Monitoring Report

CARBON OFFSET UNIT (CoU) PROJECT

Title: Small Scale Cattle Biogas to Power Projects in AP, Karnataka, Kerala and Haryana, India (UCR Project ID# 016)

Version 1.0

Date of MR: 06/11/2021

First CoU Issuance Period: 7 years, 10 months

Monitoring Period: 01

Crediting period: 01/01/2014 to 31/10/2021

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

Monitoring Report

Title of the project activity	Small Scale Cattle Biogas to Power Projects in AP, Karnataka, Kerala and Haryana, India
UCR Project Registration Number	016
Version	1
Completion date of the MR	06/11/21
Monitoring period number and duration of this monitoring period	Monitoring Period Number: 1 Crediting Period: 01/01/2014 to 31/10/2021
Project participants	Urja Bio System Pvt. Ltd., Pune, Maharashtra, India
Host Party	India
Applied methodologies and standardized baselines	AMS.I.C. Thermal energy production with or without electricity Version 21.0 UCR Protocol Standard Baseline AMS-III.D: Methane recovery in animal manure management systems Version 21.0
Sectoral scopes	SECTORAL SCOPE - 01 Energy industries (Renewable/NonRenewable Sources) 13 Waste handling and disposal
	2014: 38919 CoUs
	2015: 38919 CoUs
	2016: 38919 CoUs
	2017: 49314 CoUs
	2018: 49314 CoUs
	2019: 49314 CoUs
	2020: 49314 CoUs
	2021: 48942 CoUs
Total:	**362955 CoUs (362955 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 **Small Scale Cattle Biogas to Power Projects in AP, Karnataka, Kerala and Haryana, India** is located across 7 Villages in the State of Andhra Pradesh, Haryana, Kerala and Karnataka, Country: India.

The details of the registered project are as follows:

Purpose of the project activity:

The **Small Scale Cattle Biogas to Power Projects in AP, Karnataka, Kerala and Haryana, India** is located across the following Districts: Hyderabad, Rajahmundri, Gurgaon, Nuh, Kollam and Malur, State: Andhra Pradesh, Haryana, Kerala and Karnataka, Country: India.

The project activity involves the installation of 7 independent biogas digesters between the 100 m^3 and 1500 m^3 capacity range, for serving the captive electricity needs at the location of the project activities. Fresh cattle dung is fed into the anaerobic digesters.

In the absence of the project activity, cattle dung is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere. The project activity recovers and utilizes biogas for producing electricity for captive use and hence displaces electricity from the grid using fossil fuels. The project activity hence avoids CH_4 and CO_2 emissions and is beneficial to the environment and community.

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

The project activities involve the installation of 7 independent biogas digesters between the 100 m^3 and 1500 m^3 capacity range, for serving the captive electricity needs at the location of the project activities. Fresh cattle dung is fed into the anaerobic digesters.

Name	Location Village	State	Capacity	Commissioning Date
Kapila dairy	Hyderabad	AP	1500 m3/180KWH	22/06/2012
Haveli Dairy Farm	Hyderabad	AP	1500 m3/180KWH	31/12/2013
Manoharamma Dairy	Rajahmundri	AP	500 m3/60kwh	15/01/2010
DS Dairy Farm	Gurgaon	Haryana	600 m3/72kwh	14/06/2016
Nutri India Dairy	Nuh	Haryana	150 m3/20kwh	15/09/2010
JK farms	Kollam	Kerala	400 m3/50kwh	02/01/2017
Maa Gou Products Pvt Ltd	Malur	Karnataka	100 m3/12kwh	15/03/2011

By using the biogas captured from the digesters the project activity generates power for captive use. The project activity is the controlled biological treatment of biomass or other organic matters through anaerobic digestion in closed reactors equipped with biogas recovery for electricity

generation and a combustion/flaring system.

The technical specifications of the modified KVIC model bio-digesters are as follows:

Specification	Value
Total Installed Capacity	4750 m^3
Mixing Proportion	(Water: Waste) 1:1
Number of units (digesters)	7
Feed Material	Cow Dung
Biogas Power Installed Capacity	0.574 MW_h
Working Days	330
Calorific Value Biogas	20 MJ/m^3
Concentration of methane in the biogas	0.43008kg $CH4/m^3$ Applied an expected fraction of methane in biogas of 0.60 m3CH4/m3 multiplied by the density of methane at normal conditions of 0.7168 kg/m3

Year	2014	2015	2016	2017	2018	2019	2020	2021
Capacity Installed m3	3750	3750	3750	4750	4750	4750	4750	4750

Number Annually Within PoA	2014	2015	2016	2017	2018	2019	2020	2021
Cattle	5000	5000	5000	6334	6334	6334	6334	6334

The cattle dung from each dairy farm is collected from the cattle sheds within the project boundary and unloaded into the underground primary collection tank fitted with agitator to prepare homogenous slurry with a dry solid content of 20 %. The dry solid content of the homogenous slurry is measured periodically in the laboratory for ensuring the percentage of the dry solid content.

The raw slurry from the underground RCC collection tank is fitted with submersible stirrer to homogenously mix the substrate.

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

UCR Project Authorization #: 016

Start Date of Crediting Period: 01/01/2014

Project Commissioned: 15/09/2010

Total Biogas Units in the monitoring period: 7

This is the first monitoring report for the first crediting period for the period 01 January 2014 to 31st October 2021.

