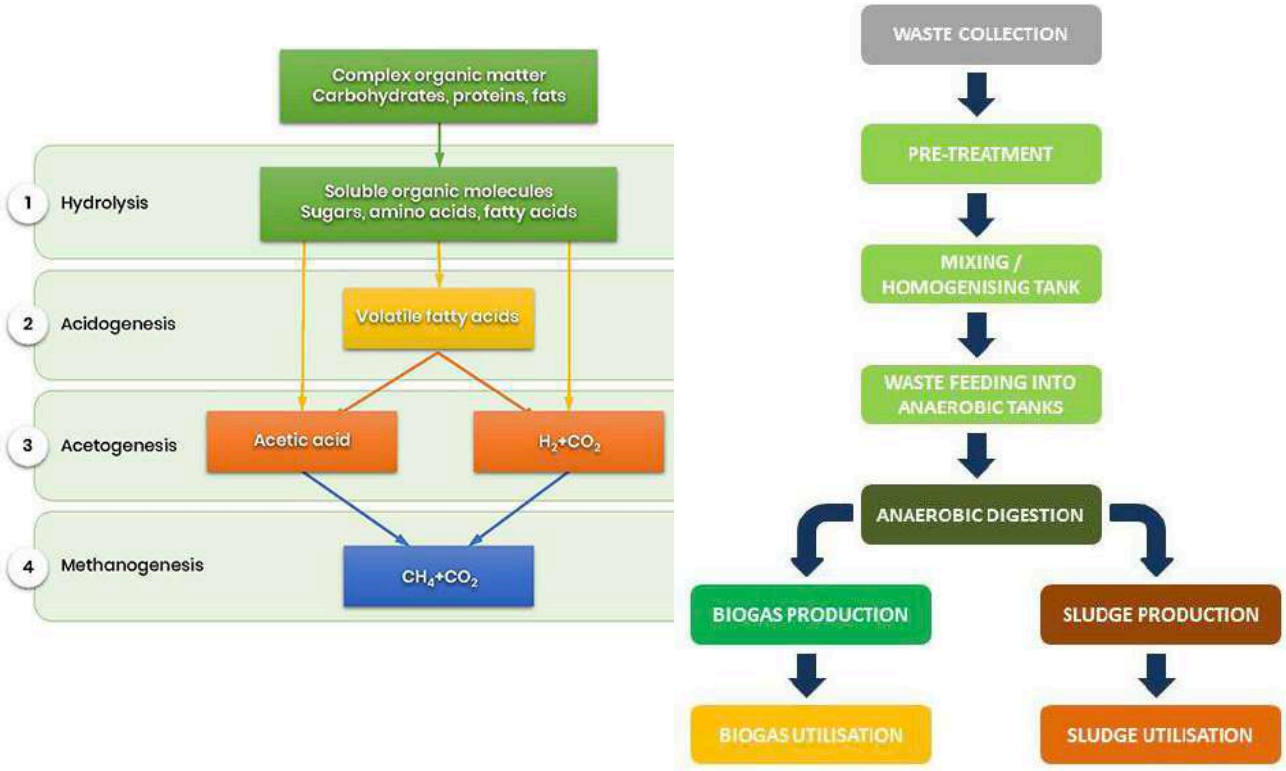
BioCNG Proposal

MEDIGREEN ENERGY	Proposal submitted to	Bengal Gas Company Ltd.
	Proposal submitted by	Medigreen Energy Pvt. Ltd.
	Date	Thursday, 18 July 2024
	Ref	ME/CBG/OFF/BGCL- 01

Introduction

Bio-CNG (Bio-Compressed Natural Gas) is purified and upgraded Biogas that is made up of not less than 94% CH4 with the remaining being CO2 and trace gases. Bio-CNG is similar to fossil based CNG (compressed natural gas) in terms of composition and properties. Like regular CNG, Bio-CNG has a high-octane number which results in the high thermal efficiency. CNG is produced by compressing natural gas under high pressure. Bio-CNG is a carbon-neutral and Sulphur-free renewable energy product. It is classified as a green renewable fuel.



AD process involves the following 4 steps

Hydrolysis—Complex organics are broken down into simple organics. Specifically, hydrolytic microorganisms break down complex organic compounds such as proteins, carbohydrates, and fats.

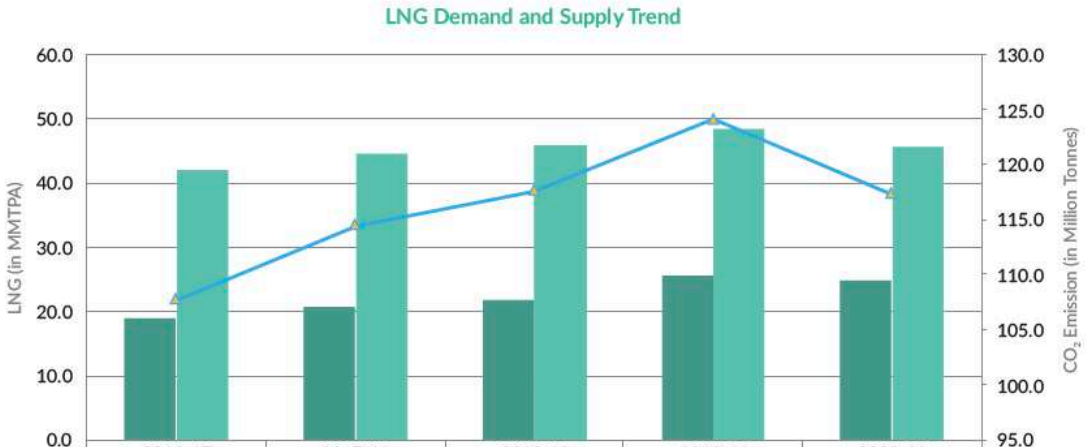
Acidogenesis—Acidogenic microorganisms ferment the simple organics into short-chain fatty acids (also called volatile fatty acids [VFAs]), CO2, and hydrogen gases.

Acetogenesis—Acetogenic microorganisms convert the mixture of short-chain fatty acids to acetic acid, with the release of more CO2 and hydrogen gases.

Methanogenesis—CH4-producing microorganisms called methanogens convert acetic acid and hydrogen to biogas. The biogas is a mixture of CH4, CO2, other compounds of lesser proportion such as H2S, and numerous trace elements. There are two classes of methanogens: one class primarily converts the acetic acid to CH4, while the other class combines the hydrogen and CO2 into CH4; some unique methanogens can do both.

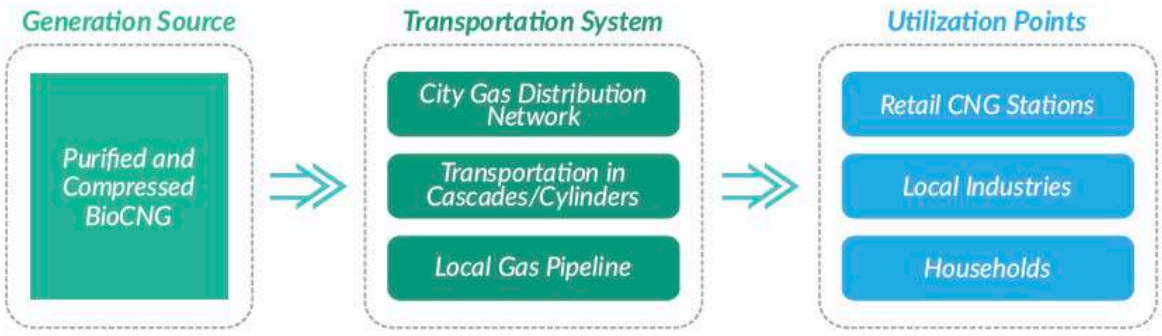
Growth of BioCNG in India

Figure 1: Demand and supply trend of LNG and estimated CO_2 emission from it



	2016-17	2017-18	2018-19	2019-20	2020-21
Import	18.8	20.7	21.7	25.6	24.8
Total Consumption	42.0	44.7	45.9	48.4	45.8
CO_2 Emission	107.8	114.5	117.6	124.1	117.3

Figure 14: Broad overview of the Supply Chain Logistics for BioCNG in India



BioCNG has the potential to reduce net carbon emissions, replace CNG and LPG in domestic, commercial and industrial applications. This in turn will save foreign exchange due to less dependence on import of petroleum products. BioCNG can be produced from various feedstocks including agricultural residue, MSW, sugarcane press mud, distillery spent wash, cattle dung, and STP waste. It is estimated that approximately 62 million tonnes (MT) of BioCNG can be created in India from various sources that can include bio-manure generation capacity of ~206 MT[8]. In order to realize this potential and meet national targets, global commitments, energy security and environment sustainability, GOI had launched the SATAT Scheme.

Bio CNG Fuel Benefits

CHEAPER, CLEANER FUEL WITH GREAT ENGINE PERFORMANCE

The BioCNG system offers a simple and effective technology for producing CNG vehicle fuel at a fraction of the cost of gasoline or diesel while getting similar or better engine performance. The environmental benefits that come along with this clean fuel production process are a great bonus, along with positive community relations that arise from the projects.

