



**Monitoring report form for CDM project activity  
(Version 07.0)**

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

**MONITORING REPORT**

<b>Title of the project activity</b>	Social Education and Development Society (SEDS) Biogas CDM project for the rural poor	
<b>UNFCCC reference number of the project activity</b>	3541	
<b>Version number of the PDD applicable to this monitoring report</b>	14	
<b>Version number of this monitoring report</b>	01	
<b>Completion date of this monitoring report</b>	18/03/2020	
<b>Monitoring period number</b>	05	
<b>Duration of this monitoring period</b>	01/01/2018 to 31/12/2019 (first and last days included)	
<b>Monitoring report number for this monitoring period</b>	01	
<b>Project participants</b>	M/s Social Education and Development Society (SEDS) (Host Country)  Evangelisches Werk für Diakonie und Entwicklung e.V. (Annex I Country)	
<b>Host Party</b>	India	
<b>Applied methodologies and standardized baselines</b>	AMS. I.E. Switch from non-renewable biomass for thermal applications by the user. Version 7.	
<b>Sectoral scopes</b>	1	
<b>Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period</b>	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0 tCO <sub>2</sub>	24,623 tCO <sub>2</sub>
<b>Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD</b>	31,498 tCO <sub>2</sub> e	

## SECTION A. Description of project activity

### A.1. General description of project activity

>> The purpose of this biogas CDM Project activity is to set up 5,000 biogas plants (digesters) of 2 m<sup>3</sup> capacity each for single households in 5 Mandals of Anantapur District. Each household has installed a 2 m<sup>3</sup> biogas plant and feed cattle dung into the anaerobic digester for the production of biogas for cooking purpose and heating 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 in this way replace non-renewable biomass with biogas for cooking and hot water heating.

Anantapur is a drought prone region, with very meagre forest area. Nearly 90% of 3.37 t of biomass used per family per year for cooking and heating water in the District is non-renewable. By burning this firewood, the users were causing emission of greenhouse gases in the baseline. In the project activity, fuel wood is replaced with the renewable biogas, thus avoiding greenhouse gas emissions of the baseline.

The 5,000 biogas units were constructed during the first crediting period. This is the second crediting period. During this period, there were no construction and only monitoring of the systems, repair and maintenance of damaged systems are done.

### A.2. Location of project activity

- (a) >> Host Parties: India
- (b) Region/State/Province: Andhra Pradesh
- (c) City/Town/Community: Anantapur District, 5 Mandals – Penukonda, Roddam, Somandepalli, Gorantla and Chilamathur.
- (d) Physical/Geographical location:

Anantapur District lies between 13°-40' and 15°-15' Northern Latitude and 76°-50' and 78°-30' Eastern Longitude. It is bound by Bellary, Kurnool District on the North, Cuddapah and Kolar Districts of Karnataka on South East and North respectively. The coordinates of the Mandals are as follows:

Mandals	Co-ordinates
Penukonda	14° 05' 00" North, 77° 35' 00" East
Roddam	14° 06' 00" North, 77° 26' 00" East
Somandepalli	14° 00' 44" North, 77° 36' 30" East
Gorantla	13° 59' 21" North, 77° 46' 13" East
Chilamathur	13° 34' 25" North, 80° 00' 12" East

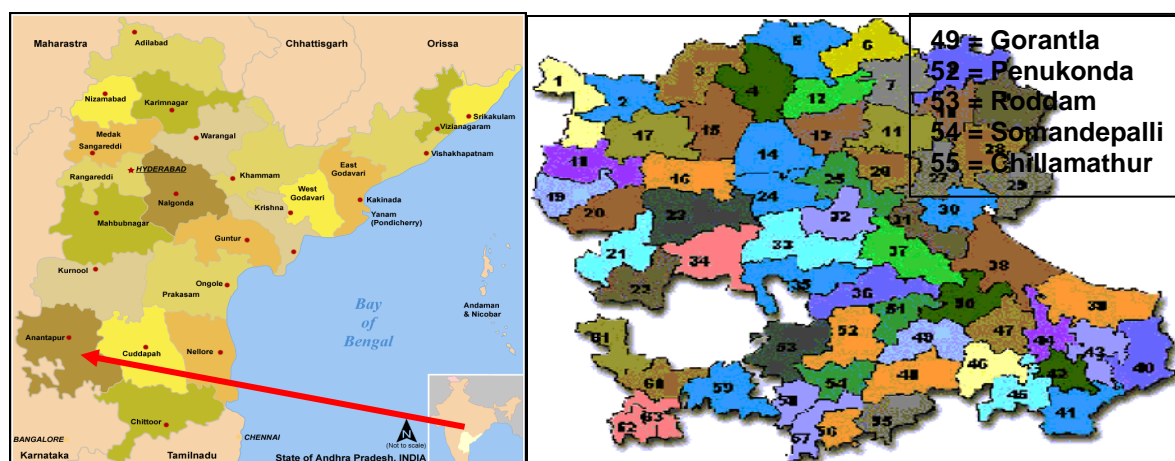


Fig 1: Map of Andhra Pradesh with an arrow indicating the location of Anantapur district and Anantapur district showing the Mandals in which the project is implemented

**A.3. 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: M/s Social Education and Development Society (SEDS)	No
Germany (Annex I)	Evangelisches Werk für Diakonie und Entwicklung e.V.	No

**A.4. References to applied methodologies and standardized baselines**

>> TYPE I - RENEWABLE ENERGY PROJECTS, I.E. Switch from Non-Renewable Biomass for Thermal Applications by the User, Version 07.

**A.5. Crediting period type and duration**

>>

- (a) Type: Renewable
- (b) Start Date: 01/01/2011 for the first crediting period;  
01/01/2018 for the second crediting period
- (c) Length of the crediting period: 7 yrs – 0 months  
First Crediting Period (01 Jan 11 - 31 Dec 17)  
Second Crediting Period (01 Jan 18 - 31 Dec 24)
- (d) Monitoring Period corresponding to this Verification: 01/01/2018 – 31/12/2019

**SECTION B. Implementation of project activity****B.1. Description of implemented project activity**

>> The biogas plant (Deenabandhu 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 will be provided to supply biogas to a 2-ring stove inside the house.

