

TEMPLATE

MONITORING REPORT

PUBLICATION DATE **14.10.2020**

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)	GS980
Title of the project (s) covered by monitoring report	Accion Fraterna Biogas CDM project for rural communities in Anantapur, Andhra Pradesh
Version number of the PDD/VPA-DD (s) applicable to this monitoring report	GS4GG PDD, version 8, dated 14/12/2021
Version number of the monitoring report	03
Completion date of the monitoring report	27/01/2026
Date of project design certification	CDM – 20/01/2012 GS – 02/07/2012
Date of Last Annual Report	16/12/2022
Monitoring period number	06
Duration of this monitoring period	01/01/2023 to 31/07/2025
Project Representative	ACCION FRATERNA ECOLOGY CENTRE
Host Country	India
Activity Requirements applied	☒ Community Services Activities ☐ Renewable Energy Activities ☐ Land Use and Forestry Activities/Risks & Capacities ☐ N/A
Methodology (ies) applied and version number	AMS. I.E. Switch from Non-Renewable Biomass for Thermal Applications by the User, version 11.0
Product Requirements applied	☒ GHG Emissions Reduction & Sequestration ☐ Renewable Energy Label ☐ N/A

Table 1 - Sustainable Development Contributions Achieved

Sustainable Development Goals Targeted	SDG Impact	Amount Achieved		Units/ Products
13 Climate Action (mandatory)	Reduction of CO ₂	2023	5,438	tCO ₂
		2024	5,267	
		2025	2,902	
		Total	13,607	
3: Good health and well-being	i. Reduction in indoor air pollution (100% of HHs)	i. 100% of surveyed households		i. %
	ii. Reduction in health issues due to better indoor air quality	ii. 100% of surveyed households report reduction in health problems		ii. %
5: Gender Equality	Reduction in time for fuelwood collection and cooking due to ease of cooking on biogas	57.68% reduction in time compared to baseline for cooking and 66.92% for fuelwood collection		%
7: Affordable and Clean Energy	i. Number of biogas units constructed	i. 3,351 units		i. Number
	ii. Number of units operational	ii. 81.02%% units operational		ii. %
8: Decent work and economic growth	Number of jobs created	112 jobs created due to the project activity of which 93.75% are women; 8 permanent and 104 temporary jobs		i. Number
17: Partnerships for the Goals	Domestic/international carbon funding to construct and maintain biogas units	93.32 million Rs. for the project so far and 10.79 million for the monitoring period i.e. 100% carbon revenue for construction and maintenance of units		i. Rs. And %

Table 2 – Product Vintages

		Amount Achieved		
Start Dates	End Dates	GS VERs		...
01/01/2023	31/12/2023	5,438	tCO ₂	
01/01/2024	31/12/2024	5,267	tCO ₂	
01/01/2025	31/07/2025	2,902	tCO ₂	
Total		13,607	tCO ₂	

SECTION A. DESCRIPTION OF PROJECT

A.1. General description of project

>> This is a GS CDM Project. The project is transitioned as a GS VER Project, without deregistration from CDM. The GS VERs will only be claimed once and will not be claimed again with the UNFCCC. The project will not issue both CER/other compliance units under Paris Agreement and GS VER for the same vintage.

Accion Fraterna Ecology Centre (AF Ecology Centre) is a Non-Governmental Organization (NGO) working in Anantapur district of Andhra Pradesh, India. The purpose of this Biogas CDM Project activity is to set up 15,000 biogas plants (digesters) for single households in all Mandals¹ of Anantapur District.

Biogas of 2 cum capacity is installed in each household and fed cattle dung into the anaerobic digester for the production of biogas for cooking purposes. By utilizing cattle dung in a controlled anaerobic digestion and combustion system, biogas is available as thermal energy, which is used for cooking and water heating for bath. Biogas is used on a two-ring gas stove supplied as part of the project activity. Households having cattle or willing to collect cattle dung have participated in the project activity. The project was implemented upon registration of the project as a CDM project activity, as the project is financed completely from carbon revenues. The project contributes to social, environmental, economic and technological benefits which contribute to sustainable development of the local environment and the country.

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 water heating for bath.

¹ Mandal is an administrative unit below the district consisting of a group of villages with administrative and local government functions.

The project activity is claiming credits for the 2nd crediting period. This is the second monitoring report under the second crediting period. The 2nd crediting period is from 31/5/2021. The project after completion of the first crediting period, renewed the project activity for CDM with the UNFCCC and with GS4GG. The project has also transitioned from GS CERs to GS VERs without deregistering from CDM.

A.2. Location of project

>> Host Party; INDIA, Region/state/province, etc.; ANDHRA PRADESH

City/town/community, etc.; All Mandals of Anantapur

Physical/geographical location:



Figure 1: Map of Andhra Pradesh and Anantapur district in which the project is implemented

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.

A.3. Reference of applied methodology

>> SECTORAL SCOPE - 01 Energy industries (Renewable/Non-renewable sources)

TYPE I - Renewable Energy Projects

CATEGORY- AMS. I.E. Switch from Non-Renewable Biomass for Thermal Applications by the User, version 11.0

A.4. Crediting period of project

>>

Type: Renewable

First Crediting Period: 31/05/2014; 7 years, 0 months – 31/05/2014 to 30/05/2021

Second Crediting Period: 31/05/2021; 5 years, 0 months - 31/05/2021 to 30/05/2026

SECTION B. IMPLEMENTATION OF PROJECT

B.1. Description of implemented project

>> The guiding principle of AF Ecology Centre is concern for the poor and reaching out to as many needy people as possible. AF Ecology Centre took up this project to provide biogas to the rural communities of the drought prone and biomass scarce Anantapur district of Andhra Pradesh, India.

The project activity is construction of 15,000 biogas plants in the project area. Of these, 3,351 were constructed and commissioned so far till 31st December 2022. During this monitoring period there was no construction of new biogas units. Only repair and maintenance of the constructed units were done. The biogas project involves implementation of the technology, maintenance and monitoring the emission reductions. The construction of biogas plants was done in a phased manner. The details of the units commissioned and operational at Mandal level are as follows:

Mandals	2014	2015	2016	2017	2018	2019	2020	2021	Total
Anantapur		36	129	51	19	9		1	245
Atmakur		112	24	9				4	149

Battalapalli		55	144	25	19	38	45	20	346
Bukkarayasamudram		106	171	37	25	20		4	363
Dharmavaram		154	106	52	37	34		14	397
Garladinne		11	73	17	28	1		2	132
Kanaganepalli		13	43	161	61	8		38	324
Kothacheruvu							51	29	80
Kuderu		46	36	8					90
Mudigubba								9	9
Narpala		62	73	56	2	6	20	6	225
Pamidi					19	10		5	34
Pedda Vadaugur						22		15	37
Putaparthi			32		17	42	15		106
Rapthadu	1	75	41	128		25		20	290
Singanamala		60	161	31	58	29	1	6	346
Tadimarri		6	111	46	6	3	6		178
Grand Total	1	736	1,144	621	291	247	138	173	3351

The table shows the biogas units commissioned for the calendar year (January – December). Cumulatively the units commissioned annually are as follows:

2014	2015	2016	2017	2018	2019	2020	2021
1	737	1,881	2,502	2,793	3,040	3,178	3,351

The list of beneficiaries, their unique user ID, village, and other details are provided in the ER calculations excel file. The dates of commission of all the biogas plants is listed in the excel sheet. The project activity of 3,351 biogas units was implemented in 166 villages of 17 Mandals, Anantapur district, the details of which are as follows.

SI No.	Mandals	Number of Households	Number of Villages
1	Anantapur	245	12
2	Atmakur	149	7
3	Battalapalli	346	22
4	Bukkarayasamudram	363	13
5	Dharmavaram	397	23
6	Garladinne	132	8

7	Kanaganepalli	324	12
8	Kothacheruvu	80	5
9	Kuderu	90	10
10	Mudigubba	9	1
11	Narpala	225	8
12	Pamidi	34	2
13	Pedda Vadagur	37	3
14	Putaparthi	106	6
15	Rapthadu	290	14
16	Singanamala	346	12
17	Tadimari	178	8
Total		3,351	166

In total during the monitoring period, 18.98% were not operational throughout the monitoring period due to various reasons which can be categorized as cattle sold, breakdown of biogas units and needs repair, temporary migration or not interest in using biogas. For the monitoring period, 81.02% of the units are operational due to repair and maintenance for the monitoring period.