Consider these benefits of BioCNG vehicle fuel:

- Cheaper in cost compared to gasoline and diesel
- Qualifies for federal Renewable Fuel Credits(RINs)
- Meets or exceeds CNG fuel specifications SAE J1616
- Complies with engine manufacturers warrantees
- Vehicle performance is similar to that of gasoline, diesel and NG fuels
- The “greenest” fuel, resulting in significant carbon footprint reduction

Replacing petroleum – a national priority

Making India less dependent on foreign oil is a national priority. The Indian Government established aggressive goals of reducing dependence on foreign oil by increasing the availability and use of domestic resources, in particular natural gas. Investing in the research and development of natural gas as a vehicle fuel is part of this ambitious plan.

Reducing emissions – far lower than gasoline and diesel

Exhaust emissions from natural gas vehicles (NGVs) are much lower than those from gasoline and diesel vehicles.

Replacing a typical older vehicle with a new NGV vehicle reduces exhaust emissions:

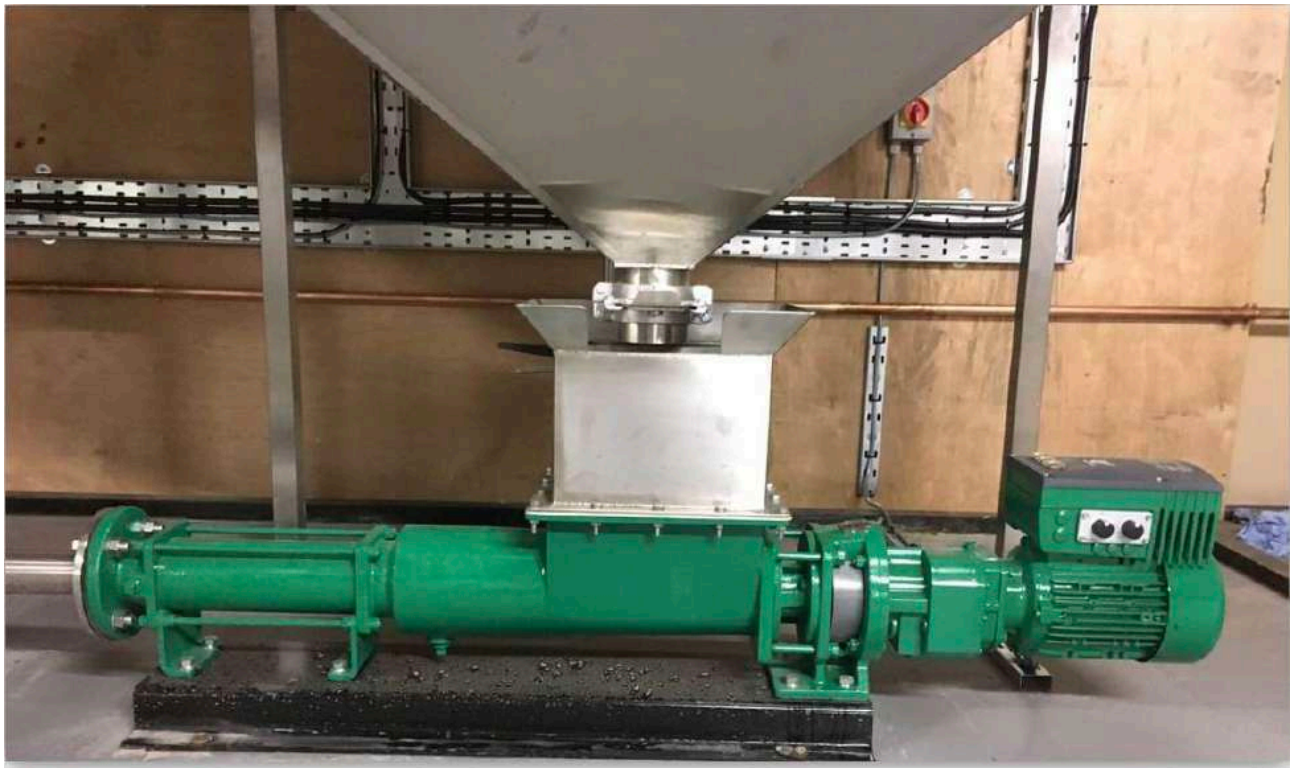
- Carbon monoxide (CO) reduced by 70-90 percent
- Non-methane organic gas (NMOG) reduced by 50-75 percent
- Nitrogen oxides (NOx) reduced by 75-95 percent
- Carbon dioxide (CO2) reduced by 20-30 percent

Shredding

KB terminator is a super power shredder to crush the organic waste to small pieces which facilitates easy digestion win the digester. Comes with a robust material with long life span.

BIO CRUSHER MACHINE.
CAPACITY : 10000KG/HOUR.
STATOR SHELL ID WEAR RESISTANCE MANGANESE LINERS.
ROTOR BLADES CUM STATOR BLADES
75KW MOTOR/PULLEY/BELT/BEARING MAKE NTN.
ROTOR MAIN SHAFT/HYDRAULIC POWER PACK/HYD CYLINDERS,
ELECTRICAL PANEL,MOTOR WITH VFD DRIVE.
SS PERFORATED SHEET AT SHELL BOTTOM SURFACE.
LOADING SIDE INSIDE HYDRAULIC OPERATED ACCESS DOOR
INLET/OUT LET CHUTE/FASTENERS/PLATFORM WITH LADDERS
ROTARY BLADES AND HAMMER BLADES
ASSEMBLY/TESTING/PAINTING
SCREW CONVEYOR (INPUT CONVEYOR)
4MTR LONG
5HP GEAR MOTOR.
CAPACITY : 10000kg /HOUR,
OUT PUT SCREW CONVEYOR
2.5MTR LONG
3HP GEAR MOTOR.
CAPACITY : 10000kg /Hr,

Bio-mix feed pump



They have many advantages:
• Extremely reliable thanks to an intelligent and very robust construction including a cordan drive
• Simple maintenance, easy to dismantle and has many access windows for easy cleaning.
• Numerous variants available. The wide neck inlet allows the dry material to flow by gravity over the coupling rod which pushes the material towards the stator inlet.

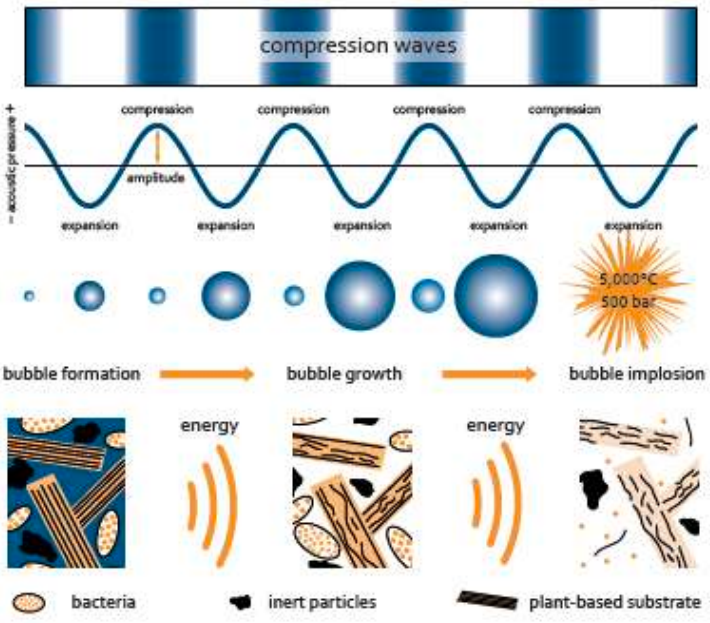
The engineering team especially designed the BioMix pumps to handle extremely difficult products with a very high solids content and non-flowing properties

Cavitation

What is necessary in order to be able to disintegrate substrates?

To disintegrate biomass by ultrasound, a hard cavitation is required. This can only be achieved by the use of rod oscillating units, which work at high amplitudes (approx. 20 µm). The cavitation bubbles generated implode at large diameters, thereby creating high shear forces.

Competing ultrasound technologies based on flat oscillators work at max. 2 µm and trigger only soft cavitation. The bubbles are much smaller and the energy released during the implosion is not sufficient to disintegrate cells. This inexpensive technology is therefore only used for cleaning (e.g. in the ultrasonic bath). The flat oscillators are often only glued to the pipe wall from the outside so that the pipe cavitates. Thus, a considerable amount of energy is lost when the cavitation bubbles are generated.



Disintegration of biomass in biogas plants

"Of all plant technologies for disintegration with ultrasound available on the market, only the high-power ultrasound systems of Ultrawaves are able to generate a hard cavitation. Only through hard cavitation biomass agglomerates are disintegrated and an intensification of the fermentation achieved".

Measurements show: Our rod transducers are approx. 10 times more efficient and are immersed directly in the medium. Thus, all power released also goes into the treated suspension, and a true cell disintegration is achieved.

What is disintegration by hard cavitation?

