

## Local energy production from biowaste



## Biogas in general



# The BIOFerm system creates biogas from organic waste

30 to 40 per cent of the volume of residential waste in Germany is organic waste. The nationwide collection of biowaste offers enormous potential. This waste can be converted to energy in biogas plants at minimal cost.

The largest as yet untapped potential lies in the field of biowaste and landscape conservation material. These elements have so far been to a large extent composted or sent unsorted to landfill sites instead of being used to generate energy.

## Waste is a resource – as part of the economic cycle

BIOFerm offers a comprehensive range of dry fermentation services. Clients have a single point of contact for the entire project execution. BIOferm provides all services from a single source, from the initial planning and consultation through to project implementation and commissioning. With sites in Germany and abroad, we can also realise international projects in the closest proximity to our customers.

BIOFerm technology enables the generation of primary energy from organic waste material: environmentally friendly, regenerative and CO<sub>2</sub> neutral. Only the most rudimentary demands are made on the source material.



Filling the digester: the patented process yields high grade biogas

The system is suitable for:

- Local authorities:  
Biowaste, green waste from gardens and parks and material from landscape conservation
- Restaurants or canteens:  
Food waste
- Food trade and industry:  
expired goods from the retail food trade and residues from food production

The fermentation residue in liquid form is used directly for agricultural purposes or can be turned into high grade organic fertiliser or compost. Composts and digestates supply basic plant nutrition while at the same time improving the humus balance of our soil.

## Biogas is regional and can be stored

The fermentation of biowaste and domestic raw materials has a positive long-term impact on the handling of fossil fuels. Short transport distances and independence from expensive energy imports also have a part to play here.

Biogas is an energy source that can be stored, enabling it to be used flexibly where and when it is required. Last but not least, the construction of biogas plants creates jobs in rural areas with poor infrastructure.

Top:

The Hitzacker biogas plant with a decentralised CHP/Vitoplex unit supplies consumers (hospital, retirement home, etc.) via a near-field heat distribution network.

Bottom:

The first dry fermentation plant in the USA, University of Wisconsin, Oshkosh – year-round electricity and heating on the university campus



# BIOFerm process – modern waste treatment

Dry fermentation for stackable, organic solids



- 1 Mixing hall with compost boxes and digesters
- 2 Exhaust system with biofilter
- 3 Gas dome
- 4 Substrate storage
- 5 Percolate storage tank
- 6 Composting

Schmack Biogas offers the BIOFerm dry fermentation technology in its portfolio for non-pumpable feedstock. The demands made on the source material are extremely low.

The process is ideal for stackable, organic solids, such as biowaste, green matter and solid manure containing up to 60 per cent dry matter content. Common features of industrial or municipal biowaste include:

- high proportion of impurities (plastic, wood, metal etc.)
- high dry matter content
- heterogeneous substrate composition
- not always separated in advance
- seasonal variations in composition

Different feedstock characteristics place different demands on the plant technology. The system is tolerant of

impurities, eliminating the need for sorting or pre-treatment of the biomass.

In dry fermentation plants, the fermentation process is divided into individual digesters (garage digesters), where the biomass is fermented anaerobically. The BIOFerm system ensures constantly high gas yields with a methane proportion up to 60 per cent. The modular structure provides greater security of supply and therefore a higher overall process stability.

The integration of BIOFerm in Schmack Biogas makes it possible to offer a complete range of dry fermentation services. From the initial consultation regarding economic feasibility and overall concept design through to project implementation and commissioning, we do everything for you.

## High plant security

The technologies and processes used in the BIOFerm system have been tried and tested worldwide. All plants are TÜV-approved, can be extended on a modular basis and meet the highest requirements in terms of operational reliability.

Top:  
Bio exhaust system on the digesters,  
Gas tank COCCUS in background

Bottom:  
Hellabrunn Zoo, Munich:  
Fermentation of zoo waste to create biogas

## Biowaste fermentation technology

### Recycling waste – the BIOFerm system



Dry fermentation: ideally suited for organic and green waste



The majority of the plant and measurement technology is located in the technical area.

The BIOFerm system works on a batch process, which means that the digesters are periodically emptied and then refilled. In the reception hall a wheeled loader mixes the stackable fresh material with the previously fermented material (a process also known as "seeding") and feeds it into the garage-shaped digesters. After approx. four weeks the digester is completely emptied and refilled with a seeded mixture.

