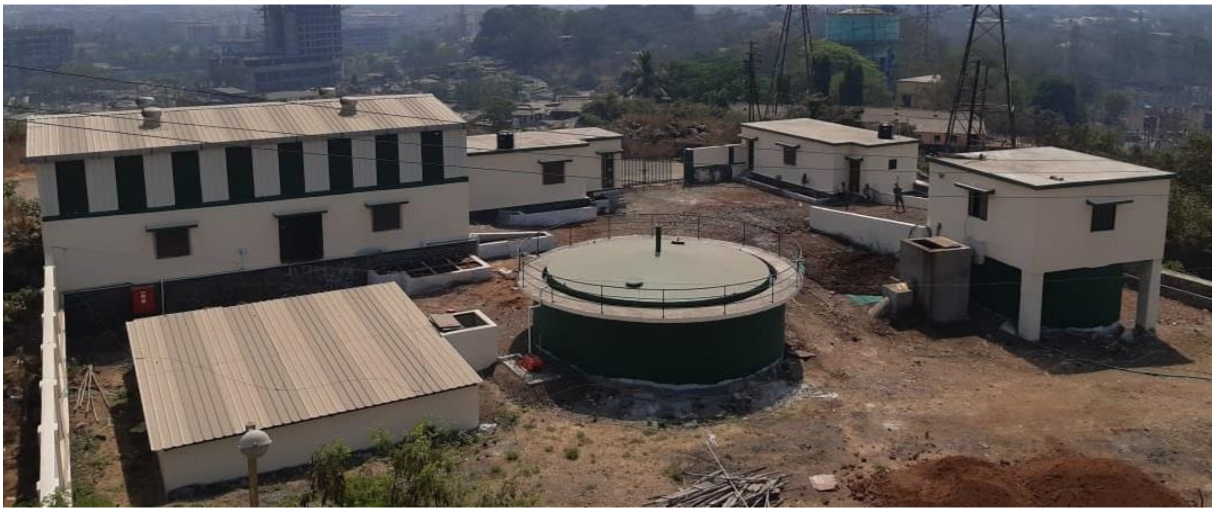
PROJECT CONCEPT NOTE

CARBON OFFSET UNIT (CoU) PROJECT



Title: <u>Food Waste Biogas to Power Project at Kachore, Maharashtra</u>

Version 1.0

PCN Report Date: 04/11/2021

First CoU Issuance Period: 0 years, 8 months

Monitoring Date: **01/03/2021 to 31/10/2021**

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

BASIC INFORMATION	
Title of the project activity	Food Waste Biogas to Power Project at Kachore, Maharashtra
Scale of the project activity	Small Scale
Completion date of the PCN	09/11/2021
Project participants	Aaryan Associates, Vadodara, Gujarat, India.
Host Party	India
Applied methodologies and standardized baselines	Small-scale Methodology AMS-I.C. Thermal energy production with or without electricity UCR Protocol Standard Baseline AMS-III.AO Methane recovery through controlled anaerobic digestion
Sectoral scopes	01 Energy industries (Renewable/NonRenewable Sources) 13 Waste handling and disposal
Estimated total GHG emission reductions over the crediting period	21172 CoUs (21172 tCO_{2eq})

SECTION A. Description of project activity

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

The project **Food Waste Biogas to Power Project at Kachore, Maharashtra** is located in Village: Kachore, District: Thane, City: Kalyan, State: Maharashtra, Country: India.

The details of the registered project are as follows:

Purpose of the project activity:

The **Food Waste Biogas to Power Project at Kachore, Maharashtra** is located in Village: Kachore, State: Maharashtra, Country: India. The project activity was commissioned on 23/02/2021. The purpose of the project activity is the set up of a 10 tonne per day (TPD) Bio-Methanation plant that produces biogas derived power, which is used for captive consumption and powering street lights in the vicinity, using food waste collected from nearby households and hotels.

The biomethanation plant cosists of one (1) biogas digester of 700 m^3 capacity, which treats the food waste and sends the scrubbed biogas to storage biogas baloons. By using the biogas captured from the digesters the project activity generates power for captive power and local street light supply. 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 flaring system.

