Project design document form
(Version 11.0)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title of the project activity	Bagepalli CDM Biogas Programme
Scale of the project activity	☐ Large-scale ☒ Small-scale
Version number of the PDD	8
Completion date of the PDD	11/07/2020
Project participants	Private Entity - Agricultural Development and Training Society (ADATS) – Host Country Private Entity - FairClimateFund B.V - The Netherlands Private Entity - Evangelisches Werk für Diakonie und Entwicklung e.V – Germany Private Entity – Velcan Energy – France Private Entity – Velcan Energy – Switzerland Private Entity - Atmosfair gGmbH - Germany
Host Party	India
Applied methodologies and standardized baselines	AMS.I.E. Switch from non-renewable biomass for thermal applications by the user, Version 10.1
Sectoral scopes	1 - Energy industries (Renewable/Non-Renewable Sources)
Estimated amount of annual average GHG emission reductions	13,519 tCO_2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The project “Bagepalli CDM Biogas Programme” is a registered CDM project activity. The details of the registered project are as follows:

UNFCCC Project Number:	0121
Registration date:	10th December 2005
Crediting Type:	Renewable
First Crediting Period:	01 Sep 06 - 31 Aug 13 (Changed from: 18 Dec 05 - 17 Dec 12)
Second Crediting Period	01 Sep 2013 – 31 Aug 2020

Through the submission of this PDD, the project proponent intends to renew the crediting period in line with the Standard CDM project standard for project activities, Version 2, CDM-EB93-A04-STAN and the PDD has been accordingly updated.

The project activity is installation of 5,500 biogas plants (digesters) of 2 m^3 capacity each for single households. Each household utilises 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 was to replace the commonly used inefficient wood fired mud stoves technology, with clean, sustainable and efficient biogas. In the baseline, GHG emissions were due to use of non-renewable biomass on traditional cook stoves. By displacing the non-renewable biomass with biogas which is a renewable energy technology, there is reduction of GHG emissions.

Families walk 2-5 km to collect this firewood as Chickballapur district, erstwhile part of Kolar District, like many other regions of India, is a fuel wood deficit region [Ref 3a]. 90% of biomass in Karnataka State, in which the project region is situated is non-renewable, which means that 90% of the fuel wood cannot be considered a renewable source of energy, and by burning this fire wood, the users are causing the emission of greenhouse gases. Fuel wood is replaced with renewable biogas and the users are avoiding greenhouse gas emissions in the baseline case.

The project is in Chickballapur district, erstwhile part of Kolar District. In this semi-arid region wood resources are very scarce, but yet they are the main cooking fuel for the very poor population. As these fuel wood users are very poor, there is no incentive on anyone’s part to grow biomass for cooking for them. Thus there is acute fuel wood scarcity combined with lack of cooking energy in any form, as they are too poor to pay for it.

A list of suitable and interested households who wished to switch from firewood to biogas was established. Implementation of the project was on the successful validation and registration of the project as a CDM project since the project was financed exclusively from carbon revenues from VELCAN ENERGY, France.

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 fuelwood (non-renewable biomass) while switching to biogas;
b) Bettering 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);
c) Protecting the local environment by reducing uncontrolled deforestation in the project area; helping women by saving cooking time.

The project boundary comprises the 5,500 biogas units in 5,500 households in 5 taluks i.e. Bagepalli, Chickballapur, Chintamani, Sidlaghatta and Gudibanda in Chickballapur District, Karntaka State, India.

The estimated annual average GHG emission reductions for the third crediting period is 13,519 tCO_2 and the total GHG emission reductions are 96,859 tCO_2.

A.2. Location of project activity

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Host Country: India
State: Karnataka
District: Chickballapur
Taluks: 5 Taluks of Chickballapur District namely Bagepalli, Chickballapur, Chintamani, Gudibanda and Sidlaghatta

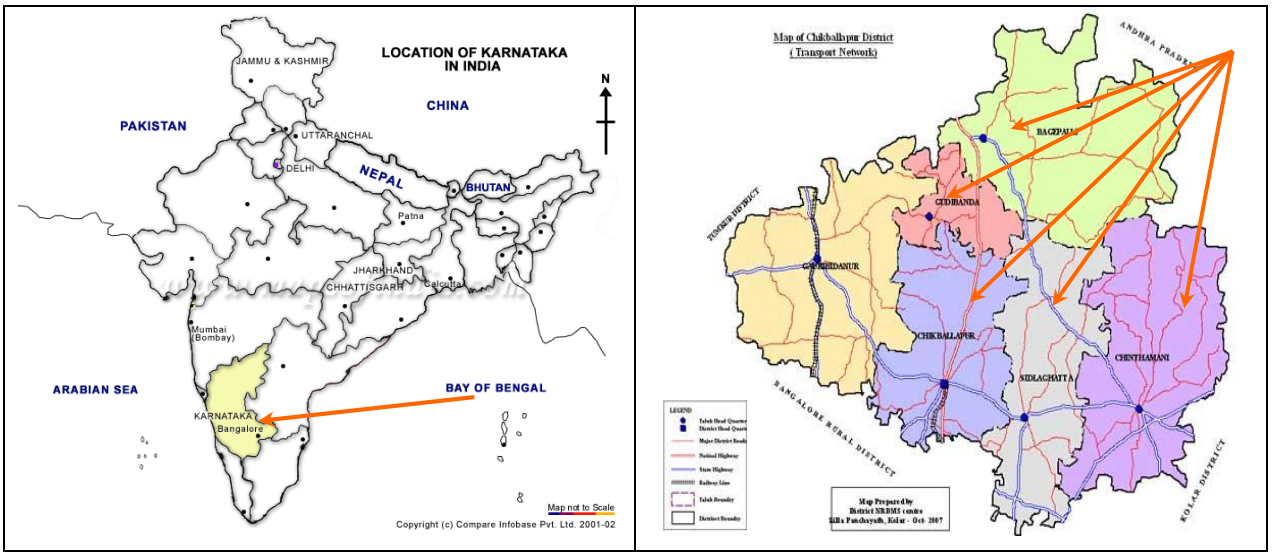

Fig 1: Map showing Karnataka State and the 5 taluks in Chickballapur district where the project is implemented.

The geographical coordinates of the taluks are as follows.

Taluks	Coordinates
Bagepalli	13° 47' 5" North, 77° 47' 35" East
Chikkaballapur	13° 26' 3" North, 77° 43' 27" East
Chintamani	13° 24' 0" North, 78° 4' 0" East
Gudibanda	13° 40' 10" North, 77° 41' 54" East
Sidlaghatta	13° 23' 17" North, 77° 51' 46" East

A.3. Technologies/measures

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The technologies/measures implemented by the project activity is household level biogas units for thermal energy. It is a small thermal appliance that displaces the use of non-renewable biomass by introducing a system for utilising cattle dung and converting it into renewable energy by means of a digester in which the substrate undergoes acidification and methanation.

The facilities, systems and equipment that were installed by the project activity are as follows;

The biogas plant of Deenbandhu model (Fig 2) consists of a digester with a fixed, non-movable gas space. Users prepare batches of dung slurry in the mixing tank, before allowing the final mixture to flow into the digester for methane formation phase. By utilizing dung substrate in an anaerobic digestion and combustion system, biogas is made available. Biogas is generated by fermentation of cellulose rich organic matter under anaerobic conditions. In anaerobic conditions, the methane-producing bacteria become more active. The anaerobic digestion consists of three stages: I Hydrolysis; II Acid formation and III Methane fermentation. The processes are carried out by two sets of bacteria namely acid forming bacteria and methane formers. The acidogenic phase I

is the combined hydrolysis and acid formation stages in which the organic wastes are converted mainly into acetate, and phase II is the methanogenic phase in which methane and carbon dioxide are formed. The recovered gas is combusted and used for cooking and water heating. The chosen methane recovery and combustion system is the time tested Deenabandhu model biogas technology which is well-known in India.

The individual plant consists of a mixing chamber where waste water and cow dung are mixed, an inlet pipe to feed the slurry into the reactor, the main biogas reactor/digester where methane formation/recovery takes place, a slurry outlet pipe, an outlet chamber, and a slurry platform. The outlet pipe and tank are provided to remove the digested/treated sludge or fermentation residue and the slurry platform is provided to maintain the treated slurry in clean condition. A pipe leading from the top of the dome to the stove is provided to supply biogas to a 2-ring stove inside the house. The cross-section of a biogas unit is as shown in Fig 2.

