PROJECT CONCEPT NOTE

CARBON OFFSET UNIT (CoU) PROJECT

Title: Vengurla Bundled Small Scale Biogas Rural Projects, Maharashtra

Version 1.0
Date of PCN Report: 03/01/2023

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

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Project Concept Note (PCN)
CARBON OFFSET UNIT (CoU) PROJECT

BASIC INFORMATION	
Title of the project activity	**<u>Vengurla Bundled Small Scale Rural Biogas Projects, Maharashtra</u>**
Scale of the project activity	Small Scale
Completion date of the PCN	03/01/2023
Project participants	<u>Project Proponent</u>: Gram Panchayat Matond and Talwade villages, District Sindhudurg, State: Maharashtra <u>UCR Aggregator:</u> Progressive Management Consultants
Host Party	India
Applied methodologies and standardized baselines	AMS.I.E. Switch from non-renewable biomass for thermal applications by the user (Ver 12.0) UCR Biogas Protocol Standard Baseline
Sectoral scopes	01 Energy industries (Renewable/NonRenewable Sources)
SDG Impacts:	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
Estimated amount of total GHG emission reductions per year	**16855** CoUs /year (**16855** tCO_{2eq}/yr)
Estimated amount of total GHG emission reductions over the crediting period	**168550** CoUs (**168550** tCO_{2eq})

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SECTION A. Description of project activity

A.1. Purpose and general description of Carbon offset Unit (CoU) project activity >>

The project activity- **<u>Vengurla Bundled Small Scale Rural Biogas Projects, Maharashtra</u>** is located in Villages: Mehsuli, Matond, Nateli, Gavthan, Khalchebambar, Madlawada, Govalwadi, Nhaviwadi, Bamanache Temb, Kajirmala, Miristewadi, Harijanwadi, Madwadi, Sukale, Talwade, Kumbhargaon and Badegaon, Post: Matond/Talwade, Taluka: Vengurla, District: Sindhudurg, State: Maharashtra, Country: India.

The project results in reductions of CO_2 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 environmentally additional and also meet the "*Do No Net Harm to Society and Environment*" criteria under the ***UCR CoU Standard***.

The details of the registered project are as follows:

Purpose of the project activity:
The **<u>Vengurla Bundled Small Scale Rural Biogas Projects, Maharashtra</u>** is located in Villages: Mehsuli, Matond, Nateli, Gavthan, Khalchebambar, Madlawada, Govalwadi, Nhaviwadi, Bamanache Temb, Kajirmala, Miristewadi, Harijanwadi, Madwadi, Sukale, Talwade, Kumbhargaon and Badegaon, Zilla: Sindhudurg, Taluka: Vengurla, District: Sindhudurg, State: Maharashtra and setup by the Gram Panchayat Matond and Talwade (Project Proponents-PPs). 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.

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, it reduces CO_2 emissions from 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 purpose of the project activity is the set up of **<u>2126</u>** independent biogas plants (digesters) of capacities between **<u>5m^3, 7m^3 and 9m^3</u>** capacities, each serving individual households comprising of an average of 4 members, using cattle dung (renewable energy fuel) collected from buffaloes, cows and calves currently being housed at such rural households in the villages of Taluka: Vengrula. The technology involves the construction of foundation, dome, biogas outlet pipe, inlet mixer tank and outlet tank into which the animal manure mixed with water for the production of biogas. Through a series of biochemical reactions, the organic matter is broken down by mesophilic microorganisms to release biogas, of which methane is the major component. The biogas is released into the pipes connected to the stoves when the stove burner is switched on. The technology to be employed is environmentally safe and sound. The project activity is implemented in a phase wise manner since **<u>12/02/2002.</u>**

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The average family size per household is 4 persons (as per the data table below).

