Monitoring Report (MR)

CARBON OFFSET UNIT (CoU) PROJECT

Title: Bio-CNG Project AJS Fuels in Savli, Gujarat

UCR Project ID: 167
MR Version 1.0
Date of MR: 21/07/2022
First CoU Issuance Period: 8 years, 0 months
Monitoring Period: 01/01/2014 to 30/12/2021 (both dates inclusive)
Crediting Period: 01/01/2014 to 30/12/2021 (both dates inclusive)

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

BASIC INFORMATION	
Title of the project activity	**Bio-CNG Project AJS Fuels in Savli, Gujarat**
Scale of the project activity	Small Scale
Completion date of the MR	21/07/2022
UCR Registration ID	167
Project participants	Project Proponent: AJS Fuels Pvt. Ltd., Savli, Gujarat, India Aggregator: Gram Vikas Trust UCR ID:741215693
Host Party	India
Sectoral scopes	13 Waste handling and disposal 07 Transport
Applied Methodology	**AMS-III.AQ.:** ***Introduction of Bio-CNG in transportation applications, Version 2.0*** ***AMS III.AO. Methane recovery through controlled anaerobic digestion, Version 1.0***
Calculated amount of GHG emission reductions per year	2014: 11077 CoUs
	2015: 15713 CoUs
	2016: 19567 CoUs
	2017: 22769 CoUs
	2018: 25431 CoUs
	2019: 27643 CoUs
	2020: 29482 CoUs
	2021: 31010 CoUs
Calculated amount of GHG emission reductions over the crediting period	**1,82,692** CoUs (**1,82,692** tCO_{2eq})

SECTION A. Description of project activity

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

The project activity, **Bio-CNG Project AJS Fuels in Savli, Gujarat** is located in State: Gujarat, Country: India

The details of the registered project are as follows:

Purpose of the project activity:
The **Bio-CNG Project AJS Fuels in Savli, Gujarat** comprises of a project activity using biogas technology for capturing methane from fresh animal dung, poultry litter and organic waste, that is fed into an anaerobic digester and the gainful use of recovered methane gas for Bio-CNG bottling purposes for use in the transport sector.

b) Brief description of the installed technology and equipment>>
The project activity by the project proponent (PP), AJS Fuels Pvt Ltd., (AJS) is located in Village: Dhantej, Taluka: Savli, District: Vadodara, State: Gujarat, Country: India.

The purpose of the AJS project activity is the setup of an independent biogas plant of 1000 m^3 capacity to co-digest fresh cattle dung, poultry litter, organic waste and pressmud (press mud is used from 2022 onwards, hence is not part of this first verification period and monitoring period between 2014-2021), from farms and sugar mills outside the project boundary, which in turn generates and captures methane due to anaerobic digestion. The project activity comprises of measures taken to avoid the emissions of methane to the atmosphere from **10 tonnes per day (TPD) of cattle dung, 3 TPD of poultry litter and 7 TPD of organic agricultural waste/ crop residues (biomass)** that would have otherwise been left to decay anaerobically between the years 2014 and 2021.

The project activities also involves the installation and operation of a Bio-CNG plant that includes processing, purification and compression of the recovered biogas to obtain up-graded biogas such that methane content, its quality and the physical and chemical properties are equivalent to the fossil CNG it replaces in vehicles. The project activities hence also invlove the gainful use of the recovered methane for replacement of fossil CNG in vehicles.

Further, the residual waste from the digestion is handled aerobically and submitted to soil application as fertilizer.

A vehicle's emission with the enriched biogas fuel (Bio-CNG) meets to the BS IV emission norms. There is no significant change in fuel economy of the vehicle fuelled with the enriched biogas (24.11 km/kg) as compared to base CNG (24.38 km/kg).

The technical specifications of the modified KVIC model bio-digesters and resulting Bio CNG are as follows:

Specification	Value
Total Installed Capacity	1000 m^3
Mixing Proportion	(Water: Waste) 1:1
Number of units (digesters)	1
Feed Material	Cattle Dung/Poultry Litter/Organic Waste
Biogas Flow rate	0.9 m^3/hr
Calorific Value Biogas from digester	20 MJ/m^3
Quantity of Organic Waste Treated	20 TPD
Bio CNG Calorific Value	52 MJ/kg
BioCNG capacity (Daily)	350 kg
Air-Fuel Stoichiometric Ratio by volume	23.9 : 1
Density @ 1 ATM, 15 °C (kg/m3)	0.79
Autoignition Temperature (°C)	630 - 810
Toxicity	Non toxic even at high concentration & low levels of oxygen.
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

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

UCR Project ID: 167

Start Date of Crediting Period: 01/01/2014

Project Commissioned: 2013

Commissioning dates of digesters: 1

Total Biogas Units in the monitoring period: 1

This is the first monitoring report for the first crediting period for the period 01/01/2014 to 31/12/2021.

The operational domestic biogas unit is 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.

