

BIOGAS

the green energy source of the future

NIELS DEN HEIJER ■ WITH AN INCREASED FOCUS ON THE CARBON DIOXIDE (CO₂) FOOTPRINT OF PRODUCTION PROCESSES, THE REDUCTION OF ENERGY CONSUMPTION AND WASTE IS MORE IMPORTANT THAN EVER. NORIT HAFFMANS CONTINUOUSLY STRIVES TO DEVELOP SOLUTIONS THAT HELP CUSTOMERS REACH THEIR SUSTAINABILITY GOALS. A RECENT INNOVATIVE SOLUTION FROM NORIT HAFFMANS PROVIDES A WAY FOR COMPANIES THAT PRODUCE BIOGAS TO USE THIS BY-PRODUCT FOR THE REPLACEMENT OF FOSSIL FUELS WITH BIOFUELS, SUCH AS BIOETHANOL, BIODIESEL OR BIOGAS. FOR BIOGAS, PRODUCED AS A BY-PRODUCT IN MANY INDUSTRIAL PROCESSES, NORIT HAFFMANS DEVELOPED AN INNOVATIVE SOLUTION, THAT IS MUCH MORE ATTRACTIVE THAN THE EXISTING STATE-OF-THE-ART TECHNOLOGIES.

The background on biogas

Biogas is produced when bacteria degrade biological material in the absence of oxygen, in a process known as anaerobic digestion. Biogas consists of methane and CO₂ and is produced from various processes such as agricultural biodigesters, wastewater treatment and landfills.

The methane part of the biogas, often up to 60 percent, can be used as a substitute for natural gas. In addition to the economic advantage, this also provides an environmental benefit as it eliminates the emission of this greenhouse gas into the atmosphere.

The biogas can be used directly for heating purposes or fed to special gas motors for the generation of electricity and heat. These gas motors are specifically designed to handle the low caloric biogas mixture in an energy-efficient way. As a result, the biogas that would otherwise be wasted is now a useful by-product that can significantly improve the economics of a wastewater treatment plant or a landfill.

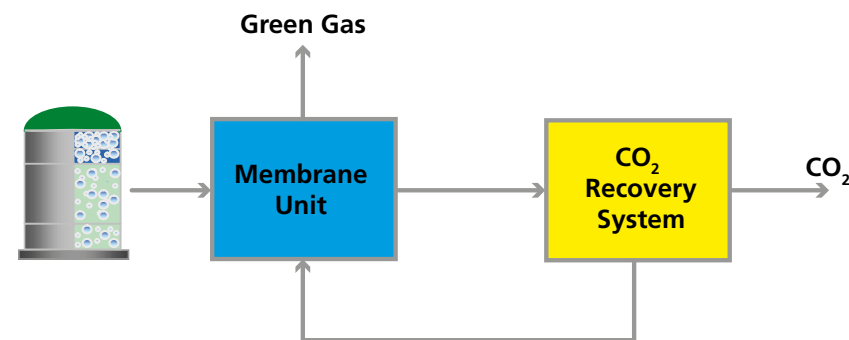
The biogas motor application does have disadvantages including lower efficiency compared to generators in power plants and the excess of heat that is generated and not used, essentially wasting energy. To eliminate these disadvantages Norit Haffmans has developed a biogas upgrading solution where the biogas is separated into green gas (>90% methane) and food-grade CO₂. The green gas can be supplied to the gas grid, or compressed to natural gas (CNG) for transportation purposes.

Norit Haffmans' solution

Norit Haffmans' system consists of a membrane separation unit and a CO₂ recovery plant. The membrane unit separates the biogas into methane and CO₂. The permeate, the gas that goes through the membranes, consists of more than 90 percent CO₂ and is upgraded to food-grade CO₂ in the subsequent CO₂ recovery plant. After the purification of the CO₂, the residue of the methane is separated during liquefaction and directed back to the membrane unit until 100 percent of the methane is recovered and finally ends up as natural gas. In other words, 1 Nm³ biogas composition of 55 percent methane and 43 percent CO₂ can be turned into 0.65 Nm³ natural gas and 0.6 kg food-grade CO₂.

As most of the biogas production plants are continuously in operation a recovery rate of nearly 100 percent can be achieved!

When the CO₂ can be used on site, at operations such as CO₂ injection in greenhouses on farms, pH adjustment of wastewater at water utilities or carbonization of beer in breweries, this is an additional cost saving. When feasible the food-grade CO₂ can be sold to companies that use CO₂, thus producing a new revenue stream.



When there is no use for the CO₂ or selling it is not profitable, Norit Haffmans can offer biogas plants a LiquiVap Heat Recovery System, which is a very interesting energy-recovery solution. With this system the cooling energy, stored in the liquid CO₂, is reused for condensing the CO₂ gas that needs to be liquefied. By "recycling" this cooling energy, up to 90 percent of the required cooling energy can be recovered.

At the moment Norit Haffmans has successfully tested its first biogas upgrading plant, installed at an agricultural biodigester in the Netherlands, where green gas and liquid CO₂ is being produced from the biogas. The tests have proven that the quantity of CO₂ produced meets the calculations made during the feasibility study. In addition, the energy consumption is even better than the calculated values, which makes these plants very attractive.

Sustainable success

Norit Haffmans developed and tested a biogas upgrading plant to transfer raw biogas into green gas. The advantage of the new system is that the upgraded gas can be sold to the gas grid or used directly as a fuel in existing gas equipment. When compared to other principles this method fully uses the methane recovered by the CO₂ recovery plant. Besides this,

the liquefied CO₂ has food-grade quality and can be used by the plant or sold to other companies. In case there is no use for the liquefied CO₂, Norit Haffmans LiquiVap provides an energy-reducing option to vent the CO₂ and minimize the energy consumption of the process dramatically.

For agricultural digesters and companies with an on-site wastewater treatment plant such as breweries or paper producing companies, Norit Haffmans' solution is excellent for recycling biomass into green gas and CO₂. The green gas can be used in their existing gas plants reducing natural gas costs and the CO₂ can be sold as an additional benefit.



MAIN ADVANTAGES

- 100% METHANE RECOVERY
- LESS WASTE
- CREATE GREEN ENERGY
- ADDITIONAL REVENUES
 - SELLING SURPLUS GREEN GAS
 - SELLING LIQUID CO₂
- CONSTANT CO₂ QUALITY
- CRADLE-TO-CRADLE

