CLEAN DEVELOPMENT MECHANISM

CDM-EB110-A07

Small-scale Methodology

AMS-III.R.: Methane recovery in agricultural activities at household/small farm level

Version 04.0

Sectoral scope(s): 15

United Nations
Framework Convention on
Climate Change

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1. Introduction

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

Table 1. Methodology key elements

Typical project(s)	Recovery and destruction of methane from manure and wastes from agricultural activities through: Installation of a methane recovery and combustion system to an existing source of methane emissions; or, change of the management practice of an organic waste or raw material in order to achieve controlled anaerobic digestion that is equipped with methane recovery and combustion system
Type of GHG emissions mitigation action	GHG destruction: Fuel switch: Destruction of methane and displacement of more-GHG-intensive energy generation

2. Scope, applicability, and entry into force

2.1. Scope

2. This project category comprises recovery and destruction of methane from manure and wastes from agricultural activities that would be decaying anaerobically emitting methane to the atmosphere in the absence of the project activity. Methane emissions are prevented by:

   (a) Installing methane recovery and combustion system to an existing source of methane emissions; or

   (b) Changing the management practice of a biogenic waste or raw material in order to achieve the controlled anaerobic digestion equipped with methane recovery and combustion system.

2.2. Applicability

3. The category is limited to measures at individual households or small farms (e.g. installation of a domestic biogas digester). Methane recovery systems that achieve an annual emission reduction of less than or equal to five tonnes of CO_2e per system are included in this category. Systems with annual emission reduction higher than five tonnes of CO_2e are eligible under “AMS-III.D.: Methane recovery in animal manure management systems”.

4. This project category is only applicable in combination with “AMS-I.C.: Thermal energy production with or without electricity” and/or “AMS-I.I.: Biogas/biomass thermal applications for households/small users” and/or “AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user”.

5. The project activity shall satisfy the following conditions:

   (a) The sludge must be handled aerobically. In case of soil application of the final sludge the proper conditions and procedures that ensure that there are no methane emissions must be ensured;

   (b) Measures shall be used (e.g. combusted or burnt in a biogas burner for cooking needs) to ensure that all the methane collected by the recovery system is destroyed.

6. This methodology is applicable only to the portion of the manure, which would decay anaerobically in the absence of the project activity that is established by a survey.

7. Aggregated annual emission reductions of all systems included shall be less than or equal to 60 kt CO_2 equivalent.

2.3. Entry into force

8. The date of entry into force is the date of the publication of the EB 110 meeting report on the 27 May 2021.

2.4. 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 13 is mandatory and application of sectoral scope 1 is conditional.

3. Normative references

10. Project participants shall apply the General guidelines for SSC CDM methodologies, ~~abbreviations and general guidance on leakage in biomass project activities~~ TOOL21: Demonstration of additionality of small-scale project activities and ~~the~~ ~~Guidelines on the demonstrating of additionality of SSC project activities~~ TOOL22: Leakage in biomass small-scale project activities available at <http://cdm.unfccc.int/Reference/Guidclarif/index.html#meth> mutatis mutandis.

11. This methodology also refers to the latest approved versions of the following approved methodologies and tools:

   (a) “AMS-I.C.: “Thermal energy production with or without electricity”;

   (b) “AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user”;

   (c) “AMS-I.I.: Biogas/biomass thermal applications for households/small users”;

   (d) “AMS-III.D.: Methane recovery in animal manure management systems”;

   (e) “Standard for sampling and surveys for CDM project activities and programme of activities”;

   (f) “TOOL03: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion”;

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

4. Definitions

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

5. Baseline methodology

5.1. Project boundary

13. The project boundary is the physical, geographical site of the methane recovery and combustion systems.

5.2. Project ~~activity~~ emissions

14. Project emissions due to physical leakage of biogas digester is estimated using one of the two options ~~using the method~~ indicated ~~under section 4.4 of~~ in ~~paragraph 13~~ AMS-III.D. "Methane recovery in animal manure management systems".

15. Project emissions consist of CO_2 emissions from use of fossil fuels or electricity for the operation of the system and the physical leakages of methane from the recovery system. The relevant methodological tools "TOOL03: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" and "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" shall be followed.