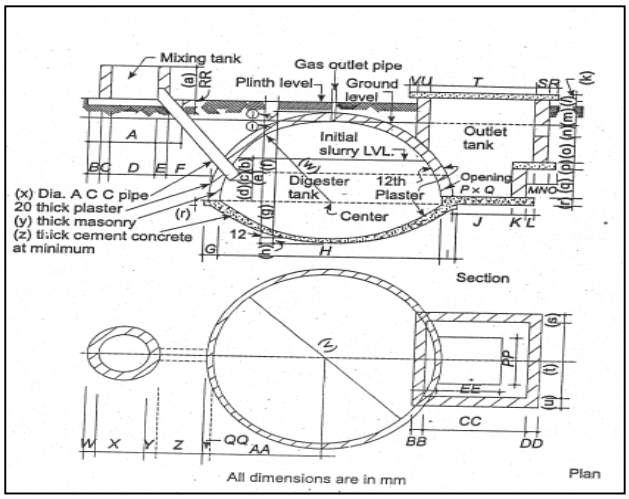
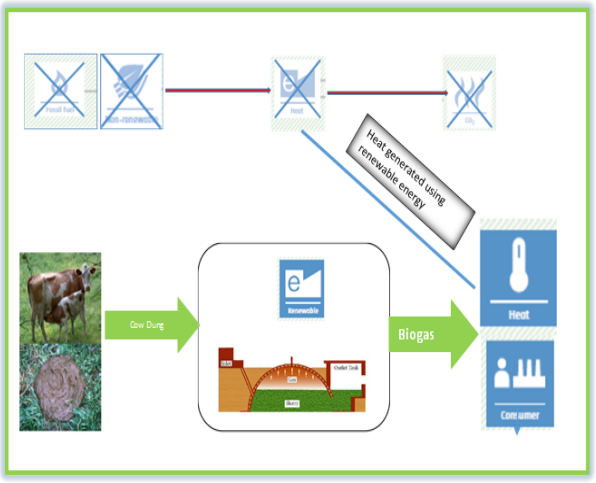


Fig 2: Cross-section of Deenabandhu biogas model



Technical process and equipment of biogas unit

Deenabhandu Model Biodigester

Biogas Stove used for Cooking

The types and levels of services provided by the facilities, systems and equipment and their relation, if any, to other facilities, systems and equipment outside the project boundary;

Table 1:

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

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. We assume that the lower methane IPCC production value from dung reflects best the situation in this district, since the cows owned by the families are typically small, similar to non-dairy cows, feeding on crop-residues. The calculations are given in Table 2. The total capacity of the biogas systems is calculated as the sum of the estimated capacity of all plants built by the project activity, and is approximately 6 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 7)

CH_4 energy from cow dung (IPCC conservative value)	MJ/cow/year	1421.9
Energy derived from 4 cows	kWh / year	1579.8
Family cooking hours per day	H	4.0
Capacity of one system	KW	1.1
Capacity of all 5500 plants	**MW**	**~6**

The chosen technology is a domestic biogas plant. It is a small thermal appliance that displaces the use of non-renewable biomass by introducing a system for utilising cattle dung and converting it into renewable energy by means of a digester in which the substrate undergoes acidification and methanation. Biogas is included in the specified methodologies as an example of a suitable end user technology. There is no relation, to other facilities, systems and equipment outside the project boundary.

The age and average lifetime of the equipment based is about 25y-0m[1]

There are no monitoring equipment for biogas. Monitoring for operational units and its extent of use is done by Village level volunteers in the project area.

The technologies/measures existing prior to the implementation of the project activity at the same site, is traditional inefficient mud/clay or three stone cook stoves that had a thermal efficiency of about 10%. Rural communities in the project area were cooking on these traditional stoves using non-renewable fuel wood for cooking and heating water for bath and other activities at household level.

The chosen methane recovery and combustion system is the time tested Deenabandhu model biogas technology which is well-known in India[2]. This technology is available in India – thus no environmentally safe and sound technology and know-how was transferred to the host party (country).

There is no more than one component in the small-scale project activity, that is included.

A.4. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	Private Entity - Agricultural Development and Training Society (ADATS)	No
The Netherlands	Private Entity - FairClimateFund B.V	No

[1] Dheenabandhu Model 2000 Biogas Units, developed by AFPRO, Action For Food Production, New Delhi

[2] Approved design by the Ministry of New and Renewable Energy. http://www.mnre.gov.in/schemes/decentralized-systems/schems-2

Germany	Private Entity - Evangelisches Werk für Diakonie und Entwicklung e.V	No
France	Private Entity – Velcan Energy	No
Switzerland	Private Entity – Velcan Energy	No
Germany	Private Entity - Atmosfair gGmbH	No

A.5. Public funding of project activity

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There was no public funding involved in the project activity. The project was financed completely with carbon revenues from VELCAN ENERGY, France, an Annex I country.

A.6. History of project activity

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This is to confirm that:

(a) The CDM project activity is neither registered as a CDM project activity nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA);

(b) The CDM project activity is not a project activity that has been deregistered.

This is to further declare that the project activity was **not**:

(c) a CPA that has been excluded from a registered CDM PoA;

(d) a registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired exists in the same geographical location as the proposed CDM project activity.

The PP has provided a written statement to confirm the above.

A.7. Debundling

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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.

Also, each of the independent biogas unit is having an installed capacity of 1.1 kW_{th}. This is not greater than 1% of small scale thresholds defined by the applied methodology I.E. under Type I – renewable energy project activity, i.e. not greater than 0.45 MW_{th} or 450 kW_{th}. Thus the project activity is exempted from performing the debundling check. Thus the small scale project is not a debundled component of a large scale project activity.

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

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i. AMS-I.E. Switch from non-renewable biomass for thermal applications by the user, Version 10.1.

ii. Tool30: Methodological tool: Calculation of fraction of non-renewable biomass, Version 02.0

iii. Methodological tool: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period, Version 3.0.1.

B.2. Applicability of methodologies and standardized baselines

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Applicability Criteria	Applicability fulfilled by the Project Activity
1. The methodology is applicable for technologies displacing use of non-renewable biomass by renewable energy.	The project activity biogas provides thermal energy from cattle dung that is renewable. It replaced the baseline technology mud/clay, three-stone traditional cook stove that used non-renewable biomass.
2. Project participants or coordinating and managing entities shall describe in the PDD/PoA-DD how the double counting of emission reductions has been addressed (e.g. between end users, distributors and producers of stoves).	The PP and end user has signed an end-user agreement that states that the end user transfers the emission reductions generated from the project activity to the PP, ADATS and is not transferable to any other entity.
3. For project activities introducing bio-ethanol cookstoves, project participants or coordinating and managing entities shall demonstrate that the bioethanol cookstoves are designed, constructed and operated to the requirements (e.g. with regard to safety) of a relevant national or local standard or comparable literature. Latest guidelines issued by a relevant national authority or an international organisation may also be used.	Not Applicable
4. The CDM-PDD or CDM-PoA-DD/CPA-DD shall explain the proposed method for distribution of project devices including the method to avoid double counting of emission reductions such as unique identifications of product and end-user locations (e.g. programme logo).	Each of the biogas unit has a unique Unit ID number. Each of the unit has “ADATS-VELCAN“ on the unit to distinguish it as part of the project activity (see fig 2).
5. The CDM-PDD or CDM-PoA-DD/CPA-DD shall also explain how the proposed procedures prevent double counting of emission reductions, for example to avoid that project stove manufacturers, wholesale providers or others also claim credit for emission reductions from the project devices.	The biogas units were constructed by the PP, ADATS for each of the end user. No other manufacturers, wholesale providers or other were involved to claim emission reductions from the project devices. The end user agreement transfers the credits to the PP and is not transferable to any other entity.

B.3. Project boundary, sources and greenhouse gases (GHGs)

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In accordance with the methodology, t*he project boundary is the physical, geographic site of the use of biomass or the renewable energy.* The project boundary is 5500 households in 5 Taluks of Chickballapur District in which the biogas units were built.

Based on the methodologies, the GHGs included are as follows:

	Sources	**GHG**	**Included/Excluded**	**Justification/Explanation**

Baseline	Emissions from burning non-renewable wood	CO_2	Included	Major source of emission from use of non-renewable biomass. However, as per methodology, emission from projected fossil fuel is considered
		CH_4	Included	As per methodology, emissions from projected fossil fuel is considered
		N_2O	Included	As per methodology, emissions from projected fossil fuel is considered
Project Activity	Emissions from use of non-renewable wood by non-project household/users that previously used renewable energy	CO_2	Included	Leakage from use of non-renewable woody biomass by non-project households/ users that previously used renewable energy is a source according methodology
		CH_4	Included	Since 5% leakage from baseline emission reduction is considered, it includes non-CO_2 emissions
		N_2O	Included	Since 5% leakage from baseline emission reduction is considered, it includes non-CO_2 emissions