The operational domestic biogas units are in continuous use after installation. In between, due to repair and maintenance, some of the biogas units were not be in operation for different durations of time. For each of the unit, the days not operational, is recorded. This information is included in the excel ER calculations sheet. The date on which the problem occurred and the problem was fixed is recorded and entered into the online monitoring solution, which is the basis for emission reduction calculations for only the operational units and operational days of installed units. The various reasons and days lost due to repairs and maintenance are as follows:

Problems	Number of Problems	Total biogas days Lost
Unit Broken down	225	197667
Sold Cattle	129	86898
Empty and Replaster Dome	127	58436
Gober Dry	104	32973
Not Interested	34	25962
Not In Village	17	13272
Replace Stove	38	11770
Repair Outlet Tank	14	9351

Replace Gas Pipe	29	6651
Repair Stove	47	5487
Kitchen not Used	4	3772
Replace Gate Valve	28	3279
Repair Gas Pipe	22	2924
Gobar Too Watery	12	1010
Change Nozzle	11	703
Drain Water in Gas Pipe	8	221
Grand Total	849	4,60,376

The beneficiaries inform the village volunteers or the biogas case workers of any repairs required. Minor repairs are done by them, while major repairs such as repair of cracked domes and re-plastering of domes are done by trained masons.

Description of the installed technology(ies), technical process and equipment

The biogas plant of Deenbandhu model (Fig 2) consists of a digester with a fixed, non-movable gas space. Users prepare batches of dung slurry in the mixing tank, before allowing the final mixture to flow into the digester for methane formation phase. By utilizing dung substrate in an anaerobic digestion and combustion system, biogas is made available. Biogas is generated by fermentation of cellulose rich organic matter under anaerobic conditions. In anaerobic conditions, the methane-producing bacteria become more active. The anaerobic digestion consists of three stages: I Hydrolysis; II Acid formation and III Methane fermentation. The processes are carried out by two sets of bacteria namely acid forming bacteria and methane formers. The acidogenic phase I is the combined hydrolysis and acid formation stages in which the organic wastes are converted mainly into acetate, and phase II is the methanogenic phase in which methane and carbon dioxide are formed. The recovered gas is combusted and used for cooking and water heating. The chosen methane recovery and combustion system is the time tested Deenabandhu model biogas technology which is well-known in India.

The individual plant consists of a mixing chamber where waste water and cow dung are mixed, an inlet pipe to feed the slurry into the reactor, the main biogas reactor/digester where methane formation/recovery takes place, a slurry outlet pipe, an outlet chamber, and a slurry platform. The outlet pipe and tank are provided to remove the digested/treated sludge or fermentation residue and the slurry platform is

provided to maintain the treated slurry in clean condition. A pipe leading from the top of the dome to the stove is provided to supply biogas to a 2-ring stove inside the house. The cross-section of a biogas unit is as shown in Fig 2.

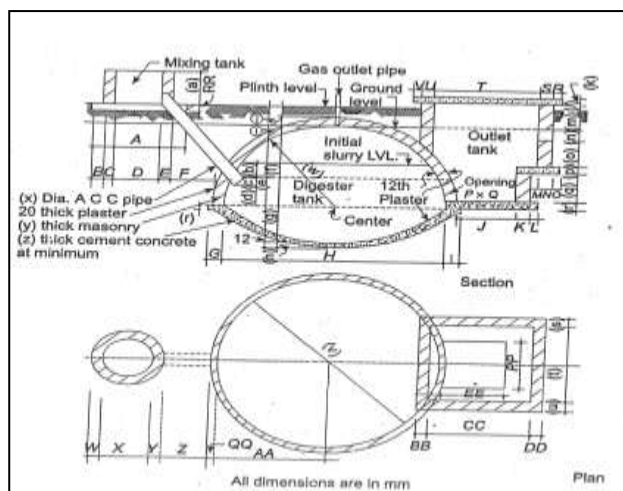
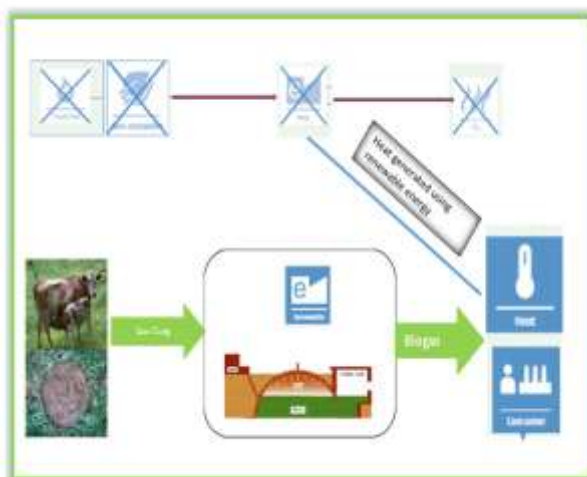


Fig 2: Cross-section of biogas model



Technical process and equipment



Deenabhandu Model Biodigester



Biogas Stove used for Cooking

B.1.1 Forward Action Requests

>>

FAR # 1: In-line with GS4GG Principles and Requirements, VVB and PP shall consider the rule below for future monitoring activities: 5.1.39: An annual update report shall be provided to GS -when design certification is achieved- for each monitoring year by the end of next calendar year for which verification is not completed.

- The annual report was submitted in 2023,2024 and 2025.

FAR # 2: At the time of Performance Review for GS-VER, the project developer shall make a declaration in writing in the monitoring report and confirm the project will not issue both CER/other compliance units under Paris Agreement and GS VER for the same vintage. VVB shall verify and confirm the same.

- This is included in the monitoring report in section A.1.

FAR # 3: 1. Section B.1 MR and Appendix 4 VR – FAR - If the same VVB wishes to performance verification of this project for which they have performed validation activity, the VVB shall ensure that the entire verification audit team, including lead auditors, auditors and sectoral experts, are different from the team that performed the validation activity. In case noncompliance, no further deviation should be approved in this case.

- This FVR is responded by the VVB in the Verification Report

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 registered monitoring plan and applied methodology

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 has been a change in the start date of crediting period. The start date of the crediting period was changed from 01 Jun 2012 - 31 May 2019 to 31 May 2014 - 30

May 2021². This is due to the fact that there was a delay in the start of the project activity.

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 permanent deviation of monitoring from the applied methodologies or other methodological regulatory documents during this monitoring period.

B.2.5. Changes to project design of approved project

>> There is no change to the project design of approved project.

²

<https://cdm.unfccc.int/UserManagement/FileStorage/9RIZOTDBXPAJ7G2MN04WSY1ELUVFH6>

SECTION C. DESCRIPTION OF MONITORING SYSTEM APPLIED BY THE PROJECT

>> **Implementation Plan**

The project activity was implemented only after registration as a CDM project activity and was able to secure carbon revenues. The project was implemented with upfront carbon revenues under an ERPA drawn up for the purpose. Carbon revenues are being used in a completely open and transparent manner to construct biogas units. A CDM Team is facilitating the construction and maintenance of the biogas units as described below.

Project Management and Monitoring

This Biogas CDM project is being implemented and monitored by AF Ecology Centre. AF Ecology Centre has constructed 3,351 domestic biogas units of 2m³ capacity, for as many farmer families in 166 villages spread over 17 Mandals of Anantapur district, Andhra Pradesh, India.

Biogas Project Management Unit within AF Ecology Centre

A CDM team has been set up within AF Ecology Centre for management and monitoring of the Biogas CDM Project with the following staff:

Biogas CDM Project Manager: A biogas CDM project manager is overall in-charge of the project activity and is responsible for overall project implementation in the initial years and meeting the requirements of monitoring protocol thereafter. His main function are to deal with CDM issues, coordinate Biogas CDM Staff and village functionaries, ensure quality from material supply, through construction, to commissioning of units and set up a repair and maintenance system to attend to issues that cannot be locally addressed through the village level systems.