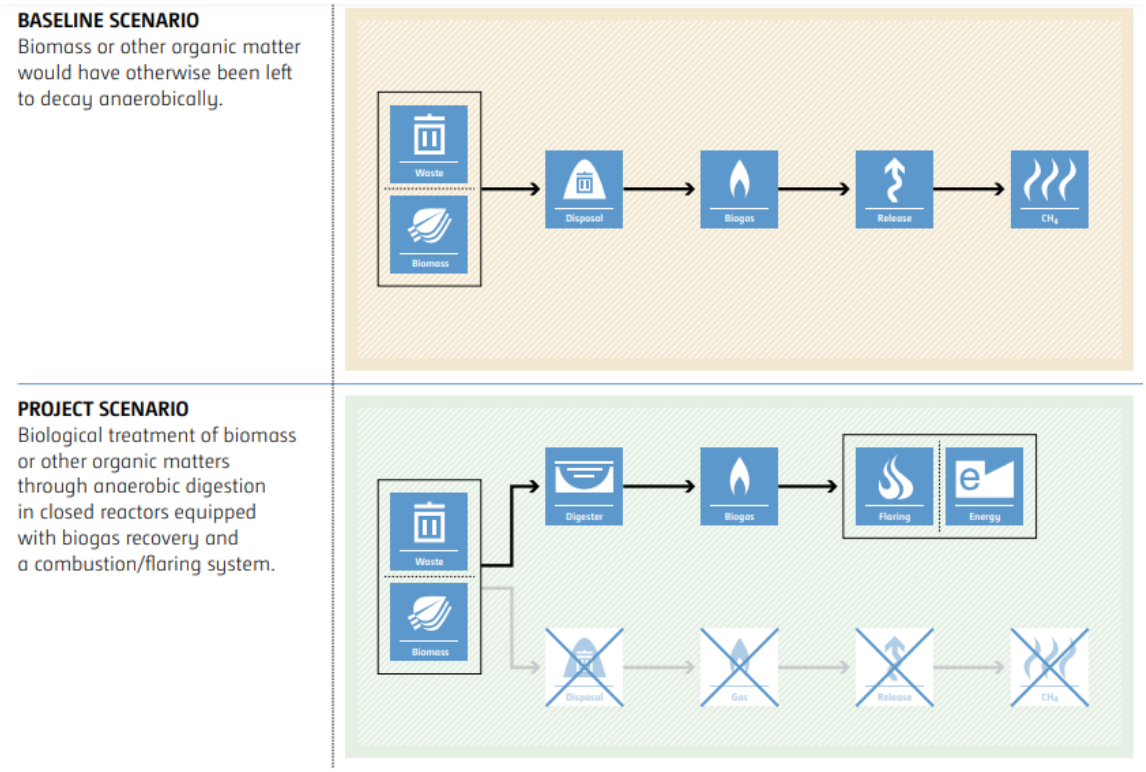
d) Total GHG emission reductions achieved or net anthropogenic GHG removals by sinks achieved in this monitoring period>>

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

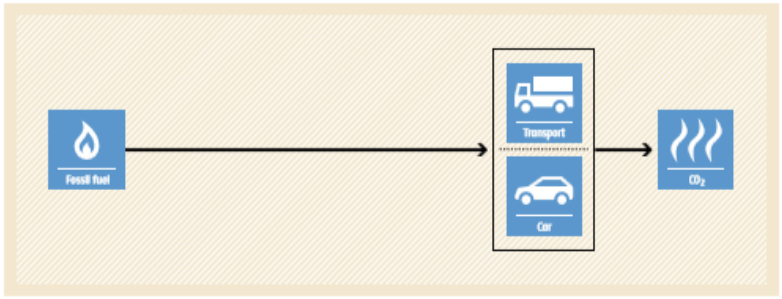
Summary of the Project Activity and ERs Generated for the Monitoring Period	
Start date of this Monitoring Period	01/01/2014
Carbon credits claimed up to	31/12/2021
Total ERs generated (tCO_{2eq})	182692 tCO_{2eq}
Leakage	NA

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

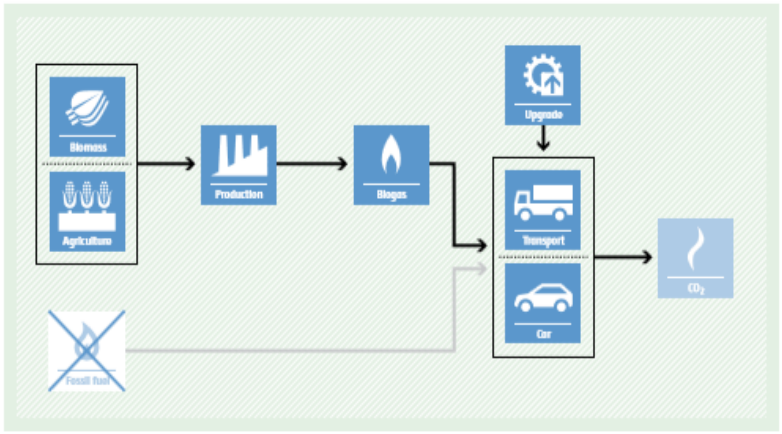
- the amount of Bio-CNG produced and distributed to replace fossil produced fuel,
- the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere. The baseline emissions are the amount of methane emitted from the decay of the degradable organic carbon in the biomass and other organic matter.