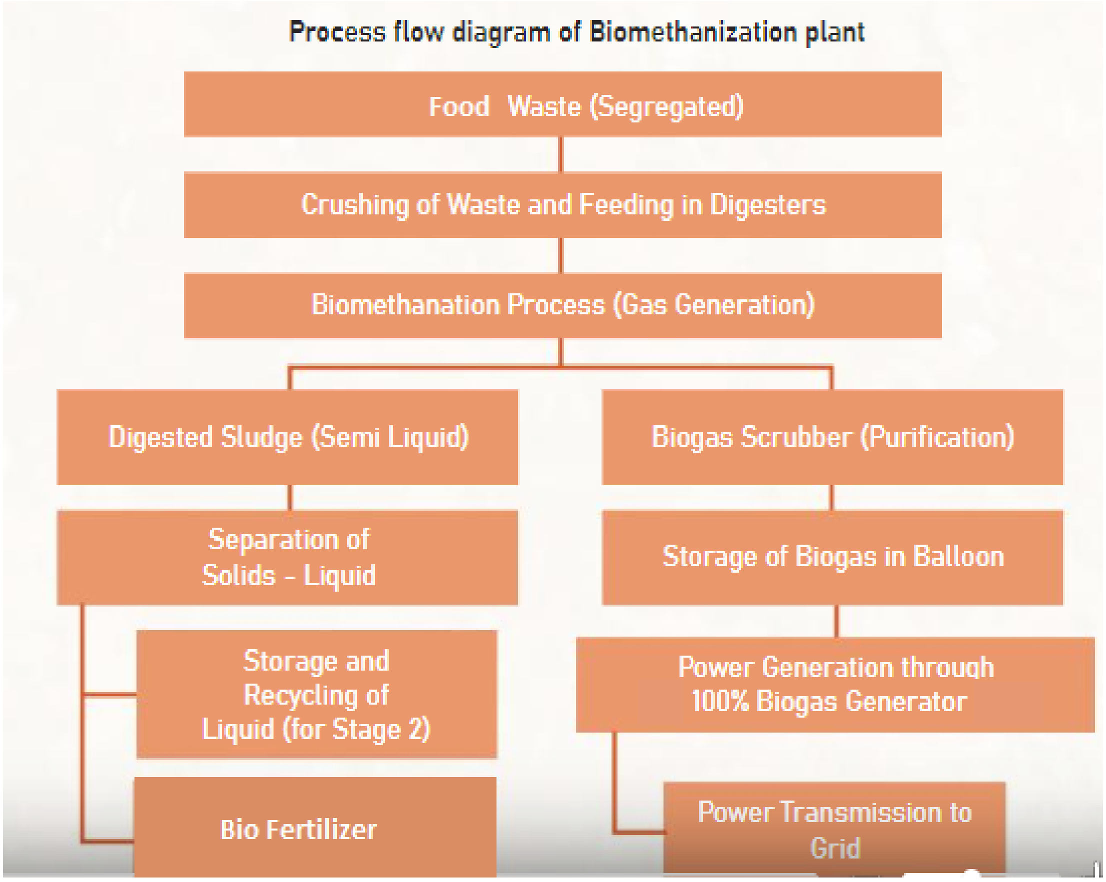
Hence the project activity avoids CH_4 (methane) emissions from being emitted due to the decay of the degradable organic carbon in the biomass and other organic matter. The project activity also involves gainful use of the captured CH_4 for the displacement of electricity for captive use that would be imported from the grid powered by more-GHG-intensive means and thus also avoids CO_2 emissions from being released into the atmosphere.

The KDMC dumping ground, which is now closed

As per the civic body, Kalyan–Dombivli Municipal Corporation (KDMC), around 35 tons of wastes are generated from hotels in the city. In the entire municipality area, 550 to 650 tonnes of waste is collected daily.