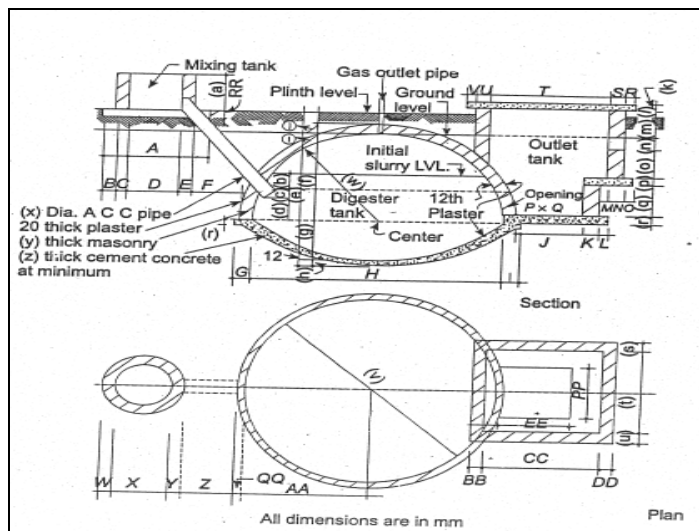


Fig 2: Diagram of a cross-section of the Deenabandhu 2 m<sup>3</sup> biogas model

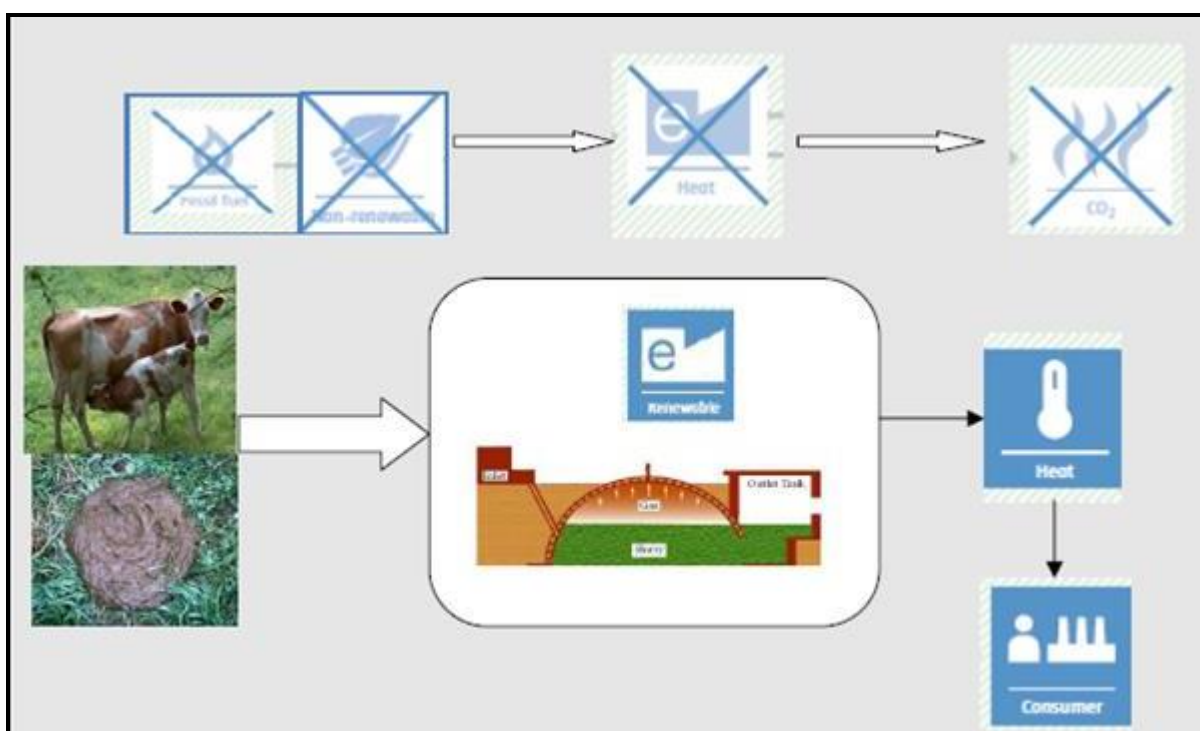


Fig 3: Technical process and equipment of biogas unit



Fig 4: Constructed Deenabandhu Biogas Unit and Biogas Stove in the kitchen

- (a) Information on the implementation and actual operation of the project activity, including relevant dates (e.g. construction, commissioning, start of operation).

- The 5,000 biogas units are constructed and commissioned during the first crediting period.
- This crediting period, only repair and maintenance of constructed units were done. The details of constructed and commissioned biogas units are as follows:

<b>Mandal</b>	<b>Number of Villages</b>	<b>Number of Households</b>
Chilamathur	70	1,030
Gorantla	82	1,058
Penukonda	33	481
Roddam	57	1,544
Somandepalli	44	887
<b>Total</b>	<b>286</b>	<b>5,000</b>

<b>Month and Year of Construction</b>	<b>Number of Households</b>
February 2011	7
March 2011	16
April 2011	8
May 2011	21
June 2011	114
July 2011	156
August 2011	215
Sept 2011	197
Oct 2011	89
Nov 2011	74
Dec 2011	162
January 2012	240
Feb 2012	194
March 2012	145
April 2012	154
May 2012	87
June 2012	55
July 2012	46
August 2012	129
Sept 2012	84
Oct 2012	114
Nov 2012	163
Dec 2012	113
January 2013	68
February 2013	52
March 2013	40
April 2013	46
May 2013	22
June 2013	27
July 2013	31
August 2013	38
September 2013	51
Oct 2013	40
Nov 2013	17
Dec 2013	28

Jan 2014	52
Feb 2014	99
March 2014	37
April 2014	59
May 2014	55
June 2014	32
July 2014	19
August 2014	40
Sept 2014	114
Oct 2014	72
Nov 2014	67
Dec 2014	169
January 2015	131
February 2015	111
March 2015	140
April 2015	97
May 2015	90
June 2015	77
July 2015	70
August 2015	11
Nov 2015	127
Dec 2015	219
January 2016	27
Feb 2016	3
April 2016	35
Aug 2016	4
<b>Grand Total</b>	<b>5000</b>

All the 5,000 units were commissioned during the first crediting period. The units are monitored for their continuous operation, including units under repair and maintenance during the monitoring period. The downtime for each of the unit has been recorded, and emission reductions has been discounted for days not used. A detailed breakdown time for each of the biogas unit is shown in the ER Calculations excel sheet.