IT Professional: The IT profession is responsible for maintaining the digitized monitoring solution and monitoring sheets for CDM Verification, ensure that authentic data is entered into the solution and make spot checks to verify, deal with the IT Company, TRISTLE that prepared the solution and peruse the analytical reports in the

digitized monitoring solution and recognise patterns to predict problem areas and under-performance.

Accountant: The accountant for the project activity is responsible for ensuring a strict and diligent spending of carbon revenues and the recording thereof in a computerised accounting package. He arranges for the bulk purchase of cement and hardware and transfers them to the Mandalam storehouses, arranges timely payments for material suppliers and masons, inspects quality of material (bricks and sand) before making payments, negotiates for the timely supply of high quality cement and hardware and prepares statutory reports for end of year audit.

Biogas Field Workers: The Biogas field workers oversee the construction of biogas units. Each field worker is in-charge of construction and report to the Project Manager and their tasks include inspecting the number of cattle, distance from kitchen in each household, mark and arrange for excavation of pits, identify local suppliers of material (bricks and sand) for each village, get the price and quality approved by the Project Manager, and arrange for transportation to the villages, transport cement and hardware from the Mandalam storehouses, assign Masons to particular villages and oversee the quality of their work and ensure that End User family labour is actively used and record the progress of processes in specially designed formats and enter the data into the digitized monitoring solution on a fixed day every week

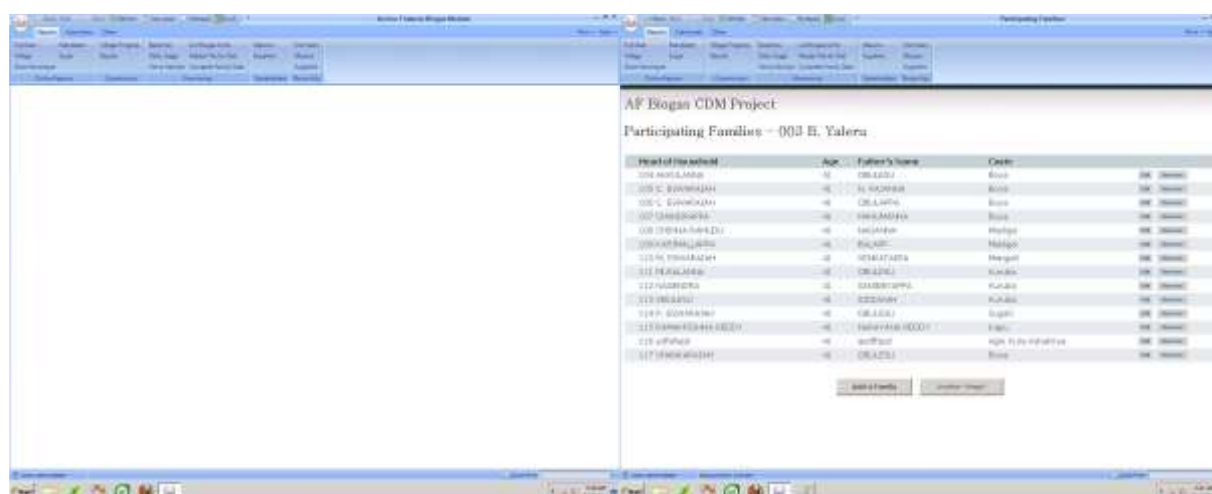
Post construction of the biogas units, the biogas field workers continue to be responsible to support village level institutions; assist in selection of volunteers and train and support them. They record the monthly totals from the daily Monitoring books maintained by Volunteers and, once a month enters the data into the digitized monitoring solution. They contract Masons and attend to major repairs that cannot be handled by the village level institutions.

Masons: Local Masons have been trained at ongoing Fair Climate Network (FCN) Biogas CDM Projects, of which Accion Fraterna Ecology Centre is also one of the members. They are assigned to each Biogas Field Worker. They are paid at a piece rate for each unit they build and their personal and contact details are stored in the digitized monitoring solution to fix responsibility. Similarly, the personal and contact details of each Material Supplier are also recorded, along with their bank account numbers. During the construction phase the masons built the 3,351 biogas units.

During this monitoring period, they are only involved in any structural repairs of the built biogas units.

Management system at village level: Village level Volunteers have been appointed to maintain the Daily Monitoring Books where non-usage days and reasons for non-usage are recorded. Each volunteer monitors usage of biogas units in 2-3 villages. She is responsible for post construction monitoring of usage and be the first to identify dysfunctional units. The Volunteer either prompts the End User Group to set right a problem or bring it to the notice of the Biogas Field Worker. Major problems such as re-plaster or reconstruction of biogas domes are done by trained masons.

Digitized Monitoring system: A customised Biogas CDM Monitoring Solution developed and tested by Tristle Technologies Pvt. Ltd., is used to maintain demographic data, construction processes, and the regular monitoring. This web-based solution is permission driven and easy to use by Project Staff and Volunteers. All activity processes, including financial transactions, are digitally monitored using an Intranet solution. Open and transparent online reports are generated and used by all the Project Staff and secondary stakeholders to know the Progress and Results. Reports are generated at all levels – Project, Mandal, Gram Panchayat, Village and Participating Family. The database is updated on an everyday basis, as and when Project Staff return from their respective villages.



The screenshot displays a web application titled "AF Biogas CDM Project" with a sub-header "Participating Families - 003 H. Yalera". It features a table with columns for "Household No.", "Age", "Father's Name", and "Gender". The table lists 15 families with their respective details. At the bottom of the table, there are two buttons: "Add New Family" and "Update Family".

Household No.	Age	Father's Name	Gender
001 H. Yalera	45	H. Yalera	Male
002 H. Yalera	45	H. Yalera	Male
003 H. Yalera	45	H. Yalera	Male
004 H. Yalera	45	H. Yalera	Male
005 H. Yalera	45	H. Yalera	Male
006 H. Yalera	45	H. Yalera	Male
007 H. Yalera	45	H. Yalera	Male
008 H. Yalera	45	H. Yalera	Male
009 H. Yalera	45	H. Yalera	Male
010 H. Yalera	45	H. Yalera	Male
011 H. Yalera	45	H. Yalera	Male
012 H. Yalera	45	H. Yalera	Male
013 H. Yalera	45	H. Yalera	Male
014 H. Yalera	45	H. Yalera	Male
015 H. Yalera	45	H. Yalera	Male

Progress Reports: Real-time Progress Reports is available to everyone in an open and transparent manner for the following:

- Implementation Progress (overall project to village reports) on

- Construction progress, time line & efficiency
- Gender disaggregated analysis & dwelling details of participating families
- Daily usage resume, Audit & Maintenance & CER generation to date
- Total expenditure & average cost per unit
- Participating Families
- Demographic details
- Mason, Commissioned Date & Usage Days
- Construction Details with Date, Process, & Who Monitored
- Construction Overview
- Village-wise Progress
- Output, Outcome & Results
- Monitoring of operating units
- Masons & Suppliers
- Masons
- Suppliers
- Photo Albums of Masons and Suppliers
- Reports that meet CER Verification requirements
- Monitoring operating units
- Full List of all the Commissioned Units
- Non-usage days

The monitoring solution is used to record the Mandals, Gram Panchayats and Villages along with the demographic details of participating families where the CDM project is implemented. Staff and Volunteer responsibilities are assigned to each of the units during the actual construction and monitoring phases, respectively.

Monitoring the Construction Phase: Construction of the Biogas Units is carried out in a phased manner. The various processes involved in the implementation of the technology are as follows:

- Selection of Participating Families
- Defining Masons & Material Suppliers
- Monitoring Construction Progress
- Marking
- Excavation
- Supplying crushed Stone Jelly, Sand, Bricks and Cement
- Supplying Hardware

- Concreting, Brick Work & Plastering
- Filling Gobar
- Supplying & Fixing Pipes and Stove
- Fixing the Safety Grill
- Commissioning the Biogas Units
- Generating End User Agreements
- Monitoring operating units
- Logging Breakdowns & Repairs – Non usage days



Project Staff ensure quality of installed Biogas Units. They check the quality and ensure that the required quantities of material are used during construction. All payments are made by cheque and Suppliers irrefutably identified with personal data and digital photographs fed into the computerized databank.