5.3. Baseline

16. The baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter are left to decay anaerobically within the project boundary and methane is emitted to the atmosphere.

17. The amount of waste or raw materials that would decay anaerobically in the absence of the project activity is determined by survey of a sample group of households/small farms with a 90% confidence interval and 10% margin of error. The survey should determine the baseline animal manure management practices applied. If the livestock is raised in shared centralized farms,[1] the project proponent shall be able to show the baseline animal manure management practices at each farm, either individually or through sampling. ~~This small-scale methodology is only applicable to the portion of the manure, which would decay anaerobically in the absence of the project activity established by the survey.~~

18. Baseline emissions (BE_y) are calculated ex ante, using one of the following methods:

(a) A simplified method with the most recent IPCC Tier 1 approach (please refer to the chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National

[1] In shared centralized farms systems, multiple households raise their animals in a centralized farm, e.g. in separate barns. In the project activity, each family collects the manure of animals raised by it at the centralized farm and uses the collected manures as feedstock for the biodigester situated at the household.

Greenhouse Gas Inventories) that only requires livestock population data by animal species/category and climate region or temperature; or

(b) The most recent IPCC Tier 2 approach (please refer to the chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories) to calculate the amount of the waste or raw material that would decay anaerobically in the absence of the project activity. Country/regional specific values shall be used if available. The option in ~~paragraph 9 and relevant formulae shown in paragraph 10 of~~ "AMS-III.D.: Methane recovery in animal manure management systems", shall be used to calculate baseline emissions.

19. If option in paragraph 18 (a) is chosen, baseline emissions are determined as follows:

$$BE_y = GWP_{CH4} \times UF_b \times \sum_{LT} \left(\frac{EF_{LT} \times N_{LT,y}}{10^6}\right) \quad \text{Equation (1)}$$

Where:

BE_y	=	Baseline emission during the year *y* (tCO_2e)
GWP_{CH4}	=	Global Warming Potential (GWP) of CH_4 applicable to the relevant period (t CO_2e/t CH_4)
EF_{LT}	=	Emission factor for the defined livestock population as referred from table 10.14 and 10.15 of chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (kg CH_4/head)
$N_{LT,y}$	=	Annual average number of animals of type *LT* in year *y* (numbers)
UF_b	=	Net-to-gross adjustment factor to account for uncertainties. The value applied is 0.89 [2]

5.4. Leakage

20. ~~If the methane recovery and combustion equipment is transferred from another activity, leakage is to be considered.~~ The applicable requirements from "TOOL22: Leakage in biomass small-scale project activities" shall be followed to calculate leakage related to use of biomass.

[2] This is to account for uncertainties of the method (See "Annex III Table of conservativeness factors", FCCC/SBSTA/2003/10/Add.2, page 25).

5.5. Emission reductions

5.5.1. Option 1

21. The emission reduction achieved by the project activity should be calculated as below under this option:

$$ER_y = BE_y - PE_y - LE_y$$ Equation (2)

Where:

ER_y	=	Emission reductions achieved by the project activity for year *y* (tCO_2e)
~~BE_y~~	=	~~Baseline emissions for year *y* (tCO_2e)~~
PE_y	=	Project emissions for year *y* (tCO_2e)
LE_y	=	Leakage for year *y* (tCO_2e)

5.5.2. Option 2

22. The emission reductions of the project activity should be determined based on monitoring of the net quantity of biogas consumed by the thermal application as follows:

$$ER_y = \sum_k N_{k,0} \times n_{k,y} \times UF_b \times BS_{k,y} \times EF \times n_{PJ/BL} \times NCV_{biogas} - LE_y$$ Equation (3)

Where:

$N_{k,0}$	=	Number of thermal applications *k* commissioned (number)
$n_{k,y}$	=	Proportion of $N_{k,0}$ that remain operating in year *y* (fraction)
UF_b	=	Net-to-gross adjustment factor. Apply 0.89 [3] in cases where the operationality ($n_{k,y}$) is determined based on questionnaire survey. In other cases, apply 1.0.
$BS_{k,y}$	=	The net quantity of biogas consumed by the thermal application *k* in year *y* (mass or volume units, dry basis)
EF	=	CO_2 emission factor (tCO_2/GJ)
$n_{PJ/BL}$	=	Ratio of efficiencies of project equipment and baseline equipment (e.g. cook stove using coal) measured once prior to validation applying the same test procedure (e.g. lab test), as per a national or an international standard. Official data or scientific literature can be used for cross-check purposes
NCV_{biogas}	=	Net calorific value of the biomass (GJ/unit mass or volume, dry basis). Use default value: 0.0215 GJ/m^3 biogas (assuming NCV of the methane: 0.0359 GJ/m^3, default methane content in biogas: 60%)

[3] This is to account for uncertainties of the questionnaire survey method, estimated to be in the range 30-50% (See "Annex III Table of conservativeness factors", FCCC/SBSTA/2003/10/Add.2, page 25).

23. The CO_2 emission factor is calculated as follows:

$$EF = \sum_j x_j \times EF_{FF,j}$$ Equation (4)

Where:

x_j	=	fraction representing fuel type *j* used by the baseline thermal applications displaced by biomass/biogas
$EF_{FF,j}$	=	CO_2 emission factor of fossil fuel type *j* (tCO_2/GJ)

6. Monitoring methodology

~~24. Monitoring shall consist of:~~

~~25. Inspection of the project systems. At the time of installation all project activity systems shall be inspected and undergo acceptance testing (commissioning) for proper operation in compliance with specifications. The installation date of each system shall be recorded;~~

26. ~~Recording annually the number of systems operating using survey methods.~~ Emission reductions can only be applied to systems that are demonstrated to be operational and in compliance with the manufacturer's required maintenance procedures~~, at least once every two years (biennial) during the crediting period. After the inspection and acceptance testing at year of installation, the inspections can be done in years 3, 5, 7, etc. and the results of such inspections can be applied to crediting years 3 and 4, 5 and 6, 7 and 8 etc. On-going rental/lease payments or a recurring maintenance fee by users can be a substitute to actual site visits. A statistically valid sample of the residences where the systems are installed, with consideration, in the sampling design, of occupancy and demographic differences can be used to determine the percentage of systems operating, as per the relevant requirements for sampling in the "Standard for sampling and surveys for CDM project activities and programme of activities". When biennial inspection is chosen, a 95% confidence interval and 10% margin of error requirement shall be achieved for the sampling parameter. On the other hand, when the project proponent chooses to inspect annually, a 90% confidence interval and 10% margin of error requirement shall be achieved for the sampling parameter;~~

27. Survey methods are used to determine the annual average animal population (N_{LT}), the amount of waste/animal manure generated on the farm and the amount of waste/animal manure fed into the system e.g. biogas digester. It shall be verified if the manure fed to the digester is consistent with the animal population and with the capacity of the system. If the livestock is raised in the shared centralized farms, the project proponent shall also

determine the number of families/households sharing the farm and the annual average animal population (N_{LT}) belonging to each household.

28. The proper soil application (not resulting in methane emissions) of the final sludge shall be verified on a sampling basis following ~~. R~~requirements in the "Standard for sampling and surveys for CDM project activities and programme of activities" ~~shall be followed~~.

6.1. Data and parameters monitored

Data / Parameter table 1.

Data / Parameter:	**$N_{LT,y}$**
Data unit:	Number
Description:	Annual average number of animals of type *LT* for the year *y*
Source of data:	-
Measurement procedures (if any):	The PDD should describe the system on monitoring the number of livestock population. The consistency between the value and indirect information (records of sales, records of food purchases) should be assessed
Monitoring frequency:	Annually, based on monthly records
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 2.

Data / Parameter:	**$N_{k,0}$**
Data unit:	Number
Description:	Number of thermal applications *k* commissioned
Source of data:	Installation records
Measurement procedures (if any):	At the time of installation all project activity systems shall be inspected and undergo acceptance testing (commissioning) for proper operation in compliance with specifications. The installation date of each system shall be recorded
Monitoring frequency:	Once, at the time of installation
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 3.