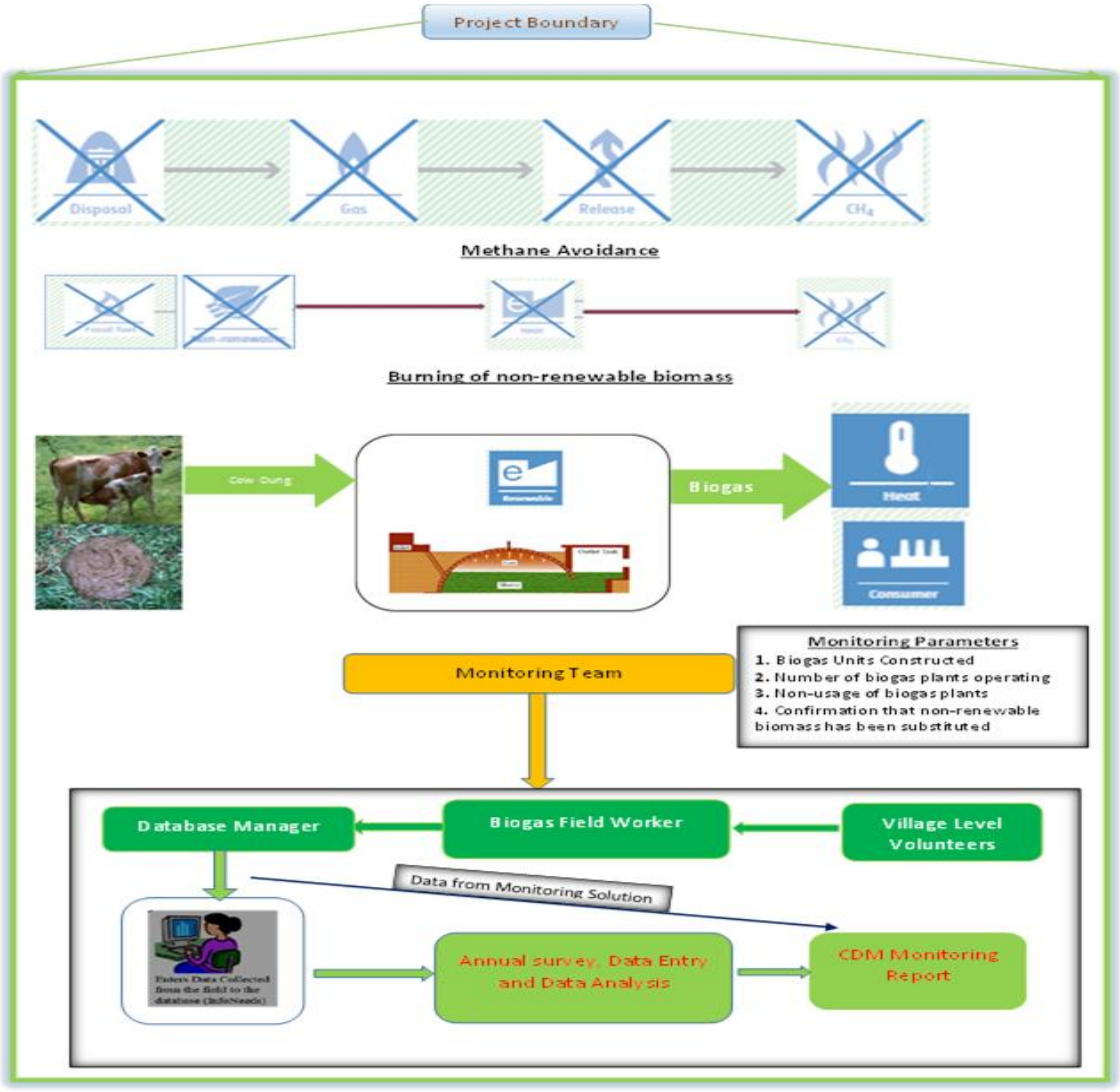

Fig 3: Technical process of the project

B.4. Establishment and description of baseline scenario

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According to the Standard CDM project standard for project activities, Version 2, (CDM-EB93-A04-STAN), the project participants has to demonstrate the validity of the original baseline or update it in accordance to the following (Paragraphs 283−286).

Para 283. To demonstrate the validity of the original baseline or its update, the project participants are not required to reassess the baseline scenario. Instead, the project participants shall assess the GHG emission reductions or net anthropogenic GHG removals that would have resulted from that scenario.

The baseline scenario is not assessed. The GHG emission reductions are reassessed that would have resulted from the scenario.

Para 284. The project participants shall assess and incorporate the impact of national and/or sectoral policies and circumstances, existing at the time of requesting renewal of crediting period, on the current baseline GHG emissions, without reassessing the baseline scenario.

This is also the Step 1.1 of the methodological Tool to assess the validity of the original/current baseline and update of the baseline at the renewal of the crediting period:

There are no relevant national and/or sectoral policies and circumstances ever since the project was registered that have an impact on the baseline. The Ministry has been supporting programmes

for the deployment of renewable energy systems and devices such as biogas plants, in rural areas of the country[3]. But the implementation of biogas is still very low. The baseline scenario remains unchanged and is the same as that determined during the start of the project activity.

According to step 1.2 of the tool, *Assess the impact of circumstances*

The baseline scenario identified at the validation of the project activity was thermal energy from fuel wood, of which a large part of it was non-renewable for domestic cooking and water heating. Thus, this project activity was a voluntary investment which replaced equivalent amount of thermal energy from renewable source, the biogas. The project proponent was not bound to incur this investment as it was not mandatory by national and sectoral policies. Thus, the continued operation of the project activity would continue to replace thermal energy from fuel wood, hence the same baseline as identified in the previous crediting period is still valid for the project. Therefore, the assessment of the changes in market characteristics is not required for the renewal of the project's crediting period under CDM.

Step 1.3. Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

The target population are the rural households of Chickballapur District. The rural households are primarily dependent on fuel wood for cooking and heating water. Based on a survey conducted in the project region, the baseline scenario is, still 73.73% rural communities use fuelwood as the dominant fuel for cooking and heating water for bath on inefficient mud/clay wood stoves that do not have chimney and grate and hence has an efficiency of 10% according to the methodology. According to census data, fire wood is still a major source of fuel in Chickballapur for cooking as 73.90% are using it as the main source for cooking[4]. According to NSS Report, in Karnataka, State, 27.3% of rural households still predominantly only use fuelwood for cooking[5]. Though LPG is promoted by the government through the Pradhan Mantri Ujjwala Yojana, there is no increase in LPG consumption among general rural consumers[6]. This shows that though LPG has been provided with subsidy to the rural communities, the refill is very expensive and rural households are still using traditional stove for cooking[7]. The region is scarce of biomass and non-renewable biomass is part of the biomass used for cooking and heating water. In 5,500 households, the fuel wood has been replaced with biogas, a renewable source of thermal energy through this CDM project activity.

Hence, the new circumstances do not have an impact on the baseline emission. The conditions used to determine the baseline emissions in the previous crediting period are still valid even now. In the absence of the project activity, the baseline scenario in the project boundary is the use of non-renewable biomass for cooking and heating water on traditional cook stoves with low efficiencies. There are no mandatory national and sectoral policies or regulations for use of biogas (renewable energy) at household level. Thus, the GHG emissions under the baseline condition comprise CO_2 emissions from the use of non-renewable biomass for thermal energy.

[3] https://www.bioenergyconsult.com/biogas-india/

[4] Chickkaballapura district at a glance, 2016-17. Page 104, District Statistical Office, Chickballapur District, Government of Karntaka.

[5] http://www.mospi.gov.in/sites/default/files/publication_reports/Report_584_final_0.pdf

[6] https://www.nature.com/articles/s41560-019-0429-8?proof=trueIn%2525EF%2525BB%2525BF

[7] https://energy.economictimes.indiatimes.com/news/oil-and-gas/indias-ujjwala-scheme-provided-lpg-access-but-failed-to-promote-its-use-study/73580017

285. The requirements contained in paragraph 284 above are not applicable to a registered CDM project activity applying the valid version of an applicable approved standardized baseline that standardizes baseline scenario in accordance with paragraph 281 above.

Not Applicable

286. If data and parameters used for determining the original baseline, that were determined ex ante and not monitored during the crediting period, are no longer valid, the project participants shall update such data and parameters in accordance with the "Methodological tool: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period".

Based on Step 1.4 of the Tool, Assessment of the validity of the data and parameters

The data and parameters that were determined at the start of the crediting period and not monitored during the crediting period were updated during this crediting period.

Step 2: Update the current baseline and the data and parameters

As per step 1.4, the data and parameters that were determined at the start of the crediting period and not monitored during the crediting period is updated.
Step 2.1 Update the current baseline

Based on this step, the baseline emissions for the 3rd crediting period is updated without reassessing the baseline scenario based on the latest approved methodology applicable to the project activity.

The data and parameters that were determined ex-ante and updated are as follows:

$BC_{BL,HH,y}$	=	Quantity of woody biomass that is substituted or displaced in tonnes
$f_{NRB,y}$	=	Fraction of woody biomass used in the absence of the project activity in year *y* that can be established as non-renewable biomass (fNRB)[8]
$NCV_{biomass}$	=	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/tonne)
$EF_{projected\_fossil\ fuel}$	=	Emission factor for the substitution of non-renewable woody biomass by similar consumers.

$NCV_{biomass}$ - 0.0156 TJ/tonne as given by AMS I.E. methodology

$EF_{projected\_fossilfuel}$ – The default regional value given for South Asia in Table 2 of AMS I.E. methodology is considered for the project activity, which is in India. Accordingly, the value is 64.4 tCO_{2e}/TJ.

Determining By

The fuelwood use in the baseline was determined by conducting a Kitchen Test in February 2020 to estimate the fuelwood use. Kitchen test was done in 160 non-project households for 3 days to assess the fuel wood use at household level from the 5 Taluks of project region.

Taluk	Number of Households

[8] Default values endorsed by designated national authorities and approved by the Board are available at <http://cdm.unfccc.int/methodologies/standard_base/index.html>.

Bagepalli	45
Chikkaballapur	30
Chintamani	40
Gudibanda	17
Sidlagatta	28
Total	**160**

Weighted amount of fuelwood was given to the households from which they used it for cooking and other activities. These are households who are only using traditional cook stove and no other fuel. The start and end weight was taken for each day to assess the fuelwood used per day. A mean of the value is considered as the baseline fuelwood use in the project area. The per capita fuelwood use per day was determined. In addition the household size was also determined from the survey. The results of the study are as follows:

	HH Size	Average fuelwood use (kg/capita/day)
Mean	**4.93**	**1.979**
Standard Deviation	1.91	0.81
Count	160	160
Standard error of mean	0.151	0.064
Confidence level (90%)	0.25	0.11
Reliability	5.03%	5.33%

Based on the study conducted, the fuelwood use is 1.979±0.11 kg/capita/day and the household size is 4.93±0.25 persons and is within 90/10 confidence/precision level. Based on the mean and standard deviation, the sufficiency of sample size was done using the formula for infinite population as follows:

$$n = \frac{1.645^2 V}{0.1^2}; where\ V = \left(\frac{SD}{mean}\right)^2$$

Accordingly, the values returned are as follows:

	Household Size	Average fuelwood
n	**40**	**45**
v	0.150	0.168
Mean	4.93	1.98
SD	1.91	0.81
90% confidence	1.645	1.645
10% relative precision	0.1	0.1

The sample size of 160 is much more than that required determining the average fuelwood use and household size. As can be seen from the Kitchen Test, the household size if 4.93 and the fuelwood use is 1.979 kgs/capita/day. Accordingly the fuelwood use is 1.979 kg/capita/day x 4.93 household size x 365 days = 3.56 t/household/year.