Each Biogas Unit is marked with a unique Identification number. Along with the Village Code and Family Code, these irrefutably identify each of the constructed Biogas Units. After commissioning and satisfactory functioning of the Biogas Unit, an End User Agreement was signed with the Participating Family. Full account of emission reduction is considered from Day 1 of commissioning.

Monitoring after Commissioning of biogas units: A Daily Monitoring Book is maintained in each of the villages to record the biogas unit ID, the reason and the date since the biogas unit is non-functional. Once the problem is fixed, the date is noted. This data is fed into the individual Biogas User's online database, once a month, for days not used and reasons. Emission Reductions are not estimated for these days of non-operation.

If any Biogas Unit is faulty or not functional, the problem report is given to the Area Team for action. There is a continuous database maintained of all the Biogas Units not operational on a day-to-day basis. The computerized solution provides all the details at the Participating Family level for the number of non-operational days, and the reasons of non-operation. This monitoring will give the data of operational Biogas Units and serve to triangulate the data.

This monitoring solution positively impacts Staff and Volunteers to enhance Performance and produce good Results.

- The features, organisation and ordering accurately mirror the implementation plan and serve as unambiguous job descriptions for secondary stakeholders. Project processes are sequentially ordered into jobs and tasks. Project staff knows exactly where they stand in terms of progress and results. They are comfortable in the knowledge that objective standards like number of commissioned Units, recording of breakdowns, conducting timely repairs, etc. is used to measure their performance.
- The totally open and transparent reports track progress from marking to commissioning. These along with budget realisations, keeps a wider audience constantly informed on progress and financial health. They also get up-to-date information on the volume of ERs generated and this serves as an indicator on financial viability and feasibility.
- Verification data needed for ER calculations and for the DoE are generated as Excel files.

All data are archived and stored throughout the crediting period and an additional 2 years.

End User Agreements: About 15 days after commissioning each Biogas Unit (i.e. after the satisfactory functioning of the unit), a legally binding End User Agreement is signed between the Project Proponent (AF Ecology Centre) and every single End User. These formally spell out the roles, entitlements and responsibilities of both parties.

Maintenance, Servicing & dealing with Emergencies: Volunteers visit the end users on a regular basis and record data of non-usage of biogas units. The non-operational days are recorded by the village level volunteers. The volunteers visit the households at least monthly once to check on the units. Also in case of any repairs or maintenance, the end user calls the village level volunteer. The date of the issue reported or found through field visit is noted down and entered into the online monitoring solution. As and when it is repaired, it is again entered into the monitoring solution. These days are recorded as non-operational days. They are the point persons who will immediately identify problems. Minor repairs are conducted either by the End User family or the Volunteer herself, since she is trained and given a kit with tools and spare parts. If the repair involves the expenditure of monies for the

purchase of material, the matter is discussed and the Biogas Field Worker is informed and the problem attended to.

Trainings are conducted before project implementation at various stages for Orientation to end users on the effects of climate change, CDM processes and bio-gas, beneficiary farmers, particularly women on use and maintenance of bio-gas units, training the masons on construction parameters and quality of construction, including assessment of the quality of materials like bricks, cement etc. and Training the Volunteers on maintaining Monitoring Records of usage of bio-gas stoves by the families.

SECTION D. DATA AND PARAMETERS

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

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SDG13

Data/parameter	Rating Biogas
Unit	kW/digester
Description	Capacity of a digester
Source of data	Calculated as shown in Section B.2 of the registered PDD
Value(s) applied	1.78
Choice of data or Measurement methods and procedures	Calculated as shown in Section B.2.
Purpose of data	This parameter is calculated in order to establish the capacity of the digester and scale of the project activity. And it is not used in calculation of baseline emissions, project emissions or leakage.
Additional comment	Qualifies as a small-scale project activity. This parameter is fixed for the entire crediting period

Data/parameter	BC _{BL,HH,y}
Unit	Tonnes /household/year

Description	Average annual consumption of woody biomass per household before the start of the project activity
Source of data	Survey and Kitchen test conducted in the project area
Value(s) applied	2.82 tonnes/year/family
Choice of data or Measurement methods and procedures	Based on survey conducted during the renewal of crediting period to estimate the average annual consumption of woody biomass. The average annual consumption of biomass is 1.93 kg/capita/day. The adult equivalent per family in the project area is considered as 4 based on census data for Anantapur. By = 1.93 kg/capita/day x 365 days x 4/family = 2.82 t/household/yr..
Purpose of data	Estimation of Baseline Emissions
Additional comment	This parameter is fixed for the entire crediting period

Data/parameter	$f_{NRB, y}$
Unit	-
Description	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass
Source of data	Calculated based on following sources of data: 1. State of Forest Report, Forest Survey of India, 2019. 2. Kaul, M., Mohren, G.M.J., and Dadhwal, V.K., Phytomass carbon pool of trees and forests in India, Climatic Change, DOI 10.1007/s10584-010-9986-3, 2011 3. Wood is Good, Is India doing enough to meet its present and future needs? A status report by Centre for Science and Environment, CSE, 2017. 4. FAO Database of round wood consumption
Value(s) applied	0.737
Choice of data or Measurement methods and procedures	As per "TOOL30: Calculation of the fraction of non-renewable biomass, Version 3"

Purpose of data	Estimation of Baseline Emissions
Additional comment	This parameter is fixed for the entire crediting period

Data/parameter	NCV _{biomass}
Unit	TJ/tonne
Description	Net Calorific Value of Non-Renewable Woody Biomass
Source of data	I.E Methodology, Version 11
Value(s) applied	0.0156
Choice of data or Measurement methods and procedures	The baseline fuel replaced is only woody biomass. IPCC default for wood fuel, 0.0156 TJ/tonne, based on the gross weight of the wood that is 'air-dried' may be used if fuel used in project device is also woody biomass given in methodology
Purpose of data	Estimation of Baseline Emissions
Additional comment	This parameter is fixed for the entire crediting period

Data/parameter	EF _{projected_fossilfuel}
Unit	tCO ₂ /TJ
Description	Emission factor for substitution of non-renewable woody biomass by similar consumers.
Source of data	IPCC I.E Methodology, Version 11.
Value(s) applied	64.4
Choice of data or Measurement methods and procedures	AMS I.E. Methodology, Version 11
Purpose of data	Estimation of Baseline Emissions
Additional comment	This parameter is fixed for the entire crediting period
Data/parameter	Determination of Leakage
Unit	t/HH/yr
Description	woody biomass
Source of data	AMS I.E. Methodology

Value(s) applied	0.14 for household fuelwood use of 2.82 t/HH/Yr. Based on the fuelwood use determined ex-post (BCBL,HH,y,-BCPY,HH,y) leakage will be determined by net to gross adjustment factor of 0.95 to account for leakage.
Choice of data or Measurement methods and procedures	By is multiplied by a net to gross adjustment factor of 0.95 to account for leakages
Purpose of data	Leakage
Additional comment	Surveys will not be required to determine leakage.

D.2 Data and parameters monitored

>>

SDG 13

Data / Parameter	Date of commissioning of biogas units
Unit	Date
Description	Actual date of commissioning of the project device.
Source of data	Monitoring Solution
Value(s) applied	As and when commissioned for all the 3,351 biogas units.
Measurement methods and procedures	The construction processes was monitored on a day to day basis and database maintained from its initiation to completion dates for each of the biogas unit. Thus the start date of each of the unit installed recorded on the online monitoring solution.
Monitoring frequency	As and when commissioned and fixed and recorded in the monitoring solution
QA/QC procedures	This can be triangulated with the End User Agreement.
Purpose of data	To estimate baseline emissions.
Additional comment	The date of commissioning is reported in the ER calculations sheet.

