Project design document form for small-scale CDM project activities

(Version 05.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for small-scale CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Kolar Biogas Project
Version number of the PDD	Version 14
Completion date of the PDD	18/06/2015
Project participant(s)	SKG Sangha, Foundation myclimate – The Climate Protection Partnership
Host Party	India
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Version 18 of AMS-I.C "Thermal energy for user with or without electricity", Version 3 of AMS-I.E "Switch from non-renewable biomass for thermal applications by the user" Version 1 of AMS-III.R "Methane recovery in agricultural activities at the household/small farm level"
Estimated amount of annual average GHG emission reductions	45,650 tonnes of CO2 e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The proposed project will provide biogas units to households in rural areas of Kolar District in Karnataka State in India. The project will reduce the amount of fuel wood and kerosene used for cooking and heating water and will replace inefficient traditional cooking stoves with cleaner biogas stoves. The project will also reduce methane emissions from cattle manure and will contribute strongly to the sustainable development of the rural households involved in the project.

The biogas technology is tried and tested in rural India. SKG Sangha, an Indian non-governmental organisation (NGO), will implement the project. SKG Sangha has already successfully implemented over 50,000 biogas units in India over the last 15 years. Many of these biogas units were implemented with the help of government subsidies but the availability of these subsidies has reduced dramatically in recent years from around 250,000 units per year to around 5-10,000 units per year for the entire country. As there are over 600 districts in India, this equates to at best only tens of biogas units per District and an even smaller number at a Taluk level. Similarly, charity or donor financing has contributed to biogas units in the past but such financing is not able to cover the vast need for improving the energy supply to rural households in India. SKG Sangha therefore turned to the Clean Development Mechanism to provide biogas systems to rural households.

The project encompasses 9,380 households in all five Taluks in Kolar District – Srinivaspur, Kolar, Mulbagal, Malur, and Bangarapet.[1]

The Taluk is an Indian administrative unit. The Karnataka state is divided into several districts and each district is divided into taluks. Each taluk is subdivided into panchayaths for administrative purposes.

A taluk consists of several Panchayaths. Each taluk may have between 10 and 50 panchayaths. A Panchayath will have several hamlets or villages as part of it. A village is the bottom structure of human settlement. Each village may have few to few hundred households.

Generally, a Taluk consists of a city or town that serves as its headquarters, possibly additional towns, and a number of villages. As an entity of local government, it exercises certain fiscal and administrative power over the villages and municipalities within its jurisdiction. It is the ultimate executive agency for land records and related administrative matters.

In each of the 9,380 households covered by the proposed project a family size biogas unit will be installed. The biogas unit will be of either $2m^3$ or $3m^3$ capacity depending on the number and type of cattle owned by the household and the number of people in the household. At least two cattle will be required for a household to be eligible for a $2m^3$ biogas unit and at least 3 cattle will be required for a household to be eligible for a $3m^3$ biogas unit. Overall it is planned to install 2,814 units of 3 m^3 capacity and 6,566 units of 2 m^3 capacity.

The project will result in greenhouse gas (GHG) emission savings in the following ways:

- The biogas will displace GHG emissions from kerosene and fuel wood that are currently used for cooking. The biogas produced from cattle manure is a renewable source of energy as the CO_2 that is absorbed during the growth of the organic matter in the dung equals the CO_2 emitted when the biogas is burnt (see the introduction in chapter 10.1, Volume 4 of the Revised IPCC Guidelines 2006).

[1] Chikballapur District was created out of Kolar District on 23 August 2007 (http://chikballapur.nic.in/district_profile.html). As a result, Kolar is now comprised of five taluks - Srivinvaspur, Kolar, Mulbagal, Malur and Bangarapet (http://www.karnataka.com/districts/#).

In accordance with methodology AMS-I.E, emission reductions are calculated for the non-renewable part of the fuel wood and for the share of kerosene that would be used for cooking without the proposed project activity.

- The biogas will displace GHG emissions from cattle manure that is currently dumped in pits near the household. The cattle manure is dumped along with other waste such as straw from the cow shed, some kitchen waste, crop residues and other organic matter and liquids in the pit. This organic waste is never dry and does not get mixed therefore animal waste is decaying anaerobically and emitting methane. When cattle manure is fed to the biogas reactor, the emissions from the amount of manure that is added to the bioreactor will be avoided.

Biogas digester under construction

The project will have multiple sustainable development benefits in addition to the reduction in GHG emissions:

- Efficient cooking stoves fired with biogas will reduce indoor air pollution and respiratory problems currently caused by smoke from inefficient cookstoves burning fuel wood and kerosene;

- Currently the majority of the collected fuel wood used for cooking and heating water represents non-renewable biomass. The installation of a biogas unit will reduce the consumption of fuel wood by participating households and will therefore reduce the pressure on scarce forest resources in the project area;

- Women and children can use time that was otherwise required for collecting fuel wood for education and generating income;

- Biogas provides a more convenient, dependable energy source that is renewable and that reduces cooking time as there is no longer a need to set a fire and get it going;

- Cleaning of the kitchen and pots used for cooking is easier as biogas is a clean burning fuel and does not produce the levels of soot and other particulate matter that is produced by burning fuel wood and kerosene; and

- The slurry produced from the biogas units is a valuable organic fertiliser that can be applied directly to the fields or composted with other organic material to improve crop yields and reduce the use of chemical fertilisers.

SKG Sangha has developed extensive knowledge about biogas units that are suitable for rural households in Karnataka State, what functions well and what may induce problems, as well as knowledge about waste management, sludge application, composting and proper use of sludge or compost. SKG Sangha will conduct a number of meetings with eligible households and provide training to transfer this knowledge.

Total estimated reductions (tonnes of CO_2 e)	456,504
Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**45,650**

The total estimated emissions reductions are 456,504 t/CO_2e and the annual average estimated emission reductions are 45,650 t/CO_2e.

A.2. Location of project activity

The proposed project activity will be implemented in rural areas of Kolar District, which has five Taluks – Srinivaspur, Kolar, Mulbagal, Malur, and Bangarapet.

A.2.1. Host Party

India

A.2.2. Region/State/Province etc.

Karnataka State

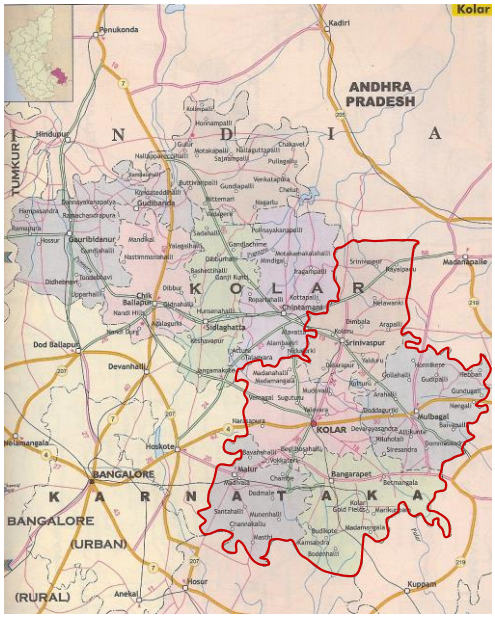
A.2.3. City/Town/Community etc.

Rural areas of Kolar District (Srinivaspur, Kolar, Mulbagal, Malur, and Bangarapet Taluks)

A.2.4. Physical/Geographical location

The map to the left shows the approximate location of the project on a large scale map of India. The actual project boundaries will be the outer boundaries of Kolar District. Kolar District encompasses the following five Taluks: Srinivaspur, Kolar, Mulbagal, Malur and Bangarapet.

The red line on the Kolar District map below shows the outer District boundaries for Kolar District.



As the proposed project activity is going to be implemented in 9,380 households distributed over an area, it is impractical to give geographic coordinates of 9,380 points. Instead, the geographical coordinates of the taluk centres are given below:

Centre	Latitude º N	Longitude, º E
Kolar Taluk	13º08´12.04´´	78º08´20.44´´
Bangarapet Taluk	12º59´04.97´´	78º10´42.40´´
Malur Taluk	12º59´20.71´´	77º55´42.12´´
Mulbagal Taluk	13º09´39.22´´	78º23´19.11´´
Srinivaspur Taluk	13º20´19.13´´	78º12´38.15´´

A.3. Technologies and/or measures

The project falls into the following categories of small-scale project activities:

I.C – “Thermal energy for the user with or without electricity”
I.E – “Switch from Non-Renewable Biomass for Thermal Applications by the User”
III.R – “Methane recovery in agricultural activities at household/small farm level”

The project will involve using cattle dung for the production of biogas (category III.R), which will displace the use of kerosene (category I.C) and non-renewable biomass (category I.E) for household cooking purposes.

The project conforms to these small-scale categories because:

- Introduced renewable energy technologies – biogas systems – have an aggregate capacity less than 45 MW: the average capacity of the units that will be installed under the proposed project activity is 2.97 kW so the aggregate capacity of the systems is in the order of 27.9MW (see justification below); and

- Recovery and destruction of methane from manure and agricultural wastes in all systems (all households) results in emission savings of less than 60kt CO_2e annually.

Justification of installed capacity

- The biogas produced from cattle manure and kitchen waste in household-size biodigesters has an average content of 60% of methane with the rest being CO_2 and traces of other gases.
- The calorific value of this biogas is 21.6 MJ/m^3 (Nijaguna, 2002), or 0.0060048 kWh/l at a normal pressure, as gas pressure at a burner is a normal pressure.
- The Average thermal stove efficiency is 55% (Nijaguna, 2002)
- A Stove with a double burner burns 900l/h Therefore the capacity of an average biogas unit is 2.97 kW, and thus the total capacity of 9,380 units is 27.9 MW, which is below 45 MW threshold.

Calculation of thermal equivalent

Parameter	Value	Unit	Source where relevant
Unit conversion rate	0.278	kWh/MJ	
Calorific Value of biogas in a biogasdigester	21.6	MJ/m3	Nijaguna, B.T. Biogas Technology (New Age International (P) Ltd, 4835/24 Ansari Road,Daryagani, New Dehli 110 002, 2002).
	6.0048	kWh/m3	
	0.0060048	kWh/l	
Gas use of buring stove	900	l/h	Stove manufacturer
Average stove thermal efficiency	55%		Stove manufacturer
Caclulated thermal installed capacity of one unit	2.97	kW	
Number of units installed	9380		
Thermal capacity of 9380 units	**27.9**	**MW**	

Technology

In each household, a family-size biodigester together with a biogas-based cooking stove unit will be installed. The biogas units will be constructed of bricks, sand, cement, pipes, pipe fittings, metal clips, wire and gas burners. Each bioreactor will be a mesophylic fixed dome. The capacity of the biodigesters will be either 2m^3 or 3m^3 of biogas per day. The biogas unit size for a particular household will be chosen based on the number and type of cattle owned by the household and the number of people in the household. SKG Sangha will build the systems with the help of people

from the households. Cattle dung and wastewater will be fed into the biodigester daily. Cattle dung and kitchen wastewater will be added to a mixing tank above ground which has an inlet pipe to a digester chamber which is below ground. The dung and wastewater slurry remains in the chamber for approximately 40 days and breaks down anaerobically producing biogas. This biogas builds up above the slurry and remains in the chamber until it is released through the gas outlet pipe at the top of the dome when the gas burner in the household is turned on (the pipe at the top of the biodigester leads to the cooking stove in the household). The biodigester also produces a slurry which is pushed into the outlet tank and displacement chamber as the biogas builds up in the digester and finally exits through the slurry discharge hole. The technology has been tested and widely used in India.

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	SKG Sangha	No
Switzerland	Foundation myclimate – The Climate Protection Partnership	No

SKG Sangha is an Indian NGO that has successfully implemented over 50,000 biogas units in India over the last 15 years. SKG Sangha is the project developer and will be responsible for the implementation of the biogas units. Full contact details for SKG Sangha are provided in Annex 1. Farmers and their families are owners of the land and they will be the operators of the biogas units.

Foundation myclimate – The Climate Protecion Partnership is a not for profit foundation based in Zürich, Switzerland, founded in 2002.
Foundation myclimate is responsible for the carbon project development and works closly together with SKG Sangha. It supports the development and buys 100% of issued credits. Full contact details for Foundation myclimate – The Climate Protection Partnership are provided in Annex 1.

A.5. Public funding of project activity

The project does not include public funding. The participating households will make a small in kind contribution of materials and labour but otherwise no other funding or assistance will be available to implement the project. The project will be funded solely from the sale of the offsets created from the project's GHG emission reductions.

A.6. Debundling for project activity

This proposed small-scale project activity is not a debundled component of a large project activity as there is no registered small-scale CDM project activity or a request for registration by another small-scale project activity:

- By the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and

- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

SKG Sangha is implementing another biogas project 'Hassan Biogas Project', which takes place in the same state (Karnataka State). This project is more than 100KM away from the location of the Kolar Biogas project activity. Thus the areas of the two proposed project activities do not border each other and there is significantly more than 1 KM between the borders of the respective project boundaries. This is clearly demonstrated in the map below.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

The following approved small scale baseline and monitoring methodologies are applied to the Kolar Biogas Project:

(i) Version 18 of AMS-I.C "Thermal energy for user with or without electricity"

(ii) Version 3 of AMS-I.E "Switch from non-renewable biomass for thermal applications by the user"

(iii) Version 1 of AMS-III.R "Methane recovery in agricultural activities at the household/small farm level"

B.2. Project activity eligibility

(i) AMS-I.C "Thermal energy for user with or without electricity", version 18

Criteria for the applicability of the methodology	Justification why the methodology is suitable for the proposed project activity
This category comprises renewable energy technologies that supply users with thermal energy that displaces fossil fuel use.	In the proposed project, this methodology is applied for estimating and monitoring emission reductions from displacing kerosene use (fossil fuel) in household cooking stoves (thermal energy) with the use of biogas generated from cattle dung and organic kitchen waste (renewable sources).
Biomass – based co – generating systems that produce heat and electricity are included in this category. For the purpose of this methodology "Cogeneration" shall mean the simultaneous generation of thermal energy and electrical and/or mechanical energy in one process.	In the proposed project activity the biogas unit will not generate electricity. The biogas stove will burn biogas for cooking purpose.
The total installed / rated thermal energy generation capacity of the projects equipment is equal to or less than 45 MW thermal	The average capacity of the biogas units is 2.97 kW so the aggregate capacity of 9,380 systems is in the order of 2.97 MW (see justification in section A.3 above)
For co-fired systems, the total installed thermal energy generation capacity of the project equipment, when using both fossil and renewable fuel shall not exceed 45 MWth.	Co – fired system uses both fossil and renewable fuels. In the proposed project activity, after introducing a biogas unit, fossil fuel will not be used; the biogas stove will burn only biogas for cooking purpose.
In case electricity and / or steam / heat produced by the project activity is delivered to another facility or facilities within the project boundary, a contract between the supplier and consumer (s) of the energy will have to be entered into specifying that only the facility generating the energy can claim emission reductions from the energy displaced.	In the proposed project activity the heat produced by the biogas units will not be delivered to another facility.
Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category	The proposed project activity will replace inefficient traditional cooking stoves with cleaner biogas stoves. The project will reduce the amount of fuel wood and kerosene used for cooking stoves with cleaner biogas stoves, there are no existing renewable energy facilities. Hence the proposed project activity does not seek to retrofit or modify an existing facility for

	renewable energy generation.
The capacity limits specified in the above paragraphs apply to both new facilities and retrofit projects. In the case of project activities that involve the addition of renewable energy units at an existing renewable energy facility, the total capacity of the units added by the project should comply with capacity limits in paragraphs in paragraphs 3 to 5 of the methodology AMS. I –C version 18 and should be physically distinct from the existing units.	The proposed project activity will replace inefficient traditional cooking stoves with cleaner biogas stoves. The project will reduce the amount of fuel wood and kerosene used for cooking stoves with cleaner biogas stoves, there are no existing renewable energy facilities.
Charcoal based biomass energy generation project activities are eligible to apply the methodology only if the charcoal is produced from renewable biomass sources.	The proposed project activity will replace inefficient traditional cooking stoves with cleaner biogas stoves. The project will reduce the amount of fuel wood and kerosene used for cooking stoves with cleaner biogas stoves, there are not charcoal energy generation.

(ii) AMS-I.E "Switch from non-renewable biomass for thermal applications by the user", version 3

Criteria for the applicability of the methodology	**Justification why the methodology is suitable for the proposed project activity**
This category comprises small thermal appliances that displace the use of non-renewable biomass by introducing new renewable energy end-user technologies. Examples of these end user technologies include biogas stoves and solar cookers.	The proposed project will introduce small, family-size biogas systems (bioreactors and cookers) that supply thermal energy for household cooking needs. In the area of the proposed Kolar Biogas Project, 78% of fuel wood used for cooking is considered non-renewable biomass (see section B.4 below for information on how the fraction was estimated). For households participating in this project, their fuel wood use will be replaced with the use of biogas generated in small biogas reactors (renewable energy derived from cattle dung).
If any similar registered small-scale CDM project activities exist in the same region as the proposed project activity then it must be ensured that the proposed project activity is not saving the non-renewable biomass accounted for by the other registered project activities.	A similar activity, 'Hassan Biogas Project' has been proposed for registration under the CDM, which is located in the same state but separated from the proposed Kolar Biogas Project by Tumkur and Bangalore Districts. The two project areas are more than 100 km apart (see A.6). This is far above the distance travelled by project participants to collect fuel wood. The baseline survey described in section B.4 below showed that the average distance for collecting fire wood is 2 km, and the maximum distance mentioned was 15 km.
Project participants are able	A number of studies on bioresource use in Karnataka show that

to show that non-renewable biomass has been used since 31 December 1989, using survey methods	non-renewable biomass has been used since 31 December 1989. In particular, Ramachandra et al in "Bioresource Status in Karnataka" (2004 – see reference 2 in Annex 5) noted that the share of fuel wood in cooking in rural areas increased from 56% in 1989/90 to nearly 62% in 1994/95. This increased demand could not have been met by renewable supplies of fuel wood in Kolar District due to the serious bioresource shortages in Kolar District. A number of studies have shown that Kolar District is a bioresource deficient zone meaning that not only is there insufficient fuel wood to meet cooking and water heating demands, there is also a shortage of other possible bioresource substitutes like animal, crop and horticultural residues. With more than 70% of the population in rural areas, Ramachandra et al (2004 – see reference 2 in Annex 5) note that there is tremendous demand on resources such as fuel wood and agricultural residues to meet people's daily fuel needs. More recent studies on non-renewable biomass use in Kolar District including Ramachandra and Rao in "Inventorying, Mapping and Monitoring of Bio-resources Using GIS and Remote Sensing" (2005 – see reference 3 in Annex 5) have noted the high level of non-renewable biomass use in Kolar District so the pattern that was established from 1989/90 has continued in more recent years due to the sustained demand on bioresources to meet rural energy needs. This is supported by the baseline survey of a sample of households in the region (see B4 below and Annex 3 for further details) which confirmed that the time for collecting fuel wood and the price for purchasing fuel wood has been increasing, which shows persistent and growing non-renewable biomass use.

