# Monitoring Report

CARBON OFFSET UNIT (CoU) PROJECT


**Title: Andhyodaya Bundled Small Scale Rural Biogas Projects (Phase 1), Kerala**

**UCR Project ID# 281**

Version 1.0

**Date of MR**: 03/03/2023

**1st CoU Issuance Period**: 01/01/2013 to 31/12/2022, 10 Years, 0 Months

**1st Monitoring Period:** 01/01/2013 to 31/12/2022, 10 Years, 0 Months

Monitoring Report (MR)
CARBON OFFSET UNIT (CoU) PROJECT

| Monitoring Report | |
|---|---|
| Title of the project activity | **Andhyodaya Bundled Small Scale Rural Biogas Projects (Phase 1), Kerala** |
| UCR Project Registration Number | 281 |
| Version | 1 |
| Completion date of the MR | 03/03/2023 |
| Monitoring period number and duration of this monitoring period | Monitoring Period Number: 1<br>Duration of this monitoring Period: (first and last days included (01/01/2013 to 31/12/2022) |
| Project participants | Project Proponent: The Andhyodaya, Ernakulam, Kerala, India<br>UCR Aggregator: The Andhyodaya, Ernakulam, Kerala, India |
| Host Party | India |
| Applied methodologies and standardized baselines | AMS.I.E. Switch from non-renewable biomass for thermal applications by the user. UCR Protocol Standard Baseline |
| Sectoral scopes | SECTORAL SCOPE -<br>01 Energy industries (Renewable/NonRenewable Sources) |
| SDG Impacts: | 1 – SDG 1 No Poverty<br>2 – SDG 3 Good health and well being<br>3 – SDG 7 Affordable and Clean energy<br>4 – SDG 8 Decent work and economic growth<br>5 – SDG 13 Climate Action<br>6 – SDG 15 Life on Land<br>7 – SDG 17 Partnerships for the goals |
| Estimated amount of total GHG emission reductions per year | **46717** CoUs /year (**46717** $tCO_{2eq}$/yr) |
| Estimated amount of total GHG emission reductions over the crediting period (01/01/2013-31/12/2022) | **467170** CoUs (**467170** $tCO_{2eq}$) |

## SECTION A. Description of project activity

### A.1. Purpose and general description of project activity >>

#### a) Purpose of the project activity and the measures taken for GHG emission reductions >>

The project activity- **Andhyodaya Bundled Small Scale Rural Biogas Projects (Phase 1), Kerala** is located in State: Kerala, Country: India

The project results in reductions of CO2 emissions that are real, measurable and give long-term benefits to the mitigation of climate change. Emission reductions attributable to the project are included in the *UCR Positive List of Project Types* deemed to be additional and also meet the "*Do No Net Harm to Society and Environment*" criteria under the ***UCR CoU Standard***.

The project activity also contributes to 7 (seven) major UN sustainable development goals (SDGs).

The details of the registered project are as follows:

**Purpose of the project activity:**
The **Andhyodaya Bundled Small Scale Rural Biogas Projects (Phase 1), Kerala** is located across many villages in the Districts: Alappuzha, Ernakulam, Idukki, Kannur, Kasaragod, Kollam, Kottayam, Kozhikode, Malappuram, Palakkad, Pathanamthitta, Thiruvananthapuram, Thrissur and Wayanad, State: Kerala, Country: India and setup by the Non-Governmental Organisation (NGO) – The Andhyodaya (Project Proponent-PP). Unlike other NGO's, the PP concentrates in four areas of development activities namely the non-conventional energy promotion, environment sanitation with emphasis on water management, farmers self-help groups and low cost building technology. The PP has undertaken projects and programmes related to the UN SDGs with a focus on rural community development.

Prior biogas programs (similar but unrelated to this particular UCR project activity) by the PP have generated carbon offsets and bought by leading global financial institutions such as the IFC- World Bank Group (source: IFC Annual Report 2008) to offset the carbon footprint of the IFC global business operations. IFC considers such projects (which generates no smoke or soot), to have strong community benefits, with a delivery model that enhances the health, safety, and economic well-being of the communities in which such projects operates.

The technology used in this project activity is the household level biogas plants and the owner of the technology is the particular household using biogas plants and the PP who maintains the biogas systems for the lifetime of the activity.

The project activity aims at avoidance of fuel wood (firewood) consumption by traditional stove users by switching to bio-digester (biogas) technology using cow dung as a renewable energy fuel. The implemented biogas units for cooking needs helps reduce the amount of fuel wood used for cooking and water heating and replaces inefficient traditional cooking stoves with cleaner biogas stoves. ***Hence, the project activity reduces $CO_2$ emissions by 46717 tonnes/year by avoiding the burning of non-renewable biomass for cooking and water heating purposes.*** This technology also reduces methane ($CH_4$) emissions from cattle manure and contributes strongly to the sustainable development of the rural households involved in the project activity. The overall objectives of the project activity are reduction of greenhouse gases, conservation of forests and woodlands as well as improved health conditions of end users due to improved indoor air quality.

The project activity involves the installation of **11429** independent biogas plants (digesters) of capacities between **1m$^3$, 3m$^3$, 4m$^3$ and 6m$^3$**, each serving individual households comprising of an average of 4-7 members, using cattle dung (renewable energy fuel) collected from buffaloes, cows and calves currently being housed at such rural households in the villages located across the districts of Alappuzha, Ernakulam, Idukki, Kannur, Kasaragod, Kollam, Kottayam, Kozhikode, Malappuram, Palakkad, Pathanamthitta, Thiruvananthapuram, Thrissur and Wayanad, in the state of Kerala. The technology involves the construction of **Deenabhandhu, FRP floating drum and FRP portable** type models.

b) Brief description of the installed technology and equipment>>

A total of 11429 biogas digesters are part of this MR as follows:

| Size of Digester (m$^3$) | Number installed |
|---|---|
| 1 | 4066 |
| 3 | 5895 |
| 4 | 978 |
| 6 | 490 |
| **Total** | **11429** |

All households within the project activity possess cattle or other bovine animals, with the number of cattle at each household ranging from 2-6. Biogas is used on a single ring gas stove having one 4" burner with a flame temperature of 870 º C, supplied as part of the project activity. The biogas slurry is used as bio-manure.

**FRP Floating Drum Model**

**FRP Portable Model**

**Deenabhandhu Model**

c) Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.)>>

The digesters have been operational for a minimum of 330 days in a year with 4 hours of daily use per household.

