CLEAN DEVELOPMENT MECHANISM

SIMPLIFIED PROJECT DESIGN DOCUMENT (PDD)

FOR SMALL SCALE PROJECT ACTIVITIES (SSC-PDD)

Version 01 (21 January, 2003)

PDD for:

Bagepalli CDM Biogas Programme

23 May 2005

CONTENTS

A. General description of project activity

A.1 Title of the project activity:

Bagepalli CDM Biogas Programme

A.2 Description of the project activity:

The project activity is to set up 5500 biogas plants (digesters) of 2 m^3 capacity each for single households. Each household will utilise the dung of its cows to feed the digester for the production of biogas for cooking purpose and heating of hot water. The aim of the project is to replace the commonly used inefficient wood fired mud stoves technology, with clean, sustainable and efficient biogas. And therefore replace the non-renewable source of biomass (wood) with the renewable biogas. Each family will also replace 46 litres of kerosene annually which is used as supplementary cooking fuel today. The project will be carried out in Kolar District.

In this semi-arid region wood resources are scarce, but also the main cooking fuel for the very poor population. A list of suitable and interested households has already been established. Implementation of the project depends on the successful validation and registration of the project as a CDM project since the project is financed to a high extent from the carbon revenues.

The project contributes to sustainable development of the region and the country by:

a) Saving GHG (Greenhouse Gas) emissions by avoiding the uncontrolled burning of unsustainable (non-renewable) fuelwood while switching to biogas;

b) saving emissions from kerosene, which is avoided when switching to biogas;

c) increase women and children's overall health situation by reducing smoke in kitchen (more women in India die from respiratory diseases caused by fumes in kitchens than from malaria);

d) protecting the local environment by reducing the uncontrolled deforestation in the project area;

e) helping women by saving cooking time.

A.3 Project participants (details in Annex 1):

Project Owner/Developer (Official contact for the CDM project activity):

Women for Sustainable Development (WSD)
32/2 Kempapura Road
Hebbal
Bangalore 560024
India

Other Participant:

Factor Consulting + Management AG
Binzstrasse 18

CH-8045 Zurich
Switzerland

A.4 Technical description of the project activity:

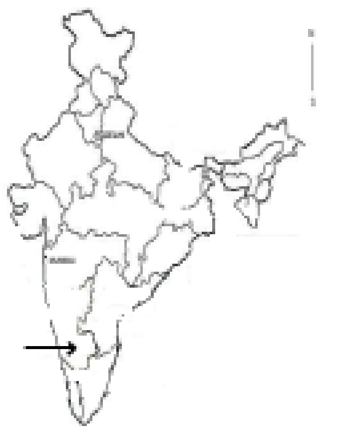
A.4.1 Location of the project activity:

A.4.1.1 Host country Party(ies): India

A.4.1.2 Region/State/Province etc.: Karnataka

A.4.1.3 City/Town/Community etc: Kolar District. The list of villages is included in Appendix 1

A.4.1.4 Detailed description of the physical location, including information allowing the unique identification of this project activity:



Office location: Suma Khadi Gramodyoga Sangha (SKGS)
105 16th B Main
Koramangala 4th Block
Bangalore 560034
India

The bearings of the office at Kolar are:
Latitude: 13 deg – 12 N
Longitude: 78 deg – 15 E

The list of villages, families with their addresses, is given in Appendix 1.

A.4.2 Type and category(ies) and technology of project activity

<u>Type and Category of the project activity:</u>

The relevant project type and category is: Type I. RENEWABLE ENERGY PROJECTS, Category I.C. - Thermal energy for the user (according to: Appendix B of the simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories)[1]

The project activity is a bundle of small biogas plants of a total of less than 15 MW total generating capacity, supplying thermal energy directly to users.

Technology:

The technology used in this project activity is already available in India – thus no environmentally safe and sound technology and know-how will be transferred to the host party (country).

The biogas plant (Deenbandhu Model) consists of a digester with a fixed, non-movable gas space. Families load the raw cow dung through the inlet into the fixed dome made of bricks and cement, located outside the kitchen. Gas is produced through anaerobic digestion of the dung and stored in the upper part of the digester before being piped to the biogas stove in the kitchen. The gas pressure displaces the digested slurry into the compensating tank, ready to be used as excellent manure.

