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TEMPLATE

MONITORING REPORT

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VERSION v. 1.1

RELATED SUPPORT - TEMPLATE GUIDE Monitoring Report v. 1.1

This document contains the following Sections

Key Project Information

0 - Description of project

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KEY PROJECT INFORMATION

Key Project Information

GS ID (s) of Project (s)	GS849
Title of the project (s) covered by monitoring report	Social Education and Development Society (SEDS) Biogas CDM project for the rural poor
Version number of the PDD/VPA-DD (s) applicable to this monitoring report	Version of CDM PDD 14
Version number of the monitoring report	03
Completion date of the monitoring report	10/07/2023
Date of project design certification	1 st Crediting Period: 9/9/2010 2 nd Crediting Period: 31/05/2018
Date of Last Annual Report	16/12/2022
Monitoring period number	06
Duration of this monitoring period	01/01/2020 to 31/12/2021 (first and last date included)
Project Representative	Social Education and Development Society (SEDS)
Host Country	India
Activity Requirements applied	<input checked="" type="checkbox"/> Community Services Activities <input type="checkbox"/> Renewable Energy Activities <input type="checkbox"/> Land Use and Forestry Activities/Risks & Capacities <input type="checkbox"/> N/A
Methodology (ies) applied and version number	AMS. I.E. Switch from non-renewable biomass for thermal applications by the user. Version 7
Product Requirements applied	<input checked="" type="checkbox"/> GHG Emissions Reduction & Sequestration <input type="checkbox"/> Renewable Energy Label <input type="checkbox"/> N/A

Table 1 - Sustainable Development Contributions Achieved

Sustainable Development Goals Targeted	SDG Impact	Amount Achieved	Units/ Products
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SDG 3	<p>i. Continued improved indoor air condition and reduced respiratory problems especially for women and children.</p> <p>ii. Reduction of pathogens in slurry compared to that of dung</p>	<p>i. 100% families reported improved indoor air pollution and 100% reduction in health issues</p> <p>ii. Reduction of 94% pathogen levels in slurry compared to dung</p>
SDG 5	Reduction in drudgery of cooking and ease of cooking	Reduction in 44% of time for cooking and 18.7 wage days/HH/yr for collection.
SDG 7	<p>i. Construction and maintenance of biogas units for rural communities.</p> <p>ii. Maintenance of constructed biogas units and elimination of use of firewood.</p>	<p>i. Construction and maintenance of 5,000 biogas units for 5,000 households.</p> <p>ii. Maintenance of constructed biogas units leading to reduction 2.13 t of fuelwood/HH/Yr</p>
SDG 13	GHGs emissions reduction per year	12,786 tCO ₂ /Yr – 2020; 10,819 t/yr - 2021
SDG 17	i. Access to domestic or international carbon funding to implement clean technologies	Forward funding of Rs.89.83 million received for implementation, repair and maintenance and monitoring of the project activity.

Table 2 – Product Vintages

		Amount Achieved		
Start Dates	End Dates	GS VERs
01/01/2020	31/12/2020	12,786		
01/01/2021	31/12/2021	10,819		
Total		23,605		

SECTION A. DESCRIPTION OF PROJECT

A.1. General description of project

>>

THIS IS A GS CDM PROJECT. THE MONITORING REPORT IS SUBMITTED TO THE GOLD STANDARD FOR ISSUANCE OF GS VERs. THE MONITORING REPORT WILL NOT BE SUBMITTED AGAIN TO CDM FOR ISSUANCE OF CERs FOR THIS MONITORING PERIOD.

The purpose of this biogas CDM Project activity is to set up 5,000 biogas plants (digesters) of 2 m³ capacity each for single households in 5 Mandals of Anantapur District. Each household has installed a 2 m³ 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 95% of 2.85 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 were done.

A.2. Location of project

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(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

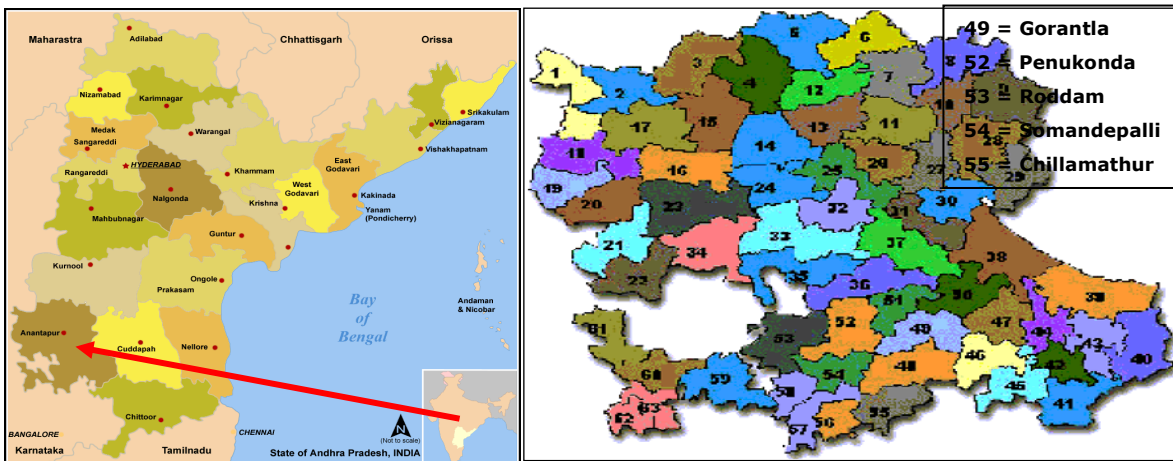


Fig 1: Map of Andhra Pradesh with an arrow indicating the location of Anantapur district and Anantapur district showing the Mandals in which the project is implemented

A.3. Reference of applied methodology

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

A.4. Crediting period of project

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(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: 01/01/2020 – 31/12/2021

SECTION B. IMPLEMENTATION OF PROJECT

B.1. Description of implemented project

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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.

