

Intelligent Drivesystems, Worldwide Services



GB

**NORD drive units  
for energy-efficient  
bio-gas plant**

  
**DRIVESYSTEMS**



# Create a lot of energy and use only a little

## Energy from the agitator

From small beginnings in the nineties, the Schmack Biogas AG in Schwandorf in the Upper Rhineland Palatinate now employs about 300 people. The company is one of the leading specialists for the planning and construction of bio-gas plants. In order to produce methane from a substrate of maize or grass silage and other ingredients, the mixture must be continually churned in order to achieve optimum fermentation with the exclusion of air. Schmack plants use enormous agitators driven by parallel gear motors from NORD Drivesystems.

Bio-gas provides three types of energy: electricity, heat and fuel. The Schwandorf company is convinced that in the long-term, bio-gas has the potential to replace a large proportion of the global consumption of natural gas. "Because it can be stored, bio-gas has a central role in the energy mix for sustainable energies," stresses the founder of the company Ulrich Schmack. The entire operating technology of a bio-gas plant must be designed so that it produces as much energy as possible while consuming as little energy as possible. For the design of the geared motors, this requirement meant that the power consumption was to be as low as possible. Because of this, two 2.2 kW three-phase motors are sufficient to drive the horizontal agitator in the 26 metre long EUACO main fermenters. The required torques of up to 30,000 Nm are achieved via a five-stage SK 9382 series parallel shaft gear unit. The agitator blades on the shaft in the container rotate at 0.8 rpm. The speed-controlled motors need to be robustly designed in order to provide the maximum availability in a continuous biological and chemical process, which does not permit standstills.

Agitator drive units		
<b>In the pre-fermenter</b>	Geared motor type	SK 9382AZ 132S/4-2 TF 4,7
	Power	5.9 KW
	Output speed	5 – 10 rpm
<b>In the post-fermenter</b>	Geared motor type	SK 9382/52 AZ 100L/4 TF
	Power	2.2 KW
	Output speed	0.8 rpm



DRIVESYSTEMS



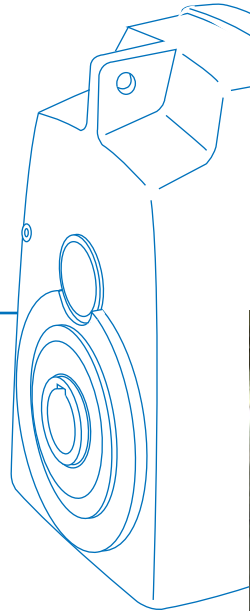
## Energy from bio-gas

Bio-gas is largely a mixture of methane, carbon dioxide and water vapour. Various types of anaerobic bacteria are involved in the process for the controlled production of bio-gas. The relative proportions of these bacteria are influenced by the raw materials, the pH value, the temperature and the rotting process. Due to the ability of these micro-organisms to adapt to the process conditions, almost all kinds of organic substances can be decomposed by rotting. Hydrolysis, the formation of acid and acetic acid and the production

of methane are the four biochemical processes necessary to ferment the biomass to produce bio-gas. This is then cleaned and the sulphur removed, so that it can be purified and compressed to the quality of natural gas. "In view of the dangers of climate change and the hunger for energy throughout the world, we are standing at an historical crossroads. In order to reduce the emission of greenhouse gases in Europe and the other industrialised countries by at least 30 percent by 2020 compared with 1990, we need rapid progress in sustainable energies and a much more efficient use of energy in Europe", commented the German Minister for the Environment Siegmund Gabriel in February 2007 on the decision of the European Energy Council to bindingly increase the proportion of bio-fuels in the overall fuel consumption to at least 10 percent by the year 2020. Gabriel also demanded that by this date the proportion of sustainable energies should be brought up to 20 percent of the total energy consumption.