BASELINE SCENARIO
Gasoline or CNG are used in the baseline vehicles.

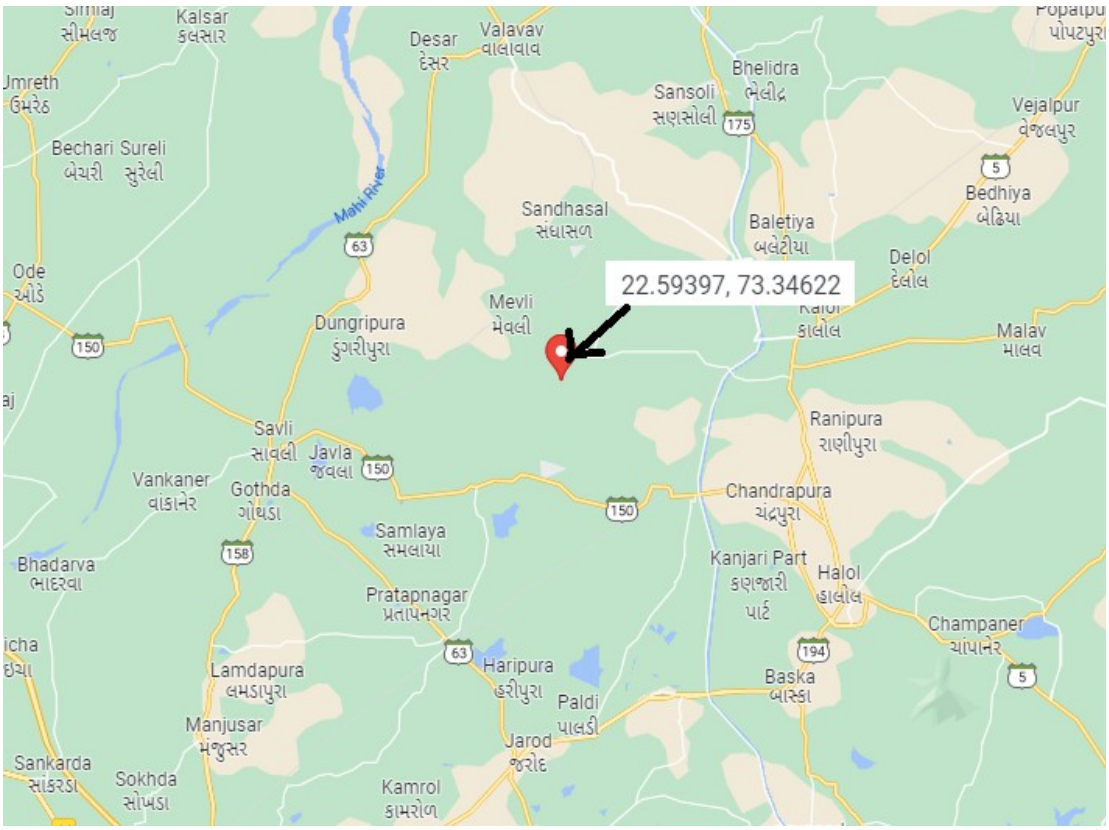


PROJECT SCENARIO
Only Bio-CNG are used in the project vehicles.



A.2. Location of project activity>>

Country: India.
Plot: Survey No. 647
Village: Dhantej
Taluka: Savli
District: Vadodara,
State: Gujarat
Latitude: 22° 35' 38.2914" N
Longitude: 73° 20' 46.392" E



A.3. Parties and project participants >>

Party (Host)	Participants
India	Project Proponent: AJS Fuels Pvt. Ltd., Savli, Gujarat, India Aggregator: Gram Vikas Trust UCR ID:741215693 Email:gvtbiogas@gmail.com

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

SECTORAL SCOPE - 07 Transport
13 Waste handling and disposal

TYPE I - Renewable Energy Projects. Displacement of more-GHG-intensive fossil fuel used in vehicles.
TYPE III-Other Project Activities

CATEGORY- ***AMS-III.AQ.: Introduction of Bio-CNG in transportation applications, Vers 2.0***
AMS III.AO. Methane recovery through controlled anaerobic digestion, Ver 1.0

A.5. Crediting period of project activity >>
Type: Renewable
State Date: 01/01/2014
End Date: 31/12/2021
Length of the crediting Period corresponding to this monitoring period: 8 years, 0 months

A.6. Contact information of responsible persons/entities >>
Aggregator: Gram Vikas Trust
UCR ID:741215693
Email:gvtbiogas@gmail.com