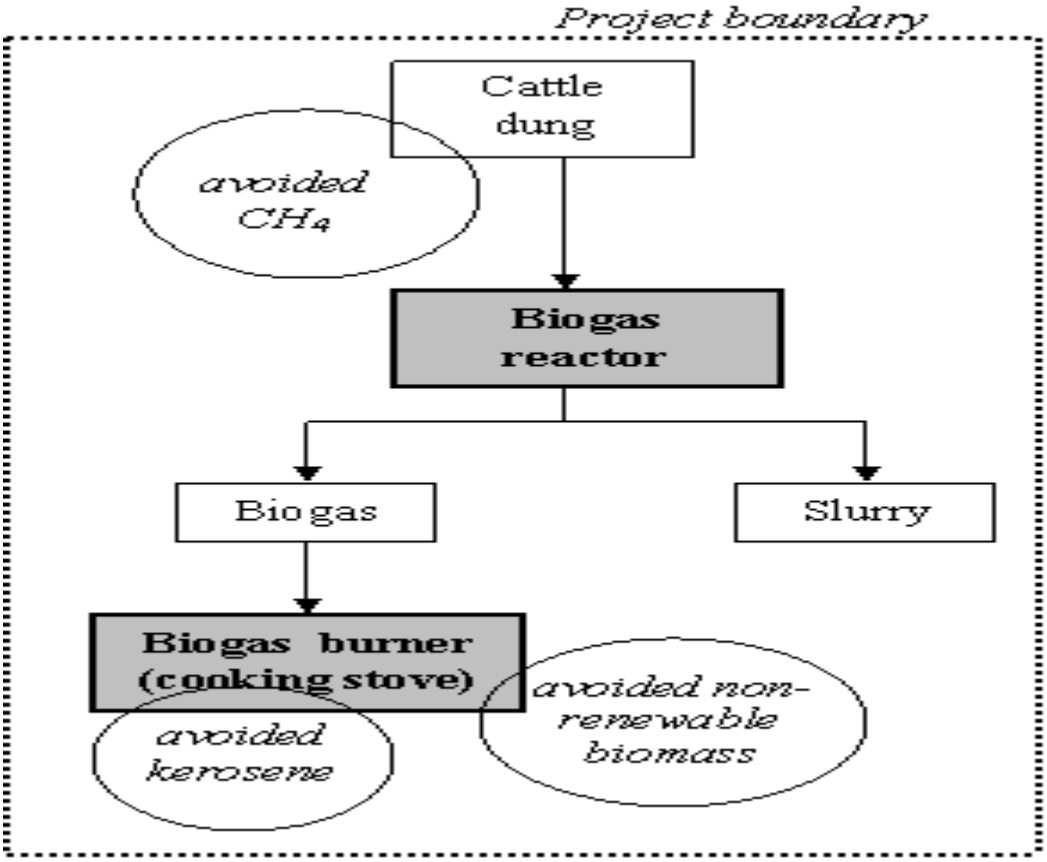
(iii) AMS-III.R "Methane recovery in agricultural activities at the household/small farm level", version 1

Criteria for the applicability of the methodology	Justification why the methodology is suitable for the proposed project activity
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.	In the proposed project activity, animal manure is currently dumped in pits. Each household has a pit in the ground which is at least 1 m deep, where waste from the cattle shed – cow dung, straw, green fodder and urine – is dumped. Waste from the cattle shed is dumped in the pit along with some crop waste, any food waste, and sometimes toilet waste. The waste is not turned or mixed during the year. Cow urine, wastewater from the kitchen and other liquids are added to keep the mass in the pits wet or liquid. During the rainy season the pits also get filled with rainwater. The pits are cleaned out once a year. Additionally the average annual temperature in the region is 29.7º C. The animal waste is decaying anaerobically in the pit and emits methane. After introducing a biogas unit, the amount of animal manure fed into biodigesters will not be left to decay anaerobically in the pit. Instead the manure that is fed into the biodigester will break down anaerobically in the biodigester. The biogas that is produced will be held in the biodigester until it is combusted in the biogas burners and used for cooking and heating water. The project scenario conforms to the (b) situation described in the methodology.
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 5 tonnes of CO2e per system are included in this category.	Biogas digesters will be installed in individual households in rural areas. A 2 m3 single biogas system avoids annually 2.36 t CO_2e and a 3 m3 unit 3.54 t CO_2e due to this methane recovery (see below for calculations) i.e. less than the 5 t CO_2e maximum annual amount from methane recovery permitted under this methodology.
This project category is only applicable in combination with AMS I.C	The methodology AMS-I-C is applied for the use of methane for thermal energy (cooking and heating water).
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.	The sludge from the bio-digesters will be used as a fertiliser by spreading thinly and directly on the ground. Training for biogas system users will include training on the proper handling of sludge.

(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.	The methane that builds up in the bio-digester is destroyed on a daily basis by burning it in cookers for meeting household cooking needs and in some cases water heating needs. The bio-digesters will not create any surplus gas over and above household requirements. This is because the bio-digesters will provide maximum energy to the household of 2.77. GJ per year which is lower than the actual household energy requirement of 5.7 GJ.
Aggregated annual emission reductions of all systems included shall be less than or equal to 60 kt CO2 equivalent.	Aggregate annual emission reductions from avoided methane of all 9,380 households included will be 25,453,574 t CO_2e. Maximum annual emission reductions from the project activity as a whole are 56,227 t CO_2e. In both cases emission reductions are less than the 60,000t CO2e limit that applies to this methodology. The calculations are based on a projection that 30% of the units will be $3m^3$ capacity units and that the remaining 70% of the units will be $2m^3$ capacity units.

B.3. Project boundary

The project boundary is defined by the physical, geographical site of biogas digesters and biogas cookers. The diagram below shows a schematic representation of the project and its boundary:



Sources and gases included in the project boundary:

	Source	Gas	Included?	Justification/explanation
Baseline	Thermal energy need –use of kerosene	CO_2	Yes	Major source of emissions
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Thermal energy need –non-renewable biomass share of the fuel wood use	CO_2	Yes	Major source of emissions
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Animal waste	CO_2	No	Excluded as emissions from animal waste are CO_2-neutral
		CH_4	Yes	Major source of emissions
		N_2O	No	Excluded for simplification
Project activity	Direct emissions from the biodigester (physical leakage)	CO_2	No	Excluded as emissions from biogas are CO_2 neutral
		CH_4	Yes	Main source of project emissions
		N_2O	No	Excluded for simplification
	Leakage	CO_2	No	Any possible leakage is more than compensated for by unclaimed (a) avoided N_2O emissions from cattle manure that goes into the biodigester, (b) avoided CO_2 emissions from avoided application of fertiliser due to improved fertiliser from the biogas slurry, and (c) avoided emissions of products of incomplete combustion of fuel wood.

B.4. Establishment and description of baseline scenario

The baseline parameters were identified using a survey of a sample of target households in the Kolar region. The survey was carried out in 361 households including:

- 75 households in Bangarpet Taluk
- 69 households in Kolar Taluk
- 69 households in Malur Taluk
- 68 households in Mulbagal Taluk
- 80 households in Srinivasapur Taluk

The survey results show that a typical household has on average 6.3 persons, an annual income of 25,468 rupees (ca. €390), and 5 heads of cattle (ca. 2.7 dairy cows, 1.4 buffalo and 0.7 non-dairy cow)[2]. The table with the main baseline survey results is given in Annex 3.

[2] These parameters have been adjusted in order to ensure a precision at 95% confidence level resulting: 2.6 dairy cows, 1.2 buffalo and 0.5 non-dairy cows.

(i) Kerosene component

According to AMS-I.C "Thermal energy for user with or without electricity", version 18,

> "For renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity times an emission for the fossil fuel displaced. IPCC default values for emission coefficients may be used."

Without the proposed programme activity, households in rural areas of the Kolar District will continue with their current practices of cooking using fuel wood and kerosene (for further discussion on this see section B.5 below).

The baseline survey results show that the average total kerosene consumption of a household in the project area that would potentially be eligible for a biogas unit is 42.5 litres per year. The average amount of kerosene that is used for starting fires and cooking from this total amount is 24.12 litres per year. The balance of the kerosene is used for lighting. The biogas systems will displace the average amount of kerosene used for cooking and starting fires as the kerosene will no longer be required as an accelerant to start cooking fires and for providing a quick convenient fuel used to boiling water for tea for visitors.

Therefore the baseline for the kerosene component of the proposed project activity is considered to be the use of 24.12 litres of kerosene per household per year. The IPCC default value for stationary combustion of kerosene in a residential category is used as the emission factor.

(ii) Non-renewable biomass component

According to AMS-I.E:

> "Switch from non-renewable biomass for thermal applications by the user", it is assumed that in the absence of the project activity, the baseline scenario would be the use of fossil fuels for meeting similar thermal energy needs."

In the proposed project activity, the average participating household uses 4.7 tonnes of fuel wood per year for cooking according to the baseline survey results. Studies at the Karnataka State level have shown that Kolar District is a bioresource deficit zone where the demand for fuel wood and other bioresources far exceeds supply. For example, in the study "*Bioresource Status in Karnataka*" (Ramachandra et al, 2004 – see reference 2 in Annex 5) Kolar District was included in the Eastern Dry Agro Climatic Zone which was identified as having a bioresource availability to demand ratio of 0.39 i.e. only 39% of the bioresources that were used could be considered to be renewable. Similar comments were made in the study "*Bioresource Potential of Karnataka: Technical Report No. 109*" (Ramachandra and Kamakshi, 2005 – see reference 4 in Annex 5). These state level studies support the results of specific studies on bioresource use in Kolar District. The study "*Inventorying, Mapping and Monitoring of Bioresources Using GIS and Remote Sensing (Kolar District)*" (Ramachandra and Rao, 2005 – see reference 3 in Annex 5) assessed bioresource use in Karnataka through remote sensing data analyses, field surveys involving village level inventorying of the tree diversity and mapping of resources using geographic information systems and global positioning systems. This study generated a bioresource availability to demand ratio for each taluk in Kolar District with an average ratio for Kolar District of 0.22. This ratio means that on average only 22% of the bioresources that are used in Kolar District are renewable and that 78% of the bioresources used in Kolar District are non-renewable. As this study is specific to Kolar District rather than a more general state level study and given that the study incorporates detailed analysis of villages in the project area these results represent the most accurate and appropriate figure for non-renewable biomass use in the Kolar District.

The households will switch to biogas systems which are able to meet all their cooking and some of their water heating needs. All fuel wood that is used for cooking will therefore be replaced once a household has a biogas unit. For the households in the project area, fossil fuels generally are too expensive and/or need expensive equipment for their use for cooking purposes (for more details see the section B.5 on additionality). There is no clear projected fossil fuel to which such families would switch, as the gap between current income and the income needed to afford fossil fuel use for cooking purposes is large. Nevertheless, kerosene could theoretically be considered as a projected fossil fuel, as it does not need expensive cooking equipment, is available in the market, and some kerosene is already used by households as an accelerant in cooking fires.

Therefore the baseline for the non-renewable biomass part of the programme is the use of kerosene for supplying the same amount of thermal energy that 3.70 t (i.e., 78% of 4.7 t) of non-renewable woody biomass generates.

(iii) Cattle manure component

According to AMS-III.R "Methane recovery in agricultural activities at the household/small farm level", version 1:

> "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. Baseline emissions (***BEy***) are calculated ex ante using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach (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). Country/regional-specific values shall be used if available."
>
> "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 confidence level of 95%. The survey should determine the baseline animal manure management practices applied. 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."

The general pattern of manure and waste management was defined during preliminary visits to potentially participating households, and then clarified during the baseline survey. In a typical household that will participate in the proposed project activity, animal manure is currently dumped in pits. Households collect animal manure produced when cattle is kept in a shed. Each household has a pit in the ground, which is on average approximately 1.4 m deep, where waste from the cattle shed – cow dung, straw, green fodder and urine – is dumped. Waste from the cattle shed is dumped in the pit along with some crop waste and any food waste. The waste is not turned or mixed during the year. During the rainy season the pits get filled with water. In other times of the year, in order to keep the material in the pit wet or liquid, kitchen waste water is also poured into the pits. The animal waste is therefore decaying anaerobically in the pit and emits methane. The pits are cleaned out once a year and the material is applied in the fields as a fertiliser. Such manure and pit management is also described in the study carried out by the Regional Biogas Development and Training Centre, University of Agriculture Sciences, Bangalore (ref. 1 in Annex 5).

Questions were included in the baseline survey on how long the material in the pits corresponds to (i) an uncovered slurry, (ii) drier cover on top but slurry below the crust, (iii) solid wet material, and (iv) solid dry material. The survey categories correspond to the following manure management systems given in Table 10.18, Chapter 10.4, Volume 4 of the IPCC 2006 Guidelines: (i) liquid/slurry manure management system, (ii) liquid/slurry with crust cover manure management system and (iii) solid storage manure management system. The survey results are backed up by the University of Agriculture Sciences study referred to above.

The survey results have shown that manure is handled in a liquid/slurry manure management system for 5.5 months, in a liquid/slurry with crust cover manure management system for 3.3 months and in a solid storage manure management system for 2.8 months. In the remaining 0.5 months the material is solid and dry[3].

Animal manure is collected primarily when the animals are kept in the sheds that are attached to or close by the house. All the manure from the shed is put into the pit. When animals are grazing outside, dung is only rarely collected and put into the pit. A check of the amount of manure going into the pit was incorporated in the survey by measuring the approximate total manure production per day and the amount of manure that is collected and dumped in the pit. This gives a share of 76%. Animals are kept in the sheds on average for 17.7 hours per day, 74%[4] of the total time. Accordingly, 74% of the total manure produced by the cattle is collected from the sheds and put into the pit as described above. Although some manure that is dropped in the fields is also collected and put into the pit, this manure has not been included in the baseline calculations for the sake of conservativeness. Estimation of the total amount of manure excreted by cattle is considered to be less accurate than estimation of the time per day when animals are kept in the shed, therefore the share identified according to the time the cattle are kept in the shed (i.e. 74%) is used for calculating the baseline.

The following table summarises how the shares of manure handled in different manure management systems have been defined:

Survey question (For how many months does the material in the pit look…)	**Corresponding manure management system according to IPCC definitions**	**Survey result** (months)	**Share of collected manure from total manure produced**	**Share of manure handled in different manure management systems (MS)**
		A	B	= A /12 * B
… like an uncovered slurry	Liquid/slurry[5]	5.30	0.72	0.32
… like a slurry with a crust cover	Liquid/slurry with crust cover[6]	3.2	0.72	0.20
… solid but wet	Solid storage[7]	2.70	0.72	0.16
… solid but dry	Solid storage	0.4		

After the installation of a biogas system, all the manure collected by an average surveyed household will be fed into the $3m^3$ biogas units. For the $2m^3$ units, the household will have fewer cattle than the $3m^3$ biogas units but in the same proportion of different cattle types.

[3] These parameters have been adjusted in order to ensure a precision at 95% confidence level, given a result of: in a liquid/slurry manure management system for 5.3 months, in a liquid/slurry with crust cover manure management system for 3.2 months and in a solid storage manure management system for 2.7 months. In the remaining 0.4 months the material is solid and dry.

[4] This parameter has been adjusted in order to ensure a precision at 95% confidence level, given a result of: animals kept in the sheds on average 17.4 hours per day, 72% of the total time.

[5] Table 10.18 in the IPCC 2006 Guidelines defines this system as the situation when "manure is stored as excreted or with some minimal addition of water in either tanks or earthen ponds outside the animal housing, usually for periods less than one year".

[6] No separate definition is given for this system in the IPCC 2006 Guidelines compared to the liquid/slurry definition, but the Methane Correction Factor is different when the material has a crust cover.

[7] Table 10.18 in the IPCC 2006 Guidelines defines this system as "The storage of manure, typically for a period of several months, in unconfined piles or stacks. Manure is able to be stacked due to the presence of a sufficient amount of bedding material or loss of moisture by evaporation".

Although the survey results are indicative of an average number of cattle aggregated for both types of households – i.e. those eligible for a 3 m^3 unit and those eligible for a 2 m^3 unit – in ex-ante calculations for the sake of conservativeness it is assumed that only 2/3 of the collected manure of an average surveyed household will be fed into the 2m^3 units (as the 2m^3 units only have 2/3 the capacity of the 3m^3 units). The methane will be captured and used for cooking.

B.5. Demonstration of additionality

The proposed project activity has not been announced to local households yet, only the project idea was presented during stakeholder consultation meetings. The project activity is dependent upon receiving carbon credits and this intention was expressed during stakeholder consultation.

The project activity formerly started on 18 December 2008. This is the date of the signed agreement between SKG Sangha and CH4NGE Ltd. Note that the crediting period will start in June 2011 (see C.2.2.1.). The first version of the PDD (PDD V01) was published for global stakeholder consultation at the commencement of the validation of the PDD on 16 September 2008, i.e. before the start of the project activity, and hence is in full compliance with EB 49 Annex 22 entitled "Guidance on the demonstration and assessment of prior consideration of the CDM".

Pre-project situation

Families in rural areas of Kolar District use traditional cooking stoves fired with fuel wood and additionally with kerosene. These can be cooking stoves made of three stones or simple design stoves made of clay. The three-stone cooking stove costs almost nothing and the traditional constructed stove costs only slightly more at 100 Indian Rupees (£1). The fuel wood is collected from woody shrubs and forested areas. The demand for fuel wood is much higher than the regeneration of the woody biomass so there is a severe shortage of fuel wood and forest resources are depleting. 78% of the collected fuel wood is non-renewable (see analysis in section B.4). Additionally, families use some kerosene for enhancing the burning of fuel wood. Each household uses 24.12 litres of kerosene per year for cooking purposes. (source: baseline survey, the template of which is provided in Annex 3)

The traditional cooking stoves have poor efficiency: a large amount of fuel wood is needed to generate enough thermal energy for the household's cooking needs. Burning of fuel wood in such cooking stoves also results in comparatively large amounts of incomplete combustion products – CH_4, N_2O, CO, and non-methane hydrocarbons (NMHC), which are all greenhouse gases more potent than CO_2.

Demonstration of additionality

Approach

The approach used to demonstrate project additionality has been based on the application of the *"Tool for the demonstration and assessment of additionality"* Version 05.2 (EB39 Annex 10). In step 3 we have also referred to specific guidance for establishing the additionality of small scale CDM (SSC) projects, namely Annex 34 of EB 35 (*"Non-binding best practice examples to demonstrate additionality for SSC project activities*"). As a consequence our approach follows the four methodological steps contained within EB39 Annex 10.

The approach used to demonstrate additionality uses four analytical steps:

Step 1. In this step we have identified alternatives to the project activity (in line with step 1 of EB39 Annex10).;

Step 2. In this step we have conducted the Investment Analysis (again in line with step 2 of EB 39 Annex 10). As there are no sources of income for the project activity other than the CDM we have applied the simple cost analysis described in sub-step 2b Option 1 of EB 39 Annex 10.

Step 3. On the completion of step 1b of EB 39 Annex 10 project developers are required to *"Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). (Project participants may also select to complete both Steps 2 and 3.)"*We have chosen to complete both the investment and the barrier analysis. This step details the barrier analysis. The barrier of relevance falls into the category of "Investment barriers" as described in step 3a of EB 39 Annex 10. It is also akin to the "Access to Finance Barrier" described in Annex 34 of EB35 (which provides non-binding best practice examples to demonstrate additionality for SSC project activities);

Step 4. The rules specified in EB 39 Annex 10 (at the end of step 2b Option 1) state *"If it is concluded that the proposed CDM project activity is more costly than at least one alternative then proceed to Step 4 (Common practice analysis)".* As we have found the project activity to be more costly than one alternative scenario we have carried out Step 4, Common Practice Analysis.

Analysis

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

In this stage we identify alternatives to the project activity in accordance with Step 1 of EB 39 Annex 10. Step 1 of EB39 Annex 10 requires the identification of project alternatives that are consistent with current laws and regulations.

Sub-step 1a: Define alternatives to the project activity:

Sub step 1 a of EB 39 Annex 10 requires the project developer to *"Identify realistic and credible alternative(s) available to the project participants or similar project developers that provide outputs or services comparable with the proposed CDM project activity".*

Alternatives to the proposed project activity could be:

Scenario 1 - Use of kerosene for all cooking purposes (subsidised fuel);
Scenario 2 - Use of Liquid Petroleum Gas (LPG) Systems (subsidised fuel);
Scenario 3 - Use of sustainable agricultural residues (traditional stove);
Scenario 4 – Project activity – use of project biogas systems; or
Scenario 5 – Pre-project situation: three stones stove plus subsidised kerosene.

Sub-step 1b: Consistency with mandatory laws and regulations:

Sub step 1 b of EB 39 Annex 10 requires the project developer to ensure that the alternative scenarios identified in sub-step 1 a are *"...in compliance with all mandatory applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution".*

There are no legal regulations for households to use renewable energy sources for their cooking needs or to capture methane from manure and organic waste. Therefore all the above alternatives are consistent with existing laws and regulations. Similarly there are no legal regulations that prohibit any of the alternative scenarios.

Step 2. Investment analysis

The investment analysis described in Step 2 of EB 39 Annex 10 requires project developers to *"Determine whether the proposed project activity is not:*

(a) The most economically or financially attractive; or
(b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs)."

The investment analysis requires project developers to conduct a number of analytical steps. These are described in turn below.