The project activity is implemented in a phase wise manner since **01/01/2002.** The majority of the digesters are of the fixed dome Deenabhandhu model, however, a few are of the floating drum and portable models. The Deenabhandhu model was developed in 1984, by Action for Food Production (AFPRO), a voluntary organization based in New Delhi. The Deenabhandhu biogas plant has a hemispherical fixed-dome type of gas holder, unlike the floating dome drum model.

The dome is made from pre-fabricated ferrocement or reinforced concrete and attached to the digester, which has a curved bottom. The slurry is fed from a mixing tank through an inlet pipe connected to the digester. After fermentation, the biogas collects in the space under the dome. It is taken out for use through a pipe connected to the top of the dome, while the sludge, which is a by-product, comes out through an opening in the side of the digester. About 90 percent of the biogas plants in India are of the Deenabhandhu type.

UCR Project ID: 281
Start Date of Crediting Period: 01/01/2013
Project Commissioned: 01/01/2002
Total Biogas Units in the monitoring period: 11429

This is the first monitoring report for the first crediting period for the period 01/01/2013 to 31/12/2022.

The operational domestic biogas units are in continuous operation after installation, with minor and major repairs as and when are reported by the PP. Entries are logged and are provided to the UCR verifier during verification. Since the UCR protocol for biogas systems is based on a conservative 330 days (default) a year operation, the project activity was never non-operational for a period of 35 days or more during any year of the monitoring period.

| Size of Digester ($m^3$) | Number installed |
|---|---|
| 1 | 4066 |
| 3 | 5895 |
| 4 | 978 |
| 6 | 490 |
| **Total** | **11429** |

d) Total GHG emission reductions achieved or net anthropogenic GHG removals by sinks achieved in this monitoring period>>

The total GHG emission reductions achieved in this monitoring period is as follows:

| **Summary of the Project Activity and ERs Generated for the Monitoring Period** | |
|---|---|
| Start date of this Monitoring Period | 01/01/2013 |
| Carbon credits claimed up to | 31/12/2022 |
| Total ERs generated in this MR ($tCO_{2eq}$) | 467170 $tCO_{2eq}$ |
| Leakage | 2458 $tCO_{2eq}$ |

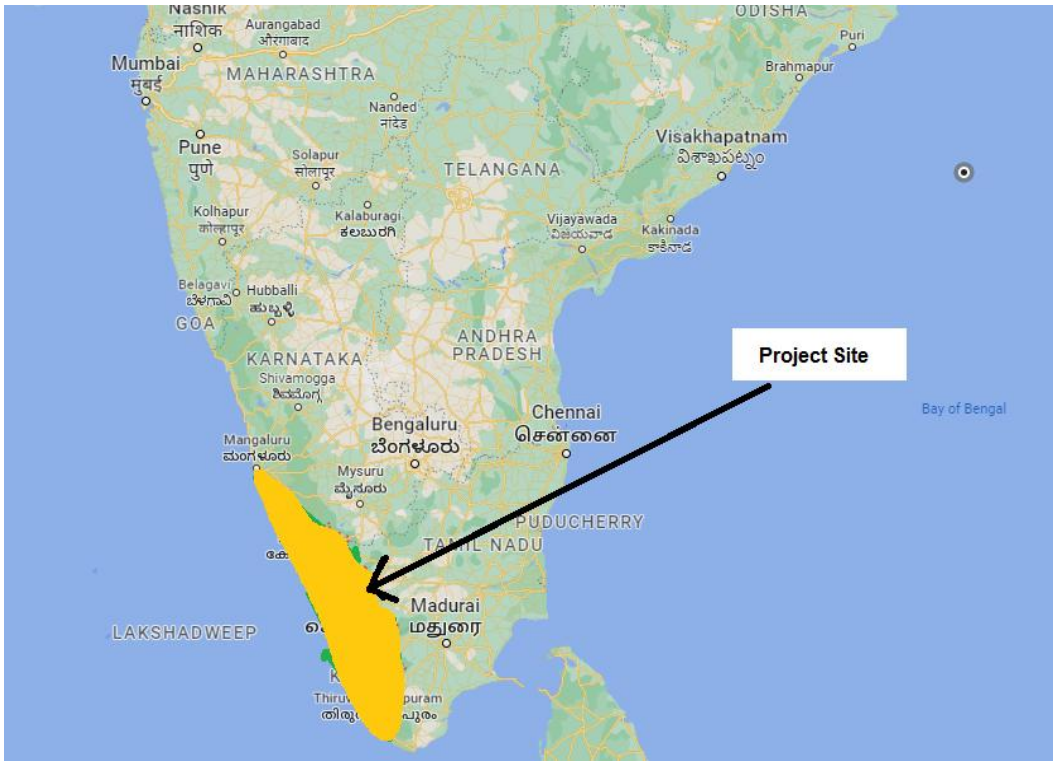
The baseline scenario is thermal energy from more GHG intensive means based on the use of non-renewable biomass for domestic cooking and water heating. Thus, this project activity was a voluntary investment which replaced equivalent amount of thermal energy from renewable source, the biogas. The baseline emission boundary is site of the anaerobic digester in the case of project activity that recovers and utilizes biogas for producing thermal energy and applies this methodology on a standalone basis, i.e. without using a Type III component of a SSC methodology.