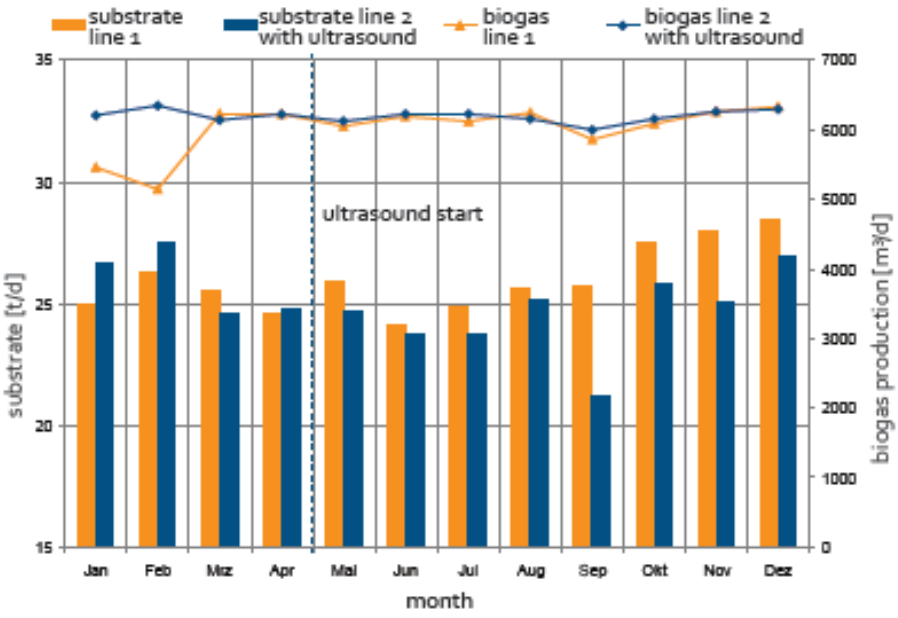
Ultrasound is sound beyond acoustic sound (i.e. from 20 kHz to themegahertz range). In aqueous media, ultrasound waves cause periodic compression (pressure) and expansion (tension, negative pressure)of the medium treated with ultrasound. In the negative pressure range, high-intensity ultrasound leads to expansion of the aqueous phase, which leads to the formation of microscopic voids in the liquid.

These bubbles fill with steam or gas. They grow in tension phases and shrink in pressure phases until they implode. This event is referred to as cavitation, a process under extreme (adiabatic) conditions. In the frequency range from 20–100 kHz particularly large cavitation bubbles are generated; these cause extreme mechanical shear forces during collapse. This results in pressures of 500 bar and a temperature of 5,000 °C on a micro-scale. These ultrasonic forces are capable of destroying any surface, no matter how robust it is.

How does this affect biomass?

By treating a biomass suspension with high-power ultrasound, organic material and enzymes are brought into solution. The substrate is thus more bio-available for active micro-organisms and can be better utilized in the bio-degradation process. This intensification results in a greater biogas yield with the same amount of input materials or less input materials are required for the same output.

- Intensiication of fermentation



The quantity of substrate added daily and biogas production in lines 1 and 2 of Bordesholm-erland biogas plant. The ultrasound system is installed in line 2.

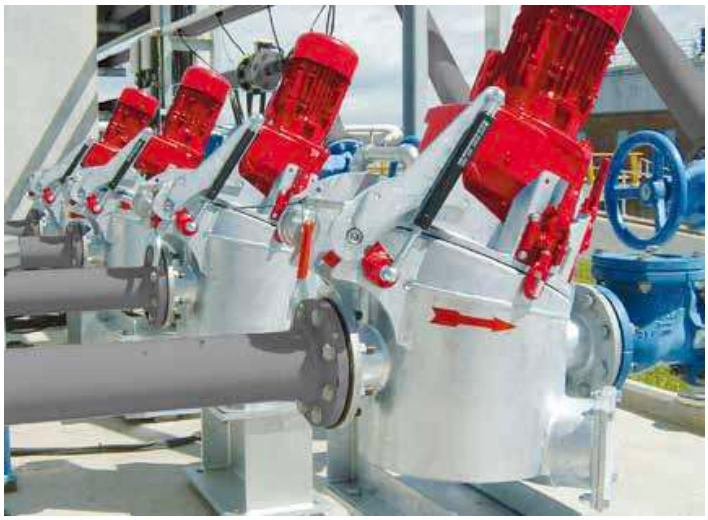
Intensification of the fermentation through Ultrasound

Ultrasound intensiies fermentation on biogas plants. The fermenting micro-organisms produce the enzymes (exo-enzymes) necessary for degradation of the organic substrate. When our high-power ultrasound equipment is used, even a small energy input results in enhanced release of these enzymes so that the activity of the micro-organisms is stimulated. Sonication also causes an increase in the interface between the liquid and solid phase (particles and locs disintegrate), which facilitates enzymatic attack. Further energy supply also destroys the walls of plant and bacterial cells and therefore results in the release of the dissolved organic cell contents, which are in turn very readily degraded by fermentation. The end effect is an intensified digestion process with further degradation of the organic substrates and increased biogas production. Therefore, by using ultrasound,on the one hand more biogas can be produced from the same biomass feed; on the other hand, it is also possible to reduce the feed quantity with unchanged biogas production. In addition, the quality of the biogas is improved by an increase in its methane content. Due to the difficult to degrade agricultural biomasses used, the methane fraction produced by conventional biogas plants is sometimes less than 50%. In addition, sonication of the volumetric low added reduces the viscosity of the fermenter content and therefore makes it more liquid. This reduces the power consumption of the agitators and pumps.

Significant Advantages

- Increase in biogas production
- Increase in methane content
- Substrate savings
- Viscosity reduction
- Lowering the power consumption for agitators and pumps

Rota-cut Maceration

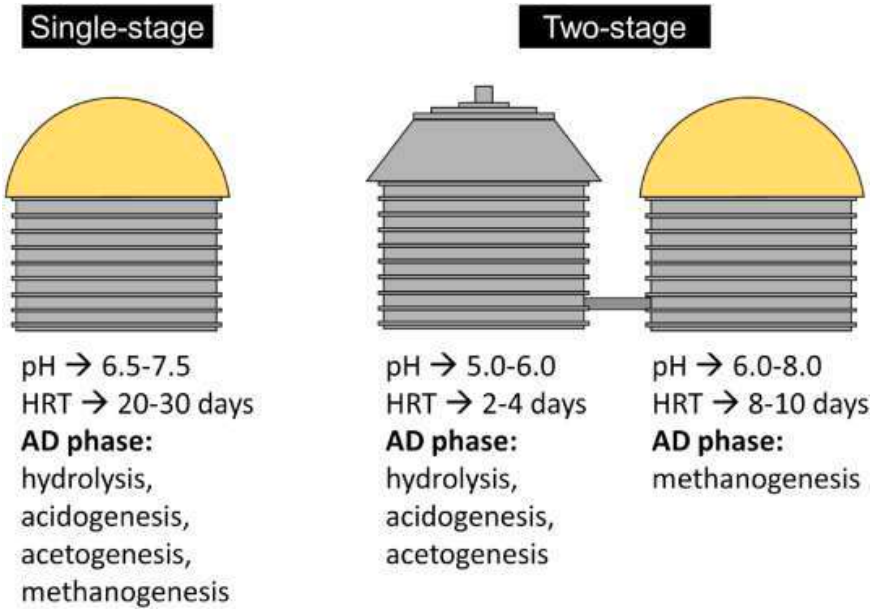


The principle

The RotaCut combines two functions in a single machine.It separates and macerates, which transforms fluids laden with fibers, solid matter and foreign materials into pumpable suspensions. While the medium continually flows through the RotaCut, heavy material such as stones or metal parts are separated out by gravity. They are easily removed later through a cleaning port. All floating and suspended substances within the medium (fibers, hair, bones, wood,entangled material, whole plant silage or grass) are transported to the cutting screen by the liquid flow and macerated by rotating, self-sharpening cutting blades. The medium is homogenized at the same time.

Rotacut enhances digestion in combination with cavitation.

Two Stage Digestion



Advantages

1. Allows selection and Seperation of trophic bacterial groups, providing optimal conditions for their enrichment.
2. Physically segregates the acid forming (acidogenesis) and methanogenic bacteria (methanogenesis)
3. Maximum loading rates and higher degradation of organic matter
4. Increased process stability
5. Higher efficiency compared to the singe stage system

Mixing

Why Mixing Matters:
Mixing plays a pivotal role in the anaerobic digestion process, where microorganisms break down organic waste in the absence of oxygen. Effective mixing fosters substrate homogeneity, ensuring equitable nutrient access for microorganisms and facilitating the breakdown of complex organic matter. Below are key reasons why mixing holds paramount importance in biogas production:

Enhanced Degradation: Mixing facilitates optimal contact between microorganisms and organic waste, resulting in improved biogas yields and shorter retention times. This bolsters the overall efficiency of the anaerobic digestion process.

Prevention of Scum and Stratification: In large-scale biogas plants, improper mixing can lead to the formation of scum and stratification. Scum, consisting of floating solids and fats, obstructs the digestion process and causes system blockages. Mixing prevents scum formation by ensuring organic matter remains in suspension and nutrients are evenly distributed.

