CLEAN DEVELOPMENT MECHANISM

AMS-III.BK

Small-scale Methodology

Strategic feed supplementation in smallholder dairy sector to increase productivity

Version 01.0

Sectoral scope(s): 15

United Nations
Framework Convention on
Climate Change

TABLE OF CONTENTS **Page**

1. Introduction

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

Table 1. Methodology key elements

Typical project(s)	Provision of strategic supplementation to large ruminants, which reduces the level of methane emissions per unit of milk produced
Type of GHG emissions mitigation action	Methane emission avoidance from large ruminants due to improved productivity by using strategic supplementation to improve digestibility

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology is applicable to project activities that use strategic supplementation to improve the digestibility of feedstuff fed to large ruminants (i.e. dairy cows and/or buffalo) in the smallholder diary sector, for the purpose of increasing milk productivity and thus reducing methane emissions per unit of milk produced.

3. The methodology is not intended for technologies/measures targeting suppression of methane emissions from the process of enteric fermentation.

2.2. Applicability

4. The methodology is applicable under the following conditions:

(a) The project supplement shall be supplied to and used by farmers who manage dairy cows and/or buffalo in smallholder dairy production systems;

(b) The population of lactating animals (dairy cows and/or buffalo) maintained in the participating smallholders shall be equal or less than 100 head per household;

(c) The project supplement shall be formulated in accordance with the nutritional requirements of the intended ruminants in the host country and shall be in compliance with the local regulation;

(d) To ensure that the supplement will increase milk productivity through enhanced digestibility, the project proponent shall demonstrate in the project design document (CDM-PDD) that the gross energy (GE) content of the supplement consumed does not exceed 10 per cent of the total GE content of the basal ration per stage of lactation for each of the respective baseline production categories;[1]

(e) Potential health limitations or safety restrictions to animals for using the project nutritional supplement shall be identified and a mechanism for informing participating farmers (e.g. trainings) shall be developed and implemented;

[1] According to the procedures in paragraph 17.

(f) Measures such as contractual agreements shall be implemented to avoid potential double counting due to claims of emission reductions by the farmer or supplier of the feed supplement. These measures shall be described in the PDD. The PDD shall also include measures ensuring that the individual smallholders of the project activity are not included in any other CDM project using this methodology;

(g) The aggregate emission reductions of a single project activity shall not exceed 60ktCO_2 equivalent per year.

2.3. Entry into force

5. The date of entry into force is the date of the publication of the EB 79 meeting report on the 1 June 2014.

3. Normative references

6. This methodology is based on the proposed small-scale methodology "SSC-NM094: Strategic supplementation of a small holder dairy sector to increase productivity and reduce methane emissions" submitted by RuMeth International Ltd.

7. Project participants shall apply the "General guidelines for SSC CDM methodologies" and the "Guidelines on the demonstration of additionality of small-scale project activities" (previously known as attachment A to appendix B) provided at: <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> mutatis mutandis.

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

(a) "Tool to calculate baseline, project and/or leakage emissions from electricity consumption";

(b) "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion";

(c) "Project and leakage emissions from transportation of freight"

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

(e) "AMS-III.F: Avoidance of methane emissions through composting";

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

4. Definitions

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

10. For the purpose of this methodology, the following definitions apply:

(a) **Large ruminants** – either dairy cows or buffalo raised for the production of milk;

(b) **Basal diet** - the total feedstuffs (excluding supplement) consumed by an animal for the purpose of body maintenance and production;

(c) **Daily milk production** - the amount of milk produced by a lactating female in a twenty-four hours period;

(d) **Fat corrected milk** (FCM)- the quantification of milk output adjusted to a uniform 4 per cent or 3.2 per cent butterfat content;

(e) **Inter-calving interval** - the time between the birth of a calf to a large ruminant and the birth of the subsequent calf;

(f) **Lactation** - the period of time between when a large female ruminant initiates milk production with the birth of a calf and when milk production ceases in preparation for the coming of a new calf. It is measured in days;

(g) **Lactation cycle and stages**- the period between initiation of lactation and the start of the subsequent lactation triggered by the birth of another calf. The lactation cycle is subdivided into two stages of production: the lactating stage (days in milk – DIM period), when milk is produced, and non-lactating stage (or dry stage);

(h) **Level of intensity** - the amount of care, management and feeding given to a large ruminant. A high level of intensity is indicated by near total confinement and the provision of harvested feed. A low level of intensity is indicated by a lack of confinement and little or no provision of feedstuffs (i.e. reliance on free range forage);

(i) **Presence of genetics** - the amount of improved genetics contained in the large ruminant genotype. A high level of genetics is indicated by near complete improved genetics in the animal. A low level of genetics is indicated by little or no improved genetics in the animal;

(j) **Production indicators** - the parameters which quantify the productivity of the large ruminant. For the purpose of this methodology, this refers to the quantity of milk produced per adult female animal;

(k) **Production system (production categories)** - the group of large ruminants categorized based on level of intensity and presence of genetics. A given location (farm) may include a number of distinct production systems;

(l) **Supplementation** - the provision of material, either organic or inorganic, which improves the digestive system of large ruminants and therefore promotes increased productivity;

(m) **Baseline survey and project survey** - the surveys that are carried out for the purpose of determining baseline and project emissions, respectively.