## **B.2. Post-registration changes**

### **B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents**

>> There are no temporary deviations from the registered monitoring plan or other methodological regulatory documents.

### **B.2.2. Corrections**

>> There are no corrections to project information or parameters fixed at validation.

### **B.2.3. Changes to the start date of the crediting period**

>> There are no changes to start date of crediting period



**B.2.4. Inclusion of monitoring plan**

>> There is no inclusion of a monitoring plan to the registered PDD that was not included at registration.

**B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents**

>> There are no permanent changes to the registered monitoring plan or other methodological regulatory documents.

**B.2.6. Changes to project design**

>> There are no changes to the registered project design in this Monitoring Report for the period 01/01/2018 to 31/12/2019.

**B.2.7. Changes specific to afforestation or reforestation project activity**

>> Not Applicable

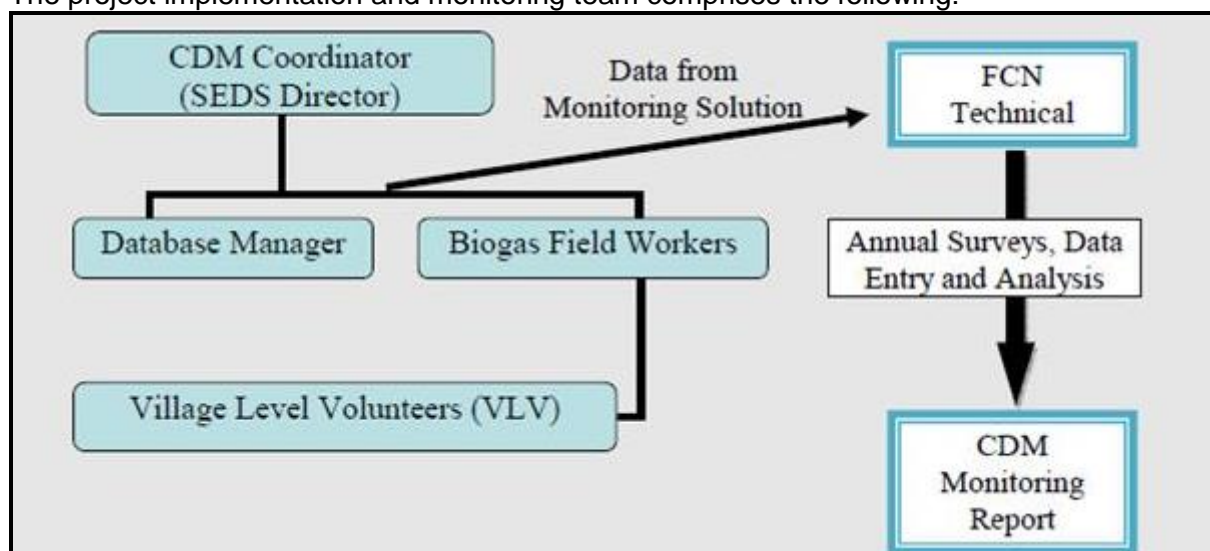
**SECTION C. Description of monitoring system**

**>> Project Management/Team structure**

This biogas CDM project is implemented and monitored by the Social Education and Development Society (SEDS). The project has constructed and commissioned 5,000 biogas units for 5,000 households who are members of the SEDS village organisational network in 286 villages.

The SEDS CDM Coordinator manages the project on a full time basis. During construction phase, one data manager and 11 biogas field workers worked to ensure movement of material and construction of biogas units in the project area. 91 masons were trained by masons from the neighboring Chickballapur district (with 2 CDM biogas project activities) to construct biogas units. These masons were contracted on a piece-rate basis for the construction of the biogas units. The village level volunteers (VLV) selected at the village level monitor the biogas units. They maintain a daily usage register for each of the unit built in their village. This data is collected by the biogas field workers and entered into the digitized monitoring system on a monthly basis.

The project implementation and monitoring team comprises the following:

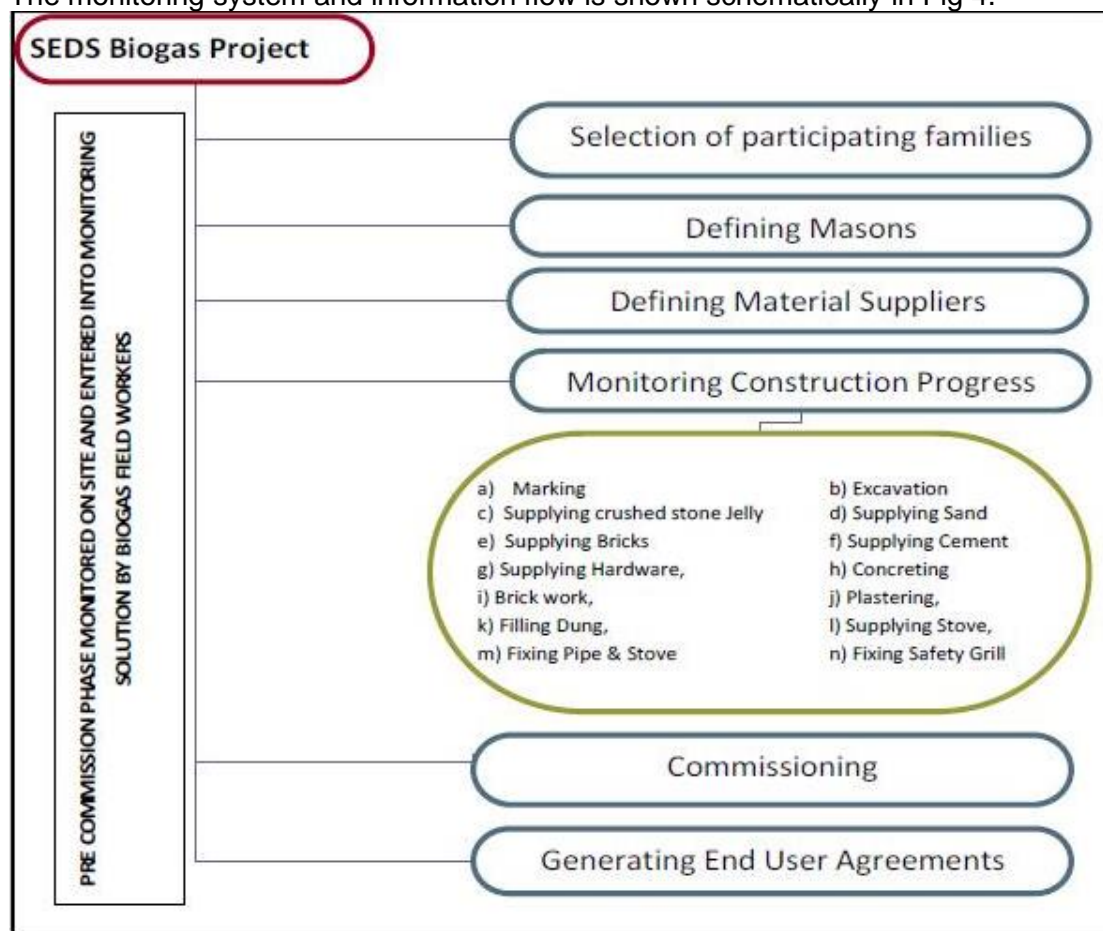


A digitized monitoring system, custom built for monitoring this Biogas CDM Project, by Tristle Technologies Pvt. Ltd is in use on a day-to-day basis. Data entry is done on a regular basis, which generates real-time Progress Reports. Inputting data into this monitoring solution is permission driven – i.e. each Biogas Field Worker can record construction progress of only those villages entrusted to them. Progress and Analytical Reports is very transparent and open for everyone.

After the construction and satisfactory functioning of each biogas plant for a minimum of 7 days, an end user agreement on legal paper was signed with the respective beneficiary, and this date is considered as the day of commissioning of that particular biogas unit. Thus, from day 1 of the commissioning of the biogas plant, full account of emission reduction is considered.

The village level volunteer through regular monitoring, records if any unit is dysfunctional. The beneficiaries also telephonically call the village level volunteers/Biogas Field Workers, to report dysfunctional units. They inform the biogas field worker who will visit the unit and assess the requirements. Thus, all the constructed biogas units are monitored for their operation.

The monitoring system and information flow is shown schematically in Fig 4.





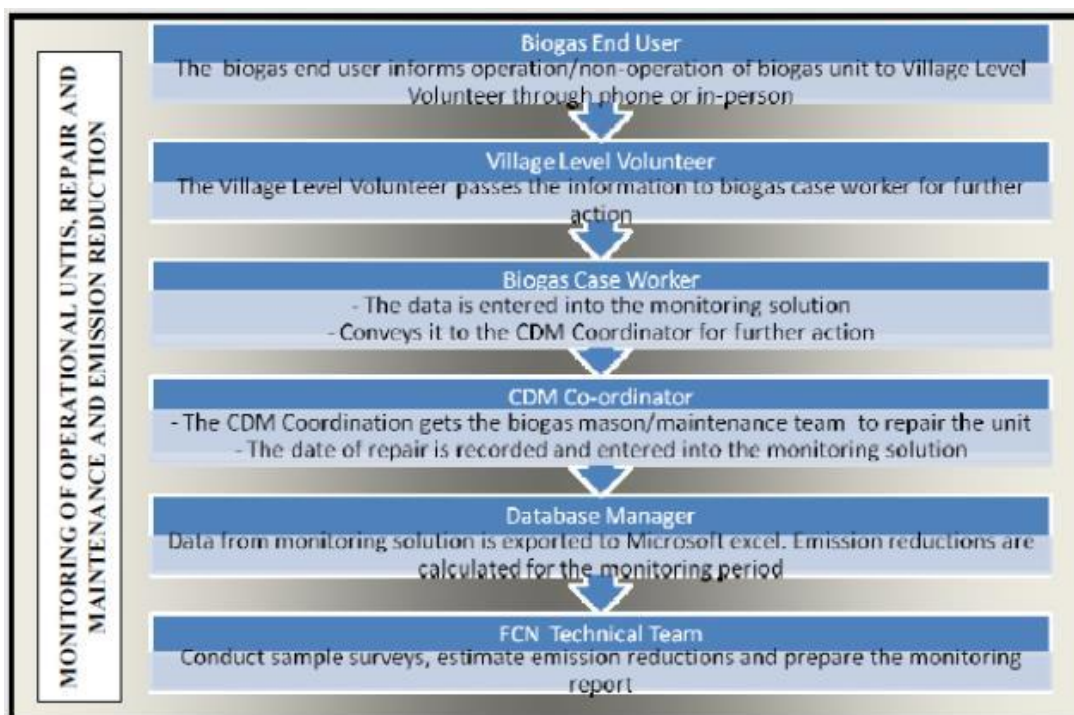


Fig 4: Schematic diagram of monitoring system and information flow in the project activity

## Monitoring system

### Data collection procedures

**Data Generation:** The data of construction processes as shown above from marking for the biogas unit to commissioning the biogas unit was recorded and entered into the monitoring database by the Biogas Field Workers. The end users of biogas units under the CDM project activity signed an end-user agreement, which contains details of the end-user, the Unit ID number, date of commissioning of biogas and other terms and conditions. These agreements are notarized legal agreements countersigned by the End User and SEDS, the NGO. This was done during the 1<sup>st</sup> crediting period.

The non-usage biogas days are recorded and entered into the monitoring database. The data entered into the monitoring database is exported to excel sheet for analysis. The generated data is used for emission reduction calculations.

### Data Aggregation and Recording

**Biogas Construction:** The biogas construction processes are monitored on a day-to-day basis and database maintained from its initiation to completion dates for each of the biogas unit. During construction phase, suppliers and masons were identified with personal data and digital photographs fed into the computerized databank for verification.

A digitized monitoring database system, custom built by Tristle Technologies Pvt. Ltd., is used to enter data to generate real-time data. Inputting data into this monitoring solution and non-usage days is done on a regular basis.

Each of the biogas unit has been marked with the Unit ID, which makes it distinct. These evidences validate the construction and commission of total 5,000 biogas plants built in the project area.

The list of biogas users are identified by a User ID, the name of the beneficiary, the village and the Mandal (*CER Calculations excel sheet*). The start date of construction, the processes during construction till the date of commissioning were monitored and entered into the database.