This was compared to the available literature for the region. A third party study by Ramachandra *et al*., 2005[9] was conducted to assess the quantity of fuelwood that is used for cooking and water heating in the district encompassing the 5 taluks of the project area. The details of the survey from the study are as follows:

[9] Ramachandra, T.V., Vamshee Krishna S and Shruthi, B.V. 2005. Decision support system for regional domestic energy planning. Journal of Scientific and Industrial Research. Vol 64, pp 163-174.

Taluk	Fuelwood for cooking (kg/capita/day)			Fuelwood for water heating (kg/capita/day)			Average Fuelwood use (kg/capita/day)
	Monsoon	Summer	Winter	Monsoon	Summer	Winter	
Bagepalli	1.35	1.31	1.36	0.68	0.66	0.7	2.02
Chickballapur	1.29	1.23	1.29	0.57	0.5	0.57	1.82
Chintamani	1.25	1.25	1.25	0.11	0.11	0.11	1.36
Gudibanda	1.42	1.42	1.42	0.55	0.5	0.58	1.96
Sidlaghatta	1.13	1.13	1.13	0.13	0.13	0.13	1.26
Average							**1.684**

Table 1: Fuelwood use for cooking and water heating in the 5 taluks of the project area

The average fuelwood use based on Ramachandra et al study is 1.684 kg/capita/day. Accordingly, the fuelwood use is 1.684 x 4.93 household size x 365 = 3.03 t/household/yr.

Comparing the fuelwood use from the survey conducted and from the third party study, it can be seen that Ramachandra et al., 2005 is conservative. The study being conservative and also has representative samples of all the seasons, the study is considered for emission reduction calculations.

The study being a third party assessment and conservative; has been considered to determine B_y.

The value considered is 3.03 t/household/yr. This is fixed ex-ante, as the project is for rural households.

Determining Non-renewable biomass (f_{NRB})

The f_{NRB} is calculated based on CDM TOOL30, Methodological Tool for calculation of the fraction of non-renewable biomass. Version 2. The fraction of woody biomass that can be established as non-renewable is

$$f_{NRB} = \frac{NRB}{NRB + RB}$$

Where
f_{NRB} = Fraction of non-renewable biomass in the country/region or project area
NRB = Quantity of non-renewable biomass (t/yr) in the country/region or project area
RB = Quantity of renewable biomass in the country/region or project area

The data/parameter determined to assess f_{NRB} are as follows:

Consumption of wood in Karnataka - H		
Activity Data	**Value**	**Source**
Fuelwood (Mt)	21.00	Wood is Good, Is India doing enough to meet its present and future needs? A status report by CSE, 2017
Timber (Mt)	13.93	
Total (Mt)	**34.93**	
Determination of RB		
Area of Forest (ha) (F_{forest})	3,857,548	FSI, 2019 page 124
Protected forests (ha) (P_{forest})	393100	FSI, 2019 page 122

Mean Annual Increment (t/ha/yr) (MAI_{forest})	1.023	Kaul et al, 2008., Page 9
Total Biomass Increment (t/yr) in Forests	3,544,130.30	Calculated
Mean Annual Increment in Forests (Mt/yr)	3.54	Calculated
Mean Annual Increment from TOF (Trees outside Forests) of Karnataka		
Growing Stock in TOF (Million cum)	103.03	Chapter 11.13, Karnataka, State of Forest Report 2019[10]
Mean Annual Increment (Million cum)	2.58	Calculated using Von Mantel's Method (t=2GS/R)[11]; where GS is the growing stock and R is the rotation period; Rotation period is 80 years based on the dominant species (long term trees) planted in TOF [12]
Mean annual Increment in TOF (Million t)	1.59	Conversion of cum to t-wood density of 0.619
RB	**5.14**	From Forests and TOF

Parameter	**Notation**	**Value**	**Source of data**
Total annual consumption of wood (Million t/yr)	H	34.93	CSE, 2017
Quantity of renewable biomass in Karnataka State (Million t/yr)	RB	5.14	From FSI, 2019 and Kaul., et al, 2008 + From trees outside forest (TOF) based on data from State of Forest Report, 2019 for Karnataka)
Quantity of non-renewable biomass in Karnataka State (Million t/year)	NRB	29.79	= H - RB
Fraction of Non-renewable Biomass	f_{NRB}	**0.85**	Calculated NRB/NRB+RB

The f_{NRB} considered for Karnataka is 0.85.

Hence the fraction of non-renewable woody biomass used in the absence of the project activity considered for the project is 0.85.

The updated data and parameters to determine Emission Reduction Calculations during this II renewal is as follows:

$BC_{BL,HH,y}$ (t)	3.03
$f_{NRB,y}$	0.85
$NCV_{biomass}$ (TJ/tonne)	0.0156
$EF_{projected\_fossil\ fuel}$ (t CO_{2e}/TJ)	64.4

[10] http://fsi.nic.in/isfr19/vol2/isfr-2019-vol-ii-karnataka.pdf

[11] Guidelines for the management of tropical forests 1. The production of wood (FAO forestry paper 135); http://www.fao.org/3/w8212e/w8212e07.htm

[12] Chapter 11.13, FSI, 2019 for relative abundance of tree species and average rotation period of tree species

B.5. Demonstration of additionality

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According to the Standard CDM project standard for project activities, Version 2, (CDM-EB93-A04-STAN) Para 280, for renewal of crediting period of a registered CDM project activity, the project participants are not required to reassess the additionality of the project activity nor update the section of the PDD relating to additionality. Hence the additionality demonstration provided during the registration of the project is retained as is below.

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

Alternative 1) 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. This the baseline scenario and represents 3.57 t CO_2 emission per family per year. The running costs of these systems are zero as the time a person spends is not counted as an opportunity cost, and the non-renewable biomass is collected from various open areas – Government Revenue, Forest Department, Panchayat lands, some farm field borders, and it is free. 5% of firewood is estimated to be renewable, with the balance 95% being non-renewable [Ref 3a].

Alternative 2) Kerosene is very expensive at around Rs 10.00 per litre in the fair price shop and around 20.00 Rs / litre in the open market if available. Around 1 kg would be needed per day, which is the equivalent of a daily labourer's daily salary. Thus it is not feasible for the target users in this project activity to use kerosene.

Alternative 3) LPG: The capital cost of a 2 m^3 biogas plant is about 6 times the cost of LPG. 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. Running cost is around Rs 10.00 per day, again about half the daily wage of a agricultural labourer. To some extent this technology is also slowly penetrating the villages. But this is also beyond the reach of this project's target population, especially also considering the remoteness of the villages.

Taking all this information into account, it can be seen that Alternative 1) the continued combustion of non-renewable biomass fuel for cooking and water heating is the cheapest option, leading to higher emissions.

(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

The commonly and widely used wood fired stoves or ovens ("traditional mud stoves" or "improved vented mud stoves") are very primitive, but anyone can build them. The basic "3-rock stove" requires practically no skill to construct, though it does take some skill to cook on such an awkward cooking arrangement. Biogas plants on the other hand have to be constructed very carefully. This takes skill, diligence, careful working, attention to detail, design care for each plant so that it is suited to the local conditions at each plot of land where it is to be constructed. There are not many good biogas gas manufacturers in India for the household user size plant, and thus the technology has low market share in the villages compared to the baseline cooking technology..

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

The prevailing practice is for poor households to depend on free sources of firewood from the "commons" – either the Forest department (illegal collection is very common though under-reported), Panchayat Land, where the poor are entitled to collect firewood but there are no programmes for reforestation or replacement of biomass removed. Thus all these sources of biomass are non-renewable to large extent; yet this is the prevailing practice. See Refs [1,2,3,3a].

(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

It takes quite special organisational and management skills and coordination amongst various implementing agencies to organise decentralised supply of small cooking systems of the kind envisaged under this project activity. Not only do the plants have to be built to suit local soil conditions, but service and maintenance crews have to be trained and stationed in all the villages to ensure smooth running of the plants. Emissions from the combustion of non-renewable biomass fuel can only be avoided through efforts on the part of a supplier to give professional attention to this rural renewable energy technology and manage it efficiently with sufficient resource inputs on all fronts. As the local market is not willing to pay the additional cost of biogas plants compared to other forms of baseline activities, these barriers can only be overcome with CDM support. A biogas plant of 2 cubic metres capacity can be financed with a 5 year advance on CERs if the CER price is 15 Euros. This illustrates the win-win opportunity under CDM compared to the baseline situation.

Also:

According to "Guidelines on the demonstration of additionality of Small-Scale Project Activities, Version 9, EB 68[13]", Para 2, d*ocumentation of barriers, is not required for the positive list of technologies and project activity types that are defined as automatically additional for project sizes up to and including the small-scale CDM thresholds (e.g. installed capacity up to 15 MW).*

According to the guidelines, the positive list comprises of project activities solely composed of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs) and where the size of each unit is no larger than 5% of the small-scale CDM thresholds, i.e. the size of each unit is under 750 kW installed capacity or under 3000 MWh of energy savings per year or 3000 tonnes of emission reductions per year.

As demonstrated in section B.2.,

- The project comprises of the isolated biogas units of 5,500 each;
- Users of each of the biogas unit are 5,500 households
- The size of each of the unit is 1.1 kW_{th} (section A.4.2), which is less than 5% of the small-scale CDM thresholds.
- The total capacity of the project activity is 9.31 MW_{th} and will remain under this limit during every year of the crediting period.

Considering the above, the project activity is eligible under the positive list of technologies and documentation of barriers is not required for positive list of technologies.