5. Baseline methodology

5.1. Project boundary

11. The spatial extent of the project boundary encompasses:

(a) Production of the supplement used in the project activities;

(b) Participating smallholders that receive and use supplement for the large ruminants; and

(c) The itineraries where the transportation of supplement occurs.

5.2. Baseline scenario

12. The baseline shall be identified by following the latest version of the "General guidelines for SSC CDM methodologies". This methodology is only applicable if the continuation of the current feed practice without supplement is demonstrated to be the most plausible baseline scenario.

5.2.1. Baseline emissions

13. Baseline emissions of year *y* are determined based on the specific methane emissions per unit of milk production in the baseline, multiplied by the milk production in the project:[2]

$$BE_y = \sum_s \left(SEF_{BL,s,y} \times \left(FCM_{PJ,s,y} \times N_{PJ,s,y} \right) \right) \times GWP_{CH4} / 1{,}000 \qquad \text{Equation (1)}$$

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2e/yr)
$SEF_{BL,s,y}$	=	Specific methane emission per litre of fat-corrected milk of production category *s* in the baseline of year *y* (kgCH_4/litre milk)
$FCM_{PJ,s,y}$	=	Fat corrected milk per productive female provided with supplementation of production category *s* in the project survey of year *y* (litres/year)
$N_{PJ,s,y}$	=	Number of equivalent productive females on lactation of production category *s* provided with supplementation in year *y* (dimensionless), determined according to paragraph 18
GWP_{CH4}	=	Global warming potential of methane (t CO_2e/t CH_4)
1,000	=	Conversion of kilograms to tonnes (kg/tonne)

14. Specific methane emission per litre of *FCM* of production category *s* ($SEF_{BL,s,y}$) in the baseline survey for year *y* is determined as below:

[2] Possible methane emissions from animal manure are not included in both baseline and project emission reductions, since it is assumed that animal manure management system in the pre-project and project scenarios are kept the same. In addition, it is acknowledged that the supplement increases the digestibility of the basal diet, and enhances overall consumption of feed gross energy and manure production. However, the improved digestion also reduces the volatile solids content in manure and its methane generation potential. Projects that include changes in animal manure management technologies to reduce emissions may apply the corresponding methodologies (AMS-III.D, AMS-III.F, AMS-III.R, etc.) as additional scopes and components.

$$SEF_{BL,s,y} = \frac{\sum_r \left(EF_{BL,r,y} \times N_{BL,r,y}\right)_s}{\sum_r \left(FCM_{BL,r,y} \times N_{BL,r,y}\right)_s}$$ Equation (2)

$$FCM_{BL,r,y} = DFCM_{BL,r,y} \times D_{BL,lac,r,y}$$ Equation (3)

Where:

$EF_{BL,r,y}$ = Methane emissions per productive female of respondent herd *r* of production category *s* in the baseline for year *y* (kg CH_4/head/year)

$N_{BL,r,y}$ = Number of productive female of respondent herd *r* of production category *s* in the baseline for year *y* (number of animals)

$FCM_{BL,r,y}$ = Fat corrected milk per productive female of the respondent herd *r* of production category *s* in the baseline for year *y* (litres milk/head/year)

$DFCM_{BL,r,y}$ = Daily fat corrected milk per productive and lactating female of respondent herd *r* of production category *s* in the baseline for year *y* (litres milk/head/day)

$D_{BL,lac,r,y}$ = Days in lactation of respondent herd *r* of production category *s* in the baseline for year *y* (days/year)

15. $EF_{BL,r,y}$ is determined as below.

$$EF_{BL,r,y} = \frac{\sum_{u,n}\left(GE_{BL,u,n,r,y} \times SD_{BL,u,n,r,y}\right) \times Y_m}{55.65}$$ Equation (4)

Where:

$GE_{BL,u,n,r,y}$ = Gross energy consumed during stage *u* of lactation per day of season *n* by a productive female of respondent herd *r* in the baseline for year *y* (MJ/head/day)

$SD_{BL,u,n,r,y}$ = Days of season *n* during stage *u* of lactation of respondent herd *r* in the baseline for year *y* (days/year)

Y_m = Conversion rate of energy to methane (%). A default value of 7.5 per cent shall be applied[3] for both baseline and project emissions calculation

55.65 = The energy content of methane (MJ/kg CH_4)

(a) $SD_{BL,un,r,y}$ accounts for the variation of basal diet intake for dairy animals at different stages (*u*) of production (lactating or non-lactating) and during different seasons (*n*) of the year (wet, dry, cold or hot). It reflects how many days in a