Data / Parameter	N_{HH}
Unit	Number
Description	Number of households in the project activity in year y
Source of data	Monitored on a daily basis and entered into the monitoring database.
Value(s) applied	3,351
Measurement methods and procedures	The 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. Thus the start date of each of the unit installed is fixed for each of the unit. In case of replacement of any unit due to demolition will be recorded and the loss days accounted for. This could be for the same user or new users in which case the baseline is the users were using fuel wood. A new end user agreement will be signed with them and recorded. There was no replacement.
Monitoring frequency	As and when the unit is commissioned and updated into the monitoring solution
QA/QC procedures	All activity processes, including financial transactions for construction of biogas units, are digitally monitored using the online monitoring solution. This provides verification for the construction of biogas units. All data is archived and stored throughout the crediting period and an additional 2 years.
Purpose of data	Baseline Emissions
Additional comment	ERs are calculated for only the installed and operational biogas units.

Data / Parameter	Number of biogas plants operating
Unit	Number

Description	Number of plants operating in year
Source of data	Log books maintained and entered in the digitized monitoring database for biogas units operating
Value(s) applied	2,715 units (81.02% of installed units)
Measurement methods and procedures	In every village, the women Volunteer monitors the biogas units that are non-operational. The days other than that non-operational will determine the biogas units which are operational. For the monitoring period, the operational days of installed biogas units is calculated by subtracting the non-usage days. The emission reduction are estimated only for operational days. Of the constructed 3,351 units, 2,715 units are operational at the end of the monitoring period.
Monitoring frequency	The data of non-operational units are done on a regular basis as and when a unit is dysfunctional. As and when biogas units are not operational, it is recorded. The remaining days are considered operational.
QA/QC procedures	Log books and digitized database is checked regularly by project staff and CDM coordinator.
Purpose of data	Baseline Emissions
Additional comment	All data is archived and stored throughout the crediting period and an additional 2 years. This is to ensure that the units are repaired and provide sustainable thermal energy to the end user.

Data / Parameter	$BC_{PJ,HH,y}$
Unit	tonnes/household/year
Description	Average annual consumption of woody biomass per household in the pre-project devices during the project activity, if it is found that pre-project devices were not completely displaced but continue to be used to some extent

Source of data	1. The days not used from the daily monitoring report for each of the unit done at the village level and data maintained on the digitized monitoring database. 2. Surveys for parallel use of traditional stoves.
Value(s) applied	1. 0.51 t/HH/yr for 2023 2. 0.59 t/HH/yr for 2024 3. 0.41 t/HH/yr for 2025 0.00056 used t/HH/day in parallel use of traditional stoves
Measurement methods and procedures	1. As and when biogas units are not functional, the beneficiaries report to the village level women volunteer, who in turn reports to the Case Worker of the project for the repair of the unit. A log book is maintained for the reason of non-function and days under repair. The data is entered into the monitoring solution for each of the unit. The appropriate fuelwood use for non-operational days of biogas units is accounted. 2. For parallel use of pre-project devices, monitoring consists of estimation of a representative sample thereof, at least once every two years (biennial). A statistically determined sample size was sampled to determine the quantity of fuelwood used on pre project devices. A household level questionnaire survey was conducted.
Monitoring frequency	1. It is monitored on a day to day basis by the Village level volunteers, which is then entered into the monitoring solution for all the biogas units. 2. At least once every two years (biennial)
QA/QC procedures	The two pronged approach to determine the data/parameter results in emission reduction calculations that are based on real time data and have less uncertainty.
Purpose of data	Baseline Emissions

Additional comment	The objective to monitor the non-functional days is to ensure prompt operation and maintenance of the units so that the rural communities can continuously use biogas and are rid of drudgery they are facing using traditional biomass cook stove.
Data / Parameter	Confirmation that non-renewable biomass has been substituted
Unit	-
Description	Confirmation that non-renewable biomass has been substituted
Source of data	Sample survey
Value(s) applied	100% of non-renewable biomass is replaced. The usage in the project scenario was only a few households using about 55% of fallen twigs and branches and 45% of crop residue.
Measurement methods and procedures	A household level sample survey was conducted to confirm that non-renewable biomass has been substituted. The survey conducted assessed the collection and usage pattern in terms of percentage collection of fallen twigs and branches, crop residue and cut and carry.
Monitoring frequency	At least once every two years (biennial) simple random Sample Survey
QA/QC procedures	This survey was done for a statistically determined number of households at 95/10 precision confidence level.
Purpose of data	Confirmation of replacement of non-renewable biomass
Additional comment	Confirmation that non-renewable biomass has been substituted

SDG 3: Good health and well-being

Target 3.9. By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

Data / Parameter	i. Reduction in indoor air pollution ii. Reduction in health issues due to better indoor air quality
Unit	i. % ii. %
Description	i. Reduction in indoor air pollution due to reduction in use of traditional cook stoves ii. Reduction in health issues due to better indoor air quality due to reduction in use of traditional cook stoves
Source of data	i and ii. Based on experience by the communities for reduction in health problems. through sample survey.
Value(s) applied	i and ii. 100% of the surveyed families
Measurement methods and procedures	Sample survey and record the experience by the communities for reduction in indoor air quality and health problems compared to baselines.
Monitoring frequency	Once in 2 years
QA/QC procedures	The sample size is as per the sample size determined for parameters to estimate Emission Reductions. In case it returns a value of less than 30, a minimum of 30 households will be surveyed.
Purpose of data	To determine the impact of the project to the SDG 3
Additional comment	50 households were sampled.

SDG 5: Gender Equality

Target 5.4. Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate

Data / Parameter	Reduction in time for fuelwood collection and cooking due to ease of cooking on biogas
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Unit	% reduction of Hrs
Description	Reduction in Hours for collection of woody biomass and cooking
Source of data	Sample survey
Value(s) applied	57.68% of time for cooking and 66.92% for fuelwood collection.
Measurement methods and procedures	Sample survey and record the experience of women for reduction in time spent and other activities undertaken compared to baseline
Monitoring frequency	Once in 2 years
QA/QC procedures	A minimum of 30 households will be sample surveyed.
Purpose of data	To determine the impact of the project to the SDG 5
Additional comment	A total of 50 households were sampled.

SDG 7: Affordable and Clean Energy

Target 7.2. By 2030, increase substantially the share of renewable energy in the global energy mix

Data / Parameter	i. Number of biogas units constructed ii. % of units operational
Unit	i. Number ii. %
Description	i. Number of biogas units constructed for the rural communities thereby reducing the use of fuelwood. ii. % of biogas units working after repaired and maintenance for continuous use of biogas units making them operational
Source of data	Based on data from online monitoring solution
Value(s) applied	i. 3,351 units ii. 2,715 units - 81.02% operational
Measurement methods and procedures	i. and ii. The village level volunteers/biogas case workers collect data of the units constructed. Also, the units that that are non-operational and needs repairs

	are collected. This information is entered into the monitoring solution for the project. As and when the units are repaired, it is entered in the monitoring solution. This data provides information of the parameter.
Monitoring frequency	Continuous
QA/QC procedures	Real time data of all the units ensure high reliability and low uncertainty as every unit is monitored
Purpose of data	To assess the contribution to the SDG 7, with regard to affordable, reliable, and sustainable thermal energy to the rural communities
Additional comment	

SDG 8: Decent work and economic growth

Target 8.5. By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value

Data / Parameter	Number of jobs created																																			
Unit	Number																																			
Description	Number of permanent and temporary jobs created due to the project activity																																			
Source of data	Financial transactions																																			
Value(s) applied	<table><tr><th>Jobs</th><th>Number</th><th>No. of Male</th><th>No. of Female</th></tr><tr><td>CDM Manager</td><td>1</td><td>1</td><td>0</td></tr><tr><td>Desk Worker</td><td>1</td><td>0</td><td>1</td></tr><tr><td>IT Person</td><td>1</td><td>1</td><td>0</td></tr><tr><td>Case Worker</td><td>5</td><td>5</td><td>0</td></tr><tr><td>Volunteers</td><td>104</td><td>0</td><td>104</td></tr><tr><td>Total</td><td>112</td><td>7</td><td>105</td></tr><tr><td colspan="2">% of Male and Female employees</td><td>93.75% female</td><td>6.25% male</td></tr></table> Of these, 8 are permanent jobs, which includes the CDM Manager, Desk worker and the Case workers. The				Jobs	Number	No. of Male	No. of Female	CDM Manager	1	1	0	Desk Worker	1	0	1	IT Person	1	1	0	Case Worker	5	5	0	Volunteers	104	0	104	Total	112	7	105	% of Male and Female employees		93.75% female	6.25% male
Jobs	Number	No. of Male	No. of Female																																	
CDM Manager	1	1	0																																	
Desk Worker	1	0	1																																	
IT Person	1	1	0																																	
Case Worker	5	5	0																																	
Volunteers	104	0	104																																	
Total	112	7	105																																	
% of Male and Female employees		93.75% female	6.25% male																																	

	village level volunteers, 104 in number, are temporary jobs.
Measurement methods and procedures	Based on financial statements of the project
Monitoring frequency	Continuous
QA/QC procedures	Is based on salaries provided as proof
Purpose of data	To assess the contribution to the SDG 8 with regard to jobs created
Additional comment	CDM Staff and Village level volunteers are involved in the monitoring, repair and maintenance of the project