SECTION B. Implementation of project activity

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

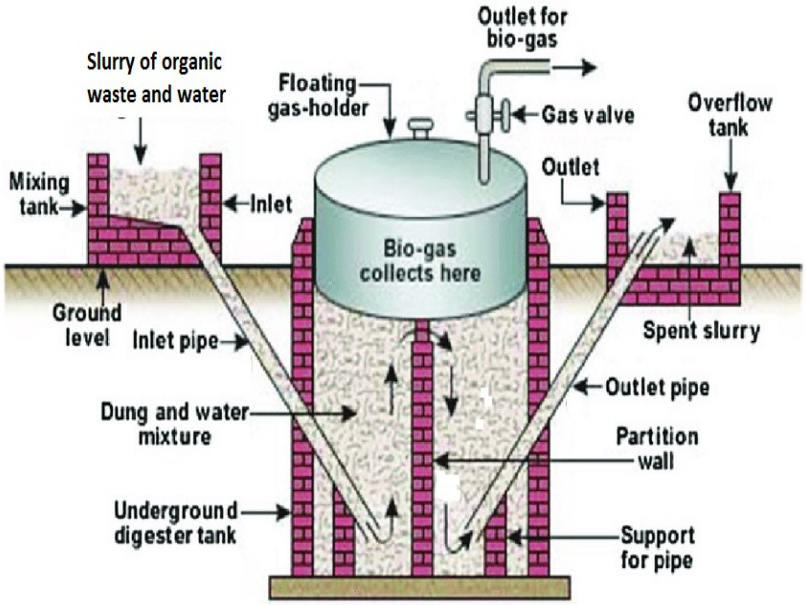
a) Provide information on the implementation status of the project activity during this monitoring period in accordance with UCR PCN>>

The purpose of the project activity is the set up 1 (one) independent biogas plant (digester) of 1000m^3 capacity for controlled biological treatment of biomass or other organic matters through anaerobic digestion in closed reactors equipped with biogas recovery. The project activity comprise of measures taken to avoid the emissions of methane to the atmosphere from 20 tonnes per day (TPD) of biomass or other organic matter that would have otherwise been left to decay anaerobically in a solid waste disposal site (SWDS).

The project activities also involves the installation and operation of a Bio-CNG plant that includes processing, purification and compression of the recovered biogas to obtain up-graded biogas such that methane content, its quality and the physical and chemical properties are equivalent to the fossil CNG it replaces in vehicles. The project activities hence invlove the gainful use of the recovered methane for replacement of fossil CNG in vehicles. Daily 350 kgs of bottled Bio-CNG is generated from the project activity.