HOUSELISTING & HOUSING CENSUS, 2011													
State Code	State Name	District Code	District Name	Area Name	Rural/ UrbanRural/ UrbanRural/ UrbanRural/	Census Year	Household size						
							1	2	3	4	5	6-8	9+
27	MAHARASHTRA	529	Sindhudurg	Sub-District - Sawantwadi	Total	2011	4.4	9.1	16	30.8	18	19	2.7
27	MAHARASHTRA	529	Sindhudurg	Sub-District - Sawantwadi	Rural	2011	6.6	8.9	14	28.7	19.8	19	3.1
27	MAHARASHTRA	529	Sindhudurg	Sub-District - Sawantwadi	Urban	2011	0.7	9.5	19.6	34.5	14.9	18.9	2

Each household has installed the biogas plant outside their household and feeds cattle dung into the anaerobic digester. The technology is tried and tested in India, and has been in use for many years. By utilizing cattle dung in a controlled anaerobic digestion and combustion system, biogas is available for cooking energy and heat water for bath. Biogas is used on a single ring gas stove having one 4" burner with a flame temperature of 870 ° C, supplied as part of the project activity. The biogas slurry is used as bio-manure.

By using biogas generated from cattle dung, the project activity replaces Non-Renewable Biomass with biogas for cooking and heating water (as per the data table below). The baseline scenario is thermal energy from fuel wood within the domestic households in the village of which a large part of it was non-renewable for domestic cooking and water heating.

HOUSELISTING & HOUSING CENSUS, 2011														
State Code	State Name	District Code	District Name	Area Name	Rural/ UrbanRural/ UrbanRural/ UrbanRural/	Census Year	Household	Type of Fuel used for Cooking						
							1	Fire-wood %	Crop residue	Cowdung cake	Coal,Lignite ,Charcoal	Kerosene	LPG/PNG	**Cooking inside house:**
27	MAHARASHTRA	529	Sindhudurg	Sub-District - Sawantwadi	Total	2011	4.4	63.5	1	0.7	0	3	31	94.3
27	MAHARASHTRA	529	Sindhudurg	Sub-District - Sawantwadi	Rural	2011	6.6	84.1	0.8	0	0	1.2	13.6	93.8
27	MAHARASHTRA	529	Sindhudurg	Sub-District - Sawantwadi	Urban	2011	0.7	27.7	1.4	2	0	6.1	61.5	95.3

This project activity contributes strongly to sustainable development of the rural households involved in the project. A biogas plant of even 2 m3 capacity is sufficient to provide cooking fuel to a four household family with four to five members each. Fuel wood scarcity has an impact directly on rural households, which are highly dependent on this fuel. Demand for fuel wood and logs from commons and forests have caused resource degradation to the extent that collection exceeds sustainable yield. The project activity will attenuate the rural thermal energy needs used for cooking and water heating. The percentage of population using fuel wood is higher in rural areas (67.3%) and 14% in urban and semi-urban areas (NSSO, 2012).

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Table 3: Trends of forest resources as reported in India's State of Forest Reports (IFSR)

Forest resource accounting variable	ISFR 2003	ISFR 2005	ISFR 2009	ISFR 2011	ISFR 2013	ISFR 2015	ISFR 2017	Net Change between 2003 to 2017	% change between 2003 to 2015
Forest Cover (in square kilometres)	686,767	692,027	6,90,899	6,92,027	6,97,898	7,01,673	7,08,273	20,506	3.13
Growing Stock in Forests (million cubic meters)	4781.414	4602.04	4498.7	4498.73	4173.36	4195.047	4218.38	-563.034	-11.78
Growing Stock in Forests and Tree outside forests (million cubic meters)	6413.752	6218.28	6098.2	6047.15	5658.05	5768.387	5822.377	-591.373	-9.22

https://www.un.org/esa/forests/wp-content/uploads/2018/04/UNFF13_Background_Note_Wood_Energy_in_IndiaTERI.pdf