[3] Table 10.12, IPCC Guidelines for National Greenhouse Gas Inventories 2006,Volume 4: Agriculture, Forestry and Other Land Use, Chapter 10: Emissions from Livestock and Manure Management.

particular season a productive female is lactating and how many days of that season the productive female is not-lactating.[4] Using data of production indicators and seasonality, $SD_{BL,u,n,r,y}$ is determined as following:

$$SD_{BL,u,n,r,y} = D_{BL,u,r,y} \times \left(\frac{S_{n,y}}{365}\right) \quad \text{Equation (5)}$$

$$D_{BL,lac,r,y} = \left(\frac{DIM_{BL,r,y}}{ICI_{BL,r,y}}\right) \times 365, if\ u = lac \quad \text{Equation (6)}$$

$$D_{BL,non-lac,r,y} = 365 - D_{BL,lac,r,y,}\ if\ u = non - lac \quad \text{Equation (7)}$$

Where:

$D_{BL,lac,r,y}$	=	Days in lactation of respondent herd *r* in the baseline for year *y* (days/year)
$D_{BL,non-lac,r,y}$	=	Days in non-lactation of respondent herd *r* in the baseline for year *y* (days/year)
$DIM_{BL,r,y}$	=	Average days in milk per lactation of respondent herd *r* in the baseline for year *y* (days/lactation)
$ICI_{BL,r,y}$	=	Average inter-calving interval of respondent herd *r* in the baseline for year *y* (days/ICI)
$SD_{BL,u,n,r,y}$	=	Days of season *n* during stage *u* of lactation of respondent herd *r* in the baseline for year *y* (days/year)
$D_{BL,u,r,y}$	=	Days during stage *u* of lactation, either lactating or non-lactating, of respondent herd *r* in the baseline (days/year)
$S_{n,y}$	=	Days of season *n* in year *y* (days/year), according to local meteorological data

(b) The total gross energy intake ($GE_{BL,u,n,r,y}$) of the productive females is determined by equation (8). In cases where an animal consumes some of its feed in a grazing situation, the dry matter intake (DMI) of the direct fed ingredients are subtracted from the maximum dry matter intake derived from equation (9)[5] and the remaining DMI is the amount attributable to the grazed forages. The composition (e.g. varieties present) of the grazed forages is determined during

[4] For example, in a project area with two seasons (i.e. wet and dry) for year *y*, there will be a $SD_{BL,lac,wet,y}$, a $SD_{BL,lac,dry,y}$, a $SD_{BL,non-lac,wet,y}$ and a $SD_{BL,non-lac,dry,y}$.

[5] Dry Matter Intake estimates are calculated using the approach outlined in Nutrient Requirements of Dairy Cattle, National Research Council, 1989 pg. 4, which is cited as Equation 10.18b, IPCC Guidelines for National Greenhouse Gas Inventories 2006,Volume 4: Agriculture, Forestry and Other Land Use, Chapter 10: Emissions from Livestock and Manure Management.

the baseline and project survey, and the nutrient data is determined by following the same procedure as for other fed ingredients (appendix 2).

$$GE_{BL,u,n,r,y} = \sum_{z} \left(DMI_{BL,z,u,n,r,y} \times GE_{z} \right) \times min\left(1, \frac{DMI_{BL,u,n,r,y}}{\sum_{z} DMI_{BL,z,u,n,r,y}} \right)$$ Equation (8)

$$DMI_{BL,u,n,r,y} = \frac{\left(5.4 \times AW_{BL,r,y} \right)}{\left(500 \times \left(1 - ATDN_{BL,u,n,r,y} \right) \right)}$$ Equation (9)

$$ATDN_{BL,u,n,r,y} = \frac{\sum_{z} \left(DMI_{BL,z,u,n,r,y} \times TDN_{z} \right)}{\sum_{z} DMI_{BL,z,u,n,r,y}}$$ Equation (10)

Where:

$GE_{BL,u,n,r,y}$ = Total gross energy consumed during stage *u* of lactation per day of season *n* by a productive female of respondent herd *r* in the baseline for year *y* (MJ/day)

$DMI_{BL,z,u,n,r,y}$ = Dry matter intake of feedstuff *z* during stage *u* of lactation per day of season *n* by a productive female of respondent herd *r* in the baseline survey for year *y*, dry matter basis (kg/day)

GE_{z} = Gross energy value of feedstuff *z*, dry matter basis (MJ/kg), determined according to appendix 2 for feedstuff nutrient testing

$DMI_{BL,u,n,r,y}$ = Total feedstuff intake during stage *u* of lactation per day of season *n* by a productive female of respondent herd *r* in the baseline survey for year *y* (kg/day)

$AW_{BL,r,y}$ = Average weight of mature productive females in respondent herd *r* in baseline survey for year *y* (kg)