SDG 17: Partnerships for the Goals

Target: **17.3.** Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

Data / Parameter	Domestic/international carbon funding to construct and maintain biogas units
Unit	Rs.
Description	Domestic/international carbon funding to construct and maintain biogas units
Source of data	Audited statement for the project
Value(s) applied	93.32 million Rs. for the project so far and 10.79 million for the monitoring period i.e. 100% carbon revenue for construction and maintenance of units
Measurement methods and procedures	Carbon fund received for construction, repair and maintenance to the project
Monitoring frequency	Continuous
QA/QC procedures	The carbon revenue will be accessible through bank and audit statements.
Purpose of data	To assess the contribution to the SDG 17, with regard to strengthening domestic/international support to projects in developing countries

Additional comment

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

Data/Parameter	Value obtained in this monitoring period		Value obtained last monitoring period	
Reduction of CO ₂	2023	5,438	2021	3,199
	2025	5,267	2022	5,878
	2025	2,902	Total	9,077
	Total	13,607		
i. Reduction in indoor air pollution (100% of HHs)	i. 100% of surveyed households		i. 100% of surveyed households	
ii. Reduction in health issues due to better indoor air quality	ii. 100% of surveyed households report reduction in health problems		ii. 100% of surveyed households report reduction in health problems	
Reduction in time for fuelwood collection and cooking due to ease of cooking on biogas	57.68% reduction in time compared to baseline for cooking and 66.92% for fuelwood collection		57% reduction in time compared to baseline for cooking and 100% for fuelwood collection	
i. Number of biogas units constructed	i. 3,351 units		i. 3,351 units	
ii. Number of units operational	ii. 80.02% units operational		ii. 88.72% units operational	
Number of jobs created	112 jobs created due to the project activity of which 93.75% are women; 8 permanent and 104 temporary jobs		92 jobs created due to the project activity of which at least 85% are women	
Domestic/international carbon funding to construct and maintain biogas units	93.32 million Rs. for the project so far and 10.79 million for the monitoring period i.e. 100% carbon revenue for construction and maintenance of units		82.53 million Rs. for the project so far and 5.57 million Rs. for the monitoring period i.e. 100% carbon revenue for construction and maintenance of units	

D.4. Implementation of sampling plan

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

- Confirmation that non-renewable biomass has been substituted
- Average annual consumption of woody biomass per household in the pre-project devices during the project activity, used in parallel.
- SDG Parameters other than SDG 13

In consideration of occupancy and demographics of the location there is no difference among the households. The socio-economic and cooking patterns of households are similar. All the households are from rural region of Anantapur District. Simple random sample was conducted to determine the parameter of interest. As a biennial inspection is chosen a 95 per cent confidence interval and a 10 per cent margin of error requirement is to be achieved for the sampling parameter. In cases where survey results indicate that 95/10 precision is not achieved, the lower bound of a 95 per cent confidence interval of the parameter value is chosen as an alternative to repeating the survey efforts to achieve the 95/10 precision.

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

(a) Sampling Design

(i) Objectives: The objective of the sampling effort is to

- a) Confirmation that non-renewable biomass has been substituted
- b) Average annual consumption of woody biomass per household in the pre-project devices during the project activity, used in parallel
- c) SDG Parameters other than SDG 13

The sampling frequency is once in every two years (biennial). As a biennial inspection is chosen a 95 per cent confidence interval and a 10 per cent margin of error requirement is targeted for the sampling parameter. The population is homogeneous in terms of cooking patterns and socio-economic strata. The biogas units implemented

in the region is also of single type – 2 cum deenabhandu model. Hence simple random sample was conducted for the project activity.

(ii) Target Population: The target population is the rural households for which biogas was constructed and operational in the Mandals of Anantapur District, Andhra Pradesh, India.

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

(iv) Sample Size: The sample was drawn at random from the sampling frame. This was done using random number tables in Microsoft Excel. A pilot study was conducted being the first monitoring report for the 2nd crediting period. The value of the pilot survey was considered to determine the sample size. The largest of sample size for the 2 parameters of interest was considered to gather information.

Based on the pilot survey conducted, the mean and standard deviation for fuelwood and calculation of number of samples is as follows.

$$n = \frac{1.96^2 NV}{(N - 1) \times 0.1^2 + 1.96^2 V}$$

where

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

39	<i>n</i>	Sample size
3178	<i>N</i>	Total number of households
3.13	<i>Mean</i>	<i>Expected mean</i>
1.01	<i>SD</i>	<i>Expected standard deviation</i>
1.96	<i>1.96</i>	Represents the 95% confidence required
0.1	<i>0.1</i>	Represents the 10% relative precision
0.1029453	<i>V</i>	

Hence the number of samples needed is 39. Based on survey of non-renewable biomass conducted, zero HHs need to be sampled. Hence the largest of the households to be sampled is 39.

The samples were selected randomly through sampling in excel sheet and was as follows:

2024			
Mandalam	Gram Panchayat	Village	No of HHs
G.D.Nellore	Bukkapatnam	Reddypalli	1
	Kothavenkatapuram	Venkatapuram	2
	Kotrakona	Garampalli	1
	Mukkalathur	Mukkalathur	1
	Nandanuru	Nandanuru	2
	Papireddypalli	Peddakuntapalli	1
	Thugundram	Thugundram	1
	Varathur	Bodapur	1
		Naralakandriga	1
	Vejjupalli	V. Bandarlapalli	1
		Vejjupalli	2
		Vejjupalli MW	1
	Velkur	Velkur	1
Karvetinagaram	Gajanki	Gajanki	2
Nagari	Ayanambakkam	Ayanambakkam	1
	Mangadu	Mangadu	1
	Mittapalem	Chinnathangal	1
	Nagari	Anandappanaidu Kandriga	1
Narayanavanam	Bopparajupalem	n	1
	Kasimmitta	Kasimmitta	1
	Narayanavanam	Keelagaram	2
Nindra	Agarampeta	Agaram	2
	Athuru	Athuru	1
	Kavanur	Kavanur	2
	Koppedu	Koppedu	2
	Nindra	Nindra	1
Pichatur	Mudiyur	Gollakandriga	1
	Vengalathuru	Vengalathuru	1
Puttur	Nesanur	Kalyanavenkateshapuram	1
	Tirumalakuppam	Tirumalakuppam	1
	Nennur	Balijapalli	1
S.R.Puram	Mangunta	Mangunta Colony	1
	Medavada	Marripalli	1
	Padmapuram	Raghavarajupuram	1
Vadamalapeta	Kallur	Kallur	1
Vedurukuppam	Bommaiahpalli	Thellagundalapalli	1
	Devaragudipalli	Adareddypalli	1
	Inamkothur	Damarakuppam	1
		G.T.Kandriga	1

	Kurivikuppam	Thimmireddykandriga	2
	Tirumalaiahpalli	Rentala Chenu	1
Grand Total			50

