fuel efficiency (η_{BLV}) is determined as follows (in order of preference):



- (a) When a specific baseline vehicle can be identified, i.e. a vehicle used along the same route and therefore with similar operating conditions and this vehicle will not be replaced over the life of the project, the following applies: η_{BLV} is determined from average operational data of the vehicle under baseline operating conditions, using at least one year of operational data, if that data is available. Otherwise data on fuel efficiency can be obtained from manufacturer's specification, if it can be demonstrated that the value is conservative given the operating conditions of the baseline vehicles.

Such cases may include the situations where the project activity is the introduction of new vehicles, and the baseline vehicle is also new and of the same capacity.

- (b) If no specific baseline vehicle can be identified or appropriate operational data is not available, then fuel efficiency should be obtained through a statistically significant control group or existing statistics. Such group or the source of data must have similar or conservative characteristics with respect to vehicle age (equal or newer), traffic conditions (equal or better), and air conditioning. The choice of such control group will be, in descending order:

- Fleet of the same company operating simultaneously with the project activity;
- Fleet of company with similar operations operating simultaneously with the project activity;
- Host country statistics;
- IPCC or other international data.

Under this option fuel efficiency 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.

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

III.S. Introduction of low-emission vehicles to commercial vehicle fleets (cont)

- (c) Other cases. Where neither option (a) or (b) is not feasible then baseline fuel efficiency is determined by using the fuel efficiency of top 20% of the fleet before project activity, as determined according to travel distance of each vehicle for the previous three years. If no data exists for the time period, a shorter period can be chosen, with a minimum period of one year.

Note that under all options (a) till (c), if the identified baseline vehicle does not have air conditioning then the data used should also be from vehicles without air conditioning.

Project Activity Emissions

13. Project emissions are determined by monitoring the consumption of fuel or energy consumed by the vehicles introduced, according to the following formula:

$$PE_y = \sum_j \sum_i FC_{i,j,y} * NCV_j * EF_{CO_2,j,y} \quad (3)$$

Where:

- PE_y Total project emissions in year y (tCO₂/yr)
- $FC_{i,j,y}$ Consumption of fuel j by vehicle i in year y (quantity of fuel)
- NCV_j Net calorific value of fuel j (as obtained by country specific data or IPCC default value)
- $EF_{CO_2,j,y}$ CO₂ emission factor of fuel used by baseline vehicle (tCO₂/energy content of fuel, country specific data or IPCC default value)

14. For electric vehicles, the emissions from the production of electricity used will constitute the project emissions. This will be determined as per the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”. in accordance with the relevant sections of category AMS I.D.

15. For hybrid vehicles that can run on fossil fuels and electricity, the emissions resulting from the fossil fuel use should also be included in the direct emissions, in addition to emissions from electricity used. The emissions from fossil fuel consumption shall be as per the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”.

16. In the case where electric vehicles consuming grid electricity are introduced project activity emissions are calculated as follows:

$$PE_y = \sum_i EC_{i,y} * EF_{elec} \quad (4)$$

Where:

- PE_y Total project emissions in year y (tCO₂/yr)
- $EC_{i,y}$ Consumption of electricity by vehicle i in year y

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

III.S. Introduction of low-emission vehicles to commercial vehicle fleets (cont)

EF_{elec} CO₂ emission factor of electricity, as determined as per the methods of AMS I-D

17. In project activities where the project vehicles have air conditioning whereas the baseline vehicles do not, then leakage of HFC shall be taken into account. If data is available this should be calculated for the specific AC units and operating conditions of the vehicles in questions. Otherwise a default value of 400 kg of CO₂e/year should be used for each vehicle.