Sub-step 2a: Determine appropriate analysis method

During sub-step 2a of EB 39 Annex 10 project developers are required to "*Determine whether to apply simple cost analysis, investment comparison analysis or benchmark analysis"*. The tool states that *"If the CDM project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option I")*. As the project generates no sources of income other than the CDM we have chosen to apply simple cost analysis. The simple cost analysis that we have carried out in step 2b is an analysis of average annual costs. Average annual costs of the project activity and each alternative scenario = (capital costs ÷ technology lifetime) + annual fuel costs + annual maintenance costs).

Sub-step 2b: Option I. Apply simple cost analysis

During sub-step 2b Option I of EB 39 Annex 10 project developers are required to *"Document the costs associated with the CDM project activity and the alternatives identified in Step 1 and demonstrate that there is at least one alternative which is less costly than the project activity"*

The costs associated with the CDM project activity and the alternatives identified in Step 1 are summarised in the table below.

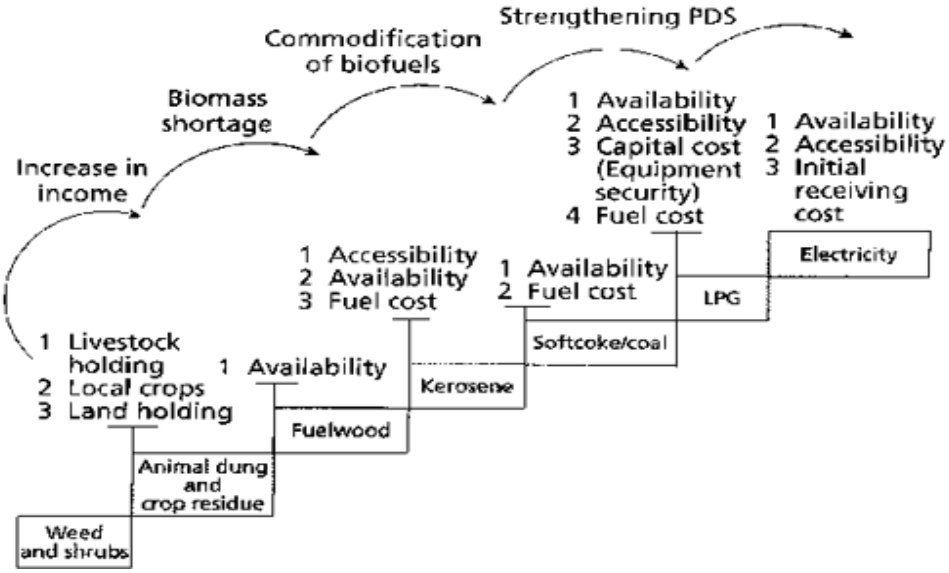
Table: Average Annual Costs of the Project Activity and Alternative Scenarios

Scenario	(1) Average annual capital cost (INR)	(2) Annual fuel cost (INR)	(3) Annual maintenance expenses (INR)	(4) Average annual costs (INR) [Sum of (1), (2) and (3)]
Scenario 1) Use of kerosene for all cooking purposes (subsidised fuel)	80.00	2,000.00	25.00	2,105.00
Scenario 2) Use of Liquid Petroleum Gas (LPG) Systems (subsidised fuel)	120.00	2,829.00	75.00	3,024.00
Scenario 3) Use of sustainable agricultural residues (traditional stove)	3.33	1,395.00	-	1,398.33
Scenario 4) Project activity - use of project bio-gas systems	1,044.95	-	500.00	1,544.95
Scenario 5) Pre-project situation: three stones stove plus subsidised kerosene	-	360.00	-	360.00

Data to calculate the costs in each case was attained from a report produced by the International Energy Initiative in 2004 entitled "Report on the use of LPG as a domestic cooking fuel option in India" (reference 6 in Annex 5), from baseline survey (subsidised kerosene cost) (the template of the survey can be seen in Annex 3), official subsidised LPG cost and bio-digester cost information that was attained from SKG Sangha. Full calculations and source information are provided in Annex 7.

The results were also corroborated against an article written by Preeti Malhotra entitled 'Environmental implications of the energy ladder in rural India'[8] which depicts a graphical representation of fuel use in India as a "ladder", on which the first step shown on the far left of the image denotes the most common and cheapest fuel sources used. Each subsequent step on the ladder from left to right of the diagram denotes the next fuel used, which is generally used less frequently than the fuel source denoted in the previous step because of cost or availability. The energy ladder obtained from this article is shown in the figure below.

Energy Ladder in Rural India



Source: 'Environmental implications of the energy ladder in rural India' (see source 7, Annex 5)

The simple cost analysis, summarised in the table, *Average Annual Costs of the Project Activity and Alternative Scenarios,* shown above, clearly demonstrates that the project activity (Scenario 4) is more expensive than the current pre-project situation (Scenario 5). It can clearly be seen that the project activity meets the requirements of sub-step 2b option 1, as, in accordance with the tool *"..there is at least one alternative which is less costly than the project activity"*

Step 3. Barrier Analysis

At the end of step 1b, EB 39 Annex 10 stipulates *"Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). (Project participants may also select to complete both Steps 2 and 3.)"* We have, in accordance with the rules chosen to complete both Steps 2 and 3. The sub-steps for this stage of the analysis are described in turn below.

Sub-step 3 a. Identify barriers that would prevent the implementation of the proposed CDM project activity:

In this step the project developer is required to *"Establish that there are realistic and credible barriers that would prevent the implementation of the proposed project activity from being carried out if the project activity was not registered as a CDM activity."*

[8] http://www.hedon.info/EnvironmentalImplicationsOfTheEnergyLadderInRuralIndia

The barrier of relevance to the project is the "investment barrier" described in Sub Step 3a, paragraph 1 (a) of EB39 Annex 10. (Note this is also akin to the "Access to Finance Barrier" described in EB35 Annex 34.)
The existence of this barrier can be demonstrated for this project on two grounds.

Firstly, the project activity would not have occurred without the CDM because beneficiary households cannot afford the bio-digester units without the 73% cost subsidy provided by the CDM. This is demonstrated by the fact that the bio-digesters cost between 82% and 103%of the average annual household income in the project activity area. This calculation is based on survey findings (see Annex 3). Surveys identified that average annual income of households in the project area is around INR 25,468 whereas the 2 cubic metre and 3 cubic metre bio-digesters cost INR 20,899 and INR 26,219, respectively. The prohibitive cost of the bio-digesters is substantiated by the fact that nearly all of the biogas systems that have been installed to date have been paid for by the government subsidy programme and almost all biogas plants owners are basically farmers with an average annual income of INR 49,640 this is shown in the "Evaluation Study On National Project on Biogas Development" (see Source 11, Annex 5). That is consistent with the EB39 Annex10, according to which investment barrier can be demonstrated by showing that similar activities have only been implemented with grants or other non-commercial finance terms.

Secondly, EB35 Annex 34 provides an example of the Access to finance barrier as being able to demonstrate that the project activity could not access appropriate capital without consideration of CDM revenues. This is true for the project. The PP was not able to approach any financial institute since they have insufficient assets to secure any finance and there is no income stream generated by the Project Activity. It would not be credible for any approach to have been made for capital finance without any CDM revenue. The PP identified CH4NGE as a source of capital but this was contingent upon validation of the project as it was only able to attain a finance agreement from CH4NGE because of its ability to generate CER income. This is evident from a letter that has been supplied by CH4NGE to the validator which demonstrated that the provision of funding was contingent upon validation of the project.

The following extracts from the Agreement between CH4NGE and S K G Sangha further demonstrate that CH4NGE is providing finance in return for the Offsets (CERs).

7. CH4NGE's Obligations
7.1 CH4NGE shall be responsible for providing funding to SKGS sufficient to allow SKGS to meet Project Costs in accordance with the relevant Budget.
7.2 CH4NGE shall be responsible for carrying out or coordinating all activities relating to the production and sale of Offsets, including (without limitation):
(a) Production of the Project Design Document;
(b) Appointment of the Validator and the Verifier and overseeing the activities of the Validator and the Verifier;
(c) Arranging for Certification of Offsets; and
(d) Arranging for the sale of Offsets to Customers (including all legal and contractual aspects of the Offset sales process).

9. Sale of Offsets
9.1 SKGS shall ensure that each household for whom it installs a bio-digester in accordance with a Projects transfers ownership of any Offsets generated from the use of its bio-digester to SKGS {or signs a waiver in favour of SKGS stating that, in consideration for the bio-digester being installed, the household disclaims any ownership rights over any Offsets}.

9.2 Title to the Offsets will rest with SKGS until completion of Certification. Title shall pass to CH4NGE immediately after Certification and SKGS hereby acknowledges that it has no right, title, benefit or interest to or in the Offsets thereafter nor shall SKGS hold itself out as having any such right, title, benefit or interest.

This is also in line with Guideline 6 of EB50 Annex13 which states: *In case the PPs make the claim for investment barriers, they should demonstrate in the PDD that the financing of the project was assured only due to the benefit of the CDM. Therefore, it should be demonstrated that the loan approval (or other significant financing decision(s)) by the lender takes explicitly the CDM registration into account.*
The provision of funding by CH4NGE is entirely dependent on the benefit of the CDM and CH4NGE explicitly took account of CDM registration in reaching their decision.

We have also used the general guidelines of EB50 Annex 13, guidelines 01 and 02

Guideline 1 states: *While demonstrating barriers related to the lack of access to capital, technologies and skilled labour, the project proponents shall provide information on the nature of the companies and entities involved in the financing and implementation of the project.*

SKG Sangha will implement the project. SKG Sangha is registered in India under the Karnataka Societies Registration Act under number 768/92-93 Its registered offices are at Devarayasamudra Village, Mulabagal Taluk, Karnataka State, India and central office at N0.532, 2nd Main Road, Gandhinagar, Kolar – 563101, Karnataka State, India

SKG Sangha relies on charitable donations for its project funding. In 2008/9 its turnover was Rs1, 62, 02,710. [approx. $US 344,775] They made a profit of Rs, 1, 50,009 [approx. $US 3,190] and their assets totalled Rs2, 17,428 [approx. $US 4, 625].

CH4NGE Limited will provide finance for project implementation in return for which it will receive title to all CERs on certification. CH4NGE is registered in England and Wales under company number 06695049. Its registered office is at c/o Martineau (Ref. DRJ), 35 New Bridge Street, London, EC4V 6BW. CH4NGE will raise the funds for the finance from shareholders/investors but this will only be possible once it can be demonstrated that the project has been validated.

Guideline 2 states: The barrier test in Step 3 of the Tool for the demonstration and assessment of additionality states that *.If the CDM does not alleviate the identified barriers that prevent the proposed project activity from occurring, then the project activity is not additional..*
The PP is required to *"Demonstrate in an objective way how the CDM alleviates each of the identified barriers to a level that the project is not prevented any more from occurring by any of the barriers. Provide transparent and documented evidence, and offer conservative interpretations of this documented evidence."*
"*For example, the prospects of a project, that it will generate CERs, may attract financiers who would normally not finance this kind of project without CDM.*" Since the project generates no revenue for the PP other than through the sale of CERs, the financiers will only provide the funding for implementation of the project in return for the CERs generated under the CDM. A copy of the agreement between SKG Sangha and CH4NGE has been provided to the DoE in confidence.

Sub-step 3 b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

In sub-step 3b of EB 39 Annex 10 project developers are required to *"Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity".*

This investment barrier does not; prevent the continuation of the pre-project situation (scenario 5). Without the project activity, the households would continue using fuel wood and kerosene, which do not require any upfront finance. This assertion is supported by the common practice analysis described in Step 4.

In the proposed project activity, the households will make an in-kind contribution in a form of labour, obtaining sand, purchasing bricks, etc. The contribution will correspond to 23% of the total costs of installing a 2 m^3 biogas unit (bio-digester and cooker), and 30% of the costs of a 3 m^3 unit.

The remaining 77% and 70% of the costs of 2 and 3 m^3 units, respectively, will be covered by revenues from carbon offsets. Without the carbon revenue, the project cannot be implemented.

Step 4. Common practice analysis

According to the methodological tool EB39 Annex10, the common practice analysis is used to complement the investment and/or barrier analysis. The common practice analysis looks at the extent to which the proposed project type has already diffused in the relevant sector and region.

Sub-step 4a: Analyze other activities similar to the proposed project activity:

The majority of rural households use traditional cooking stoves and burn fuel wood with some kerosene. There is a small number of existing biogas schemes in the Kolar District but none in the villages that will be targeted in this project (see sub-step 4b for more information).

Sub-step 4b: Discuss any similar Options that are occurring:

Some biogas systems have been installed in poor rural households of Kolar District, but they have been either supported by schemes using charity or development assistance funding or government subsidies. The Indian government used to provide annual subsidies for around 250,000 biogas units per year but now only provides subsidies for around 10,000 biogas units per year for the whole country. This amounts to only a handful of biogas units per year at a Taluk level. Letters were obtained from local authorities showing that the level of subsidies available in the project area are insufficient. [These letters were shown to the DoE.] As a result SKG Sangha have stated that they no longer use government subsidies for installing biogas units. The project could therefore not proceed on the basis of government subsidies.

The biogas units from this project will be installed in villages where there are no initiatives supported by other NGOs or public agencies for the installation of biogas digesters and the proposed biogas project activity will be solely dependent on carbon finance (apart from a small in kind contribution of labour and materials from the beneficiary households). Therefore the project is additional to what would otherwise occur.

SKG Sangha is the only organisation implementing a biogas programme in the Kolar district. This assertion is supported by a letter from the local Government which has been reviewed by the validator.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

Emission reductions are calculated as the difference between the baseline emissions of the three components – (i) displacement of kerosene, (ii) displacement of non-renewable biomass and (iii) the capture and destruction of methane from animal manure – and the project emissions.

Baseline emissions for the kerosene component are calculated based on the amount of kerosene that will be displaced, its density, net calorific value and the emissions factor for stationary combustion of kerosene in the residential category (according to AMS-I.C “Thermal energy for user with or without electricity”, version 18).

$$BE_{kerosene} = F_{kerosene,\ baseline} * N * \rho_{kerosene} * NCV_{kerosene} * EF_{kerosene} * 10^{-9} \quad (1)$$

$BE_{kerosene}$ – baseline emissions from burning of kerosene for household cooking needs (t CO_2e/year)

$F_{kerosene, baseline}$ – annual amount of kerosene used for cooking in an average household participating in the Kolar District Biogas Project (l/year)

N - Number of devices (biodigesters)

$\rho_{kerosene}$ – kerosene density (kg/l)

$NCV_{kerosene}$ – net calorific value of kerosene (TJ/Gg)

$EF_{kerosene}$ – emissions factor of kerosene (kg CO_2/TJ)

Baseline emissions for the non-renewable biomass component are calculated based on the use of the biomass (fuel wood) that is replaced, the fraction of the biomass that is non-renewable biomass, and the emissions factor of kerosene as a projected alternative fuel (according to AMS-I.E "Switch from non-renewable biomass for thermal applications by the user") The following formula is for one device (biodigester):

$$BE_{NRB} = B_{biomass, baseline} * f_{NRB} * NCV_{biomass} * EF_{kerosene} \quad (2)$$

BE_{NRB} – baseline emissions from the combustion of non-renewable part of the fuel wood used for cooking in households (t CO_2e/year);

$B_{biomass, baseline}$ – quantity of biomass per household that is substituted or replaced in an average household (t/year);

f_{NRB} – fraction of biomass used in the absence of project activity that can be established as non-renewable biomass using survey methods;

$NCV_{biomass}$ – net calorific value of the non-renewable biomass that is substituted (TJ/tonne). Default value of 0.015 TJ/tonne specified in AMS I.E is used; and

$EF_{kerosene}$ – emissions factor for kerosene combustion in households as kerosene is the most reasonable projected fossil fuel in the absence of project activity (kg CO_2/TJ). Default value 71,500 kg CO_2/TJ specified in AMS I.E. is used.

The quantity of the biomass that is replaced is calculated using option (a) in order to provide a more conservative answer.

The baseline is calculated as the product of the number of devices (biodigesters) multiplied by the estimate of average annual consumption of biomass per appliance (i.e. the annual use of fuel wood in an average household) determined based on a survey of a representative sample of households[9].

$$BE_{NRB} = B_{biomass, baseline} * N * f_{NRB} * NCV_{biomass} * EF_{kerosene} * 10^{-3} \quad (3)$$

BE_{NRB} – baseline emissions from the combustion of non-renewable part of the fuel wood used for cooking in households (t CO_2e/year);

$B_{biomass,baseline}$ – quantity of biomass per household that is substituted or replaced in an average household (t/year);

N – number of households;

f_{NRB} – fraction of biomass used in the absence of project activity that can be established as non-renewable biomass using survey methods;

$NCV_{biomass}$ – net calorific value of the non-renewable biomass that is substituted (TJ/tonne). Default value of 0.015 TJ/tonne specified in AMS I.E is used; and

$EF_{kerosene}$ – emissions factor for kerosene combustion in households as kerosene is the most reasonable projected fossil fuel in the absence of project activity (kg CO_2/TJ). Default value 71,500 kg CO_2/TJ specified in AMS I.E. is used.

[9] *Note that the variables N and 10-3 are not included in the originally equation but are needed in order to apply the equation to the 10,000 households that form the project activity and to convert the emission reduction calculations from kg into Tonnes.*

Baseline emissions for the manure component are calculated based on the amount of manure that would decay anaerobically in the pits. The calculation has been carried out in accordance with AMS-III.R "Methane recovery in agricultural activities at the household/small farm level", version 1. This methodology does not provide an equation. Instead it states that emission reductions should be calculated using the Tier 2 approach from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories). Emission factors for manure of different cattle categories (dairy cows, buffalo and other cattle) are calculated based on nationally published (where available) and IPCC default values (where nationally published values are not available) for volatile solid excreted by each animal category, maximum methane producing capacity for manure of each animal category, methane correction factors for liquid/slurry, liquid/slurry with natural crust cover and solid storage manure management systems in a warm climate with average temperature of 29.7°C and fractions of total manure handled in these manure management systems.

$$BE_{manure} = \sum_{(T)} (EF_T * N_T) / 10^6 \quad (4)$$

BE_{manure} – baseline emissions from methane emissions from anaerobic decay of manure (Gg CH_4/year);
T – species/category of livestock;
EF_T – emissions factor for a defined livestock population (category), (kg CH_4 per animal per year); and
N_T – the number of head of livestock species/category T in an average household.

The proposed project will involve N households and will avoid methane emissions which has to be converted into CO_{2e} with the Global potential warming for methane:

$$BE_{manure} = \sum_{(T)} (EF_T * N_T) * N * GWP\_CH_4 / 1000 \quad (5)$$

BE_{manure} – baseline emissions from methane emissions from anaerobic decay of manure (t CO_2e/year);
T – species/category of livestock;
EF_T – emissions factor for a defined livestock population (category), (kg CH_4 per animal per year); and
N_T – the number of head of livestock species/category T in an average household.
N – number of households
GWP_CH_4 – global warming potential for methane

$$EF_{(T)} = VS_{(T)} * 365 * B_{o(T)} * 0.67 \text{ kg/m}^3 * \sum_{(S,k)} ((MCF_{S,k}) / 100 * MS_{(T,S,k)}) \quad (6)$$

$VS_{(T)}$ – daily volatile solid excreted for livestock category T (kg dry matter per animal per day);
365 – basis for calculating annual VS production (days per year);
$B_{o(T)}$ – maximum methane producing capacity for manure produced by livestock category (T/ m^3 CH_4 per kg of VS excreted);
0.67 – conversion factor for converting m^3 CH_4 to kg CH_4;
$MCF_{(S,k)}$ – methane conversion factors for each manure management system S by climate region k (%); and
$MS_{(T,S,k)}$ – fraction of livestock category T's manure handled using manure management system S in climate region k (dimensionless).