Digester # 1 Capacity	1000m^3
Organic Waste Treated	20 TPD
Bio-CNG	350 kgs/day

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

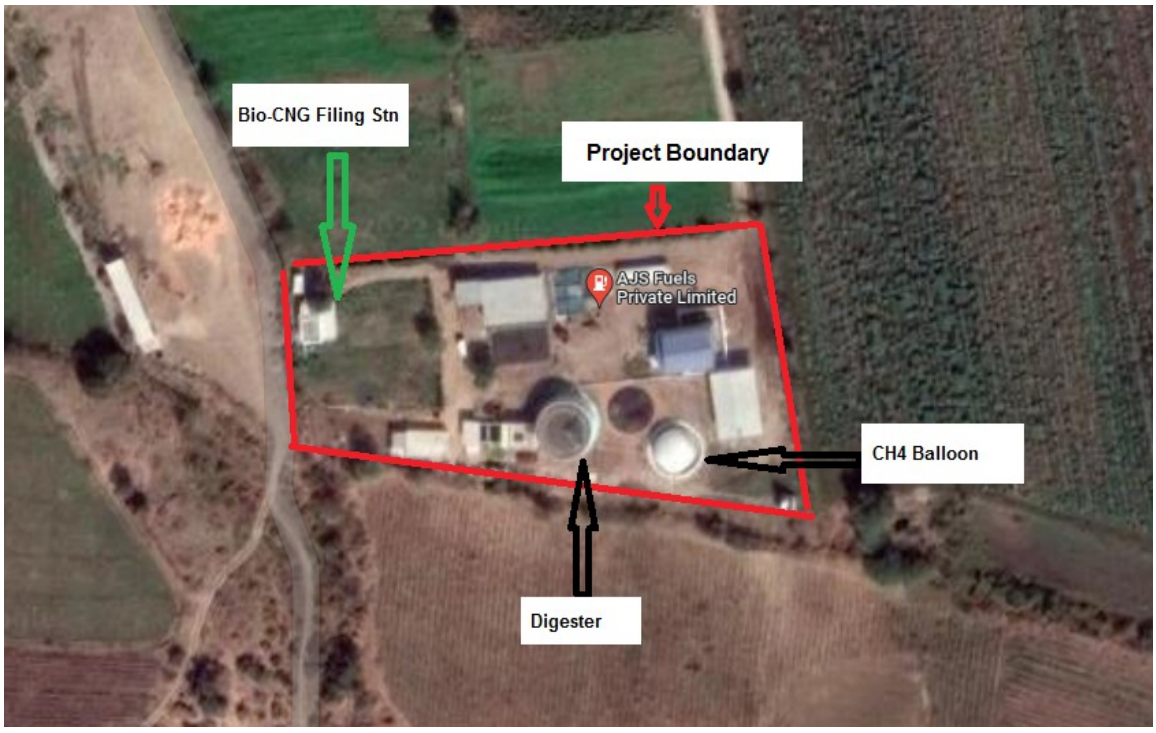


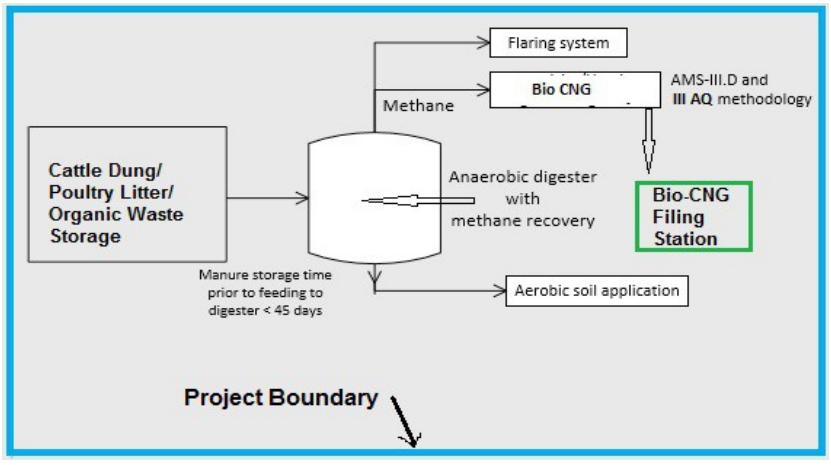
Bio-methanation is a process by which organic waste is microbiologically converted under anaerobic conditions to biogas. It is the most energy efficient and eco-friendly method for treatment

of poultry litter. With bio-methanation the project activity converts poultry litter to Bio-CNG and also good quality organic manure. AJS has set up a 1000 m^3 biogas digester which treats approximately 20 TPD of organic waste including cattle dung/poultry litter at the site in Gujarat where around 350 kg Bio-CNG is bottled in cylinders and sold at the filling station within the project boundary.

Co-digestion in the project activity is the simultaneous digestion of a homogenous mixture of two or more substrates from different sources, e.g. co-digestion of organic waste, animal manure and/or pressmud. The situation in the project activity is where cattle dung is used as a major amount of the primary basic substrate (e.g. manure) which is mixed and digested together with minor amounts of other substrates.

The project activity comprises of measures taken to avoid the emissions of methane to the atmosphere from **10 tonnes per day (TPD) of cattle dung, 3 TPD of poultry litter and 7 TPD of organic agricultural waste (total 20TPD)** that would have otherwise been left to decay anaerobically outside the project boundary between the years 2014 and 2021.





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 CNG.
- It leads to better waste management thus keeping the surroundings clean and reduce some of the disease causing pathogens
- Biogas allows poultry farms to become self-sufficient and monetise their waste.
- It leads to better waste management thus keeping the surroundings clean and reduce some of the disease causing pathogens
- Biogas CNG projects allow farms in the vicinity of the project activity to become self-sufficient and monetise their waste.

- **Environmental benefits:**
- Biogas plants not only produce energy, but also digestate, which is formed during the process of Anaerobic Digestion (AD). Digestate is a perfect biological and green fertilizer that can reduce the use of mineral fertilizers, avoiding the emissions related to their energy-intensive production.
- Avoids local environmental pollution through better waste management
- Leads to soil improvement by providing high quality manure
- Avoids global and local environmental pollution and environmental degradation by switching from fossil fuels to renewable energy, leading to reduction of GHG emissions
- Reduces air pollution, and increases use of manure rather than chemical fertilizers.
- Using biogas as an energy resource contributes to clean environment.
- Hygienic conditions are improved through reduction of pathogens by utilizing the animal and other organic wastes in the bio-digesters.
- Curbs methane emission as well as any leachate that would otherwise have been generated from the current practice of unscientific waste disposal.
- Further, by generating Bio-CNG through utilising the biogas, the project helps in replacing fossil fuel intensive fuels for transport.
- Recycling of the biogas slurry ensures that water is recycled into the biomethanation process thus resulting in water savings.
- Reduces outdoor air pollution, and increases use of manure rather than chemical fertilizers.
- Hygienic conditions are improved through reduction of pathogens by utilizing the organic wastes in the bio-digesters.
- Bio manure is a source of organic matter that stimulates biological activity.

- **Economic benefits:**
- The project is among the few the region than captures biogas and uses the same for the generation of Bio-CNG for use in transport.
- Poultry litter and cattle dung is transformed into high-quality enriched bio-manure/fertilizer which is supplied to the retail marketplace, thus providing better soil enrichment for local gardens and parks.
- Provides employment to local communities through construction and maintenance of biogas units.
- The revenue from carbon credits will make it more attractive for the setup of similar projects

across the State at scale and speed. 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 and will enable scaling up of such project activities.

B.3. Baseline Emissions>>

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

- the amount of Bio-CNG produced and distributed to replace fossil produced fuel,
- the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere. The baseline emissions are the amount of methane emitted from the decay of the degradable organic carbon in the biomass and other organic matter.