Advantages:

- low construction cost, locally available material and technology;
- no moving parts, no rusting steel parts, hence long life (20 years or more);
- safe and secure underground construction;
- low indoor emissions (pollution) from biogas combustion, families benefit immensely from smoke-free kitchens, quick, easy and clean operation, and relief of drudgery;
- construction creates locally employment.

Disadvantages:

- needs to be emptied every 5 years (build- up of mud, sand and pebbles);
- needs to be fed and maintained regularly to provide constant gas flow.

The size of the biogas digester depends on the family (household) size and the number of cows per household. For this project activity we evaluated average systems which best fit the conditions and needs in Kolar District. Table 1: provides the underlying data and assumptions

Table 1:

Biogas plant size	Benefiting households	Average persons per household	Average cows per household	Average cooking hours
2 m^3	5500	5	4	3

[1] Note: In this PDD all reference to the Simplified Small-scale Methodology I.C. refer to the version 05, 25 February 2005.

A.4.3 Brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity:

This project will achieve the reduction of anthropogenic greenhouse gas emissions by replacing inefficient wood/stoves technologies, which create local pollution and lead to greenhouse gas emissions from non-renewable firewood, with renewable biogas systems. Biogas based thermal energy generation using cow dung is a clean energy technology as the biomass for the cow fodder is coming from renewable sources of biomass in the form of agro-residue. Thus biogas is a zero-emission fuel as the CO_2 emitted during combustion of the biogas is again absorbed by the plants that are the fodder for the animal producing the dung.

Details of the underlying assumptions and calculation of the baseline and the emission reductions are provided in section B and E of this PDD.

A.4.4 Public funding of the project activity:

No public funding involved

A.4.5 Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

The small-scale project activity is not a debundled component of a large project activity since there is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category or technology; and
- Registered within the previous two years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

B. Baseline methodology

B.1 Title and reference of the project category applicable to the project activity:

Small-scale CDM Project, Type I – RENEWABLE ENERGY PROJECTS, I.C. Thermal energy for the user (according to: Annex B of simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories)

B.2 Project category applicable to the project activity:

A) This methodology is applicable as per definition in the Annex B of the simplified methodologies for selected small-scale CDM project activity categories, Type I.C Thermal energy for the user:

Para 1.: This category comprises renewable energy technologies that supply individual households or users with thermal energy that displaces fossil fuel or non-renewable sources of biomass. Examples include solar thermal water heaters and dryers, solar cookers, energy derived from biomass for water heating, space heating, or drying, and other technologies that provide thermal energy that displaces *fossil fuel. Biomass-based co-generating systems that produce heat and electricity for use on-site are included in this category.*

B) Qualification under small-scale CDM according to:

Para 2.: Where generation capacity is specified by the manufacturer, it shall be less than 15 MW.

Since no detailed information on the capacity of the biogas plants is available, we suggest a rough estimation based on the methane production potential of cow-dung according to IPCC guidelines (see Annex 4). We assume that the lower methane IPCC production value from dung reflects best the situation in Kolar district, since the cows owned by the families are typically small and non-dairy cows, feeding from crop-residues. The calculations are given in Table 2. The total capacity the biogas systems is calculated as the sum of the estimated capacity of all plants build by the project activity, and is approx.: 10 MW and thus below the limit for small-scale CDM project.

Table 2: Summarised capacity of all 2 m^3 biogas plants in the project activity (reference values see Annex 4)

CH4 energy from cow dung (IPCC conservative value)	MJ / cow / year	1’787.48
Energy derived from 4 cows	kWh / year	1986.09
Family cooking hours per day	h	3
Capacity of one system	kW	1.81
Capacity of all 5500 plants	**MW**	**~10**

C) The baseline is applied in accordance with Paragraph 5 and 6 of the definitions

For non-renewable wood:

Type 1.C., Para 6.: For renewable energy technologies that displace non-renewable sources of biomass, the simplified baseline is the non-renewable sources of biomass consumption of the technologies times an emission coefficient for the non-renewable sources of biomass displaced. IPCC default values for emission coefficients may be used.

and for kerosene:

Type 1.C., Para 5.: 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 coefficient for the fossil fuel displaced. IPCC default values for emission coefficients may be used.

Details on the applicability of this baseline are given in section B.3 and B.5.