# Special requirements for the agitator



## Churning under cover

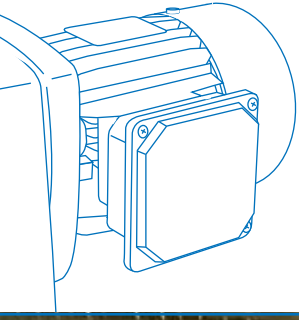
The substrate is then pumped with a conveyor screw into the post-fermenter - the pit storage fermenter - which is also used to store the bio-gas from the first stage. It is this part of the system which gives a bio-gas plant its characteristic appearance, with its dome which is visible from a great distance. The relatively large volumes, usually between 1,200 to 2,400 cubic metres, according to the size of the plant make special demands of the agitator technology. On the basis of the paddle agitator in the EUCO TS, Schmack Biogas has developed the REMEX large-blade agitator. This is also driven by parallel shaft geared motors from NORD: The agitators ensure a broad-based, three dimensional mixing of the substrate. Because they are arranged in opposition at various levels, they cover large areas of the fermenter, keep the substrate at a constant temperature, prevent settling out and therefore achieve a consistent production of bio-gas. As with the plug-flow fermenter, the geared motors are designed with a hollow output shaft to cater for the supply of heat via hot water. Supported by static heating surfaces on the walls of the container, it is easy to bring the shaft up to temperature. In both processes, the geared motors are mounted via side glands on the outside of the container. The parallel shaft gear unit results in a compact design of the motor bracket on the concrete wall. A canopy protects the drive unit from the weather. Connection powers of a maximum of 6 kW per motor and agitator speeds of up to 10 rpm are sufficient to keep the "cauldron" bubbling. The speed of the two synchronised agitators can be precisely selected. The speed control also has the advantage that especially when

the plant is started up, peak torques can be safely compensated. This solution prevents high start-up currents and at the same time protects the bearings and mechanical components from torque peaks.

## Paddles with heated shafts

The so-called plug-flow fermenter is designed as a concrete fermentation vessel with a maximum proportion of dry matter for the processing of biomass. Even dry fermentation is possible. Its construction ensures optimum, gentle mixing and an even distribution of heat - the prerequisites for a stable fermentation biology. This prevents unwanted floating and sinking layers. At the same time, the position of the shovel-like agitator paddles on the heated shaft ensures the slow, continuous transportation of the fermenting substrate. Designed for loads of about 30,000 Nm, this process demands high performance from the gear units. For this a hollow shaft version of the SK 9382 is installed. Because of this, it was easy for the Schwandorf company to heat the shaft through the gear unit. "We operate the fermentation at over 40 degrees and provide the micro-organisms with optimum conditions for the best possible production of bio-gas", explains engineer Norbert Hutzler.





Pit-storage fermenter with large-blade agitator

Main drive:  
Geared motor with hollow shaft



# Sustainable energy in the pipeline

In comparison with other important types of sustainable energy such as electricity generated by solar energy, bio-gas has the advantage that it can be stored easily and cheaply. As necessary, it can later be converted to electricity and heat in combined heat and power stations (CHPs). In the future, bio-gas will increasingly be able to be fed directly into the gas network. In Pliening, to the east of Munich (Ebersberg Rural District), construction of one of the first bio-gas plants of this type was completed about two years ago. With an annual processing capacity of about 3.9 million Nm<sup>3</sup> (standard cubic metres) of bio-methane, the Pliening plant is the largest in Bavaria

and one of the largest in Germany. The bio-methane plant has an energy input capacity of about 40 million kWh, which roughly corresponds to the annual consumption of natural gas by about 1,300 four-person households. With the bio-methane, which is fed directly into the natural gas network of the Munich utility company, E.ON Bayern operates two combined heat and power stations (CHP) in Poing and Puchheim. These generate electricity and input the waste heat which is produced into a district heating network.

