PROJECT CONCEPT NOTE (PCN)

CARBON OFFSET UNIT (CoU) PROJECT

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

Version 1.0

Date 03/06/2022

First CoU Issuance Period: 8 years, 0 months

Crediting Period: 01/01/2014 to 30/11/2021 (both dates inclusive)

Project Concept Note (PCN)
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 this PCN	03/06/2022
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***
Estimated amount of GHG emission reductions per year (ex-ante)	19700 CoUs/yr (19700 tCO_{2eq}/yr)

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 and poultry litter 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. The project was commissioned in **2013**.

The project activity by the project proponent, 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 the first verification period 2014-2021), from farms and sugar mills outside the project boundary, which in turn generates and captures methane due to anaerobic digestion. 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 and 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/ crop residues (biomass)** that would have otherwise been left to decay anaerobically between the years 2014 and 2021. From year 2022 onwards, the PP is also using press mud in the co-digestion process for methane gas capture.

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.

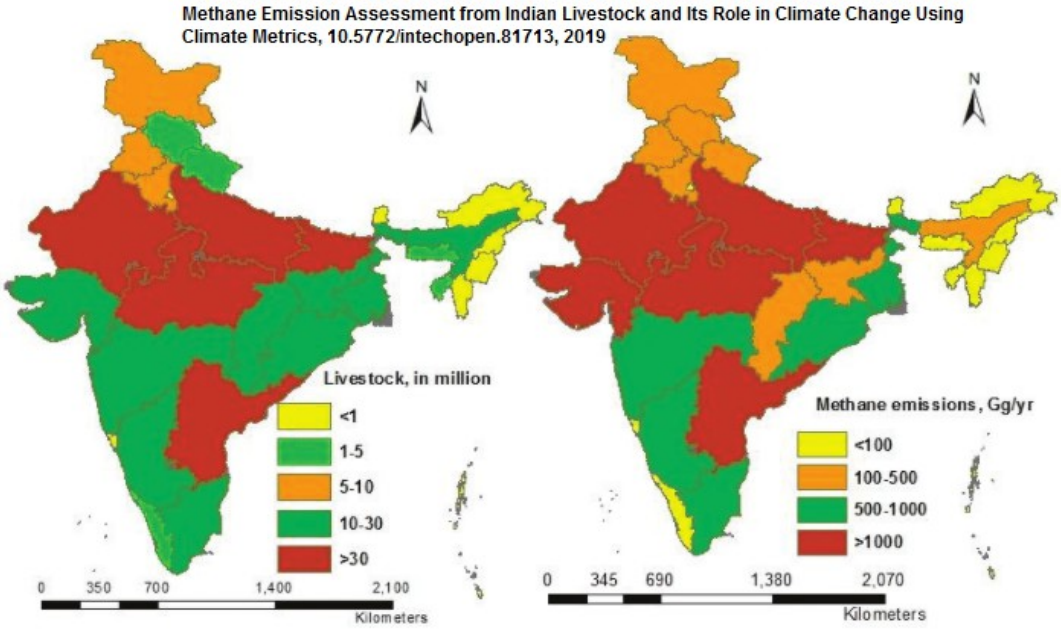
A vehicle's emission with the enriched biogas fuel (Bio-CNG) meets to the BS IV emission norms. There is no significant change in fuel economy of the vehicle fuelled with the enriched biogas (24.11 km/kg) as compared to base CNG (24.38 km/kg). The biogas plant such as the project activity, are significant and growing contributors to achieve world climate-neutrality by 2050.

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), or in an animal waste management system (AWMS).

In the project activity, controlled biological treatment of organic matter is introduced through co-digestion of multiple sources of biomass substrates, i.e organic waste and animal manure, where those organic matters would otherwise have been treated in an anaerobic treatment system without

biogas recovery. Further, the project activity achieves methane recovery and gainful use of the recovered methane to generate Bio CNG to be used in the transport sector.