Leakage

18. No leakage calculation is required.

Monitoring

19. The following shall be monitored:

Abbr.	Item, unit	Monitoring method / item
$DT_{PJ,i,y,k}$	Total distance travelled by vehicle i in year y on route k (km/yr)	Driver logs and route maps, confirmed by odometer reading
η_{BLVi}	Efficiency of baseline vehicle (quantify of fuel/km)	As detailed in paragraph 12
$FC_{i,j,y}$ $EC_{i,y}$	Consumption of fuel j (or electricity) by vehicle i in year y (quantity of fuel or electricity consumed)	Purchase or consumption records, whose higher value is taken to ensure conservativeness
NCV_j	Net calorific value of fuel j (energy content of fuel/quantity of fuel)	Country specific data or IPCC default value
$EF_{CO2,j,y}$	CO ₂ emission factor of fuel used by project vehicles (tCO ₂ /energy content of fuel)	As per the “Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion”
$EF_{CO2,j}$	CO ₂ emission factor of fuel used by baseline vehicles (tCO ₂ /energy content of fuel)	Country specific data or IPCC default value
EF_{elec}	CO ₂ emission factor of grid electricity used by project vehicle (tCO ₂ /MWh)	As per AMS-I.D procedure and “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”
P_i	Total annual passengers or goods transported by each baseline vehicle	Monitored data before project begins
$P_{i,y,k}$	Total annual passengers or goods transported by each project vehicle in year y on route k	Monitored data during the project e.g. driver logs and route maps, plus sales receipts
D_i	Total annual distance travelled by each baseline vehicle	Monitored data before project begins
dp_i	Annual average distance of transportation per person or tonne of freight by each baseline vehicle i	Monitored through company/operators records

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

III.S. Introduction of low-emission vehicles to commercial vehicle fleets (cont)

Abbr.	Item, unit	Monitoring method / item
$dp_{i,y}$	Annual average distance of transportation per person or tonne of freight by each project vehicle i	Monitored through company/operators records
$D_{k,y}$	Distance of route k in year y	Monitored through company/operators records
$SL_{k,y}$	Service level in terms of total passengers or volume of goods on route k in year y	Monitored for each route, from company/operators records, e.g. driver logs and route maps, plus sales receipts
$SL_{BL,k}$	Service level in terms of total passengers or volume of goods carried on route k before the beginning of project	Determined from company/operators records, e.g. driver logs and route maps, plus sales receipts

20. Service level determined by number of passengers or volume of goods times the average distance of transportation per person or tonne of freight ($SL_{k,y}$) shall be capped at baseline level ($SL_{BL,k}$). Emission reductions beyond this level will not be counted.

Project activity under a programme of activities

The following conditions apply for use of this methodology in a project activity under a programme of activities:

21. In case the project activity involves fossil fuel switching measures leakage resulting from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary shall be considered. The guidance provided in the leakage section of ACM0009 shall be followed in this regard.

22. In case the project activity involves the replacement of equipment, and the leakage effect of the use of the replaced equipment in another activity is neglected, because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. For this purpose scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.

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

III.S. Introduction of low-emission vehicles to commercial vehicle fleets (cont)

Annex 1**(GUIDANCE ON LEAKAGE BELOW CONCERNS PROJECT ACTIVITY UNDER A PROGRAMME OF ACTIVITIES)****Leakage**

1. Leakage may result from fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of fossil fuels outside of the project boundary. This includes mainly fugitive CH₄ emissions and CO₂ emissions from associated fuel combustion and flaring. In this methodology, the following leakage emission sources shall be considered:⁴

- Fugitive CH₄ emissions associated with fuel extraction, processing, liquefaction, transportation, re-gasification and distribution of natural gas used in the project plant and fossil fuels used in the grid in the absence of the project activity.
- In the case LNG is used in the project plant: CO₂ emissions from fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression into a natural gas transmission or distribution system.

Thus, leakage emissions are calculated as follows:

$$LE_y = LE_{CH_4,y} + LE_{LNG,CO_2,y} \quad (1)$$

Where:

LE_y Leakage emissions during the year y in t CO₂e

$LE_{CH_4,y}$ Leakage emissions due to fugitive upstream CH₄ emissions in the year y in t CO₂e

$LE_{LNG,CO_2,y}$ Leakage emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year y in t CO₂e

Note that to the extent that upstream emissions occur in Annex I countries that have ratified the Kyoto Protocol, from 1 January 2008 onwards, these emissions should be excluded, if technically possible, in the leakage calculations.