**Biogas End User Report**

101 002 Padmavathi

Unit ID: 1613  
 Name: 002 Padmavathi  
 Village: 101 Arumakulapallil  
 Gram Panchayat: Tekuldo  
 Taluk/Mandal: Chillamathur  
 Caste: Kapu / Reddy  
 House: Brick Walls Stone Roof – 19 ft x 18 ft  
 Family Strength: 4  
 Commissioned on: 16 January 2012  
 Biogas Unit Age: 12 months  
 Mason: [39\\_kotiopalli - P. Venkatesulu](#)

**Unit Details**

Date	Process	Monitored By	Days taken
19 Nov 2011	Mark	venkatesh	0 days
20 Nov 2011	Excavate	venkatesh	1 days
24 Nov 2011	Supply Cement	venkatesh	5 days
25 Nov 2011	Supply Bricks	venkatesh	6 days

**Fig 5: Screen Shot of the Monitoring database solution**

**Non-Usage Days:** The information on biogas non-usage days are recorded by the VLV or Biogas Field Workers. The end users also communicate through mobile phones either to VLV or Biogas Field Workers. The information is updated to the individual biogas user's Monitoring Database on a regular basis.

**Data Storage for calculations of emission reductions:** The parameters monitored daily during construction of the units were entered into the Monitoring Database for each of the biogas unit.

The non-usage days of biogas units are recorded and entered into the Monitoring Database on a regular basis.

Thus, data of all processes of biogas construction and non-usage is stored and maintained at the SEDS head office on the SEDS Monitoring Database.

The data of surveys conducted as described in section D.3 was entered into excel sheets and analysed. This data is stored on paper and electronically.

**Calculation and reporting:** The data generated through monitoring is stored in the SEDS monitoring database. From this database, data is exported to Microsoft excel sheets, which is used for emission reduction calculations and reporting.

The emission reduction calculations in excel sheet submitted to the DOE is thus transparent and verifiable with the SEDS Monitoring Solution.

**QA & QC procedures and emergency procedures for the monitoring system:** After selection of the beneficiary, an agreement between SEDS and the Beneficiary of SEDS Biogas Project was signed, For each of the unit, the dates of material supply and the processes are maintained on paper, which is entered into the monitoring database. All the monitoring books are maintained at the SEDS head office. The statutory reports, receipts and payments made for the construction are maintained for verification.

Each unit has the unit ID number and date of construction etched on it for field identification and cross check.

Tristle Monitoring Solution has its own software for data backup and restore. The Data Manager has to just select the path and save the backup. This software will back up the entire Database along with photographs. In addition, SEDS does a backup on a daily basis on the server, including the Tristle Monitoring Solution Pvt. Ltd.

Quality Control was ensured wherein the end-user supervised the construction, checked the quality of installed biogas plants to ensure that the required materials were used for the construction of biogas units. They endorsed the installation through a signed beneficiary acknowledgement, after which the end user agreement was signed. Suppliers and masons were identified with personal data and digital photographs fed into the computerized databank for verification.

The data from the monitoring solution is analysed and emission reduction calculated independently by FCN Technical Team. FCN Tech Team also conducted annual surveys for inclusion in the Monitoring Report. Thus, a third party is involved in preparation of CDM Monitoring Report.

## SECTION D. Data and parameters

### D.1. Data and parameters fixed ex ante

<b>Data/Parameter</b>	$f_{NRB,y}$
Unit	<i>Fraction</i>
Description	Fraction of woody biomass saved by the project activity during year y that can be established as non-renewable biomass
Source of data	Assessment of Non Renewable Biomass based on data provided by Forest Survey of India, 2011, Ministry of Environment and Forests, Government of India.
Value(s) applied	0.95
Choice of data or measurement methods and procedures	Based on data from State of Forest Report, 2011. Forest Survey of India, Ministry of Environment and Forests, Government of India. The data gives the consumption of fuel wood and production of fuel wood from forests and from trees outside forests. This data is assessed at the state level. Thus the $f_{NRB}$ for Andhra Pradesh is applied for the project activity.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This parameter is fixed for the entire crediting period. The $f_{NRB}$ calculations is based on the latest available statistics of the Forest Survey of India, Government of India. Further, $f_{NRB}$ calculations done at the project activity level, i.e. Anantapur district, based on latest statistics gives a value of 0.98. As this value is conservative, it has been used.

<b>Data/Parameter</b>	$N_{HH}$
Unit	Number
Description	Number of households in the project activity in year y
Source of data	Online Monitoring Solution
Value(s) applied	5,000
Choice of data or measurement methods and procedures	<b>Established ex ante prior to start of the project activity</b>
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	During calculation of Emission Reduction, it will be based on actual number of households in which the units have been constructed and commissioned

<b>Data/Parameter</b>	<b>BC<sub>BL,HH,y</sub></b>
Unit	tonnes/year/family
Description	Average annual consumption of woody biomass per household before the start of the project activity, tonnes/household/year
Source of data	Based on survey in the project region during 2016-17 as mentioned in the methodology
Value(s) applied	2.85 tonnes/year/family and 14,257 t/year for 5,000 families
Choice of data or measurement methods and procedures	Calculated using option (a) Calculated as the product of the number of households multiplied by the estimate of average annual consumption of woody biomass per household displaced by the project activity (tonnes/household/year).
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This parameter is fixed for the entire crediting period. According to CDM-EB93-A04-STAN Standard CDM project standard for project activities, 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". 85.71% of the rural population in Anantapur district still use fuelwood for cooking and hence the new circumstances have not impacted the baseline scenario. Based on a survey conducted during 2016-17, the fuelwood use has been updated, which is lesser than that considered for the first crediting period.