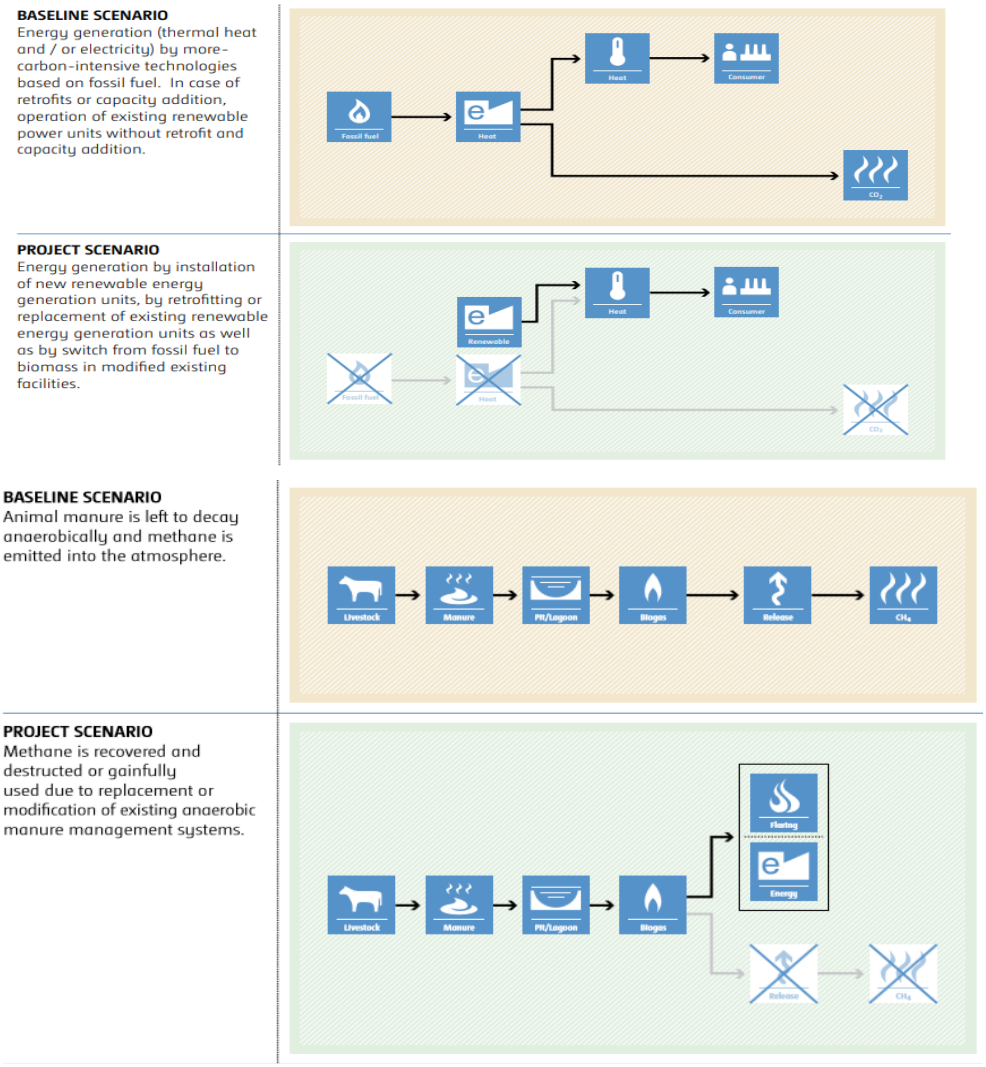
The operational domestic biogas units are in continuous operation after installation, with minor and major repairs as and when are reported by the project owner. Since the UCR protocol for biogas systems is based on a conservative 330 days a year operation, the project activity was never non-operational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

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	01/01/14
Carbon credits claimed up to	31/10/21
Total ERs generated (tCO_{2eq})	362955 tCO_{2eq}
Leakage	NA

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



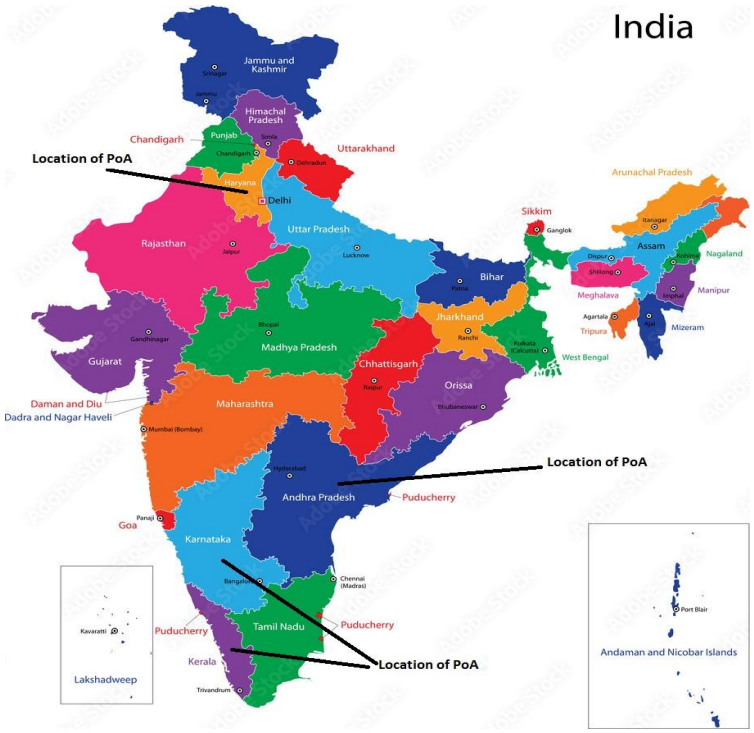
- where, in the absence of the project activity, animal manure is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere.

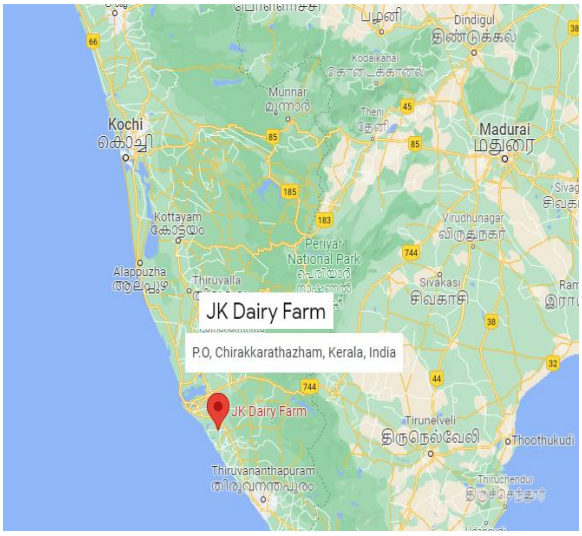
- the fuel consumption of the technologies that would have been used in the absence of the project activity, times an emission factor for the fossil fuel displaced. Hence the baseline scenario is also electricity imported from a grid in the absence of the project activity.