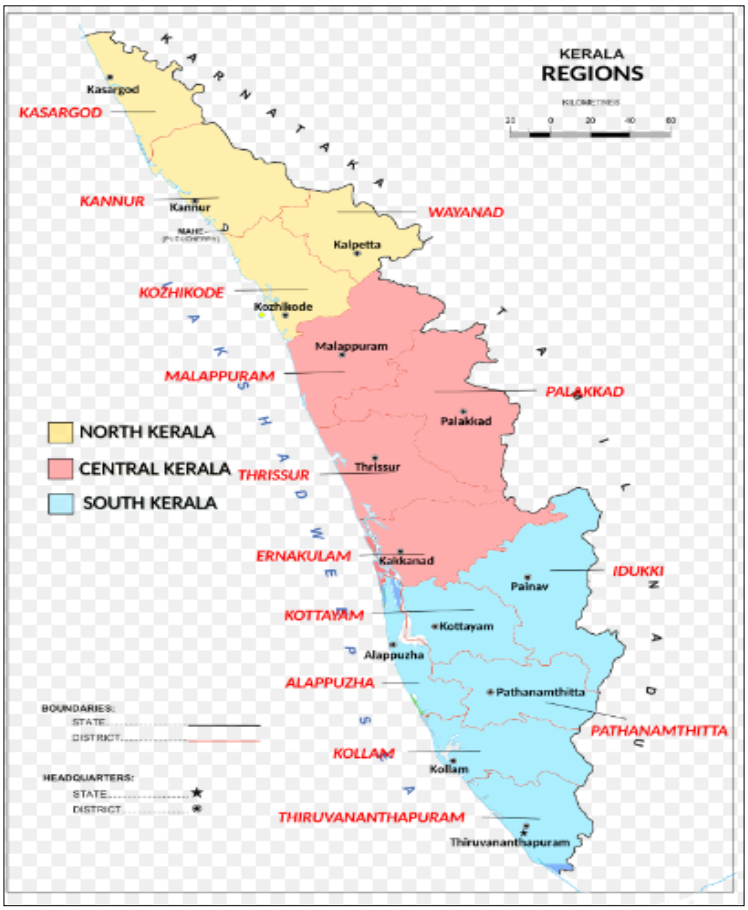
The project proponents are not bound to incur this investment as it was not mandatory by national and sectoral policies. The CoUs or emission reductions for small-scale biogas units are based on approved fossil fuel emission displacement rates established by the UCR Standard. These rates have taken into account the size of the biogas unit, fossil fuel displaced and size of a household.

A.2. Location of project activity>>

Country: India
District: Alappuzha, Ernakulam, Idukki, Kannur, Kasaragod, Kollam, Kottayam, Kozhikode, Malappuram, Palakkad, Pathanamthitta, Thiruvananthapuram, Thrissur and Wayanad

State: Kerala
Latitude: 11° 15' 30.1788" N
Longitude: 75° 54' 36.1224" E



## A.3. Parties and project participants >>

| Party (Host) | Participants |
|---|---|
| India | Project Proponent: The Andhyodaya, Ernakulam, Kerala, India<br>UCR Aggregator: The Andhyodaya, Ernakulam, Kerala, India |

## A.4. References to methodologies and standardized baselines >>

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

The baseline scenario identified at the MR stage of the project activity is:

*thermal energy from more GHG intensive means based on the use of non-renewable biomass for domestic cooking and water heating*.

All the biogas digesters within the project activity are a voluntary investment which replaced equivalent amount of thermal energy from renewable source, the biogas. The PP are not bound to incur this investment as it was not mandatory by national and sectoral policies. Thus, the continued operation of the project activity would continue to replace thermal energy from fuel wood and fight the impacts of climate change.

The PP hopes that carbon revenues from 2013-2022 period accumulated as a result of carbon credits will help repay the loans/investment and/or in the continued maintenance of this project activity, including upgrades as applicable. The rural households across India are primarily dependent on fuel wood for cooking and heating water. Further, when complications have arisen in the functioning of plants, a common complaint articulated is that there is a lack of available technical support and funds for repair. In this way, digesters are allowed to fall into disrepair, when their functioning depends upon adequate maintenance skills, which should be available in every village. There is a danger that biogas may come to be thought of as a useless and inappropriate initiative.

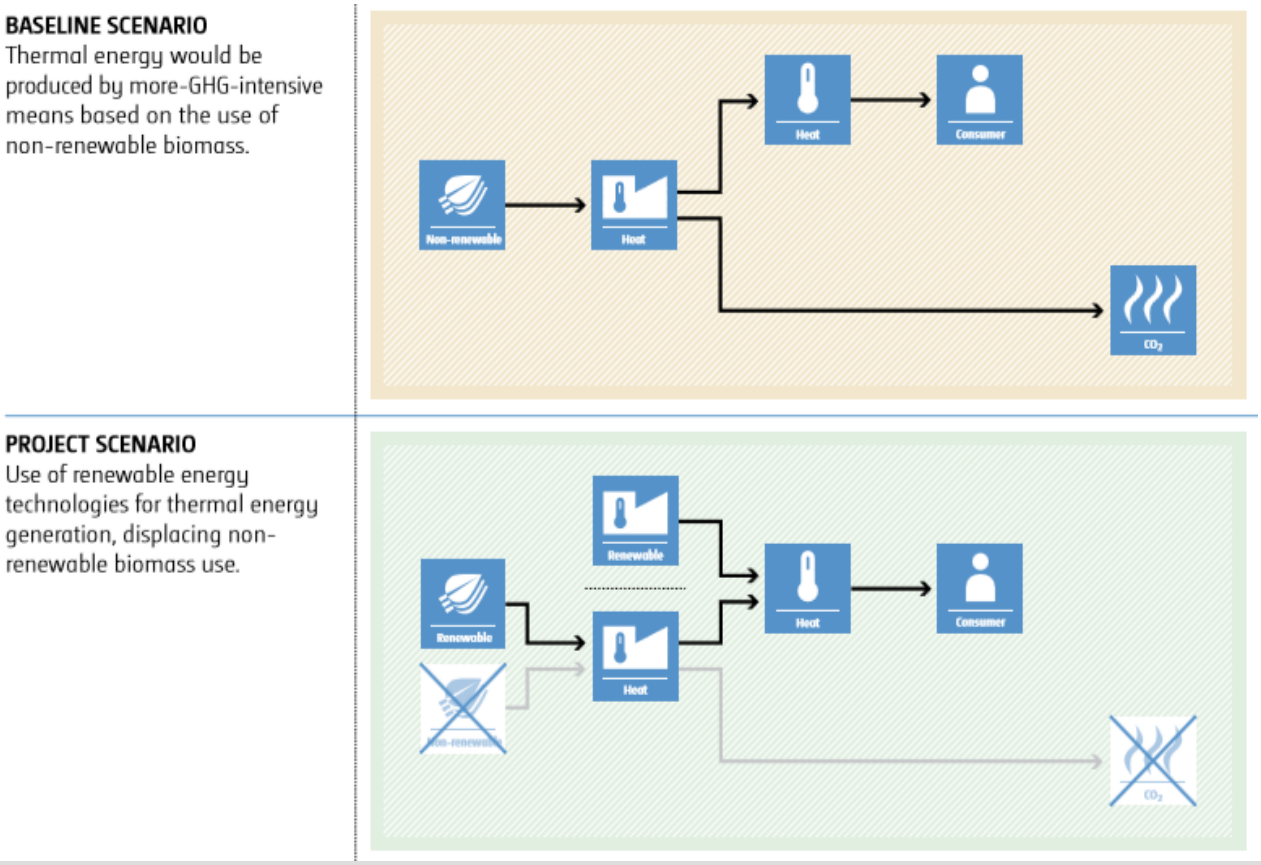
Fuel usage correlates with income levels and lower income households tend to use more fuelwood as cost is still a barrier for use of LPG in rural areas. All the non-biogas households were still using fuelwood as the dominant fuel for cooking and heating water for bath on inefficient mud/clay wood stoves that do not have chimney and grate.