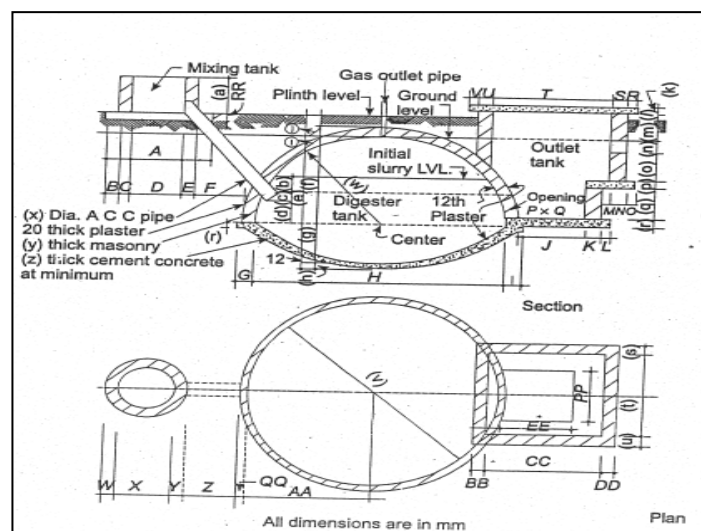


Fig 2: Diagram of a cross-section of the Deenabandhu 2 m³ biogas model

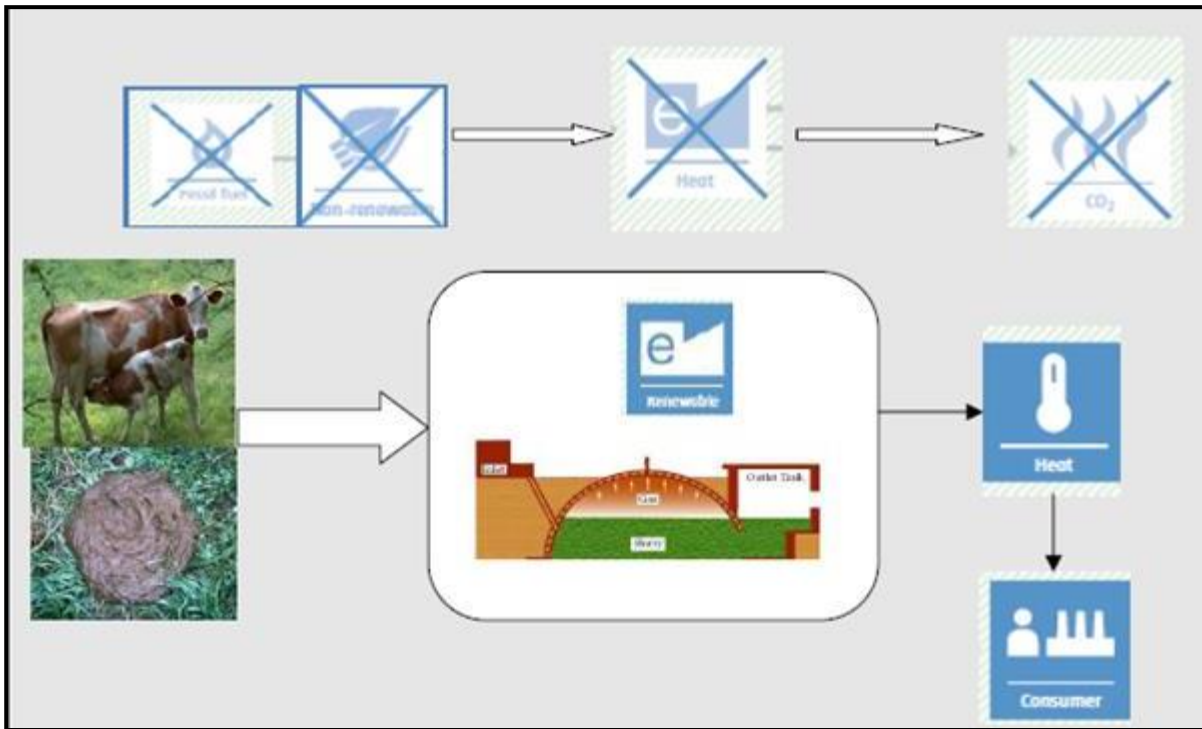


Fig 3: Technical process and equipment of biogas unit



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

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

Month and Year of Construction	Number of Households
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
Grand Total	5,000

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 this 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. In addition, the parallel use of traditional stoves/gas was also recorded and emission reductions not accounted for the equivalent fuelwood use.

B.1.1 Forward Action Requests

>> There are no forward action requests

B.2. Post-Design Certification changes

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B.2.1. Temporary deviations from the approved Monitoring & Reporting Plan, methodology or standardized baseline

>> 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 start date of crediting period

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

B.2.4. Permanent changes from the Design Certified monitoring plan, applied methodology or applied standardized baseline

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

B.2.5. Changes to project design of approved project

>> There are no changes to the registered project design in this Monitoring Report for the period 01/01/2020 to 31/12/2021.

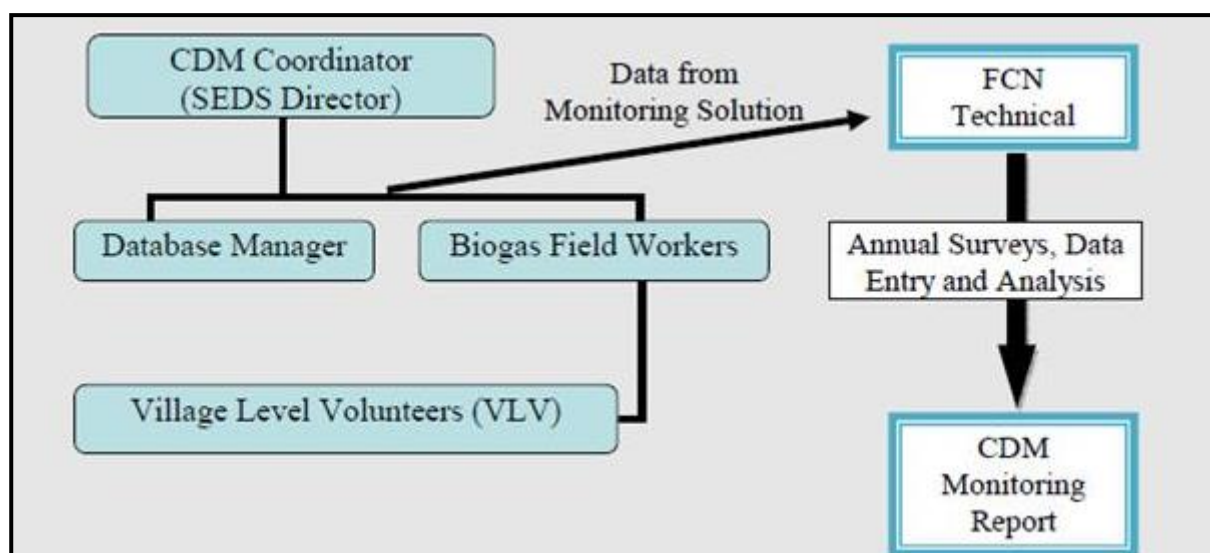
SECTION C. DESCRIPTION OF MONITORING SYSTEM APPLIED BY THE PROJECT

>> 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 organizational 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:



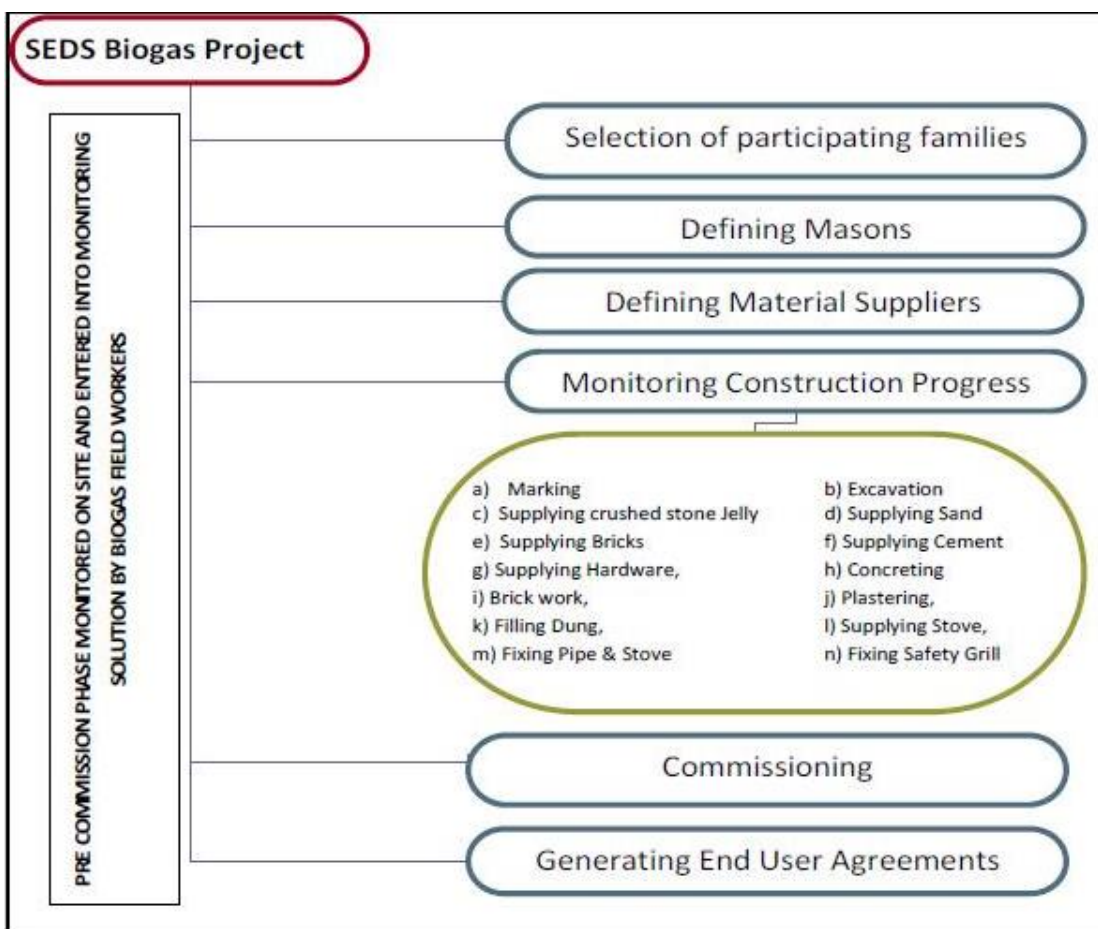
A digitized monitoring system, custom built for monitoring this Biogas CDM Project, by Tristle Technologies Pvt. Ltd is in use on a day-to-day basis. Data entry is done on a regular basis, which generates real-time Progress Reports. Inputting data into this

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.