B.4. Debundling>>

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

SECTION C Application of methodologies and standardized baselines

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

SECTORAL SCOPE - 07 Transport
13 Waste handling and disposal

TYPE I - Renewable Energy Projects. Displacement of more-GHG-intensive fossil fuel used in vehicles.
TYPE III-Other Project Activities

CATEGORY- ***AMS-III.AQ.: Introduction of Bio-CNG in transportation applications, Version 2.0***

This methodology comprises activities for production of Biogenic Compressed Natural Gas (Bio-CNG) from biomass including biomass residues to be used in transportation applications. The project activity involves installation and operation of Bio-CNG plant that includes:

(a) Anaerobic digester(s) to produce and recover biogas;
(b) Biogas treatment system that includes processing and purification of the biogas to obtain up-graded biogas such that methane content, its quality and the physical and chemical properties are equivalent to the CNG;
(c) Filling stations, storage and transportation.

This methodology covers the use of Bio-CNG in various types of transportation applications such as Compressed Natural Gas (CNG) vehicles, modified vehicles. Examples include buses, trucks, three-wheeler, cars, jeeps, etc.

AMS III.AO. Methane recovery through controlled anaerobic digestion, Version 1.0

This methodology comprises measures to avoid the emissions of methane to the atmosphere from biomass or other organic matter that would have otherwise been left to decay anaerobically in a solid waste disposal site (SWDS). In the project activity, controlled biological treatment of biomass or other organic matters is introduced through anaerobic digestion in closed reactors equipped with biogas recovery and combustion/flaring system.

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

The project activity comprises measures to avoid the emissions of methane to the atmosphere from biomass or other organic matter that would have otherwise been left to decay anaerobically in a solid waste disposal site (SWDS). The project activity also involves installation and operation of Bio-CNG plant that includes: • (a) Anaerobic digester(s) to produce and recover biogas; • (b) Biogas treatment system that includes processing, purification of the biogas to obtain up-graded biogas such that methane content, its quality and the physical and chemical properties are equivalent to the CNG; • (c) Filling stations, storage and transportation.
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 digested residue waste leaving the reactor is handled aerobically and sold to local clients who submit residue to soil application in gardens and parks.The storage time of the agricultural waste does not exceed 45 days before being fed into the digesters.
The project activity does not recover or combust landfill gas from the disposal site, does not undertake controlled combustion of the waste that is not treated biologically in a first step and does not recover biogas from wastewater

treatment.
The storage time of the organic waste does not exceed 45 days before being fed into the digesters.
The activities for production of Biogenic Compressed Natural Gas (Bio-CNG) are from biomass including biomass residues from municipal solid waste.
Methane content of the upgraded biogas is in accordance with relevant national regulations and over the minimum volume specified for India.
Only the producer of the Bio-CNG is claiming emission reductions under this methodology.
Biogas treatment system that includes processing, purification of the biogas to obtain up-graded biogas such that methane content, its quality and the physical and chemical properties are equivalent to the CNG;
Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually

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

The biogas unit along with the meters is constructed within the project boundary and has a unique ID, which is visible on the biogas unit and log books. The control room has all the details and specifications of the equipment installed at the project site. The project activity is not registered under any GHG program since being commissioned.

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

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

- Where the treatment of biomass or other organic matters through anaerobic digestion takes place;
- Where the residual waste from biological treatment or products from those treatments, like slurry, are handled, disposed, submitted to soil application, or treated thermally/mechanically;
- Where biogas is burned/flared or gainfully used, including biogas sale points, if applicable;
- The Bio-CNG plant and sale points are located within the Project Boundary;

	Source	GHG	Included?	Justification/Explanation
Baseline	CO_2 emissions from CNG from fossil origin CH_4 Emissions from biomass decay	CO_2	**Included**	Major source of emission
		CH_4	**Included**	Major source of emission
		N_2O	Excluded	Excluded for simplification. This is conservative
Project Activity	CH_4 Emissions from anaerobic digester CH_4 Emissions from flaring of the biogas	CO_2	Excluded	There is no incremental emissions related to transport of waste to project site as compared to the disposal site.
		CH_4	**Included**	Methane emissions due to physical leakages from the digester / recovery system and flaring per year
		N_2O	Excluded	Excluded for simplification. This is conservative

Leakage Emissions under AMS III.AO is not applicable as the project technology is not transferred from another activity and neither is the existing equipment being transferred to another activity.

Leakage Emissions under AM III.AQ related to the substitution of Bio-CNG for CNG from fossil origin reduces indirect ("upstream") emissions associated with the production of fossil CNG and is treated as negative leakage, hence is not considered and is conservative in the approach to calculate baseline emissions.

The waste transported to the project site is not more than 200 km, hence project emissions on account of transport has been neglected.

C.5. Establishment and description of baseline scenario (UNFCCC CDM-UCR Protocol) >>

As per ***AMS-III. A.O methodology,*** *since* the project activity treats animal manure as a substrate, the relevant sub methodology applicable is ***AMS-III.D Methane recovery in animal manure management systems***, has been applied. The baseline scenario under AMS III. D 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 under AMS III.D (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).