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

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Baseline emissions

Baseline emissions would be calculated as:

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossil\_fuel}$$ Equation (1)

Where:

BE_y = Baseline emissions during the year y in t CO2e

[13] https://cdm.unfccc.int/Reference/Guidclarif/meth/methSSC_guid05.pdf

B_y	=	Quantity of woody biomass that is substituted or displaced in tonnes
$f_{NRB,y}$	=	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass (f_{NRB})
$NCV_{biomass}$	=	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/tonne)
$EF_{projected\_fossil\ fuel}$	=	Emission factor for the substitution of non-renewable woody biomass by similar consumers.

B_y is determined by using options (a) of the methodology, which is :

Calculated as the product of the number of households multiplied by the estimate of average annual consumption of woody biomass per household that is displaced by the project activity (tonnes/household/year);

$$B_y = N_{HH} \times (BC_{BL,HH,y} - BC_{PJ,HH,y}) \quad \text{Equation (3)}$$

Where:

N_{HH}	=	Number of households in the project activity, number
$BC_{BL,HH,y}$	=	Average annual consumption of woody biomass per household before the start of the project activity, tonnes/household/year
$BC_{PJ,HH,y}$	=	If it is found that pre-project devices were not completely displaced but continue to be used to some extent, average annual consumption of woody biomass per household in the pre-project devices during the project activity, tonnes/household/year

fNRB,y is determined as per TOOL30 and is described in section B.4.

The emission factor is as given in the methodology, AMS. I.E. for South Asia in Table 2 of AMS I.E. methodology.

Project emissions

The project activity (PE_y) does not involve cultivation, use, processing and transportation of biomass. Hence there are no project emissions to be considered for the project activity.

Leakage emissions

The project activity does not involve cultivation, use, processing and transportation of biomass. Hence leakage emissions from biomass are not applicable.

Leakage emissions (LE_y) is related to non-renewable woody biomass saved by the project activity is considered. B_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.

The project activity involves switching from fuelwood to biogas. It does not include switching to charcoal or processed biomass (briquette, pellets, and woodchips) to consider these leakages.

Emission reductions

Emission reductions are estimated as

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (4)}$$

Where:
ER_y = Emission reductions in year *y*, tonnes CO_2eq

B.6.2. Data and parameters fixed ex ante

Data/Parameter	$f_{NRB,y}$
Data unit	-
Description	Fraction of woody biomass saved by the project activity during year *y* that can be established as non-renewable biomass
Source of data	Calculated based on following sources of data: 1. State of Forest Report, Forest Survey of India, 2019. 2. Kaul, M., Mohren, G.M.J., and Dadhwal, V.K.,Phytomass carbon pool of trees and forests in India, Climatic Change, DOI 10.1007/s10584-010-9986-3, 2011 3. Wood is Good, Iis India doing enough to meet its present and future needs? A status report by Centre for Science and Environment, CSE, 2017. 4. Ratnam, J., Chengappa,S.K., Siddarth, J., Machado, Nandita Nataraj, Anand M. Osuri and Mahesh Sankaran. Functional Traits of Trees From Dry Deciduous Forests of Southern India Suggest Seasonal Drought and Fire Are Important Drivers. Frontiers in Ecology and Evolution. Brief Research Report, 2019, doi: 10.3389/fevo.2019.00008
Value(s) applied	0.85
Choice of data or measurement methods and procedures	As per "TOOL30: Calculation of the fraction of non-renewable biomass"
Purpose of data	Baseline Emissions
Additional comment	The data is based on Government data and statistics as per TOOL30.

Data/Parameter	$BC_{BL,HH,y}$
Data unit	tonnes/household/year
Description	Average annual consumption of woody biomass per household before the start of the project activity
Source of data	1. Kitchen Test conducted in the project area and 2. Third party study "Ramachandra, T.V., Vamshee Krishna S and Shruthi, B.V. 2005. Decision support system for regional domestic energy planning. Journal of Scientific and Industrial Research. Vol 64, pp 163-174."
Value(s) applied	3.03
Choice of data or measurement methods and procedures	Determined ex ante based on Historical third party data and sample survey conducted as per the latest version of the "Standard: Sampling and surveys for CDM project activities and programme of activities;" As the third party study was conservative in terms of per capita fuelwood use, it was used for determining the value.
Purpose of data	Baseline Emissions
Additional comment	Conservative approach is adopted, wherein the third party study conducted in the project area is more conservative than the value from Kitchen Test Survey.

Data/Parameter	$NCV_{biomass}$
Data unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass
Source of data	AMS 1.E. Methodology
Value(s) applied	0.0156
Choice of data or measurement methods and procedures	As the project is implemented and no more biogas units will be constructed, the baseline fuel replaced is woody biomass IPCC default for wood fuel, 0.0156 TJ/tonne, based on the gross weight of the wood that is 'air-dried' may be used if fuel used in project device is also woody biomass given in methodology
Purpose of data	Baseline Emissions
Additional comment	Fixed for the entire crediting period

Data/Parameter	$EF_{projected\_fossil\ fuel}$
Data unit	t CO_{2e}/TJ
Description	Emission factor for the substitution of non-renewable woody biomass by similar consumers.
Source of data	AMS I.E. Methodology
Value(s) applied	64.4
Choice of data or measurement methods and procedures	AMS 1.E. Methodology
Purpose of data	Baseline Emissions
Additional comment	Fixed for the entire crediting period

Data/Parameter	**Determination of Leakage**
Data unit	t/HH/yr
Description	woody biomass
Source of data	AMS I.E. Methodology
Value(s) applied	0.15 for household fuelwood use of 3.03 t/HH/Yr. Based on the fuelwood use determined ex-post ($BC_{BL,HH,y,}$-$BC_{PY,HH,y}$) leakage will be determined by net to gross adjustment factor of 0.95 to account for leakage.
Choice of data or measurement methods and procedures	By is multiplied by a net to gross adjustment factor of 0.95 to account for leakages
Purpose of data	Leakage
Additional comment	Surveys will not be required to determine leakage.

B.6.3. Ex ante calculation of emission reductions

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$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossil\_fuel}$$

Without Leakage			
Data	**Value**	**Description**	**Source**
BE_y	14,230.98	Baseline emissions during the year *y* in t CO_2e	Calculated

B_y	16665.00	Quantity of woody biomass that is substituted or displaced in tonnes	Based on survey and third party study
$f_{NRB,y}$	0.85	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass (fNRB)	Calculated
$NCV_{biomass}$	0.0156	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/tonne)	Methodology
$EF_{projected\_fossil\ fuel}$	64.4	Emission factor for the substitution of non-renewable woody biomass by similar consumers.	Methodology (value for South Asia)

$$B_y = N_{HH} \times (BC_{BL,HH,y} - BC_{PJ,HH,y})$$

By	16665.00	Quantity of woody biomass that is substituted or displaced in tonnes	Calculated
N_{HH}	5500	Number of households in the project activity, number	PDD
$BC_{BL,HH,y}$	3.03	Average annual consumption of woody biomass per household before the start of the project activity, tonnes/household/year	Based on survey and third party study
$BC_{PJ,HH,y}$	0	If it is found that pre-project devices were not completely displaced but continue to be used to some extent, average annual consumption of woody biomass per household in the pre-project devices during the project activity, tonnes/household/year	Assumed as zero for ex-ante calculations; For ex-post calculations, will be based on surveys conducted in the project area

After considering Leakage			
Activity Data	Value	Description	Source
BEy	13,519.43	Baseline emissions during the year *y* in t CO_2e	Calculated
B_y	15831.75	Quantity of woody biomass that is substituted or displaced in tonnes	Based on survey and third party study
$f_{NRB,y}$	0.85	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass (fNRB)	Calculated
$NCV_{biomass}$	0.0156	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/tonne)	Methodology
$EF_{projected\_fossil\ fuel}$	64.4	Emission factor for the substitution of non-renewable woody biomass by similar consumers.	Methodology (value for South Asia)

By	15831.75	Quantity of woody biomass that is substituted or displaced in tonnes	Calculated

N_{HH}	5500	Number of households in the project activity, number	PDD
$BC_{BL,HH,y}$	3.03	Average annual consumption of woody biomass per household before the start of the project activity, tonnes/household/year	Based on survey and third party study
$BC_{PJ,HH,y}$	0	If it is found that pre-project devices were not completely displaced but continue to be used to some extent, average annual consumption of woody biomass per household in the pre-project devices during the project activity, tonnes/household/year	Assumed as zero for ex-ante calculations; For ex-post calculations, will be based on surveys conducted in the project area

PEy	0	Project Emissions	

LEy	771.55	Leakage as tCO_2 due to reduction of By by 5%	Calculated as (BE_y-$BE_{y,with\ leakage}$)

BEy	14,231	Baseline emissions during the year *y* in t CO_2e
PEy	0	Project emissions during the year *y* in t CO_2e
LEy	712	Emissions due to leakage during the year *y* in t CO_2e
ERy	**13,519**	Emission Reduction during the year *y* in t CO_2e for 5,500 households

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)
2020-21 (starting from 1st Sept 2020)	14,231	0	712	13,519
2021-22	14,231	0	712	13,519
2022-23	14,231	0	712	13,519
2023-24	14,231	0	712	13,519
2024-25	14,231	0	712	13,519
2025-26	14,231	0	712	13,519
2026-27 (ending 31st August 2027)	14,231	0	712	13,519
Total	99,617	0	4,984	94,633
Total number of crediting years				7
Annual average over the crediting period	14,231	0	712	13,519

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	**Date of commissioning of biogas units**
Data unit	Date
Description	Actual date of commissioning of the project device.

