Energy&Waste
Condorchem Group

SOLUTIONS FOR THE BIOGAS TREATMENT

www.cleanbgas.com

Energy & Waste is an environmental engineering firm that specializes in processes for the treatment and recovery of biogas, as well as energy generation from solid, liquid and gaseous waste.

The company was founded in 2017 and acquired by the Condorchem Group in 2018.

Before its acquisition by Condorchem Group, Energy & Waste carried out numerous waste recovery projects in Europe and America. In this new phase, Energy & Waste aims to become an international player in waste treatment and recovery.

Energy & Waste is a company driven by technological research, development and innovation (RDI), as the basis for offering the most efficient solution to each client, so that it can optimize its environmental and financial results.

The main activities of Energy & Waste include:

Gas treatment

- Cleaning/treatment of biogas (reducing humidity, particles, foams, H_2S and siloxanes).
- Transforming biogas into fuel for automobiles or injection into the natural gas power grid. Biomethane.
- Scrubbing gases from pyrolysis and gasification processes.
- Air-freshening of the atmosphere in dry.

Solid waste treatment

- Pyrolysis for a range of different waste types.
- Drying sludge in fluidized beds.
- Biomass gasification (wood, sludge, paper, cardboard, etc.).
- Spray drying of concentrates.
- Inertization of complex waste water in the dispersed phase.
- Water degasification through membranes (NH_3 , CO_2 and O_2).
- Obtaining salts from saline water.

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Are there dangerous components in the biogas? Then remove them

Foam, particles, water vapour, H_2S, $C0_2$ and hydrocarbons

Guarantee an optimal operation of your CHP system, **engine, turbine and boiler.**

Biogas drying, Biogas cleaning, Biogas upgrading, Foam removal and so on.

The biogas coming from landfill, wastewater treatment plant or digester plants is a fuel gas which is useful for energy production, biofuel for vehicles or injection into the natural gas grid. However, in order to do so, the biogas must previously be cleaned. That is, all harmful. components must be removed from it in order for it to be used as a biofuel.

Gas treatment Odour removal Biogas cleaning

- Active carbon filters for gas treatment.
- Odour removal in sewage treatment plants.
- Biogas cleaning in sewage treatment plants, landfills and digesters.
- Removal of Siloxanes, H_2S and hydrocarbons in the biogas stream.
- Fully automatization.
- Easy handling of adsorbent loading.
- Single bed filters or multi beds.
- Adsorbent regeneration system upon request.

Adsorbents

ACF Equipment Drawing

CLEAN-BGAS® MP DRY

Biogas Cleaning System

Biogas is a gas mixture formed primarily of CH_4, $C0_2$, water vapour and traces of other components (H_2S, siloxanes, NH_3, hydrocarbons and others). In order for it to be used within the CHP system, its moisture content needs to be reduced and all harmful compounds must be removed to ensure the durability of the equipment involved in its use as a biofuel.

The **CLEAN-BGAS® MP DRY** module, ensures the reduction of these components (water vapour, particles, H_2S and siloxanes). The technology has two parts: the biogas cooling and adsorption of active carbon. The active carbon is selected for the main dangerous component. All the equipment is located within a base for easy operation, maintenance and installation.

View of energy recovery.

Overview of the plant

Technical features

- Modular system.
- Suitable for all types of biogas.
- Continuous operation since its installation.
- Simultaneous reduction of temperature, water vapour, H_2S, NH_3, halogenated hydrocarbons and siloxanes.
- Works on a vacuum or pressure line.
- It incorporates a separation system for particles and foam.
- Fully automation.
- The active carbon filter offers easy handling.
- Delivers high quality of biogas.
- Could have an energy recovery system or reheating.

Process

A process based on cooling, condensation, water washing and absorption of active carbon.

Applications

- Siloxane and hydrocarbon removal.
- Water vapour removal.
- H_2S and NH_3 removal.
- Temperature reduction.
- Landfill gas.
- Sewage gas.

Biogas Dryer

Biogas cleaning plants for WWTP

Advantages

- Production of high quality biogas.
- Reduce power consumption by up to 30 %
- Long life of the adsorbent.
- Low maintenance cost.
- Fully automated.
- Improve exhaust flue emissions from cogeneration systems.

CLEAN-BGAS® DRY
Biogas Drying System

Biogas is a wet gas that needs to be dried for use in order to avoid the:

- Troubleshooting of CHP systems.
- Corrosion.
- Plugging by where the biogas is moved.

CLEAN-BGAS® DRY technology combines cooling and condensation techniques which allows an elimination efficiency of over 95% to be achieved, depending on the working temperature, while also offering low operating costs. This can include a recoverer-washer, which in addition to minimizing the energy needs of the operation, allows the biogas to be washed with its own condensates. This produces a partial reduction of the H_2S and NH_3, that accompany the biogas, which is why it can be considered a multipurpose technology.