2025			
Mandalam	Gram Panchayat	Village	No of HHs
G.D.Nellore	Agaramangalam	A. Venkatapuram	1
		Agaramangalam	1
	Athmakur	Rasimareddypalli	1
	Balaganganapalli	Aravachenupalli	1
		Gaddampalli	1
	Bangareddypalli	Bangareddypalli	1
		Samsireddypalli	1
	Chinnavepanjeri	Manginayanikuppam	1
	Kothavenkatapuram	Venkatapuram	1
	Kotrakona	K.Kothuru	1
	Papireddypalli	Peddakuntapalli	1
	Vejjupalli	Vejjupalli	4
		Vejjupalli MW	1
	Velkur	Velkur	1
	Vepanjeri	Vepanjari	1
Karvetinagaram	D.M.Puram	Moolakandriga	1
	Kollagunta	Battuvapuripalli	2
Nagalapuram	S.S.Puram	Adavikandriga	1
Nagari	Mittapalem	Chinnathangal	1
	Nagari	Nagaripetai	1
		Natham Kandriga	2
Narayanavanam	Narayanavanam	Keelagaram	1
	Thumbur	Veluthurkandriga	1
Nindra	Agarampeta	Agaram	1
	Koppedu	Koppedu	1
	Kunam Rajupalem	Kunam Rajupalem	1
	Nindra	Nindra	1
	Orurpeta	Orurpeta	1
Pichatur	Mudiyur	Gollakandriga	1
	Sivagiri	Gollakandriga	1
Puttur	Krishnasamudram	Krishnasamudram	1
	Nesanur	Kalyanavenkateshapuram	1
	Tirumalakuppam	Tirumalakuppam	2
S.R.Puram	49 Kothapallimitta	48 Basivireddy Palli	1
	Katikapalli	Pilligundalapalli	1
	Mangunta	Mangunta Colony	2
	Medavada	Marripalli	1
		Medavada	2
	Muddikuppam	Diguva Muddikuppam	1
	Pillarikuppam	Pillarikuppam	1

	Udamalakurthi	Udamalakurthi	1
Vedurukuppam	Kurivikuppam	Kuruvikuppam	1
Grand Total			50

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

$$n \geq \frac{1.96^2 N \times p(p-1)(N-1)}{(N-1) \times 0.1^2 \times p^2 + 1.96^2 p(p-1)}$$

Where

n = sample size

N = Total number of households

p = expected proportions

1.96 = Represents the 95% confidence required

0.1 = Represents the 10% relative precision

Checking Reliability

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

Where

z-value is 1.96

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

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

f is the sample fraction

n is total population

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

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

$$n \geq \frac{1.96^2 NV}{(N-1) \times 0.1^2 \times 1.96^2 V}$$

Where

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

n = sample size

N = Total number of households

p = expected proportions

1.96 = Represents the 95% confidence required

0.1 = Represents the 10% relative precision

Checking Reliability

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

Where

z-value is 1.96

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

f is the sample fraction – the proportion of the population that is sampled

s² is the sample variance (s is the sample standard deviation)

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

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

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

(v) Sampling Frame: The sampling frame used is the complete listing of all the rural households for which biogas has been built and operational under the project activity in the Mandals of Anantapur District, Andhra Pradesh State. Each of the household has a unique identify number with all the required details of the family.

(b) Data:

(i) Field Measurements: The variable recorded/measured on field is Confirmation that non-renewable biomass has been substituted and the average annual consumption of woody biomass per household in the pre-project devices during the project activity, used in parallel. A household level questionnaire was designed to collect information for the parameter of interest. It was field tested when administered for the first time and modified accordingly based on its ease of getting information on the field and its analysis. The frequency of measurement is once two years. The parameter of interest is not subject to seasonal fluctuations. Hence it was conducted at 2 years interval.

(ii) Quality Assurance/Quality Control: 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, checked and verified further for any typographic mistakes.

(iii) Analysis: The data entry was done in Microsoft excel sheet. The data was cross checked with the filled in questionnaire as QA/QC procedure. The data was analyzed for the parameter. The analysis of the survey shows that 100% HHs confirm that non-renewable biomass has been substituted and average annual consumption of woody biomass per household in the pre-project devices in parallel to use of biogas during the project activity is zero.

But based on monitoring by the village level volunteers, the days not used due to repair and other reasons were considered to account for $BC_{PJ,HH,y}$. the parallel use of fuelwood along with biogas is 0.00056 t/HH/day, But those units which are not working the fuelwood use is considered as $[BC]_{(PJ,HH,y)}$, So the days since not working to the date of repair, for the non-use of biogas, fuelwood use is considered. This accounts for 0.51 t/HH/yr; 0.59 t/HH/yr and 0.41 t/HH/yr for 2023, 2024 and 2025 respectively.

(c) Implementation:

(i) Implementation Plan: The implementation of sampling effort was done by the NGO in consultation with CDM Team of Fair Climate Network (FCN). The FCN has the skill and resources to implement the sampling procedure. The team is experienced with rural energy CDM projects implemented for the rural poor for more than 20 years. The collected data was analysed by the FCN for inclusion in the monitoring report

SECTION E. CALCULATION OF SDG IMPACTS

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

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SDG 13

It is assumed that in the absence of the project activity, the baseline scenario would be the use of fossil fuels for meeting similar thermal energy needs.

Baseline emissions are calculated as:

$$BE_y = B_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossil_fuel} \quad \text{Equation (1)}$$

Where:

BE_y	=	Baseline emissions in the year y (tCO ₂ e)
B_y	=	Quantity of woody biomass that is substituted or displaced in year y (tonnes)
$f_{NRB,y}$	=	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass (fraction or %)
$NCV_{biomass}$	=	Net calorific value of the non-renewable woody biomass that is substituted (TJ/tonne)
$EF_{projected_fossil\ fuel}$	=	Emission factor of fossil fuels projected to substitute non-renewable woody biomass by similar consumers (tCO ₂ e/TJ).

According to Para 29, B_y is determined by following option (a) as follows:

Calculated as the product of the number of households using cookstoves distributed under the project activity multiplied by the estimate of average annual consumption of woody biomass per household that is displaced by the project activity:

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

Where:

- $N_{HH,y}$ = Number of households with functional cookstoves distributed under the project activity in year y (number)
- $BC_{BL,HH}$ = Average annual consumption of woody biomass per household before the start of the project activity or at the renewal of each crediting period, whichever is later (tonnes/household/year)
- $BC_{PJ,HH,y}$ = Average annual consumption of woody biomass per household in the pre-project devices during the project activity (tonnes/household/year). This parameter shall be considered if it is found that pre-project devices were not completely displaced but continue to be used to some extent

Emissions from the use of Non-renewable biomass for meeting similar thermal energy needs, I.E. Version 10.1					
Activity Data	Value (2023)	Value (2024)	Value (2025)	Unit	ID Ref
Number of Households	3,351	3,351	3,351	Number	N_{HH}
Average annual consumption of woody biomass per HH before the start of the project activity	2.820	2.828	1.638	tonnes/HH/ Monitoring Period	$BC_{BL,HH}$
Average annual consumption of woody biomass per HH in the pre-project devices during the Monitoring Period	0.51	0.59	0.41	tonnes/HH/ Monitoring Period	$BC_{PJ,HH}$
Quantity of Biomass that is substituted	7,731.47	7,488.55	4,125.51	tonnes/HH/ Monitoring Period	B_y
Fraction of f_{NRB}	0.737	0.737	0.737	-	$f_{NRB, y}$
NCV Biomass	0.0156	0.0156	0.0156	TJ/tonne	$NCV_{biomass}$
Emission factor	64.4	64.4	64.4	tCO ₂ /TJ	$EF_{projected_fossilfuel}$
Baseline Emissions	5,725	5,545	3,055	tCO ₂ / Monitoring Period	BE_y

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

>>

According to Para 36 of the methodology, if the project cook stoves use biomass, the sources of project emissions as detailed in Para 36 (a), i, ii, iii and iv and 36 (b) has to be considered as applicable, bearing in mind that some sources may be only relevant for specific fuels (e.g. production of bioethanol):

- Project Emissions is not applicable as the cook stoves do not use biomass.

According to Para 37 of the methodology, in case of electric cook stoves, if back up diesel generators are used in compliance with paragraph 6 above, project emissions due to use of diesel shall be accounted for, using the latest version of "TOOL03: Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion".