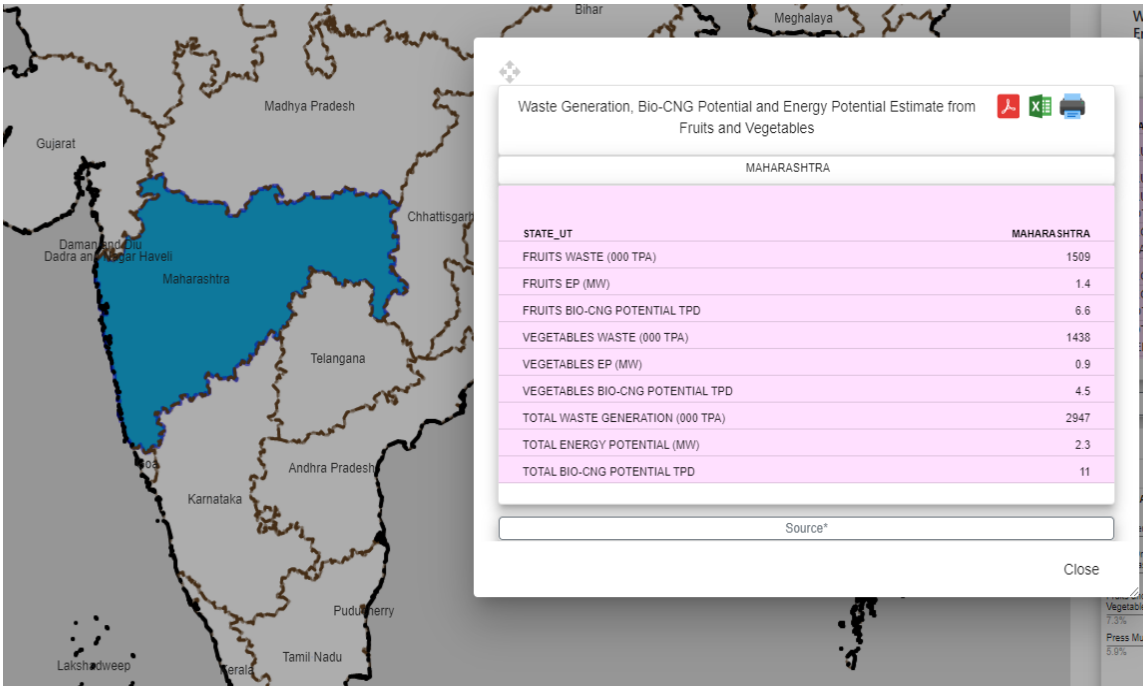
About 18 lakh people live in the KDMC area, spread over an a spread over an area of 116 sq km. Earlier, the waste was dumped at the Adharwadi landfill/ground and the people had to bear the stink emanating from the landfill. Apart from that, frequent fires due to uncontrolled methane emissions from organic waste at the Adharwadi dumping ground also caused smoke in the area and further degraded the environment and made residents sick with respiratory problems, skin and eye irritation. The waste is now sent to several processing plants located in the KDMC area, and the project activity is one of such plants.



The plant is processing the bio-degradable waste of the city to generate electricity and compost and is currently processing 10 TPD of food waste.

This plant is helping in the solid waste management of the city and is also a step towards reducing the burden on non-renewable resources by producing electricity. The waste sludge is dried and is then converted to organic fertilizer that is sold locally at reduced rates by the project proponents. The sludge leachate is then recycled back into the biomethanation system.

Today, an estimated one-third of all the food produced in the world goes to waste. That's equal to about 1.3 billion tons of fruits, vegetables, meat, dairy, seafood, and grains that either never leave the farm, get lost or spoiled during distribution, or are thrown away in hotels, grocery stores, restaurants, schools, or home kitchens. It could be enough calories to feed every undernourished person on the planet. When organic waste such as fruits and vegetables in the project activity goes to waste, we also waste all the energy and water it takes to grow, harvest, transport, and package it. And when such biomass goes to the landfill and rots, it produces methane—a greenhouse gas even more potent than carbon dioxide. About 6%-8% of all human-caused greenhouse gas emissions could be reduced if we stop wasting food and such organic waste. Decomposing organic material in anaerobic conditions — by microbes in the absence of oxygen — releases methane into the atmosphere. Anaerobic fermentation is common in landfill and open stockpiles such as manure piles. Global emissions from waste have almost doubled since 1970 and now produce 3% of anthropogenic (human origin) emissions (IPCC 2014). About half of these emissions come from the anaerobic fermentation of solid waste disposal on land.



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:

- The project contributes in improving the environmental condition in the region of by hygienic treatment of agricultural waste resulting in improvement of health standard in the city.

- The project provides employment opportunity to the locals who collect waste from surroundign agricultural markets in the city and ensure that only organic waste is treated.
- The project provides both direct and indirect employment opportunity to the people of the region.
- 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
- Around 4 lakh people from the city of Kalyan, living in the vicinity of the former landfill site now have access to clean air from the closure of the former landfill site that used to be the dumping ground for such food wastes in the past.