Vertical dryer

Control Panel

Condensate pot

Technical features

- Modular system.
- Continuous Operation.
- It can reduce water vapour and, in turn, H_2S, NH_3, hydrocarbons and siloxanes as needed.
- It can work, both in the suction line or pressure line within the biogas installation.
- It may include the operation control system if requested by the client .
- Automatic operation.
- High biogas moisture removal efficiency.
- Could have an energy recovery system or reheating.

How it works

It is based on the combination of cooling and condensation. Sometimes works as a scrubber.

Applications

- Removing water vapour from biogas.
- Partial reduction of D-type siloxanes.
- Partial reduction of H_2S, NH_3 and hydrocarbons.
- Reduced gas temperature and relative humidity.

Advantages

- Produces a gas stream with low-moisture content.
- High elimination efficiency.
- Low power consumption.
- Low maintenance cost.
- Completely automated.
- Robust installation.

Inside water vapor removal

Outside water vapor removal

Vertical dryer

CLEAN-BGAS® UPGR
Biogas upgrading solution

CLEAN-BGAS® UPGR is a technology focused on biomethane production . There are different stages in the technology and it is based on a chemical process which includes a chemical scrubber with amine. The technology has different modules.

Biogas Cleaning: It aims to separate all the impurities from the biogas before its entry into the CO_2 removal process. At this stage undesirable compounds such as siloxanes, moisture, particulates, halogenated hydrocarbons and NH_3, that can poison the solvent used for scrubbing, are removed.

CO2 removal / Biomethane. This is performed by chemical absorption. The biogas is washed with a suitable chemical solvent (Alkanolamine) to remove up to 100% of CO_2 from this stream, as well as possible traces of H_2S that can be found in biogas. As a result of the process, a biogas stream with a high level of CH_4, similar to natural gas is obtained.

Solvent recovery. The regeneration of the solvent is made by distillation. By doing so the CO_2 stream is removed from the solvent, captured from the biogas. The solvent is once again used in the absorption operation while the CO_2 can be destined to other uses (filling fire extinguishers, dry ice, seaweed farming, petrochemicals, etc.).

Drying gas / biomethane: Drying gas: Its purpose is to ensure a dry gas for its compression and storage. This operation involves cooling and drying by adsorption. For the last operation, substances with a high adsorption capacity are used.

Technical features

- Suitable for any type of biogas.
- Compact equipment installed in modified shipping containers.
- Modular equipment depending on the vehicle fleet.
- Operates at low pressures.
- Intelligent management of energy produced.
- Fully automatic.
- Produces a high CO2 concentration stream useful for the market.

Applications

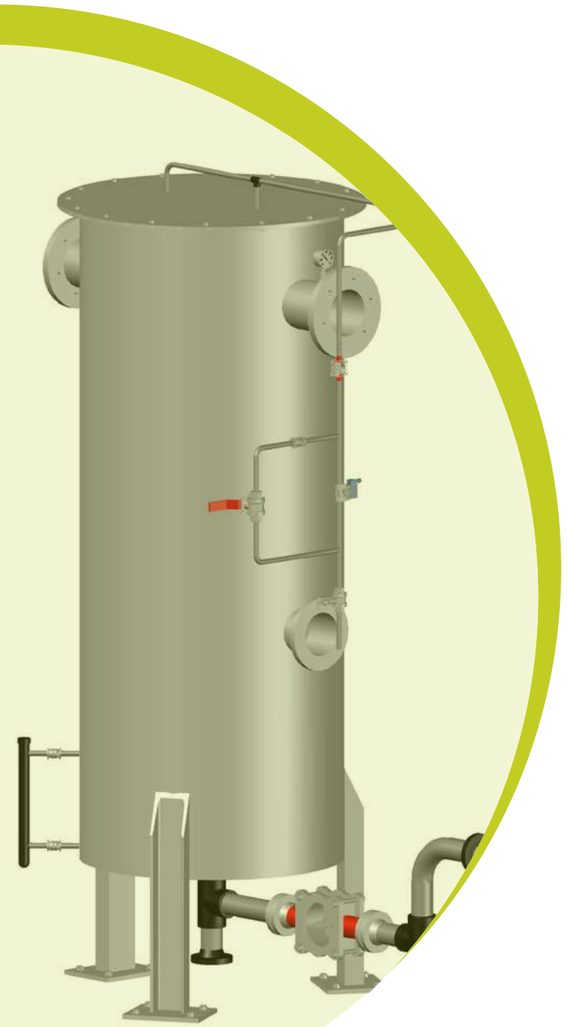
- Biofuel for vehicles.
- Injection into natural gas grid.
- Raw material for production of methanol and hydrogen.
- High purity CO_2.
- As natural gas.