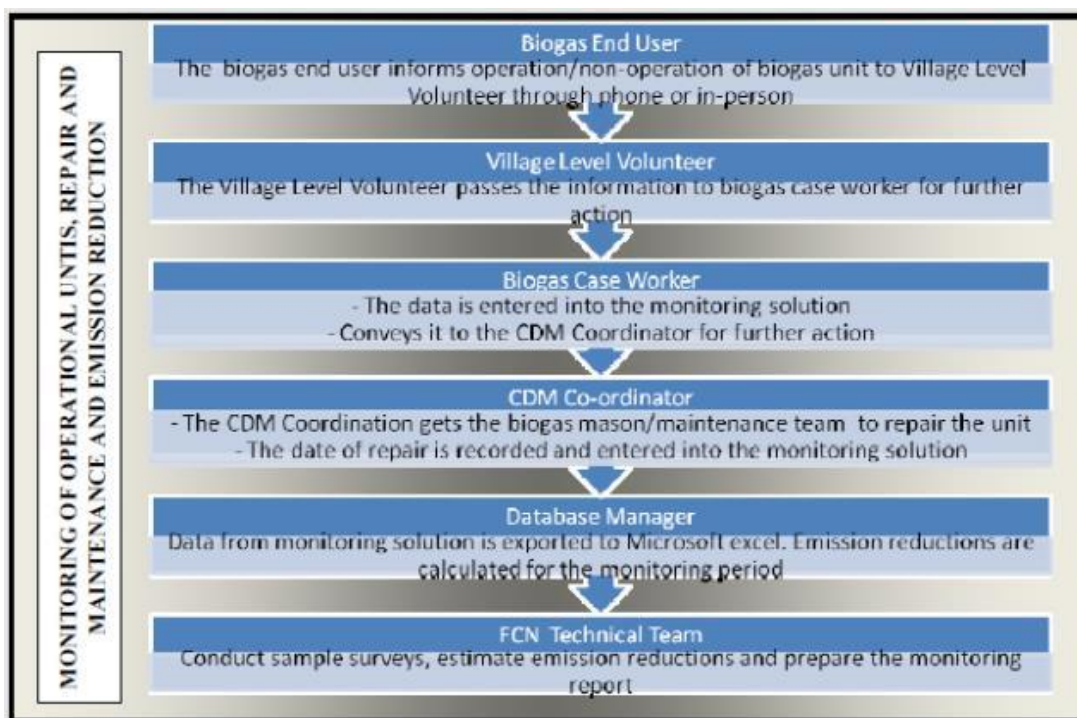


Fig 4: Schematic diagram of monitoring system and information flow in the project activity

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 1st 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.

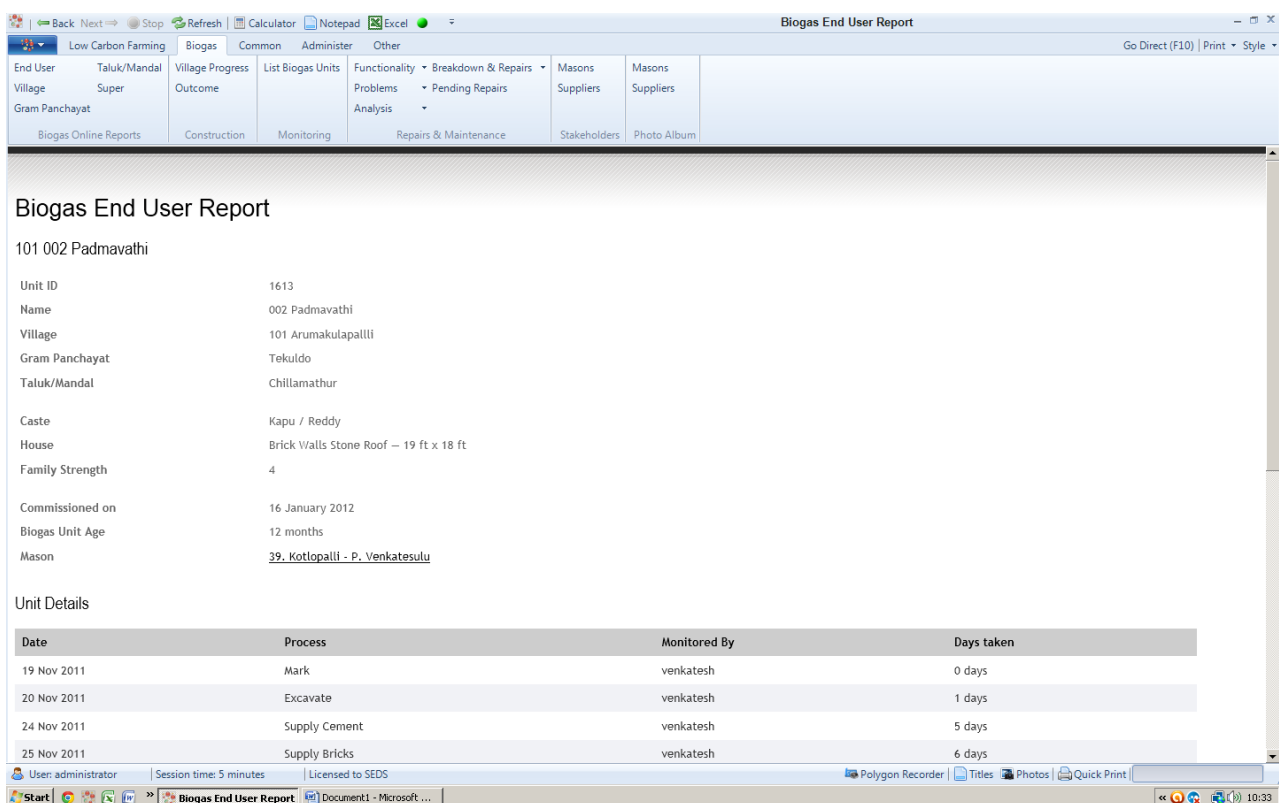


Fig 5: Screen Shot of the Monitoring database solution

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 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 sample surveys for inclusion in the Monitoring Report.

SECTION D. DATA AND PARAMETERS

D.1. Data and parameters fixed ex ante or at renewal of crediting period

>>

Data/Parameter	$f_{NRB,y}$
Unit	Fraction
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.

Data/Parameter	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	Established ex ante prior to start of the project activity
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

Data/Parameter	BC_{BL,HH,y}
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.

Data/Parameter	Diversion of non-renewable biomass saved under the project activity by non-project households
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 _y 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_y will be multiplied by 0.95, which is fixed for the crediting period. Biomass (t) – $2.85 \times 0.95 = 2.71$ 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_y can be multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required. $2.85 \times 0.95 = 2.71$ 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

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Data/Parameter	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

Data/Parameter	$NCV_{biomass}$
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.