Source: FSI 2003; FSI, 2005; FSI 2009; FSI 2011; FSI 2013; FSI 2015; FSI 2017

Fuel wood is largely used by women for cooking purpose and they approximately spends more than 374 hours in a year for collecting fuel wood. The fuel wood is collected from forests, trees grown on farm lands, homesteads and common land outside forest. The annual fuel wood consumption by 854 million people in India is 216.4 million tonnes per year (FSI, 2011). Around 27% of fuel wood is collected from Government owned forests (Public Land). The smoke from burning such fuels causes alarming household pollution and adversely affects the health of women & children causing several respiratory diseases/ disorders. Biogas technology is a particularly useful system in the Indian rural economy, and can fulfill several end uses. The gas is useful as a fuel substitute for firewood, dung, agricultural residues, petrol, diesel, and electricity, depending on the nature of the task, and local supply conditions and constraints, thus supplying energy for cooking and lighting. Biogas systems also provide a residue organic waste after anaerobic digestion that has superior nutrient qualities over the usual organic fertilizer, cattle dung, as it is in the form of ammonia. Anaerobic digesters also function as a waste disposal system, particularly in curbing methane emissions from cattle dung which is stockpiled and untrreated in most villages.

Livestock production can result in methane (CH_4) emissions from enteric fermentation and both CH_4 and nitrous oxide (N_2O) emissions from livestock manure management systems. Cattle are an important source of CH_4 in many countries because of their large population and high CH_4 emission rate due to their ruminant digestive system.

Methane emissions from manure management tend to be smaller than enteric emissions, with the most substantial emissions associated with confined animal management operations where manure is handled in liquid-based systems. The conventional method of handling manure has been to use sufficient bedding to keep the manure relatively dry and then to move it out of the confinement area and deposit it into a manure pile for months prior to the project activity.

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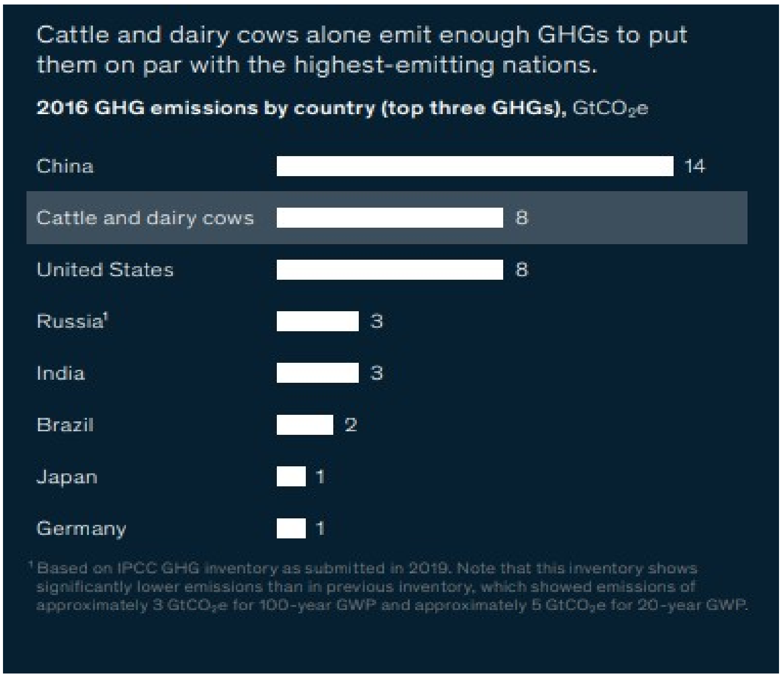

Due to constraints associated with manure management, feeding, breeding, health and management, the Indian dairy sector is one of the most greenhouse gas (GHG) emission intensive sector in the country. The typical manure management system across India involves manure stacking in piles prior to dung cake making.

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.