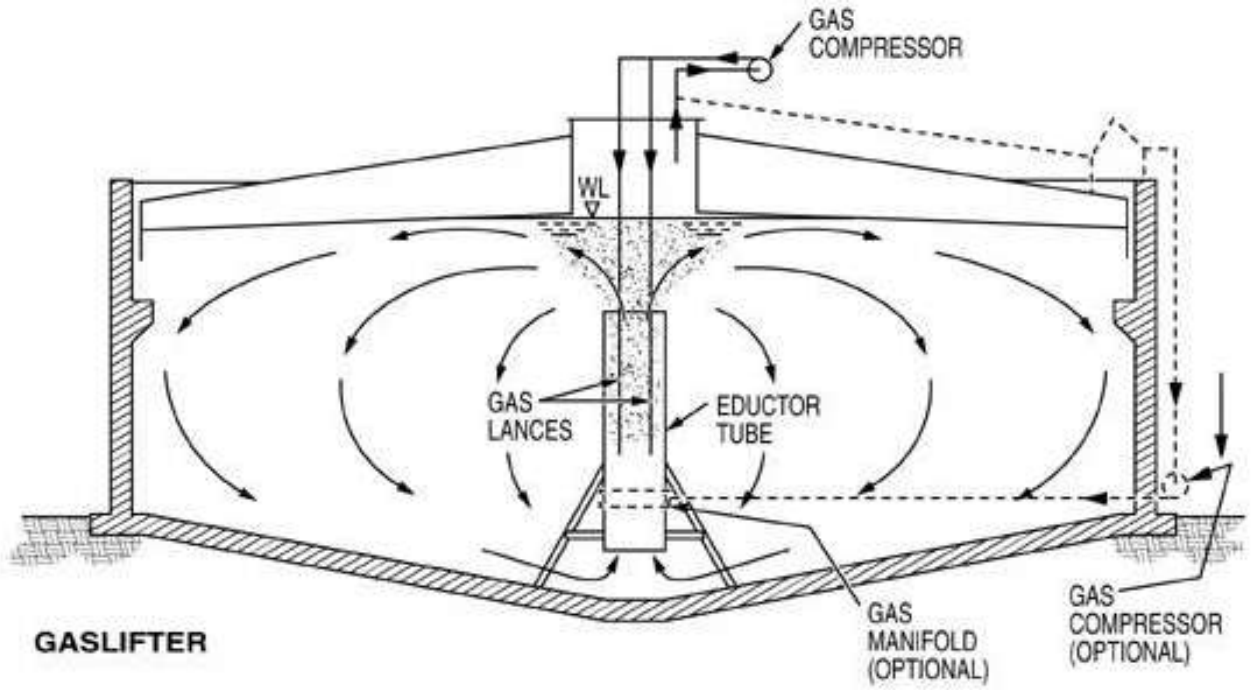
Temperature Control: Proper mixing ensures uniform heat distribution within the digester, thereby maintaining the requisite temperature for optimal microbial activity. By averting temperature fluctuations and hotspots, mixing guarantees stable and reliable biogas production.

Reduction of Dead Zones: Dead zones, characterized by minimal or no mixing, impede biogas production as they harbor non-active zones. Effective mixing eliminates dead zones, maximizing the utilization of the entire digester volume for biogas generation.

Type of mixing	**Power consumed per turnaround per m3, watts**
Propellar mixers	18-20 watts
Recirculation pumps	50 watts
Jet mixing	20-26 watts
Gas lifter	0.45 watts

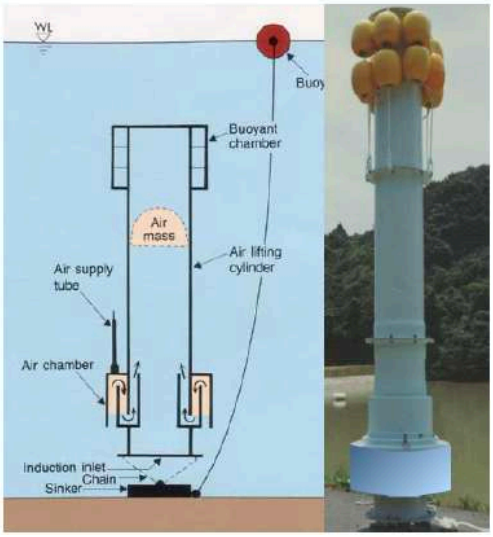
Gas Recirculation: Gas recirculation entails collecting a portion of the produced biogas and reintroducing it into the digester. The rising gas bubbles through the substrate promote mixing, improving contact between microorganisms and organic matter.

Our Unique Gas Lifter



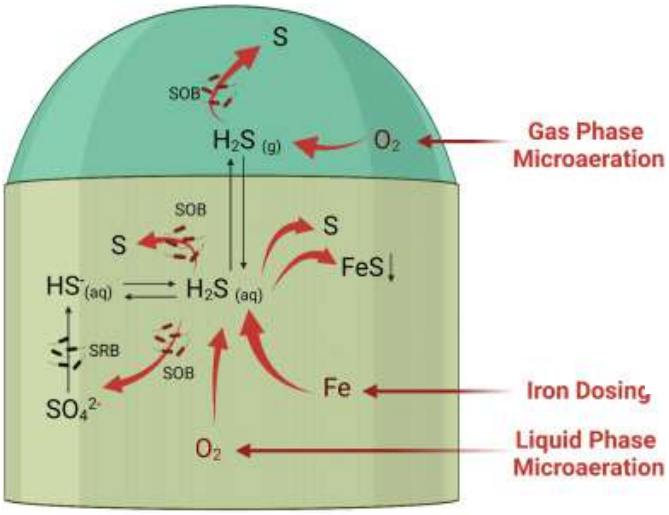
Gas Lifter Mechanism

- **Highly efficient mixing**
- **Japanese know how with**
- **proven track record**
- **Very low power requirement**
- **Life cycle more than 25 years**



Micro aeration for H2S removal

Microaeration, which consists of dosing of a limited amount of air to anaerobic digesters, has emerged as one of the most cost-effective technologies for H2S removal from biogas. The microaerophilic conditions created by air supply support the partial oxidation of H2S to S° by the action of sulfide-oxidizing bacteria. In Europe, several full-scale plants have already implemented this technology to remove H2S from biogas. Indeed, microaeration has been traditionally employed to control H2S in full-scale digesters treating agricultural waste. Interestingly, microaeration does not inhibit organic matter removal nor CH4 productivity. On the contrary, significant enhancements in organic matter hydrolysis and methanogenic activity have been reported, likely due to the suppression of the inhibition caused by sulfide.



SOB: Sulfur Oxidizing Bacteria
SRB: Sulfur Reducing Bacteria

(1) $H_2S + ½\ O_2 \rightarrow S^0 + H_2O$
(2) $H_2S + 2\ O_2 \rightarrow SO_4^{2-} + 2H^+$

- Simple, highly efficient and stable method for H_2S removal from the biogas.
- High H_2S removal efficiency (99%) at high initial H_2S concentration (4,000 mg m^{-3}).

Glass Fused Tank Digester

Glass Coating Process:

The enameling of the steel is a thermical process which happens in the enameling-o about 800 Degrees Celsius. Thereby forming a glass layer on the outside of the steel, this is a very tight bound, due to a chemical/physical process. This glass-like, extremely resistant enamel coating permanently protects the steel surface.

Glass-Fused Steel (Glass-Lined-Steel) is a unique tank finish. Two materials are fused together to achieve the best properties, strength and flexibility of both steel combined with the corrosion resistance of glass. Applied to both interior and exterior surfaces, Glass Fused Steel is able to provide many years of trouble free service in harsh environments.

GFS Tanks Features and Benefits

- A one-of-a-kind and highly sought-after glass formulation created with bespoke ingredients.
- Electrostatic application that is unique in that it is ‘dry.’
- Glass enamel coating technology has reached a new level of excellence.
- Optimal purity is achieved.
- There will be less reliance on on-the-ground solutions.
- Coating coverage has been increased.
- This product meets or exceeds the coating requirements of EN ISO 28765.
- System that is modular in design.
- Confidence in the quality and performance of the coating.
- Construction is completed in a short period of time.
- Quality that is consistent and regulated no matter where the tank is shipped or built.
- Confidence in the quality and performance of the coating.
- Coating with excellent performance.
- There is no requirement for re-coating.
- Corrosion resistance is built in and specified.
- The coating has a long life span and requires little maintenance.
- There is no corrosion allowance required, resulting in the reduction of unnecessary material and cost.
- The ability to be UV stable and abrasion resistant extends the life of the product and reduces the need for through-life maintenance.