Data/Parameter	$BC_{PJ,HH,y}$
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	<p>For the monitoring period, the fuelwood used due to non-usage of biogas due to repair and maintenance was 2,144.582 t, while due to parallel use of traditional stove, accounted to 4997.57 t.</p> <p>- 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.</p> <p>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. Animals are sold whenever there is severe drought and there is difficulty of getting fodder. With better conditions, the families buy cattle again, as milk is also one of the income sources for them. In many cases, the family are disinterested, especially the younger generation to continue using it. The village level volunteers and the Biogas Field Workers speak to the end users and motivate them to use biogas units. As there are no structural issues, it is restored back to use. With regard to migrations, it is not permanent migration. The few members of the household go to nearby towns for work. Anantapur is a drought prone area and getting work becomes difficult during off-agriculture season. The villagers migrate to the towns for work for short period of time and get back home, after which the family resumes using it. Of course a few of the elderly and very young stay back and biogas is used, though not to full capacity.</p>

	<p>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 $2.85/365 \times 30 \text{ days} = 0.234 \text{ t}$.</p>										
<p>Monitoring equipment</p>	<p>-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 2020 and 2021. The surveys were conducted during the end of the year during November to December for both the years.</p> <p>A Kitchen test was conducted for 33 households 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:</p> <table border="1" data-bbox="536 1227 1353 1361"> <thead> <tr> <th>Year</th> <th>2020</th> <th>2021</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Fuelwood use due to parallel use of traditional stoves (t)</td> <td>1990.51</td> <td>2996.33</td> <td>4986.84</td> </tr> </tbody> </table>	Year	2020	2021	Total	Fuelwood use due to parallel use of traditional stoves (t)	1990.51	2996.33	4986.84		
Year	2020	2021	Total								
Fuelwood use due to parallel use of traditional stoves (t)	1990.51	2996.33	4986.84								
<p>Measuring/reading/recording frequency</p>	<p>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</p>										
<p>Calculation method (if applicable)</p>	<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 $(2.85/365) \times 30 = 0.2342 \text{ t}$ of fuelwood use.</p> <table border="1" data-bbox="536 1803 1248 2027"> <thead> <tr> <th>Unit ID</th> <th>Sum of Days Lost</th> </tr> </thead> <tbody> <tr> <td>Animals Sold and repurchased</td> <td>43794</td> </tr> <tr> <td>Gas not forming</td> <td>1572</td> </tr> <tr> <td>Gobar Stop</td> <td>179603</td> </tr> <tr> <td>Gobar Stop - Less Gas</td> <td>239</td> </tr> </tbody> </table>	Unit ID	Sum of Days Lost	Animals Sold and repurchased	43794	Gas not forming	1572	Gobar Stop	179603	Gobar Stop - Less Gas	239
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	Gobar Stop (Beneficiary Not Interested)	327																		
	Gobar Stop (Migrated)	13048																		
	Repair Gas Pipe	230																		
	Repair Inlet Tank	197																		
	Repair Stove	821																		
	Replace Gas Pipe	170																		
	Replace Gate Valve	88																		
	Replace Stove	203																		
	Replaster Dome (outside)	8																		
	Unit Demolished	34357																		
	Grand Total	2,74,657																		
	<p>A Kitchen test was done for 33 households 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>A pilot kitchen test was conducted for 10 households, from the project area 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 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. and accordingly, sample size was determined. Accordingly, the sample size returned are as follows:</p>																			
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Cook Ragi Meal	3																			
Make Non-Vegetarian Dishes	3																			
<p>Based on CDM Review on the adequacy of the sample size, 33 additional households were sampled. As the surveys are done for non-project households, the survey conducted after the monitoring period does not impact the outcome of this monitoring period in any way. Based on the 33 household data, 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>																				
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	<p>This proportion of baseline fuelwood was deducted for parallel use of woody biomass. This Kitchen test done will be applied for the entire second crediting period.</p> <p>For ex. heating water accounts for 28.83% of fuelwood use. If it was used for 3 days/week for 6 months/year, the calculations are $(2.85 \times 29.24\%) / 365 \times 6 \text{ months} \times 4 \text{ weeks} \times 3 \text{ days} = 0.1621 \text{ t/year}$.</p>																			
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</td> <td>2.89%</td> </tr> <tr> <td>Hot Water for Bathing</td> <td>3.90%</td> </tr> <tr> <td>Cook Rice</td> <td>4.34%</td> </tr> <tr> <td>Cook Lentils/Dal</td> <td>3.47%</td> </tr> <tr> <td>Cook Vegetables/Curry</td> <td>3.32%</td> </tr> <tr> <td>Make Tea Only</td> <td>1.83%</td> </tr> <tr> <td>Cook Ragi Meal</td> <td>5.90%</td> </tr> <tr> <td>Make Non-Vegetarian Dishes</td> <td>2.71%</td> </tr> </tbody> </table>		Food Items	Reliability	Fodder Preparation	2.89%	Hot Water for Bathing	3.90%	Cook Rice	4.34%	Cook Lentils/Dal	3.47%	Cook Vegetables/Curry	3.32%	Make Tea Only	1.83%	Cook Ragi Meal	5.90%	Make Non-Vegetarian Dishes	2.71%
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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																		

Data/Parameter	B_y
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 11,566 t for 2020 and 9,792 for 2021.
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 By
Purpose of data/parameter	Calculation of Baseline emissions
Additional comments	ERs will be accounted only for functional days of the units

SDG 3

Data/Parameter	i. Continued improved indoor air condition and reduced respiratory problems especially for women and children. ii. Reduction of pathogens in slurry compared to that of dung
Unit	i. % ii. %
Description	Due to shift from traditional cookstoves to biogas, improved indoor air quality reducing health issues for women, especially eye and respiratory problems ii. Reduction in pathogens in biogas slurry, reducing pathogens in the surrounding regions and to soil
Measured/calculated/default	Measured
Source of data	i, from sample survey ii. Laboratory Report
Value(s) of monitored parameter	i. 100% i. 94%
Monitoring equipment	i, from sample survey ii. Laboratory Analysis
Measuring/reading/recording frequency	Once in two years
Calculation method (if applicable)	
QA/QC procedures	
Purpose of data/parameter	To determine the contribution of the project to SDG
Additional comments	

SDG 5

Data/Parameter	Reduction in drudgery of cooking and ease of cooking
Unit	% of time reduction
Description	Reduction in time spent
Measured/calculated/default	Measured
Source of data	Sample Survey
Value(s) of monitored parameter	Reduction in 44% of time for cooking and 18.7 wage days/HH/yr for collection.
Monitoring equipment	Sample Surveys
Measuring/reading/recording frequency	Once in two years

Calculation method (if applicable)	Based on the sample survey determine the time spent during baseline scenario and project scenario and compare the values to determine the reduction in time reduction for cooking and collecting fuelwood
QA/QC procedures	Randomly selected sample survey
Purpose of data/parameter	To determine the contribution to the SDG 5.
Additional comments	

SDG 7

Data/Parameter	i. Construction and maintenance of biogas units for rural communities. ii. Maintenance of constructed biogas units and elimination of use of firewood.
Unit	i. Number ii. Repair and maintenance of biogas units
Description	i. Construction of 5,000 units with upfront 100% carbon revenue ii.
Measured/calculated/default	Measured
Source of data	Online monitoring solution of SEDS
Value(s) of monitored parameter	i.5,000 biogas units constructed ii Repair and maintenance of biogas units as shown in leading to reduction in 2.13 t wood/HH/yr
Monitoring equipment	i and ii Online monitoring solution
Measuring/reading/recording frequency	Continuous
Calculation method (if applicable)	No calculations, based on the data from online monitoring solution
QA/QC procedures	
Purpose of data/parameter	
Additional comments	

SDG 17

Data/Parameter	Access to domestic or international carbon funding to implement clean technologies
Unit	Rs.
Description	Forward funding for construction and repair and maintenance of biogas units
Measured/calculated/default	Measured
Source of data	Finance Statements

Value(s) of monitored parameter	Rs.89.83 million
Monitoring equipment	There are no monitoring equipment
Measuring/reading/recording frequency	Measured
Calculation method (if applicable)	No calculation method
QA/QC procedures	Based on actual transfer of carbon money received from carbon investor
Purpose of data/parameter	To determine the contribution to SDG 17.
Additional comments	