Data / Parameter:	**$n_{k,y}$**
Data unit:	Fraction
Description:	Proportion of $N_{k,0}$ that remain operating at year *y* (fraction)
Source of data:	-

Measurement procedures (if any):	Monitoring of operationality of the biogas systems shall be conducted using one of the following methods: (a) Census of users or survey of the users at randomly selected sample sites; (b) Based on on-going rental/lease payments or a recurring maintenance fee by users; (c) Measurement campaigns using biogas flow meters. For all cases where sampling is applied, the "Standard: Sampling and surveys for CDM project activities and programme of activities" shall be used for determining the sample size to achieve 90/10 (for annual monitoring) or 95/10 (for biennial monitoring) confidence/precision levels. For the case of measurement campaigns using biogas flow meters, it may be undertaken at randomly selected sample sites. The selected samples should take into account possible stratification of the population according to the capacity, biogas digester types and region where the digesters are installed (e.g. 6 cubic metre or 8 cubic metre capacity, fixed dome or floating dome type, regions where seasons influence average ambient temperature). For each measurement campaign at each site, continuous measurement shall be carried out for at least 30 days. The operational rate of each system is determined by dividing the number of days in operation by the length of the campaign. An operational day is a day in which biogas is consumed
Monitoring frequency:	At least once every two years (biennial) during the crediting period
QA/QC procedures:	Net-to-gross adjustment factor of 0.89 is applicable in cases where the operationality is determined based on user reported questionnaire survey i.e. using option (a) above to account for uncertainties,
Any comment:	-

Data / Parameter table 4.

Data / Parameter:	$BS_{k,y}$
Data unit:	mass or volume units
Description:	The net quantity of biogas consumed by the thermal application *k* in year *y*
Source of data:	Direct measurement or conservative default

Measurement procedures (if any):	(a) In the specific case of biogas project activities using biogas flow meters to monitor accumulated biogas supplied to thermal energy equipment: • Measurement campaigns shall be undertaken at randomly selected sample sites in each year of the crediting period. • The "Standard: Sampling and surveys for CDM project activities and programme of activities" shall be used for determining the sample size to achieve 90/10 confidence/precision levels. • The selected samples should take into account possible stratification of the population according to the capacity, types and region where the digesters are installed (e.g. 6 cubic metre or 8 cubic metre capacity, fixed dome or floating dome type, regions where seasons influence average ambient temperature). • For each measurement campaign at each site, continuous measurement shall be carried out for at least 30 days. • To account for seasonal variation in biogas generation from biogas digesters, it may be measured over a year during several disjointed periods (e.g. one week per quarter), but still covering at least 30 days for a year. These figures are then turned into an annual figure for a biogas digester. However, if disjoint periods are not practical or too expensive, then a single period may be chosen, from which an annualised figure is derived taking into account seasonality. If adjustment for seasonality is not possible, then a conservative approach shall be taken where a single period is chosen corresponding to the least amount of biogas generation, which is then scaled. (b) Alternatively, for biogas project activities, project proponents may use a default biogas generation rate of 0.13 Nm3.m-3.day-1 (i.e. volume of biogas generated in normal conditions of temperature and pressure per unit useful volume of the digester per day) for regions/countries where annual average ambient temperature is higher than 20°C
Monitoring frequency:	Annual
QA/QC procedures:	-
Any comment:	-

6.2. Project activity under a Programme of Activities

29. The methodology is applicable to a programme of activities, no additional leakage estimations are necessary other than that indicated under leakage section above.

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Document information

Version	*Date*	*Description*
04.0	27 May 2021	EB 110, Annex 7 Revision to allow the use of biogas flow meters to demonstrate operationality of the biogas system remotely.
03.0	13 September 2012	EB 69, Annex 23 To introduce the IPCC Tier 1 approach as an alternative method for calculation of baseline emissions.
02	18 February 2011	EB 59, Annex 4 • To allow the combination of this category with AMS-I.I. and/or AMS-I.E.; • To revise the guidance on calculation of project emissions from physical leakage and baseline emissions; • To revise sampling requirements; • To remove the conditions for PoA.
01	19 October 2007	EB 35, Annex 27 Initial adoption.

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