The baseline emissions under AMS III.AQ are calculated based on the amount of Bio-CNG produced and distributed, and it is applicable to project activities that use Bio-CNG in modified diesel vehicles and modified gasoline vehicles when such vehicles are not included in the boundary. All vehicles have been assumed to converted to run on natural gas, which is then considered being the baseline fuel.

Project Activity Emissions

1. Project activity emissions consist of:

   (a) Methane emissions from physical leakages of the anaerobic digester;

   (b) Methane emissions due to flare inefficiency;

$PE_{phy,leakagey}$ = Methane emissions due to physical leakages from the digester and recovery system. Methane emissions due to physical leakages from the digester and recovery system (leakagey phy PE ,) shall be estimated using a default factor of 0.05 m3 biogas leaked/m3 biogas produced.

$PE_{flare,y}$ = Methane emissions due to incomplete flaring in year *y* as per the "Tool to determine project emissions from flaring gases containing methane"(tCO_2e).

$PE_{transport,y}$ = Nil. The biomass and animal manure is transported to the project activity site within a radius of 200 km of the project boundary. Hence incremental emissions on account of transport is neglected.

Estimated Annual Emission Reductions: $BE_y = BE_{y1} + BE_{y2} + BE_{y3} - PE_{phy,leakagey} - PE_{flare,y}$

BE_y = Total Baseline Emissions in a year.

BE_{y2} = The baseline emissions under AMS III.AQ are calculated based on the amount of Bio-CNG produced and distributed, and it is applicable to project activities that use Bio-CNG in modified diesel vehicles and modified gasoline vehicles when such vehicles are not included in the boundary. All vehicles have been assumed to converted to run on natural gas, which is then considered being the baseline fuel.

$$BE_{y2} = FS_{BIO\text{-}CNG,\ Y} \times NCV_{BIO\text{-}CNG} \times EF_{CO2,\ BIO\text{-}CNG}$$

$FS_{BIO\text{-}CNG,\ Y}$	Amount of Bio-CNG distributed directly to retailers, filling stations by the project activity in year y (tonnes)
$EF_{CO2,\ BIO\text{-}CNG}$	CO2 emission factor of CNG (tCO2e/GJ), determined using reliable local or national data (0.053 TCO2/GJ)
$NCV_{BIO\text{-}CNG}$	Net calorific value of Bio-CNG (GJ/tonne). For NCV of CNG, reliable local or national data shall the used. (43.5 GJ/T IPCC Default)

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

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

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} = Avg. Wt. at Site (cattle/poultry) in kg

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

nd_y = Number of days in year y where the treatment was operational (Avg 330 days/yr)

$VS_{default\_cattle/poultry}$ = Volatile solids of livestock LT entering the animal manure management system in year y as per IPCC default for poultry/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) (Poultry=0.02) (Cattle= 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 (Poultry=2%), solid storage, (Cattle=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 (Poultry =0.24). IPCC 2006 - IPCC Default Value taken for 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.

$VS_{Default,\ poultry}$ 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) = 0.01

The feed digestibility in the range of 50 to 60% has been considered as appropriate for this project activity. 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) selected as conservative.

$\boldsymbol{BE_{y3} = BE_{swds,y}}$ = The baseline scenario under AMS III.AO is the situation where, in the absence of the project activity, biomass/organic matter are left to decay within the project boundary and methane is emitted to the atmosphere. The baseline emissions are the amount of methane emitted from the decay of the degradable organic carbon in the biomass and other organic matter.

The yearly baseline emissions are the amount of methane that would have been emitted from the decay of the cumulative quantity of the waste diverted or removed from the disposal site, to date, by the project activity, calculated as the methane generation potential using the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site."

The project proponent was not bound to incur this investment as it was not mandatory by national and sectoral policies.

$BE_{swds,y}$ = Baseline emission determination of digested waste that would otherwise have been disposed in stockpiles shall follow relevant procedures in AMS-III.E. This is equal to the yearly methane generation potential of the SWDS at the year y, considering all the wastes deposited in it since its beginning of

operation, and without considering any removal of wastes by the project activity.

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

Project Activity Emissions

PE_y = 1264 tCO_{2eq}/year

BE_{y1} = 1571 tCO_2 + 4919 tCO_2 = **6490 tCO_{2eq}/yr**

BE_{y2} = **272 tCO_2/yr**

Year	2014	2015	2016	2017	2018	2019	2020	2021
Baseline emissions on account of organic waste **BE_{y3}**	5579	10215	14069	17271	19933	22145	23984	25512
Baseline emissions on account of poultry litter and cow dung waste **BE_{y1}**	6490	6490	6490	6490	6490	6490	6490	6490
Baseline emissions on account of bottling BIO-CNG **BE_{y2}**	272	272	272	272	272	272	272	272
Project Emissions due to Digester Leakage and flaring **PE_y**	1264	1264	1264	1264	1264	1264	1264	1264
ER (tCO2)	**11077**	**15713**	**19567**	**22769**	**25431**	**27643**	**29482**	**31010**

Calculated Total Emission Reductions (ER) over the crediting period = 1,82,692 CoUs

B.6. Prior History>>

The project activity has not applied to any other GHG program for generation or issuance of carbon offsets or credits in the past or for the current crediting period.