Fugitive methane emissions

For the purpose of determining fugitive methane emissions associated with the production — and in case of natural gas, the transportation and distribution of the fuels — project participants should multiply the quantity of natural gas consumed in all element processes i with a methane emission factor for these upstream emissions ($EF_{NG,upstream,CH_4}$), and subtract for all fuel types k which would be used in the absence of the project activity the fuel quantities multiplied with respective methane emission factors ($EF_{k,upstream,CH_4}$), as follows:

⁴ The Meth Panel is undertaking further work on the estimation of leakage emission sources in case of fuel switch project activities. This approach may be revised based on outcome of this work.

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

III.S. Introduction of low-emission vehicles to commercial vehicle fleets (cont)

$$LE_{CH_4,y} = \left[FF_{project,y} \cdot NCV_{NG,y} \cdot EF_{NG,upstream,CH_4} + \sum_k FF_{baseline,k,y} \cdot NCV_k \cdot EF_{k,upstream,CH_4} \right] \cdot GWP_{CH_4} \quad (2)$$

with

$$FF_{project,y} = \sum_i FF_{project,i,y} \quad \text{and} \quad (3)$$

$$FF_{baseline,k,y} = \sum_i FF_{baseline,i,k,y} \quad (4)$$

Where:

$LE_{CH_4,y}$	Leakage emissions due to upstream fugitive CH ₄ emissions in the year y in t CO ₂ e
$FF_{project,y}$	Quantity of natural gas combusted in all element processes during the year y in m ³
$FF_{project,i,y}$	Quantity of natural gas combusted in the element process i during the year y in m ³
$NCV_{NG,y}$	Average net calorific value of the natural gas combusted during the year y in MWh/m ³
$EF_{NG,upstream,CH_4}$	Emission factor for upstream fugitive methane emissions from production, transportation and distribution of natural gas in t CH ₄ per MWh fuel supplied to final consumers
$FF_{baseline,k,y}$	Quantity of fuel type k (a coal or petroleum fuel type) that would be combusted in the absence of the project activity in all element processes during the year y in a volume or mass unit
$FF_{baseline,i,k,y}$	Quantity of fuel type k (a coal or petroleum fuel type) that would be combusted in the absence of the project activity in the element process i during the year y in a volume or mass unit
NCV_k	Average net calorific value of the fuel type k (a coal or petroleum fuel type) that would be combusted in the absence of the project activity during the year y in MWh per volume or mass unit
$EF_{k,upstream,CH_4}$	Emission factor for upstream fugitive methane emissions from production of the fuel type k (a coal or petroleum fuel type) in t CH ₄ per MWh fuel produced
GWP_{CH_4}	Global warming potential of methane valid for the relevant commitment period

Where reliable and accurate national data on fugitive CH₄ emissions associated with the production, and in case of natural gas, the transportation and distribution of the fuels is available, project participants should use this data to determine average emission factors by dividing the total quantity of CH₄ emissions by the quantity of fuel produced or supplied respectively.⁵ Where such data is not available, project participants may use the default values provided in Table 2 below. In this case, the natural gas emission factor for the location of the project should be used, except in cases where it can

⁵ GHG inventory data reported to the UNFCCC as part of national communications can be used where country-specific approaches (and not IPCC Tier 1 default values) have been used to estimate emissions.



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

III.S. Introduction of low-emission vehicles to commercial vehicle fleets (cont)

be shown that the relevant system element (gas production and/or processing/transmission/distribution) is predominantly of recent vintage and built and operated to international standards, in which case the US/Canada values may be used.

Note that the emission factor for fugitive upstream emissions for natural gas ($EF_{NG,upstream,CH_4}$) should include fugitive emissions from production, processing, transport and distribution of natural gas, as indicated in the Table 2 below. Note further that in case of coal the emission factor is provided based on a mass unit and needs to be converted in an energy unit, taking into account the net calorific value of the coal.