B.3 Description of how the anthropogenic GHG emissions by sources are reduced below those that would have occurred in the absence of the proposed CDM project activity *(i.e. explanation of how and why this project is additional and therefore not identical with the baseline scenario)*

Reduction of GHG Emission by Sources

The anthropogenic GHG emissions by sources are reduced below what would have occurred in the absence of the proposed CDM project because nearly all other forms (than biogas from anaerobic digesters) of cooking fuel in India today produce Greenhouse Gases. Reasons:

a) they are based on fossil fuels, or

b) they are based on low efficiency biomass burning stove technologies using unsustainable sources of fuelwood.

In Kolar District, all the cooking fuel is non-renewable wood and some kerosene. The wood used for cooking come from unsustainable sources. (see details in section B.5).

The commonly used stove technology in Kolar District (traditional or improved mud stoves) contributes to climate change in two ways: on one hand they are fired with unsustainable sources of wood, on the other hand the burning process of these highly inefficient and primitive stoves causes relatively high rates of emissions of products of incomplete combustion (CH_4, N_2O, CO, NMHC), which partly have a higher Global Warming Potential (GWP) than CO_2 [1]. By promoting the use of biogas plants (and therefore switching to a highly efficient, clean and renewable source) the Greenhouse Gas emissions can be significantly reduced.

Greenhouse Gas emissions from existing cooking practices in India is a very complex subject, and has been studied extensively [1,2]. The underlying assumptions and values used for the calculations of the emissions reductions in this project are discussed in detail in the baseline section.

Biogas offers potentially attractive opportunities for true win-win interventions that achieve important global benefits in the form of GHG reductions, while providing even greater benefits for the local population by saving the local environment and increasing the health situation.

Barriers and Additionality

More than 2 million digesters of different sizes have been constructed in India during the National Project on Biogas Development (started in 1981), most of them in rural parts of the country. Despite the fact that this technology is widely spread in India, the proposed project has to overcome various barriers like prevailing practice or other more economically attractive options. Barriers make it unlikely that biogas plants in Kolar are build today in the absence of the CDM and would automatically lead to an implementation of a technology with higher emissions:

The prevailing practice by the public sector in India today is to make kerosene as cooking fuel available to families below the poverty line through the public distribution system at the market price or just slightly below it. The public distribution system for subsidised fossil fuel in the cooking fuel sector (including LPG) is working very well, and expanding rapidly. However, in many cases the kerosene is still too expensive for families and only three (3) litres per month are available through the public distribution system – too less for an average household. On the other hand the described government programme for providing biogas plants for the poor has been reduced at the State level in all states, and thus the capital shortfall prevents the continued expansion of the biogas programme in India. Sadly, the least cost approach has come to dominate National and State level cooking fuel policy. The plan for Kolar District for this year is to build only 500 biogas plants through central government subsidies.

The capital cost of a 2 m^3 biogas plant is about **6** times the cost of LPG. The commonly and widely used wood fired stoves or ovens ("traditional mud stoves" or "improved vented mud stoves") cost around 5 Euros, a basic "3-rock stove" almost zero. In cities and in rural municipalities with some level of income, LPG is the preferred cooking fuel of all the classes, upper, middle and lower middle class and working class. To some extent this technology is also slowly penetrating the villages. The capital cost for LPG is ten time lower than for biogas for a normal household. But this is beyond the reach of this project's target population in the region of Karnataka. Taking all this information into account, it is very unlikely that any of the poorer inhabitants in the project area will be able to afford a biogas plant. Even though, compared to the other options, it is in the long-term a cheaper, cleaner and locally and globally more beneficial technology.

The reason why some biogas plants are built at all is because idealistic investors and to a limited extent the central government are willing to make efforts to:

a) support rural technologies;

b) support distributed and decentralised thermal heat generation in order to reduce women's health problems and provide affordable cooking fuel, and

c) to support the rural biomass economy.

The hope is that the CDM will enable to overcome the described barriers and reactivate and enforce the programmes to promote the biogas plants in India.

The described project activity is clearly additional because it is financed almost completely through the revenues from the CER sales, and cannot be realised without the revenues from the carbon credits.

B.4 Description of the project boundary for the project activity:

As per Paragraph 4 of the small-scale baseline methodology I.C. Thermal energy for the user:

Type 1.C., Para 4.: The physical, geographical site of the renewable energy technologies generating thermal energy delineates the project boundary.

The physical, geographical site of the renewable energy technologies generating the thermal energy and the equipment that uses the thermal energy produced delineates the project boundary. The project boundary encompasses the physical geographical site of all individual biogas plants (digester system, pipe leading to the stove and the stove itself) realised by the project activity. 5500 such plants will be distributed in this project during the next 2 or 3 years across Kolar District.