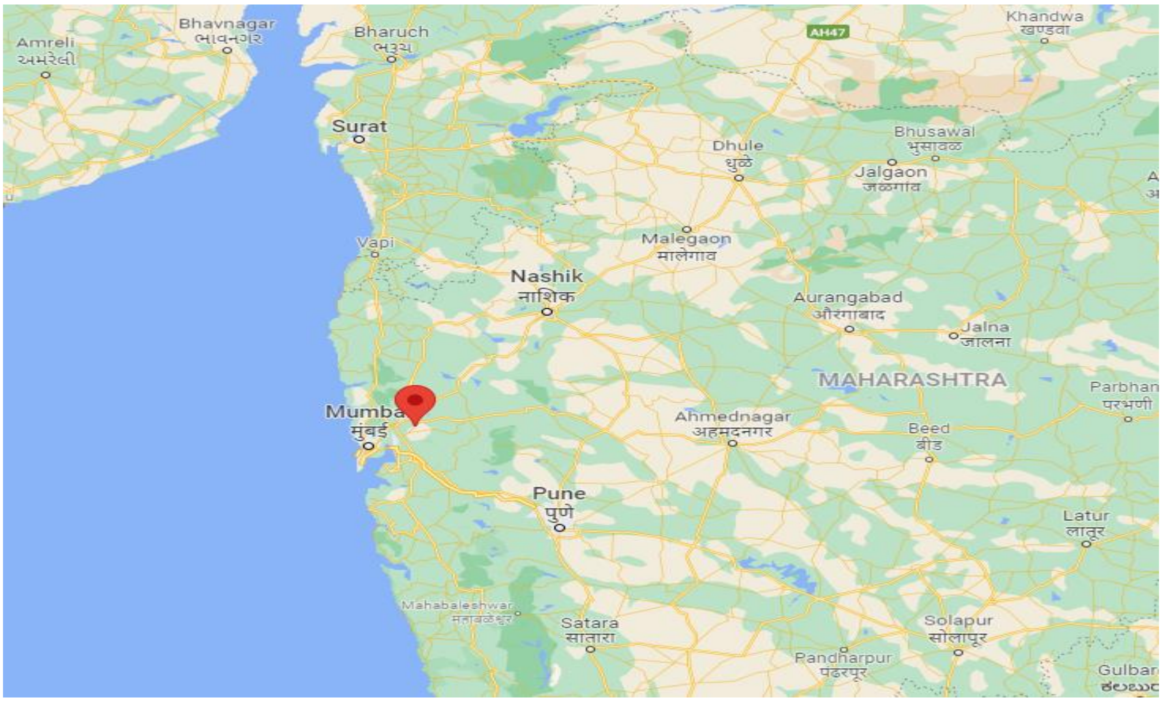
Environmental benefits:

- Curbs methane emission as well as any leachate that would otherwise have been generated from the current practice of unscientific waste disposal.
- The land requirement used for a disposal site is removed as also is the area for dumping of equivalent amount of waste. This indirectly enables region towards a better way of land utilisation, like construction of housing, hospital etc.
- Further, by generating electricity through utilising the biogas, the project helps in replacing fossil fuel intensive power generation to the local grid.
- Avoids local environmental air pollution through better waste management
- Leads to soil improvement by providing high quality manure.
- 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.
- Liquid leachate is recycled back into the biomethanation system, thus reducing the requirement of water and conserving natural resources.

- **Economic and Technological benefits:**
- Provides employment to local communities through construction and maintenance of biogas units.
- The project is among the few the region than captures biogas and uses the same for the generation of electricity for captive use.
- Food waste is transformed into high-quality enriched bio-manure/fertilizer which is supplied at a lower cost than would normally be available at the retail marketplace, thus providing better soil enrichment for local gardens and parks.
- The revenue from carbon credits will showcase such efforts undertaken to make the waste disposal environmentally sustainable by making them responsive toward the recycling of waste and maintaining the energy of ecosystem of city.