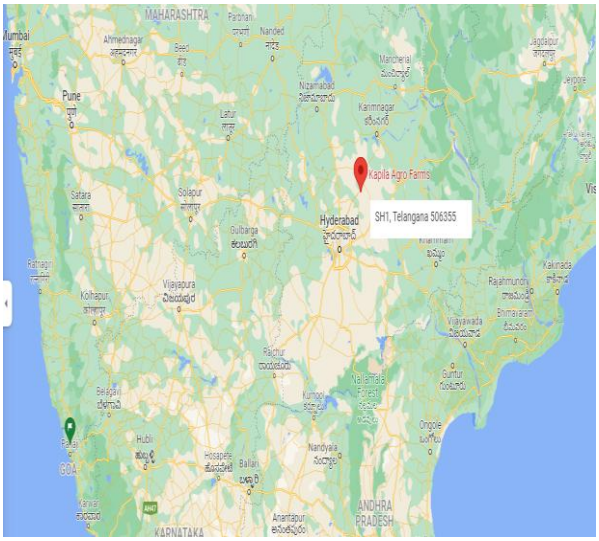
A.2. Location of project activity>>

Districts: Hyderabad, Rajahmundri, Gurgaon, Nuh, Kollam and Malur
State: Andhra Pradesh, Haryana, Kerala and Karnataka,
Country: India.

Name	Village	State
Kapila dairy , Utkoor Mogdumpur Road 506355	Hyderabad	AP
Manoharamma Dairy dc//26/3/7, y junction road, jampeta, rajahmundry , East godavari,	Rajahmundri	AP
DS Dairy Farm Village - Chanadala Dungarwas, Tehsil - Manesar, Panchgaon, Gurgaon, Haryana - 122413	Gurgaon	Haryana
Nutri India Dairy Village Palla Pin: 122107	Nuh	Haryana
JK Farms P.O, Chirakkarathazham	Kollam	Kerala
Maa Gou Products Pvt Ltd Gangapura Village, Kolar,	Malur	Karnataka
HaveliDairy Farm Survey No.118,Rajiv Rahadari Highway,Mulugu Village Siddipe	Hyderabad	AP

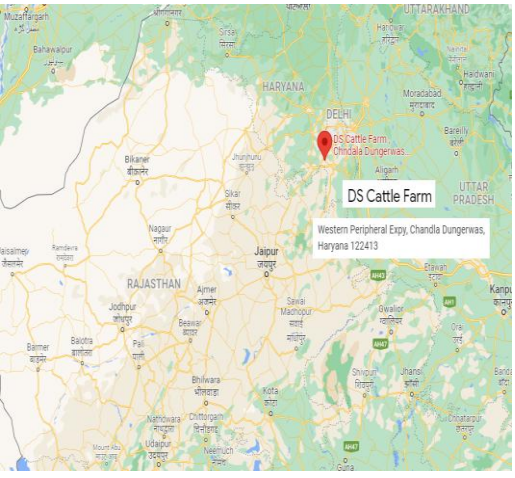



JK Dairy Farm
P.O, Chirakkarathazham, Kerala, India
JK Dairy Farm
Kochi
Madurai
Dindigul
Munnar
Kottayam
Alappuzha
Thiruvalla
Periyar National Park
Sivakasi
Tirunelveli
Thoothukudi
Thiruvananthapuram


Kapila Agro Farms
SH1, Telangana 506355
Pune
Hyderabad
MAHARASHTRA
KARNATAKA
ANDHRA PRADESH
GOA


Manoharamma dairy Products Pvt Ltd
D.No.26-3-7, Jampet, Rajhamundry, AP
TELANGANA
Hyderabad
Rajahmundry
Kakinada
Vijayawada
Nellore
Tirupati
Chennai
Bengaluru
ANDHRA PRADESH


2VQR+GWM, Channigarayapura, Karnataka 562114
Maa Gou Products Pvt.Ltd
Maa Gou Products Pvt.Ltd
KARNATAKA
PRADESH
Davanagere
Shivamogga
Chitradurga
Tumakuru
Bengaluru
Hassan
Mysuru
Hosur
Vellore


DS Cattle Farm
Western Peripheral Expy, Chandla Dungerwas, Haryana 122413
DS Cattle Farm Chndala Dungerwas
HARYANA
DELHI
UTTARAKHAND
UTTAR PRADESH
RAJASTHAN
Jaipur
Bikaner
Jodhpur
Ajmer


Haveli Dairy Farm
Address: Survey No. 118, Rajiv Rahadari Highway, Mulugu Village & Mandal, Siddipet, Telangana 502279
Haveli Dairy Farm
Temporarily closed
Surat
Nagpur
Amravati
Raipur
Nashik
Aurangabad
Pune
Solapur
Nanded
Kolhapur
Gulbarga
Hyderabad
Vijayawada
Belagavi
Hubli
GOA
KARNATAKA
ANDHRA PRADESH
Nellore
Chennai
Bengaluru
Mangalore
Mysuru
PUDUCHERRY
TAMIL NADU
Kozhikode
Tiruchirappalli
Kochi
Madurai
LAKSHADWEEP


Nutrifarm
4X9G+6GP, Haryana 122107
Nutrifarm
UTTARAKHAND
HARYANA
Bikaner
UTTAR PRADESH
Jaipur
Lucknow
RAJASTHAN
Jodhpur
Ajmer
Gwalior
Kanpur
Kota
Prayagraj
Udaipur

A.3. Parties and project participants >>

Party (Host)	Participants
India	Urja Bio System Pvt. Ltd., Pune, Maharashtra, India M/S Gram Vikas Trust , Gujarat, gvtbiogas@gmail.com

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

SECTORAL SCOPE - 01 Energy industries (Renewable/Non-renewable sources)
13 Waste handling and disposal

TYPE I - Renewable Energy Projects

CATEGORY- ***AMS-I.C.: Thermal energy production with or without electricity ,Ver 21.0***

This methodology comprises renewable energy technologies that supply users i.e. residential, industrial or commercial facilities with thermal energy that displaces fossil fuel use. These units include technologies such as energy derived from renewable biomass and other technologies that provide thermal energy that displaces fossil fuel.