The proposed project lies in one climatic region (with high temperatures). The manure management system is different at different times of the year (see Table in section B.4 to see how fractions of manure handled in different manure managements systems were defined). Therefore the formula used is:

$$EF_{(T)} = VS_{(T)} * 365 * B_{o(T)} * 0.67 \text{ kg/m}^3 * (MCF_{liquid}/100 * MS_{liquid} + MCF_{liquid\ with\ crust}/100 * MS_{liquid\ with\ crust} + MCF_{solid}/100 * MS_{solid}) \quad (7)$$

MCF_{liquid} - methane conversion factor for the liquid/slurry manure management system [note: liquid/slurry is a type of manure management system]

MS_{liquid} fraction of livestock category T's manure handled using liquid/slurry manure management system

$MCF_{liquid\ with\ crust}$ methane conversion factor for the liquid/slurry manure management system with natural crust cover

$MS_{liquid\ with\ crust}$ fraction of livestock category T's manure handled using liquid/slurry manure management system with natural crust cover

MCF_{solid} methane conversion factor for the solid storage manure management system

MS_{solid} fraction of livestock category T's manure handled using solid storage manure management system

Project emissions

AMS - III.R: Project emissions are calculated under methodology AMS-III.R "Methane recovery in agricultural activities at the household/small farm level", version 1 as a physical leakage of methane from the biogas unit (in the biogas reactor and when biogas is combusted in the burner). No fossil fuels or electricity is used for constructing or managing the biogas units and does only the physical leakage of methane from biogas need to be accounted.

$$PE = LF_{AD} * (GWP\_CH_4 * D_{CH4} * B_{o(T)} * VS_{(T)}) / 1000 \quad (8)$$

PE – annual project emissions from physical leakages in the biogas digesters (t CO_2e/year);

LF_{AD} – methane leakages from anaerobic digesters (dimensionless). Default value of 0.1 specified in the AMS-III.R is used;

0.67 – conversion factor of m^3 CH_4 to kg CH_4;

B_o – maximum methane producing capacity for manure produced by livestock category T (m^3 CH_4 per kg of VS excreted)

GWP_{CH4} - Global Warming Potential of CH_4

$VS_{(T)}$ – daily volatile solid excreted for livestock category T (kg dry matter per animal per day).

$$PE = LF_{AD} * \sum_{(T)} (GWP\_CH_4 * 0.67\ kg/m^3 * B_{o(T)} * N_{(T)} * VS_{(T)} * 365) / 1000 \quad (9)$$

PE – annual project emissions from physical leakages in the biogas digesters (t CO_2e/year);

LF_{AD} – methane leakages from anaerobic digesters (dimensionless). Default value of 0.1 specified in the AMS-III.R is used;

0.67 – conversion factor of m^3 CH_4 to kg CH_4;

B_o – maximum methane producing capacity for manure produced by livestock category T (m^3 CH_4 per kg of VS excreted)

$N_{(T)}$ - Average number of heads by livestock category T; and

$VS_{(T)}$ – daily volatile solid excreted for livestock category T (kg dry matter per animal per day).GWP_{CH4} - Global Warming Potential of CH_4

AMS - I.C: The use of biodigesters does neither include the consumption of fossil fuels or electricity nor are there any other significant emissions associated with the project activity within the project boundary.

Emissions through fuelwood consumption due to use of traditional stove in case of non-operation of bio-digester will be included in project emissions. Any form of fuelwood consumption due to use of traditional stove will be monitored by yearly surveys and any use found in these surveys will be applied for all the project households. Following equation will be used:

$PE_{y, NRB}= B_{biomass\ project} * f_{NRB,y}*NCV_{biomass} * EF_{kerosene}$ (10)

Where:

$PE_{y,NRB}$	Project emissions per household from use of biomass during the year *y* in tCO_2e
$B_{biomass\ project}$	Quantity of woody biomass that is used per household in Project Activity in tonnes
f_{NRB}	Fraction of woody biomass used in the absence of the project activity in year *y* that can be established as non-renewable biomass using survey methods
$NCV_{biomass}$	Net calorific value of the non-renewable woody biomass that is substituted (According to AMS.I.E. para 5, IPCC default for wood fuel, 0.015 TJ/tonne)
$EF_{kerosene}$	Emission factor for the substitution of non-renewable woody biomass by similar consumers. The upper value of 73,7 tCO2/TJ for kerosene used in project emissions is used

The fixed parameters are:

Parameter	**Value**	**Unit**	**Source**
$NCV_{biomass}$	0.015	TJ/t	AMS.I.E. para 5.
$EF_{kerosene}$	73,700	kg CO_2/TJ	IPCC

AMS - I.E: According to the applied methodology, no project emissions need to be considered.

Emissions through kerosene consumption due to use of traditional kerosene stove in case of non-operation of bio-digester will be included in project emissions. Any form of kerosene consumption due to use of kerosene stove will be monitored by yearly surveys and any use found in these surveys will be applied for all the project households. Following equation will be used:

$$PE_{kerosene} = F_{kerosene,\ project} * \rho_{kerosene} * NCV_{kerosene} * EF_{kerosene} * 10^{-9} \quad (11)$$

$PE_{kerosene}$	Project emissions per household from burning of kerosene (t CO_2e/year)
$F_{kerosene,project}$	Annual average amount of kerosene used for cooking per HH during the project activity (l/year)
$\rho_{kerosene}$	kerosene density (kg/l)
$NCV_{kerosene}$	net calorific value of kerosene (TJ/Gg)
$EF_{kerosene}$	emissions factor of kerosene (kg CO_2/TJ)

The fixed prameters are:

Parameter	**Value**	**Unit**	**Source**
$\rho_{kerosene}$	0.817	Kg/l	http://www.simetric.co.uk/si_liquids.htm
$NCV_{kerosene}$	43.8	TJ/Gg	IPCC
$EF_{kerosene}$	71,500	kg CO_2/TJ	AMS.I.E.

Leakage

Leakage relating to non-renewable biomass as per AMS -I.E will be assessed from ex-post surveys of users and areas from where biomass is sourced.

For calculation of Leakage relating to substitution of non-renewable biomass, following equation will be used:

$$LE_y = (B_{biomass,non\text{-}project,y} - B_{biomass,y}) * f_{NRB,y} * NCV_{biomass} * EF_{kerosene}$$

Where:

LE_y	Project emissions due to leakage during the year y in tCO_2e
$B_{biomass\ non\text{-}project,y}$	Quantity of woody biomass that is used during Project Activity in non-project household in tonnes
$B_{biomass\ y}$	Total Quantity of woody biomass that is used in Baseline in tonnes
f_{NRB}	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass using survey methods
$NCV_{biomass}$	Net calorific value of the non-renewable woody biomass that is substituted (According to AMS.I.E. para 5, IPCC default for wood fuel, 0.015 TJ/tonne)
$EF_{kerosene}$	Emission factor for the substitution of non-renewable woody biomass by similar consumers.

There is no ex-ante leakage. For methodology AMS I-C (version 18) and for methodology AMS I-E (version 3) and AMS-III.R (version 1) if the energy generating equipment is transferred from another activity or if existing equipment is transferred to another activity, leakage is to be considered. Since there is no activity prior to the project activity, this project will not result in any such transfer and there will be no ex-ante leakage.

In the same way there are not CO2 emissions from collection/processing/transportation of biomass residues to the project site.

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$F_{kerosene,\ baseline}$
Unit	l (litres)
Description	Annual amount of kerosene used for cooking and starting fires in an average household
Source of data	Baseline survey
Value(s) applied	24.12
Choice of data or Measurement methods and procedures	The value is defined based on a survey of a representative sample of households. The survey is described in Annex 3.
Purpose of data	Calculations of Baseline Emissions
Additional comment	-

Data / Parameter	$\rho_{kerosene}$
Unit	kg/l (kilogrammes per liter)
Description	Density of kerosene
Source of data	http://www.simetric.co.uk/si_liquids.htm
Value(s) applied	0.817
Choice of data or Measurement methods and procedures	Local or regional value for kerosene used in the project area is not available, therefore the commonly suggested density is used (e.g. http://www.simetric.co.uk/si_liquids.htm)
Purpose of data	Calculations of Baseline and Project Emissions
Additional comment	-

Data / Parameter	**$NCV_{kerosene}$**
Unit	TJ/Gg (terajoules per gigagramme)
Description	Net calorific value of kerosene
Source of data	Table 1.2 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1.
Value(s) applied	43.8
Choice of data or Measurement methods and procedures	Default net calorific value suggested by IPCC
Purpose of data	Calculations of Baseline and Project Emissions
Additional comment	-

Data / Parameter	**$EF_{kerosene}$**
Unit	kg CO_2/TJ (kilogrammes of CO2 per terajoule)
Description	Emissions factor from burning of kerosene in households
Source of data	Table 2.5 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 2.
Value(s) applied	71,900
Choice of data or Measurement methods and procedures	Default emissions factor for stationary combustion in the residential category suggested by IPCC
Purpose of data	Calculations of Baseline and Project Emissions
Additional comment	This value is used for calculating $BE_{kerosene}$. For BE_{NRB}, the default value specified in AMS I.E, 71,500 kg CO2/TJ, is used. For Project Emissions based on AMS.I.C, as per defined tool the upper value of 73,700 kg CO2/TJ for kerosene is used.

Data / Parameter	$B_{biomass, baseline}$
Unit	T (Tonnes)
Description	Quantity of biomass that is substituted or replaced in an average household
Source of data	Baseline survey
Value(s) applied	4.74
Choice of data or Measurement methods and procedures	The value is defined based on a survey of a representative sample of households. The survey is described in Annex 3.
Purpose of data	Calculations of Baseline Emission
Additional comment	-

Data / Parameter	f_{NRB}
Unit	Dimensionless
Description	Fraction of biomass used in the absence of project activity that can be established as non-renewable biomass using survey methods
Source of data	”Inventorying, Mapping and Monitoring of Bioresources Using GIS and Remote Sensing” study (Ramachandra and Rao 2005 – see reference 3 in Annex 5)
Value(s) applied	0.78
Choice of data or Measurement methods and procedures	The study by Ramachandra and Rao is both recent and specific to Kolar District. It uses remote sensing data analyses, field surveys involving village level inventorying of the tree diversity and mapping of resources using geographic information systems and global positioning systems in villages in the project area. The 0.78 value is obtained from the average bioresource availability to demand ratio for the Taluks in Kolar District (for details on the calculations see Annex 3).
Purpose of data	Calculations of Baseline and Project Emissions
Additional comment	-

Data / Parameter	GWP_CH_4
Unit	t CO_2 / t CH_4 (tonnes of CO_2 per tonne of CH_4)
Description	Global warming potential for methane
Source of data	IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	21, 25
Choice of data or Measurement methods and procedures	Default value suggested by IPCC
Purpose of data	Calculation of Baseline Emissions
Additional comment	-

Data / Parameter	$N_{(T)}$
Unit	Dimensionless (number)

Description	Number of heads per cattle species/category in an average household
Source of data	Baseline survey
Value(s) applied	2.56 for dairy cows, 1.17 for buffalos, 0.55 for other cattle
Choice of data or Measurement methods and procedures	The values are defined based on a survey of a representative sample of households. The survey is described in Annex 3
Purpose of data	Calculation of Baseline and Project Emissions
Additional comment	The parameters ensure a precision at 95% confidence level

Data / Parameter	$\mathbf{VS_{(T)}}$
Unit	kg (kilogrammes) dry matter / (head * day)
Description	Daily volatile solid excreted for livestock category T
Source of data	Tables 10A-4 to 10A-6 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 4, Chapter 10), Biogas Technology by B.T. Nijaguna (see reference 5 in Annex 5), Table 2.12 p29.
Value(s) applied	3.8 for dairy cow, 3.1 for buffalo, 1.4 for other cattle
Choice of data or Measurement methods and procedures	India specific value taken for dairy cows from Biogas Technology by B.T. Nijaguna (see reference 5 in Annex 5). As nationally published values are not available for other cattle, IPCC default Indian subcontinent values are used for buffalo and other cattle.
Purpose of data	Calculation of Baseline and Project Emissions
Additional comment	-

Data / Parameter	$\mathbf{B_{o(T)}}$
Unit	m^3 CH_4/kg VS (cubic meters of CH_4 per kilogramme Volatile Solid)
Description	Maximum methane producing capacity for manure produced by livestock category T
Source of data	India specific value taken for diary cows from Biogas Technology by B.T. Nijaguna (see reference 5 in annex 5). As nationally published values are not available for other cattle, IPCC default values are used for buffalo and other cattle. Tables 10A-4 to 10A-6 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10.
Value(s) applied	0.15 for dairy cattle, 0.1 for buffalo and other cattle
Choice of data or Measurement methods and procedures	India specific value taken for diary cows from Biogas Technology by B.T. Nijaguna (see reference 5 in annex 5). As nationally published values are not available for other cattle, IPCC default values are used for buffalo and other cattle. Tables 10A-4 to 10A-6 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10.
Purpose of data	Calculation of Baseline and Project Emissions
Additional comment	-

Data / Parameter	$\mathbf{MCF_{manure}}$ $\mathbf{(MCF_{liquid}, MCF_{liquid\ with\ crust}, MCF_{solid})}$
Unit	% (percentage)
Description	Methane correction factor for cattle manure for each manure management system S by climate region k

Source of data	Table 10.17 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10.
Value(s) applied	80 for liquid/slurry manure management system (MCF_{liquid}), 50 for liquid/slurry manure management system with natural crust cover ($MCF_{liquid\ with\ crust}$), 5 for solid storage manure management system (MCF_{solid})
Choice of data or Measurement methods and procedures	Values corresponding to average annual temperature of 29.6°C are taken for MCF_{liquid}, $MCF_{liquid\ with\ crust}$ and MCF_{solid}. Temperature data was taken from Natural resources data management system, a Brach of Department of Science and Technology, Government of India, Kolar District office
Purpose of data	Calculation of Baseline Emissions
Additional comment	-

Data / Parameter	**MS_{manure} (MS_{liquid}, $MS_{liquid\ with\ crust}$, MS_{solid})**
Unit	Dimensionless
Description	Fraction of livestock category T's manure handled using manure management system S in climate region k (fraction of livestock manure handled using liquid/slurry manure management system, fraction of livestock manure handled using liquid/slurry with natural crust cover and fraction of livestock manure handled using solid storage manure management system)
Source of data	Based on baseline survey
Value(s) applied	0.32 for liquid/slurry manure management system (MS_{liquid}), 0.20 for liquid/slurry with crust cover manure management system ($MS_{liquid\ with\ crust}$), 0.16 for solid storage manure management system (MS_{solid})
Choice of data or Measurement methods and procedures	See manure component in section B.4 for the detailed explanation.
Purpose of data	Calculation of Baseline Emissions
Additional comment	The parameters ensure a precision at 95% confidence level

B.6.3. Ex ante calculation of emission reductions

Baseline emissions

(i) Avoided kerosene

Annual baseline emissions for 1 operating unit:

$$BE_{kerosene} = F_{kerosene,\ baseline} * \rho_{kerosene} * NCV_{kerosene} * EF_{kerosene} * 10^{-9}$$

The following parameters are used:

Parameter	Value	Unit	Source
$F_{kerosene,\ baseline}$	24.12	L	Baseline survey
$\rho_{kerosene}$	0.817	kg/l	IPCC
$NCV_{kerosene}$	43.8	TJ/Gg	IPCC 2006 T.1.2

$EF_{kerosene}$	71,900	kg CO_2/TJ	IPCC 2006 T.2.5

Therefore:

$BE_{kerosene}$ = 24.12 l * 0.817 kg/l * 43.8 TJ/Gg * 71,900 kg CO_2/TJ * 10^{-9} = 0.062 t CO_2

(ii) Avoided non-renewable biomass

Annual baseline emissions for 1 operating unit:

$BE_{NRB} = B_{biomass, baseline} * f_{NRB} * NCV_{NRB} * EF_{kerosene} * 10^{-3}$

The following parameters are used:

Parameter	Value	Unit	Source
$B_{biomass, baseline}$	4.74	T	Baseline survey
f_{NRB}	0.78	-	Study by Ramachandra and Rao 2005, see Annex 5
NCV_{NRB}	0.015	TJ/t	IPCC 2006 T.1.2
$EF_{kerosene}$	71,500	kg CO_2/TJ	AMS I.E

Therefore:

BE_{NRB} = 4.74 t * 0.78 * 0.015 TJ/t * 71,500 kg CO_2/TJ * 10^{-3} = 3.966 t CO_2

(iii) Avoided methane from cattle manure

Annual baseline emissions for 1 operating unit:

$BE_{manure} = \sum_{(T)} (EF_T * N_T) * N * GWP\_CH_4 / 1000$

$EF_{(T)} = VS_{(T)} * 365 * B_{o(T)} * 0.67$ kg/m^3 * (MCF_{liquid}/100 * MS_{liquid} + * $MCF_{liquid\ with\ crust}$/100 * $MS_{liquid\ with\ crust}$ + MCF_{solid}/100 * MS_{solid})

The following parameters are used:

Parameter	Value	Unit	Source
GWP_CH_4	21	kg CO_2 / kg CH_4	IPCC
MCF_{liquid}	80	%	IPCC 2006 T. 10A-4 to 10A-6
$MCF_{liquid\ with\ crust}$	50	%	IPCC 2006 T. 10A-4 to 10A-6
MCF_{solid}	5	%	IPCC 2006 T. 10A-4 to 10A-6
MS_{liquid}	0.32	-	Baseline survey
$MS_{liquid\ with\ crust}$	0.20	-	Baseline survey
MS_{solid}	0.16		Baseline survey
Dairy cow			
N_T	2.56	-	Baseline survey
$VS_{(T)}$	3.8	kg dry matter/(head*day)	Biogas Technology by B.T. Nijaguna
$B_{o(T)}$	0.15	m^3 CH_4/kg VS	Biogas Technology by B.T. Nijaguna
Buffalo			
N_T	1.17	-	Baseline survey

$VS_{(T)}$	3.1	kg dry matter/(head*day)	IPCC 2006 T. 10A-4 to 10A-6
$B_{o(T)}$	0.1	m^3 CH_4/kg VS	IPCC 2006 T. 10A-4 to 10A-6
Other Cattle			
N_T	0.55	-	Baseline survey
$VS_{(T)}$	1.4	kg dry matter/(head*day)	IPCC 2006 T. 10A-4 to 10A-6
$B_{o(T)}$	0.1	m^3 CH_4/kg VS	IPCC 2006 T. 10A-4 to 10A-6

Therefore:

$EF_{dairy\ cow}$ = 3.8 kg VS/(head*day) * 365 * 0.15 m^3 CH_4/kgVS * 0.67 kg/m^3 * * (80/100 * 0.24 + 50/100 * 0.20 + 5/100 * 0.16) = 50.59 kgCH_4/year

$EF_{buffalo}$ = 3.1 kg VS/(head*day) * 365 * 0.1 m^3 CH_4/kgVS * 0.67 kg/m^3 * * (80/100 * 0.24 + 50/100 * 0.20 + 5/100 * 0.16) = 27.52 kgCH_4/year

$EF_{other\ cattle}$ = 1.4 kg VS/(head*day) * 365 * 0.1 m^3 CH_4/kgVS * 0.67 kg/m^3 * * (80/100 * 0.24 + 50/100 * 0.20 + 5/100 * 0.16) = 12.43 kgCH_4/year

BE_{manure} for a 3m^3 unit = (50.59 kgCH_4/year*2.56+ 27.52 kgCH_4/year*1.17 + 12.43 kgCH_4/year*0.55)* *21 kgCO_2/kgCH_4 / 1000 = 3.54 tCO2e

BE_{manure} for a 2m^3 unit = 3.54 tCO2e * 2/3 = 2.36 tCO2e

As it is planned that 30% of the units are 3m^3 units and 70% are 2m^3 units, then BE_{manure} for 1 average unit is:

BE_{manure} = 3.54 tCO2e * 0.3 + 2.36 tCO2e * 0.7 = 2.714 t CO_2e

(iv) Total baseline emissions for one operating unit:

$BE = BE_{kerosene} + BE_{NRB} + BE_{manure}$ = 0.062 t CO_2 + 3.966 t CO_2 + 2.714t CO_2e = 6.74 t CO_2e

Project emissions

Annual project emissions for one operating unit:

$PE = LF_{AD} * \sum_{(T)} (GWP\_CH_4 * 0.67\ kg/m^3 * B_{o(T)} * N_{(T)} * VS_{(T),} * 365) / 1000 =$
$= LF_{AD} * GWP\_CH_4 * 0.67\ kg/m^3 * 365 * \sum_{(T)} (B_{o(T)} * N_{(T)} * VS_{(T)})$

The same parameters as the ones used for calculating baseline emissions from cattle manure are used.