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: 8 years, 0 months

Crediting Period – 01/01/2014 to 31/12/2021
Monitoring Period: 1
Duration: 8 years, 0 months

B.8. Monitoring plan>>

Relevant parameters are monitored as indicated below.

- Amount of poultry litter manure used at the plant ($\mathbf{Q_{poultry\ litter}}$) each day
- Amount of cow dung used at the plant ($\mathbf{Q_{cow\ dung}}$) each day
- Amount of organic waste/biomass used at the plant ($\mathbf{Q_{biomass}}$) each day
- Amount of biogas generated per day ($\mathbf{BG_{fuelled,\ y}}$)
- Mass flow of methane in the residual gas in the minute m (kg) ($\mathbf{FCH_{4,RG,m}}$)
- Annual average ambient temperature at a weather station nearby project site. $\mathbf{T_{region}}$
- Methane content in biogas $\mathbf{W_{CH4,\ y}}$
- Pressure of biogas at flow measurement site **P**
- Temperature of biogas at flow measurement site **T (26 Deg C)**
- Fraction of Manure handled in the digester. **MS% (100%)**
- Annual operational days of the digesters $\mathbf{n_{dy}}$
- Amount of organic manure disposed from the project boundary on a daily basis.$\mathbf{Q_{Organic\ manure}}$
- Volumetric component of component i in the residual gas in the hour h where I is $\mathbf{CH_{4\ fv\ i,h}}$

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
1	Q_y,	Quantity of solid waste	20 tons per day	Daily	On-site data sheets recorded monthly using weigh bridge. Weighbridge is subject to periodic calibration (in accordance with stipulation of the weighbridge supplier)
2	$w_{CH4,y}$	Methane content in biogas in the year *y*	60%	*Monthly*	As per the relevant procedure in AMS-III.H
3	*FE*	The flare efficiency	10%	Yearly	As per the "Tool to determine project emissions from flaring gases containing Methane". Regular maintenance is carried out to ensure optimal operation of flares. O&M is available in the log sheets.

Data/Parameter	Date of commissioning of biogas unit
Data unit	2013
Description	Actual date of commissioning of the project
Source of data Value(s) applied	Monitoring Report 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.
Monitoring frequency	As and when commissioned and fixed and recorded in the monitoring report
Purpose of data	To estimate baseline emissions

Data / Parameter:	**$w_{CH4,y}$**
Data unit:	95.00%
Description:	*Methane content in the Bio-CNG*
Source of data:	-
Measurement procedures (if any):	The fraction of methane in the gas is to be measured with a continuous analyzer or, alternatively, with periodical measurements at a 90/10 sampling confidence/precision level. It shall be measured using equipment that can directly measure methane content in the biogas.
Monitoring frequency:	Continuous/periodic
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	**$NCV_{Bio-CNG}$**
Data unit:	43.5 GJ/t
Description:	*Net calorific value of Bio-CNG*
Source of data:	-
Measurement procedures (if any):	Measured according to relevant national/international standards through sampling

Monitoring frequency:	Monthly or as prescribed by the applied national/international standard
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	**$FS_{Bio\text{-}CNG,y}$**
Data unit:	350 kg/day (231 t/yr)
Description:	*Amount of Bio-CNG distributed/sold directly to retailers, filling stations by the project activity in year y*
Source of data:	Measurements of the amount of Bio-CNG distributed/sold to retailers/filling stations are undertaken using calibrated meters at the delivery section of Bio-CNG production site. Records for sold amount (e.g. invoices/receipts) and with the amount of biogas produced is kept on file.
Measurement procedures (if any):	Continuously or in batches
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

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

Data/Parameter	$N_{L\ cows}$
Data unit	667
Description	Calculated minimum number of head of cows per year based on average of 10TPD of cow dung transported to the project site.
Source of data Value(s) applied	Head count of cows, whose waste is used for generating biogas
Measurement methods and procedures	Based on back-calculation of cow/poultry litter requirement of the plant. Cow average generation data (15kg / head / day).
Monitoring frequency	Based on daily cow dung quantity transported to the project site as per log books and payment receipts for the same.
Purpose of data	To estimate baseline emissions

Data / Parameter:	VS
Data unit:	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):	Poultry=0.02 Cattle= 2.6
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:	N_y
Data unit:	Number of operational days in a year
Description:	Measured
Value(s) applied	330
Source of data:	-
Measurement procedures (if any):	Records kept in the log book.
Monitoring frequency:	Annually, based on monthly records
QA/QC procedures:	-
Any comment:	-Baseline Emissions

Data/Parameter	$N_{L\ poultry}$
Data unit	75000
Description	Calculated minimum number of poultry per year on farms based on average of 3 TPD of poultry litter transported to the project site.
Source of data Value(s) applied	Head count of poultry, whose waste is used for generating biogas
Measurement methods and procedures	Based on back-calculation of poultry litter requirement of the plant. Poultry average generation data (i.e. 40 g / head / day)
Monitoring frequency	Based on daily poultry litter quantity transported to the project site as per log books and payment receipts for the same.
Purpose of data	To estimate baseline emissions