D.3. Comparison of monitored parameters with last monitoring period

Data/Parameter	Value obtained in this monitoring period	Value obtained last monitoring period
$BC_{PJ,HH,y}$	For the monitoring period, the fuelwood used due to non-usage of biogas due to repair and maintenance was 2,144.582 t, while due to parallel use of traditional stove, accounted to 4997.57 t.	
B_y	For the monitoring period, it accounted for 11,575 t for 2020 and 9,794 for 2021.	
Emission Reductions	12,786 tCO ₂ for 2020 10,819 tCO ₂ for 2021	
i. Continued improved indoor air condition and reduced respiratory problems especially for women and children.	i.100% families reported improved indoor air pollution and 100% reduction in health issues	
ii. Reduction of pathogens in slurry compared to that of dung	ii. Reduction of 94% pathogen levels in slurry compared to dung	
Reduction in drudgery of cooking and ease of cooking	Reduction in 44% of time for cooking and 18.7 wage days/HH/yr for collection.	

i. Construction and maintenance of biogas units for rural communities.	i. Construction and maintenance of 5,000 biogas units for 5,000 households.
ii. Maintenance of constructed biogas units and elimination of use of firewood.	ii. Maintenance of constructed biogas units leading to reduction 2.13 t of fuelwood/HH/Yr
i. Access to domestic or international carbon funding to implement clean technologies	Forward funding of Rs.89.83 million received for implementation, repair and maintenance and monitoring of the project activity.

D.4. Implementation of sampling plan

>>

SDG 13

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 2021. 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.

A pilot kitchen test was conducted for 10 households, from the project area to assess the fuelwood use for each of the cooking item during January 2019 (Appendix 1). 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.

Food Item	Mean (Kg/day/family)	Std Dev (Kg/day/family)
Fodder Preparation	1.25	0.165
Hot Water for Bathing	2.39	0.321
Cook Rice	0.74	0.085
Cook Lentils/Dal	0.83	0.048
Cook Vegetables/Curry	0.74	0.033
Make Tea Only	0.13	0.012
Cook Ragi Meal	0.86	0.058
Make Non-Vegetarian Dishes	1.02	0.071

The sample size was determined for non-project household (infinite population size) as follows:

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

Accordingly, the sample sizes returned are as follows:

Food Items	Fodder Preparation	Hot Water for Bathing	Rice	Lentils/Dal	Vegetables/Curry	Tea	Ragi Meal	Non-Vegetarian Dishes
n Value	5	5	4	1	1	3	2	2

V Value	0.0173	0.0181	0.0131	0.0034	0.0020	0.0084	0.0046	0.0049
Mean	1.25	2.39	0.74	0.83	0.74	0.13	0.86	1.02
Standard Deviation	0.165	0.321	0.085	0.048	0.033	0.012	0.058	0.071
90% confidence	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
10% relative precision	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

As the sample size returns a value less than 30, Student’s t distribution was used. The student t-distribution test was conducted. The iterated value till there is no change in the value of sample size n gives the maximum value of 7-20 for the different food items. Based on the CDM Review question and to be in line with the adequacy of sampling for the entire crediting period, additional households were sampled in January 2021. As the surveys are done for non-project households, the survey conducted after the monitoring period does not impact the outcome in any way for this monitoring period. A total of 33 households were sampled. The average fuelwood for each of the food item was determined. 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:

Food Item	Percentage to the total	Kg/HH/day
Fodder Preparation	14.43%	0.0011
Hot Water for Bathing	28.83%	0.0023
Cook Rice	9.77%	0.0008
Cook Lentils/Dal	10.58%	0.0008
Cook Vegetables/Curry	9.54%	0.0007
Make Tea Only	1.50%	0.0001
Cook Ragi Meal	11.23%	0.0009
Make Non-Vegetarian Dishes	14.12%	0.0011

The reliability of the data was determined as ½ width of confidence interval/mean x 100%. The reliability was achieved as shown below in the table.

Food Item	Mean (kg/HH/day)	Standard Deviation	Standard Error of Mean	Confidence (90%)	Reliability
Fodder Preparation	1.21	0.122	0.021	0.035	2.89%

Hot Water for Bathing	2.42	0.329	0.057	0.094	3.90%
Cook Rice	0.82	0.124	0.022	0.036	4.34%
Cook Lentils/Dal	0.89	0.108	0.019	0.031	3.47%
Cook Vegetables/Curry	0.80	0.093	0.016	0.027	3.32%
Make Tea Only	0.13	0.008	0.001	0.002	1.83%
Cook Ragi Meal	0.94	0.194	0.034	0.056	5.90%
Make Non-Vegetarian Dishes	1.18	0.112	0.020	0.032	2.71%

The mean values determined meet the 90/10 confidence/precision required.

This proportion of baseline fuelwood was deducted for parallel use of woody biomass. For ex. heating water accounts for 28.834% of fuelwood use. If it was used for 3 days/week for 6 months/year, the calculations are $(2.85 \times 28.83\%) / 365 \times 6 \text{ months} \times 4 \text{ weeks} \times 3 \text{ days} = 0.1621 \text{ t/year}$. The emission reduction calculations sheet shows the calculations at the household level.

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

Other SDGs

The sustainable development indicator parameters were monitored through following 3 processes:

- i. Sample Survey
- ii. Laboratory Analysis
- iii. Daily monitoring which is entered into digitised Monitoring Database Solution

Sample Survey: The FCN Technical Team (CDM Consultant) and the SEDS staff conducted a sample survey to assess the project activity on sustainable development. The questionnaire designed, field tested and implemented for the survey during the first monitoring period was employed. A stratified random sampling was conducted in the project area to monitor the following sustainable development parameters:

- ✓ Improvement of health problems due to reduction in smoke and better indoor air quality

- Community’s response to reduction in health problems after use of biogas
- ✓ Generation of quality employment and increase in their income
 - Income generation activities taken up women after the project activity
- ✓ Improvement of livelihood of communities especially of women in the family
 - Reduction of time in collection, processing and storage of fuel wood for cooking and hot water bath
 - Reduced time for cooking
 - Better social environment at home due to reduced drudgery especially for women
- ✓ Human and institutional capacity
 - Empowerment of women as they have more time now to take up other activities
 - Children can attend school in time

The objective of the survey is to obtain unbiased and reliable data of above sustainable development parameters in order to assess the impact of project activity as discussed in the GS4GG transition document.

Details of the conducted Sample Survey

Date of Survey: 22nd – 23rd December 2020 and 23rd – 29th January 2022

During 2020, largely telephonic and few physical surveys were conducted due to the pandemic and during 2022, it was physical surveys. The details of the interviewees are given in Annex 2, along with details of their Mandal, village and biogas ID number are given in the sample survey sheets in Microsoft Excel Sheet. The details of interviewers for the surveys and their details are as follows:

Name	Designation	Contact Number	Contact Email
Deepa N	CDM Facilitator, FCN	9900951321	deepa@fairclimate.com
Nagamani	Co-Ordinator, SEDS	9440868656	nagamani.seds@gmail.com
Tanveer	System-Admin, SEDS	9000565355	tanveer.seds@gmail.com
Waheed	CDM Facilitator, FCN	78999 45736	waheed@fairclimate.com
P. Pakkirappa	Case Worker	9949194871	pakkirappa.seds@gmail.com

M. Rathnamma	Case Worker	9491355313	rathnamma.seds@gmail.com
S.G. Govindamma	Case Worker	7675994084	govindamma.seds@gmail.com
Radha Rani	Case Worker	8179329469	radharani.seds@gmail.com
Kondappa	VLV	9603743607	-
Shankar Reddy	VLV	9000173693	-
Mallikarjuna	VLV	9652366517	-
Y. Madhu Sudha Reddy	VLV	6305247220	-
P. Nagamanemma	VLV	7780464690	-

Reliability Requirement

Sample survey was conducted to determine the various parameters as stated above. Determination of sample size is in accordance with Annex 06, EB 67, "Guidelines for sampling and surveys for CDM project activities and programme of activities" which specifies the reliability requirements and describes appropriate sampling methods applicable to small-scale projects. For developing a sampling plan, the sample size needs to be determined to achieve a required level of reliability. The sample size was determined to obtain 90/10 confidence/precision levels.