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- **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 three households 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

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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 8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training	Number of jobs created Number of people trained
15 – Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss	15.2: By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	Amount of fuel wood saved by the project
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

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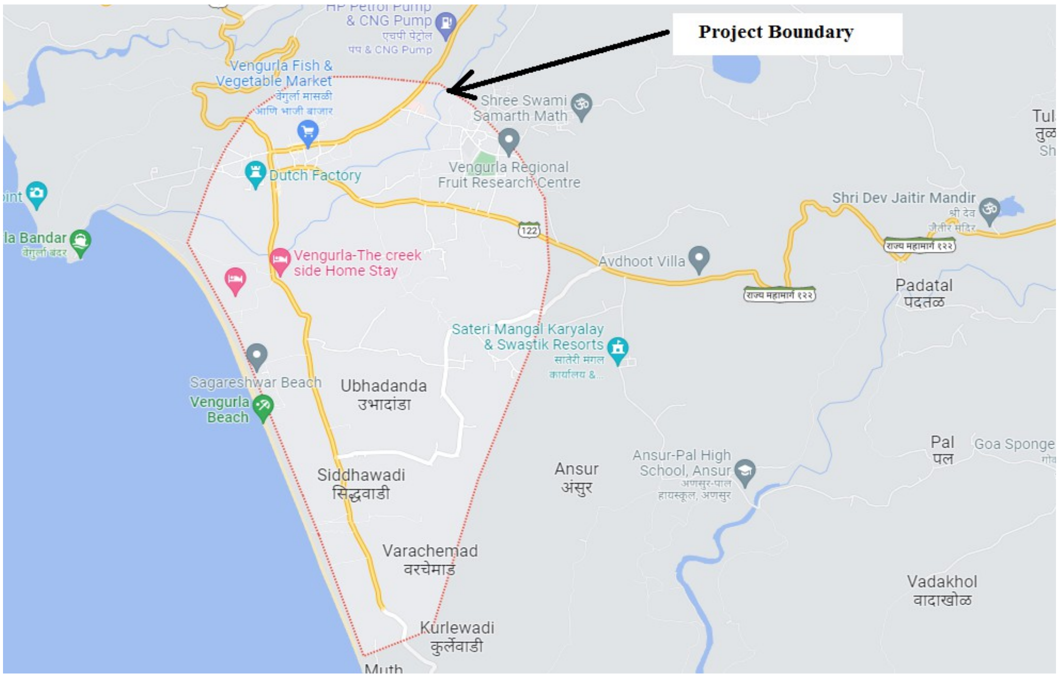
A.3. Location of project activity >>

Country: India.
Villages: Mehsuli, Matond, Nateli, Gavthan, Khalchebambar, Madlawada, Govalwadi, Nhaviwadi, Bamanache Temb, Kajirmala, Miristewadi, Harijanwadi, Madwadi, Sukale, Talwade, Kumbhargaon and Badegaon
District: Sawantwadi
State: Maharashtra
Latitude: 15° 51' 2.088" N
Longitude: 73° 38' 25.62" E



A.4. Technologies/measures >>

A total of 2126 independent biogas plants (digesters) of capacities between $5m^3$, $7m^3$ and $9m^3$ capacities have been installed since 12/02/2002. All households within the project activity possess cattle or other bovine animals, the number of cattle at each household ranges from 2-6.

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 idea of the biogas digester was triggered in order to have a proper disposal system for the cow dung. Before the establishment of biogas plants, the dung would be collected in households, streets, empty spaces and left there itself till it was sold to some external contractor. The contractor would collect the dung once in a year which resulted in dung being piled up in large quantities. This was an unhygienic practice and raised health concerns.

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.

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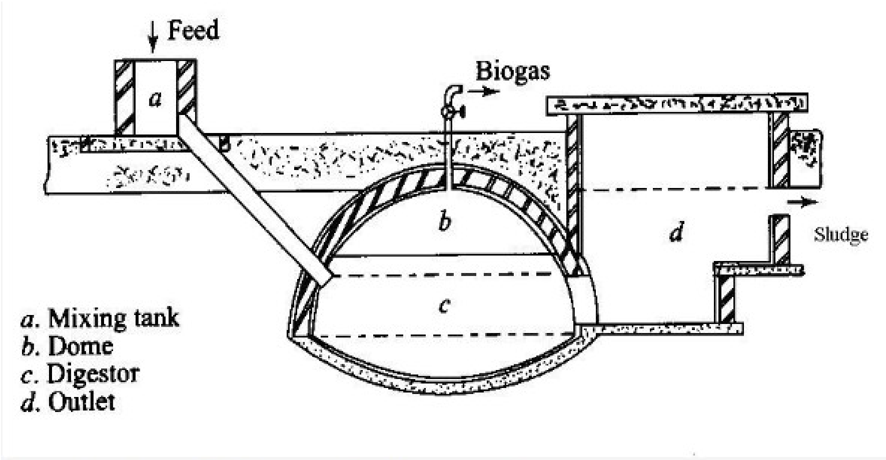
Size	Number
5m3	429
7m3	644
9m3	1053

Installations in the project activity

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.