AMS-III.D: Methane recovery in animal manure management systems, Ver 21.0

Replacement or modification of existing anaerobic manure management systems in livestock farms, or treatment of manure collected from several farms in a centralized plant to achieve methane recovery and destruction by flaring/combustion or energetic use of the recovered methane**.**

A.5. Crediting period of project activity >>

Type: Renewable
Crediting State date: 01-01-2014
First Issuance Period: 7 years, 10 months – 01/01/2014 to 31/10/2021

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

M/S Gram Vikas Trust , Gujarat,
UCR Seller #741215693
Email: gvtbiogas@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>>

Modified KVIC Floating Methanization Digesters: The project activities have a total of 7 independent biogas digesters between the 100 m^3 and 1500 m^3 capacity range with arrangements of continuous stirring. The genset capacities in the project sites ranges between 12 kwh to 180 kwh with a total number of 7 generators installed within the project activities. The electrical efficiency is about 38% of each generator.

Year	2014	2015	2016	2017	2018	2019	2020	2021
Capacity Power kwh	452	452	452	574	574	574	574	574

Name	Location Village	State	Capacity	Commissioning Date
Kapila dairy	Hyderabad	AP	1500 m3/180KWH	22/06/2012
Haveli Dairy Farm	Hyderabad	AP	1500 m3/180KWH	31/12/2013
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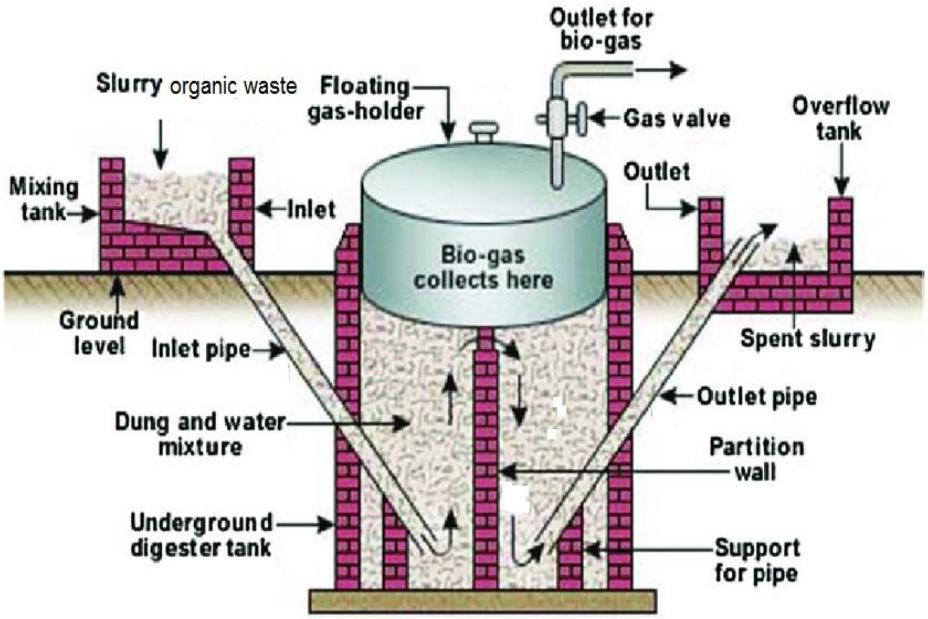
JK farms	Kollam	Kerala	400 m3/50kwh	02/01/2017
Maa Gou Products Pvt Ltd	Malur	Karnataka	100 m3/12kwh	15/03/2011

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



The technical specifications of the modified KVIC model bio-digesters are as follows:

Specification	Value
Total Installed Capacity	4750 m^3
Mixing Proportion	(Water: Waste) 1:1
Number of units (digesters)	7
Feed Material	Cow Dung
Biogas Power Installed Capacity	0.574 MW_h
Working Days	330
Calorific Value Biogas	20 MJ/m^3
Concentration of methane in the biogas	0.43008kg $CH4/m^3$ Applied an expected fraction of methane in biogas of 0.60 m3CH4/m3 multiplied by the density of methane at normal conditions of 0.7168 kg/m3

Year	2014	2015	2016	2017	2018	2019	2020	2021
Capacity Installed m3	3750	3750	3750	4750	4750	4750	4750	4750

Number Annually Within PoA	2014	2015	2016	2017	2018	2019	2020	2021
Cattle	5000	5000	5000	6334	6334	6334	6334	6334

Type of waste	Estimated TPD treated in the PoA
Cattle dung	99-100 TPD

The cattle dung from each dairy farm is collected from the cattle sheds within the project boundary and unloaded into the underground primary collection tank fitted with agitator to prepare homogenous slurry with a dry solid content of 20 %. The dry solid content of the homogenous slurry is measured periodically in the laboratory for ensuring the percentage of the dry solid content.

The raw slurry from the underground RCC collection tank is fitted with submersible stirrer to homogenously mix the substrate.

Modified KVIC Floating Methanization Digesters: The project activities have a total of 7 independent biogas digesters between the 100 m^3 and 1500 m^3 capacity range with arrangements of continuous stirring. The high rate digester treats cattle dung under anaerobic condition and converts 50 % of organic carbon to produce Biogas.
The retention time of slurry in the digester is 25 days with an operating temperature of 55˚C. The methanization digesters are fitted with stirrers that ensure dry solid control within the digester to an average value of 15%.

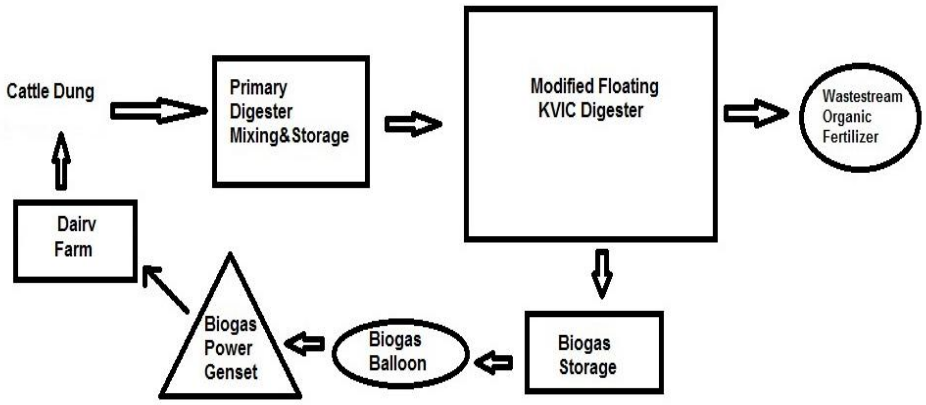
Processing of Treated Slurry: The treated slurry is dewatered and the dry cake is used as high quality organic fertilizer.