$ATDN_{BL,u,n,r,y}$ = Average TDN consumed during stage *u* of lactation per day of season *n* by a productive female of respondent herd *r* in the baseline survey for year *y*, on a dry matter basis (energy percentage)

TDN_{z} = Total digestible nutrients (TDN) of feedstuff *z* on a dry matter basis (energy percentage)

5.4. Project emissions

16. Project emissions include:

(a) Methane emissions from enteric emissions with project supplementation;

(b) Emissions from consumption of energy in the process of production of supplement, including the fuel consumption associated with transportation of the product.

$$PE_y = \sum_s \left(SEF_{PJ,s,y} \times \left(FCM_{PJ,s,y} \times N_{PJ,s,y}\right)\right) \times \frac{GWP_{CH4}}{1{,}000} + PE_{EG,y} + PE_{trans,y} \quad \text{Equation (11)}$$

Where:

PE_y	=	Project emissions in year *y* (t CO_2/yr)
$SEF_{PJ,s,y}$	=	Specific methane emission per litre of fat-corrected milk of production category *s* in the project survey of year *y* (kg CH_4/litre)
$FCM_{PJ,s,y}$	=	Fat corrected milk per productive female provided with supplementation of production category *s* in the project survey of year *y* (litres milk/year)
$N_{PJ,s,y}$	=	Number of equivalent productive females on lactation of production category *s* provided with supplementation in year *y* (unitless), determined according to para 18
GWP_{CH4}	=	Global warming potential of methane (t CO_2e/t CH_4)
1,000	=	Conversion of kilograms to tonnes (kg/tonne)
$PE_{EG,y}$	=	Project emissions from energy consumption in producing the supplemental feed (t CO_2/yr)
$PE_{trans,y}$	=	Project emissions from fuel consumption associated with transportation of the supplemental feed (t CO_2/yr)

17. $SEF_{PJ,s,y}$ and $FCM_{PJ,s,y}$ of production system *s* impacted by the project supplementation is determined as follows:

(a) Use the same procedure for determining parameter $SEF_{BL,s,y}$ and $FCM_{BL,s,y}$ used in the baseline calculations;

(b) Parameters needed for equations (2, 3) shall be estimated by using the data from the project survey;

(c) The same value of feedstuff nutrient content (GE_z) used in the baseline estimates shall be used;

(d) The DMI and gross energy intake from the supplement shall be included in the calculation of $SEF_{PJ,s,y}$;

(e) The incremental GE provided by the supplement to an animal in the project scenario shall be less than 10 per cent of the total GE content of the basal ration per certain stage of lactation for each of the respective baseline production categories.

18. For the purpose of determining $N_{PJ,s,y}$, the following step-wise approach shall be followed:

(a) Step1: Determine the amount of supplement purchased by project participating farmers allocated amongst the different production management categories ($GS_{s,y}$). In this step, allocation of supplement into different production categories is determined by using the information on total amount of supplement purchased by producers in a given year and the information on the detailed utilization of supplement in the project survey for each category.

$$GS_{s,y} = \%GSA_{s,y} \times GS_y \quad \text{Equation (12)}$$

Where:

$GS_{s,y}$ = Total amount of supplement purchased by participating farmers in production category *s* in year *y* (kilograms/year)

$\%GSA_{s,y}$ = Percentage of total supplement purchased attributable to production category *s* in year *y* (percentage)

GS_y = Total amount of supplement purchased by participating farmers in year *y* (kilograms/year)

$$\%GSA_{s,y} = \frac{GSA_{s,y}}{\sum_s GSA_{s,y}} \quad \text{Equation (13)}$$

$$GSA_{s,y} = \left(\frac{\sum_r PS_{r,s,y}}{\sum_r SA_{r,s,y}}\right) \times NP_{s,y} \quad \text{Equation (14)}$$

Where:

$GSA_{s,y}$ = Total amount of supplement purchased by sampled respondents attributable to the production category *s* (kilograms/year)

$PS_{r,s,y}$ = Amount of supplement purchased of respondent herd *r* in given production category *s* in project survey in year *y* (kilograms/year)

$SA_{r,s,y}$ = Number of productive females of respondent farm *r* in a given production category *s* in project survey in year *y* (number of animals)

$NP_{s,y}$ = Total number of productive females in the production category *s* in year *y* (number of animals)

$\%GSA_{s,y}$ = Percentage of total supplement purchased attributable to production category *s* in year *y* (percentage)

(b) Step 2: determine the discount factor to account for portion of purchased supplement given to non-productive animals or wasted (%$US_{s,y}$).
In this step, a discount factor is determined to account for supplement that has been purchased by participating farmers but not utilized by the productive female population (i.e. males, immature females, and non-large ruminant species).

$$\%US_{s,y} = \frac{\sum_r US_{r,s,y}}{\sum_r PS_{r,s,y}}$$ Equation (15)

Where:

$\%US_{s,y}$ = Discount factor to account for supplement fed to non-productive animals or lost to waste in production category *s* in year *y* (percentage)