Sampling Frame

The Sampling frame is the complete listing of all the rural households for which biogas was built under the project activity in Penukonda, Roddam, Somandepalli, Gorantla and Chilamathur Mandals of Anantapur District, Andhra Pradesh. Each of the household has a unique identification number with all the required details of the family, which makes it simple and easy to select sample households.

Target Population

The target population is 5,000 rural households for which biogas were constructed in 5 Mandals of Anantapur district.

Mandal	Total Biogas Units
Chilamathur	1,030
Gorantla	1,058

Penukonda	481
Roddam	1,544
Somandepalli	887
Total	5,000

Table 2: Target Population

Sampling Method

Household level questionnaire method was employed to conduct the survey and collect information. The questionnaire adopted for the survey is included in Annex 1. The questionnaire was composed on various sections keeping in view the order, ease of questioning by surveyors and answering by respondents. The questionnaire was field tested during preparation of the first monitoring report, to obtain an approximate idea of how well the draft questionnaire worked and then finalized.

The sampling method chosen for the project area is stratified random sampling, wherein each Mandal is a stratum. It is easy to implement as the sampling frame (household details for which biogas were implemented) is collected and stored in the monitoring database. Each of the five Mandals - Penukonda, Roddam, Somandepalli, Gorantla and Chilamathur was treated as a stratum. Thus sampling was done for each of the Mandal to ensure that all the areas were well represented.

Determination of Sample Size and Sample Size Calculations

The sample size was determined based on the parameters which need to be determined to assess the sustainable development indicators as discussed in GS passport. Determination of sample size is in accordance with Annex 06, EB 67, "Guidelines for sampling and surveys for CDM project activities and programme of activities", which specifies the reliability requirements and describes appropriate sampling methods applicable to small-scale projects. The level of confidence and precision considered is 90/10.

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

Where:

n Sample size

N Total number of households (5,000)

p Our expected proportion (0.90 for 2018 and 2019) (Based on the status of biogas units demolished from online monitoring solution).

1.645 Represents the 90% confidence required

0.1 Represents the 10% relative precision p

2020	2021
$n = \frac{1.645^2 \times 5000 \times 0.9(1 - 0.9)}{(5000 - 1) \times 0.1^2 + 1.645^2 \times 0.9(1 - 0.9)}$ $= 25$	$n = \frac{1.645^2 \times 5000 \times 0.9(1 - 0.9)}{(5000 - 1) \times 0.1^2 + 1.645^2 \times 0.9(1 - 0.9)}$ $= 25$
If we expect the response rate from the sampled households to be only 80%, then the scale up for the survey would be 25/0.8 = 31 households.	If we expect the response rate from the sampled households to be only 80%, then the scale up for the survey would be 25/0.8 = 31 households.

Apportioning to all the Mandals, the number of households to be sampled is as follows:

Mandals	Total Number of Households (2018)	Total Number of Households (2019)
Chilamathur	$\frac{1030}{5000} \times 31 = 6$	$\frac{1030}{5000} \times 31 = 6$
Gorantla	$\frac{1058}{5000} \times 31 = 7$	$\frac{1058}{5000} \times 31 = 7$
Penukonda	$\frac{481}{5000} \times 31 = 3$	$\frac{481}{5000} \times 31 = 3$
Roddam	$\frac{1544}{5000} \times 31 = 10$	$\frac{1544}{5000} \times 31 = 10$
Somandepalli	$\frac{887}{5000} \times 31 = 5$	$\frac{887}{5000} \times 31 = 5$
Total	31	31

The villages and households were selected randomly. The details of the survey and the field studies conducted for the study is as follows:

Mandal	Village	2020	2021	Total
Chilamathur	Appanapalli	1	1	2
	Kambalapalli (C)	3	3	6
	Lalepalli	5	4	9
	Maruva Kothapalli	1		1

Chilamathur Total		10	8	18
Gorantla	G. Maruvapalli	3	2	5
	Gajulavandlapalli	3	2	5
	Mereddipalli	3	3	6
	Thipparajupalli	2	1	3
Gorantla Total		11	8	19
Penukonda	Chinnapareddipalli (P)	2		2
	Parameswarapuram	2		2
	Vaggappagari Kunta	2		2
Penukonda Total		6		6
Roddam	Gowrajupalli	4		4
	Kallukunta (R)		3	3
	R. Kottala	4	6	10
	Seshapuram	4	3	7
Roddam Total		12	12	24
Somandepalli	Chinnababaiahpalli		6	6
	Nallagondrayunipalli		3	3
	Somandepalli		2	2
Somandepalli Total			11	11
Grand Total		39	39	78

Table 3: Mandal wise details of villages and end user households sampled

It can be seen from Table 4 that the number of households covered for the sample surveys is more than adequate to represent the parameters in the project area. Oversampling was done as a good practice to compensate for any attrition, outliers or non-response associated with the sample.

The data collected was entered into excel sheet for data storage and analysis.

4.1 Laboratory Analysis

Samples of biogas slurry from project biogas unit and cow dung from ordinary pit were collected in separate plastic containers. These samples were tested in an accredited laboratory. The biogas slurry tests were compared with the baseline sample load of dung done in 2012. Both the samples were analysed for total bacterial count. This is monitored only once in the start of the crediting period.

4.2 Monitoring Solution

A digitised monitoring solution, customised software provided by TRISTLE Technologies Pvt, Ltd is used to monitor the CDM activity. This solution tracks all the events of the

project activity i.e., selecting and managing biogas beneficiary details, construction progress of biogas unit starting from digging the pit to commissioning of unit, supplying the construction materials to the construction site and supplier or vendor details who supplies the materials, mason details, breakdown details of the unit and all other financial information regarding the project activity. Real time reports can be generated from the solution to track the project activity.

5 Data

5.1 Field Measurements

A household level questionnaire was designed to collect information for the parameters of interest. The frequency of measurement was once a year during the monitoring period.

5.2 Quality Assurance/Quality Control

The CDM survey team comprised of staff of SEDS NGO and FCN technical team. Qualified and trained people monitor the Sustainable Development parameters and emission reduction calculations. The FCN Technical team was involved in sample surveys, calculating emission reductions and writing the monitoring report. In the complete implementation and monitoring plan, SEDS, the NGO is the sole agency responsible for implementation and monitoring.

The QA/QC procedure was to achieve good quality data through field measurements. The household level questionnaire was designed and field-tested before administering the actual questionnaire survey. Oversampling was done to replace non-respondents, if any. The data collected was entered by and further cross-checked by the FCN Team.

6 Data Analysis

The data from the survey was entered in to Microsoft excel and analyzed using MS Excel Data Analysis.

SECTION E. CALCULATION OF SDG IMPACTS

E.1. Calculation of baseline value or estimation of baseline situation of each SDG Impact

>>

SDG 13

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).