Therefore PE for one 3 m^3 unit:

PE_3m3 = 0.1 * 21 kgCO_2/kgCH_4 * 0.67 kg/m^3 * 365 * (2.56 heads * 0.15 m^3 CH_4/kgVS * * 3.8 kgVS/(head*day) + 1.17 heads * 0.1 m^3 CH_4/kgVS * 3.1 kgVS/(head*day) + 0.55 heads * 0.1 m^3 CH_4/kgVS * * 1.4 kg VS/(head*day)) / 1000 = 0.975 t CO_2e

PE for one 2 m^3 unit:

PE_2m3 = 2/3 * PE_3m3 = 0.650 t CO_2e

Assuming 30% of the units are $3m^3$ units and 70% of the units are $2m^3$ units, than PE for 1 average unit is:

$$PE = 0.975 \text{ t } CO_2e * 0.3 + 0.650 \text{ t } CO_2e * 0.7 = 0.748 \text{ t } CO_2e$$

Project emissions due to kerosene and fuelwood consumption during project activity are based on the monitoring survey results. There are no project emissions due to fuelwood and kerosene consumption expected and thus for the ex-ante calculation of emission reductions $PE_{y, NRB}$ and $PE_{kerosene}$ are assumed to be = 0.

Emission reductions

Emission reductions for one operating unit:

$$ER = BE - PE - L = 6.74 \text{ t } CO_2 - 0.748 \text{ t } CO_2e - 0 = 5.99 \text{ t } CO_2e$$

Annual emission reductions for the whole project are calculated by multiplying emission reductions for one operating unit by number of biogas units operating in that year. Schedule for construction and operation of biogas units is provided in the table below:

Year	**Units built**	**Cumulative units installed by the end of each year**	**Units in Operation**
2012	2,484	2,848	1,242
2013	1,595	4,079	3,282
2014	2,500	6,579	5,329
2015	2,500	9,079	7,829
2016	301	9,380	9,230
2017		9,380	9,380
2018		9,380	9,380
2019		9,380	9,380
2020		9,380	9,380
2021		9,380	9,380
2022		9,380	9,380

The table above shows:

- the number of bio-digester units installed during each year (the build schedule);
- the cumulative number of units that will have been installed by the end of each year; and
- the average number of units that will have been operating, that is producing biogas and creating emission reductions in each year.

The average number of units that will be operating in each year is one of the main determinants of project activity emission reductions. In the three years in which units are being installed (2009 - 2011) the average number of units that will be operating in each year will always be lower than the cumulative number of units that have been installed by the end of each year. This is because units will be added gradually throughout each year and therefore not all units will be operating throughout the entire year. For example if a unit is installed on the first day of the year it can clearly be seen that that unit can be regarded as having operated all year. If, however, a unit is installed on the first day of the last month in the year it will only be operating for $1/12^{th}$ of the year. Approximately one month lag should be allowed from the start of construction to the start of proper operation, as construction and technical checks last on average one month.

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2012	8'374	929	0.0	**7'445**
2013	22'124	2'453	0.0	**19'670**
2014	35'928	3'984	0.0	**31'944**
2015	52'783	5'853	0.0	**46'930**
2016	62'225	6'900	0.0	**55'325**
2017	63'240	7'013	0.0	**56'227**
2018	63'240	7'013	0.0	**56'227**
2019	63'240	7'013	0.0	**56'227**
2020	63'240	7'013	0.0	**56'227**
2021	63'240	7'013	0.0	**56'227**
2022	15'810	1'753	0.0	**14'057**
Total	513'441	56'936	0.0	**456'504**
Total number of crediting years	10			
Annual average over the crediting period	**51'344**	**5'694**	0.0	**45'650**

Please note that the 10 year project crediting period takes place from 01/04/2012 – 31/03/2022. Therefore 11 years are listed but the year 2012 only corresponds to 9 month and the year 2022 only to 3 month.

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$N_{operating}$
Unit	Dimensionless
Description	Number of systems (biogas units) operating
Source of data	SKG Sangha
Value(s) applied	
Measurement methods and procedures	When SKG Sangha starts biogas unit installation in a village, it trains a local person (the motivator) to be the main contact with SKG Sangha, to maintain and repair biogas systems, and to monitor and report the operation of systems. All biogas unit beneficiaries in the village are introduced to this person. They report any faults to the motivator and normally any faults with the biodigesters are resolved by this person on the same day as the complaint is lodged. The motivator records any periods of non-functioning (in days). In addition, the motivator visits the beneficiaries at least once per month to check whether biodigesters and burners are functioning properly. All records are made by the motivator by hand in two paper copies of a monitoring journal. One copy is sent at the end of the month to the taluk level, and another copy is kept at the village level.
Monitoring frequency	Continuously
QA/QC procedures	The level of uncertainty of recording this parameter is low. The methodology requires recording the number of systems operating annually. In this case, the recording will be done monthly, and any periods of nun-functioning will be recorded. Beneficiaries are not likely not to report faults, as any non-functioning means non availability of clean and simple cooking. Normally beneficiaries want to resolve any problems as soon as they appear. Nevertheless, monitoring team from the project level will do random checks to check whether the data recorded by the motivator is correct.
Purpose of data	Calculation of baseline and project emissions
Additional comment	

Data / Parameter	H_{stove}
Unit	H (Hours)
Description	Annual hours of operation of an average system (hours of burner functioning)
Source of data	SKG Sangha
Value(s) applied	
Measurement methods and procedures	A sample (at least 30% of beneficiaries in the first year of the crediting period, at least 5% thereafter - only those who can write) will be given a sheet where they will make records for a week writing down each day hours when a burner is functioning. i.e. each day a beneficiary will write down the time of starting cooking and finishing cooking, and note whether one or two burners were used. The motivator will distribute the sheets and collect the answers.
Monitoring frequency	Yearly
QA/QC procedures	This parameter is not used for calculating emission reductions. It is used for checking whether the biodigester produced enough biogas to substitute previous use of non-renewable biomass and kerosene. Nevertheless, during the household visits by the taluk level monitoring team, it will be checked whether recorded hours are reasonable.
Purpose of data	Capacity calculation
Additional comment	-

Data / Parameter	$F_{kerosene, project}$
Unit	L (Litres)
Description	Amount of kerosene consumed by household after installation of biogas unit
Source of data	SKG Sangha
Value(s) applied	
Measurement methods and procedures	Survey of a representative sample (at minimum of 30% of beneficiaries in the first year of the crediting period, a minimum of 5% thereafter). The surveys will be carried out once per year by the taluk level monitoring team. Annex 6 contains the survey sheet. The amount will be determined from discussions with the beneficiaries during the visit. The average amount of kerosene still used for cooking will be subtracted from the baseline level of 24.12 l per household per year.
Monitoring frequency	Yearly
QA/QC procedures	Monitoring team from the project level will do random checks to check whether the data recorded by the Taluk level team is reasonable.
Purpose of data	Calculation of project emissions
Additional comment	

Data / Parameter	$\mathbf{B_{biomass, project}}$
Unit	T (Tonnes)
Description	Consumption of fuel wood in households participating in the project activities
Source of data	Surveys by SKG Sangha (taluk level monitoring team)
Value(s) applied	
Measurement methods and procedures	Survey of a representative sample (at least 30% of beneficiaries in the first year of the crediting period, at least 5% thereafter). The surveys will be carried out once per year by the taluk level monitoring team. Annex 6 contains the survey sheet. Information will be sought on the quantity of biomass consumed after implementation of the project activity (determined during discussions and by weighing wood consumed on the day of the visit). The difference between the total fuel wood consumption in the baseline (7.9 t) and the total fuel wood consumption after project implementation (monitored value) will be used for calculating emission reductions from saved biomass, after applying the fraction of non-renewable biomass.
Monitoring frequency	Yearly
QA/QC procedures	Monitoring team from the project level will do random checks to check whether the data recorded by the taluk level team is reasonable and correct.
Purpose of data	Calculation of project emissions
Additional comment	

Data / Parameter	$\mathbf{B_{biomass,non-project}}$
Unit	T (Tonnes)
Description	Consumption of fuel wood in households not participating in the project activities.
Source of data	Surveys by SKG Sangha (taluk level monitoring team)
Value(s) applied	
Measurement methods and procedures	Survey of 100 non-project households that use fuel wood. The surveys will be carried out once per year by the taluk level monitoring team. Annex 6 contains the survey sheet. Information will be sought on the quantity of biomass consumed (from discussions and by weighing wood consumed on the day of the visit). This information will be used to calculate $\mathbf{B_{NRB\_non\_project}}$ (consumption of non-renewable biogas by households not participating in the project activities) by applying F_{NRB} of 78% to the monitoring parameter.
Monitoring frequency	Yearly
QA/QC procedures	Monitoring team from the project level will do random checks to check whether the data recorded by the taluk level team is reasonable and correct.
Purpose of data	Calculation of Leakage
Additional comment	

Data / Parameter	N_T
Unit	Dimensionless
Description	Annual average animal population in a household (number of heads of dairy cow, buffalo and other cattle).
Source of data	Survey of a sample of households by SKG Sangha (taluk level monitoring team).
Value(s) applied	
Measurement methods and procedures	Survey of a representative sample (at least 30% of beneficiaries in the first year of the crediting period, at least 5% thereafter). The surveys will be carried out once per year by the taluk level monitoring team. Annex 6 contains the survey sheet. The team will count the number of heads of cattle and will clarify with the household people during a discussion whether there were any changes in number of heads throughout a year.
Monitoring frequency	Yearly
QA/QC procedures	Monitoring team from the project level will do random checks to check whether the data recorded by the taluk level team is reasonable and correct.
Purpose of data	Calculation of baseline and project emissions
Additional comment	

Data / Parameter	$B_{manure,generated}$
Unit	T (Tonnes)
Description	Average amount of animal manure generated per household per year.
Source of data	Survey of a sample of households by SKG Sangha (taluk level monitoring team).
Value(s) applied	
Measurement methods and procedures	Survey of a representative sample (at least 30% of beneficiaries in the first year of the crediting period, at least 5% thereafter). The surveys will be carried out once per year by the taluk level monitoring team. Annex 6 contains the survey sheet. The amount will be determined by during discussions with the beneficiaries.
Monitoring frequency	Yearly
QA/QC procedures	Monitoring team from the project level will do random checks to check whether the data recorded by the taluk level team is reasonable. Additionally the parameter will be cross-checked with calculated amount of generated manure by multiplying heads of different types of cattle by typical amount of manure generated by these cattle types.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	$B_{manure,fed}$
Unit	T (Tonnes)
Description	Average amount of animal manure fed into a biogas digester per year.
Source of data	Survey of a sample of households by SKG Sangha (taluk level monitoring team).
Value(s) applied	
Measurement methods and procedures	Survey of a representative sample (at least 30% of beneficiaries in the first year of the crediting period, at least 5% thereafter). The surveys will be carried out once per year by the taluk level monitoring team. Annex 6 contains the survey sheet. The amount will be determined from discussions with the beneficiaries and by weighing manure fed into the biodigester at the day of the visit.
Monitoring frequency	Yearly
QA/QC procedures	Monitoring team from the project level will do random checks to check whether the data recorded by the taluk level team is reasonable.
Purpose of data	Calculation of baseline emissions
Additional comment	

Data / Parameter	**Application of sludge**
Unit	n/a (qualitative information)
Description	Proper application of the sludge from the biogas unit.
Source of data	Survey of a sample of households by SKG Sangha (taluk level monitoring team).
Value(s) applied	
Measurement methods and procedures	Survey of a representative sample (at least 30% of beneficiaries in the first year of the crediting period, at least 5% thereafter). The surveys will be carried out once per year by the taluk level monitoring team. Annex 6 contains the survey sheet. Application of the sludge will be determined from discussions with the beneficiaries on where, how and when the sludge is used.
Monitoring frequency	Yearly
QA/QC procedures	Monitoring team from the project level will do random checks to check whether the information recorded by the taluk level team is reasonable.
Purpose of data	Checking is sludge is applicated properly
Additional comment	SKG Sangha will conduct a number of meetings with eligible households and provide training to transfer this knowledge. The project biogas units will have wide and very low depth collection pits to gather the spent slurry. The accumulated slurry will be used either for vermicompost production or for direct application in agricultural soils as manure or both. Beneficiaries will be trained in the correct application.

B.7.2. Sampling plan

Sampling is applied for the listed parameters as following:

A. Monitoring of annual hours of operation

A sample (at least 30% of beneficiaries in the first year of the crediting period, at least 5% thereafter - only those who can write will be selected) will be given a sheet where they will make records for a week writing down each day the hours when a burner was functioning. i.e. each day a beneficiary will write down the time of starting cooking and finishing cooking, and note whether one or two burners were used. The motivator will distribute the sheets and collect the filled sheets, which will be sent to the project level monitoring team. The team will enter the data into the database and calculate average annual hours of operation for 2 m^3 and 3 m^3 sizes. Some households that do this monitoring of annual hours of operation will be included in the sample of random visits to check whether the data recorded by beneficiaries is reasonable.

B. Surveys of a sample of units

Taluk level monitoring teams will carry out annual surveys of a sample of beneficiaries to determine the following parameters and information:

- Annual hours of operation of a unit (operation of a burner)
- Annual amount of kerosene used
- Annual amount of fuel wood used
- Animal population per household (for each type of cattle)
- Amount of manure generated on the farm
- Amount of animal manure fed into the system
- Proper soil application of the final sludge

The sampling plan is detailed in Annex 4 and the survey sheet is given in Annex 6.

The schedule of surveys is projected to be as follows:

- 250 households in the 1st year
- 208 households in the 2nd year
- 392 households in the 3rd year
- 469 households in each subsequent year

Surveys will be carried out each year, but over an extended period, as only a few beneficiaries can be surveyed by one person or team in one day.

Survey sheets will be delivered to the project level monitoring team, which will enter the data into the database and calculate average values of each parameter, separately for 2 m^3 and 3 m^3 sizes. The resulting data will be used for calculating and checking emission reductions.

C. Surveys of non-project households

Taluk level monitoring teams will carry out annual surveys of at least 100 households in the project area to determine the amount of biomass uses for cooking purposes, the sources of biomass and trends in sourcing the biomass. Survey sheet is provided in Annex 6.

B.7.3. Other elements of monitoring plan

Through its work with biogas plants over the last 15 years, SKG Sangha has developed a system of installing and maintaining the biogas units. The operational and monitoring plan builds on this experience. Monitoring is done in a hierarchical manner with a large number at the village level reporting to and supervised by a small team at each taluk in turn reporting to the project coordinator and his team at the main office.
The scheme in the page below shows the distribution of monitoring tasks and responsibilities between different levels of project implementation: the project level (the main SKG Sangha office: project coordinator with a team), the taluk level (supervisor with a team) and the village level (motivator).

In each village cluster where SKG Sangha starts installing biodigesters, a local person is selected to be the motivator. The motivators are trained in how to:

- supervise project implementation in the village;
- maintain and repair the biogas units;
- monitor the functionality of biogas units;
- keep records; and
- report to Taluk level

A number of separate training sessions are also run for the households who have biodigesters installed to ensure that beneficiaries use their units correctly. All users will receive training from SKG Sangha for the use of the digester as soon as it is installed. The motivator participates in the training sessions to ensure all beneficiaries are familiar with the main contact in the village. The beneficiaries are instructed to report any faults or problems with the units to the motivator.

During installation the household will sign three pieces of paper to confirm that the masonry work, the pipe fitting work and the overall biodigester has been installed satisfactorily. A technician from SKG Sangha will check the unit once it has been installed to ensure the biogas unit has been installed correctly and this information will then be recorded and logged in SKG Sangha's records as well as in paper monitoring journals of the relevant motivator. The records will also include information on the size of each unit – whether it is a 3 m^3 unit or a 2 m^3 unit. During project implementation, SKG Sangha will make records of every biogas unit installed, and calculation of real emission reductions may be adjusted according to the actual ratio of 2 m^3 and 3 m^3 biogas units if the ratio turns out to be slightly different than is currently planned. Each biodigester is given a unique identification marking to indicate:

- who sponsored the biodigester;
- who built the biodigester;
- which year the biodigester was built in; and
- which number biodigester it is for that village for that year.

Monitoring scheme

Project / district level	Project coordinator Team of 4-5	Project coordinator has an overall responsibility for the project The team includes the main monitoring officer and supporting officers, who: • Collect monthly (paper) monitoring reports from taluks, • Enter all data to a database • Organise annual surveys • Conduct random checks at the village level to check the monitoring data (over the year visits 5 % of participating households) • Compile annual project level reports • Organise and conducts training for taluks and village level monitoring teams
Taluk level	Supervisor 2-3 assistants	Superviser coordinates and supervises monitoring in villages of a taluk. The team: • Collects monthly reports from villages • Compiles monthly taluk level reports (on paper): keeps on copy and send one copy to the project level • Conducts annual surveys (under the supervision of the project monitoring officers)
Village level	Motivator	The motivator is the main direct contact with the beneficiaries: 1. Records any periods of biogas unit non-functioning (beneficiaries contact the motivator in case of any problem with a biogas digester or the burner) 2. Checks functioning of all units at least once per month Makes records in two copies, stores one copy and send one copy to the taluk level at the enSuperviser coordinates and supervises monitoring in villages of

Monitoring of biogas unit functionality

Once the unit is installed and checked by the technician, the motivator marks the start of unit operation. Beneficiaries are instructed to report any faults or problems with a biodigester or a burner to the motivator. Normally any problems with the biogas units will be resolved the same day as the original complaint. The motivator will record any periods (in days) when the unit was not operating. Households also have a separate pre-paid post form that they can send directly to SKG Sangha to inform SKG Sangha of any problems in the event that they experience any problems with their village representative. The fact that households make an in-kind contribution to the construction of biogas units also makes them more interested in making proper use of these units. Besides recording problems, the motivator will check all project units in the village at least once per month to record whether they are functioning properly. The records will be made by hand writing, on two copies of a monitoring journal. At the end of each month one copy will be delivered to the taluk level monitoring team, and one copy remains with the motivator.

The taluk level monitoring team collects monitoring journals from the villages in their taluk, and compiles monthly taluk-level reports, which include:

- Number of units that started operations before the monitoring period (i.e. before the beginning of the relevant monitoring month), separately for 2 m^3 and 3 m^3 sizes;
- Detailed records of units installed during the monitoring month, including the location, the beneficiary, the size of the biodigester, and the date of start of operations;
- Sum of non-operational days of a 2 m^3 unit and a 3 m^3 unit (i.e. if there were 10 units of 2 m^3 size that were not operational for 1 day, the record is that a 2 m^3 unit was not operational for 10 days.

The monthly reports are made in two copies, one of which is delivered to the project level (main SKG Sangha office), and another one remains at the taluk level.

The project level monitoring team collects the monthly reports. Throughout the year it makes random visits to villages to check whether the data recorded by the motivator is correct.

The project level monitoring team enters all data into the central project database, which includes:

- Records of every unit installed, including the location, the beneficiary, the size of the biodigester, the date of start of operations, and the end of operations in case the unit broke down
- Records of non-operational days, separately for 2 m^3 and 3 m^3 sizes, for every village (corrected after the random visits if needed)

Calculation of emission reductions

Emission reductions will be calculated using formulae (1), (3), (7), and (9). Kerosene consumption in the baseline will be adjusted by monitored value of $F_{kerosene}$ and $B_{biomass}$. Difference of the value of $B_{biomass\ non\text{-}project}$ determined before project implementation and monitored after project implementation will be used for establishing the leakage (after adjusting it for the NRB fraction).

Monitored values $B_{manure\_generated}$ and B_{manure_fed} will be used for adjusting $f_{collected}$ in the formula (7).

Monitored value H_{stove} will be used for checking whether the biogas covers at least the same energy needs that were covered by burning fuel wood and kerosene in traditional stoves. This will allow checking whether the biogas fully displaces the NRB and kerosene use in the baseline.

The overall project emission reductions will also be adjusted for the real proportion of operational 2 m^3 and 3 m^3 size units.