Deenbandhu model was developed in 1984, by Action for Food Production (AFPRO), a voluntary organization based in New Delhi. The Deenbandhu biogas plant has a hemispherical fixed-dome type of gas holder, unlike the floating dome of the KVIC-design. 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 Deenbandhu type.



Schematic diagram of a Deenabandhu biogas plant

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Mixing Tank

Dome/Digester Size: 5m^3

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Dome/Digester Size: 9m^3

The technical specifications of the Deenbandhu model bio-digesters installed are as follows:

Specification	Value
Total installed capacity	16130 m^3
Mixing Proportion	(Water: Dung) 1:1
Number of units (digesters)	2126
Feed Material	Cattle Dung
Biogas Flow rate	0.47 m^3/hr (4.2 hrs/day Nijajuna, B. T. (2002) pg.157)
Number of Stoves	1 per household
Unit Conversion rate MJ -> kWh	0.28
Efficiency of Burners	60.00%
Calorific Value Biogas	22.1 MJ/m^3 Source: Nijajuna, B. T. (2002): Biogas Technology. New Age International Publishers. New Delhi.
Rated Capacity (thermal) MW$_{thermal}$	10.4 MW$_{th}$

A.5. Parties and project participants >>

Party (Host)	Participants
India	Project Proponent: Gram Panchayat Matond and Talwade villages, District Sindhudurg, State: Maharashtra UCR Aggregator: Progressive Management Consultants UCR # 110736904 Email: info@progressive-iso.com

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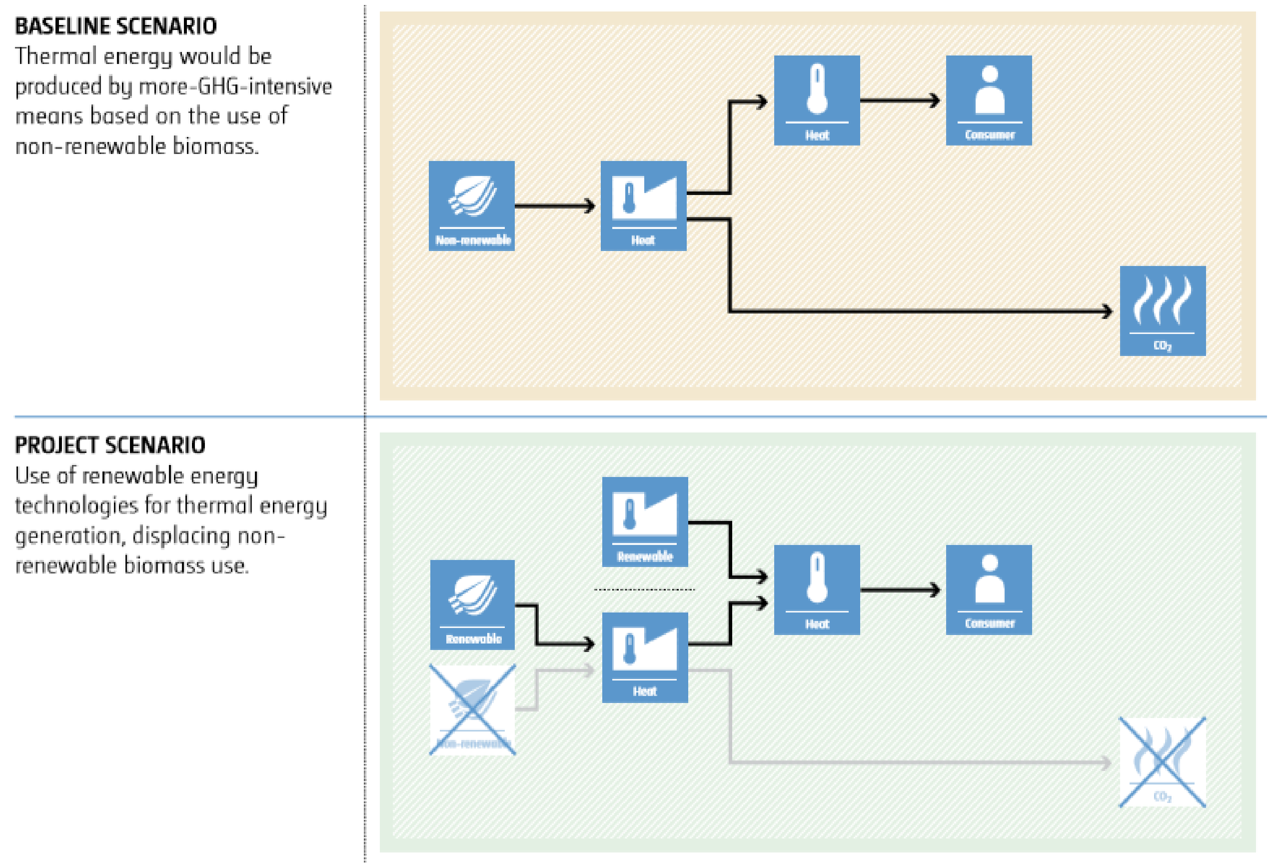
A.6. Baseline Emissions>>