Majority of the firewood users believe that cooking with this fuel improved their financial wellbeing because selling firewood generated income, whilst collecting the fuel gave them an opportunity to socialise and is a tradition they would like to continue. They viewed LPG as a financial burden that gave food an undesirable taste and feared a fatal canister explosion. This shows that though LPG has been provided with subsidy to the rural communities, the refill is very expensive and rural households are still using traditional stove for cooking. Easy availability of biomass, affordability and concerns of safety issues deter households from adopting LPG and

continue using fuelwood. The region is scarce of biomass and non-renewable biomass is part of the biomass used for cooking and heating water.

## A.5. Crediting period of project activity >>

Type: Renewable
State date: 01/01/2013
Length of the crediting period corresponding to this monitoring period: 10 years 0 months
Crediting Period: 01/01/2013 to 31/12/2022




## A.6. Contact information of responsible persons/entities >>

Mr Peter Thettayil, Executive Director
The Andhyodaya, Ernakulam, Kerala, India
Email: andhyodaya@gmail.com

## SECTION B. Implementation of project activity

### B.1. Description of implemented registered project activity >>

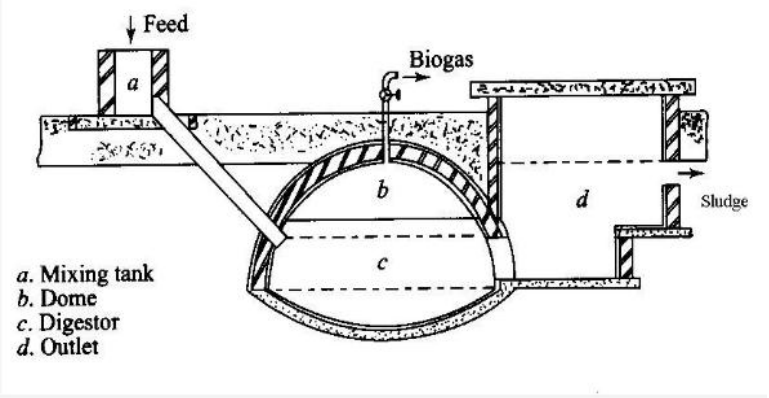
a) Provide information on the implementation status of the project activity during this monitoring period in accordance with UCR PCN>>

Total Biogas Units in this monitoring period: 11429 individual units.

| No. of Digesters | Capacity m3 |
|---|---|
| 4066 | 1 |
| 5895 | 3 |
| 978 | 4 |
| 490 | 6 |

b) For the description of the installed technology(ies), technical process and equipment, include diagrams, where appropriate>>

The project activity is implemented in a phase wise manner since **01/01/2002.** The majority of the digesters are of the fixed dome Deenabhandhu model, however, a few are of the floating drum and portable models. The Deenabhandhu model was developed in 1984, by Action for Food Production (AFPRO), a voluntary organization based in New Delhi. The Deenabhandhu biogas plant has a hemispherical fixed-dome type of gas holder, unlike the floating dome drum model.




Schematic diagram of a Deenabandhu biogas plant

Biogas is a mixture of methane and carbon dioxide. It also has traces of hydrogen sulphide (3%), ammonia, oxygen, hydrogen, water vapour etc., depending upon feed materials and other conditions. Biogas is generated by fermentation of cellulose rich organic matter under anaerobic conditions. In anaerobic conditions, the methane-producing bacteria become more active. Thus, the gas produced becomes rich in methane. The optimum utilization depends upon the successful physical installations, which in turn depend upon plant design and its selection. The basic conversion principle is that when a non-ligneous biomass is kept in a closed chamber for a few

days, it ferments and produces an inflammable gas. 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 better the three stages merge with each other, the shorter the digestion process.

The animal stalls are in the front yard/backyard/porch of the household in most of the cases. The animals are allowed to graze in the free pastures of the village or in some cases fed in the stall itself. One cow produces around 10-12 kg cow dung per day. Before the establishment of the biogas plant, this cow dung used to be dried and processed into dung cakes which were then used to fuel gobar chullas or sold annually to external contractors.

The technical specifications of the project activity are as follows:

| Specification | Value |
|---|---|
| Total installed capacity | 28603 $m^3$ |
| Mixing Proportion | (Water: Dung) 1:1 |
| Number of units (digesters) | 11429 |
| Feed Material | Cattle Dung |
| Biogas Flow rate (2 burners each 4") | 0.47 $m^3$/hr per burner (0.9 m3/hr) Nijajuna, B. T. (2002) pg.157) |
| Number of Stoves (typical 2 burner) | 1 per household |
| Unit Conversion rate MJ -> kWh | 0.28 |
| Efficiency of Burners | 60.00% |
| Calorific Value Biogas | 22.1 $MJ/m^3$<br>Source: Nijajuna, B. T. (2002): Biogas Technology. New Age International Publishers. New Delhi. |
| Rated Capacity (thermal) $MW_{thermal}$ | 31.78 $MW_{th}$ |

**Two ring burner cookstove**

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.

**A.2 Do no harm or Impact test of the project activity>>**

As per the Schedule 1 of the EIA notification 2006, given by the Ministry of Environment and Forests under the Environment (Protection) Act 1986, the project activity doesn't fall under the list of activities requiring EIA.

There are social, environmental, economic and technological benefits which contribute to sustainable development.

- **Social benefits:**
- Reduces drudgery to women and children who spend long hours and travel long distances to collect fuel wood. Biogas has a significant impact on rural women's lives. A regular supply of energy piped to the home reduces, if not removes, the daily task of fuelwood gathering, which can, in areas of scarcity, be the single most time consuming task of a woman's day - taking more than three hours in some areas. Freeing up energy and time for a woman in such circumstances often allows for other activities, some of which may be income generating.
- Reduces indoor air pollution, thus eliminating health hazards for women and children.
- The project provides security of energy supply
- It leads to better manure management thus keeping the surroundings clean and reduce some of the disease causing pathogens
- Children are able to attend school in time as food will be cooked in time.
- An important point that should be stressed upon here is the involvement of men folk in carrying the dung to the digester. Thus, this model of biogas plant reduces the efforts required to be put in by women, who in other cases are alone responsible for the operation and maintenance of collection of firewood for traditional cooking methods.