<b>Data/Parameter</b>	<b>Diversion of non-renewable biomass saved under the project activity by non-project households</b>
Unit	tonnes / year
Description	Diversion of non-renewable biomass saved under the project activity by non-project households
Source of data	Based on the methodology B <sub>y</sub> will be multiplied by a net to gross adjustment factor of 0.95 to account for leakages.
Value(s) applied	The parameter shall be adjusted for leakage, wherein B <sub>y</sub> will be multiplied by 0.95, which is fixed for the crediting period.  Biomass (t) – 2.85 x 0.95 = 2.71 t/yr for 365 days. The biomass diversion is 2.85 – 2.71 = 0.14 t/family/yr.
Choice of data or measurement methods and procedures	According to I.E, Version 07, B <sub>y</sub> can be multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required. 2.85 x 0.95 = 2.71 t/household/yr. Thus the diversion is 2.85 – 2.71 = 0.14 t/family/yr.
Purpose of data/parameter	Calculation of leakage
Additional comments	This parameter is fixed for the entire crediting period. Surveys will not be conducted to determine leakage

## D.2. Data and parameters monitored

<b>Data/Parameter</b>	Date of commissioning of project device of type <i>i</i>
Unit	Date
Description	Actual date of commissioning of the project device.
Measured/calculated/default	Measured

Source of data	Internal records – Monitoring Solution
Value(s) of monitored parameter	The dates of commissioning of biogas for the 5,000 houses is shown in the CER calculations sheet for each of the beneficiary
Monitoring equipment	Fixed and recorded at the time of commissioning
Measuring/reading/recording frequency	5000 biogas units, i.e.100% of the units was monitored from the procurement of material till construction and commissioning of the biogas units
Calculation method (if applicable)	There is no calculations method. The date of commissioning is recorded in the monitoring solution based on monitored field data.
QA/QC procedures	This can be triangulated with the receipts and audit statements for the project
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	End use agreements with the users will provide additional information of the units commissioned

<b>Data/Parameter</b>	$NCV_{biomass}$
Unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass, briquettes or charcoal used in project devices
Measured/calculated/default	Default
Source of data	Methodology I.E. Version 07.
Value(s) of monitored parameter	0.015 TJ/tonne
Monitoring equipment	As the baseline fuel is woody biomass, based on the methodology, 0.015 TJ/tonne is the value applied
Measuring/reading/recording frequency	Yearly
Calculation method (if applicable)	There is no calculations method. This is based on the methodology.
QA/QC procedures	There were no units commissioned during this monitoring period falling under the second crediting period. The annual survey conducted showed fuelwood as the only alternate use.
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	All the units were commissioned in the first crediting period.

<b>Data/Parameter</b>	$BC_{PJ.HH.y}$
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
Measured/calculated/default	Measured
Source of data	-From the online monitoring solution which has the data entered from continuous monitoring for non-usage -From annual survey of all households for fuelwood use on traditional stoves in parallel to biogas units.
Value(s) of monitored parameter	For the monitoring period, the fuelwood used due to non-usage of biogas due to repair and maintenance was 5,864.64 t, while due to parallel use of traditional stove, accounted to 345.06 t.

- As and when the biogas units are not functional, the beneficiaries report to the village level volunteer, who in turn reports to the Biogas Field 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 of continuous monitoring was entered into the monitoring solution by the Village Volunteers.

The days the units are not used due to other reasons such as migration, are also accounted as days when the woody biomass was used.

Depending on the number of days the units are not working, the  $BC_{PJ,HH,y}$  woody biomass consumption was determined based on the baseline fuelwood use that would have been used in the absence of the project activity. So essentially it is based on data monitored for non-usage. For ex. if the unit was not used for 30 days in a year, the proportional woody biomass used is  $2.85/365 \times 30 \text{ days} = 0.234 \text{ t}$ .

Reason for not using biogas	Fuelwood use due to non-functioning of biogas (t)
Animals Sold	753.04
Dome crack	550.3
Empty and Replaster Dome	26.7744
No gas formation	3867.58
House Not Interested to use biogas	54.1344
Migrated	121.652
Kitchen not Used	1.84274
Repair Gas Pipe	66.2605
Repair Inlet Tank	39.7438
Repair Outlet Tank	43.6401
Repair Stove	13.2896
Replace Gas Pipe	2.80315
Replace Stove	0.8511
Replaster Dome (out side)	54.8293
Unit Demolished	267.9
<b>Total</b>	<b>5864.64</b>

-In addition, the parallel use of traditional stoves with biogas was also monitored for all the systems. The village volunteers also monitored the activities for which woody fuelwood was used. This was collected once a year for all households with operational biogas units. For ex., if water heating is done using fuelwood weekly thrice for 6 months/year, it was recorded for the household. The annual survey was conducted for the year 2018 and 2019. The surveys were conducted during the end of the year during November to December for both the years.

A Kitchen test was conducted to assess the quantity fuelwood (@90/10 confidence/precision level) used for each of the activity, i.e. Fodder Preparation, Hot Water for Bathing, Cook Rice, Cook Lentils/Dal, Cook Vegetables/Curry, Make Tea Only, Cook Ragi Meal, Make Non-Vegetarian Dishes. These are the common food that is cooked in the region. This proportion of baseline fuelwood was deducted for parallel use of woody biomass for the particular food type for which the traditional stove was used. The woody biomass determined for cooking various food items with the Kitchen test done will be applied for the entire second crediting period. Based on the surveys and the Kitchen test, the overall parallel use of fuelwood for the monitoring period along with biogas for some of the food items is as follows:

Monitoring equipment



	Year	2018	2019	Total																																		
	Fuelwood use due to parallel use of traditional stoves (t)	155.89	189.17	345.06																																		
Measuring/reading/recording frequency	i. Continuous monitoring for all the biogas units for non-usage due to repair and maintenance ii. Annual Survey of all households with functional biogas units to determine the average annual consumption of fuelwood due to parallel use of baseline stoves																																					
Calculation method (if applicable)	<p>Will range from 0 to 2.85 t/HH/year, depending on the extent of usage of traditional stoves in absence/parallel to biogas. Monitoring consisted of estimation of all project devices.</p> <p>For days biogas was not used the per day fuelwood usage was determined. For ex. Biogas unit not used for a month, the fuelwood use is <math>(2.85/365)*30 = 0.2342</math> t of fuelwood use.</p> <p>A Kitchen test was done to assess the average fuelwood use (@90/10 confidence/precision level) used for each of the common cooking item for non-project households where only traditional stoves are used, i.e. i. cooking rice/vegetable, ii. Heating water iii. Making fodder for livestock, etc.</p> <p>The kitchen test was conducted for 10 households, 2 from each Mandals to assess the fuelwood use for each of the cooking item during January 2019. The number of household members was 4-5. Fuelwood was weighed before cooking. After cooking the remaining fuelwood was weighed to determine the quantity of fuelwood used. The determination of fuelwood required for all the various food items was done in the same 10 selected households. The mean and standard deviation was calculated from the 10 household data to assess if it met the required sample size and was within the required confidence/reliability. Accordingly, the sample size returned are as follows:</p> <table border="1"> <thead> <tr> <th>Food Item</th> <th>Number of samples required based on 10 samples</th> </tr> </thead> <tbody> <tr> <td>Fodder Preparation (KG)</td> <td>1</td> </tr> <tr> <td>Hot Water for Bathing (KG)</td> <td>5</td> </tr> <tr> <td>Cook Rice (KG)</td> <td>4</td> </tr> <tr> <td>Cook Lentils/Dal (KG)</td> <td>1</td> </tr> <tr> <td>Cook Vegetables/Curry (KG)</td> <td>1</td> </tr> <tr> <td>Make Tea Only (KG)</td> <td>2</td> </tr> <tr> <td>Cook Ragi Meal (KG)</td> <td>1</td> </tr> <tr> <td>Make Non-Vegetarian Dishes (KG)</td> <td>1</td> </tr> </tbody> </table> <p>The sample size is adequate as 10 households were sampled. The average fuelwood use as proportion for each of the food item to the total fuelwood was determined. The proportion of fuelwood use was as follows:</p> <table border="1"> <tbody> <tr> <td>Fodder Preparation</td> <td>15.71%</td> </tr> <tr> <td>Hot Water for Bathing</td> <td>30.04%</td> </tr> <tr> <td>Cook Rice</td> <td>9.30%</td> </tr> <tr> <td>Cook Lentils/Dal</td> <td>10.43%</td> </tr> <tr> <td>Cook Vegetables/Curry</td> <td>9.29%</td> </tr> <tr> <td>Make Tea Only</td> <td>1.62%</td> </tr> <tr> <td>Cook Ragi Meal</td> <td>10.80%</td> </tr> <tr> <td>Make Non-Vegetarian Dishes</td> <td>12.82%</td> </tr> </tbody> </table>				Food Item	Number of samples required based on 10 samples	Fodder Preparation (KG)	1	Hot Water for Bathing (KG)	5	Cook Rice (KG)	4	Cook Lentils/Dal (KG)	1	Cook Vegetables/Curry (KG)	1	Make Tea Only (KG)	2	Cook Ragi Meal (KG)	1	Make Non-Vegetarian Dishes (KG)	1	Fodder Preparation	15.71%	Hot Water for Bathing	30.04%	Cook Rice	9.30%	Cook Lentils/Dal	10.43%	Cook Vegetables/Curry	9.29%	Make Tea Only	1.62%	Cook Ragi Meal	10.80%	Make Non-Vegetarian Dishes	12.82%
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QA/QC procedures	<p>Though the methodology requires sample survey biannually, continuous monitoring was done, to ensure that the households use biogas with proper repair and maintenance.</p> <p>The results of the kitchen test was within the required confidence and reliability requirements.</p> <table border="1"> <thead> <tr> <th>Food Items</th> <th>Reliability</th> </tr> </thead> <tbody> <tr> <td>Fodder Preparation (KG)</td> <td>6.58%</td> </tr> <tr> <td>Hot Water for Bathing (KG)</td> <td>6.99%</td> </tr> <tr> <td>Cook Rice (KG)</td> <td>5.96%</td> </tr> <tr> <td>Cook Lentils/Dal (KG)</td> <td>3.03%</td> </tr> <tr> <td>Cook Vegetables/Curry (KG)</td> <td>2.47%</td> </tr> <tr> <td>Make Tea Only (KG)</td> <td>4.64%</td> </tr> <tr> <td>Cook Ragi Meal (KG)</td> <td>3.52%</td> </tr> <tr> <td>Make Non-Vegetarian Dishes (KG)</td> <td>3.23%</td> </tr> </tbody> </table>	Food Items	Reliability	Fodder Preparation (KG)	6.58%	Hot Water for Bathing (KG)	6.99%	Cook Rice (KG)	5.96%	Cook Lentils/Dal (KG)	3.03%	Cook Vegetables/Curry (KG)	2.47%	Make Tea Only (KG)	4.64%	Cook Ragi Meal (KG)	3.52%	Make Non-Vegetarian Dishes (KG)	3.23%
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Purpose of data/parameter	Calculation of Baseline emissions																		
Additional comments	ERs will be accounted only for functional days of the units																		

<b>Data/Parameter</b>	<b>B<sub>y</sub></b>
Unit	tonnes /year
Description	Quantity of woody biomass that is substituted or displaced
Measured/calculated/default	Calculated
Source of data	Based on continuous monitoring
Value(s) of monitored parameter	For each of the family it ranged from zero when biogas is not used to 2.85 tonnes/ year/ family. For the monitoring period, it accounted for 22,290.299 t.
Monitoring equipment	There are no monitoring equipment
Measuring/reading/recording frequency	Continuous monitoring
Calculation method (if applicable)	Calculated as $B_y = N_{HH} \times (BC_{BL,HH,y} - BC_{PJ,HH,y})$
QA/QC procedures	Continuous monitoring of all biogas units was done to estimate B <sub>y</sub>
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	ERs will be accounted only for functional days of the units

### D.3. Implementation of sampling plan

>> The parameters that will be required for calculation of emission reductions are the date of commissioning of the biogas units, units that are operational and the biogas units that are under repair and not operational. These parameters are monitored by the village volunteers and the biogas case workers on a continuous basis and entered into the monitoring solution. Further,

parallel use of traditional stoves was monitored annually at household level. These together determines  $BC_{PJ,HH,y}$ .

Hence the project activity does not rely on sample surveys.

Only the Kitchen test which will be done once during the crediting period was conducted during January 2019. The average fuelwood use for cooking each of the food item was determined.

A Kitchen test was done to assess the average fuelwood use to the total fuelwood use of the family (@90/10 confidence/precision level) for each of the common cooking item for non-project households where only traditional stoves are used, i.e. i. cooking rice/vegetable, ii. Heating water iii. Making fodder for livestock, etc.

The kitchen test was conducted for 10 households, 2 from each Mandal to assess the fuelwood use for each of the cooking item during January 2019. The number of household members was 4-5. Fuelwood was weighted and used before cooking. After cooking the particular food item, the remaining fuelwood was weighed to determine the quantity of fuelwood used. The determination of fuelwood required for all the various items was done in the same 10 selected households. The mean and standard deviation was calculated from the 10 household data to assess if it met the required sample size and was within the required confidence/reliability.