$US_{r,s,y}$ = Amount of supplement fed to non-productive animals or lost to waste of project respondent herd *r* in production category *s* in year *y* (kilograms/year)

$PS_{r,s,y}$ = Amount of supplement purchased for project respondent herd *r* in production category *s* in year *y* (kilograms/year)

(c) Step 3: calculate the equivalent number of productive females per project category ($N_{PJ,s,y}$).
In this step, the equivalent number of productive females on lactation in a given production category is calculated ($N_{PJ,s,y}$). The result from equation (16) below shall be further cross checked with $NP_{s,y}$, i.e. it shall be less than or equal to $NP_{s,y}$ for the same category *s*. Otherwise, the smaller number between the two shall be used as the $N_{PJ,s,y}$.

$$N_{PJ,s,y} = \frac{GS_{s,y} \times \left(1 - \%US_{s,y}\right) \times \sum_r SA_{r,s,y}}{\sum_r PS_{r,s,y} - \sum_r US_{r,s,y}}$$ Equation (16)

Where:

$N_{PJ,s,y}$ = Number of equivalent productive animals on lactation within production category *s* provided with supplementation in year *y* (number of animals)

$GS_{s,y}$ = Total amount of supplement purchased by participating farmers in production category *s* in year *y* (kilograms/year)

$\%US_{s,y}$ = Discount factor to account for supplement fed to non-productive animals or lost to waste in a given production category in year *y* (percentage)

$SA_{r,s,y}$ = Number of productive females of respondent herd *r* in production category *s* in the survey sample in year *y* (number of animals)

$PS_{r,s,y}$ = Amount of supplement purchased for project respondent herd *r* in production category *s* in year *y*(kilograms/year)

$US_{r,s,y}$ = Amount of supplement fed to non-productive animals or lost to waste in project respondent herd *r* in production category *s* in year *y* (kilograms/year)

19. Project emissions ($PE_{EG,y}$) from energy consumed in manufacturing the supplement shall be calculated by following the tools "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and/or "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".

20. Project emissions ($PE_{trans,y}$) from fuel use associated with the transportation of supplement shall be determined by following the methodological tool "Project and leakage emissions from transportation of freight".

5.5. Leakage

21. If urea is used in the supplementation, emissions from production of urea shall be considered as leakage (LE_y). In case of the absence of reliable project specific data, a conservatively calculated value of 1.54 t CO_2e/tonne urea based on IPCC may be used which accounts for GHG emissions during ammonia production, intermediate CO_2 storage in urea and CO_2 release due to urea application.[6]

5.6. Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$ Equation (17)

6. Monitoring methodology

22. Relevant parameters shall be monitored as indicated in the tables below. The applicable requirements specified in the "General guidelines for SSC CDM methodologies" are also an integral part of the monitoring guidelines specified below and therefore shall be referred by the project participants.

23. For parameters that will be determined through sampling method, the latest version of the "Sampling and surveys for CDM project activities and programme of activities" shall be followed. Refer to appendix 1 below for further guidance for conducting baseline and project survey.

[6] See 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3: Industrial Processes and Product Use; Chapter 3.2 Ammonia Production.

Data / Parameter table 1.

Data / Parameter:	**$N_{BL,r,y}$**
Data unit:	Number of animals
Description:	Number of productive female of respondent herd *r* in the baseline survey for year *y*
Source of data:	Sampled parameter from the baseline respondent herd producer
Measurement procedures (if any):	Count the productive females on the respondent producer's farm
Monitoring frequency:	At project initiation and annually thereafter
QA/QC procedures:	-
Any comment:	Used for equation 2

Data / Parameter table 2.

Data / Parameter:	**$AW_{r,y}$**
Data unit:	Kg
Description:	Average weight of mature productive females in respondent herd *r* in baseline or project survey for year *y*
Source of data:	Sampled parameter from the baseline respondent herd producer
Measurement procedures (if any):	Weight shall be determined through the use of heart-girth measurement, i.e. a tape is placed around that section of the productive female and based on the measurement, the animals' weight can be determined
Monitoring frequency:	(a) In case of baseline survey: at project initiation and annually thereafter; (b) In case of project survey: annually
QA/QC procedures:	Weight data to be collected from randomly selected 10 per cent of the respondent herd. If the herd is less than ten productive females then data is collected from one half of the herd. If the herd is less than five productive females then data is collected from all animals
Any comment:	-

Data / Parameter table 3.