- **Environmental benefits:**
- Improves the local environment by reducing uncontrolled deforestation in the project area. Fuel wood collection and consumption are intricately linked to degradation of natural resource management. Demand for fuel wood from commons and forests cause resource degradation.
- Avoids local environmental pollution through better waste management
- Leads to soil improvement by providing high quality manure
- Avoided global and local environmental pollution and environmental degradation by switching from non-renewable biomass to renewable energy, leading to reduction of GHG emissions
- Reduces deforestation, reduces indoor air pollution, and increases use of manure rather than chemical fertilizers.
- Using biogas as an energy resource contributes to clean environment. Cattle dung is transformed into high-quality enriched bio-manure/fertilizer.
- Hygienic conditions are improved through reduction of pathogens by utilizing the animal and other organic wastes in the bio-digesters.
- The high-quality manure produced will lead to improvement in soil conditions.
- A clean and particulate-free source of energy also reduces the likelihood of chronic diseases that are associated with the indoor combustion of biomass-based fuels, such as respiratory infections, ailments of the lungs; bronchitis, asthma, lung cancer, and increased severity of coronary artery disease.
- The slurry that is returned after the biogas system process is superior in terms of its nutrient content as the process of methane production serves to narrow the carbon:nitrogen ratio (C:N).

- **Economic benefits:**
- Higher productivity of family members as they have adequate cooking fuel supply
- Provides employment to local communities through construction and maintenance of biogas units.
- The project reduces cooking time, thus providing the households in the project activity to take up income generating activities like farming and other compost related sale activities.
- A regular supply of energy piped to the home reduces, if not removes, the daily task of fuelwood gathering, which can, in areas of scarcity, be the single most time consuming task of a woman's day - taking more than three hours in some areas. Freeing up energy and time for a woman in such circumstances often allows for other activities, some of which may be income generating.

**The project activity also contributes to the following sustainable development goals (SDGs):**

1. SDG 1: No Poverty
2. SDG 3: Good health and well being
3. SDG 7: Affordable and Clean energy
4. SDG 8: Decent work and economic growth
5. SDG 13: Climate Action
6. SDG 15: Life on Land
7. SDG 17: Partnerships for the goals

| Sustainable Development Goals Targeted | Most relevant SDG Target SDG Impact | Indicator (SDG Indicator) |
|---|---|---|
| 13 Climate Action (mandatory) | 13.2: Integrate climate change measures into national policies, strategies and planning | Amount of GHG Emission reduction |
| 1 - End poverty in all its forms everywhere | 1.4: By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance | Number of household the bio digesters are installed & operating |
| 3 – Ensure healthy lives and promote well-being for all at all ages | 3.9: By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination | Number of households having reduced indoor pollution |
| 7 – Ensure access to affordable, reliable, sustainable and modern energy for all | 7.1: By 2030, ensure universal access to affordable, reliable and modern energy services | Number of household the bio digesters are installed & operating |
| 8 – Promote inclusive and sustainable economic growth, employment and decent work for all | 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<br><br>8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training | Number of jobs created<br><br>Number of people trained |
| 15 – Sustainably manage forests, | 15.2: By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, | Amount of fuel wood saved by the project |

| | | |
|---|---|---|
| combat desertification, halt and reverse land degradation, halt biodiversity loss | restore degraded forests and substantially increase afforestation and reforestation globally | |
| 17 – Strengthen the means of implementation and revitalize the global partnership for sustainable development | 17.7: Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms including on concessional and preferential terms, as mutually agreed | Number of new technology digesters installed that are produced in India.<br><br>IFC-World Bank Group had purchased carbon credits in support of the earlier biogas project from the same PP. |

## B.2. Baseline Emissions>>

The baseline scenario is thermal energy from more GHG intensive means based on the use of non-renewable biomass for domestic cooking and water heating. Thus, this project activity was a voluntary investment which replaced equivalent amount of thermal energy from renewable source, the biogas. The baseline emission boundary is site of the anaerobic digester in the case of project activity that recovers and utilizes biogas for producing thermal energy and applies this methodology on a standalone basis, i.e. without using a Type III component of a SSC methodology.

The project proponents are not bound to incur this investment as it was not mandatory by national and sectoral policies. Thus, the continued operation of the project activity would continue to replace thermal energy from fuel wood.

The CoUs or emission reductions for small-scale biogas units are based on approved fossil fuel emission displacement rates established by the UCR Standard. These rates have taken into account the size of the biogas unit, fossil fuel displaced and size of a household.

| 1-2 cubic meter | 3 cubic meter | 4 cubic meter | 5 cubic meter | >5 cubic meter |
|---|---|---|---|---|
| 3.5 CoUs/year | 4.5 CoUs/year | 5.3 CoUs/year | 5.5 CoUs/year | Biogas units that have a capacity above 5 cubic meters that follow this UCR Protocol will be credited at the 5 cubic meters rate |

Leakage Emissions is not applicable as the project biogas cook stove is not switching to charcoal or processed renewable biomass.

Leakage related to the non-renewable woody biomass saved by the project activity: The following potential source of leakage shall be considered:

- (a) The use/diversion of non-renewable woody biomass saved under the project activity by non project households/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 households/users, that is attributable to the project activity, then BEy is adjusted to account for the quantified leakage.
- (b**) Alternatively, BEy is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.**

There is no transfer of equipment, being currently utilized transferred, from outside the project boundary to the project boundary. All the biogas units are constructed at the site. Thus leakage from equipment transfer need not be monitored.

Option (b) is selected wherein, *"BEy is multiplied by a net to gross adjustment factor of 0.95 to account for leakages",* and hence in this case, surveys of non-renewable woody biomass used by the non-project households/users will not be required.

## B.3. Debundling>>

This small scale project is not a debundled component of a larger carbon or GHG project activity.

## SECTION C. Application of methodologies and standardized baselines

### C.1. References to methodologies and standardized baselines >>

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 (Ver.12.0)***

This methodology comprises of activities to displace the use of non-renewable biomass by introducing renewable energy technologies to households, communities, and/or institutions such as schools, prisons or hospitals (hereinafter referred as end-users). Examples of these technologies include, but are not limited to:
**Biogas stoves**.