Biogas Storage System: The biogas from all the digesters are collected in a gas storage facility and then sent to balloon holding chamber with a cumulative storage capacity of 4750 m^3 in this group of project activities.

Scrubbing System: From the ballons, the raw biogas is sent to scrubbing containers that remove CO_2 and H_2S gases and provide the raw biogas with a methane content of approximately 60%. This purified CH4 is then typically stored in another ballon chamber for further usage.

Power Generation: The scrubbed biogas is then sent to biogas generators which is typically a spark ignition inter-cooler engine generator. The genset capacities in the project sites ranges between 12 kwh to 180 kwh with a total number of 7 generators installed within the project activities. The electrical efficiency is about 38% of each generator.

Year	2014	2015	2016	2017	2018	2019	2020	2021
Capacity Power kwh	452	452	452	574	574	574	574	574



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

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

- **Social benefits:**
- Reduces outdoor air pollution, thus eliminating health hazards for people in the vicinity.
- The project provides security of energy supply since it generates biogas based electricity
- It leads to better waste management thus keeping the surroundings clean and reduce some of the disease causing pathogens. Biogas allowed farms in the project activities to become self-sufficient in power and monetise their waste.

- **Environmental benefits:**
- While carbon dioxide remains in the atmosphere for hundreds to thousands of years, it takes only about a decade for methane to break down. So, reducing methane emissions now would have an impact in the near term and is critical for helping keep the world on a path to 1.5°C. Further, by generating electricity through utilising the biogas, the project helps in replacing fossil fuel intensive power generation from the local grid.
- Biogas is environmentally friendly and does not release as many greenhouse gases when burned compared to other fuels
- Leads to soil improvement by providing high quality manure to farmers from waste stream.
- Reduces outdoor air pollution, and increases use of manure rather than chemical fertilizers.
- Methane is the primary contributor to the formation of ground-level ozone, a hazardous air pollutant and greenhouse gas, exposure to which causes 1 million premature deaths every year worldwide.

- **Economic and Technological benefits:**
- The project is among the few in the region than captures biogas and uses the same for the generation of electricity for captive uses at the project site.
- Cattle dung is transformed into high-quality enriched bio-manure/fertilizer which provides better soil enrichment in the areas surrounding the project activities.
- The revenue from carbon credits will showcase such efforts undertaken to curb CH_4 emissons as being highly profitable and will encourage larger capacity installations and

additions across all livestock farms and make the Indian dairy and livestock sector environmentally sustainable. Finance is another hurdle for setup of such biogas plants. A biogas plant is a large investment. However, revenue from the sale of carbon credits will force green entrepreneurs to give it a second thought under the UCR Program. India's biogas potential from cattle dung is estimated at 1000 MTA from 300 million cows & buffaloes.

B.3. Baseline Emissions>>

The baseline scenario identified of the project activity is:

- where, in the absence of the project activity, animal manure is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere.

- the fuel consumption of the technologies that would have been used in the absence of the project activity, times an emission factor for the fossil fuel displaced. Hence the baseline scenario is also electricity imported from a grid in the absence of the project activity.

B.4. Debundling>>

This project activity is not a debundled component of a larger registered carbon 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)
13 Waste handling and disposal

TYPE I - Renewable Energy Projects

CATEGORY- ***AMS-I.C.: Thermal energy production with or without electricity***

This methodology comprises renewable energy technologies that supply users i.e. residential, industrial or commercial facilities with thermal energy that displaces fossil fuel use. These units include technologies such as energy derived from renewable biomass and other technologies that provide thermal energy that displaces fossil fuel.

AMS-III.D: Methane recovery in animal manure management systems

Replacement or modification of existing anaerobic manure management systems in livestock farms, or treatment of manure collected from several farms in a centralized plant to achieve methane recovery and destruction by flaring/combustion or energetic use of the recovered methane.

- **C.2. Applicability of methodologies and standardized baselines >>**

This project activity comprises measures to avoid the emissions of methane to the atmosphere from cattle dung within the project boundary.
No methane recovery and destruction by flaring or combustion for gainful use takes place in the baseline scenario.
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);
Biogas is used for renewable power generation for captive use.
The project activity is biogas power plant and is not a co-generation project.
In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than one month
Residual waste from the digestion is handled aerobically
The storage time of the manure after removal from the animal barns, including transportation, does not exceed 45 days before being fed into the anaerobic digester
Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO2 equivalent annually from all Type III components of the project activity.
This is a small scale project with total electricity capacity of 0.574 MW which is not greater than small scale thresholds defined by the applied methodology I.C. under Type I – renewable energy project activity, i.e. the total installed electrical energy generation capacity of the project equipment does not not exceed 15 MW.

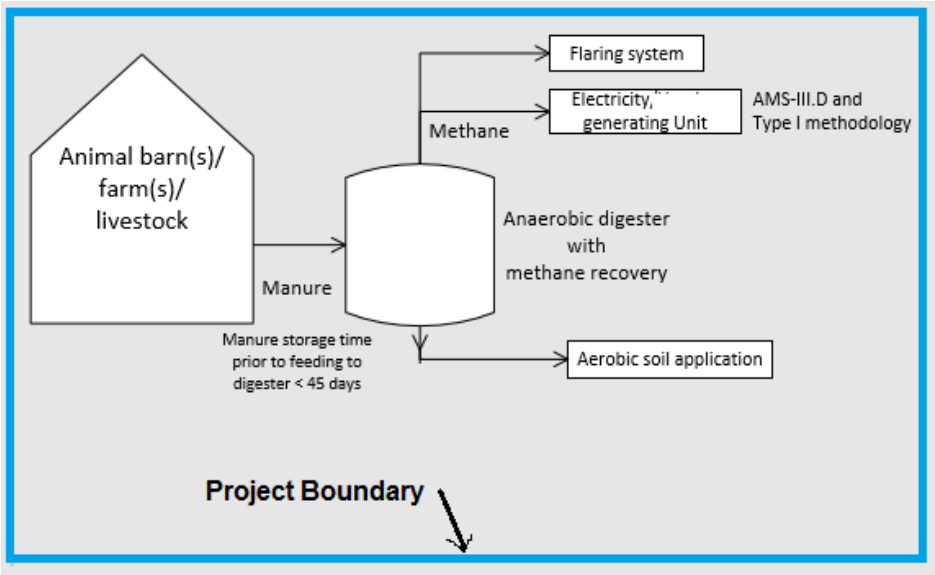
C.3. Applicability of double counting emission reductions >>