Worldwide, agricultural operations are becoming progressively more intensive to realize economies of production and scale. The pressure to become more efficient drives significant operational similarities between farms of a "type," as inputs, outputs, practices, genetics, and technology have become similar around the world. This is especially true in livestock operations (poultry, dairy cows, etc.) which can create profound environmental consequences, such as greenhouse gas emissions, odour, and water/land contamination (including seepage, runoff, and over application), that result from storing (and disposing of) animal waste.



India has the some of the world's largest livestock population at 500 million heads. Methane has a warming potential 21 times higher than carbon dioxide. Better livestock management can reduce atmospheric methane levels. Livestock emissions worldwide – from manure and gastroenteric releases – account for roughly 32 per cent of human-caused methane emissions. Methane has accounted for roughly 30 per cent of global warming since pre-industrial times and is proliferating faster than at any other time since record keeping began in the 1980s. In fact, according to data from the United States National Oceanic and Atmospheric Administration, even as carbon dioxideemissions decelerated during the pandemic-related lockdowns of 2020, atmospheric methane shot up.

Waste Type Treated	Quantity Treated
Cattle Dung	10 TPD
Poultry Litter	3 TPD
Organic Waste/Agricultural Farm Waste	7 TPD

The cattle and poultry owners surrounding the project activity can be classified as small to medium-level farmers who are feeding a combination of green fodder and crop residues. Feed intake is typically measured in terms of gross energy (eg., megajoules (MJ) per day) or dry matter (eg.

kilograms (kg) per day).

Manure is a primary source of methane (CH4) emissions into the atmosphere. A large proportion of CH4 from manure is emitted during storage (varies with storage methods). Poultry farmers usually rake the droppings into a heap and let them dry in the sun or compost it. There are few takers for the manure. However, such biogas treatment of poultry litter is a sustainable solution that helps keep the surrounding environment clean and eliminates the issue with odour from poultry litter.

There is no regulation in India, applicable to the project activity, that requires the collection and destruction of methane from livestock manure or poultry litter or organic waste. In the absence of the project activity, poultry litter and animal manure is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere. The project activity recovers and utilizes biogas for Bio CNG bottling purposes and hence displaces fuel using fossil fuels (CNG). The project activity hence avoids CH_4 and CO_2 emissions and is beneficial to the environment and community.

A.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.

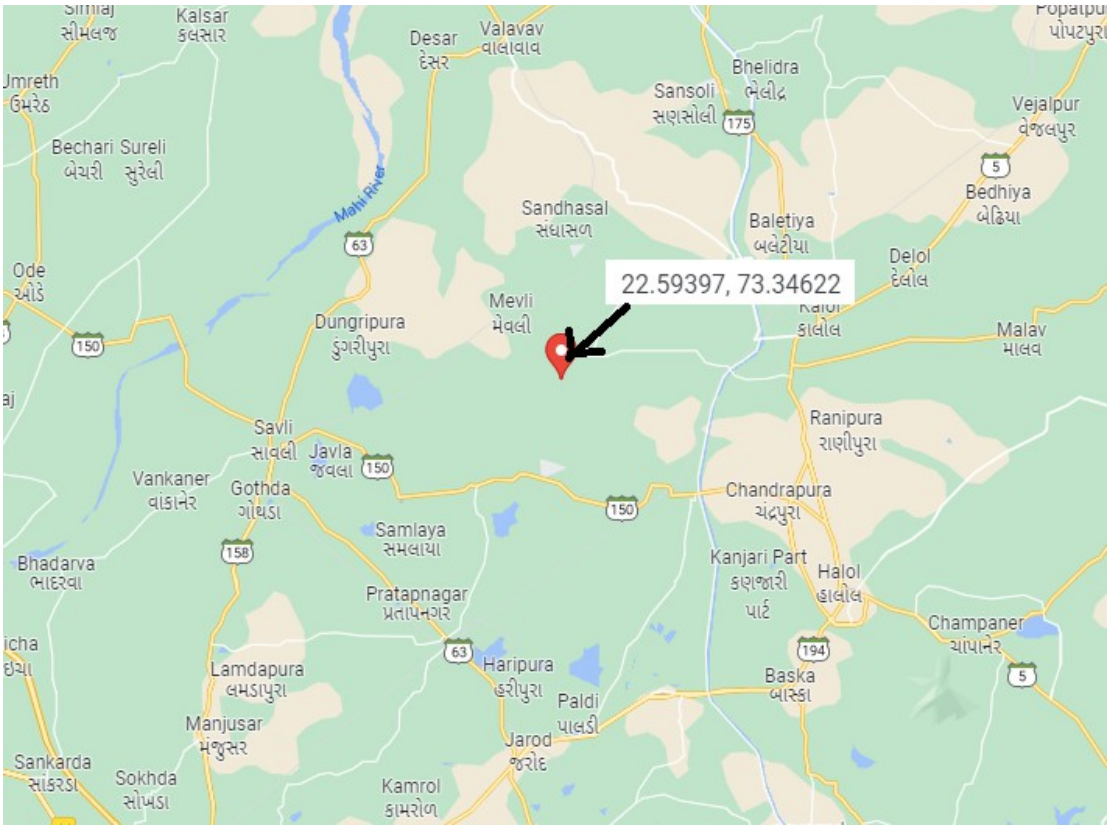
- **Environmental benefits:**
- Biogas plants not only produce energy, but also digestate, which is formed during the process of Anaerobic Digestion (AD). Digestate is a perfect biological and green fertilizer that can reduce the use of mineral fertilizers, avoiding the emissions related to their energy-intensive 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.