Concrete Tank

Advantages – 1. Possible in different shapes and sizes 2. Large volumes of storage possible

Disadvantages – 1. Long construction periods. 2. Need a large number of labors. 3. Design specifications allow for a small level of cracking is expected. 4. Takes more space

Welded Tank

Advantages – 1. Possible in different shapes and sizes 2. Large volumes of storage possible

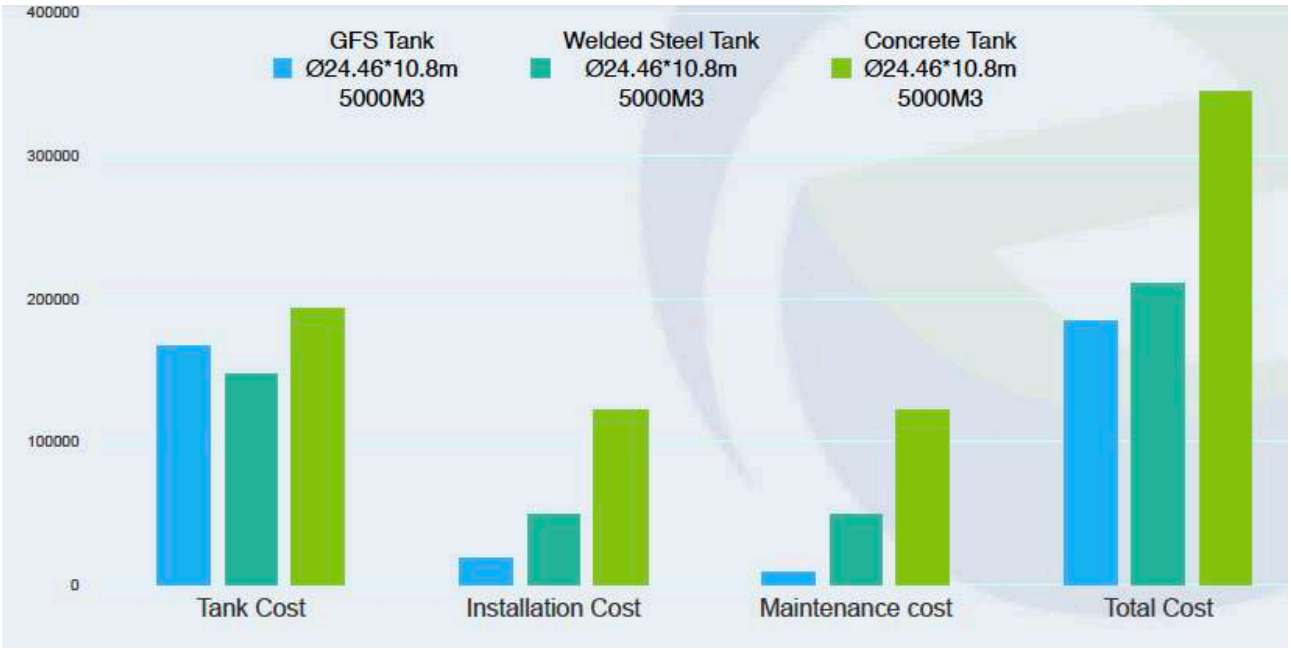
Disadvantages – 1. Long lead and construction times. 2. Limited by external environmental factors. 3. Need a large number of skilled workers 4. Continuous inspection of welding process 5. Poor coating quality

GFS Steel Tank

Advantages – 1. Short construction period – more than 50% quicker. 2. Easy to install. 3. No need for big installation equipment and highly skilled labor. 4. Safer operation as most of the work is done on the ground 5. Not easily affected by weather 6. Cost saving option with embedded concrete base.

Disadvantages – 1. Tank shape is normally cylindrical. 2. Initial training/supervision is required at site

recovery of SCCA



Double membrane gas holder

The mounted double membrane gas holder combines fermentation gas storage into a single unit. The bottom portion consists of a digester tank body, while the upper portion is a 3/4 spherical gas storage structure made of special polyester material, This design greatly conserves ground space.

The outer membrane of the mounted double membrane gas holder is sealed and connected to the tank opening edge of the fermentation tank independently, while the inner membrane is used for storing generated biogas. They are both anchored to the embedded fasteners in the foundation and sealed. The inner membrane stores the produced biogas and releases it as needed under the control of the outer membrane's pressure.

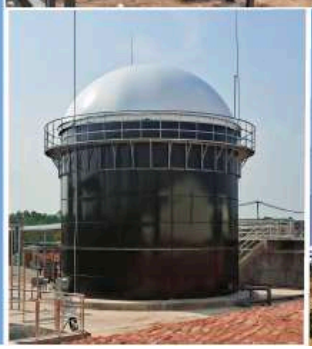
1. Outer membrane
2. Inner membrane
3. Safety belt and net
4. Outer membrane pressure relief valve
5. Backing piate and pressing plate
6. Positive and negative pressure water seal
7. Range finder
8. Check window
9. Outer membrane pressure relief valve 1
10. Air blower
11. Control system

The safety protection system is designed to safeguard the double membrane gas holder by preventing excessive pressure in the inner or outer membrane due to system malfunctions, ensuring controlled discharge. The control cabinet system primarily detects gas holder pressure and inner membrane capacity, allowing for pressure relief protection and control of gas intake as per the design requirements.

The role of the outer membrane of the biogas holder is to create a pressure-regulating space, providing constant external pressure to the inner membrane to maintain consistent biogas output. Simultaneously, the outer membrane offers protection to the inner membrane.

FEATURES:

- High operating pressures
- High volumes up to a hemispherical shape
- Suitable for high snow and wind loads
- Permanently gas-tight
- Low investment and running costs
- Short construction time
- High reliability
- Various fittings possible

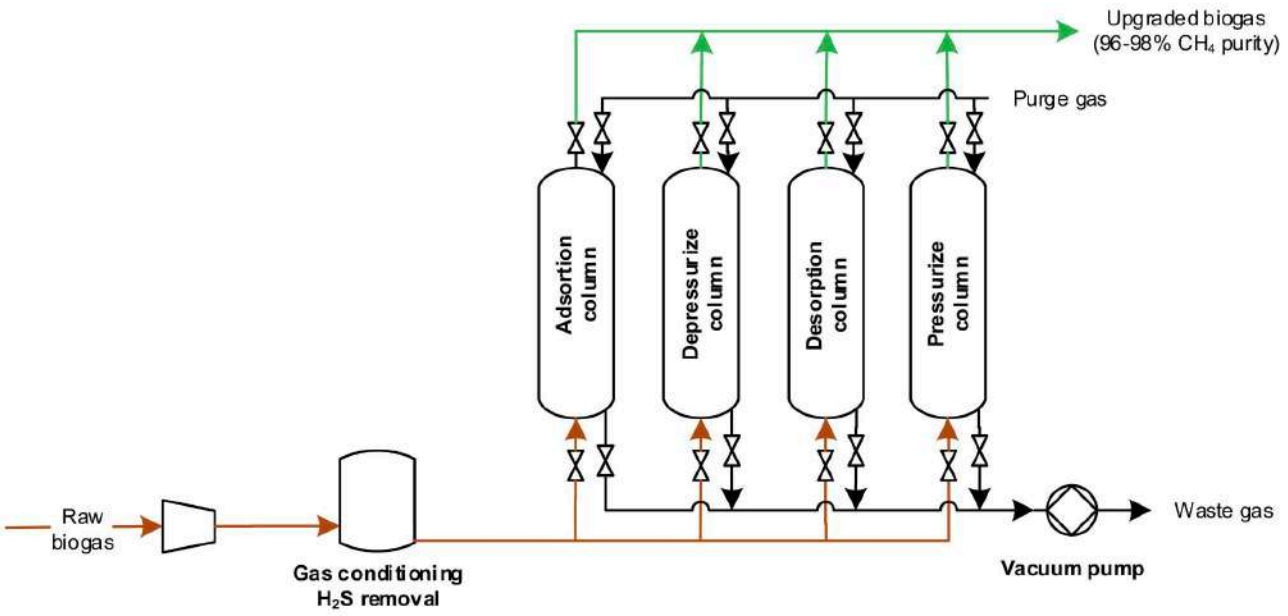


Biogas Upgrading

VPSA with 2 stage recovery

VPSA model is the way to go. It's a specially designed gas separation system that uses adsorbent to separate the gas. Adsorbents are like molecular sieves, with a tiny pore on their surface that allows them to selectively adsorb molecules like Co2 and N2 under a certain pressure.

Once it's adsorbed, it's regenerated by being depressurized. These PSA systems use this process to produce the purified methane-enriched gas over and over, repeating the process over and over. The process of biogas purification increases the concentration of methane and decreases the concentration of carbon dioxide in the biogas, resulting in increased calorific value.