### C.2. Applicability of methodologies and standardized baselines >>

| **Applicability of methodologies and standardized baselines >>** |
|---|
| The project activity is biogas cook stove for households and provides thermal energy from cattle dung that is renewable. It replaced the baseline technology mud/clay, three-stone traditional cook stove that used non-renewable biomass at the household level. The biogas produced is also used for captive power generation. All biogas units distinct from each other. |
| Biogas produced by the digesters are used. The project involves the installation of bio digester and biogas stoves that replace the use of traditional stoves fuelled by non-renewable biomass. Hence the project fulfils the applicability criteria of AMS I.E. |
| The annual average temperature of the biogas site is located is higher than 5°C |
| The storage time of the manure after removal from the animal barns, including transportation, does not exceed 45 days before being fed into the digesters. |
| The livestock population in the farm is managed under confined conditions. Manure or the streams obtained after treatment are not discharged into natural water resources (e.g. river or estuaries). |
| The residual waste from the animal manure management system is handled aerobically. |
| The communities across India are using non-renewable biomass since 31st December 1989. This is based on using published literature, official reports and statistics. |
| The project activity does not use renewable biomass. The renewable source is cattle dung. |
| The project activity is biogas cook stove and is not electric cook stoves. |
| There is a technology switch from traditional stove to biogas stove. |
| This is a small scale project with total thermal capacity of 31.78 $Mw_{th}$ which is not greater than the small scale thresholds defined by the applied methodology I.E. the limit of 45 MWth is the installed/rated capacity of the thermal application equipment or device/s (e.g. biogas stoves)". |

### C.3. Applicability of double counting emission reductions >>

Each of the biogas unit is constructed by the project participant close to the household. The details of the end user is provided in the emission report in the following sample format:

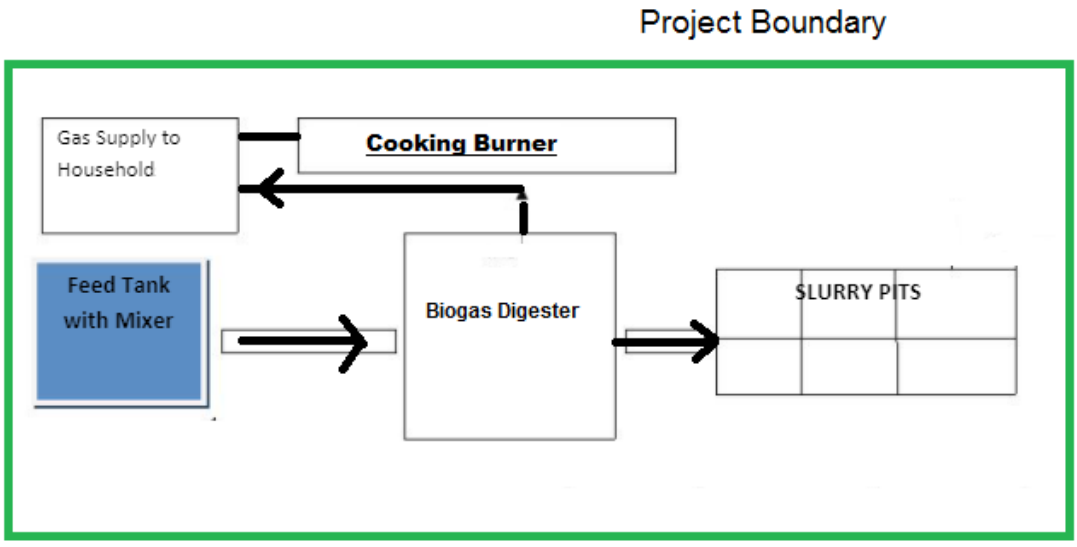
| Sl. No. | UID Number | Date of installation | Head of the Family | Address | District | Family Members | Capacity | Type | No. of owned Cattle | Grama Panchayat |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AYA/MLP/2002/0010 | 02-02-2002 | Cheriyan | Padavil( H ),Edivanna P.O 679329 | Malappuram | 6 | 6m3 | Drum | 10 | Chaliyar |
| 2 | AYA/MLP/2002/0016 | 21-02-2002 | Panghajaskhi | Cheriyamackal(h)Kuttamballekodu(po) 679354 | Malappuram | 5 | 1m3 | Deenabandhu | 2 | Pothukall |
| 3 | AYA/MLP/2002/0018 | 23-02-2002 | George Thomas | Chengalath ( H ),Uppada P.O 679354 | Malappuram | 6 | 6m3 | Dheenabhandhu | 5 | Pothukallu |
| 4 | AYA/MLP/2002/0020 | 28-02-2002 | Mammukutty M | Mancheriyil(H)Pookottumpadam P.O 679332 | Malappuram | 4 | 3m3 | Dheenabhandhu | 6 | Amarambalam |
| 5 | AYA/MLP/2002/0021 | 03-03-2002 | K V Thomas | Kazhuthuveettil( H ),Edivanna P.O 679329 | Malappuram | 4 | 6m3 | Drum | 3 | Chaliyar |
| 6 | AYA/MLP/2002/0025 | 10-03-2002 | K.V.Thomas | Kodavanal(h)Munderi(po) 679354 | Malappuram | 5 | 1m3 | Deenabandhu | 3 | Pothukall |
| 7 | AYA/MLP/2002/0026 | 10-03-2002 | P M Chacko | Pedikattukunnel,Kakkadampoyyil P O 673604 | Malappuram | 3 | 1m3 | Drum | 2 | Urangattari |
| 8 | AYA/MLP/2002/0032 | 03-04-2002 | Joy George | Thattambil(h)Edivannam(po) 679329 | Malappuram | 6 | 1m3 | Deenabandhu | 2 | Chaliyar |

The UID Number is unique for all the digesters in the project activity. The project participants have not applied for carbon credits under any other GHG program.