Data / Parameter:	**$DFCM_{r,y}$**
Data unit:	Litres milk/head/day
Description:	Daily fat corrected milk per productive and lactating female of respondent herd *r* of production category *s* in the baseline or project survey for year *y*
Source of data:	Sampled parameter from the baseline or impact respondent herd producer
Measurement procedures (if any):	Based on interviews with respondent herd producer
Monitoring frequency:	(a) In case of baseline survey: at project initiation and annually thereafter; (b) In case of project survey: annually

QA/QC procedures:	In surveys, producer records should be used when available. The milk production shall be determined by following the two options below: 1. Test the produced milk for its butterfat content according to standard in the dairy sector in the country or using the method included in James, Ceirwyn S. (1994)[7] and correct the milk production at a 4 per cent or 3.2 per cent butterfat basis; or 2. Use the sales receipt from participating farmers, either on the basis of fat corrected milk or volume of milk without correction. In such a case the use of milk production with or without fact correction shall be consistent in the baseline and project
Any comment:	-

Data / Parameter table 4.

Data / Parameter:	**$DIM_{r,y}$**
Data unit:	Days
Description:	Average days in milk per lactation of respondent herd *r* in the baseline or project survey for year *y*
Source of data:	Sampled parameter from the baseline or project respondent herd producer
Measurement procedures (if any):	Based on interviews of respondent herd producer
Monitoring frequency:	(a) In case of baseline survey: at project initiation and annually thereafter; (b) In case of project survey: annually
QA/QC procedures:	Documentation from local sources about the typical lactation days for dairy cows, or documentation dealing with similar climatic conditions and animal responses should be cross referenced
Any comment:	Note: lactation days and non-lactating days shall be broken down for each season. Seasons can be broken down by wet/dry or summer/spring/winter/fall

Data / Parameter table 5.

Data / Parameter:	**$ICI_{r,y}$**
Data unit:	Days
Description:	Average inter-calving interval of respondent herd *r* in the baseline or project survey for year *y*
Source of data:	Sampled parameter from the baseline or project respondent herd producer
Measurement procedures (if any):	Based on interviews with respondent herd producer

[7] James, Ceirwyn S. (1994). *Analytical Chemistry of Foods*. Springer. pp. 50–51. ISBN 978-0-8342-1298-5.

Monitoring frequency:	(a) In case of baseline survey: at project initiation and annually thereafter; (b) In case of project survey: annually
QA/QC procedures:	ICI shall be greater than 304 days (gestation for a large ruminant is 283 days, and the following ovulation cycle, i.e. 21 days)
Any comment:	-

Data / Parameter table 6.

Data / Parameter:	$\mathbf{S_{n,y}}$
Data unit:	days/year
Description:	Days of season *n* in year *y*
Source of data:	Host country climatologic service
Measurement procedures (if any):	N/A
Monitoring frequency:	At project initiation and annually thereafter
QA/QC procedures:	The sum of the given days per season shall equal 365
Any comment:	-

Data / Parameter table 7.

Data / Parameter:	$\mathbf{DMI_{z,u,n,r,y}}$
Data unit:	kg/day
Description:	Dry matter intake of feedstuff *z* during stage *u* of lactation per day of season *n* by a productive female of respondent herd *r* in the baseline or project survey for year *y*, dry matter basis
Source of data:	Sampled parameter from the respondent herd producer
Measurement procedures (if any):	Based on interviews with respondent herd producer. In cases where some of the animal feed is from grazing, its amount is determined according to para 15 (b)based on the animal weight (*AW*)
Monitoring frequency:	(a) In case of baseline survey: at project initiation and annually thereafter; (b) In case of project survey: annually
QA/QC procedures:	In cases where some of animal feed is from grazing, it shall be crossed checked that large ruminants will have a Dry Matter Intake of between 2 per cent and 3 per cent of their bodyweight[8]
Any comment:	-

Data / Parameter table 8.

Data / Parameter:	$\mathbf{GS_y}$
Data unit:	kilograms/year
Description:	Total amount of supplement purchased by participating farmers in year *y*

[8] Page 10.21, IPCC Guidelines for National Greenhouse Gas Inventories 2006, Volume 4: Agriculture, Forestry and Other Land Use, Chapter 10: Emissions from Livestock and Manure Management.

Source of data:	Project records
Measurement procedures (if any):	Data is derived from review of the supplement manufacturing product sales records minus any product returns
Monitoring frequency:	Annually
QA/QC procedures:	May be cross referenced by examining the accounting records of the manufacturing facility
Any comment:	-

Data / Parameter table 9.

Data / Parameter:	**$PS_{r,s,y}$**
Data unit:	kg/year
Description:	Amount of supplement purchased of respondent herd *r* in given production category *s* in project survey in year *y*
Source of data:	Sampled parameter from the project respondent herd producer
Measurement procedures (if any):	Sale records should be cross-checked with both buyer and seller of the supplemental feed to make sure records are consistent. Each record should be inputted into a database for review by the DOE
Monitoring frequency:	Annually
QA/QC procedures:	Source documentation shall be archived
Any comment:	-

Data / Parameter table 10.

Data / Parameter:	**$SA_{r,s,y}$**
Data unit:	Number of productive females
Description:	Number of productive females per respondent farm in a given production category in the survey sample
Source of data:	Sampled parameter from the project respondent herd producer
Measurement procedures (if any):	Based on interview with respondent herd producer
Monitoring frequency:	Annually
QA/QC procedures:	Survey response documentation shall be archived in both written and digital form
Any comment:	-

Data / Parameter table 11.