Source of data	Monitoring Solution
Value(s) applied	As and when commissioned
Measurement methods and procedures	The construction processes were monitored on a day to day basis and database maintained from its initiation to completion dates for each of the biogas unit in first crediting period of the project activity. Thus the start date of each of the unit installed in fixed for each of the unit.
Monitoring frequency	As and when commissioned and fixed and recorded in the monitoring solution
QA/QC procedures	This can be triangulated with the End User Agreement.
Purpose of data	To estimate baseline emissions.
Additional comment	All the units were commissioned during the first crediting period. There will be no new units that will be constructed during this crediting period. Only repair and maintenance will be continued. The date of commissioning is reported during verification in the ER calculations sheet.

Data/Parameter	**N_{HH}**
Data unit	Number
Description	Number of households in the project activity in year y
Source of data	Monitored on a daily basis and entered into the monitoring database. The units have been constructed during the first crediting period.
Value(s) applied	5,500
Measurement methods and procedures	The construction processes were monitored on a day to day basis and database maintained from its initiation to completion dates for each of the biogas unit. Thus the start date of each of the unit installed in fixed for each of the unit. In case of replacement of any unit due to demolition will be recorded and the loss days accounted for. This could be for the same user or new users, in which case the baseline is the users were using fuel wood. A new end user agreement will signed with them and recorded.
Monitoring frequency	All the units were installed for the project activity during the first crediting period.
QA/QC procedures	All activity processes, including financial transactions for construction of biogas units, are digitally monitored using the online intranet solution that is integrated into ADATS's intranet based monitoring system InfoNeeds. This provides verification for the construction of biogas units. All data will be archived and stored throughout the crediting period and an additional 2 years.
Purpose of data	Baseline Emissions
Additional comment	ERs are calculated for only the installed and operational biogas units.

Data/Parameter	**Number of biogas plants operating**
Data unit	Number
Description	Number of plants operating in year
Source of data	Log books maintained and entered in the digitized monitoring database for biogas units operating
Value(s) applied	5,500
Measurement methods and procedures	In every village, the women Volunteer monitors the biogas units that are non-operational. The days other than that non-operational will determine the biogas units which are operational. For the monitoring period, the operational days of installed biogas units will be calculated by subtracting the non-usage days. The emission reduction will be estimated only for operational days.
Monitoring frequency	The data of non-operational units are done on a regular basis as and when a unit is dysfunctional. As and when biogas units are not operational, it is recorded. The remaining days are considered operational.

QA/QC procedures	Log books and digitized database will be checked regularly by project staff and CDM coordinator.
Purpose of data	Baseline Emissions
Additional comment	All data will be archived and stored throughout the crediting period and an additional 2 years. This is to ensure that the units are repaired and provide sustainable thermal energy to the end user.

Data/Parameter	$BC_{PJ,HH,y}$
Data unit	tonnes/household/year
Description	Average annual consumption of woody biomass per household in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent
Source of data	1. The days not used from the daily monitoring report for each of the unit done at the village level and data maintained on the digitized monitoring database. 2. Surveys for parallel use of traditional stoves.
Value(s) applied	0 for ex-ante calculations
Measurement methods and procedures	1. As and when biogas units are not functional, the beneficiaries report to the village level women volunteer, who in turn reports to the Case Worker of the project for the repair of the unit. A log book is maintained for the reason of non-function and days under repair. The data is entered into the monitoring solution for each of the unit. The appropriate fuelwood use for non-operational days of biogas units will be accounted. 2. For parallel use of pre-project devices, monitoring shall consist of estimation of a representative sample thereof, at least once every two years (biennial). A statistically determined sample size will be sampled to determine the quantity of fuelwood used on pre project devices. A household level questionnaire survey will be conducted.
Monitoring frequency	1. It will be monitored on a day to day basis by the Balakendra/Village Health Workers, which is then entered into the monitoring solution for all the biogas units. 2. At least once every two years (biennial)
QA/QC procedures	The two pronged approach to determine the data/parameter will result in emission reduction calculations that are based on real time data and have less uncertainty.
Purpose of data	Baseline Emissions
Additional comment	The objective to monitor the non-functional days is to ensure prompt operation and maintenance of the units so that the rural communities can continuous use biogas and are rid of drudgery they are facing using traditional biomass cook stove.

Data/Parameter	**Confirmation that non-renewable biomass has been substituted**
Data unit	-
Description	Confirmation that non-renewable biomass has been substituted
Source of data	Sample survey
Value(s) applied	100% of non-renewable biomass is replaced
Measurement methods and procedures	A household level sample survey will be conducted to confirm that non-renewable biomass has been substituted.
Monitoring frequency	At least once every two years (biennial) simple random Sample Survey
QA/QC procedures	This survey will be done for a statistically determined number of households at 95/10 precision confidence level.
Purpose of data	Confirmation of replacement of non-renewable biomass
Additional comment	

B.7.2. Sampling plan

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The parameters that need to be monitored through sample surveys are:

(i) Confirmation that non-renewable biomass has been substituted
(ii) Average annual consumption of woody biomass per household in the pre-project devices during the project activity, used in parallel.

In consideration of occupancy and demographics of the location there is no difference among the households. The socio-economic and cooking pattern of households are similar. All the households are from rural region of Chickballapur District. Simple random sample will be conducted to determine the parameter of interest. As a biennial inspection is chosen a 95 per cent confidence interval and a 10 per cent margin of error requirement will be achieved for the sampling parameter.

In cases where survey results indicate that 95/10 precision is not achieved, the lower bound of a 95 per cent confidence interval of the parameter value will be chosen as an alternative to repeating the survey efforts to achieve the 95/10 precision.

The sampling plan to monitor the parameters is described here based on "Guidelines for sampling and surveys for CDM project activities and programme of activities, Version 4", which details information relating to: (a) sampling design; (b) data that will be collected; and (c) implementation plan.

(a) Sampling Design

(i) Objectives:

The objective of the sampling effort is to

(i) Confirmation that non-renewable biomass has been substituted
(ii) Average annual consumption of woody biomass per household in the pre-project devices during the project activity, used in parallel.

The sampling frequency will be once in every two years (biennial).

As a biennial inspection is chosen a 95 per cent confidence interval and a 10 per cent margin of error requirement will be achieved for the sampling parameter.

The population is homogeneous in terms of cooking patterns and socio-economic strata. The biogas units implemented in the region is also of single type – 2 cum deenabhandu model. Hence simple random sample will be conducted for the project activity.

(ii) Target Population: The target population is the rural households for which biogas was constructed and operational in the 5 taluks of Chickballapur District, Karnataka, India.

(iii) Sampling Method: The sampling method chosen for the project area will be simple random sampling. Households with operational units will be the population from which the sampling will be randomly selected.

(iv) Sample Size:

The sample will be drawn at random from the sampling frame. This will be done using random number tables or using the random number generator of appropriate software. A pilot study will be conducted based on which, the sample size will be assessed. Subsequently, the value of the previous survey will be considered.

The largest of sample size for the 2 parameters of interest will be considered to gather information.

i) The sample size will be determined for "Confirmation that non-renewable biomass has been substituted" as follows:

$$n \geq \frac{1.645^2 N \times p(p-1)}{(N-1) \times 0.1^2 \times p^2 + 1.645^2\, p(p-1)}$$

Where

n	=	sample size
N	=	Total number of households
p	=	expected proportions
1.645	=	Represents the 90% confidence required
0.1	=	Represents the 10% relative precision

Checking Reliability

The reliability will be estimated as

The standard error of proportion is calculated as
$\sqrt{(1-f)\frac{pq}{n}}$,

Where p is the sample proportion and q = (1-p)

Precision associated with proportion is z-value x standard error of the proportion.

z-value is 1.6449

The ratio of precision to the proportion gives the relative precision, which needs to be within 10%

ii) For the parameter Average annual consumption of woody biomass per household in the pre-project devices during the project activity, used in parallel, the sample size will be determined as follows:

$$n \geq \frac{1.645^2\, NV}{(N-1) \times 0.1^2 + 1.645^2 V}$$

Where:

$$V = \left(\frac{SD}{mean}\right)^2$$

n	Sample size
N	Total number of households
Mean	*Expected mean*
SD	*Expected standard deviation*
1.645	Represents the 90% confidence required
0.1	Represents the 10% relative precision

Checking Reliability

The standard error of mean is calculated as
$\sqrt{(1-f)\frac{s^2}{n}}$,

where

f is the sampling fraction – the proportion of the population that is sampled,
s^2 is the sample variance (s is the sample standard deviation).

Precision associated with mean is t-value x standard error of the mean.

t value will be derived in Microsoft Excel using the TINV function. =TINV(0.10, (sample minus 1))

The ratio of precision to the mean gives the relative precision, which needs to be within 10%.

(***v) Sampling Frame:*** The sampling frame to be used is the complete listing of all the rural households for which biogas has been built and operational under the project activity in the 5 taluks, Chickballapur District, Karnataka State. Each of the household will have a unique identify number with all the required details of the family.

(b) Data:

(i) Field Measurements: The variable to be recorded/measured on field is Confirmation that non-renewable biomass has been substituted and the average annual consumption of woody biomass per household in the pre-project devices during the project activity, used in parallel.

A household level questionnaire will be designed to collect information for the parameter of interest. The questionnaire that is administered is given in Appendix 5. It will be field tested when administered for the first time and modified accordingly based on its ease of getting information on the field and its analysis. The frequency of measurement will be once two years. The parameter of interest is not subject to seasonal fluctuations. Hence it will be conducted at 2 years interval.