A.3. 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.4. Technologies/measures >>

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 and 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 that would have otherwise been left to decay anaerobically outside the project boundary between the years 2014 and 2021.

Modified KVIC Floating Methanization Digesters: The project activity has a total of 1 independent biogas digester of 1000 m^3 capacity with arrangements of continuous stirring. The CSTR high rate digester treats under anaerobic condition and converts 50 % of organic carbon to produce Biogas.

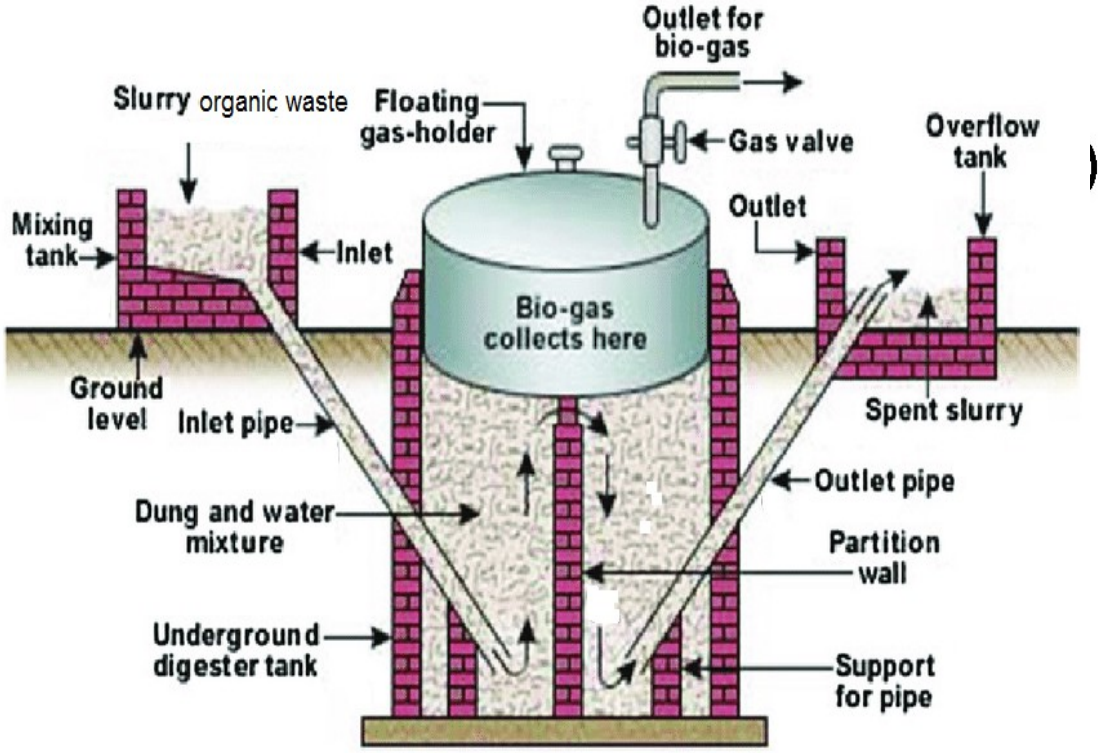
The retention time of slurry in the digester is 25 days with an operating temperature of 55˚C. The methanization digesters are fitted with stirrers that ensure dry solid control within the digester to an average value of 15%.