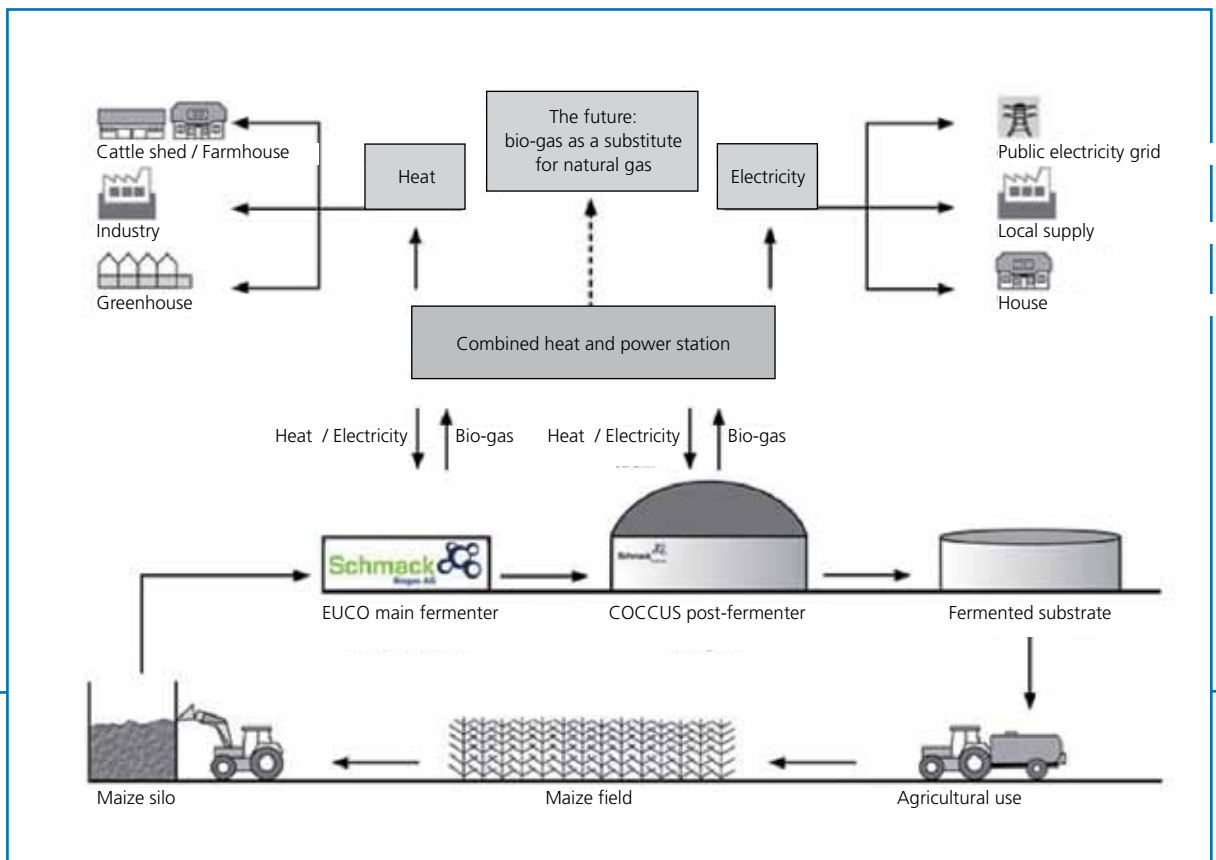


Diagram of the bio-gas plant From field to energy



## Schmack Biogas GmbH Company background

Together with BIOFerm GmbH, Schmack Biogas GmbH is the biogas specialist in the Viessmann group and one of Germany's leading suppliers of bio-gas plants. With our innovative technologies, we make an active contribution to CO<sub>2</sub>-neutral energy production. The company was founded in 1995 and has been a member of the Viessmann group since January 2010. It now provides services in the business areas of planning and construction as well as service and operation and is therefore one of the few complete suppliers in the sector. In addition to technical support, we focus on providing a comprehensive microbiological service.



## Getriebebau NORD Company background

NORD develops, produces and sells drive technologies, and is one of the international leaders in the industry. In addition to standard drives, NORD supplies application-specific concepts and solutions, even for special applications, for example with energy-saving drives or explosion-protected systems. NORD produces a wide variety of drive units for torques from 10 Nm to 200,000 Nm, electric motors with powers from 0.12 kW to 200 kW as well as the necessary power electronics in the form of frequency inverters and servo controllers. The company, which was founded in 1965, recently achieved a turnover of around 330 million Euro. At present it has over 35 subsidiaries around the world. The closely meshed sales and service network ensures optimum availability for short delivery times and customer-oriented services.

NORD Drivesystems | Always close to you



[www.nord.com/locator](http://www.nord.com/locator)

**Headquarters:**

Getriebebau NORD GmbH & Co. KG  
Rudolf-Diesel-Strasse 1  
D - 22941 Bargteheide  
Tel.: +49 (0) 4532 / 401 -0  
Fax +49 (0) 4532 / 401 -253  
info@nord.com  
www.nord.com

  
**DRIVESYSTEMS**