The sample size was determined as follows:

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

where

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

Accordingly, the sample sizes returned are as follows:

Food Item	Number of samples required
Fodder Preparation (KG)	1
Hot Water for Bathing (KG)	5
Cook Rice (KG)	4
Cook Lentils/Dal (KG)	1
Cook Vegetables/Curry (KG)	1
Make Tea Only (KG)	2
Cook Ragi Meal (KG)	1
Make Non-Vegetarian Dishes (KG)	1

The sample size is adequate as 10 households were sampled. The average fuelwood for each of the food item was determined. The reliability of the data was determined as ½ width of confidence interval/mean x 100%. The reliability was achieved as shown below:

Food Items	Reliability
Fodder Preparation (KG)	6.58%
Hot Water for Bathing (KG)	6.99%
Cook Rice (KG)	5.96%
Cook Lentils/Dal (KG)	3.03%

Cook Vegetables/Curry (KG)	2.47%
Make Tea Only (KG)	4.64%
Cook Ragi Meal (KG)	3.52%
Make Non-Vegetarian Dishes (KG)	3.23%

The average fuelwood use was represented as proportion for each of the food item to the total fuelwood. The proportion of fuelwood use was as follows:

Fodder Preparation	15.71%
Hot Water for Bathing	30.04%
Cook Rice	9.30%
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This proportion of baseline fuelwood was deducted for parallel use of woody biomass. For ex. heating water accounts for 30.04% of fuelwood use. If it was used for 3 days/week for 6 months/year, the calculations are  $(2.85 \times 30.04\%) / 365 \times 6 \text{ months} \times 4 \text{ weeks} \times 3 \text{ days} = 0.1688 \text{ t/year}$ .

This value obtained during the Kitchen test done will be applied for the entire second crediting period.

## SECTION E. Calculation of emission reductions or net anthropogenic removals

### E.1. Calculation of baseline emissions or baseline net removals

>> Baseline emissions would be calculated as:

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

$B_y$  is determined by using option (a) which is as follows:

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).

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

$$B_y = 5000 \times (5.7 - 1.24) = 22290.299 \text{ t}$$

Baseline emissions		
Activity Data	Value	ID Ref
Quantity of Biomass substituted (t/yr) for 5,000 families	22,290	$B_y$
Fraction of NRB ( $f_{NRB}$ )	95%	$f_{NRB,y}$
NCV Biomass (TJ/t)	0.015	$NCV_{biomass}$
Emission factor (tCO <sub>2</sub> /TJ)	81.6	$EF_{projected\_fossil\_fuel}$

<b>Baseline emissions (tCO<sub>2</sub>/yr/5,000 family)</b>	<b>25,919</b>	<b>BE<sub>y</sub></b>
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### E.2. Calculation of project emissions or actual net removals

>> There is no cultivation of biomass for the project activity. Hence a project emission is zero.

$$PE_y = 0$$

### E.3. Calculation of leakage emissions

>> B<sub>y</sub> is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys will not be required.

Thus B<sub>y</sub> is considered as 22,290 t x 0.95 = 21,176 t Thus survey was not conducted to account for leakage.

### E.4. Calculation of emission reductions or net anthropogenic removals

After considering leakage, the emission reductions were calculated as follows:

Baseline emissions		
Activity Data	Value	ID Ref
Quantity of Biomass substituted (t/yr) after considering leakage	21,176	B <sub>y</sub>
Fraction of NRB (f <sub>NRB</sub> )	95%	f <sub>NRB,y</sub>
NCV Biomass (TJ/t)	0.015	NCV <sub>biomass</sub>
Emission factor (tCO <sub>2</sub> /TJ)	81.6	EF <sub>projected_fossil_fuel</sub>
<b>Emissions Reductions (tCO<sub>2</sub> for the monitoring period)</b>	<b>24,623</b>	<b>BE<sub>y</sub></b>

	Baseline GHG emissions or baseline net GHG removals (t CO <sub>2</sub> e)	Project GHG emissions or actual net GHG removals (t CO <sub>2</sub> e)	Leakage GHG emissions (t CO <sub>2</sub> e)	GHG emission reductions or net anthropogenic GHG removals (t CO <sub>2</sub> e)		
				Before 01/01/2013	From 01/01/2013	Total amount
<b>Total</b>	<b>25,919</b>	<b>0</b>	<b>1,296</b>	<b>0</b>	<b>24,623</b>	<b>24,623</b>

### E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO <sub>2</sub> e)	Amount estimated ex ante for this monitoring period in the PDD (t CO <sub>2</sub> e)
24,623	31,498

#### E.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the PDD”

>> The amount estimated ex-ante is calculated as follows:

Activity Data	Value
B <sub>y</sub> (t/year/5000 family)	28,514
<b>B<sub>y</sub> adjusted for leakage (B<sub>y</sub> x 0.95) (t/year/5000 family)</b>	<b>27,088.30</b>

$f_{NRBy}$	0.95
$NCV_{biomass}$ (TJ/tonne)	0.015
$EF_{projected\ fossilfuel}$ (tCO <sub>2</sub> /TJ)	81.60
<b>ER generated/year/5,000 households</b>	<b>31,498</b>

**E.6. Remarks on increase in achieved emission reductions**

>> There is no increase in achieved emission reductions.

**E.7. Remarks on scale of small-scale project activity**

>> The project remains as a small-scale project activity, as the total capacity of the project activity for 5,000 units is 9 MW<sub>th</sub> and is below 45 MW<sub>th</sub>.



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### Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
07.0	31 May 2019	Revision to: <ul style="list-style-type: none"> <li>• Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN);</li> <li>• Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period;</li> <li>• Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes;</li> <li>• Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods;</li> <li>• Make editorial improvements.</li> </ul>
06.0	7 June 2017	Revision to: <ul style="list-style-type: none"> <li>• Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN);</li> <li>• Make editorial improvements.</li> </ul>
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> <li>• Include provisions related to delayed submission of a monitoring plan;</li> <li>• Provisions related to the Host Party;</li> <li>• Remove reference to programme of activities;</li> <li>• Overall editorial improvement.</li> </ul>
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> <li>• Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0));</li> <li>• Include provisions related to standardized baselines;</li> <li>• Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1;</li> <li>• Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>;</li> <li>• Editorial improvement.</li> </ul>
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).

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<i>Version</i>	<i>Date</i>	<i>Description</i>
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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Document Type: Form  
Business Function: Issuance  
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