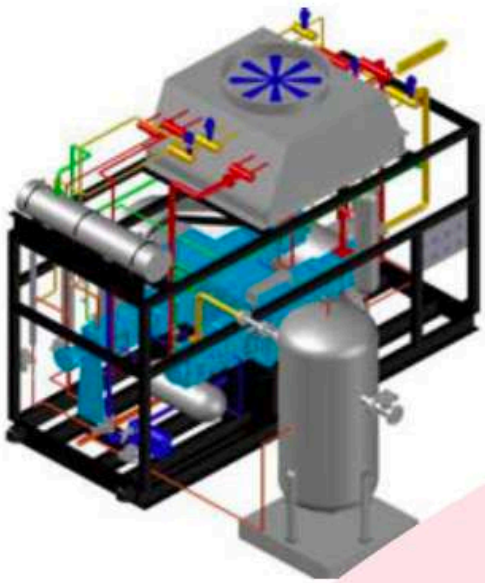
Key Benefits/Value of Using VPSA Systems

- The use of these systems eliminates impurities such as carbon monoxide, hydrogen sulphide, and moisture to produce pure and high-quality biogas.
- It also utilizes less energy consumption when compared to other available traditional cleaning methods, so it's a great option if you're looking for an affordable alternative.
- The VPSA system’s design can be molded to fit smaller facilities, and is suitable for a wide range of applications.
- These systems are highly scalable, depending on the biogas production volume, and can be redesigned to fit different project sizes as per your industry requirements.
- The cycle of VPSA makes it possible to run on a continual basis, guaranteeing a consistent flow of clean biogas, and relatively low maintenance levels.
- With cleaner biogas, there are fewer carbon emissions and fewer pollutants in the air, which helps with environmental sustainability.
- It can be built in a variety of ways, including modular units/bed configurations/layouts, so you can easily add more units and make changes as needed.

BioCNG Compressors

MEDIUM CAPACITY

- Type: Reciprocating, Lubricated, Horizontal Balanced-opposed
- Capacity: 200 to 800 Nm3/hr
- Suction pressure: 0.1 to 0.5 Barg
- Discharge pressure: 250 Barg
- Cooling medium: Closed Loop Cooling Water/Air Cooled/ Water Cooled



The offered BIOCNG compressor Package is designed for safety, reliability and applicability, seeking the lowest possible operating cost and lowest initial investment cost as much as possible, and all performance meets the requirements of the customer specification and material standards.

The package includes Compressor, Electric Motor and Starter panel with all necessary ancillary equipment like, pressure transducers, valves, tubing and fittings & instrumentation for safe operation, mounted on compact skid structures.

Solid Liquid seperation

Description

Solid-Liquid Separator is a machine composed by a feed device (Feeding hopper or a compensator tank depending on whether the material is conveyed mechanically or pumped), a separator casing including a screw conveyor and a cylindrical screen, a compacted solid material outlet module and one or two separated liquid outlets. The drive unit and basement complete the machine.

Function

Solid-Liquid Separator is solids-liquids separating machine with screw conveyor and pump. Using both principles of separation, by gravity and squeezing, the machine is designed to separate the liquid phase from the solid phase in wild range of substances such as sludge, sewage, solid-liquid mixtures, vegetables, processing waste and others, where the percentage of

liquid inside the solid is often considerably different. The separated solid and liquid phase can be handled in a easier and cheaper way.

Operation

The machine receives the material to be separated and conveys it using the screw conveyor and pump inside the casing. The liquid phase is separated through the mesh of the cylindrical screen which encloses the screw conveyor and pump. Along its path toward the exit, the material gradually separates progressively the less linked liquid and then the more strongly linked liquid unit plug of almost dry material has formed before the outlet.

Advantages

1. Compliant with as wide range of materials and throughputs
2. Optimized feeding tanks to compensator tank
3. Outlet diaphragm for solid manufactured in anti-wear engineering polymer: cost saving in spares parts
4. Self-balanced pressure at the solid outlet : steady and safe operation
5. Self-cleaning screen: long life and high performance operation in time
6. Modular screw manufactured in anti-wear engineering polymer: simple operation and cost saving in spare parts
7. Continuous operation
8. Quick return on investment

Digestate liquid treatment and reuse

The liquid fraction (liquor) after solid liquid separation still contains considerable amounts of suspended solids and nutrients. The exact concentrations depend on the feedstock, as well as the separation technology and any applied enhanced nutrient removal. It is never possible to achieve a liquor which can meets sufficient environmental standards so that it can be directly discharged to receiving streams. Part of the liquor can be used for the mashing of the feedstock. This amount depends on the one hand on the water content of the feedstock, and on the other hand on the concentration effect of ammonia nitrogen and salts in the process. In any case, at least a partial reutilisation as process water is recommended as this reduces the treatment effort for the liquor. If other facilities are also near the biogas plant the liquor can also be used to moisturise compost heaps or bio filters. In these cases the reduction of the ammonia concentration will probably be necessary in order to reduce ammonia emissions.

The Liquid fraction is partially tarter through a dissolved air flotation unit. The DAF unit will reduce the TSS, and some organic levels so that the liquid is fit for slurry preparation.

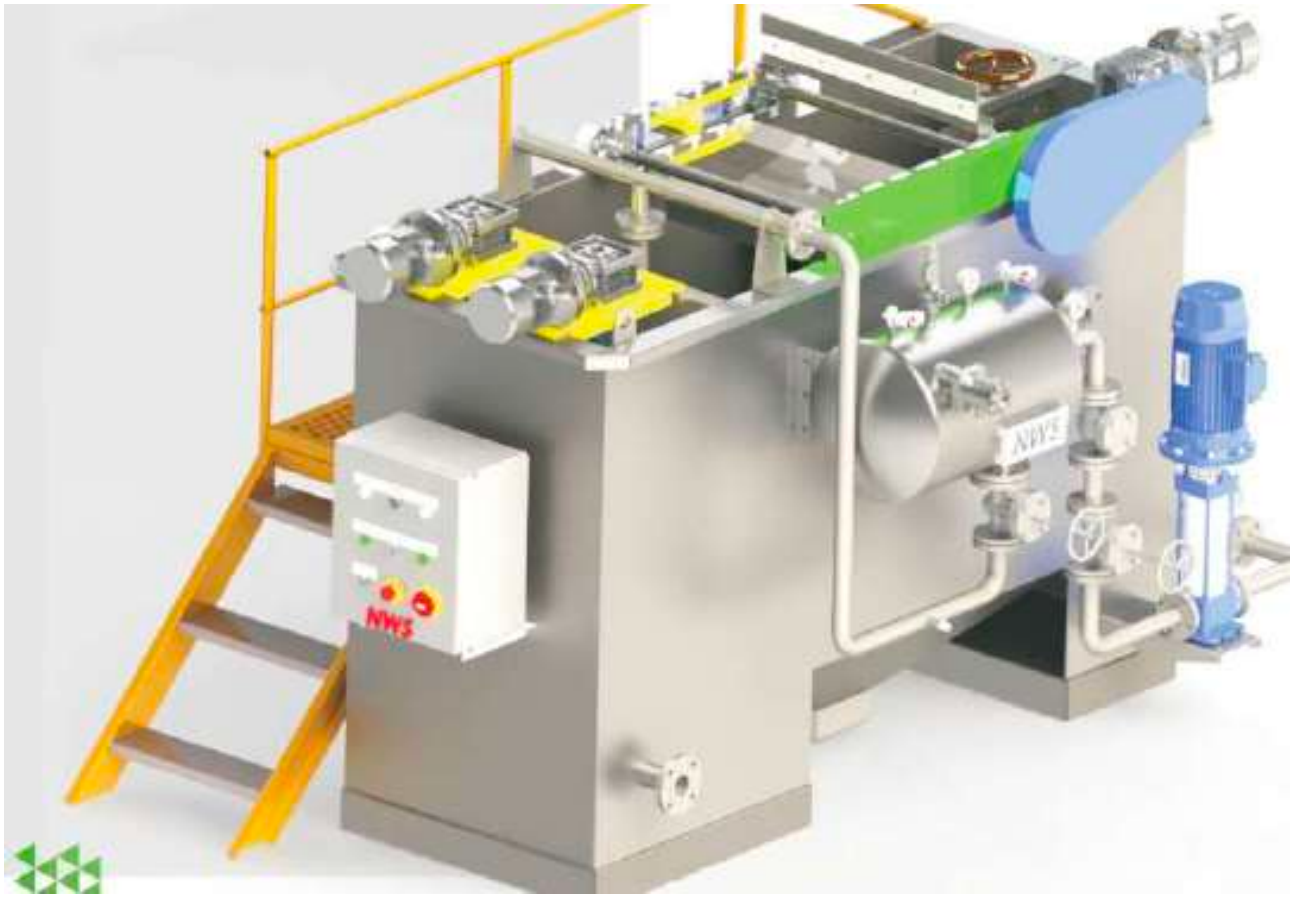
DAF Dissolved Air Flotation Description

Brief Introduction

DAF Dissolved air flotation machine is one kind of high efficient water Treatment equipment that clarifies water by removing suspended matters, is Now widely used in treatment process to remove suspended solids and partially organics present. The removal is achieved by dissolving air into water under pressure and then Releasing the air to atmospheric pressure in flotation tank.

How Does It Work

The feed water to DAF float tank is often (but not always) dosed with a Coagulant (such as ferric chloride or aluminum sulfate) to coagulate the Colloidal particles and/or flocculants to conglomerate the particles into bigger Clusters. A portion of clarified effluent water leaving the DAF tank is pumped into a Small pressure vessel (called air dissolving tank or saturator) into which Compressed air is also introduced. This process saturates pressurized effluent water with air under pressure (2.5-4kg/cm2) The air-saturated water stream is recycled to the front of the float tank and Flows through a pressure reduction valve just as it enters the front of the float Tank, which results in the air being released in the form of tiny bubbles. These bubbles attach to, and form with, the solids or chemical flocculants entering the vessel, causing them to float to the surface where they are Retained and form scum layer, and subsequently removed by a skimmer.