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

For 2020 $B_y = 5000 \times (2.85 - 0.535) = 11,575$ t

For 2021 $B_y = 5000 \times (2.85 - 0.891) = 9,794$ t

Baseline emissions			
Activity Data	2020	2021	ID Ref
Quantity of Biomass substituted (t/yr) for 5,000 families	11,575	9,794	B_y
Fraction of NRB (f_{NRB})	95%	95%	$f_{NRB, y}$
NCV Biomass (TJ/t)	0.015	0.015	$NCV_{biomass}$
Emission factor (tCO ₂ /TJ)	81.6	81.6	$EF_{projected_fossil_fuel}$
Baseline emissions (tCO₂/yr/5,000 family)	13,458	11,388	BE_y

Other SDGs

SDG	SDG Impact	Baseline estimate
13	GHGs emissions reduction per year	12,786 tCO ₂ for 2020 10,819 tCO ₂ for 2021
3	i. Continued improved indoor air condition and reduced respiratory problems especially for women and children.	i. 100% of families report indoor air pollution and health issues
		ii. Total bacterial count of 3.65×10^7 CFU/g

	ii. Reduction of pathogens in slurry compared to that of dung	
5	Reduction in drudgery of cooking and ease of cooking	3.98 hrs cooking/day and 18.8 wage days/year/family for fuelwood collection
7	i. Construction and maintenance of biogas units for rural communities. ii. Maintenance of constructed biogas units and elimination of use of firewood.	i. No biogas units in the baseline and ii. 2.85 t/HH/yr is the fuelwood use
17	i. Access to domestic or international carbon funding to implement clean technologies	No funding for the 5,000 biogas units in the baseline

E.2. Calculation of project value or estimation of project situation of each SDG Impact

>>

SDG 13

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

$$PE_y = 0$$

Other SDGs

SDG	SDG Impact	Project estimate
13	GHGs emissions reduction per year	No project emissions
3	i. Continued improved indoor air condition and reduced respiratory problems especially for women and children. ii. Reduction of pathogens in slurry compared to that of dung	i. 100% families reported improved indoor air pollution and 100% reduction in health issues ii. Total bacterial count of 0.225×10^7 CFU/g
5	Reduction in drudgery of cooking and ease of cooking	Reduction in 44% of time for cooking and 18.7 wage days/HH/yr for collection.
7	i. Construction and maintenance of biogas units for rural communities. ii. Maintenance of constructed biogas units and elimination of use of firewood.	i. Construction and maintenance of 5,000 biogas units for 5,000 households. ii. Maintenance of constructed biogas units leading to reduction 2.13 t of fuelwood/HH/Yr
17	i. Access to domestic or international carbon funding to implement clean technologies	Forward funding of Rs. Rs.89.83 million received for implementation, repair and maintenance and monitoring of the project activity.

E.3. Calculation of leakage

>> B_y 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_y is considered as $11,575 \times 0.95 = 10,996$ t for 2020 and $9,794 \times 0.95 = 9,305$ t for 2021. Thus survey was not conducted to account for leakage.

E.4. Calculation of net benefits or direct calculation for each SDG Impact

SDG	SDG Impact	Baseline estimate	Project estimate	Net
13	GHGs emissions reduction per year	12,786 tCO ₂ for 2020 10,819 tCO ₂ for 2021	No project emissions	12,786 tCO ₂ for 2020 10,819 tCO ₂ for 2021
3	i. Continued improved indoor air condition and reduced respiratory problems especially for women and children. ii. Reduction of pathogens in slurry compared to that of dung	i.100% of families report indoor air pollution and health issues ii. Total bacterial count of 3.65×10^7 CFU/g	i. 100% families reported improved indoor air pollution and 100% reduction in health issues ii. Total bacterial count of 0.225×10^7 CFU/g	i.100% families reported improved indoor air pollution and 100% reduction in health issues ii. Reduction of 94% pathogen levels in slurry compared to dung
5	Reduction in drudgery of cooking and ease of cooking	3.98 hrs cooking/day and 18.8 wage days/year/family for fuelwood collection	2.23 hrs cooking/day and 0.1 wage day/year/family for fuelwood collection	Reduction in 44% of time for cooking and 18.7 wage days/HH/yr for collection.
7	i. Construction and maintenance of biogas units for rural communities. ii. Maintenance of constructed biogas units and elimination of use of firewood.	i. No biogas units in the baseline and ii. 2.85 t/HH/yr is the fuelwood use	i. 5,000 biogas units constructed in the project scenario and ii. 0.714 t/HH/yr is the fuelwood use in project scenario	i. Construction and maintenance of 5,000 biogas units for 5,000 households. ii. Maintenance of constructed biogas units leading to reduction 2.13 t of fuelwood/HH/Yr
17	i. Access to domestic or international carbon funding to implement clean technologies	No funding for the 5,000 biogas units in the baseline	Forward funding of Rs.89.83 million received for implementation, repair and maintenance and monitoring of the project activity.	Forward funding of Rs.89.83 million received for implementation, repair and maintenance and

monitoring of the project activity.

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

Emission Reductions after considering leakage			
Activity Data	2020	2021	ID Ref
Quantity of Biomass substituted (t/yr) after considering leakage	10,996	9,305	B_y
Fraction of NRB (f_{NRB})	95%	95%	$f_{NRB, y}$
NCV Biomass (TJ/t)	0.015	0.015	$NCV_{biomass}$
Emission factor (tCO ₂ /TJ)	81.6	81.6	$EF_{projected_fossil_fuel}$
Emissions Reductions (tCO₂ for the monitoring period)	12,786	10,819	BE_y

	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)		
				Before 01/01/2013	From 01/01/2013	Total amount
2020	12,786	-	672	-	12,786	12,786
2021	10,819	-	568	-	10,819	10,819
Total	23,605	-	1,240	-	23,605	23,605

E.5. Comparison of actual SDG Impacts with estimates in approved PDD

SDG	Values estimated in ex ante calculation of approved PDD for this monitoring period	Actual values ¹ achieved during this monitoring period
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¹ Whenever emission reductions are capped, both the original and capped values used for calculations must be transparently reported. Use brackets to denote original values.

3	<p>i.100% reduction in indoor air pollution; ii.50% Reduction of pathogen load in biogas slurry</p>	<p>i.100% families reported improved indoor air pollution and 100% reduction in health issues</p> <p>ii. Reduction of 94% pathogen levels in slurry compared to dung</p>
5	<p>At least 50% reduction in time and drudgery to women due to project activity</p>	<p>Reduction in 44% of time for cooking and 18.7 wage days/HH/yr for collection..</p>
7	<p>i.5,000 biogas units constructed and 100% functionality of biogas units due to repairs and maintenance of biogas units and ii.reduction of 2.85 t of fuelwood/HH.</p>	<p>i. Construction and maintenance of 5,000 biogas units for 5,000 households. ii. Maintenance of constructed biogas units leading to reduction 2.13 t of fuelwood/HH/Yr</p>
13	<p>15,749 metric tonnes CO2 equivalent per annum</p>	<p>12,777 tCO₂/Yr – 2020; 10,817 tCO₂/yr - 2021</p>
17	<p>50% Carbon Funding to construct, repair, maintain and monitor the project</p>	<p>100% forward funding of Rs.89.83 million received for implementation, repair and maintenance and monitoring of the project activity.</p>

E.5.1. Explanation of calculation of value estimated ex ante calculation of approved PDD for this monitoring period

>>

SDG	Values estimated in ex ante calculation of approved PDD for this monitoring period	Calculations
3	<p>i.100% reduction in indoor air pollution; ii.50% Reduction of pathogen load in biogas slurry</p>	<p>i. Based on sample survey and responses to the surveys by biogas users. ii. Pathogen tests of dung and biogas slurry at the beginning of the crediting period.</p>
5	<p>At least 50% reduction in time and drudgery to women due to project activity</p>	<p>Based on sample survey, the time for cooking and frequency of fuelwood collection in baseline scenario - Based on sample survey, the time for cooking and frequency of fuelwood collection in project scenario = Reduction in time and drudgery to women</p>

7	i. 5,000 biogas units constructed and 100% functionality of biogas units due to repairs and maintenance of biogas units and ii. reduction of 2.85 t of fuelwood/HH.	Number of biogas units constructed during the project scenario Baseline fuelwood use – fuelwood use in project scenario = reduction of fuelwood use
13	15,749 metric tonnes CO2 equivalent per annum	Based on I.E. methodology, Version 7.
17	50% Carbon Funding to construct, repair, maintain and monitor the project	Extent of carbon revenue for construction, repair, maintenance and monitoring of the project activity.

E.6. Remarks on increase in achieved SDG Impacts from estimated value in approved PDD

>>

There is no increase in the achieved impacts from estimated value in the approved PDD. In fact the emission reductions achieved is lesser than ex-ante estimation due to dysfunction of biogas units and parallel use of fuelwood.

SECTION F. SAFEGUARDS REPORTING

>>

There are no safeguards that need to be reported.