## C.4. Project boundary, sources and greenhouse gases (GHGs)>>

The project boundary includes the physical, geographical site(s) of:

- Biogas digesters;
- Households using biogas for heating and cooking




| | Source | GHG | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Emissions from burning non-renewable wood | $CO_2$ | **Included** | Major source of emission |
| | | $CH_4$ | Excluded | Excluded for simplification. This is conservative |
| | Emissions from animal manure stored on site | $N_2O$ | Excluded | Excluded for simplification. This is conservative |

| | | | | |
|---|---|---|---|---|
| Project Activity | Emissions from residue from anaerobic digester | $CO_2$ | Excluded | Heat is generated from collected biogas, hence these emissions are not accounted for. CO2 emissions from the decomposition of organic waste are not accounted |
| | | $CH_4$ | Excluded | Excluded for simplification. This is conservative |
| | | $N_2O$ | Excluded | Excluded for simplification. This is conservative |

**Leakage Emissions**: Not applicable as the project cook stove is not switching to charcoal or processed renewable biomass.

**Leakage related to the non-renewable woody biomass saved by the project activity**: The following potential source of leakage shall be considered:

- (a) The use/diversion of non-renewable woody biomass saved under the project activity by non project households/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 households/users, that is attributable to the project activity, then BEy is adjusted to account for the quantified leakage.
- (b**) Alternatively, BEy is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.**

There is no transfer of equipment, being currently utilized transferred, from outside the project boundary to the project boundary. All the biogas units are constructed at the site. Thus leakage from equipment transfer need not be monitored.

Option (b) is selected wherein***, "BEy is multiplied by a net to gross adjustment factor of 0.95 to account for leakages",*** and hence in this case, surveys of non-renewable woody biomass used by the non-project households/users will not be required.

## C.5. Establishment and description of baseline scenario (UCR Protocol) >>

The baseline scenario is thermal energy from more GHG intensive means based on the use of non-renewable biomass for domestic cooking and water heating. Thus, this project activity was a voluntary investment which replaced equivalent amount of thermal energy from renewable source, the biogas. The baseline emission boundary is site of the anaerobic digester in the case of project activity that recovers and utilizes biogas for producing thermal energy and applies this methodology on a standalone basis, i.e. without using a Type III component of a SSC methodology.

According to the UCR project standard for such project activities, CoUs or carbon credits for small-scale biogas units are based on approved fossil fuel emission displacement rates established worldwide.

These rates have taken into account the size of the biogas unit, fossil fuel displaced and size of a household.

| 1-2 cubic meter | 3 cubic meter | 4 cubic meter | 5 cubic meter | >5 cubic meter |
|---|---|---|---|---|
| 3.5 CoUs/year | 4.5 CoUs/year | 5.3 CoUs/year | 5.5 CoUs/year | Biogas units that have a capacity above 5 cubic meters that follow this UCR Protocol will be credited at the 5 cubic meters rate |

**BEy** is determined by taking the following option: (a) Calculated as the product of the number of appliances multiplied by the estimate of average annual consumption of woody biomass per appliance (tonnes/year). This is derived as follows:

***Calculated Annual Emission Reductions**: $BE_y = HG_{ythermal} \times EF_{FF, CO2}$*

$BE_y$ = Emission reductions from the use of non-renewable biomass as per the UCR protocol in a year y.

where:

$HG_{y, thermal}$ = Total thermal capacity of the number of digesters in year y

$EF_{FF, CO2}$ = 5.5 CoUs/year -$CO_2$ emission factor of the fossil fuel displaced in the baseline as determined by the UCR Standard for $5m^3$. $CO_2$ emission factors for $3m^3$ and $4m^3$ are used at 4.5 CoUs/year and 5.3 CoUs/year respectively as indicated in the UCR Standard. $CO_2$ emission factors for $6m^3$, $7m^3$, $8m^3$ and $9m^3$ are as follows:

| Baseline Emissions tCO2/yr As per UCR BIOGAS PROTOCOL | Capacity m3 |
|---|---|
| 3.5 | 1 |
| 4.5 | 3 |
| 5.3 | 4 |
| 5.5 | 5 |
| 6.6 | 6 |
| 7.7 | 7 |
| 8.8 | 8 |
| 9.9 | 9 |

$NCV_{CH4}$= NCV of methane ($MJ/Nm^3$) (default value: 35.9 $MJ/Nm^3$)

$NCV_{biomass}$ = Net calorific value of the non-renewable biomass as per UCR Standard (0.015 TJ/tonne )

There is not transfer of equipment being currently utilized transferred from outside the project boundary to the project boundary. All the biogas units are constructed at site. Thus leakage from

equipment transfer is not monitored.

| Year | Baseline Emissions (tCO2eq) | Leakage (tCO2eq) | Emission Reductions (tCO2eq) |
|---|---|---|---|
| 2013 | 49175.9 | 2458.795 | 46717 |
| 2014 | 49175.9 | 2458.795 | 46717 |
| 2015 | 49175.9 | 2458.795 | 46717 |
| 2016 | 49175.9 | 2458.795 | 46717 |
| 2017 | 49175.9 | 2458.795 | 46717 |
| 2018 | 49175.9 | 2458.795 | 46717 |
| 2019 | 49175.9 | 2458.795 | 46717 |
| 2020 | 49175.9 | 2458.795 | 46717 |
| 2021 | 49175.9 | 2458.795 | 46717 |
| 2022 | 49175.9 | 2458.795 | 46717 |
| **Total** | | | **467170** |

## C.6. Prior History>>

The project activity has not applied to any other GHG program for generation or issuance of carbon offsets or credits. There has been no diversion of ODA funding towards "India" for this project activity.

## C.7. Monitoring period number and duration>>

**Date of MR**: 03/03/2023
**Monitoring Period UCR:** 01
**1st Monitoring Period:** 01/01/2013 to 31/12/2022, 10 Years, 0 Months
**1st CoU Issuance Period**: 10years, 0 months – 01/01/2013 to 31/12/2022

## C.8. Changes to start date of crediting period >>

There is no change in the start date of crediting period.

## C.9. Permanent changes from PCN, PCN monitoring plan, applied methodology or applied standardized baseline >>

There are no permanent changes from registered PCN, monitoring plan and applied methodology**.**

## C.10. Monitoring plan>>

The PP has a large team engaged in the project activity consisting of nearly 150 master masons, 20 district/ taluk level coordinators and 5 Engineers. A record keeping system is operated and maintained for each biogas digester by the PP, which contains at least the following information

- Name and ID of the system
- Date of construction
- Location
- Repair History

The various parameters that need to be monitored as described in the UNFCCC CDM methodology are:

- (i) Biogas units constructed
- (ii) Number of biogas plants operating
- (iii) Non-usage days of biogas plants
- (iv) Confirmation that non-renewable biomass has been substituted

The timeline of construction of the units is monitored and database maintained by the PP. Each

biogas unit is marked with the unique ID (UID) number.