A.3. Location of project activity >>

Country: India.
District: Thane
Village: Kachore
City: Kalyan
State: Maharashtra

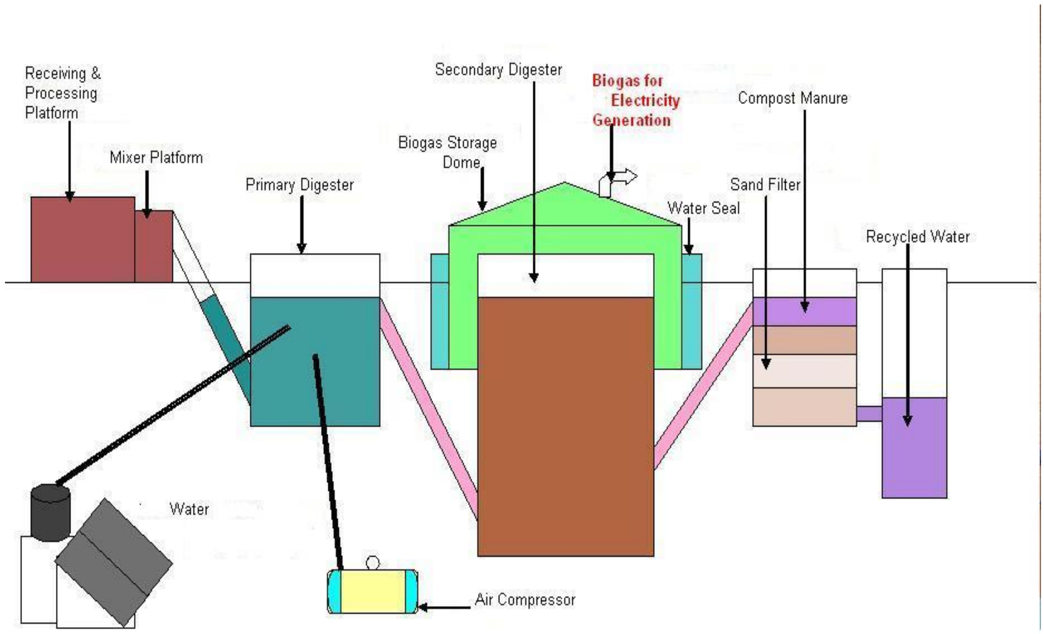


A.4. Technologies/measures >>

The technology is based on the NISARGRUNA Biogas plant process.

The NISARGRUNA biogas is a large scale biogas plant which is able to process biodegradable food waste such from household and restaurant/hotel kitchens in the vicinity. It offers zero garbage and effluent and provides high quality manure and methane gas. Weed-free manure obtained from such waste has high nitrogen contents and acts as an excellent soil conditioner.

This technology of biphasic bio-methanation has high potential of solving the solid waste management problems of the urban areas and provides organic manure and bio-gas as a fuel.



Biogas is a mixture of methane and carbon dioxide. It also has traces of hydrogen sulphide (3%), ammonia, oxygen, hydrogen, water vapour etc., depending upon feed materials and other conditions. Biogas is generated by fermentation of cellulose rich organic matter under anaerobic conditions. In anaerobic conditions, the methane-producing bacteria become more active. Thus, the gas produced becomes rich in methane. The optimum utilization depends upon the successful physical installations, which in turn depend upon plant design and its selection. The basic conversion principle is that when a non-ligneous biomass is kept in a closed chamber for a few days, it ferments and produces an inflammable gas. The anaerobic digestion consists of three stages: I Hydrolysis; II Acid formation and III Methane fermentation. The processes are carried out by two sets of bacteria namely acid forming bacteria and methane formers. The acidogenic phase I is the combined hydrolysis and acid formation stages in which the organic wastes are converted mainly into acetate, and phase II is the methanogenic phase in which methane and carbon dioxide are formed. The better the three stages merge with each other, the shorter the digestion process.

The technical specifications of the NISARGRUNA model bio-digester are as follows:

Specification	Value
Capacity Digester (Total)	700 m^3
Mixing Proportion	(Water: Waste) 1:1
Number of units (digesters)	1
Feed Material	Food Waste
Biogas Power Engine Capacity	0.03 MWh
Working Days	330
Calorific Value Biogas	20 MJ/m^3

The segregated food waste is brought to the project activity site in bins and containers. It is loaded on a sorting platform and residual plastic, metal; glass and other non-biodegradable items are further segregated. The waste is loaded into a Waste Crusher along with water, which is mounted on the platform. The food waste slurry mixed with hot water is directly charged into the Primary digester of 700 m^3 capacity.