Advantages

- Low power consumption.
- Minimum investment in civil works.
- Ecological fuel.
- Operation at low pressures.
- The solvent is selective, minimal loss of methane.

Biogas compressor

Biiogas cleaning



CLEAN-BGAS® FR
Foam removal

CLEAN-BGAS® FR is designed to eliminate foam and remove particles from the Digester Gas Discharge. The use of this kind of equipment can avoid the clogging of down-stream equipment by utilizing Foam Removal.

The removal of foam and solids from the biogas is accomplished through two different techniques. First directing the biogas stream into a baffle that is located in an oversized chamber. Secondly, the gas is subjected to an extended exposure of continuous water spray.

As a result, the foam is broken down and removed through the drain located in the lower part of the equipment.

Condensate pot

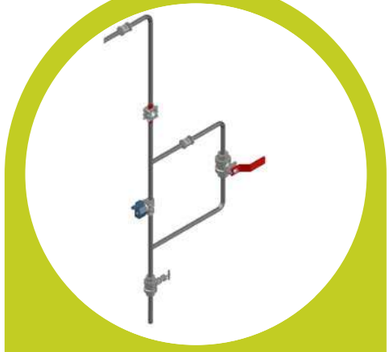
Spray nozzle

Technical features

- Eliminates foam.
- Removes particles.
- Continuous water spray systems.
- High and low level alarms.

Construction CLEAN-BGAS® FR

The main vessel is made of 304 or 316 stainless steel and is it available in vessels with different diameters. The biogas inlet and outlet size is determined by the actual biogas flow. Water inlet connections depend on the water stream. Speed flows between 1.2 and 2.4 m/s are typical for this line. Drain connections are 2", DIN PN10 flat face flanges. The unit is equipped with an ATEX level switch for high and low water level alarms. A high level alarm is connected to an ATEX solenoid valve locat¬ed on the water supply line. A rotating vane flow indicator is provided in the water drain piping for visual indication of flow.



Flow control system

BIOMASS GASIFICATION

Micro-cogeneration (CHP) Module.

The technology based on biogas gasification are low and medium power using downdraft gasifiers. This technology is aimed at small agricultural communities, rural houses, hotels, as well as, entities located far from the electric grid. This gasification module is useful for meeting both the heat and electricity demand of such facilities, where it is very feasible to have different biomass types.

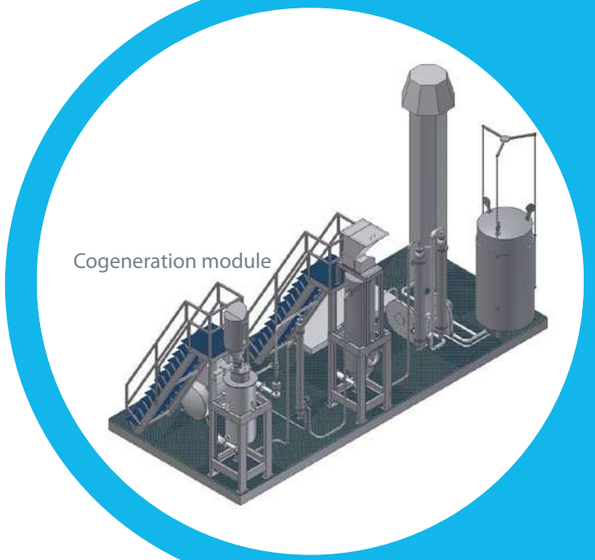
The modules are composed of four stages: biomass storage, gasification, cleaning gas system and CHP system. All mounted on a base that facilitates both access to different parts of the module, such as transport or movement. The module is fully automated, it has a control panel for the whole system which facilitates the operation of the facility.

The module allows to get electricity and heat at the same time. The calorific energy could be in way of hot water or hot air or both at the same time.

Heat Recovery System

Biomass

Gas Cleaning System



Technical features

- Inverted downdraft gasifier.
- Electric heater/gasoil burner.
- Biomass feed system.
- Cyclone as a particle separation system.
- Gas treatment.
- Combustion engine.
- Heat recovery system.
- Production of heat in form of hot water or hot air.
- Control system.

Applications

- Electricity and heat production.
- Agricultural farms.
- Rural houses.
- Rural Hotels.

Advantages

- Simultaneous generation of electricity and heat.
- Production of hot air or hot water.
- Easy transportation, installation and maintenance.
- Easy handling.

Particle Removal System

Heat Recovery System

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