Each of the biogas unit is constructed within the project boundary. Each biogas unit has a unique ID, which is visible on the biogas unit and each power generator set has a unique ID and metering system. The details of the end user's name and the location i.e. District, Mandal, village in which it is constructed along with the Unique ID is provided to the UCR verifier during verification.

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

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

- (a) The livestock;
- (b) Animal manure management systems (including centralised manure treatment plant where applicable);
- (c) Facilities which recover and use methane for power generation.



	Source	GHG	Included?	Justification/Explanation
Baseline	Methane Emissions from manure decay	**CO_2**	**Included**	Major source of emission
		CH_4	**Included**	Major source of emission
	Emissions from electricity generated using fossil fuels	N_2O	Excluded	Excluded for simplification. This is conservative
Project Activity	Co_2 Emissions from on-site electricity use	CO_2	Excluded	Electricity is generated from collected biogas, hence these emissions are not accounted for.
	CH_4 Emissions from flaring of the biogas	**CH_4**	**Included**	Included in project emissions
	CH_4 Emissions associated with anerobic digesters	N_2O	Excluded	Excluded for simplification. This is conservative

The project activity recovers and utilizes biogas for producing electricity and applies AMS IC methodology in addition to using a Type III component of a SSC methodology, hence any incremental carbon emissions occurring due to the implementation of the project activity is neglected.

C5. Establishment and description of baseline scenario (UCR Protocol) >>

The baseline scenario is the situation where, in the absence of the project activity, animal manure is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere. Baseline emissions (BE_{y1}) are calculated by using the following option: a) Using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC Tier 2 approach (please refer to the chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories). For this calculation, information about the characteristics of the manure and of the management systems in the baseline is required. Manure characteristics include the amount of volatile solids (VS) produced by the livestock and the maximum amount of methane that can be potentially produced from that manure (Bo).

For renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity, times an emission factor for the fossil fuel displaced. Hence the baseline scenario is also electricity is imported from a grid.

The project proponent was 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 fossil fuel derived grid electricity.

Estimated Annual Emission Reductions: $\boldsymbol{BE_y = BE_{y1} + Be_{generated,y} - PE_{flare} - PE_{AD,y}}$

$\boldsymbol{BE_y}$ = Total Baseline Emissions in a year.

$\boldsymbol{BE_{generated}} = EG_{y,generated} \times EF_{y,grid}$

BE_{grid} = Baseline emissions for the grid electricity displaced by the project in year y (t CO2e)

$EG_{y,grid}$ = Amount of grid electricity displaced by project in year y (MWh)

$EF_{y,grid}$ = Emission factor of the grid (t CO2e/MWh) = 0.9 (UCR Standard)

$$BE_{y1} = GWP_{CH4} \times D_{CH4} \times UF_b \times \Sigma MCF_j \times B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%_{Bl,j}$$

$$VS_{LT,y} = (W_{site} / W_{default}) \times VS_{default} \times nd_y$$

BE_{y1} = Using the amount of manure that would decay anaerobically in the absence of the project activity based on direct measurement of the quantity of manure treated together with its specific volatile solids (VS) content

$N_{LT,y}$ = Average number of animals of type LT in a year

W_{site} = 275 kg Avg. Wt. at Site (cow) in kg

$W_{default}$ = 275 kg Avg. Default Wt. of (cow) as per IPCC for Dairy Cow in India.

nd_y = Number of days in year y where the treatment was operational

$VS_{default\_cattle}$ = Volatile solids of livestock LT entering the animal manure management system in year y as per IPCC default for cattle in India

UF_b = Model correction factor to account for model uncertainties (0.94) Default

VS_{jLTy} = Specific volatile solids content of animal manure from livestock type LT and animal manure management system j in year y (tonnes/tonnes, dry basis) (Cow=2.6). As per IPCC guidelines

D_{CH4} = CH_4 density (0.00067 t/m^3 at room temperature (20 ºC) and 1 atm pressure)

MCF_j = Annual methane conversion factor (MCF) for the baseline animal manure management system j (Dairy Cow = 5%), solid storage.

$B_{O,LT}$ = Maximum methane producing potential of the volatile solid generated for animal type LT (m^3 CH_4/kg dm) in Indian Subcontinent (Cow =0.13). IPCC 2006 - IPCC Default Value taken for Indian Subcontinent

VS = Volatile Solids

The feed digestibility in the range of 50 to 60% has been considered as appropriate for this PoA. The production of volatile solids is very much dependent on the feed digestibility levels. Corresponding to the feed intake levels, the estimated dietary net energy concentration of diet of 5.5 MJ kg (NEma) has been found appropriate considering the default Values for Moderate Quality Forage taken from IPCC 2006, Ch. 10, Vol. 4, Table 10.8 Page 10.23. Based on the above value, at 50 to 60% feed digestibility levels, the Dry Matter Intake comes around 49 kg/day for a 295kg cattle head as per the equation (Equation 10.18a in IPCC 2006 chapter 10, volume 4, Page 10.22) as follows :

DMI = BM0.75 x[{[(0.0119xNEma 2)+0.1938]}/NEma] where:

DMI = Dry Matter Intake;
BM = Live Body Weight = Default Value of 275 Kg (as given in IPCC 2006

table 10.A.6, chapter 10, volume 4, Page 10.77 considered).