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.

Purification System: From the ballons, the raw biogas is sent to a compressor with processing and purification systems for the biogas to obtain up-graded biogas such that methane content, itsquality and the physical and chemical properties are equivalent to the CNG and this is in turn stored in Bio-CNG bottles for further use in the transport sector.

Biogas is a product from the process of degradation of organic matter by anaerobic bacteria. The biogas generation process consists of four subsequent chemical and biochemical reactions i.e. Hydrolysis reaction, Acidogenesis reaction, Acetogenesis reaction and Methanogenesis reaction.



Hydrolysis reaction decomposes organic molecule such as carbohydrates, proteins and fats into glucose, amino acids and fatty acids, respectively. Acidogenesis converts those generated small organic molecules to volatile organic acids with help from bacteria. During the Acetogenesis process, bacteria in the acetic group digests volatile organic acids and releases acetic acid. Lastly, anaerobic bacteria in the methanogenic producing bacteria group will complete the Methanogenesis process by converting acetic acid to methane gas and other gases like carbon dioxide and hydrogen sulfide. Hydrogen sulfide is a corrosive gas. Presence of carbon-dioxide in the bio-gas reduces its calorific value. Hence the bio-gas needs to be purified. The raw Biogas is purified for methane enrichment by removal of other gases and purified gas have methane content of more than 93%.

The optimum utilization depends upon the successful physical installations, which in turn depend upon plant design and its selection. The basic conversion principle is that when a non-ligneous biomass is kept in a closed chamber for a few days, it ferments and produces an inflammable gas. The anaerobic digestion consists of three stages: I Hydrolysis; II Acid formation and III Methane fermentation. The processes are carried out by two sets of bacteria namely acid forming bacteria and methane formers. The acidogenic phase I is the combined hydrolysis and acid formation stages in which the organic wastes are converted mainly into acetate, and phase II is the methanogenic phase in which methane and carbon dioxide are formed. The better the three stages merge with each other, the shorter the digestion process.

The 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 CH_4/m^3 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/m3