B.7.4. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

17th June 2009. CarbonAided Ltd.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

The project activity started on 18 December 2008. This is the date of the signed agreement between SKG Sangha and CH4NGE Ltd.

C.1.2. Expected operational lifetime of project activity

At least 20 years.

C.2. Crediting period of project activity

C.2.1. Type of crediting period

The project activity will use a fixed crediting period.

C.2.2. Start date of crediting period

The crediting period will start on 01/06/2011 or on the date that the CDM project activity is registered with the CDM Executive Board, whichever is later.

C.2.3. Length of crediting period

10 years

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

No negative environmental impacts were identified. The project will have the following positive environmental impacts in addition to the reduction in CO_2 and CH_4 emissions:

- The project will reduce consumption of fuel wood reducing pressure on scarce forest resources. Currently the major part of collected fuel wood represents non-renewable biomass;
- Efficient cooking stoves will reduce indoor air pollution;

- Soil quality and its water retention capacity are expected to improve after replacing indiscriminate use of chemical fertilisers with application of high-quality compost; and

- The risk of water pollution will be reduced due to proper management of wastewater and reduced use of chemical fertilisers and pesticides.

An Environmental impact analysis for the project activity is not required by Indian laws.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

Representatives of the local government (Zilla Panchayath, Taluk Panchayath and Gram Panchayath) and general population in the project areas (people from households that could potentially be project beneficiaries, farmers, women from local self-groups [also known as Self-help Groups. These are the groups formed by the rural women. The group membership varies from 7 to 25 members. Each village can have one or more groups. The PP has contacted these groups and organized meetings with them to explain about the biogas project. Many of the groups have taken part in the Stake Holder Consultation Meetings and overwhelmingly supported the project.], NGOs, as well as village representatives) were invited to the stakeholder consultation meetings. Some village people were consulted at their homes.

Representatives of the local government were invited to the meeting by sending to them invitation letters together with a non-technical summary of the project. Village people were invited in the form of tom tom (a form of announcement made in the villages beating a leather drum to gain attention of the people to announce the subject) one day in advance of the consultation meeting, and in the bigger villages SKG Sangha members also personally met people and invited them to the main consultation meeting.

The main meetings were held in Lions Club building, Antharagange Road, Kolar on 29.12.2008.

In the main consultation meetings, SKG Sangha presented the project, some farmers who already have biogas systems installed told about their experiences. Meeting attendees were invited to make comments and discuss the project. A blind sustainable development exercise was also conducted to identify stakeholders' opinion on project's environmental and social impacts. Finally, the attendees filled in short evaluation forms.

E.2. Summary of comments received

During the discussion participants raised a number of questions and wanted clarifications on area limitation, size of the plant, cost to the beneficiary, etc. Organisers explained the limitation of the small scale CDM project for its restricted carbon savings, price of the CERs as the limiting factor for recovery of unit cost and upfront payment required for the project implementation and the related issues as clarifications.

The meeting attendees expressed overwhelming support to the project and welcomed the initiative taken by SKG Sangha. Main comments and answers are summarised in a table below.

Stakeholder Comment	Response to comment
Explain better how the households contribute	Beneficiaries contribute in labour or by purchasing some of the materials, e.g. manual work to build the plant together with the mason; getting sand; or purchasing bricks.
Why don't atmosphere spoilers bare the entire cost?	Explained about the Kyoto Mechanism, CDM Gold Standard methods and CER pricing. Organisers assured the participants that they will try their best to get the highest price for the CERs so that the stakeholders' contribution will be minimal.
Why not take up this programme in other Taluks?	The present programme is meant for 5 taluks and SKAG Sangha is looking for possibilities to do similar projects in other taluks
Why has the SKG Sangha not undertaken this programme earlier?	They were told that CDM EB approved the needed methodology during later period of 2007 and since then the SKG Sangha is collecting the baseline information required for the project and now it came to this stage.
Why not do something for the household who does not have cattle?	SKG Sangha is trying to take up the installation of improved cook stove programme in the near future to tackle the problem of indoor air pollution in the households who do not have cattle and bioreactor.

The majority of responses to written evaluation forms also indicate that stakeholder consultation meeting attendees liked the meeting and enjoyed learning about biogas. Some representative answers and main points raised in the meeting evaluation forms can be summarised as follows:

Q: What is your impression of the meeting?

1. 'I learned about biogas / composting.'
2. Majority of the participants simply wrote that the meeting went well

Q: What do you like about the project?

1. 'Savings and health improvement'
2. 'Now we can afford the unit'
3. 'Clean environment and affordability '
4. Faster cooking, time saving

Q: What do you not like about the project?

1. 'It is not useful to the people who do not own cattle', 'Cow dung is a must'

2. ‘Limiting the project to our district alone’
Many said there is nothing in the project they do not like

E.3. Report on consideration of comments received

The comments did not influence the project design, as no negative comments and assessments that could influence the project design were received from stakeholders. Stakeholders liked and welcomed the project idea. Negative comments were only related to reasons behind project area restriction – why it cannot be expanded to other taluks and to households with less cattle. Households with fewer cattle may not profit from the biogas reactors as the reactors would not generate enough biogas. Project expansion to other taluks may be possible if a biomass availability study can be conducted and if it shows a high share of non-renewable biomass.

SECTION F. Approval and authorization

A letter of approval from the Host Party for the project activity is available.

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	SKG Sangha
Street/P.O. Box	2nd Main Road, Gandhi Nagar
Building	532
City	Kolar
State/Region	Karnataka State
Postcode	563 101
Country	India
Telephone	+91 9243436266, +91 81522 25370
Fax	+91 8152224146
E-mail	skgsangha@gmail.com
Website	www.skgsangha.org
Contact person	
Title	President
Salutation	Mr
Last name	Sagar
Middle name	Vidya
First name	Devabhaktuni
Department	n/a
Mobile	+91 98441 60038
Direct fax	+91 81522 24146
Direct tel.	+91 9243436266
Personal e-mail	president@skgsangha.org

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Foundation myclimate – The Climate Protection Partnership
Street/P.O. Box	Sternenstrasse 12
Building	
City	Zürich
State/Region	Zürich
Postcode	8002
Country	Switzerland
Telephone	+41 44 500 43 50
Fax	+41 44 500 43 51
E-mail	info@myclimate.org
Website	www.myclimate.org
Contact person	
Title	
Salutation	Ms
Last name	Schmid
Middle name	
First name	Tanja
Department	-
Mobile	-
Direct fax	-
Direct tel.	+41 44 500 43 72
Personal e-mail	tanja.schmid@myclimate.org

Appendix 2. Affirmation regarding public funding

The proposed project activity does not involve any public funding. The participating households will make a small in kind contribution of materials and labour but otherwise no other funding or assistance will be available to implement the project. The project will be funded solely from the sale of the offsets created from the project's GHG emission reductions.

Appendix 3. Baseline Information

A. English translation of baseline survey sheet:

Household Energy & Manure Management Survey			
Village:	Taluk:	Date:	Survey Number in Village:

1. General Data

Name:	
Number of people in household:	
Income:	.....Rs ☐ per day ☐ per week ☐ per month ☐ per year

2. Fuel Consumption

Kerosene			
Used for	**Amount (litres)**		**Price per litre (Rs)**
Cooking:		☐ per day ☐ per week ☐ per month ☐ per year	Subsidised:
Lighting Fire:		☐ per day ☐ per week ☐ per month ☐ per year	
Lighting:		☐ per day ☐ per week ☐ per month ☐ per year	In the market:
Other:		☐ per day ☐ per week ☐ per month ☐ per year	
Amount subsidised by government:		☐ per day ☐ per week ☐ per month ☐ per year	

Firewood					
Use and Source		**Amount (kg)**			
Used for cooking			☐ per day	☐ per week ☐ per month	☐ per year
Used for other purposes			☐ per day	☐ per week ☐ per month	☐ per year
Purchased			☐ per day	☐ per week ☐ per month	☐ per year
Collected from forests			☐ per day	☐ per week ☐ per month	☐ per year
Collected from private land			☐ per day	☐ per week ☐ per month	☐ per year
Other source (specify).....			☐ per day	☐ per week ☐ per month	☐ per year
Purchased wood:	Price:		..... Rs / kg, or ..... Rs/tonne		
	Price trend in recent years:		☐ increasing ☐ stable	☐ decreasing	☐ don't know
Collected Wood:	Time spent collecting (hours):			☐ per day ☐ per week ☐ per month	
	Trend in time taken to collect wood in recent years:		☐ increasing ☐ stable	☐ decreasing	☐ don't know
	Distance to collection area:				
	Distance trend in past years:		☐ increasing ☐ stable	☐ decreasing	☐ don't know
	Type of firewood collected (if possible, provide approximate share)		Chopped trees:	☐	
			Chopped branches:	☐	
			Dead wood on ground:	☐	
			Other:	☐	

Other biomass					
Type (specify)	**Amount (kg)**				
		☐ per day	☐ per week	☐ per month	☐ per year
		☐ per day	☐ per week	☐ per month	☐ per year

3. Manure management

Livestock numbers:	Dairy cows: ……		Buffalos: …..	Other cattle: ……
Where do you normally keep the animals?	□ In a shed	….. □ hours per day ….. □ share (%)	□ In the fields	……. □ hours per day ……. □ share (%)
Where is the manure from the shed put?	□ In a pit	□ On the fields	□ Other ……	
What happens to the manure from the animals when they are in the fields?	□ Collected and put in pit	□ Left in the fields	□ Other……	
Total amount of manure produced by animals (approximately, if known):	□ kg □ tonnes □ baskets		□ per day □ per month	□ per week □ per year
Total amount of manure collected from shed and put in pit:	□ kg □ tonnes □ baskets		□ per day □ per month	□ per week □ per year
Total amount of manure collected from fields and put in pit:	□ kg □ tonnes □ baskets		□ per day □ per month	□ per week □ per year

If some dung goes into a compost pit		
(i) What is the depth of the pit (in metres)?	…… m	
(ii) Apart from dung, what else is added to the pit?	□ Crop waste □ Food waste □ Toilet waste □ Other	
(iii) What share of the pit is made up of this other waste?	Approximately …… % of the total material in the pit	
(iii) For how many months of the year is the material in the pit most like the following state?	□ An uncovered slurry □ A covered slurry or slurry with crust □ Solid material but wet □ Solid material and dry	…… months …… months …… months …… months
(v) How long does it take the pit to fill up?	…… months	
(vi) What happens to manure and other pit waste once the pit is full?	□ Manure and other waste is piled on top of the existing pit □ A new pit is dug and manure and waste is put in there □ Other ……	
(vii) Does the material in the pit get mixed or turned?	□ yes □ no (if yes please indicate how often)	
(viii) How often does the pit get emptied?	□ once per year (indicate month(s) when pit emptied……) □ more than once per year (indicate how often ……)	

4. Interest in biogas

Are you interested in getting a biogas unit?	
If yes, why?	□ money savings □ time savings □ cleaner □ less smoke □ more convenient to cook □ other
If no, why?	

B. Survey results:

Survey Question	Average value	Unit	Corresponding baseline parameter	Value	Unit
Kerosine use per month					
- for cooking	1,69	l/month	F_kerosene	24,12	l/year
- for starting fire	0,32	l/month			
Firewood use per day					
- for cooking	12,99	kg	B_biomass	4,7	t/year
Heads of cattle					
- Dairy cows	2,56	head	N_dairy_cow	2,56	-
- Buffalo	1,17	head	N_buffalo	1,17	-
- Other cows	0,55	head	N_other_cattle	0,55	-
Animals kept in the shed	17,38	h/day	f_collected	0,72	-
Months per year when material in the pits is:					
- as uncovered slurry	5,32	months	MS_liquid (= F7.2 / 12 * f_collected)	0,32	-
- as covered slurry	3,24	months	MS_liquid_with_crust (=F7.3 / 12 * f_collected)	0,20	-
- solid but wet	2,72	months	MS_solid_storage (=F7.4 / 12 * f_collected)	0,16	-

C. Calculations:

Kerosene component

Methodology: AMS-I.C. "Thermal energy for user with or without electricity", version 13

BE_kerosene = F_kerosene * N * [ro]_kerosene * NCV_kerosene * EF_kerosene * 1.0 E-9

Parameter	Abbr.	Value	Unit	Source
Number of households	N	9380		Project plan
Kerosene use per household per year	F_kerosene	24.12	l	Baseline survey
Density	[ro]_kerosene	0.817	kg/l	http://www.simetric.co.uk/si_liquids.htm
Net calorific value	NCV_kerosene	43.8	TJ/Gg	IPCC
Emissions factor	EF_kerosene	71900	kgCO2/TJ	IPCC
Factor to convert units		1.00E-09		
BE annual	BE_kerosene	**582.11**	t CO2e	
BE annual for 1 unit		0.062	t CO2e	

Non-renewable biomass component

Methodology: AMS-I.E. "Switch from non-renewable biomass for thermal applications by the user", version 1

BE_NRB = B_biomass * N * f * NCV_biomass * EF_kerosene * 1.0 E-3

Parameter	Abbr.	Value	Unit	Source
Number of households	N	9380		Project plan
Quantity of biomass substituted per unit per year	B_biomass	4.74	t	Baseline survey
Fraction of biomass that is non renewable	f	0.78		Ramachandra, 2005
Net calorific value of biomass	NCV_biomass	0.015	TJ/t	IPCC
Emissions factor of kerosene	EF_kerosene	71500	kgCO2/TJ	IPCC
Factor to convert units		1.00E-03		
BE annual	BE_NRB	**37'204.61**	t CO2e	
BE annual for 1 unit		3.966		

NRB Fraction Calculation - Kolar District

Taluk Name	Bioresource Availability/Demand Ratio
Bagepalli	0.149
Bangarpet	0.1518
Chikballapur	0.422
Chintamani	0.12
Gauribidanur	0.155
Gudibanda	0.159
Kolar	0.3259
Malur	0.2122
Mulbagal	0.184
Sidllaghatta	0.173
Srinivasapur	0.3858
Average	0.22
NRB Fraction	78%

Source: *Inventorying, Mapping and Monitoring of Bio-Resources Using GIS and Remote Sensing (Kolar District)* by T V Ramachandra and G R Rao (see reference 3 in Annex 5).

Manure component

Methodology: AMS-III.R "Methane recovery in agricultural activities at the household/small farm level", version 1

EF = VS*365*Bo*0.67*(MCF_liquid/100*MS_liquid+MCF_liquid_crust/100*MS_liquid_crust+MCF_solid/100*MS_solid)

BE = (EF_dairy_cow * N_dairy_cow + EF_buffalo * N_buffalo + EF_other_cattle * N_other_cattle) *N*GWP_CH4/1000

Note: the project involves the deployment of two different sizes of bio-digester: 30% will have a capacity of 3 cubic metres, while the remaining 70% will have a capacity of 2 cubic metres. This is reflected in the baseline calculations detailed below

Parameter	Abbr.	Value for 3 cubic metre	Value for 2 cubic metre	Unit	Source
Number of households (units)	N	9380	9380		Project plan
Average number of heads of dairy cattle per unit	N_dairy_cow	2.56	2.56		Baseline survey
Average number of heads of buffalo per unit	N_buffalo	1.17	1.17		Baseline survey
Average number of heads of other cattle per unit	N_other_cattle	0.55	0.55		Baseline survey
Daily volatile solid excreted for dairy cow	VS_dairy_cow	3.8	3.8	kg dry matter/head/day	B.T. Nijaguna
Daily volatile solid excreted for buffalo	VS_buffalo	3.1	3.1	kg dry matter/head/day	IPCC
Daily volatile solid excreted for other cattle	VS_other_cattle	1.4	1.4	kg dry matter/head/day	IPCC
Maximum methane producing capacity for manure produced by dairy cow	Bo_dairy_cow	0.15	0.15	m3 CH4/kg VS	B.T. Nijaguna
Maximum methane producing capacity for manure produced by buffalo	Bo_buffalo	0.1	0.1	m3 CH4/kg VS	IPCC
Maximum methane producing capacity for manure produced by other cattle	Bo_other_cattle	0.1	0.1	m3 CH4/kg VS	IPCC
Methane correction factor for liquid/slurry manure management system	MCF_liquid	80	80	%	IPCC
Methane correction factor for liquid/slurry with crust manure management system	MCF_liquid_crust	50	50	%	IPCC
Methane correction factor for solid storage manure management system	MCF_solid	5	5	%	IPCC
Fraction of manure handled in liquid/slurry manure management system	MS_liquid	0.32	0.32		Baseline survey
Fraction of manure handled in liquid/slurry with crust manure management system	MS_liquid_crust	0.20	0.20		Baseline survey
Fraction of manure handled in solid storage manure management system	MS_solid	0.16	0.16		Baseline survey
Global warming potential of methane	GWP_CH4	21	21	t CO2/t CH4	IPCC
Scaling factor to represent lower proportion of manure going into 2cu.m.			0.67		
Emission factors:					
Emissions factor for dairy cow	EF_dairy_cow	50.59	50.59	kg CH4/animal/year	
Emissions factor for buffalo	EF_buffalo	27.52	27.52	kg CH4/animal/year	
Emissions factor for other cattle	EF_other_cattle	12.43	12.43	kg CH4/animal/year	
BE annual for 1 unit	BE_manure	3.54	2.36	t CO2e/year	
BE annual for 30% 3 cubic metre units and 70% 2 cubic metre units	BE_manure		**25'453**	t CO2e	
BE annual for 1 average unit			2.714	t CO2e	

Project emissions

PE=LF*GWP_CH4*0.67*365/1000*
*(N_diary_cow*Bo_diary_cow*VS_diary_cow+N_buffalo*Bo_buffalo*VS_buffalo+N_other_cattle*Bo_other_cattle*VS_other_cattle)

Note: the project involves the deployment of two different sizes of bio-digester: 30% will have a capacity of 3 cubic metres, while the remaining 70% will have a capacity of 2 cubic metres. This is reflected in the baseline calculations detailed below

Parameter	Abbr.	Value for 3 cubic metre unit	Value for 2 cubic metre unit	Unit	Source
Leakage factor	LF	0.1	0.1		AMS-III.R
Number of households	N	9380	9380		Project plan
Average number of heads of diary cattle per unit	N_dairy_cow	2.56	2.56		Baseline survey
Average number of heads of buffalo per unit	N_buffalo	1.17	1.17		Baseline survey
Average number of heads of other cattle per unit	N_other_cattle	0.55	0.55		Baseline survey
Daily volatile solid excreted for diary cow	VS_dairy_cow	3.8	3.8	kg dry matter/head/day	B.T. Nijaguna
Daily volatile solid excreted for buffalo	VS_buffalo	3.1	3.1	kg dry matter/head/day	IPCC
Daily volatile solid excreted for other cattle	VS_other_cattle	1.4	1.4	kg dry matter/head/day	IPCC
Maximum methane producing capacity for manure produced by diary cow	Bo_diary_cow	0.15	0.15	m3 CH4/kg VS	B.T. Nijaguna
Maximum methane producing capacity for manure produced by buffalo	Bo_buffalo	0.1	0.1	m3 CH4/kg VS	IPCC
Maximum methane producing capacity for manure produced by other cattle	Bo_other_cattle	0.1	0.1	m3 CH4/kg VS	IPCC
	GWP_CH4	21	21		IPCC
Scaling factor to represent lower proportion of manure going into 2cu.m. unit			0.67		
PE annual for 1 unit		0.975	0.650	t CO2e	
PE annual for 9,380 units, where 30% are 3 cubic metre units, and 70% are 2 cubic metre units			**7'012.70**	t CO2e	
PE annual for 1 average unit			0.748	t CO2e	

Appendix 4. Monitoring Information

Through its work with biogas plants over the last 15 years, SKG Sangha has developed a system of installing and maintaining the biogas units. The operational and monitoring plan builds on this experience. Monitoring is done in a hierarchical manner with a large number at the village level reporting to and supervised by a small team at each taluk in turn reporting to the project coordinator and his team at the main office.

The scheme in the page below shows distribution of monitoring tasks and responsibilities between different levels of project implementation: the project level (the main SKG Sangha office: project coordinator with a team), the taluk level (supervisor with a team) and the village level (so-called motivator).