NEma = estimated dietary net energy concentration of diet (Default Values for Moderate Quality Forage taken from IPCC 2006, Ch. 10, Vol. 4, Table 10.8 Page 10.23 = 5.5 MJ kg^{-1}

$VS_{Default, Cow}$ is the value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population (kg dm/animal/day) = 2.6

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

Project Emissions:

$PE_{flare,y}$ = Emissions from flaring of the biogas stream in the year y (tCO_{2e})

$$PE_{flare,y} = GWP_{CH4} \times \Sigma TM_{RG,h} \times (1 - \eta_{flare,h}) \times 0.001$$

$PE_{AD,y}$ = Project Emissions associated with anerobic digesters in year y (tCO_{2e})

$PE_{leakage}$ = Nil

$PE_{transport}$ = Nil

Emissions from incremental transportation in the year y (t CO2e), and physical leakage is negligible since the dung is generated within the project boundary of all the sites in the PoA.

$PE_{power, y}$ = Nil.

No fossil fuel is used for power generation within the PoA. The electricity generated for captive use. The use of the recovered biogas is within the project boundary and its output is monitored in order to ensure that the recovered biogas is actually destroyed. Project emissions on account of storage of cattle dung before being fed into the anaerobic digester is not accounted since the storage time of the dung after removal from the cattle shed, including transportation, does not exceed 24 hours before being fed into the anaerobic digester.

Parameter	Unit	2014	2015	2016	2017	2,018	2,019	2,020	2,021
$ER_y = (BE_y - PEy - LE_y)_{AMS III.D} + (ER)_{y\,AMS IC}$		38,919.00	38,919.00	38,919.00	49,314.00	49,314.00	49,314.00	49,314.00	48,942.00
Baseline Emissions		36,880.14	36,880.14	36,880.14	46,719.77	46,719.77	46,719.77	46,719.77	46,719.77
$BE_y = GWP_{CH4} \times D_{CH4} \times UF_b \times \sum MCF_j \times B_{0,LT} \times N_{LT,y} \times VS_{LT,y} \times MS\%$									
Project Emissions		1,181.48	1,181.48	1,181.48	1,496.54	1,496.54	1,496.54	1,496.54	1,496.54
$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power} + PE_{transport,y} + PE_{storage} + PE_{AD,y}$									

Estimated yearly baseline emission reductions (*BE*) =

Year	Emission Reductions
2014	38919
2015	38919
2016	38919
2017	49314
2018	49314
2019	49314
2020	49314
2021	48942
Total	362955

*Mid year capacity additions have not been considered for the year/s in which they were commissioned in order to be conservative, however project emissions have been considered in the total emission reductions for the commissioned years in order to be conservative (example year 2016).

C.6. Prior History>>

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

C.7. Monitoring period number and duration>>

First CoU Issuance Period: 7 years, 10 months
Monitoring Period: 01
Crediting period: 01/01/2014 to 31/10/2021

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

Start Date of the project activity : 01/01/2014
There is no change in the start date of crediting period.

C.9. 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

C.10. Monitoring plan>>

The project activity applies the monitoring methodology AMS-I.C., for monitoring of emission reduction and AMS-III.D.
The data required to be monitored include:

- Quantity of gross electricity generation by the project plant/unit in year y (EGgross,y)
- Amount of cattle dung used at the plants (**$Q_{cattle\ dung}$**)
- Amount of biogas generated per day from the polutry litter. (**$BG_{fuelled,\ y}$**)
- Mass flow of methane in the residual gas in the minute m (kg) (**$FCH_{4,RG,m}$**)
- Annual average ambient temperature at a weather station nearby project site. **T_{region}**
- Methane content in biogas **$W_{CH4,\ y}$**
- Number of days cattle is alive in the farm in the year y **$N_{da,y}$**
- Site average animal weight of the defined livestock population **W_{site}**
- Number of animals produced annually of type LT for the year y **$N_{p,y}$**
- Pressure of biogas at flow measurement site **P**
- Temperature of biogas at flow measurement site **T (26 Deg C)**
- Annual average interval between manure collection and delivery for treatment at a given storage device
- Fraction of Manure handled in the digester. **MS% (100%)**
- Annual operational days of the digesters **n_{dy}**
- Amount of organic manure disposed from the project boundary on a daily basis.**$Q_{Organic\ manure}$**

 Volumetric component of component i in the residual gas in the hour h where I is $CH_{4\ fv\ i,h}$

Data/Parameter	N_L
Data unit	<table><tr><th>Year</th><th>Cattle Count</th></tr><tr><td>2014</td><td>5000</td></tr><tr><td>2015</td><td>5000</td></tr><tr><td>2016</td><td>5000</td></tr><tr><td>2017</td><td>6334</td></tr><tr><td>2018</td><td>6334</td></tr><tr><td>2019</td><td>6334</td></tr><tr><td>2020</td><td>6334</td></tr><tr><td>2021</td><td>6334</td></tr></table>
Description	Number of head of cattle
Source of data Value(s) applied	Head count of cattle whose dung is used for generating biogas
Measurement methods and procedures	Based on back-calculation of cattle dung requirement of the plant. Cow average generation data (i.e. 15kg / head / day).
Monitoring frequency	Fixed (conservative estimate)
Purpose of data	To estimate baseline emissions

Data / Parameter:	MCF
Data unit:	5.00%
Description:	Annual methane conversion factor. The MCF indicates the extent to which, under certain conditions, the degradable substances will actually be converted into methane.
Source of data:	-IPCC Guidelines
Measurement procedures (if any):	Default values provided in 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10. The project proponent has used the IPCC default values to estimate the baseline emissions. It also ensures that the baseline emissions are calculated in a conservative manner.
Monitoring frequency:	Fixed
QA/QC procedures:	-
Any comment:	-Baseline emissions are calculated in a conservative manner.