B.5 Details of the baseline and its development:

B.5.1 Specify the baseline for the proposed project activity using a methodology specified in the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities:

The following methodology will be applied:

For non-renewable wood:

Type 1.C., Para 6.: For renewable energy technologies that displace non-renewable sources of biomass, the simplified baseline is <u>the non-renewable sources of biomass consumption of the technologies times an emission coefficient for the non-renewable sources of biomass displaced</u>. IPCC default values for emission coefficients may be used

and for kerosene:

Type 1.C., Para 5.: 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 coefficient for the fossil fuel displaced. IPCC default values for emission coefficients may be used.*

Non-renewable source of biomass (wood) and fuelwood consumption

Recent surveys showed that of total domestic fuel needs in India, 60% in rural areas and 40% in urban areas are met from wood fuel. In rural areas of Kolar district traditional fuel such as wood, agriculture and animal residues, still meets 85-95% of the demand [3]. A study from Ramachandra et al. [3] stated that the biomass (wood) produced in the semi-arid region of Kolar district does not supply the fuelwood demand by the population and is therefore, as per definition, coming from a non-renewable source of biomass. Detailed information is available from the papers [3,5]. It is expected that with this biogas project the deforestation in the scarce forest areas of the project region of Kolar district / will drop substantially.

Different surveys and studies showed an estimated average consumption of fuelwood for a medium size family between 1300 kg / year [3] and 1700 kg / year [2] in this region. Based on the local experience and of WSD and SKGS in Kolar a separate survey with focus on Kolar District and the specific project region has been carried out [11]. The following consumption values for wood and kerosene present best the situation in the project region and are taken for further calculations.

Single Household, 5 persons: <u>2.88 t fuelwood per year.</u>

Kerosene consumption

Families receive 3 litres of kerosene per month through the public distribution system, and all of it goes for cooking and water heating. It is all being replaced with biogas energy. But nevertheless, the kerosene consumption in the project region per person resp. household was carried out in the same survey as described above [11]. The following average value has been calculated:

Single Household, 5 persons: <u>46 kg kerosene per year.</u>

Details on the emission coefficient for non-renewable sources of biomass

Smith et al. have published different studies during the last years, dealing with the GHG emission of different stove/fuel combinations commonly used in households in rural regions of India. Interesting in the context of this project are the findings for the combinations of basic mud stoves and wood fuel, since this project activity takes place in a rural and poor region of India and uses unsustainable source of biomass (wood) as its baseline.

Detailed information about the methods and results of these studies are available in the respective papers and will not be discussed here in detail (see references [1,2]).

However, Smith et al. suggests in his publication [1] not to be restricted to the standard gases in the estimation of GHG emissions from household stoves. The standard calculations do not reflect the real situation, due to the additional contribution to global warming from products of incomplete combustion (PIC: CO, CH4, NMHC, N2O), which occurs at high rate in the inefficient stoves. Basically they propose two adjustments:

1. Include CO and NMHC in the estimation of the GHG emissions. Many of the tested stove/wood combinations produced a high amount of these PICs, mainly CO. The fact that CO can oxidise relatively fast to CO2 under certain conditions should be considered accordingly.

2. Instead of standard GWP for each gas slightly different GWP shall be used. Including relatively high GWPs for CO and NMHC.

Smith et al. calculated an average emission coefficient for traditional mud stoves fired with wood is of 866 g CO2e per MJ delivered Energy (to pot), which is relatively high compared to the value calculated according to IPCC [2] rules (~560 g CO2e per MJ delivered Energy). Table 3 provides some of the measured emission data from Smith et al. [1,2] on a pollutant mass by fuel mass basis (g pollutant / kg wood) and on a pollutant by delivered energy to pot basis (g pollutant / MJ del) for typical stove/wood combinations.