Data / Parameter:	**$NP_{s,y}$**
Data unit:	number of animals
Description:	Total number of productive females in the production category *s* in year *y*
Source of data:	Supplement processing facility
Measurement procedures (if any):	Based on records in the supplement processing facility's customer database

Monitoring frequency:	Annually
QA/QC procedures:	Source documentation shall be archived
Any comment:	-

Data / Parameter table 12.

Data / Parameter:	**$US_{r,s,y}$**
Data unit:	kg/year
Description:	Amount of supplement fed to non-productive animals or lost to waste of project respondent herd *r* in production category *s* in year *y*
Source of data:	Sampled parameter from the project respondent herd producer
Measurement procedures (if any):	Based on interview with cattle herd producer
Monitoring frequency:	Annually
QA/QC procedures:	Survey response documentation shall be archived in both written and digital form
Any comment:	-

Data / Parameter table 13.

Data / Parameter:	$PE_{EG,y}$ **$PE_{EG,y}$**
Data unit:	t CO_2
Description:	Project emissions from energy consumed in manufacturing the supplemental feed in year *y*
Source of data:	Operation records
Measurement procedures (if any):	Apply the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and/or "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"
Monitoring frequency:	Annually
QA/QC procedures:	Cross check with receipts and inventory
Any comment:	-

Data / Parameter table 14.

Data / Parameter:	**$PE_{trans,y}$**
Data unit:	t CO_2
Description:	Project emissions from fuel used associated with the transportation of supplement feed in year *y*
Source of data:	Operation records
Measurement procedures (if any):	Apply the tool "Project and leakage emissions from transportation of freight"
Monitoring frequency:	Annually
QA/QC procedures:	Cross check with receipts and inventory
Any comment:	-

6.1. Project activity under a programme of activities

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

Appendix 1. Additional guidance on the baseline survey and project survey

1. Baseline survey

1. Stratified multi-stage cluster sampling method shall be used in the baseline survey for the purpose of determining parameters for baseline emissions calculation. Baseline survey is carried out in those non-participating farms in the smallholder dairy sector, following the same production system as those participating ones, at the initiation of the project and updated annually. In doing so, the latest version of the "Sampling and surveys for CDM project activities and programme of activities" shall be followed and the latest version of the guideline "Sampling and surveys for CDM project activities and programmes of activities" may be referred to for the best practice regarding stratified multi-stage sampling method.

2. The baseline survey conducted at the start of the project (before any of the project supplements are available) is mainly to ascertain the level of variability in the population and hence the appropriate sample size needed to get the desired level of accuracy of future estimates. Annual baseline surveys (as well as project surveys) will then be conducted within one to two months after the close of the crediting year for which the monitoring data (i.e., monitoring period) is required.

3. One focus of the baseline survey is to characterize dairy production within the project area. Therefore, data of the milk productivity and management of productive dairy animals shall be collected,[1] including: (a) the level of intensity; (b) presence of genetics; (c) basal diets of the productive females; and (d) production indicators.

4. The intensity of management and the level of improved genetics with the respondent herd are each separated into three categories:

    (a) Level of management intensity

        (i) Intensive, total confinement of productive females with all roughage provided, no grazing (A);

        (ii) Semi-intensive, partial confinement of productive females with some roughage provided and some grazing (B);

        (iii) Extensive, no confinement of productive females with no roughage provided other than grazing (C);

    (b) Presence of genetics;

[1] As such, data regarding the support animal group, i.e. males and immature females, are not to be collected. This is because the supplementation in this methodology targets only the productive (lactating) animals. For the purpose of conservativeness, the possible resultant decrease in methane emissions from the support animal group (i.e. males for breeding and replacement females) in the project activities is not considered.

(i) Purebred, productive females with more than 75 per cent improved genetics (a);

(ii) Crossbred, productive females with between 25 per cent and 75 per cent improved genetics (b);

(iii) Native stock, productive females with less than 25 per cent improved genetics (c).

5. Based on the survey data above, production systems can be identified by cross referencing of the animal management systems and the level of improved genetics (see table 1 below).[2]

Table 1. Potential production systems

Intensity genetics	Intensive (A)	Semi-intensive (B)	Extensive (C)
Purebred (a)	Aa	Ba	Ca
Crossbred (b)	Ab	Bb	Cb
Native (c)	Ac	Bc	Cc

6. For the purpose of data regarding basal diet, the feeding patterns of the productive females of the respondent herd are needed. Specifically the roughage and non-roughage inputs (kilograms per day) of the animals' basal diets and the number of days occurring in each season are compiled in order to later to disaggregate the basal ration for seasonality and the productive females' stage of productivity (lactating versus non-lactating).[3]

(a) Roughage inputs:

(i) Forage:

a. Species identified by scientific name;

b. Stage of maturity when fed;

c. Fed ad libitum or measured;

(ii) Crop residues:

a. Crop species identified by scientific name;

b. Condition;

c. Fed ad libitum or measured;

(b) Non-roughage inputs:

a. Concentrates identified by nutrient composition;

[2] It is possible that some combinations will not be found in a given location. For example, Ca and Ac are less likely combinations.