This digester serves mainly as hydrolysis cum acidification tank for the treatment of suspended solids. For breaking slag compressed air is used for agitation of slurry. Compressed air is also supplied to help in increasing aeration since bacteria involved in this tank are aerobic in nature. The tank is designed in such a way that after the system reaches equilibrium in initial 4-5 days, the fresh slurry entering the tank will displace equal amount of digested matter from top into the main digester tank. Main digester tank serves as a methane fermentation tank and BOD reduction takes place here. The treated overflow from this digester is connected to the manure pits. This manure can be supplied to locals in the area or municipal gardens and local gardens in the area.

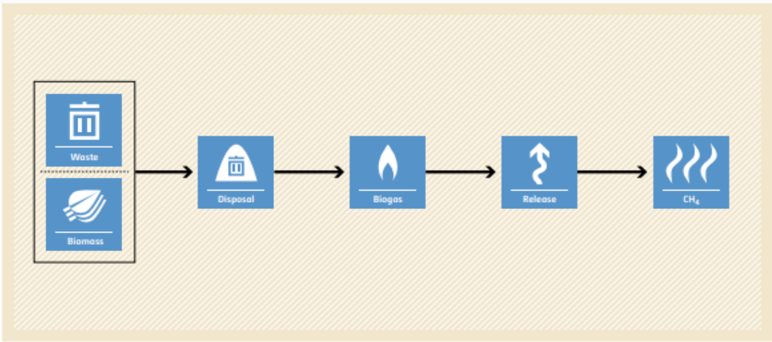
The biogas is collected in a balloon (Gas holder) like structure which collects the biogas, which is produced from the slurry inside the digester as it gets decomposed and rises upward, being lighter than air. The biogas is stored inside storage balloons and is then used for electric power generation purposes.

A.5. Parties and project participants >>

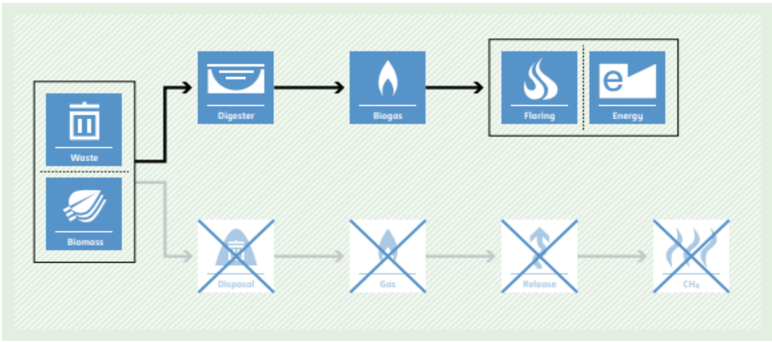
Party (Host)	Participants
India	Aaryan Associates, Vadodara, Gujarat, India.

A.6. Baseline Emissions>>

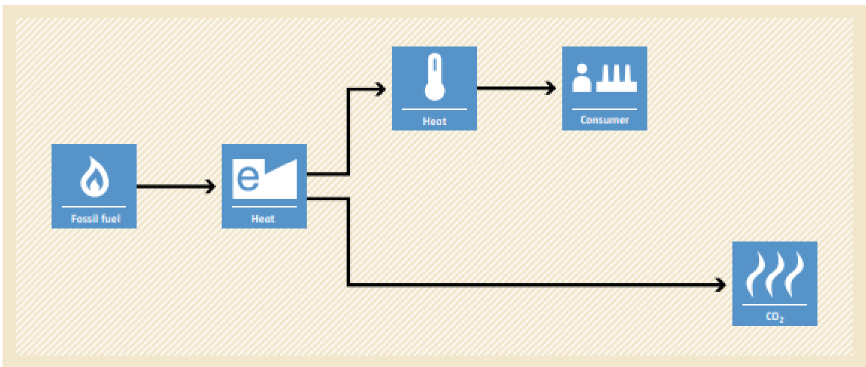
BASELINE SCENARIO
Biomass or other organic matter would have otherwise been left to decay anaerobically.