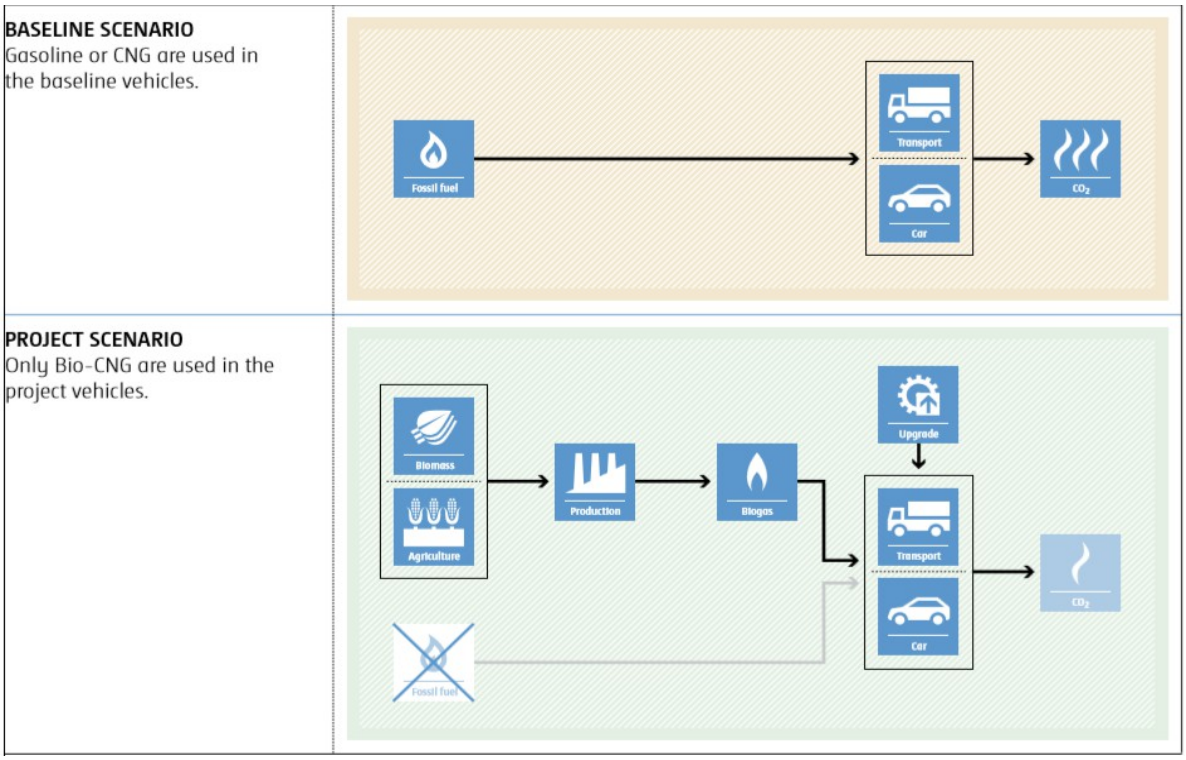
A.5. Parties and project participants >>

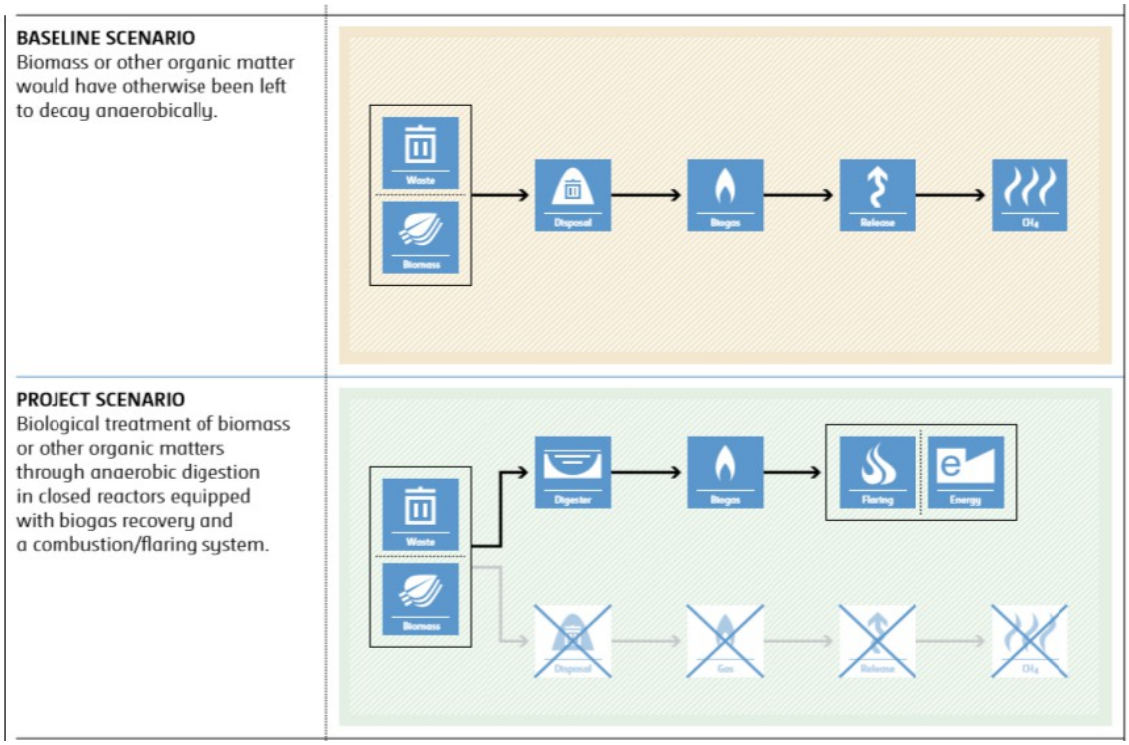
Party (Host)	Participants
India	Project Proponent: AJS Fuels Pvt. Ltd., Savli, Gujarat, India Aggregator: Gram Vikas Trust UCR ID:741215693 Email:gvtbiogas@gmail.com