#### Accelerated fermentation process

Seeding the fresh mass speeds up the decomposition process, which greatly accelerates gas production. The fermentation of the material takes place in a closed system with no oxygen (anaerobic). During this process, liquid forms as a so-called percolate. A sprinkler system feeds the percolate through the contents of the digester on a continuous basis. The conversion of the organic mass to biogas happens partly in the digesters, and partly in a separate percolate storage tank.

#### Technically advanced systems

As the digester heats up, it creates an optimal temperature for bacteria of approx. 40°C. An additional heat input comes from sprinkling the percolate. The retention time per digester is about 28 days, depending on the input material properties. The resulting biogas is collected in a membrane gas tank, which leads off the percolate tank as a double membrane roof (COCCUS system). There the biogas is desulphurised by the addition of oxygen and then sent to the biogas consumer for use.

Certain atmospheric conditions must prevail within the garage fermenter for it to be opened. To that end, the digester is flushed with fresh air and the resulting waste air (known as lean gas) is tested using a so-called lean gas flare.

All the waste air from the biogas plant (mixing hall, waste air from the digester) is channelled through a biofilter system to clean it.

With the exception of the loading and emptying of the digester using a wheeled loader, the entire plant is automatically controlled and regulated using a programmable logic controller (PLC). Any faults are detected at an early stage by the controller, which records the problem and reports it to the operator via phone, fax or SMS.

# Economic benefits from tried and tested technology

## Greater returns with robust and reliable components

Dry fermentation technology is constantly evolving in terms of efficiency, ease of maintenance and economic viability. A great many tried and tested components from the Schmack wet fermentation system were transferred to the BIOFerm system as a result.

### Technical adaptation

- Garage digester roof structure
- Optimised drainage system
- Percolate tank as round fermenter with double membrane roof
- External gas storage

### Optimised roof structure

The digester's roof has no housing, following the design of the Schmack EUCO high performance digester. Only the front three metres of the digester are covered to form a technical area, which houses the majority of the plant and measurement technology.

### Comprehensive drainage

The optimised drainage system absorbs the percolate and draws it away from the digester in a controlled manner through a header pipe. The header pipe of each digester is frost proof and leads to the drainage shaft.

### Percolate storage tank with double membrane roof

The percolate storage tank is designed as a round COCCUS-type digester with a double membrane roof (as used for gas storage tanks). The biogas from the individual digesters is drawn off to a gas dome, which has built-in overpressure and underpressure safety valves, and then fed to the gas tank via a gas header pipe. The biogas is desulphurised to the desired  $H_2S$  value through the internal wooden roof structure.

### Substrate barrier and digester gate

The gas dome is not our only in-house development: we have also designed the substrate barrier and the digester gate. Their key features are secure operation and high stability.

Substrate barrier – simple and robust:

- The barrier is locked and unlocked by the wheeled loader
- Made of wood on a stainless steel frame
- Additional floor support

Gate system – innovative technology:

- Welded stainless steel construction
- Decoupled from concrete structure to make it an independent component
- Operated from a central locking unit
- Redundant seal system, charged and monitored with compressed air



Digester gate with substrate barrier

## Flexible substance handling thanks to combined technology

**Integrating different biogas technologies enables the maximum exploitation of all source materials**

In conventional biowaste fermentation, the source substrate is extremely heterogeneous. Furthermore, the material input varies according to the season. The expected gas yields from biowaste are therefore highly variable.

### **Hybrid system: Tried and tested technology, new process benefits**

Since not all biogenic residues are suitable for dry fermentation, they have to be used in so-called hybrid systems (combined wet and dry fermentation). The combination of these two tried and tested technologies means that the best use can be made of a wide range of source materials with different levels of impurity and different dry matter content. The various input materials are sent to the most efficient fermentation type in each case. These are two separate systems with different feedstock and procedures. Intersection points for both systems include gas collection, heating distribution and gas treatment.

The benefits of the hybrid system

- Most efficient use of input materials
- Balancing out of seasonal variations compared to dry fermentation alone
- Synergies in processing/ electricity generation technology
- Joint heat utilisation

The combination of the individual value added stages (dry and wet fermentation) produces the most efficient exploitation of heterogeneous source material.



Stausebach biogas plant

# Technical and biological service to secure maximum yields

**Our responsibility: maximum availability for your plant**

Even after the biogas plant has been built, BIOFerm customers can rely on a comprehensive technical and biological service. With the Schmack service concept, our customers secure the operational reliability of their plant and keep their performance at a permanently high level.