The baseline scenario identified at the PCN 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 these biogas digesters within the project activity are a voluntary investment which replaced equivalent amount of thermal energy from renewable source, the biogas. 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 and fight the impacts of climate change.

The Project Proponent hopes that carbon revenues from 2013-2022 accumulated as a result of carbon credits generated will help repay the loans 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. 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 households were still using fuelwood as the dominant fuel for cooking and heating water for bath on inefficient mud/clay wood stoves that

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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.7. Debundling>>

This project activity is not a debundled component of a larger project activity.

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SECTION B. Application of methodologies and standardized baselines

B.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.

B.2. 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 are between $5m^3$, $7m^3$ and $9m^3$ capacity and distinct from each other.
Biogas produced by the digesters are used or flared.
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 10.4 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)".

B.3. Applicability of double counting emission reductions >>

Each of the biogas unit is constructed by the PP close to the household. Each biogas unit has a unique ID, which is visible on the biogas unit. The Monitoring Report has the details of the end user's name and the location in which it is constructed along with the Unique ID.

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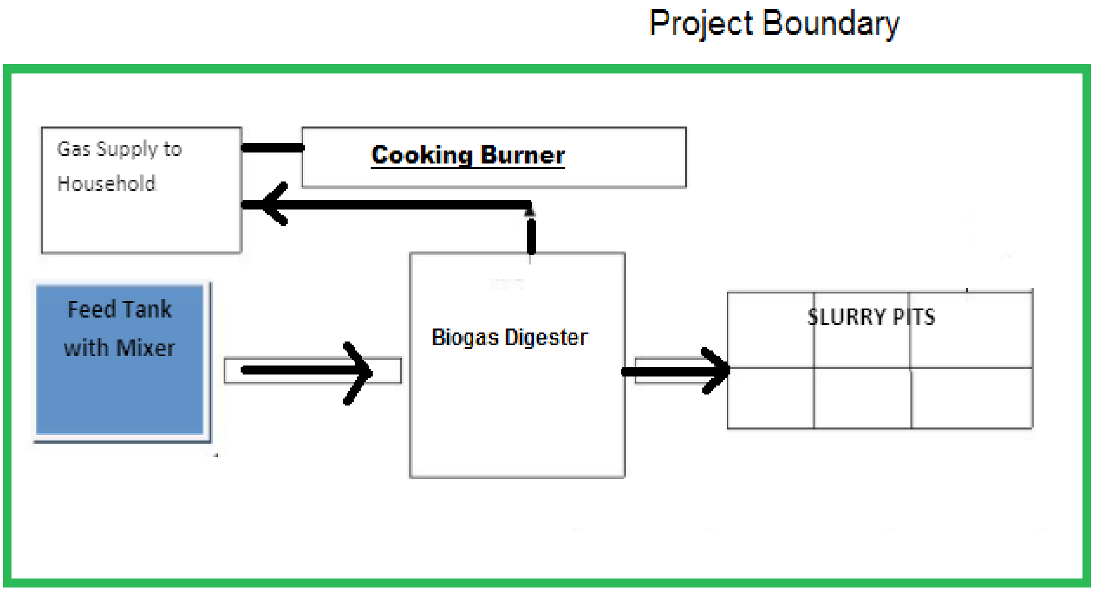
B.4. Project boundary, sources and greenhouse gases (GHGs)>>