A.6. Baseline Emissions>>

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

- the amount of Bio-CNG produced and distributed to replace fossil produced fuel,
- where, in the absence of the project activity, biomass is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere.





A.7. Debundling>>

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

SECTION B. Application of methodologies and standardized baselines

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

SECTORAL SCOPE - 07 Transport
13 Waste handling and disposal

TYPE III - OTHER PROJECT ACTIVITIES

Mitigation action: GHG formation avoidance. Methane formation avoidance, Renewable Energy. Displacement of more-GHG-intensive fossil fuel for combustion in vehicles.

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 within the project boundary.

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. A.O: Methane recovery through controlled anaerobic digestion, Version 1.0

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.

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

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, 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 project activity comprises measures to avoid the emissions of methane to the atmosphere from poultry litter/cow dung/organic waste within the project boundary. This 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.
No methane recovery and destruction by flaring or combustion for gainful use takes place in the baseline scenario.
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. Co-digestion of multiple sources of biomass substrates, e.g. Fruit and vegetable waste, cattle dung and poultry litter, where those organic matters would otherwise have been treated in an anaerobic treatment system without biogas recovery.

Manure or the streams obtained after treatment are not discharged into natural water resources (e.g. river or estuaries);
The storage time of the organic matter/poultry litter/cow dung, including transportation, does not exceed 45 days before being fed into the anaerobic digester
The activities for production of Biogenic Compressed Natural Gas (Bio-CNG) are from organic matter/cattle dung/poultry litter
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
The annual average temperature of the biogas site is located is higher than 5°C
Residual waste from the digestion is handled aerobically and submitted to local farmers for soil application.
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.

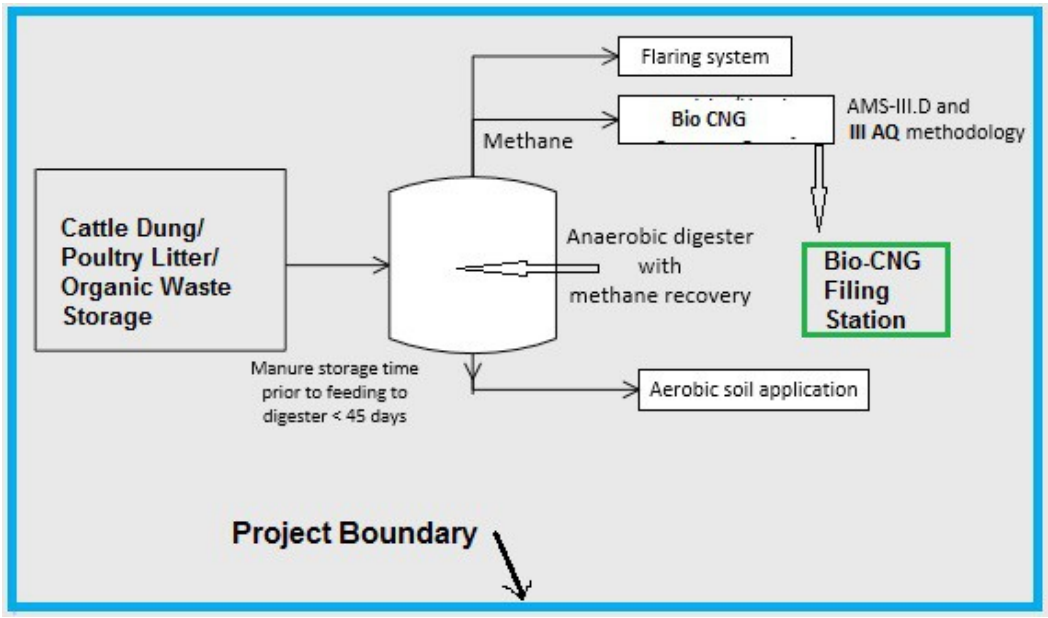
B.3. Applicability of double counting emission reductions >>

The biogas unit is constructed within the project boundary and has a unique ID, which is visible on the biogas unit and log books. The Monitoring Report has the details of the same and the Unique ID. The project activity is not registered under any GHG program since being commissioned.