Biogas flaring Unit

Main Features:

- Reliable Operation
- Increased destruction efficiency
- Semi & fully automatic system
- Easy maintenance
- Low operating cost

Biogas flares are used to safely burn biogas that is surplus to the demand of energy recovery plant or where recovery plant fails. They may also provide the only means of safely disposing of biogas produced by anaerobic bioprocesses where the economics of energy recovery have not proved viable. The flare provides for efficient and environmentally safe combustion of biogas. The Exhaust gas emissions meet stringent environmental requirements with temperatures ranging from 1000 – 1200°C and with a defined residence time of >0.3s.

As soon as the start command is given and the required start pressure is reached, the flare starts up, and ignition is activated by an automatic ignition device. The burner unit controls the ignition process and monitors the flare. The combustion is automatically regulated by the air supply in relation to the optimum combustion temperature. All control functions are integrated by supply in relation to the optimum combustion temperature. All controls are integrated in a weather proof control cabinet, wired up ready for connection.

Process Instrumentation Package and Automation, Electrical

Continuous monitoring of the process is very vital to avoid break downs and to provide a consistent output. This also ensures to plan a proper preventive maintenance. Hence our package is packed with an array of instruments which provides continuous health of the plant. Following instruments are part of our package.

Instrument	Purpose
Water flowmeter	To measure the water used for slurry preparation
Electromagnetic flowmeter	To measure the slurry flow into the digester and recirculation flow in the cavitation process
pH sensor	To sense the pH in the digesters
ORP sensors	To sense the oxidation potential in the digester

Temperature sensors	To measure the temperature in the digester
Gas flowmeter	To measure the biogas flow
Biogas analyzer	To measure the purified biogas quality
Pressure sensors	To indicate the gas line pressure
Level sensors	To measure them level of liquid
Ultrasonic level sensor	To check the level of the gas holder
Dew point sensors	To measure the gas pressure

Process control equipment is used for supervision and regulation operation of the plant and for the limitation of damage. In case of emergency (for example, breakdown of the electrical power supply) the biogas plant is automatically transferred to safe operating conditions by the process instrumentation. Critical electrically driven devices are supplied with emergency power. An automatic system allows the supervision of the plant in real time and to recognize and correct aberrations immediately; to run the plant at its optimum saving resources and costs; and to record for the electronic database

operation parameters. The automatic system consists of a control cabinet and sensors for parameter control of technological processes and execution of technological processes and execution devices.

The control cabinet is designed based on the industrial controller Siemens CPU315-DP2, using periphery distributing system Simatic ET200S, and operator panel OP277 Touch with touch-sensitive controls. Communications is executed by PROFIBUS and MPI with physical interface RS-485. The control program is designed based on the Simatic Step7. The control cabinet is a modular design. The upper part has a power box with central and front-end processor. The periphery distributing system, Simatic ET2005, is installed with input - output units. The lower part with interface relay and clips is installed for connecting execution devices. The entire plant is controlled by a single operator.

SCADA (supervisory control and data acquisition) is a unify monitoring system used to control a complete system in industries such as thermal power plant, glass production plant, nuclear power plant. SCADA system collects the information from plant and transfers the information to plant and display the information using HMI [9]. This system is very simple to operate and easy to monitor and supervise the plant.

SYSTEM

The developed automated system for monitoring and process control for biogas and electricity through SCADA software is implemented on the basis of Programmable logical controllers. They have built three communications ports:

1. MPI port-used to connect to the control panel;
2. PtP port-communication port with RS485 interface;
3. Ethernet port-used to connect to the bioreactor and SCADA system.
4. The control panel has been designed with touch- screen monitor which is used for monitoring and management of the installation by the operator or automatically by the SCADA software.

The developed SCADA system is working in real time.

The main tasks are:
1. Loading of input data and parameters of the technology process.
2. Data transfer of information between the devices, PLC and industrial computer via Ethernet and remote control via Internet.
3. Data archive in normal and emergency mode.
4. The SCADA system offers wide range of technical features as follows:
5. Connection of biogas and energy generating equipment in complete non interruptible process.
6. Centralized management system with minimal personnel.
7. Safety control of the equipment.

PROCESS VISUALIZATION

The values of the technology process parameters are registered by the sensors, connected to PLC devices. The developed software visualizes processes on the operators display in real time. The internal communication is realized by the Ethernet port of PLC controller and TCP/IP protocol. The data are stored in the fixed by the operator time intervals.

Features of our Electrical Control Panel :

1. Better workability.
2. Strong and durable nature.
3. Efficient construction.
4. Easy maintenance.
5. Superior technology
6. With or without panel coolers
7. Single / double / triple Cubible type
8. Simple in operation
9. Demand minimum maintenance
10. High degree protection
11. Short circuit withstand capacity
12. Special enclosure types and sizes
13. Combination control packages
14. Special wire types and mounting channels

Process Design

Feedstock	Wet Organic fraction of MSW
TS content	15-20%
Quantity required	100 TPD
Inlet Methane content	55-60%
BioCNG production	3 TPD
BioCNG Purity	96-97%
Bio - manure (with 40% moisture)	10-12 TPD
Power consumed per day, KW	3000 KW
Area required, acres	5

PROCESS DESIGN

Feedstock	Qty, kgs/day	TS content, %	TS qty, kgs/day	VS Content, % TS	VS qty, kgs/day	BGY, m3/ton of FM	Total Biogas, m3/ day
Org MSW	100000	15	15000	85	12750	80	8000
TOTAL	100000	15	15000		12750		8000
	Total BioCNG, Kgs/day						3175
	Water required to make 10% slurry, lts						150000
	Water in feedstock, lts						85000
	Net water required, lts						65000
	Slurry tank volume, m3						165
	Digester volume required, m3						3300
	Digester 1 volume, m3						825
	Digester 2 volume, m3						2475
	Stage 2 digester outer chamber volume, m3						1609
	Stage 2 digester inner chamber volume, m3						866
	TS in digestate, kgs/day						4500
	Dewatered digestate with 70% moisture, kgs/day						15000
	Liquid filtrate, lts/day						150000
	Slurry feed rate to digester, m3/hr						8.25
	Minimum Cavitation flow, m3/hr						0.75
	Maximum cavitation flow, m3/hr						3.75
	Biogas flow, Nm3/hr						400
	Gas holder volume, m3						2400

Bill of Quantities

S.no.	Components	Qty
1	MSW shredder with conveyor, complete system	One set
2	Bio-slurry feed pump, progressive cavity type, 10 m3/hr at 15 mwc, CI construction	2 nos
3	Glass fused digester tank with double membrane gas holder and accessories for Digester -1 and Digester 2	1 no.
4	Cavitation system comprising of Circulating pump, Ultrasonic cavitator mechanism	1 no.
5	Rota cut inlet size DN 150 Outlet size DN 150 Housing material Stainless steel Surface Housing Pickled and passivated Combination of materials Steel / stainless steel	1 no.
6	Gas Lifter mechanism comprising of gas eductior, fixing accessories and compressor	One set
7	Micro aeration system comprising of micro compressor and controls	1 no.
8	Digestate feed pump , progressive city type in CI construction,10 m3/hr at 2 bar	2 nos.
9	Solid Liquid Seperator Solid Liquid Separators Out put Capacity : 1000 to 1600kg/hr. Gear Box Ratio : 50:1 Solid Material : 3 to 4% Motor Rating : 10HP/1450 RPM MOC : SS304 Wetted Parts Structure MS painted.	1 no.
10	Filtrate water transfer pump, submersible type, CI, 10 m3/hr at 10 mwc	2 nos
11	Slurry mixer in SS 304 contraction for slurry mixing in the digester	1 set

12	Biogas Upgrading unit based on VPSA technology, with H2S scrubbing unit, booster compressor, vacuum pump, adsorption column, chiller, dryer, surge vessel, piping, valves and instruments	One set
13	Gas flaring unit of capacity 400 m3/hr with accessories	1 no.
14	High pressure compressor for **VPSA** 1. Design flowrate - 400 Nm3/hr @ 0.2-0.3 Barg suction pressure 2. Suction Pressure – 10 to 11 Barg 3. Suction temperature – 40 Deg C 4. Discharge Pressure – 250 Barg 5. Motor 415 Volts, 4 Pole, 3 Phase, 1500 RPM, IE2, Exec type 6. No. of Stages – single 7. Closed loop cooling water, V-Belt Driven	1 no.
15	BioCNG piping manifold in SS 316	1 set
16	Instruments comprising of pH sensor, flowmeter, pressure sensor, ORP sensor, temperature sensor, Biogas analyzer, transmitter, Dew point meter, level sensors.	1 set
17	Control Panel, HMI and SCADA	1 set
18	Power and instrumentation cabling, cable trays, glands and supports	1 set
19	Piping in UPVC, MS, SS as required, pipe supports	1 lot
20	All valves including pressure relief valve in CI and PP construction as required	1 lot
21	Fire fighting pumps with pumps and piping as required	1 set