Table 3: Measured GHG emissions from typical wood/stove combinations in India. Eucal = wood from eucalyptus three, Acacia = wood from acacia three, 3R = 3-rock-stove, IVM = improved vented mud stove, TM = traditional mud stove (for a detailed description see paper Smith et al.[1,2])

Wood/stove combinations	CO2	CO	CH4	NMHC	N2O
	g pollutant / kg wood				
Eucal 3R	1’536.00	60.15	2.83	7.98	0.07
Eucal IVM	1’338.00	139.10	11.45	25.13	0.16
Acacia 3R	1’374.00	64.70	9.40	9.65	0.18
Acacia IVM	1’391.00	66.47	3.94	7.76	0.09
Acacia TM	1’260.00	125.80	10.79	11.94	0.19
	g pollutant / MJ del to pot				
Eucal 3R	566.10	22.17	1.04	2.94	0.03
Eucal IVM	396.70	41.26	3.40	7.45	0.05
Acacia 3R	502.80	23.67	3.44	3.53	0.07
Acacia IVM	506.30	24.19	1.43	2.82	0.03
Acacia TM	355.00	35.45	3.04	3.37	0.05

Despite this attractive approach (from the view of the resulting high emission reductions) we decide to use more conservative data and assumptions [2] in our baseline calculations, and focus only on the official IPCC emission coefficients of the three main GHGs: CO2, CH4 and N2O, and on the commonly used GWP of 21 for CH4 and 310 for N2O. Table 4 compares to official IPCC values [4] and the calculated average emission coefficient from the Smith et al. data in Table 3.

Table 4: Official IPCC GHG emissions coefficient for wood [2] and calculated average emissions coefficients for India specific wood/stove combinations (average from Table 3)

	g pollutant / kg wood		
	CO2	CH4	N2O
IPCC official	1661.00	5.00	0.06
in CO2e	*1661.00*	*105.00*	*18.60*
in % CO2	*100%*	*6.3%*	*1.1%*

[2] A list of the used official values and parameters as well as some basic calculations are available in Annex 4

Average from Table 3	1379.80	7.68	0.14

As we see in Table 4 the IPCC value for CO2 emission from wood combustion is higher than the average value from Smith et al. because of the higher CO emission in the Smith et al. studies. Our approach is now, to use only the CO2 emission as the baseline emissions. CH4 and N2O times the respective GWP makes 7.4% of the CO2 emissions, but is not considered in the baseline to compensate possible leakage of the project activity (details see leakage section).

B.5.2 Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:

05/05/2005

B.5.3 Name of person/entity determining the baseline:

Anandi Susan Sharan-Meili
Chief Functionary

WSD
32/2 Kempapura Road
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Bangalore 560024
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(m) 9448034562
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The person/entity is also a project participant and is the designated official contact for this project activity.

B.6 Leakage

Appendix B of the Simplified Methodologies for Small-scale CDM Project Activities states in Section A Paragraph 8: In the case of the project activities using biomass, leakage shall be considered.

Leakage may occur from different sources:

Direct emissions related to the biogas system (project emissions)

- Day to day handling: It is possible that a amount of CH4 will be emitted due to the day to day handling like cooking, loading of cow dung through the inlet or taking out the manure from the compensating tank. But it is assumed that this amount is relatively small compared to the used/ combusted amount of CH4.

- Emission from the defective digesters: CH4 emissions may occur in case a system is damaged and the digester has cracks. With the stringent monitoring plan such faults will be recognised and avoided in a early stage and therefore leading to only minor emissions compared to over-all reductions from the project activity.

- Digester clean up: As described in the technical section, some CH4 will be emitted all 5 years when the digester has to be emptied and cleaned from mud, sand and pebbles.

Indirect emissions related to the biogas system (leakage)

- A certain part of CH_4 an N_2O is avoided by removing the cow dung from the ground and putting it into the closed digester, instead of burning or composting it (manure management)

- The manure coming from the digester replaces chemical fertiliser used by some families. Thus some GHG emissions from the energy consumption for the fertiliser production may be avoided.

It is difficult to estimate the exact amount of leakage and closer related emissions resulting from this project activity, and it would be to expensive to perform detailed studies in this context. We assume that summed up there is a certain amount of leakage. To address this issue we accounted in the baseline only for the CO_2 emissions. The CH_4 and N_2O reductions not considered in the baseline (7.4% of the CO_2 emissions) shall be used to compensate the leakage and grant a conservative overall approach.

Enteric fermentation

Since no additional cows are provided by the project activity to the households, CH_4 emissions from enteric fermentation can be neglected. According to the IPCC dataset for the Indian subcontinent the CH_4 emission from non-dairy cattle is around 650 kg CO_2e / cow / year, which would offset nearly 15% of the total emission reductions from a 2 m^3 biogas system if a cow is supplied with the plant.