In each village where SKG Sangha starts installing biodigesters, a local person is selected to be the so-called motivator. The motivators are trained in how to:

- supervise project implementation in the village;
- maintain and repair the biogas units;
- monitor the functionality of biogas units;
- keep records;
- report to taluk level.

A number of separate training sessions are also run for the households who have biodigesters installed to ensure that beneficiaries use their units correctly. All users will receive training from

SKG Sangha for the use of the digester as soon as it is installed. The motivator participates in the training sessions to ensure all beneficiaries are familiar with the main contact in the village. The beneficiaries are instructed to report any faults or problems with the units to the motivator.

During installation the household will sign three pieces of paper to confirm that the masonry work, the pipe fitting work and the overall biodigester has been installed satisfactorily. A technician from SKG Sangha will check the unit once it has been installed to ensure the biogas unit has been installed correctly and this information will then be recorded and logged in SKG Sangha's central records as well as in paper monitoring journals of the relevant motivator. The records will also include information on the size of each unit – whether it is a 3 m^3 unit or a 2 m^3 unit. Each biodigester is given a unique identification marking to indicate:

- who sponsored the biodigester;
- who built the biodigester;
- which year the biodigester was built in; and
- which number biodigester it is for that village for that year.

Monitoring scheme

Project / district level	Project coordinator Team of 4-5	Project coordinator has an overall responsibility for the project The team includes the main monitoring officer and supporting officers, who: • Collect monthly (paper) monitoring reports from taluks, • Enter all data to a database • Organise annual surveys • Conduct random checks at the village level to check the monitoring data (over the year visits 5 % of participating households) • Compile annual project level reports • Organise and conducts training for taluks and village level monitoring teams
Taluk level	Supervisor 2-3 assistants	Superviser coordinates and supervises monitoring in villages of a taluk. The team: • Collects monthly reports from villages • Compiles monthly taluk level reports (on paper): keeps on copy and send one copy to the project level • Conducts annual surveys (under the supervision of the project monitoring officers)
Village level	Motivator	The motivator is the main direct contact with the beneficiaries: • Records any periods of biogas unit non-functioning (beneficiaries contact the motivator in case of any problem with a biogas digester or the burner) • Checks functioning of all units at least once per month • Makes records in two copies, stores one copy and send one copy to the taluk level at the end of each month

A. Monitoring of biogas unit functionality

Once the unit is installed and checked by the technician, the motivator marks the start of unit operation. Beneficiaries are instructed to report any faults or problems with a biodigester or a burner to the motivator. Normally any problems with the biogas units will be resolved the same day as the original complaint. The motivator will record any periods (in days) when the unit was not operating. Households also have a separate pre-paid post form that they can send directly to SKG Sangha to inform SKG Sangha of any problems in the event that they experience any problems with their village representative. The fact that households make an in-kind contribution to the construction of biogas units also makes them more interested in making proper use of these units. Besides recording problems, the motivator will check all project units in the village at least once per month to record whether they are functioning properly. The records will be made by hand writing, on two copies of a monitoring journal. At the end of each month one copy will be delivered to the taluk level monitoring team, and one copy remains with the motivator.

The taluk level monitoring team collects monitoring journals from the villages in their taluk, and compiles monthly taluk-level reports, which include:

- Number of units that started operations before the monitoring period (i.e. before the beginning of the relevant monitoring month), separately for 2 m^3 and 3 m^3 sizes;
- Detailed records of units installed during the monitoring month, including the location, the beneficiary, the size of the biodigester, and the date of start of operations;
- Sum of non-operational days of a 2 m^3 unit and a 3 m^3 unit (i.e. if there were 10 units of 2 m^3 size that were not operational for 1 day, the record is that a 2 m^3 unit was not operational for 10 days.

The monthly reports are made in two copies, one of which is delivered to the project level (main SKG Sangha office), and another one remains at the taluk level.

The project level monitoring team collects the monthly reports. Throughout the year it makes random visits to villages to check in whether the data recorded by the motivator is correct.

The project level monitoring team enters all data into the central project database, which includes:

- Records of every unit installed, including the location, the beneficiary, the size of the biodigester, the date of start of operations, and the end of operations in case the unit broke down
- Records of non-operational days, separately for 2 m^3 and 3 m^3 sizes, for every village (corrected after the random visits if needed)

B. Monitoring of annual hours of operation

A sample (at least 30% of beneficiaries in the first year of the crediting period, at least 5% thereafter - only those who can write will be selected) will be given a sheet where they will make records for a week writing down each day the hours when a burner was functioning. i.e. each day a beneficiary will write down the time of starting cooking and finishing cooking, and note whether one or two burners were used. The motivator will distribute the sheets and collect the filled sheets, which will be sent to the project level monitoring team. The team will enter the data into the database and calculate average annual hours of operation for 2 m^3 and 3 m^3 sizes. For the random checks the team will be doing for monitoring of unit functionality, some households that do monitoring of annual hours of operation will be included in the sample of random visits to check whether the data recorded by beneficiaries is reasonable.

C. Surveys of a sample of units

Taluk level monitoring teams will carry out annual surveys of a sample of beneficiaries to determine the following parameters and information:

- Annual hours of operation of a unit (operation of a burner)
- Annual amount of kerosene used
- Annual amount of fuel wood used
- Animal population per household (for each type of cattle)
- Amount of manure generated on the farm
- Amount of animal manure fed into the system
- Proper soil application of the final sludge

The sampling plan is detailed in F. Below. The Survey sheet is given in Appendix A.

The schedule of surveys is projected to be as follows:

- 250 households in the 1st year
- 208 households in the 2nd year
- 392 households in the 3rd year
- 469 households in each subsequent year

Surveys will be carried out each year, but over an extended period, as only a few beneficiaries can be surveyed by one person or team in one day.

Survey sheets will be delivered to the project level monitoring team, which will enter the data into the database and calculate average values of each parameter, separately for 2 m^3 and 3 m^3 sizes. The resulting data will be sued for calculating and checking emission reductions.

D. Surveys of non-project households

Taluk level monitoring teams will carry out annual surveys of at least 100 households in the project area to determine the amount of biomass uses for cooking purposes, the sources of biomass and trends in sourcing the biomass. Survey sheet is provided in Appendix A.

E. Calculation of emission reductions

Emission reductions will be calculated using formulae (1), (3), (7), and (9). Kerosene consumption in the baseline will be adjusted by monitored value of $F_{kerosene}$ and $B_{biomass}$. Difference of the value of $B_{biomass\ non\text{-}project}$ determined before project implementation and monitored after project implementation will be used for establishing the leakage (after adjusting it for the NRB fraction).

Monitored values $B_{manure\_generated}$ and B_{manure_fed} will be used for adjusting $f_{collected}$ in the formula (7).

Monitored value H_{stove} will be used for checking whether the biogas generated in the biodigester covers at least the same energy needs that were covered by burning fuel wood and kerosene in traditional stoves. This will allow checking whether the biogas fully displaces the NRB and kerosene use in the baseline.

The overall project emission reductions will also be adjusted for the real proportion of operational 2 m^3 and 3 m^3 size units.

F. Sampling Plan

1. **Sampling Objective.**

Eight different parameters will be monitored using sampling. $N_{operating}$, the number of units operating, is not included in the sampling plan as all units that are operating will be monitored. Whilst, the parameter, **Application of sludge,** is included in the sampling plan, it should be noted that this variable does not impact emissions arising from or saved by the project activity. This parameter is monitored for sustainability reasons. That is to ensure that project participants derive the most value from being able to use the sludge as a fertilizer.

The objective is to determine the mean average annual value of each of the parameters listed below during the crediting period and with a 90/10 confidence/ precision:

$\mathbf{H_{stove}}$ (hours) - Annual hours of operation of an average system (hours of burner functioning)
$\mathbf{F_{kerosene,project}}$ (Litres) – Amount of kerosene consumed by household after installation of biogas unit
$\mathbf{B_{biomass,project}}$ (Tonnes)– Consumption of fuel wood in households participating in project activity
$\mathbf{B_{biomass,\ non\text{-}project}}$ (Tonnes) – Consumption of fuel wood in households not participating in project activity
$\mathbf{N_t}$ (dimensionless) – annual average animal population in a household (number of heads of dairy, cow, buffalo and other cattle)
$\mathbf{B_{manure\_generated}}$ (Tonnes) **–** Average amount of animal manure generated per household per year
$\mathbf{B_{manure,fed}}$ (Tonnes) – Average amount of animal manure fed into a biogas digester per year
Application of sludge (qualitative information) – Proper application of the sludge from the biogas unit

2. **Field Measurement Objectives and Data to be collected.**

Information on the variables and data to be collected, the scope and method of the survey and their frequency are provided for each parameter in the following paragraphs:

$\mathbf{H_{stove}}$ (hours) – There are three key variables for this parameter that will determine average annual hours of operation of an average system (hours of burner functioning): cooking start time, cooking end time and whether one or two burners were used. Data on these variables will be collected for at least 30% of project beneficiaries in year 1 (June 2011 to May 2012) and at least 5% of project beneficiaries thereafter. The survey will be carried out once a year by village level Project Motivators. Each Project Motivator will distribute sheets of paper to project beneficiaries (that are able to write) in their village, on which beneficiaries will make records for every day during one week in the year for the three variables described above.

$\mathbf{F_{kerosene,project}}$ (litres) – There is one key variable, for this parameter, kerosene used for cooking. Data for this variable will be collected for at least 30% of project beneficiaries in year 1 and 5% of project beneficiaries thereafter. The survey will be carried out once a year by village level Project Motivators. Each Project Motivator will meet with project beneficiaries in their village and determine kerosene used for cooking (distinguishing this from kerosene used for other purposes such as lighting) through discussions with the beneficiaries and by measuring kerosene usage on the day of their visit. The motivators will enter findings from their discussions into survey questionnaire sheets which will be completed for each household.

$\mathbf{B_{biomass,project}}$ (Tonnes) – There is one key variable, consumption of fuel wood in households participating in the project activity. Data for this variable will be collected for at least 30% of project beneficiaries in year 1 and 5% thereafter. The survey will be carried out once a year by village level Project Motivators. Each Project Motivator will meet with project beneficiaries in their village and determine fuel wood usage through discussions with each relevant beneficiary and by weighing wood consumed on the day of the visit. The Project Motivators will enter findings from their discussions into survey questionnaire sheets which will be completed for each beneficiary.

$\mathbf{B_{biomass,\ non\text{-}project}}$ (Tonnes) – There is one key variable, consumption of fuel wood in households not participating in the project activity. Data for this variable will be collected by surveying 100 non-project households that use fuel wood. The survey will be carried out once a year by the Taluk level monitoring team. The team will meet with households and determine fuel wood usage through discussions with each relevant household and by weighing wood consumed on the day of the visit. Team members will enter findings from their discussions into survey questionnaire sheets which will be completed for each household.

$\mathbf{N_t}$ (Dimensionless) – There is one key variable, annual average animal population in a household. Data for this variable will be collected by surveying at least 30% of project beneficiaries in year 1 and 5% of project beneficiaries thereafter. The survey will be carried out once a year by the Taluk level monitoring team. The team will meet with beneficiaries, count the number of heads of cattle on the day of their visit and will clarify through discussions with each relevant beneficiary whether there were changes in number of heads throughout the year. Team members will enter findings from their discussion into survey questionnaire sheets which will be completed for each beneficiary.

$\mathbf{B_{manure,generated}}$ (Tonnes) – There is one key variable, average amount of animal manure generated per project beneficiary per year. Data for this variable will be collected for at least 30% of project beneficiaries in year 1 and 5% thereafter. The survey will be carried out once a year by the Taluk level monitoring team. The team will meet with the beneficiaries, and will determine the amount of manure generated through discussions with each relevant beneficiary and by weighing manure on the day of their visit. Team members will enter findings into survey questionnaire sheets which will be completed for each beneficiary.

$\mathbf{B_{manure,fed}}$ (Tonnes) – There is one key variable, average amount of manure fed into a bio-digester per project beneficiary per year. Data for this variable will be collected for at least 30% of project beneficiaries in year 1 and 5% thereafter. The survey will be carried out once a year by the Taluk level monitoring team. The team will meet with the beneficiaries, and will determine the amount of manure fed into the bio-digester through discussions with each relevant household and by weighing manure on the day of their visit. Team members will enter findings into survey questionnaire sheets which will be completed for each beneficiary.

Application of sludge (qualitative information) – There is one key variable, use of sludge from the biogas unit. Information for this variable will be collected for at least 30% of project beneficiaries in year 1 and 5% thereafter. The survey will be carried out once a year by the Taluk level monitoring team. The team will meet with the beneficiaries, and will determine sludge application through discussions with each relevant beneficiary. Team members will enter findings into survey questionnaire sheets which will be completed for each beneficiary.

3. **Target Population and Sampling Frame.**

For all parameters with the exception of $\mathbf{B_{biomass,\ non\text{-}project}}$ the target population is the beneficiaries that will receive the bio-digesters in the project. The sampling frame for these parameters will be at least 30% of beneficiaries with bio-digesters in year 1 and 5% thereafter (see section 5). A clustered sampling approach considering 5 geographic clusters each corresponding to one of the 5 regions "Taluks" involved in the project will be adopted. As two types of bio-digester will be deployed in the project (a $2M^3$biogas unit and a $3M^3$biogas unit) there will also be an element of stratification in the sampling frame, distinguishing beneficiaries by type of biogas unit.

For $\mathbf{B_{biomass,\ non\text{-}project}}$ the target population is households that are not involved in the project activities but are located in the same regions in which the project activities take place. The sampling frame for this parameter is 100 households in the project activity regions that are not involved in the project activity. As for all other parameters, a clustered sampling approach considering 5 geographic clusters each corresponding to one of the 5 regions "Taluks" involved in the project will be adopted.

4. **Sample Method.**

The sampling method will be carried out as follows:

Sampling objectives
The sampling objectives have been clearly defined (as summarized in section 1 of the sampling plan above) and these objectives will be clearly communicated by the Project Communicator and his team to Taluk supervisors, the project motivators and Taluk monitoring team members that will carry out and review the surveys. To ensure that the data needs are clearly understood and collated in a consistent manner, standard survey sheets have been prepared for completion by all individuals that will carry out the sampling. A copy of this is provided in Annex 6.

Target population
For all parameters with the exception of $\mathbf{B_{biomass,\ non\text{-}project}}$ the target population is the beneficiaries that will receive the bio-digesters in the project For $\mathbf{B_{biomass,\ non\text{-}project}}$ the target population is households that are not involved in the project activities but are located in the same regions in which the project activities take place.

Sampling frame
For all parameters with the exception of $\mathbf{B_{biomass,\ non\text{-}project}}$, the overall sampling frame will be the full list of households receiving bio-digesters in the project and have sufficient levels of literacy to track some of the data that will be required. To ensure that the target population accounts for literacy, information on the literacy of project beneficiaries will be recorded by Project Motivators at the time of installing the bio-digesters and this information will be kept in the central project database that will be managed by the Project Coordinator. To enable clustering by geographic area, for each bio-digester installed, the Project Coordinator and his team will, in the central project database, record details of the village and Taluk in which the bio-digester was installed and whether it was a small ($2M^3$biogas unit) or large ($3M^3$) biogas unit.

For $\mathbf{B_{biomass,\ non\text{-}project}}$ the sampling frame are households that are not involved in the project activities but are located in the same villages in which the project activities take place.

Randomizing cases and drawing sample
To promote the drawing of a representative and random sample, the Project Coordinator and his team will develop the sample list of households as follows:

a. <u>Developing a representative sample</u>
When drawing the sample the Project Coordinator and his team will firstly analyze the deployment distribution of operating biogas units to determine the number of households to be sampled in each Taluk in order to generate a sample population that reflects the distribution of biogas units by region and size.

e.g.

Number of biogas units installed by region and size

Type of unit	**Srinivaspur**	**Kolar**	**Mulbagal**	**Malur**	**Bangarapet**	**Total**
Small $2M^3$)	700	4,000	1,800	480	1,000	7,980
Large($3M^3$)	300	1000	200	20	500	2,020
Total	**1,000**	**5,000**	**2,000**	**500**	**1,500**	**10,000**

Based on this information, the Project Coordinator and his team will analyze the distribution (%) of digesters by size and region.

e.g.

Distribution of biogas units by region and size

Type of unit	Srinivaspur	Kolar	Mulbagal	Malur	Bangarapet	Total
Small 2M^3)	7.0%	40.0%	18.0%	4.8%	10.0%	79.8%
Large(3M^3)	3.0%	10.0%	2.0%	0.2%	5.0%	20.2%
Total	**10%**	**50%**	**20%**	**5%**	**15%**	**100%**

The Project Coordinator and his team will then apply this distribution to the sample population needed to deliver the required level of precision (e.g. 500) to determine the proportion of households in the sample that should be surveyed by region and unit type for the specific year.

e.g.

Number of households to be surveyed in year by region and type of bio-digester

Type of unit	Srinivaspur	Kolar	Mulbagal	Malur	Bangarapet	Total
Small 2M^3)	35	200	90	24	50	**399**
Large(3M^3)	15	50	10	1	25	**101**
Total	**50**	**250**	**100**	**25**	**75**	**500**

b. Randomizing the selection of households in the sample population

For each category of the population (size of unit by region) the Project Coordinator and his team will use a random number generator function in Excel to select the households to be sampled (from the full list of households falling into each category, by region and type of biogas unit).

The Project Coordinator and his team will then develop a schedule for biogas visits for each year (reviewed on a monthly basis) with an aim of ensuring that 1/12 of the sample population is surveyed in each month (to try to prevent problems associated with seasonal cycles).

Selecting the most effective information gathering method
As described in section 2, information will be gathered by the Project Motivators and Taluk level monitoring team using a mixture of visual inspections, measurement of parameters during visual inspections, self reporting and discussions with project beneficiaries.

In all cases data will be entered into standardized survey forms prepared by the Project Coordinator and his team to be completed by members of the monitoring team/Project Motivators or beneficiaries.

The forms will then be transferred, on a monthly basis, upwards through the monitoring team hierarchy (shown above in the “Monitoring Scheme” figure) until finally data is entered into the database kept by the Project Coordinator and his team.

Conducting surveys and measurements
Procedures will be put in place to ensure that field data collection is performed properly and that any potential intentional errors or unintentional errors are minimized and documented. These will include:

- Preparation of standard survey forms to be completed by the monitoring team and households (see Annex 6)
- Training of project monitoring team
- Establishing a clear project monitoring hierarchy, which will enable sample data to be checked at various stages

- Monthly analysis of survey findings by the Project Coordinator and his team to identify outliers and possible errors, which will be documented in the database
- Subsequent discussion of possible errors with Taluk level supervisors, who will, in turn, discuss these errors with the individuals responsible for conducting the surveys. On the basis of these discussions, surveys will be carried out again or eliminated from the sample, with the resulting corrective action communicated to the Project Coordinator, who will then log this in the central project database.

Minimizing non-response
A core feature of the project is the central role that project motivators play in the monitoring process. With project motivators being members of the communities in which the biogas units are installed they will have existing relationships with the beneficiaries. These relationships should minimize the chance of non-response. Further, project motivators will be involved in the installation of biogas units and will serve as a point of contact and issue resolution in the case that biogas unit do not work as planned and therefore will be continuously exposed to the households that will be surveyed.

Not-withstanding this feature of the project, a number of corrective measures will be employed, including over-sampling (see section 5). Further, as sampling will be carried out throughout the year, the Project Coordinator will be in a position to review response rates as the year progresses and take action to increase sampling efforts if non-response is an issue.

5. **Desired Precision/Expected Variance and Sample Size.**

Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project categories (I.E/ Version 3) states that a sample size shall be chosen for a 90/10 level of precision (a 90% confidence interval and 10% margin of error).

The proposed sampling approach has been found to meet this requirement. This is demonstrated as follows:

The formula for determining the minimum sample size of a population that should be used to demonstrate a 90% confidence interval is as follows:

$$n = (Z_{\alpha/2} * \sigma/E)^2$$

Where:

n = the sample size
$Z_{\alpha/2}$= 1.65 for a confidence interval of 90%
σ = the standard deviation
E = the maximum error of estimate – in this case 10% of the average value of the specific parameter

As neither σ nor E is known for the parameters to be sampled, these values were calculated from an analysis of the results obtained from the baseline survey, the results of which have been inspected by the validator.