Exclusions

S.no	Items
1	Land, fencing
2	Statutory Clearances
3	Transformers, Plant lIghting
4	Incoming power supply
5	Utilities like power and water
6	All Civil works
8	BioCNG Cascades
9	Seeding culture like dung for initial startup
10	Bagging for compost
11	Bulk loaders for waste and compost
12	Connecting to gas grid
13	Back up power

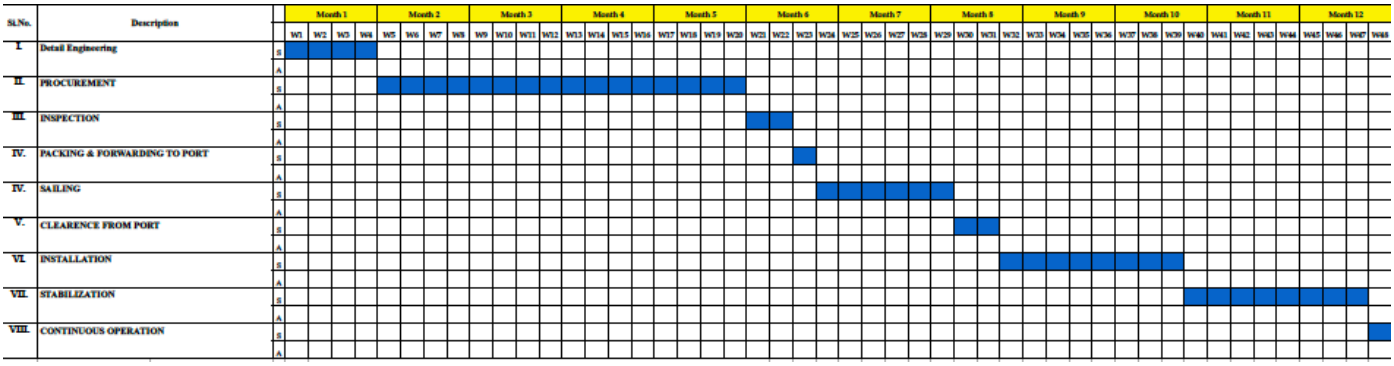
Note

The MSW should be completely segregated. No hazardous waste , biomedical waste and construction waste is allowed in the mix.

Operating cost

Heads	Annual, INR
Operation & maintenance- man power consumables like lubrication oil, grease	7500000
Power cost for consumption at 3000 KW and at INR 7 per unit	7665000
Spares	3000000
Diesel	2000000
Grand Total	**20165000**
Annual production of BioCNG, TPA	**1000**
Cost of BioCNG per ton in INR	**20165**

Project Milestones



The Total EPC project can be completed in 12 months time. The plant will be fit for production of BioCNG on a continuous basis thereafter.

Any statutory clearances delay will affect the project schedule.

Makes of components

S.no	Items	Makes
1	Shredder	**Medigreen Energy**
2	Pumps	Roto Pumps/ Lubi/ Kirloskar
3	Motors	ABB/ Crompton/ Bharath Bijlee
4	Mini air compressor	Bibus India
5	Air compressor	ELGI / Parth / Indo
6	High pressure compressor	Jyotech/ Chroma/ Kirloskar Pneumatic
7	Twin lobe compressor	Kay / Everest
8	Glass fused tank	Central Enamel
9	Double membrane gas holder	Lucky International / Agastiya
10	Rotacut	Vogelsang
11	Biosonicator cavitation	Ultrawaves
12	Gas lifter	SoenCo, Japan
13	BioCNG Purification Plant	USM/ Atmos
14	Cables	Finolex/L&T/Polycab
15	PLC, SCADA	Siemens, AB, Fuji
16	Pipes - Metal MS	Tata, Jindal
17	Pipes - Metal SS	Apex Tubes / Scoda / Ramanuj / Venus / Sunrise / Ratnatech
18	Non metalic pipes	Ashirwad Pipes
19	Valves	Aira Euromatic

20	Instruments	Endress & Hausser/ Jumo/Baumer/ Excel/ Eurpoean/ Bhoomi/ CS instruments/ Burak
21	Gas Flare	JS Combustor/ Maxtherm/
22	Wastewater treatment plant	**Medigreen Energy**

Our Bio CNG Benefits

1.Robust pretreatment with Cavitation technology
2.Can handle multiple feedstocks
3.Clog free feeding mechanism
4.Two stage digestion for better process control and outputs
5.Glass fused/ FRP tank construction digester
6.Micro aeration for H2S removal
7.Unique Gas mixing system
8.Low operating cost
9.Multiple resource recoveries
10.Smart Monitoring
11. Longest Life span
12.Concept to Commissioning, Operation

20% more output

Commercial

Description	Price, INR
Price for design, engineering, supply of Mechanical and electrical , instrumentation	**29,00,00,000 (Rupees Twenty Nine Crores Only)**
Our Charges for Installation & Commissioning, Trial run , Training	**1,00,00,000 (Rupees One Crore Only)**
Civil Estimates	Can be provided after site visits and soil report
	Civil work order can be placed directly to our Civil vendor with a separate agreement.

TERMS & CONDITIONS PRICE	**Prices quoted are Ex-works Pune.**
TAXES & DUTIES	Our prices are excluding of all taxes, duties, levies etc.
FREIGHT CHARGES	Freight charges extra to be borne by client.
TRANSIT INSURANCE	Transportation to be arranged by the customer. Transit insurance to be arranged by Customer, upon receipt of dispatch intimation from our side.
TERMS OF PAYMENT	50% advance along with PO 40% against readiness of material before dispatch 5% against Installation 5% against Commissioning
Note: Payment for Partial delivery should be allowed.	
DELIVERY	The entire project will take about 6-8 months for Delivery from the date of receipt of advance and progress of work by customer. Note: Partial delivery should be allowed to complete the Project on time.

MECHANICAL GUARANTEE	18 Months from the date of dispatch of equipment or 12 Months from the date of Commissioning, whichever is earlier.
FORCE - MAJEURE	Clauses for the purpose of this contract shall be either or all the following:
a.	Natural phenomena including but not limited to weather conditions, floods, droughts, earthquakes, epidemics, COVID 19 Pandemics.
b.	Acts of Governmental Authority, domestic or foreign, including but, not limited to an emergency, declared or undeclared priorities guarantees embargoes, licensing control of production or distribution restrictions.
c.	Accidents and disturbances including but not limited to fires, explosions, and break down of essential machinery or equipment and power shortage.
d.	Transportation delay due to Force-de-majeure non-availability of railway wagons or accidents, damage to equipment in transit or during erection.
e.	Strikes, slow down, lockouts and sabotage.
f.	Failure or delay in our sub-contractor's/sub-suppliers source of supply due to Force-de-majeure clauses enumerated in (a) to (b) above.
In case of late deliveries or late completion of this contract due to above reasons, we shall not be held as defaulters	
CANCELLATION OF THE ORDER	The Company reserves the right to refuse cancellation of order once it has been accepted unless a mutual agreement between the Company and the Purchaser is reached regarding the compensation due to the Company including recovery of all costs and expenses incurred, attendant normal interest and overhead charges and reasonable profit.
WARFAGE, DEMURRAGES	All warfage/demurrages etc., for late retirement of documents from the Bank due to any reason will be to the buyers account.

DAMAGES	Damages Damages arising out of this Contract and claimed will not cover working losses of profits, losses of stored/in transit goods or consequential damages.
FACILITIES TO BE PROVIDED BY YOU	Facilities to be provided by you Suitable and secured premises for storage of equipment and tools free of charge.
LIMITATION OF LIABILITY IN GENERAL	Seller shall not be liable for incidental, consequential, indirect, special, punitive or exemplary damages of any kind or for lost goodwill, lost profits, lost business, cost of cover or other indirect economic damages and further including injury to property,whether such claim is based on Theories of contract, negligence, tort (including strict liability) or otherwise as a result of breach of any warranty or other term of this agreement, regardless of whether seller was advised, had other reason to know, or in fact knew of the possibility of such damages. It is however made clear that by virtue of operation of this agreement if there is any claim raised as mentioned in the foregoing Para or in general for violation of any Indian law protecting rights of a customer as against any product of parts wherever manufactured, there will beexception to this clause.
ARBITRATION	Any or all disputes, differences or questions relating to all arising out of this contract, including without limitation any questions relating to the existence, validity and enforceability of any of the provisions of the contract above (together called disputes) will be subject to the exclusive jurisdiction of the court at Pune, and the language of the proceedings shall be in English language only.
ACCOMODATION	Free accommodation at site for Medigreen Energy officers/engineers will be provided at client's end during installation and commissioning. Canteen facilities may be made available to our personnel at nominal charges.

MEDIGREEN ENERGY PVT. LTD.

sales@medigreenenergy.com

www.medigreenenergy.com

9123029557, +918240937118

Door No: 2, FIRST FLOOR M/s
Datta Guru Industries Gat no. 53
Dehu Alandi Road Talawade Pune
Maharastra