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

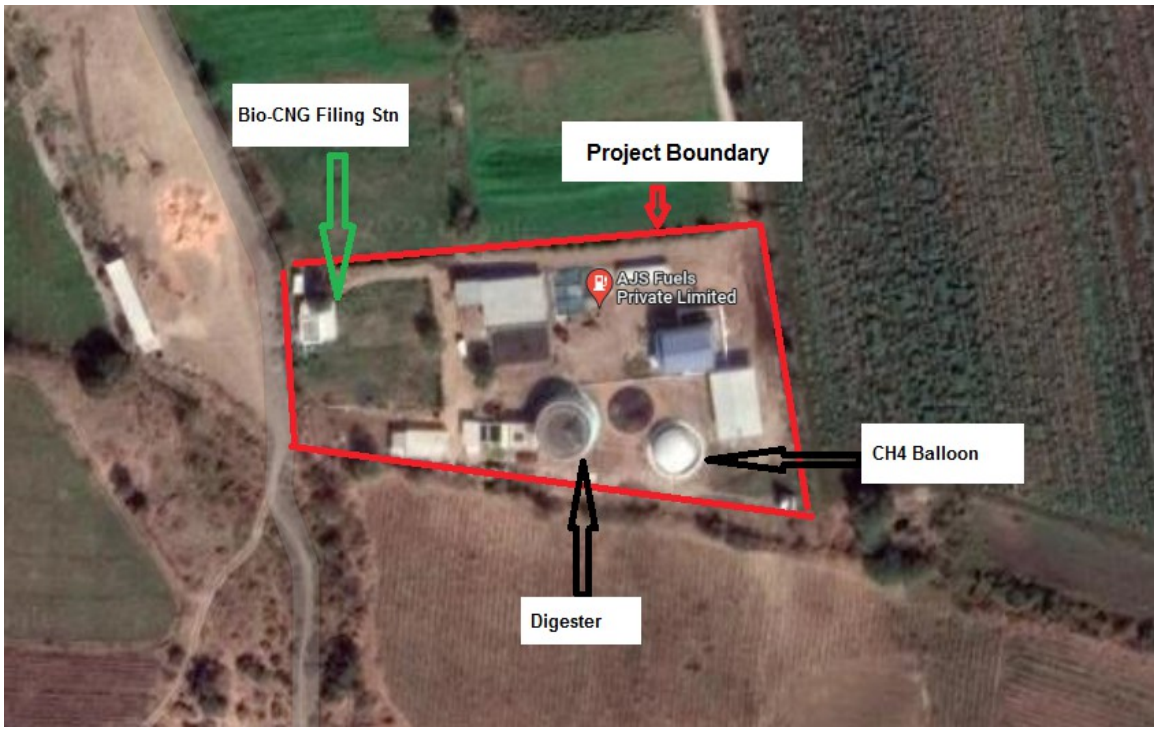
The project boundary includes the physical, geographical site(s) of:

- 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. D 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. Project Leakage of methane emissions due to physical leakages from the digester / recovery system and flaring per year is considered using default values per m3 capacity.



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

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.

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

Project activity emissions consist of:

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

(b) Methane emissions due to flare inefficiency;

PE $_{transport}$ = Nil. Emissions from incremental transportation in the year y (t CO2e), and physical leakage is negligible since the dung/poultry litter/organic waste is generated under 200km from the project boundary and the Bio-CNG filing station is located within the Project Boundary.