C. Duration of the project activity and crediting period

C.1 Duration of the project activity:

C.1.1 Starting date of the project activity (DD.MM.YYYY):

01.08.2005

C.1.2 Expected operational lifetime of the project activity: *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)*

20y-0m

C.2 Choice of the crediting period and related information: (Please underline the selected option (C.2.1 or C.2.2) and provide the necessary information for that option.)

C.2.1 Renewable crediting period (at most seven (7) years per crediting period)

C.2.1.1 Starting date of the first crediting period (DD/MM/YYYY):

01.08.2005

C.2.1.2 Length of the first crediting period *(e.g. 2y-4m.)*:

7y-0m

C.2.2 Fixed crediting period *(at most ten (10) years)*:

C.2.2.1 Starting date *(DD/MM/YYYY)*:

C.2.2.2 Length (max 10 years): *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)*

D. Monitoring methodology and plan

D.1 Name and reference of approved methodology applied to the project activity:

The monitoring methodology from the corresponding baseline methodology Type I.C. Thermal energy for the user is used:

9. Monitoring shall consist of:

………………

(c) If the emissions reduction per system is less than 5 tonnes of CO2 a year:

(i) Recording annually the number of systems operating (evidence of continuing operation, such as on-going rental/lease payments could be a substitute); and

(ii) Estimating the annual hours of operation of an average system, if necessary using survey methods. Annual hours of operation can be estimated from total output (e.g. tonnes of grain dried) and output per hour if an accurate value of output per hour is available.

D.2 Justification of the choice of the methodology and why it is applicable to the project activity:

Methodology (c) is the preferred option for the monitoring. The emissions reduction per system (biogas plant) is less than 5 tonnes of CO_2 a year, and the annual recording of the numbers of systems operating is a cost effective and technologically simple to realise for this project activity.

Monitoring plan and procedures

The monitoring of this project will be part of the operation and maintenance activities of SKGS, who are the project implementing agency and manufacturers of the biogas plants. The organisation has nearly 300 masons and supervisors who will be responsible for monitoring. Families are also part of the local management of this project.

SKGS maintains a list with all families being part of this project activity. In this database every household or family with a biogas plant has a unique identifier and necessary personnel information.

The number of installed and operating systems is monitored twice a year. The differentiation between installed and operating systems is made to control the over-all performance of the project activity. SKGS will have trained the family members of the households to report according to the monitoring format when the biogas plant is built and handed over. SKGS will ensure that this monitoring process is reliable and transparent.

Thus as mentioned, the initial monitoring of the plant performance or occasional problems will be done naturally and systematically by the family reporting to SKGS. This collaboration between customer and supplier is simple and cost effective. The reports on the problems of the biogas plants will be passed on to the team of masons from SKGS. The service contract obliges SKGS to respond to complaints with 24 hours and rectify any problems within 1 week. SKGS are the most experienced biogas plant manufacturers in India and this operation and maintenance procedure adopted by families after installation, as well as the service contract with SKGS ensures that all systems will be operational.

All information is recorded on paper and electronically. Once a year all reported information will be compiled for the detailed annual monitoring report, which will be sent to the DOE verification team.

Note: The estimated daily operating time of the system (cooking time) is not required for the calculation of the emission reduction. But it will be reported on an estimated basis by the family for possible later calculations of efficiencies.

D.3 Data to be monitored:

ID	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1	*Number of installed 2 m^3 systems*	*IS*	*Units*	*m*	*Every six (6) months*	*All*	*e & p*	*Crediting period plus 2 years*	*Not used for calculations of the emission reductions*
2	*Number of operating 2 m^3 systems*	*OS*	*Units*	*m*	*Every six (6) months*	*All*	*e & p*	*Crediting period plus 2 years*	
3	*2 m^3 system average daily operating time*	*T*	*Hours*	*e*	*Every six (6) months*	*All*	*e & p*	*Crediting period plus 2 years*	*Not used for calculations of the emission reductions*

D.4 Name of person/entity determining the monitoring methodology:

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The person/entity is also a project participant and is the designated official contact for this project activity.