(ii) Quality Assurance/Quality Control: The QA/QC procedure will be to achieve good quality data through field measurements. The household level questionnaire will be designed and field tested before administering the actual questionnaire survey. Oversampling will be done to replace non-respondents, if any. The data collected will be entered, checked and verified further for any typographic mistakes.

(iii) Analysis: The data entry will be done in Microsoft excel sheet. The data will be cross checked with the filled in questionnaire as QA/QC procedure. The data will be analyzed for the parameter.

(c) Implementation:

(i) Implementation Plan: The implementation of sampling effort will be done by the NGO in consultation with CDM Team of Fair Climate Network (FCN). The FCN has the skill and resources to implement the sampling procedure. The team is experienced with rural energy CDM projects implemented for the rural poor for more than 15 years. The collected data will be analysed by the FCN for inclusion in the monitoring report.

B.7.3. Other elements of monitoring plan

>>

Management

ADATS is in charge of the Programme. ADATS is in charge of construction, service and maintenance, and data collection for preparation of monitoring reports. ADATS will provide support in the villages through the Bagepalli Coolie Sangha Units and coordinate for training users.

Suitable project data collection methods:

ADATS is the project implementing agency and manufacturers of the biogas plants. They bring 300 masons and supervisors to the consortium activities, who will be responsible for plant supervision, maintenance, and monitoring.

Users are also part of the local management of this project. By being given user education which imparts a sense of pride and responsibility in the users, they will understand the need for perfect plant operation on a daily basis.

The users will be firmly told that they must keep their plants 100% operational, and make use of the provisions under the service and maintenance contract for any support.

ADATS maintains a list of all the users who have installed plants under this project activity on their InfoNeeds Database. In this database every household with a biogas plant has a unique identifier and updated information taken from the individual plant logbooks concerning parameters listed below. The number of installed and operating systems is updated monthly at the ADATS office. The differentiation between installed and operating systems is made to control the over-all performance of the project activity. ADATS will have trained the family members of the households as above. In addition, ADATS will run internal training programmes for supervisors and masons to ensure that both the service and maintenance procedures, and the collection of monitoring data described below is understood by all, and is reliable and transparent. There will be a supervisor for every 50 plants or so, or at least for every village. This system is already in place and is simple and cost effective. The reports on the problems of the biogas plants are passed on by the local supervisor to the office team and other masons at the ADATS office in case the local supervisor cannot rectify the fault within 24 hours on his own. The service contract obliges the office to respond to complaints within 24 hours and rectify any problems within 1 week. ADATS provides normative operation and maintenance procedures which must be adopted by families after installation. ADATS will ensure that the service contract provisions are used by the users – thus ensuring that all the biogas plants installed under this project activity are guaranteed to 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.

Data: The data to be collected in addition to the project specific standards data referred to above, consist of the monitoring data listed Number of installed 2 m^3 systems, Number of operating 2 m^3 systems, non-usage days. ADATS has a system in place which builds on the current practice already in place and supplements and strengthens it as required.

Number of installed systems: Survey sheet “Installed systems” lists name of householder, date of installation and supervisor responsible for plant service and maintenance.

Number of operating systems: Survey sheet “operating systems” lists name of householder, date of installation, dates of supervisor visit and maintenance activities if any. It will cross reference to the plant log book being maintained for each plant by the supervisor in charge. Non usage days will be recorded to estimate ERs only for days the systems were operational.

Project performance review:

This will be carried out on a monthly basis on the basis of the review of the performance standard tests and the monthly aggregated logbooks from all the plants.

Techniques for data interpretation for monitoring and verifying GHG emission reductions with specific focus on technical/efficiency/performance parameters:

ADATS will maintain the Bagepalli CDM Biogas Programme project activity in such a way as to eliminate variance in terms of GHG reductions between plants. The aim is to establish accurate average values for a) non-renewable biomass fuel combustion in the baseline case and b) eliminate all together non-renewable biomass consumption in the project case. This will be done by ensuring correct assessment of needs and management practices prior to installation of plant.

Review, scrutiny and benchmarking against established norms for monitoring and verification – internal audit for GHG compliance:

This refers mainly to service and maintenance norms: it will be ADATS's task to ensure that every plant owner is fully aware of their rights and obligations under this project activity in terms of ensuring 100% functioning of their plant. Intensive user education is the first step, followed by education and training of supervisors, and rigorous checking of follow-up action at the ADATS office to ensure immediate rectification of faults. Random checking of operating plants is key to internal quality assurance measure to ensuring the veracity of the monitoring data, and to ensure that there are no surprises during verification. The CERs will be computed from this value.

All monitoring and control functions will be thus be done as per the internal standards and norms of ADATS. There are no instruments that need calibrating**.**

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

>>
18/12/2005

C.2. Expected operational lifetime of project activity

>>
25y-0m[14]

C.3. Crediting period of project activity

C.3.1. Type of crediting period

>>
Renewable

C.3.2. Start date of crediting period

>>
Start date of first crediting period: 01/09/2006
Start date of second crediting period: 01/09/2013
Start date of third crediting period: 01/09/2020

C.3.3. Duration of crediting period

>>
First crediting period: 7 years, 0 months - 01/09/2006 to 31/08/2013
Second crediting period: 7 years, 0 months - 01/09/2013 to 31/08/2020
Third crediting period: 7 years, 0 months - 01/09/2020 to 31/08/2027

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
Not Applicable.

D.2. Environmental impact assessment

>>
Not Applicable.

[14] Dheenabandhu Model 2000 Biogas Units, developed by AFPRO, Action For Food Production, New Delhi

SECTION E. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

>>
The excerpts of local stakeholder consultation are from those conducted before the start of the project.

ADATS has 15,000 members in 800 villages in Kolar District who have suffered from acute shortage of biomass fuel for combustion over the years. ADATS and WSD carried out a improved cookstove programme to address the issues in a partial manner. SKGS has built 100 000 plants all over South India to address this problem. Interviews with 1000s of families have been conducted over the years by WSD and ADATS and SKGS, including a fuelwood and kerosene consumption survey of 200 households on a random basis to ascertain the interest level in Kolar District.

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. ADATS has 29 years of interaction with members of the local community in Kolar District and have been dealing with the fuelwood crisis for many years. SKGS have conducted numerous camps to educate the public on the benefits of biogas. WSD have participated actively in CDM in order to bring the problem of non-renewable biomass fuel combustion dependence to the attention of the international community. 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. 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.

E.2. Summary of comments received

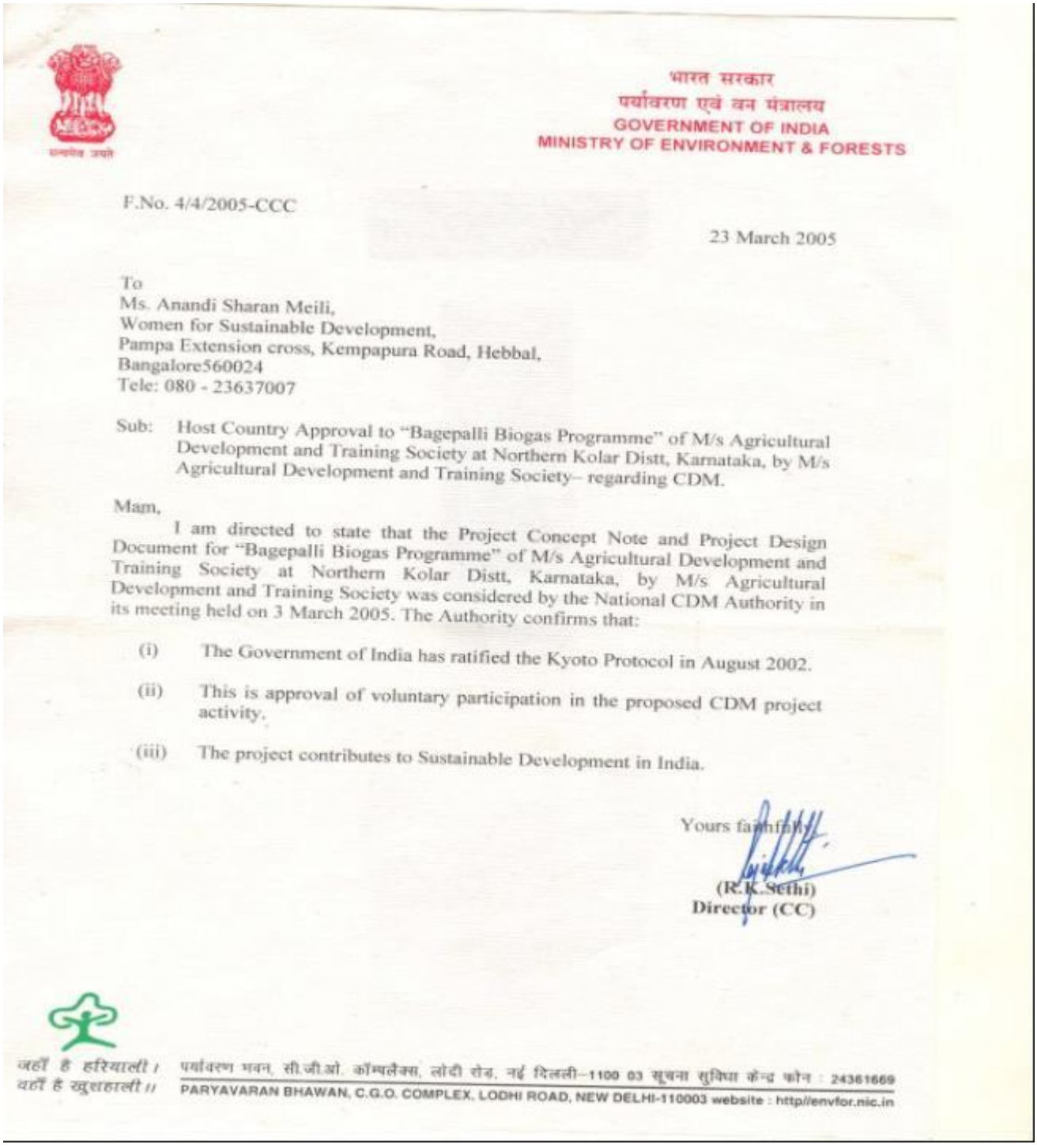
>>
The pre-project phase has showed that there is a high interest of the families and that the project is realised as fast as possible. The project participants have been flooded with requests to supply plants. Various NGOs have asked for the project to be run in their areas of operation. Thousands of 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.