**UID Number on each digester**

| Data/Parameter | Date of commissioning of biogas units |
|---|---|
| Data unit | 01/01/2002 is the start date of the first digester in the project activity and the last digester was commissioned on 31/12/2007. Dates are provided as per Section A.1(c) of this MR |
| Description | Actual date of commissioning of the project device is recorded and available on file. |
| Source of data<br>Value(s) applied | Monitoring Report<br>As and when commissioned |
| Measurement methods and procedures | The construction processes are maintained from its initiation to completion dates for the biogas unit. Thus the start date of each of the unit installed is recorded in the monitoring report. Commissioning certificates will be provided for any sample units selected by the UCR Verifier |
| Monitoring frequency | As and when commissioned and fixed and recorded in the monitoring report |
| Purpose of data | To calculate baseline emissions |

| Data/Parameter | Number of Households Served |
|---|---|
| Data unit | 11429 |
| Description | Number of households in the project activity in year y |
| Source of data<br>Value(s) applied | Commissioning certificates and log sheets.<br>As and when commissioned |

| | |
|---|---|
| Measurement methods and procedures | The number of household connected to each biogas digester is recorded in log sheets. The log sheets for the sample households selected by the UCR verifier will be provided during verification. |
| Monitoring frequency | Fixed during commissioning. |
| Purpose of data | To calculate baseline emissions |

| Data/Parameter | Number of Working Days for Project Activity per year |
|---|---|
| Data unit | 330 days |
| Description | Number of working days are conservative as per UCR Standard |
| Source of data<br>Value(s) applied | Conservative estimate to offset repair and maintenance activities at the farm of biogas systems. |
| Measurement methods and procedures | |
| Monitoring frequency | Recorded in log books |
| Purpose of data | To calculate baseline emissions. Usage of non-renewable biomass in case of non-performance of biogas units. As and when the biogas units are not functional, the digester owners report it to the PP, who in turn repair the unit. A log book is maintained for the reason of non-function and days under repair. For the monitoring period, the $N_{days}$ (operational days of installed biogas units) is taken as 330 days which is conservative under the UCR Biogas Protocol. The emission reduction is estimated only for 330 operational days even though all the digesters function for more than those days in each year of operation. |

| Data/Parameter | $f_{NRB,y}$ |
|---|---|
| Data unit | 0.65 |
| Description | fraction of non-renewable biomass |
| Value(s) applied | UCR Standard<br>As per IPCC Guidelines/Standard |
| Measurement methods and procedures | Conservative Estimate |
| Monitoring frequency | NA |
| Purpose of data | To calculate baseline emissions |

| Data/Parameter | $NCV_{biomass}$ |
|---|---|
| Data unit | 0.0156 TJ/tonne |
| Description | Average annual consumption of woody biomass per household in the pre-project devices during the project activity. |
| Value(s) applied | UCR Standard<br>As per IPCC Standard |
| Measurement methods and procedures | Fixed |
| Monitoring frequency | NA |
| Purpose of data | To calculate baseline emissions |

| Data/Parameter | Firewood Consumption in Baseline |
|---|---|

| | |
|---|---|
| Data unit | 3306 kgs/household/year |
| Description | Average annual consumption of woody biomass per household in the preproject devices during the project activity. |
| Source of data<br>Value(s) applied | UCR Standard Protocol<br>As per Standard the data is conservative |
| Measurement methods and procedures | Fixed |
| Monitoring frequency | NA |
| Purpose of data | To calculate baseline emissions |

**Sampling Plan During Verification:**

The objective of the sampling effort is to determine the mean yearly value of the following parameters with 90/10 confidence/precision during the crediting period:

- *Confirmation that non-renewable biomass has been substituted*

Sample Size: The sample size will be determined by the UCR verifier using the following equation

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

***n***: Sample size
***N***: Total number of households (11429)
***p:*** Expected proportion (0.75)
***1.645***: Represents the 90% confidence required
***0.1***: Represents the 10% relative precision

Therefore the required sample size is at least **89.50 (~90) households**. This is assuming that 75% of the biogas units would be operating during the verification process. This assumption is conservative as the biogas systems within the monitoring report are all currently operational since the PP ensures that all the digesters are immediately repaired and operational. Since, the parameter of interest, i.e. confirmation that non-renewable has been replaced, will be in terms of percentage of households, there is no need to specify a variance to estimate.

All necessary data is archived and stored throughout the crediting period and is available for review with the PP.

## THE ANDHYODAYA BIOGAS PROGRAMME

**Annual Monitoring Report by Field staff**

**Year:** **Date of Visit :**

| | | | |
|---|---|---|---|
| 1 | Biogas Plant UID No. | : | |
| 2 | Address of Biogas Plant | : | |
| 3 | Name of District ; Gramapanchyath/Municipality | : | |
| 4 | Number of family members | : | 4 /5 /6 /7 /8 /9 |
| 5 | Capacity & Type of Biogas plant | : | 1m3 /2m3 /3m3 /4m3 /6m3 |
| | | : | Fixed /Dome /Floating Drum |
| 6 | Year of installation of Biogas plant | : | |
| 7 | Number of cattle | : | 2 /3 /4 /5 /6 |
| 8 | Approximate quantity of cow dung & organic waste available per day in KG | : | 25 /50 /75 /100 /125 |
| 9 | Is the family feeding biogas plant everyday | | Yes / No |
| 10 | Do they feed any Non-organic matter into the biogas plant | : | Yes / No |
| 11 | Is there slurry discharge everyday | : | Yes / No |
| 12 | Has family done periodical refilling of biogas plant | : | Yes / No |
| 13 | Does get into the biogas plant from outside | : | Yes / No |
| 14 | Is the biogas pipeline proper | : | Yes / No |
| 15 | Is the biogas stove functional | : | Yes / No |
| 16 | Has the family done any alteration to biogas stove | : | **Yes** / **No** |
| 17 | Is the family cleaning the stove every quarter | : | Yes / No |
| 18 | Is the family able to save time for cooking in comparison with use of fire wood | : | Yes / No |
| 19 | Do they get the required quantity of gas everyday | : | Yes / No |
| 20 | Is the family happy about the biogas plant | : | Yes / No |

Name & signature of field staff :

**Sample Annual Monitoring Report on File**