By applying the formulae to the values calculated from the survey findings, the minimum sample size (n) for each parameter was calculated and is summarized in the table below.

Calculation of minimum sample size required to deliver a 90% confidence interval and a 10% margin of error for each parameter to be sampled.

Parameter	Units	$Z_{\alpha/2}$	σ	Average value from survey	E	n
$F_{kerosene,project}$	Litres	1.65	1.58	2.00	0.20	169
$B_{biomass}$,project	Kg	1.65	6.00	12.99	1.30	58
$B_{biomass,\ non-project*}$	Kg	1.65	6.00	12.99	1.30	58
N_t	No. of cattle	1.65	3.05	4.78	0.48	111
$B_{manure\_generated}$	Kg	1.65	55.61	98.18	9.82	87
B_{manure_fed**}	Kg	1.65	43.20	80.12	8.01	79

The table shows that the sample size required to achieve a confidence interval of 90% of the different factors ranges from 58 to 169.

A minimum sample of 169 households is needed to achieve a confidence interval of 90%.

For $B_{biomass,\ non-project}$ we propose to sample a minimum of 100 households. With a minimum sample size of 58 required for this parameter, this should allow for the possibility of non-response.

For all other parameters, we propose to sample a minimum of 30% of households with bio-digesters in Yr 1 and 5% thereafter. In each year the Project Coordinator will be responsible for ensuring that an adequate number of households are sampled to deliver the required level of precision and will sample more households (than the 30%, 5% approach detailed) if necessary to ensure a confidence interval of 90%. The table below shows the anticipated number of households that would be sampled in each year using various sampling approach when applied to the anticipated bio-digester deployment plan and shows that in each case more than 169 beneficiaries (the maximum value of n for all parameters) will be sampled, allowing for the possibility of non-response. Specifically, 250, 208 and 392 beneficiaries will be surveyed in years 1, 2 and 3, respectively. Thereafter, 469 beneficiaries will be sampled.

	Year 1 2012/2013	Year 2 2013/2014	Year 3 2014/2015	Year 4 onwards 2015/2016 +
Cumulative units installed	2,500	6,000	9,380	9,380
Average units operating in year	833	4,167	7,833	9,380
Units to be surveyed using:				
5% sampling	42	**208**	**392**	**469**
10% sampling	83	417	783	1,000
20% sampling	167	833	1,567	2,000
30% sampling	**250**	1,250	2,350	3,000

The baseline survey did not capture information on two of the parameters that will be sampled, H_{stove} and **Application of sludge.** Neither of these parameters will be used to calculate project activity emissions. They will instead be monitored to check whether the bio-digesters produce enough bio-gas to substitute previous use of non-renewable biomass and kerosene and to check the appropriate use of sludge as a fertilizer. Information for both parameters will be gathered by sampling 30% of households in year 1 and 5% thereafter.

For $\mathbf{H_{stove}}$ sample data gathered during the project activity will be analyzed on a quarterly basis (using the formula shown above) to calculate the minimum sample size required to achieve a confidence interval of 90% and the number of households to be sampled will be amended in subsequent quarters if necessary to achieve this. Information on the application of sludge is qualitative and therefore a minimum sample size is difficult to calculate. However, as the sampling approach has been derived in order to ensure that a 90% confidence interval can be achieved for all other parameters, it is expected that this will ensure that sufficient information is captured for reliably monitoring this parameter.

6. **Procedures for Administering Data Collection and Minimizing Non-Sampling Errors.**

Procedures for data collection
As described in section 2, sampling will be carried out by the village level Project Motivators or the Taluk level monitoring teams, with review of findings carried out at the Taluk level and overall project level. Sampling will be carried out on a monthly basis, with the aim of collating information for 1/12 of the sample population in each month. This will overcome any issues associated with seasonality.

To promote effective data collection, project motivators and monitoring team members will use standardized forms developed by SKG Sangha and will also receive training from SKG Sangha.

In all cases, the survey sheets for all beneficiaries and households surveyed in each village will be collected by the Project Motivator or the Taluk level monitoring teams. In each case copies of survey findings will be kept on file by the individuals conducting the survey. Copies will also be sent to the relevant Taluk level supervisor. The Taluk level supervisors will collate all survey sheets for their Taluk, keeping copies on file and sending copies to the Project Coordinator and his team.

The Project Coordinator (and his team) has responsibility to enter all survey data into a database and to use the survey information to analyze sample findings.

Quality assurance
The results from sample findings will be reviewed once a month by the Project Coordinator and his team to identify response rates, check that sampling is on track to achieve the 90/10 precision and to identify any values that appear to deviate significantly from what was expected. This will enable the Project Coordinator to adjust sample sizes in subsequent months and to discuss unexpected results with the relevant Taluk level supervisors, Project Motivators or monitoring team members to check whether results can be justified or are the result of errors in data capture/ entry. If results appear to be the result of errors, this will be documented in the database and the household will be re-surveyed or excluded from the sample.

Response rates will be maximized by the involvement of project motivators in sampling. Project motivators will be individuals selected from the local communities in which the bio-digesters are implemented. As such project motivators are likely to have good relationships with project beneficiaries that should maximize response rates. In addition, response rates will be maximized by use of a sufficiently large sample that allows room for non-response. Further, the Project Coordinator and has team will review response rates on a monthly basis and adjust target sample numbers for subsequent periods, if response rates are lower than anticipated.

7. **Implementation.**

The schedule for implementing the sampling effort should be defined as well as indication of who will conduct the actual data collection and the analyses; include qualifications, experience and any potential conflicts of interest of those involved in the data collection and analyses.

The Project Coordinator will have responsibility for determining and implementing the sampling schedule for the year. This will be carried out as follows:

At the start of each year, The Project Coordinator will be aware of the target number of beneficiaries and households to be surveyed in the period (30% in year 1, 5% thereafter and 100 non-project households). The Project Coordinator will, however, need to develop monthly sampling schedules that not only take account of these overall aims, but also reflect actual deployment rates by area and type of digester. The Project Coordinator will receive information on the number of units installed and operating in each month from the Taluk level monitoring team (who, in turn, will receive this information from project motivators).

The Project Coordinator, will then develop a schedule for the operating units to be sampled in the subsequent month. This will be done, using the sample method described in (4) and with a view to sampling the total number of beneficiaries required to achieve a 90% confidence interval (described in 5).

The Project Coordinator will then issue the list of beneficiaries to be surveyed in each month to the Taluk level monitoring team, who in turn, will distribute lists to the project motivators. At the end of each month, sample findings will be relayed to the Project Coordinator and his team for analysis and the Project Coordinator will use these findings to finalise the list of households to be surveyed in the subsequent month. This will be done with reference to possible errors, non-response rates and verification that sampling is on track to deliver the 90/10 level of precision.

The "Monitoring Scheme" diagram above summarises the individuals that will be responsible for the actual data collection and analyses.

The qualifications and experience of the Project Coordinator and other team member who have responsibility for managing the sampling and analysis are provided below.

Data collation will be carried out by a number of Project Motivators and the project monitoring team. Although these will be employees of SKG Sangha who is the Project Owner and will indirectly benefit from the sale of the CERs, there are no anticipated potential conflicts of interest in those involved in data collection and analyses. The funding is provided to SGS in advance and the funder takes the risk of short delivery hence the monitors are sufficiently removed from the reward that there is no potential conflict of interest.

CURRICULUM VITATE

A. Project Coordinator

1. **First name :** Kiran Kumar
2. **Surname :**Kudaravalli
3. **Date and place of birth :** 13-04-1957
4. **Nationality :** Indian
5. **Civil Status :** Married
6. **Address :** H.NO.2462, 3rd Main, 3rd Cross, PC Extension, Kolar – 563 101, Karnataka State, India
7. **Educational background**

Institution	Osmania University
years	1979 – 83
Obtained degrees	Masters in Philosophy and Education

8. Linguistic knowledge

Language	Level	Understanding	Speaking	Writing
Telugu	Mother tongue	Good	Good	Good
English	Good	Good	Good	Good
Hindi	Good	Good	Good	Good
Kannada	Good	Good	Good	Good
Tamil	Good	Good	Good	Moderate

9. Associations or professional body :

a. Asia Regional Cook stove Program **(ARECOP),**
b. Kolar Voluntary Associations Network **(KOVAN),**
c. African Carbon Forum
d. Gold Standard Foundation (**GS**)

10. Other qualifications: Experience in organic farming

11. Current position: Secretary, SKG Sangha

12. Duration of professional experience: > 20 years

13. Main qualifications: Project developer

14. Specific experiences:

Country	Dates	Name and brief description of the project
India	-	Renewable energy projects – Biogas and Micro-Hydro. Biogas programme carried out for different Communities, Institutional and industrial in different states of India including Karnataka, Tamil-Nadu, Kerala, Andhra Pradesh, West Bengal, and present project in Uttar Pradesh. Micro-Hydro projects. Project carried out in Karnataka for rural communities. Capacity – 0.25 Kw Taken main role in development of GS VER, CDM projects documents Designed different models and treatment methods for different kinds of feed materials for biogas production Main trainer of trainers on biogas projects and trainer of biogas plant masons and supervisors
Kenya		Renewable Energy Project – Family size biogas units Biodigester size for each family– $8m^3$ Design of the units to suit the climatic conditions of Kenya and availability of materials.

		Training of beneficiaries on use of biodigesters. Development of the maintenance manual for the units.
		Up-coming biogas Project in Mali, Senegal, Ghana, Indonesia, Uganda and Honduras.

15. Professional experience:

Date	1992 until now
Place	Karnataka State, India
Firm	SKG Sangha
Position	Secretary
Description of the job	As a secretary, the job mainly involves designing biogas plants and projects that being implemented in different states and countries by SKG Sangha team. It also includes preparing design documents, managing and training workers teams trainers; and training trainers of the projects

16. Others (ex: publications)

a. Developed baseline and monitoring survey questionnaires
b. Developed biogas plant maintenance manuals
c. Developed Vermicompost units manual

B.Team Member

1. **First name :** Raghava Rao
2. **Surname :** Vasireddy
3. **Date and place of birth :** 01-11-1957
4. **Nationality :** Indian
5. **Civil Status :** Married
6. **Address :** H.NO.532, 2nd Main Road, Gandhi Nagar, Kolar – 563 101, Karnataka State, India
7. **Educational background**

Institution	Nagarjuna University
Date :	1980 - 82
Obtained degree:	Graduate

8. Linguistic knowledge

Language	Level	Understanding	Speaking	Writing
Telugu	Mother tongue	Good	Good	Good
English	Good	Good	Good	Good
Hindi	Moderate	Good	Moderate	Moderate
Kannada	Good	Good	Good	Good
Koya	Good	Good	Good	Good

9. Associations or professional body:

1. Kolar Voluntary Associations Network **(KOVAN),**

10. Other qualifications: Good knowledge in agricultural practices

11. Current position: Director, SKG Sangha

12. Duration of professional experience: 20 years

13. Main qualifications: Quality control and replication

14. Specific experiences:

Country	Dates	Name and brief description of the project
India	-	Renewable energy projects – Biogas Biogas programme carried out for different Communities, Institutional and industrial in different states of India including Karnataka, Tamil-Nadu, Kerala, Andhra Pradesh, West Bengal Taken main role in development of GS VER, CDM projects implementation, monitoring, maintenance and trainings Main trainer on biogas plants, training of masons and supervisors

15. Professional experience:

Date	1998 until now
Place	Karnataka State, India
Firm	SKG Sangha
Position	Director
Description of the job	As a Director, the job mainly involves propagation of biogas plants and projects that being implemented in different states by SKG Sangha team. It also includes preparing work schedules, procuring and arranging materials managing workers teams and training the workers and beneficiaries.

16. Others (ex: publications)

1. Taken part in developing biogas and vermicompost units maintenance manuals

Appendix 5. References

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3. Malhotra, P, *Environmental implications of the energy ladder in rural India*, Boiling Point Issue 42 (1999) (see http://www.hedon.info/EnvironmentalImplicationsOfTheEnergyLadderInRuralIndia)
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Appendix 6. Monitoring survey sheet

Project Beneficiary Energy & Manure Management Survey				
Village and taluk:		Date:		Biogas unit size: ..... m^3
Name of the beneficiary:			Biogas unit number:	
Biogas use				
Average hours of operating burner*:		□ per day □ per week □ per month □ per year		
Kerosene				
Used for	**Amount (litres)**			
Cooking:		□ per day □ per week □ per month □ per year		
Lighting Fire:		□ per day □ per week □ per month □ per year		
Lighting:		□ per day □ per week □ per month □ per year		
Other:		□ per day □ per week □ per month □ per year		
Firewood				
Use and Source	**Amount (kg)**			
Used for cooking		□ per day □ per week □ per month □ per year		
Used for water heating		□ per day □ per week □ per month □ per year		
Used for other purposes		□ per day □ per week □ per month □ per year		
Purchased		□ per day □ per week □ per month □ per year		
Collected from forests		□ per day □ per week □ per month □ per year		
Collected from private land		□ per day □ per week □ per month □ per year		
Other source (specify)		□ per day □ per week □ per month □ per year		
Other biomass				
Type (specify)	**Amount (kg)**			
		□ per day □ per week □ per month □ per year		
		□ per day □ per week □ per month □ per year		
Manure and slurry management				
Livestock numbers**:	Dairy cows: ……	Buffalos: …..	Other cattle: ……	
Total amount of manure produced by animals	.....	□ kg □ tonnes □ baskets	□ per day □ per week □ per month □ per year	

Total amount of manure fed into the biodigester:	.....	□ kg □ tonnes □ baskets	□ per day □ per week □ per month □ per year
Describe application of the slurry from biodigester: where is it used, how, when			

*** - when two burners are functioning at the same time, count as one burner functioning double time**

*** - adjust the number to reflect the number prevailing over the year if e.g. at the moment there are 3 cows but the third one was bought half a year ago, count as 2.5 cows**

Non-project Household Biomass Use Survey	
Village and taluk:	Date:
Name of the beneficiary:	

Firewood use				
Use and Source				
Used for cooking	..... kg	□ per day □ per year	□ per week	□ per month
Used for water heating	..... kg	□ per day □ per year	□ per week	□ per month
Used for other purposes	..... kg	□ per day □ per year	□ per week	□ per month
Purchased	..... kg	□ per day □ per year	□ per week	□ per month
Price	.....Rs.			
Collected from forests		□ per day □ per year	□ per week	□ per month
Distance to the source:	.....km			
Other source (specify)		□ per day □ per year	□ per week	□ per month
Other biomass				
Type (specify)	**Amount (kg)**			
		□ per day □ per year	□ per week	□ per month
		□ per day □ per year	□ per week	□ per month

Notes:

Appendix 7. Simple cost analysis of the project activity and alternative scenarios

Scenario	(1) Capital cost (INR)	(2) Useful life (years)	(3) Average annual capital cost* (INR)	(4) Fuel price (INR/ litre or INR/kg)	(5) Annual fuel usage (litre/year; kg/year)	(6) Annual fuel cost** (INR)	(7) Annual maintenance expenses (INR)	(8) Average annual costs*** (INR)
Scenario 1) Use of kerosene for all cooking purposes (subsidised fuel)	400.00	5.00	80.00	10.00	200.00	2,000.00	25.00	2,105.00
Scenario 2) Use of Liquid Petroleum Gas (LPG) Systems (subsidised fuel)	1,800.00	15.00	120.00	24.60	115.00	2,829.00	75.00	3,024.00
Scenario 3) Use of sustainable agricultural residues (traditional stove)	10.00	3.00	3.33	1.00	1,395.00	1,395.00	-	1,398.33
Scenario 4) Project activity - use of project bio-gas systems	20,899.00	20.00	1,044.95	-	-	-	500.00	1,544.95
Scenario 5) Pre-project situation: three stones stove plus subsidised kerosene	-	n/a	-	10.00	36.00	360.00	-	360.00

*** Average annual capital cost = value shown in column (1) ÷ value shown in column (2)** Annual fuel cost = value shown in column (4) multiplied by value shown in column (5)**

***** Average annual costs = value shown in column (3) + value shown in column (6) + value shown in column (7)**

Source of data	Capital cost (INR)	Useful life (years)	Interest (discount) rates (%)	Price fuel (INR / litre; INR / kg)	Annual fuel usage (litre / year; kg / year)	Annual fuel cost (INR)	Annual maintenance expenses (INR)
Scenario 1) Use of kerosene for all cooking purpose (subsidised fuel)	Report	Report	Report	Baseline survey	Report	Report + baseline survey	Report
Scenario 2) Use of Liquid Petroleum Gas (LPG) systems (subsidised fuel)	Report	Report	Report	2008 Subsidised price*	Report	Report + 2008 fuel price	Report
Scenario 3) Use of sustainable agricultural residues (traditional stove)	Report	Report	Report	Report	Report	Report	Report
Scenario 4) Use of project biogas systems (data from SKG Shanga)	SKG Shanga	Nijaguna, B.T, *Biogas Technology*	Report	The biogas is free	The biogas is free	The biogas is free	SKG Shanga
Scenario 5) Pre - project situation: three stones stove + subsidised kerosene	There is not capital cost for a 3 stones stove	It does not make any difference as the capital cost is zero	It does not make any difference as the capital cost is zero	Baseline survey	Baseline survey	Baseline survey	There is not maintenance expenses

Report = Report on the use of LPG as a domestic cooking fuel option in India", International Energy Initiative, 2004 (see Annex 3)

* A domestic LPG cylinder has 14.2 kg and it sells at 350 Rs.
http://timesofindia.indiatimes.com/Cities/Kolkata_/LPG_switch_catalyst_for_gas_racket_/articleshow/3730124.cms

Appendix 8. Summary of post registration changes

Following permanent changes from registered monitoring plan, applied methodology or applied standardized baseline have been applied:

1. The Start of crediting period has been changed from 24/11/11 – 23/11/21 to 01/04/12 – 31/03/22. This change has already been approved by the UNFCCC. As a consequence the year and dates of the monitoring periods as written in the PDD were not correct anymore. All the dates have now been adapted accordingly to the prevailing crediting period. Also the length of the first and the last monitoring period have been changed: the first monitoring period lasts now 1 year and 9 month and the last monitoring period lasts now 1 year and 3 month. In total there are now only 9 monitoring periods.

2. The biogas implementation plan has been adapted to the current status. Number of units installed per year has been corrected down.

Number of Total units installed under the project activity has been corrected down from 10,000 units to 9,380 units.

3. The parameter GWP_CH4 has been changed from 21 to 25 for the second commitment period. The value remains 21 for the first commitment period.

4. The parameter $EF_{\_kerosene}$ used under AMS-I.C has been changed from 71,500 kg CO2/TJ to 73,700 kg CO2/TJ for the project emissions and is now in line with the methological tool used (am-tool-03-v2). The Emission Reduction Calculations are now more conservative, because the value used for calculation of project emissions is higher.

5. The ER calculation have been adapted according to all the parameters changed.

6. The parameter $B_{Biomass}$ has been subdivided in $B_{Biomass,baseline}$ and $B_{Biomass,project}$ to make the parameter clearer. The same is for parameter $F_{\_Kerosene.}$,which has been subdivided in $F_{\_Kerosene,baseline}$ and $F_{\_Kerosene,project.}$

7. The project participants have been changed; CarbonAided Ltd and CH4NGE Ltd have withdrawn and foundation myclimate – The Climate Protection Partnership were added.

8. Several editorial changes have been made to improve to PDD quality.

Document information

Version	*Date*	*Description*
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for small-scale CDM project activities (these instructions supersede the "Guidelines for completing the project design document form for small-scale CDM project activities" (Version 01.1)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and **Fehler! Verweisquelle konnte nicht gefunden werden.**; • Change the reference number from *F-CDM-SSC-PDD* to *CDM-PDD-SSC-FORM*; • Editorial improvement.
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	13 March 2012	EB 66, Annex 9 Revision required to ensure consistency with the “Guidelines for completing the project design document form for small-scale CDM project activities”
03.0	15 December 2006	EB 28, Annex 34 • The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.
02.0	08 July 2005	EB 20, Annex 14 • The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
01.0	21 January 2003	EB 07, Annex 05 Initial adoption.

Decision Class: Regulatory
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Business Function: Registration
Keywords: project design document, SSC project activities