Table 2: Default emission factors for fugitive CH₄ upstream emissions

Activity	Unit	Default emission factor	Reference for the underlying emission factor range in Volume 3 of the 1996 Revised IPCC Guidelines
Coal			
Underground mining	t CH ₄ / kt coal	13.4	Equations 1 and 4, p. 1.105 and 1.110
Surface mining	t CH ₄ / kt coal	0.8	Equations 2 and 4, p.1.108 and 1.110
Oil			
Production	t CH ₄ / PJ	2.5	Tables 1-60 to 1-64, p. 1.129 - 1.131
Transport, refining and storage	t CH ₄ / PJ	1.6	Tables 1-60 to 1-64, p. 1.129 - 1.131
Total	t CH ₄ / PJ	4.1	
Natural gas			
<i>USA and Canada</i>			
Production	t CH ₄ / PJ	72	Table 1-60, p. 1.129
Processing, transport and distribution	t CH ₄ / PJ	88	Table 1-60, p. 1.129
Total	t CH ₄ / PJ	160	
<i>Eastern Europe and former USSR</i>			
Production	t CH ₄ / PJ	393	Table 1-61, p. 1.129
Processing, transport and distribution	t CH ₄ / PJ	528	Table 1-61, p. 1.129
Total	t CH ₄ / PJ	921	
<i>Western Europe</i>			
Production	t CH ₄ / PJ	21	Table 1-62, p. 1.130
Processing, transport and distribution	t CH ₄ / PJ	85	Table 1-62, p. 1.130
Total	t CH ₄ / PJ	105	
<i>Other oil exporting countries / Rest of world</i>			
Production	t CH ₄ / PJ	68	Table 1-63 and 1-64, p. 1.130 and 1.131
Processing, transport and distribution	t CH ₄ / PJ	228	Table 1-63 and 1-64, p. 1.130 and 1.131
Total	t CH ₄ / PJ	296	

Note: The emission factors in this table have been derived from IPCC default Tier 1 emission factors provided in Volume 3 of the 1996 Revised IPCC Guidelines, by calculating the average of the provided default emission factor range.

CO₂ emissions from LNG

Where applicable, CO₂ emissions from fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system ($LE_{LNG,CO_2,N}$) should be estimated by multiplying the quantity of natural gas combusted in the project with an appropriate emission factor, as follows:

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

III.S. Introduction of low-emission vehicles to commercial vehicle fleets (cont)

$$LE_{LNG,CO_2,y} = FF_{project,y} \cdot EF_{CO_2,upstream,LNG} \quad (5)$$

Where:

$LE_{LNG,CO_2,y}$ Leakage emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system during the year y in tCO₂e

$FF_{project,y}$ Quantity of natural gas combusted in all element processes during the year y in m³

$EF_{CO_2,upstream,LNG}$ Emission factor for upstream CO₂ emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system

Where reliable and accurate data on upstream CO₂ emissions due to fossil fuel combustion / electricity consumption associated with the liquefaction, transportation, re-gasification and compression of LNG into a natural gas transmission or distribution system is available, project participants should use this data to determine an average emission factor. Where such data is not available, project participants may assume a default value of 6 t CO₂/TJ as a rough approximation.⁶

- - - -

History of the document

Version	Date	Nature of revision
02	EB 55, Annex 32 30 July 2010	<ul style="list-style-type: none"> To include retrofitting of vehicles, further elaboration of types of vehicles covered, to replace fixed route requirements with conditions to prove comparability of routes featuring in baseline and project scenarios; Under the PoA section leakage provisions pertaining to project activities involving fossil fuel switch referring to ACM0009 procedures have been retained while the textual guidelines in the methodology pertaining to the same topic has been excluded to avoid redundancies
01	EB 36, Annex 23 30 November 2007	Initial adoption.
Decision Class: Regulatory Document Type: Standard Business Function: Methodology		

⁶ This value has been derived on data published for North American LNG systems. "Barclay, M. and N. Denton, 2005. Selecting offshore LNG process. http://www.fwc.com/publications/tech_papers/files/LNJ091105p34_36.pdf (10th April 2006)".