E. Calculation of GHG emission reductions by sources

E.1 Formulae used:

E.1.1 Selected formulae as provided in appendix B:

Since the project emissions come from a renewable source, the emission reductions are equal to the baseline emissions, which are calculated as:

Type 1.C.; Para 6.: For renewable energy technologies that displace non-renewable sources of biomass, the simplified baseline is <u>the non-renewable sources of biomass consumption of the technologies</u> times an <u>emission coefficient for the non-renewable sources of biomass displaced</u>. IPCC default values for emission coefficients may be used

And also:

Type 1.C.; Para 5.: For renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the <u>fuel consumption of the technologies</u> that would have been used in the absence of the project activity times an emission coefficient for the fossil fuel displaced. IPCC default values for emission coefficients may be used.

The following formula and values are used to obtain to total yearly emission reduction of the project activity:

$$CER_y = OS_y \ x \ EM_y$$

where:

CER_y : yearly Certified Emission Reductions

OS_y : 2 m^3 systems operating in year y. Calculated as the average value of the semi-yearly monitored operating system in one year

EM_y = 4.93 t CO2e = Baseline emissions from a household with a 2 m^3 biogas system. Calculated as the average yearly wood consumption of a household times the emission coefficient for (non-renewable) wood, plus the average yearly kerosene consumption of a household times the emission coefficient for kerosene. Details see Annex 4.

E.1.2 Description of formulae when not provided in appendix B:

→ not applicable

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the project activity emissions:

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHG's in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities: *(for each gas, source, formulea/algorithm, emissions in units of CO_2 equivalent)*

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

E.2 Table providing values obtained when applying formulae above:

Emission reductions per household with installed 2 m^3 system: 4.93 t CO2e

Table 5: Estimated total project emission reductions for each year of the crediting period.

Year	Installed 2 m^3 systems	CERs
2006	5500	27’115
2007	5500	27’115
2008	5500	27’115
2009	5500	27’115
2010	5500	27’115
2011	5500	27’115
2012	5500	27’115
Total	**5500**	**189’805**

F. Environmental impacts

F.1 If required by the host Party, documentation on the analysis of the environmental impacts of the project activity: ***(if applicable, please provide a short summary and attach documentation)***

→ Not applicable

G. Stakeholders comments

G.1 Brief description of the process by which comments by local stakeholders have been invited and compiled:

A survey of 1000 families was conducted including fuelwood and kerosene consumption survey of 50 households on a random basis to ascertain the interest level in Kolar District. The final list of members who will be building biogas plants in the project activity will be provided in Appendix 1 to this PDD prior to registration of this project as a CDM project activity.

The project participants are active members of the local community with in depth knowledge of the cooking problems faced in drought prone villages. The stakeholders were consulted in the following way: Families: All 5500 families in Kolar in this programme area experience at first hand the conditions in their own homes. Numerous women and children have been to hospital with respiratory illnesses such as coughs, bronchial illness and other illnesses and weaknesses due to smoke exposure. Hundreds of papers have been published on this problem in India and all over the world. The Ministry of Non-Conventional Energy representatives attended the DNA meeting during the host country approval process and praised the project participants for their initiative. The Karnataka State Government representatives welcome the project and attended various meetings at which the project proponents presented the project activity idea and the concept. The Kolar District administration welcomes the project and provided letters of support at the time when the Central Government Letter of Approval was being sought. The Taluk level government machinery has extended all support. The Gram Panchayat Secretaries and elected members in the participating villages have extended all support. Thus all levels of the government are actively welcoming this project and extending as much support as they can.

G.2 Summary of the comments received:

The pre-project phase has showed that there is a high interest of the families and that the project is realised as fast as possible. The project participants have been flooded with requests to supply plants. Various NGOs have asked for the project to be run in their areas of operation. Thousands of families have asked for plants to be built in their homes. There is a high level of knowledge of the benefits of these systems, and there is absolutely no hesitation by any of the families participating in the scheme. As the rains are expected to be good this year many families are again expecting their cows to be healthy and give plenty of dung.

G.3 Report on how due account was taken of any comments received:

This project activity itself was launched in response to popular demand for clean and efficient cooking facilities. The project participants have been waiting for the methodologies for Small Scale CDM projects to become available and for the Kyoto Protocol, to come into force for many years. There is an urgent need to approve this project so that it can be replicated in many more taluks and Districts.

Annex 1

CONTACT INFORMATION FOR PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	WSD
Street/P.O.Box	32/2 Kempapura Road
Building:	Hebbal
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URL:	www.climateindia.com
Represented by:	
Title:	Chief Functionary
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This is a unilateral CDM project and no Annex 1 country with CER requirements has as yet been identified. The declaration regarding public funding will be made once the official Annex 1 country buyers are identified.