- Project Emissions is not applicable as the project cook stoves are not electric stoves.

E.3. Calculation of leakage

>> *If the cookstoves distributed under the project activity involve the use of biomass, leakage emissions (LE_y) shall be calculated using the latest version of "TOOL16: Project and leakage emissions from biomass", including leakage emissions due to production of processed renewable biomass and bioethanol (e.g. CO₂ emissions due to consumption of fossil fuels and electricity).*

- Leakage Emissions is not applicable as the project cook stoves do not use biomass.

Leakage emissions related to the non-renewable woody biomass saved by the project activity shall be assessed based on ex post surveys of users and the areas from which this woody biomass is sourced (using 90/30 precision for a selection of samples). The following potential source of leakage shall be considered: the use/diversion of non-renewable woody biomass saved under the project activity by non-project end-users that previously used renewable energy sources. If this leakage assessment quantifies an increase in the use of non-renewable woody biomass used by the non-project end-users that is attributable to the project activity, then B_y is adjusted to account for the quantified leakage. Alternatively, B_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.

- B_y will be multiplied by a net to gross adjustment factor of 0.95 to account for leakages. Hence survey will not be conducted to assess leakage related to non-renewable woody biomass saved by the project activity.

Project activities switching from baseline device using woody biomass to efficient project device using charcoal or switching from woody biomass to processed renewable biomass (briquette, pellets, and woodchips), shall take into account the leakage effects related to the charcoal or processed biomass production.

- Leakage Emissions is not applicable as the project cook stoves are not switching to charcoal or processed renewable biomass.

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

	Value (2023)	Value (2024)	Value (2025)
B_y after considering leakage ($B_y \times 0.95$) tonnes/Monitoring Period	7,344.90	7,114.12	3,919.24
$f_{NRB,y}$	0.737	0.737	0.737
$NCV_{biomass}$ (TJ/tonne)	0.0156	0.0156	0.0156
$EF_{projected_fossilfuel}$ (tCO ₂ /TJ)	64.4	64.4	64.4
ER_y after considering leakage (tCO ₂ /Monitoring Period)	5,438	5,267	2,902
LE_y tCO ₂ /Monitoring Period	287	278	153

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

Emission reductions

Emission reductions are to be estimated based on the equation below.

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (11)}$$

Where:

$$ER_y = \text{Emission reductions in year } y, \text{ tonnes CO}_2\text{eq}$$

Vintage Year	Baseline GHG emissions or baseline	Project GHG emissions or actual net GHG removals	Leakage GHG emissions	Emission Reductions
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	net GHG removals			
	(t CO ₂ e)	(t CO ₂ e)	(t CO ₂ e)	(t CO ₂ e)
2023 (01/01/2023 to 31/12/2023)	5,725	0	287	5,438
2024 (01/01/2024 to 31/12/2024)	5,545	0	278	5,267
2025 (01/01/2025 to 31/07/2025)	3,055	0	153	2,902
Total	14,325	-	718	13,607

SDG	SDG Impact	Baseline estimate	Project estimate	Net benefit	
 SDG 13: CLIMATE ACTION	GHG emission reductions per year	Emissions of 14,325 tCO ₂ emitted by using traditional cook stoves by 3,351 households	Zero Emissions in tCO ₂ emitted by using biogas and 718 tCO ₂ estimated as leakage	13,607 tCO ₂	
				2023	5,438
				2024	5,267
				2025	2,902
				Total	13,607
 SDG 3: GOOD HEALTH AND WELL-BEING	i. Reduction in indoor air pollution ii. Reduction in health issues due to better indoor air quality	i. Use of traditional cookstove causing indoor smoke and health hazards in 3,351 households – 100% households. ii. 0% of HHs having clear indoor air	i. Reduction in indoor air pollution (100% of HHs) ii. Reduction in health issues due in 100% households to better indoor air quality	i. Reduction in indoor air pollution (100% of HHs)	
				ii. Reduction in health issues due in 100% households to better indoor air quality	
 SDG 5: GENDER EQUALITY	i. Reduction in Hours for collection	Women spent time 369.04 hours/yr for fetching, processing and	i. 123.02 hrs/year time spent for fetching, processing and storing fuelwood	i. 66.92% reduction in time spent for fetching, processing and storing	

GENDE R EQUAL ITY	of woody biomass and cooking	storing fuelwood and 4.845 hours/days for cooking on traditional stoves	and 2.04 hours/days for cooking on biogas stoves	fuelwood and 57.68% for cooking food.
 SDG 7: AFFOR DABLE AND CLEAN ENERG Y	i. Constructio n of biogas units for rural communitie s. ii. Maintena nce of constructed biogas units and elimination of use of firewood.	No Biogas Units	i. 3,351 biogas units constructed ii. 81.02% of units operational	i. 3,351 biogas units constructed ii. 81.02% of units operational
 SDG 8. Decent work and econo mic growt h	Number of jobs created	No project related jobs created	112 jobs created due to the project activity of which 93.75% are women; 8 permanent and 104 temporary jobs	112 jobs created due to the project activity of which 93.75% are women; 8 permanent and 104 temporary jobs
 SDG	i. Access to domestic or international	No funding in the baseline scenario	93.32 million Rs. for the project so far and 10.79 million for	93.32 million Rs. for the project so far and 10.79 million for the

17:	al carbon	the monitoring	monitoring period i.e.
PARTN	funding to	period i.e. 100%	100% carbon revenue
ERSHI	implement	carbon revenue for	for construction and
PS	clean	construction and	maintenance of units
FOR	technologie	maintenance of units	
THE	s		
GOALS			

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 ³ achieved during this monitoring period								
13	76,949 for the monitoring period	<table><tr><td>2023</td><td>5,438</td></tr><tr><td>2024</td><td>5,267</td></tr><tr><td>2025</td><td>2,902</td></tr><tr><td>Total</td><td>13,607</td></tr></table>	2023	5,438	2024	5,267	2025	2,902	Total	13,607
2023	5,438									
2024	5,267									
2025	2,902									
Total	13,607									
3	i. 100% of surveyed households ii. 100% of surveyed households report reduction in health problems	i. 100% of surveyed households ii. 100% of surveyed households report reduction in health problems								
5	50% reduction in time compared to baseline	57.68% reduction in time compared to baseline for cooking and 66.92% for fuelwood collection								
7	i. 15,000 units ii. 100% units operational	i. 3,351 units ii. 81.02%% units operational								
8	At least 10 jobs created due to the project activity of which at least 50% are women	112 jobs created due to the project activity of which 93.75% are women; 8 permanent and 104 temporary jobs								
17	At least 50% carbon revenue for construction and maintenance of units	93.32 million Rs. for the project so far and 10.79 million for the monitoring period i.e. 100% carbon revenue for construction and maintenance of units								

³ Whenever emission reductions are capped, both the original and capped values used for calculations must be transparently reported. Use brackets to denote original values.

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

>> The emission reductions for the monitoring period is estimated based on the assumption that the targeted 15,000 biogas units would be constructed by this period. Hence the emission reduction estimated ex-ante is estimated as follows

1 st January 2023 – 31 st July 2025	29,784 tCO ₂ /365 days x 943 days = 76,949 t CO ₂
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According to the PDD, the per unit tCO₂/HH/yr is 1.99, while the emission reduction for the monitoring period is 1.57 tCO₂/HH/yr.

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

>>

There is no increase in emission reductions for the monitoring period.

SECTION F. SAFEGUARDS REPORTING

>> There are no safeguards that needs to be monitored and 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.

>> The various inputs and grievances that were received through village level volunteers or biogas case workers are repair and maintenance of biogas units. The following issues were reported and repaired during the monitoring period.

Problems	Fixed Units
Changed Nozzle	8
Drain Water in Gas Pipe	7
Empty and Replastered Dome	46
Set right Watery dung substrate	11
Dry Dung reloaded	42
Re-starting using	1
Repair Gas Pipe	19
Repaired Stove	39
Replaced Gas Pipe	14

Replaced Gate Valve	21
Replaced Stove	4
Rebought Cattle	1
Grand Total	213

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 was been no legal contest that has arisen with the project during the monitoring period.

Revision History

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