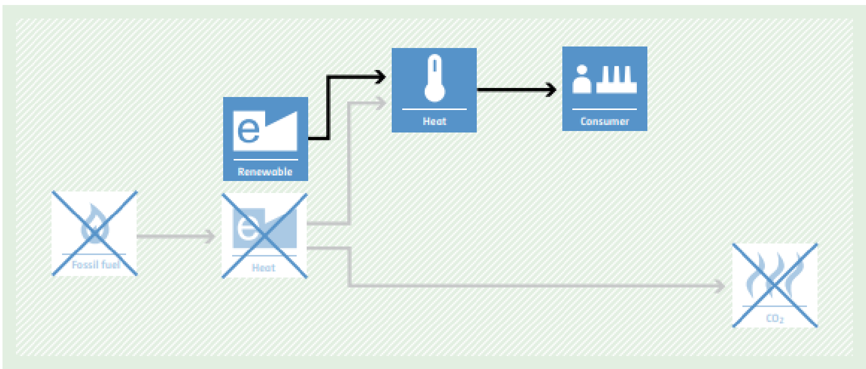
PROJECT SCENARIO
Biological treatment of biomass or other organic matters through anaerobic digestion in closed reactors equipped with biogas recovery and a combustion/flaring system.



BASELINE SCENARIO
Energy generation (thermal heat and / or electricity) by more-carbon-intensive technologies based on fossil fuel. In case of retrofits or capacity addition, operation of existing renewable power units without retrofit and capacity addition.



PROJECT SCENARIO
Energy generation by installation of new renewable energy generation units, by retrofitting or replacement of existing renewable energy generation units as well as by switch from fossil fuel to biomass in modified existing facilities.



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

- the situation where, in the absence of the project activity, biomass and other organic matter (including manure where applicable) 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 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.7. Debundling>>

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

SECTION B. Application of methodologies and standardized baselines

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

SECTORAL SCOPE - 01 Energy industries (Renewable/Non-renewable sources)
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 solar thermal water heaters and dryers, solar cookers, energy derived from renewable biomass and other technologies that provide thermal energy that displaces fossil fuel. Emission reductions for this methodology are allowed from a biomass cogeneration or trigeneration system can accrue from electricity and/or thermal energy production for on-site consumption or for consumption by other facilities.

AMS III.AO. Methane recovery through controlled anaerobic digestion

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), or in an animal waste management system (AWMS), or in a wastewater treatment system (WWTS). 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.

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

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 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. Co-digestion of multiple sources of biomass substrates, e.g. Food waste, where those organic matters would otherwise have been treated in an anaerobic treatment system without biogas recovery.
Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually under AMS III. AO.
The biogas unit is of 700m^3 capacity.
The project activity recovers and utilizes biogas for producing electricity
The total installed electrical energy generation capacity of the project equipment does not exceed 15 MW
The annual average temperature of the biogas site is located is higher than 5°C
All biogas captured from the digester is combusted/flared
Residual waste from the digestion is handled aerobically and submitted to local farmers for soil application.
The storage time of the agricultural waste does not exceed 45 days before being fed into the digesters.
The outflow from the digestion is recycled and reused within the biogas digester.
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.

This is a small scale project with total electricity capacity of 0.03 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.

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. The electricity meter unit is distinct and has its own unique ID. The Monitoring Report has the details of the of all metering units and IDs.

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

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

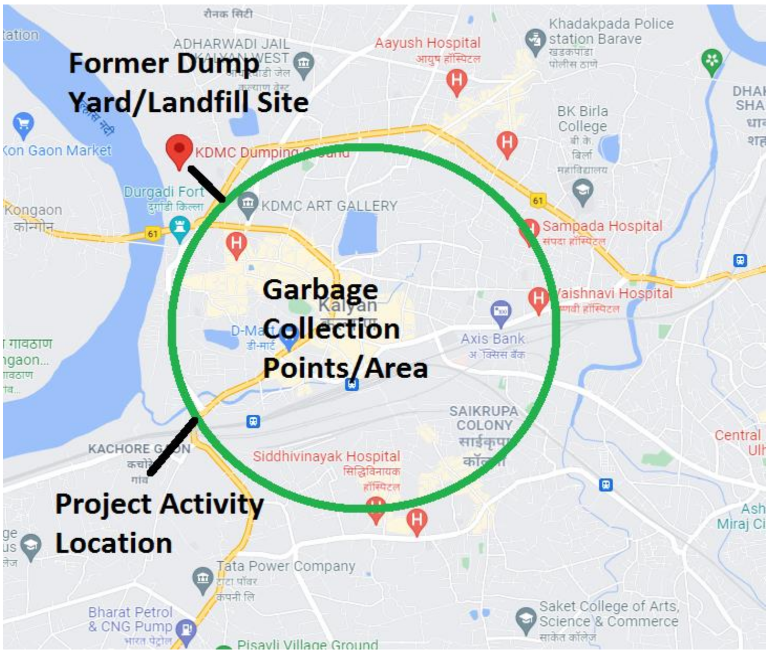
- (a) All plants generating electricity and/or thermal energy located at the project site,
- (b) Industrial, commercial or residential facility, or facilities, consuming energy generated by the system and the processes or equipment affected by the project activity;
- (c) Where the treatment of biomass or other organic matters through anaerobic digestion takes place;
- (d) 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