[3] The quality and quantity of the feed inputs may vary significantly by season and the animals' stage of production.

b. Supplements identified by type and nutrient composition;

c. Salt/mineral identified by feeding mechanism and composition;

(c) Production indicators:

(i) Data for four specific animal production characteristics are required: (a) animal weight; (b) daily milk production in litres of Fat Corrected Milk; (c) days in milk per lactation; and (d) the inter-calving interval. Those data parameters and their respective identifying nomenclature are as follows. The way of measurement are included in the monitoring section:

a. Number of productive females in the respondent herd;

b. Mature productive female weight - kilograms;

c. Fat corrected milk - kilograms per day;

d. Days in milk/lactation - days;

e. Inter-calving interval - days;

f. The number of calendar days occurring in each season.

2. Project survey

7. Project survey applying stratified multi-stage cluster sampling method is used annually to determine the changes in feed characteristics, productivity and methane emissions brought about by a supplementation project, so that the project emissions can be quanitified.

8. Changes in a sub-set of the production systems shall be tracked in project surveys. Should a given participating farm change their conditions with regard to their production category, they are re-classified to the appropriate category, thus changing their basis of comparison with the non-project population.

9. The project proponent shall establish and maintain a database of supplement users and to ensure regular and routine collection of information on supplement sales/distribution. The database shall include information on size of the lactating herds, and the genetics and management system used by purchasers as well as their physical location[4] and contact data for subsequent follow-up.

10. The database of supplement users is divided into the same production categories as identified in the baseline survey. Each of these production categories is considered a separate sample frame from which stratified multistage cluster samples will be taken. In doing so, the latest version of the "Sampling and surveys for CDM project activities and programme of activities" shall be followed and the latest version of the guideline "Sampling and surveys for CDM project activities and programmes of activities" may be referred to for the best practice regarding stratified multi-stage sampling method.

[4] Where GIS information is available, or as it is collected during sample surveys, it should also be added to the customer database to facilitate validation.

11. The survey method used to gather data from the selected respondents is nearly identical to that used in the baseline survey. The only difference is the addition of data that pertains directly to supplement usage:

    (a) Length of time productive females were kept on the supplement, amount of supplement given [5] and the amount of supplement given to non-producing animals i.e. males, immature females, other animal species (for the purpose of determining discount factor);

    (b) Amount of supplement purchased in previous year.

[5] Part of the survey given to randomly sampled beneficiaries must ask for a physical demonstration of the quantity of supplement given to an animal. The enumeration team then measures the amount of feed supplement demonstrated by the producer and records the data.

Appendix 2. Further guidance for feedstuffs nutrient analysis

1. For the purpose of determining GE_z, the following procedure for determining nutrient content shall be followed:

   (a) A reliable nutrient profile of each of the feedstuffs prevalent in the identified basal rations is required for the determination of GE. For each identified feedstuff, the International Feed Number including the Feed Class Number should be included when available in the profile description. The following two sources may be used for determining nutrient content of the identified feedstuffs, in the order of preference:

      (i) Physical analysis, Proximate or Near Infrared Spectrometry: Physical analysis of the actual feedstuffs prevalent in the categorized production systems is the most preferred method for determining nutrient content. An independent laboratory, either governmental or private, should be used to conduct the analysis;

      (ii) Published nutrient profiles: Should it not be practical to obtain physical analysis of the actual feedstuffs, the use of published nutrient profiles is acceptable. These profiles can be found either in published feed tables (international, regional and/or country specific) or in peer reviewed technical publications;

   (b) Nutrient data required:

      (i) For each identified feedstuff, the required nutrient profile shall include Dry Matter content (% mass), Gross Energy (GE - Mega Joules/kilogram dry matter basis) or Digestible Energy (DE -Mega Joules/kilogram dry matter basis) and Total Digestible Nutrients (TDN - % dry matter basis). In case the GE level is not readily available, GE may be derived by dividing DE by the digestibility factor of the feedstuff.[1]

- - - - -

[1] Global Impact Domain: “Methane Emissions”, Feed Characteristics, section 2.2, Food and Agriculture Organization, 2000 <http://www.fao.org/wairdocs/lead/x6116e/x6116e02.htm#b2-2.2%20Feed%20Characteristics>.

Document information

Version	*Date*	*Description*
01.0	1 June 2014	EB 79, Annex 13 Initial adoption.

Decision Class: Regulatory
Document Type: Standard
Business Function: Methodology
Keywords: avoidance of methane emission, simplified methodologies, type (iii) projects