SECTION G. STAKEHOLDER INPUTS AND LEGAL DISPUTES

G.1. List all Inputs and Grievances which have been received via the Continuous Input and Grievance Mechanism together with their respective responses/mitigations.

>>

There were no inputs and grievances that were received as the construction of biogas units were completed during the first crediting period. There were repairs and maintenances that were done based on monitoring from VLV, which were done. Based on the monitoring solution during the monitoring period, they were as follows:

Repairs addressed	Fixed
Gas not forming	97
Repair after dung slurry has become hard	2,439
Gobar Stop - Less Gas	12
Repair after dung slurry is not generating due to return of Migrated families	43
Repair Gas Pipe	6
Repair Stove	19

Replace Gas Pipe	9
Replace Gate Valve	1
Replace Stove	102
Replaster Dome (outside)	1
Grand Total	2,729

Based on the sample survey, the following repairs were done since the time of construction

Repairs	% of surveyed families
Stove_Knob	79%
Restoration_of_Gobar_Dried	9%
Restoration of Gobar Too Watery	1%
Replaced/Repaired Pipe	91%
Replace Stove	65%
Stove Burners	55%
Rain Water in Dome	5%
Nozzle Blocked	58%
Empty and Replaster Dome	1%

G.2. Report on any stakeholder mitigations that were agreed to be monitored.

>>

There are no stakeholder mitigations that were agreed to be monitored

G.3. Provide details of any legal contest that has arisen with the project during the monitoring period

>>

There are no legal contest that has arisen with the project during the monitoring period.

Appendix 1: Questionnaire used to collect information on sustainable development indicators of the project activity

SURVEY OF BIOGAS USERS

Team Members:		Date of Survey	
---------------	--	----------------	--

Beneficiary Details

Name			
District	Anantapur	Mandal	
Village		Unit ID	

MONITORING SUSTAINABLE DEVELOPMENT INDICATORS

SDG 01: Air Quality

Air Quality	Reduction of smoke?	Yes	No
Health	Reduction in Health Problems?	Yes	No
If Yes, Reduction in.	Eye irritation / Tears / Weak vision		
	Nasal irritation / Throat irritation / Ear Problem		
	Breathing Problems / Cough / Wheeze		
	Chest Pain / Rapid Pulse Rate		
	Dizziness / Tiredness / Stress / Nausea / Headache		
	Burns / Wounds		
	No Changes		

SDG 03: Livelihood of the Poor

Easy of Cooking

Scenario	Morning (Hrs)	Afternoon (Hrs)	Evening (Hrs)	Total Hours(Hrs)
Baseline (TS)				
Project (Biogas)				

Time spent for collecting fuelwood by women		Baseline	After project implementation
Fuelwood Purchased (P) or Collected (C)			
Time spent for fuel	No. of Hours		
	Frequency		
	Mode of Collection		

wood collection	Purchase (Qty) Amount (Rs/Mode)		
-----------------	------------------------------------	--	--


<input type="checkbox"/> Reduction in frequency of repainting the walls <input type="checkbox"/> Clean Home <input type="checkbox"/> Water saving <input type="checkbox"/> Clean Vessels <input type="checkbox"/> Ease in cooking <input type="checkbox"/> Eating together <input type="checkbox"/> Time for socializing <input type="checkbox"/> Better hospitality to guests <input type="checkbox"/> Reach School in Time Other Impacts

SDG – 04: Access to affordable and clean energy services

Was you Biogas Repaired after installation, if so, what were the repairs?

<input type="checkbox"/> Empty and Replaster Dome	<input type="checkbox"/> Repair of Rain Water in Dome
<input type="checkbox"/> Restoration of Gobar Dried	<input type="checkbox"/> Repair Stove/Burners
<input type="checkbox"/> Restoration of Gobar Too Watery	<input type="checkbox"/> Replace Stove
<input type="checkbox"/> Nozzle Blocked	<input type="checkbox"/> Restored Unit that was Demolished
<input type="checkbox"/> Stove Knob	<input type="checkbox"/> Replaced/Repaired Pipe

Annex 2: Laboratory Report



Test Report


Report No.: B20210002483-ANN	ULR No.: NA	Date of Report.: 04/06/2020
Customer Detail		
Name of Customer : Social Education and Development Society		
Address : Anandapuram HO,Somandepalli Mandal,Penakonda Anantapur District-Hyderabad		
Contact Person : Mr Waheed		
Pin Code : 515124		
Samples Drawn by the Laboratory : NO		
Sample Details #		
Sample Name : Bio Gas With Slurry-1	Sample Qty : 500 g	
Batch No : NA	Mfg Date : NA	
Mfg by : NA	Nature : Solid	
Packing : Packet	Any other relevant information : NA	
Stamped/Sealed : NA	Condition of sample : Acceptable	
Laboratory Analysis Detail		
Testing performed at : Permanent facility	Date of sample Receipt : 27/05/2020	
Date of starting Analysis : 30/05/2020	Date of Completion : 03/06/2020	

Deviation in Environmental condition which may affect the result or required for interpretation of result: No

Biological Testing:

Parameter	Method	Result	LOQ	Unit	Deviation/ addition/ exclusion from method
Total Bacterial count	IS: 3622-1981 IS: 3622-1981	2250000	-	cfu/g	No

Remarks: Note: All the above tests are conducted in Location 2 (D-98).
..... END




B20210002483-ANN

LABORATORY:-
Merieux NutriSciences Bangalore Private Limited,
D-98 and D-98, 4th Main, HSSDC Industrial Estate,
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Email: customerscare.bh@merieux.com
CIN: U71200KA2018PTC099120
GST: 29AAGC8757AQL
PAN: AAGC8757A TAN: BLR8118310
<https://www.merieuxnutrisciences.com/in/>

Format No. BTH/GF/106



BANGALORE TEST HOUSE
65, 20th Main, Marehalli, Vijayanagar, Bangalore - 560 040.
Ph: 23356415, 23151665, Fax: 080-23385979
e-mail: testhouse@satyam.net.in website: www.bhindia.com




TEST CERTIFICATE

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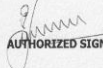
Report No. : ED/2012/11/0333	Report Date : 16/11/2012
Issued to : Social Education & Development Society (SEPS),	Your Reference : RFA, Dated: 09.11.2012
Anandapuram, Peddamanthur (SO), Penakonda,	Date of Receipt : 09/11/2012
Ananthapur (District) - 515124	Date of Analysis : 13/11/2012
Sample Nature/ Name : Cowdung	Job Order No. : ED/2012/11/0333
	Sample Particulars : Cowdung

Sample Description : Green coloured paste.

SL No.	PARAMETERS	RESULTS	PROTOCOL
1	MICROBIOLOGICAL REQUIREMENTS:		
2	Total Bacterial Count	36500000 CFU/g	IS: 5402 - 2002



ANALYST



AUTHORIZED SIGNATORY

NOTE : 1. The result listed refer only to the tested samples & applicable parameters. Endorsement of products is neither inferred nor implied. 2. Samples will be destroyed after 15 days from the date of issue of test certificate unless otherwise specified. 3. This report is not to be reproduced wholly or in part & cannot be used as an evidence in the Court of law & should not be used in any advertising media without our special permission in writing. 4. Sample(s) not drawn by us unless otherwise stated. 5. Total liability of our laboratory is limited to the invoice amount. Any dispute arising out of this report is subject to Bangalore Jurisdiction only.

Revision History

Version	Date	Remarks
1.1	14 October 2020	<p>Hyperlinked section summary to enable quick access to key sections</p> <p>Improved clarity on Key Project Information</p> <p>Section for POA monitoring</p> <p>Forward action request section</p> <p>Improved Clarity on SDG contribution/SDG Impact term used throughout</p> <p>Clarity on safeguard reporting</p> <p>Clarity on design changes</p> <p>Leakage section added for VER/CER projects</p> <p>Addition of Comparison of monitored parameters with last monitoring period</p> <p>Provision of an accompanying Guide to help the user understand detailed rules and requirements</p>
1.0	10 July 2017	Initial adoption