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
		N_2O	Excluded	Excluded for simplification. This is conservative
Project Activity	Combustion of renewable biogas for cooking 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 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 nonproject households/users that previously used renewable energy sources. If this leakage

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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.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.

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 Biogas Protocol. 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

Estimated Annual Emission Reductions: $BE_y = HG_{ythermal} \, x \, EF_{FF, CO2}$

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

$EF_{FF, CO2}$ = CO_2 emission factor of the fossil fuel displaced in the baseline as determined by the UCR

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Standard.

GWP_{CH4} = 21 is the default IPCC value of CH_4 applicable to the crediting period (tCO_{2e}/t CH_4)

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)

Estimated total baseline emission reductions per year (*BE*$_y$) = 17743 tCO2eq/yr

Project Emissions due to leakage = 887.15 tCO2eq/yr

Estimated total Emission Reductions per year (*BE*$_y$) = 16855 tCO2eq/yr (16855 CoUs/yr)

B.6. Prior History>>

The project activity has not applied to any other GHG program for generation or issuance of carbon offsets or credits.

B.7. Changes to start date of crediting period >>

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

B.8. Permanent changes from PCN monitoring plan, applied methodology or applied standardized baseline >>

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

B.9. Monitoring period number and duration>>

First Issuance Period: 10 years, 0 months – 01/01/2013 to 31/12/2022

B.8. Monitoring plan>>

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

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Data / Parameter:	f_{nrb}
Data unit:	Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass
Description:	Determination of the share of NonRenewable woody biomass
Source of data:	UCR Standard
Measurement procedures (if any):	Fixed
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data/Parameter	Number of Functional digesters
Data unit	N
Description	Number of functional digesters in households in the project activity in year y
Source of data Value(s) applied	Monitoring Report As and when commissioned
Measurement methods and procedures	The repair and maintenence sheets are maintained from its initiation to completion dates for the biogas unit. Though the methodology requires monitoring this parameter biennially, it is done on a day to day basis. This is to ensure regular energy supply to the rural households through continuous monitoring and immediate repairs to decrease downtime.
Monitoring frequency	In the village, the PP is the monitoring agency entrusted with repairing the biogas units that are non-operational. The days other than that non-operational will determine the biogas units which are operational.
Purpose of data	To estimate baseline emissions

Data/Parameter	B_y
Data unit	tonnes/household/year
Description	Average annual consumption of woody biomass per household in the project before the project activity.
of data Value(s) applied	UCR Standard Protocol As per Standard
Measurement methods and procedures	Fixed
Monitoring frequency	NA
Purpose of data	To estimate baseline emissions

Sampling Design

The sampling method chosen for the project area is simple stratified random sampling as the target population is homogeneous in nature. A simple random sample is a subset of a population chosen randomly, such that each biogas of the population has the same probability of being selected. The sample-based estimate of mean is an unbiased estimate of the population parameter. It is also easy to implement as the sampling frame (household details for which biogas has been implemented) is collected and stored in the PP database. If the sample size calculation returns a value of less than 30 samples, a minimum sample size of 30 will be chosen.

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