	Source	GHG	Included?	Justification/Explanation
Baseline	Emissions from biomass decay Emissions from electricity generated using fossil fuels	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	CO2 Emissions from on-site electricity use CO2 Emissions due to transport of waste CH4 Emissions from anaerobic digester CH4 Emissions from flaring of the biogas	CO_2	Excluded	Electricity is generated from collected biogas and supplied to the grid, hence these emissions are not accounted for. CO2 emissions from the decomposition of organic waste are not accounted. All collection vehicles are e-vehicles, hence they are powered from the power generated from the biogas unit at the 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

Project Emissions:

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

PE $_{transport,y}$ = Emissions from incremental transportation in the year y (tCO2e) = Nil
Project activity emissions on account for the transport of the food waste into the project activity boundary is neglected since the incremental distances between the collection points of food waste and the project site, as compared to the baseline solid waste disposal site is the same.



PE $_{phy,leakagey}$ = Methane emissions due to physical leakages from the digester and recovery system shall be estimated using a default factor of 0.05 m^3 biogas leaked/m^3 biogas produced.

PE$_{flare,y}$ = Emissions from flaring of the biogas stream in the year y (tCO2e)

Leakage:
For Type III activities, the project technology is not the equipment transferred from another activity, hence leakage effects are not considered (**LE**$_y$)

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

The baseline scenario is 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. 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.”

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. 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: $BE_y = BE_{y1} + BE_{grid} - PE_{phy,leakagey} - PE_{flare,y}$

BE_y = Total Baseline Emissions in a year.

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

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)

$BE_{y1} = BE_{swds,y} + BE_{manure,y} + BE_{WW,y} – MD_{reg,,y} \times GWP_{CH4}$

BE_{y1}	=	Baseline emissions from biomass and other organic matter left to decay within the project boundary and methane is emitted to the atmosphere
$BE_{swds,y}$	=	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.
$BE_{manure,y}$	=	Baseline emissions from the manure co-digested by the project activities = 0
$BE_{WW,y}$	=	Baseline emissions from the wastewater co-digested = 0
$MD_{reg,,y}$	=	Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations (tonne) = 0
GWP_{CH4}	=	21 is the default IPCC value of CH_4 applicable to the crediting period (tCO_{2e}/t CH_4)

Estimated total emission reductions (*ER*) = 21172CoUs (21172 tCO_{2eq})

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.
Monitoring Start Date: 01/03/2021 to 31/10/2021
Crediting Period: 01/01/2021-31/10/2021
Project Commissioning Date: 23/02/2021

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: 0 years, 8 months
Monitoring Date: 01/03/2021 to 31/10/2021

B.8. Monitoring plan>>

Data / Parameter:	Q_{waste}
Data unit:	tons
Description:	Quantity of food waste
Source of data:	Measured
Measurement procedures (if any):	On-site data sheets recorded monthly using weigh bridge
Monitoring frequency:	Monthly-
QA/QC procedures:	Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier)
Any comment:	To estimate baseline emissions-

Data / Parameter:	$\mathbf{N_y}$
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:	-

Data / Parameter:	$EG_{grid,y}$
Data unit:	MWh
Description:	Quantity of electricity generated
Source of data	Plant 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	-
Measurement procedures (if any):	As described in UCR Standard
Monitoring frequency:	Annual
QA/QC procedure	-

Any comment:	The parameter need to be monitored for project activities which displaces grid electricity

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