PE $_{power,\ y}$ = Nil. The captive power requirements at the project activity site are met by biogas power derived from the biogas digesters. No fossil fuel is used for power generation within the project activity. The biogas based 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 poultry litter before being fed into the anaerobic digester is not accounted since the storage time of the poultry litter after removal from the cages, including transportation, does not exceed 24 hours before being fed into the anaerobic digester.

$PE_{phy,leakage_y}$ = Methane emissions due to physical leakages from the digester and recovery system are considered.

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

Estimated annual baseline emission reductions (BE_y) = 19700 **CoUs/yr (19700 tCO_{2eq}/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 CoU Issuance Period: 8 years, 0 months
Crediting Date: 01/01/2014 to 31/12/2021 (both days inclusive)
Monitoring Period: 01/01/2014 to 31/12/2021 (both days inclusive)

B.8. Monitoring plan>>

Relevant parameters shall be monitored as indicated below.

No.	Parameter	Description	Unit	Monitoring/recording Frequency	Measurement Methods and Procedures
1	Q_y ,	Quantity of cattle dung/ poultry litter/other biomass/ organic waste	tons	Monthly	On-site data sheets recorded monthly using weigh bridge or capacity of vehicles incoming daily. Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier)
2	$w_{CH4,y}$	Methane content in biogas in the year *y*	%	Monthly	As per the relevant procedure in AMS-III.H
4	*T*	Temperature of the biogas	ºC	Daily	As per the relevant procedure in AMS-III.H
5	*P*	Pressure of the biogas	Pa	Daily	As per the relevant procedure in AMS-III.H
6	*FE*	The flare efficiency	%	Daily	As per the "Tool to determine project emissions from flaring gases containing Methane". Regular maintenance shall be carried out to ensure optimal operation of flares

Data/Parameter	N_L
Data unit	Number
Description	Estimated Number of head of poultry birds/cows
Source of data Value(s) applied	Head count of poultry birds/cow, whose waste is used for generating biogas
Measurement methods and procedures	Based on back-calculation of cow/poultry litter requirement of the plant. Poultry average generation data (i.e. 40 g / head / day) Cow average generation data (15kg / head / day.
Monitoring frequency	As and when commissioned and fixed and recorded in the monitoring report
Purpose of data	To estimate baseline emissions

Data/Parameter	Date of commissioning of biogas unit
Data unit	Date.
Description	Actual date of commissioning of the project device
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:	NCV_i
Data unit:	GJ/t
Description:	Methane content in biogas in the year *yNet calorific value of gasoline/blended gasoline that was used by project vehicle k*
Source of data:	Measured according to relevant national/international standards
Measurement procedures (if any):	NA
Monitoring frequency:	At verification and annually during the crediting period
QA/QC procedures:	-
Any comment:	-

Data / Parameter:	$w_{CH4,y}$
Data unit:	%
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:	**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:	$NCV_{Bio\text{-}CNG}$
Data unit:	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:	-Baseline Emissions

Data / Parameter:	$FP_{Bio\text{-}CNG,y}$
Data unit:	t
Description:	Quantity of the Bio-CNG produced by the project activity in the year y
Source of data:	-
Measurement procedures (if any):	Measurements are undertaken using calibrated meters at the outlet of the biogas upgrading section of the Bio-CNG production site
Monitoring frequency:	Continuously
QA/QC procedures:	-
Any comment:	-Baseline Emissions

Data / Parameter:	$FS_{Bio\text{-}CNG,y}$
Data unit:	t
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. Measurements results shall be cross checked with records for sold amount (e.g. invoices/receipts) and with the amount of biogas produced
Measurement procedures (if any):	Continuously or in batches
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-Baseline Emissions

Data / Parameter:	N_y
Data unit:	Number of operational days in a year
Description:	Measured
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:	MCF
Data unit:	%
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):	AMS-III.D provides three options for obtaining the manure production and methane production potential. These include: • Data from nationally published sources; • Estimated from actual feed intake levels, via the enhanced characterisation method (tier 2) • 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:	Annually, based on monthly records
QA/QC procedures:	-
Any comment:	-Baseline emissions are calculated in a conservative manner.