E.3. Consideration of 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 Districts and States.

SECTION F. Approval and authorization

>>



भारत सरकार
पर्यावरण एवं वन मंत्रालय
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT & FORESTS

F.No. 4/4/2005-CCC

23 March 2005

To
Ms. Anandi Sharan Meili,
Women for Sustainable Development,
Pampa Extension cross, Kempapura Road, Hebbal,
Bangalore560024
Tele: 080 - 23637007

Sub: Host Country Approval to "Bagepalli Biogas Programme" of M/s Agricultural Development and Training Society at Northern Kolar Distt, Karnataka, by M/s Agricultural Development and Training Society– regarding CDM.

Mam,

I am directed to state that the Project Concept Note and Project Design Document for "Bagepalli Biogas Programme" of M/s Agricultural Development and Training Society at Northern Kolar Distt, Karnataka, by M/s Agricultural Development and Training Society was considered by the National CDM Authority in its meeting held on 3 March 2005. The Authority confirms that:

(i) The Government of India has ratified the Kyoto Protocol in August 2002.

(ii) This is approval of voluntary participation in the proposed CDM project activity.

(iii) The project contributes to Sustainable Development in India.

Yours faithfully,

(R.K.Sethi)
Director (CC)

जहाँ है हरियाली। वहाँ है खुशहाली॥

पर्यावरण भवन, सी.जी.ओ. कॉम्प्लेक्स, लोदी रोड, नई दिल्ली–1100 03 सूचना सुविधा केन्द्र फोन : 24361669
PARYAVARAN BHAWAN, C.G.O. COMPLEX, LODHI ROAD, NEW DELHI-110003 website : http//envfor.nic.in

Appendix 1. Contact information of project participants

Organization name	**Agricultural Development and Training Society**
Country	India
Address	ADATS Campus, Bagepalli, Chickballapur District, Karnataka, 561207
Telephone	+91 8150282175
Fax	+91 8150282376
E-mail	ram@adats.com
Website	www.adats.com
Contact person	Mr. Ram Esteves

Organization name	- FairClimateFund B.V
Country	The Netherlands
Address	Arthur van Schendelstraat 752 3511 MK Utrecht, the Netherlands
Telephone	+31 (0) 6 50 65 73 58
Fax	
E-mail	geest@fairclimatefund.nl
Website	
Contact person	Neera van der Geest

Organization name	Evangelisches Werk für Diakonie und Entwicklung e.V
Country	Germany
Address	Caroline-Michaelis-Strasse 1, 10115 Berlin, Germany
Telephone	+49 30 65211 1608
Fax	+49 30 65211 3608
E-mail	joerg.kruttschnitt@ewde.de , christian.schehle@ewde.de
Website	
Contact person	Jörg Kruttschnitt, Christian Schehle

Appendix 2. Affirmation regarding public funding

There is no public funding for the project activity.

Appendix 3. Applicability of methodologies and standardized baselines

The applicability of selected methodology is described in section B.2

Appendix 4. Further background information on ex ante calculation of emission reductions

The ex-ante calculations are described in section B.4 and B.6.3.

Appendix 5. Further background information on monitoring plan

The questionnaire that will be administered as per the methodology is as follows:

Survey format B: Project survey

1.1. General information[15]

Title of project activity	
Name of Surveyor	
Date of survey	mm/dd/yyyy
Period of measurements (for consumption rate)	mm/dd/yyyy to mm/dd/yyyy

1.2. Household profile

Name (Household representative)	
Household size (total number of people)	
- Adult	
- Children	
Address	
Phone number (if available)	

1.3. Household fuel consumption pattern post the project implementation

Cooking device	
Model name/number	
Unique ID	
Date of installation	mm/dd/yyyy
Do you use the project cookstove? (Physically check the stove).[16]	Yes/No
Do you use your traditional (baseline) cookstove also?	Yes/No
- If yes, how many meals did you prepare using traditional (baseline) cookstove last week or last month?[17]	Meals/week or month
Do you use any other stove? (ICS etc.)[18]	Yes/No
If yes, list the types and number of other non-project stoves	
How many times a week do you use the non-project stoves?	
How much do you spend on fuel for cooking/type of cooking device in a week/month?	

1.3.1. Fuel use for cooking

	Yes/No	Quantity of usage	Unit	Money spent on fuel/month/year
Charcoal			kg/month or year	

[15] Selection of households will be based on a sampling plan of operational biogas units.

[16] The question is to determine if the cookstove is currently in use, i.e. to address the parameter of "usage factor." Physical checks to verify the usage may be done by checking the conditions of stoves, e.g. warm to touch.

[17] The question is to determine if the baseline stove is being used to account for project emissions.

[18] The question is to cross-check if the project cookstove is used for all cooking requirements. It may also detect the situation where a household is taking part in more than one project activity, avoiding double-counting.

Crop Residue			Head load/week	
Wood			Head load/week	
LPG			Months/1 cylinder use	
Kerosene			Liters/month or year	
Coal			kg/month or year	
Electricity			kWh/month or year	
Other fuels (explain)				

1.4. Replacement of non-renewable biomass

If Wood is still used, how is it collected?		Percentage[19]
Collection of twigs and branches fallen down		
Lopping of twigs and branches		
Cut and carry wood		

Monitoring during pre-commission and commission of biogas units:

During implementation, the project was monitored continuously for various processes. The construction of biogas plants was done in a phased manner. The various processes involved in the implementation of the technology as shown below were monitored for all the units which were commissioned during the first crediting period.

1. Selection of participating families
2. Defining Masons
3. Defining Material Suppliers
4. Monitoring Construction Progress
    - Marking
    - Excavation
    - Supplying crushed stone Jelly
    - Supplying Sand
    - Supplying Bricks
    - Supplying Cement
    - Supplying Hardware
    - Concreting
    - Brick work
    - Plastering
    - Filling Gobar (Dung)
    - Supplying Stove
    - Fixing Pipe & Stove
    - Fixing Safety Grill
5. Commissioning
6. Generating End User Agreements

These processes were monitored on a day to day basis and database maintained from its initiation to completion dates for each of the biogas unit. Quality Control Supervisors comprising of the Audit team and the case worker of ADATS, the key persons to conduct the overall supervision of installed plants, checked the quality of installed biogas plants to ensure that the required materials were used for the construction of biogas units. All payments for construction of biogas units were made by cheque and suppliers were identified with personal data and digital photographs fed into the computerized databank for verification.

[19] The total should be 100% if value entered.

Statutory reports, including Trial Balance, Receipts & Payments statement, Income & Expenditure statement and Balance Sheet, are generated for the project activity. The books of accounts are audited by a certified Chartered Accountant. This financial accounting system gives proof of the construction of these biogas plants under the CDM project activity. Each of the biogas unit has been marked as "ADATS-VELCAN" and the date of construction on the doom, which makes it distinct. The Unit ID numbers are also marked on the biogas units. These evidences validate the construction and commission of the biogas plants built in the project area.

The list of biogas users are identified by a User ID, the name of the beneficiary, the CSU membership number, the village and taluk, and other details such as family strength, land holding, caste, etc. Other information includes the start date of construction and the date of commissioning.

All activity processes, including financial transactions for construction of biogas units, were digitally monitored using an online intranet solution that is integrated into ADATS's intranet based monitoring system InfoNeeds that tracks various Coolie Sangha activities. Reports can be generated at all levels i.e. Project, Taluk, Area, Cluster, Village and individual Family level. The database is updated on a daily basis, as and when Field Staff return from their respective villages.

The information on the daily operating units is gathered by the village health worker or Balakendra teacher from its users on a day to day basis or during the weekly Mahila meetings[20] held in every village. The information is updated to the individual biogas user's monitoring database maintained by ADATS by the case worker on monthly basis. All activity processes, including financial transactions for construction of biogas units, are digitally monitored using an online intranet solution that is integrated into intranet based monitoring system InfoNeeds that tracks various tasks that is under this project.

Monitoring of Non-Usage Days: After commission of biogas plants, the staffs also log-in the repairs required and the dates from when the units were not operational. The day the unit is attended of the problem, the person attending to it and date is logged-in. These in between days are the non-operational days for the units. The information on biogas non-usage days are recorded either by the Balakendra or Village Health worker from its users on a day to day basis or during the weekly Mahila meetings[21] held in every village. The information is updated to the individual biogas user's data base InfoNeeds by the case worker on regular basis. The end users also communicate through mobile phones to the Balakendra or Village Health workers. Thus there is a continuous database maintained of all the biogas units.

[20] These Mahila meetings have been held regularly since many years to discuss all issues of coolie sangha

[21] These Mahila meetings have been held regularly since many years to discuss all issues of coolie sangha

Appendix 6. Summary report of comments received from local stakeholders

The initial local stakeholder's meeting comments are included in section E.

Appendix 7. Summary of post-registration changes

The section is left blank intentionally

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Document information

Version	*Date*	*Description*
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.

Version	*Date*	*Description*
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • 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 Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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