Data / Parameter:	$EG_{grenerated,y}$
Data unit:	kWh
Description:	

	<table><tr><th>Year</th><th>kwh Generated</th></tr><tr><td>2014</td><td>3579840</td></tr><tr><td>2015</td><td>3579840</td></tr><tr><td>2016</td><td>3579840</td></tr><tr><td>2017</td><td>4546080</td></tr><tr><td>2018</td><td>4546080</td></tr><tr><td>2019</td><td>4546080</td></tr><tr><td>2020</td><td>4546080</td></tr><tr><td>2021</td><td>4132800</td></tr></table>
Source of data	Plant records/Meter records
Measurement procedures (if any):	Measured using calibrated meters. Calibration shall be as per the relevant methodologies.
Monitoring frequency:	Continuous monitoring, integrated hourly and at least monthly recording
QA/QC procedure	-
Any comment:	The parameter need to be monitored for project activities which displaces grid electricity

Data / Parameter:	**$EF_{grid,y}$**
Data unit:	t CO_2e/MWh
Description:	CO_2 emission factor for the grid electricity in year *y*
Source of data	-As described in UCR Standard
Measurement procedures (if any):	0.9
Monitoring frequency:	NA
QA/QC procedure	-
Any comment:	The parameter need to be monitored for project activities which displaces grid electricity

Data / Parameter:	**VS**
Data unit:	2.6 kg/head/day
Description:	Volatile Solids production per head
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories under the volume 'Agriculture, Forestry and other Land use' for 'Emissions from Livestock and Manure Management' -
Measurement procedures (if any):	Fixed Default
Monitoring frequency:	NA
QA/QC procedure	The project proponent has used a combination of the field values and the IPCC default values to estimate the baseline emissions and an assessment on its suitability has been provided. It also ensures that the baseline emissions are calculated in a conservative manner
Any comment:	Baseline Emissions

Data/Parameter	$B_{0,LT}$
Data unit	0.13 m^3 CH_4/kg dm
Description	Maximum methane producing potential of the volatile solids generated for animal type LT

Source of data Value(s) applied	IPCC 2006 table 10.A.6 , chapte r 10, volume 4, Value taken for India
Measurement methods and procedures	The selected default value is appropriate as it reflects the feed intake levels at the site. The option as per AMS III D Para 18 (c), Page 8, is utilised to adjust the default IPCC values for VS for a site-specific animal weight .The methane producing potential is utilised to calculate the volatile solids generated.
Monitoring frequency	Fixed
Purpose of data	To estimate baseline emissions

Data / Parameter:	Q_{waste}
Data unit:	

Year	TPD Treated
2014	75
2015	75
2016	75
2017	95
2018	95
2019	95
2020	95
2021	95

Description:	Quantity of cattle dung used in the biogas digesters each year.
Source of data:	Measured
Measurement procedures (if any):	On-site data sheets recorded monthly and daily using weigh bridge
Monitoring frequency:	Monthly-
QA/QC procedures:	Weighbridge is subject to periodic calibration (in accordance with stipulation of the weighbridge supplier)
Any comment:	Log of data entry is provided to UCR verifier

Data/Parameter	N_y
Data unit	

	<table><tr><th>Year</th><th>Days of Operation</th></tr><tr><td>2014</td><td>330</td></tr><tr><td>2015</td><td>330</td></tr><tr><td>2016</td><td>330</td></tr><tr><td>2017</td><td>330</td></tr><tr><td>2018</td><td>330</td></tr><tr><td>2019</td><td>330</td></tr><tr><td>2020</td><td>330</td></tr><tr><td>2021</td><td>330</td></tr></table>
Description	Number of working days of the biogas units in each year
Source of data Value(s) applied	Conservative estimate to offset repair and maintenance activities at the site
Measurement methods and procedures	Recorded in log books
Monitoring frequency	Recorded in log books
Purpose of data	To estimate baseline emissions

Data / Parameter:	$fv_{i,h}$
Data Unit	Fraction Description Volumetric component of component i in the residual gas in the hour h where I is CH_4
Source of data	Continuous Gas Analyser - Applied an expected fraction of methane in biogas of 0.60 m^3CH_4/m^3 multiplied by the density of methane at normal conditions of 0.7168 kg/m^3.
Value(s) applied	0.43
Measurement methods and procedures	The same basis (dry or wet) is considered for this measurement and the measurement of the volumetric flow rate of the residual gas (FVRG,H) when the residual gas temperature exceed 60°C.
Monitoring frequency	Continuously. Values shall be averaged hourly.
QA/QC procedures	Analysers shall be periodically calibrated as per manufacturer's recommendation
Purpose of data	To ensure the applicability of Flare Efficiency of 90%
Additional comment	All gas volumes other than CH4 is considered as N2 for simplification

Data / Parameter	**T**
Data Unit	°C
Description	Temperature of biogas at flow measurement site
Source of data:	Monitored through thermometer
Value(s) applied	38 °C Measured regularly as per the technical guidance issued by the manufacturer for the installed equipment. Measurement methods and procedures .
Monitoring:	The temperature of the biogas will be monitored regularly and 12 measurements (one measurement per month) shall be taken

	each year. (As per Box 4 – Non-binding Best Practices in the methodology)
Data Type:	Temperature of the biogas is °C
Recording:	The data shall be recorded monthly.
Archiving Policy:	All the electronic and paper monitoring documents will be archived during the crediting period and two years thereafter.
Monitoring frequency	The value will be monitored regularly and 12 measurements (one measurement per month) shall be recorded.
QA/QC procedures	The parameter is monitored regularly and the measurements are logged in the log book. All measurement devices shall be procured from reputed manufacturers. The instruments used for monitoring are calibrated once a year.
Purpose of data	To calculate the baseline emissions
Additional comment	NA

Data / Parameter	**P**
Data Unit	Pa
Description	Pressure of biogas at flow measurement site
Source of data:	Monitored through pressure meter
Value(s) applied	100 mmWC
Data Type:	Pressure of the biogas is mbar or MMWC
Recording:	The data shall be recorded monthly.
Archiving Policy:	All the electronic and paper monitoring documents will be archived during the crediting period and two years thereafter.
Monitoring frequency	The value will be monitored regularly and 12 measurements (one measurement per month) shall be recorded.
QA/QC procedures	The parameter is monitored regularly and the measurements are logged in the log book. All measurement devices shall be procured from reputed manufacturers. The instruments used for monitoring are calibrated once a year.
Purpose of data	To calculate the baseline emissions
Additional comment	NA