Annex 3

REFERENCES

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11. Estimation of fuelwood consumption in Kolar region, Anandi Sharan-Meili, Women for Sustainable Development, Bangalore, 2005

Annex 4

	Description	Unit	Value	in % of CO2 from wood combustion	Source
Factors and reference values					
	Family wood consumption per year (1)	**kg / year**	**2'880.00**		**WSD [11]**
	Calorific value wood	MJ / kg wood	15.10		IPCC 1.45
	CO2 wood IPCC Standard	g / MJ wood	110.00		IPCC 1.45
	CO2 wood IPCC Standard	**g / kg wood**	**1'661.00**		
	CO2 wood India Dataset (average)	g / kg wood	1'479.00		Smith [1,2]
	CH4 wood IPCC Standard	**g / kg wood**	**5.00**		**IPCC / Smith**
	CH4 wood India Dataset MIN	g / kg wood	2.80		Smith [1,2]
	CH4 wood India Dataset MAX	g / kg wood	11.50		Smith [1,2]
	N2O wood IPCC Standard	**g / kg wood**	**0.06**		**IPCC / Smith**
	N2O wood India Dataset MIN	g / kg wood	0.07		Smith [1,2]
	N2O wood India Dataset MAX	g / kg wood	0.20		Smith [1,2]
	CH4 GWP (IPCC)		21.00		IPCC
	N2O GWP (IPCC)		310.00		IPCC
CO2 wood combustion					
	Family wood consumption per year	kg / year	2'880.00		
	Energy production	MJ / year	43'488.00		
	Wood/stove combustion efficiency	optimistic average value	0.20		Smith [1]
	Usable energy	MJ / year	8'697.60		
	CO2 emission per year	**t CO2 / year**	**4.78**	**100.0%**	
CH4 wood combustion					
	Family wood consumption per year (1)	kg / year	2'880.00		
	CH4 emission per year	**kg CO2e / year**	**302.40**	**6.3%**	
N2O wood combustion					
	Family wood consumption per year (1)	kg / year	2'880.00		
	N2O emission per year	**kg CO2e / year**	**53.57**	**1.1%**	
CO2 kerosene combustion					
	Family kerosene consumption per year (1)	kg / year	46.00		WSD [11]
	Net calorific value of kerosene	MJ / kg	44.75		IPCC 1.23
	Carbon emission factor of kerosene	t C / TJ	19.60		IPCC 1.13
	CO2 emission from kerosene per year	**t CO2 / year**	**148.07**	**3.1%**	
CO2 total emissions					
	from wood + kerosene consumption	**t CO2 / year / family**	**4.93**		
CH4 enteric fermentation					
	Non-dairy cattle (2)	kg CH4 / cow / year	31.00		IPCC 4.33
		kg CO2e / cow / year	651.00	13.6%	
CH4 manure management					
	Average systems / Non-dairy cattle	kg CH4 / cow / year	2.00		IPCC 4.44
		kg CO2e / cow /year	42.00	0.9%	
CH4 potential cow dung (2) & (3)					
	Calorific value CH4	MJ / kg	35.00		
	Density CH4	kg / m3	0.88		
	VS Excretion dry mass / dairy cattle	kg (dry mass) / cow / day	2.64		IPCC 4.41
	VS Excretion dry mass / non-dairy cattle	kg (dry mass) / cow / day	1.59		IPCC 4.41
	CH4 production capacity / VS dairy	m3 / kg	0.13		IPCC 4.41
	CH4 production capacity / VS non-dairy	m3 / kg	0.10		IPCC 4.41
	MIN CH4 production	m3 CH4 / cow / year	58.04		
	MAX CH4 production	m3 CH4 / cow / year	125.27		
	MIN CH4 production	kg CH4 / cow / year	51.07		
	MAX CH4 production	kg CH4 / cow / year	110.24		
	MIN CO2e production	kg CO2e / cow / year	1'072.49	22.4%	
	MAX CO2e production	kg CO2e / cow / year	2'314.95	48.4%	
	MIN CH4 energy	MJ / year	1'787.48		
	MAX CH4 energy	MJ / year	3'858.25		
IPCC:	IPCC, Reference Manual, Vol. 3; 1996 (Section)				
(1):	Family = 5 persons				
(2):	Dataset for Indian Subcontinent				
(3):	VS = Volatile solids = degradable organic material				