## **Technical service: Professional and fast**

For us, customer service begins long before any component wears or needs replacement – through qualified advice, preventative maintenance and appropriate planning by our in-house customer service team. Our service engineers safeguard the function of your biogas plant through predictive spare parts logistics and a highly efficient customer service team.

## **Laboratory service**

Apart from safe, reliable plant technology, another factor exerts a decisive influence on the viability of a biogas plant: a stable fermentation process. Our biological service takes care of monitoring and supporting biogas plants from commissioning onwards.

## **Complete operational management**

As an investor you want to keep the costs of your biogas plant as low as possible. That's no problem. Our all-round service offers complete operational management. We supervise the biological and technical maintenance, including remote monitoring. This includes all the other services that are required for the operation of the plant, from staff and raw material management to maintenance measures.

## **Reliability**

Remote monitoring round-the-clock from our EUVIS control centre reduces downtimes to a minimum. The minimisation of downtimes and the elimination of time-consuming service calls lead to continuous and reliable

plant operation. The high security standards during construction and operation protect people, the environment and, naturally, the plant itself.

## **Consulting: We are the feed consultants for your biogas plant**

Scientific experts determine, in our own laboratory, the quality of the matter to be used and check the fermentation contents by means of process-specific parameters. The results form the basis for individual advice and feed recommendations to maintain and/or improve the capacity of your plant.

We also train our customers on an individual basis and tailor the training to the specific plant to enable optimum and economical operation.

The in-house laboratory of Schmack Biogas Service GmbH is accredited to DIN EN ISO/IEC 17025:2005.

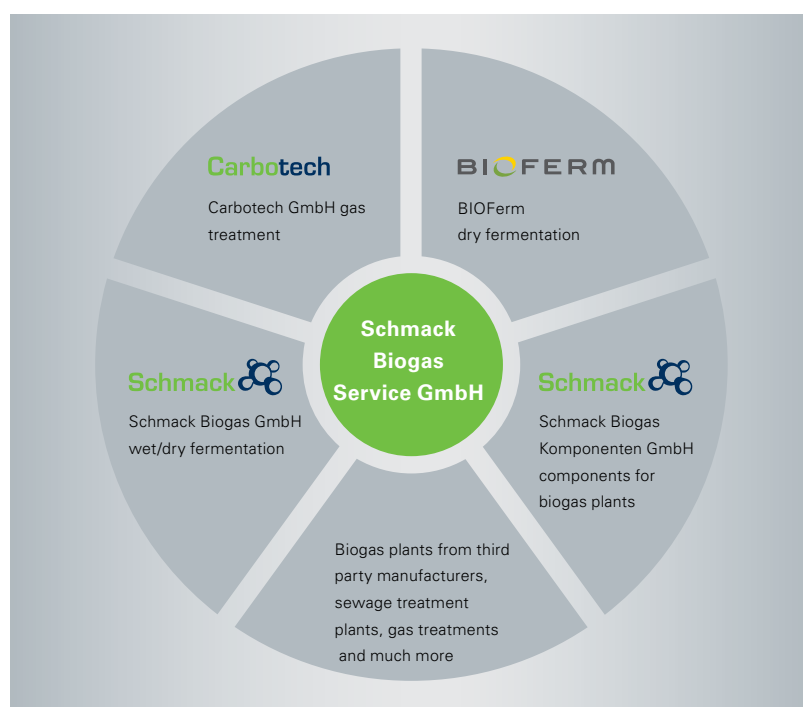


Accreditation of the laboratory at Schmack Biogas Service GmbH



Laboratory at Schmack Biogas Service GmbH

All-round service –  
not just for their own plants



## BIOFerm biogas plants— Full output in constant use

Their good performance makes our biogas plants stand out year after year.  
They operate with great reliability, whatever their size or system design.



### **Sogliano Ambiente (Italy)**

Installed output: 1 MW (electrical)

Throughput p. a.:

40000 t biowaste and household refuse

Number of digesters: 11

Digester size: 30 x 7 x 5 m

(Length x Width x Height)

Construction started: July 2011

Commissioning: February 2013



### **Viessmann Biomasse KG (Germany)**

Installed output: 190 kW (electrical)

Throughput p. a.:

4500 t (landscape conservation material)

Number of digesters: 4

Digester size:

20 x 7 x 4.50 m

(Length x Width x Height)

Construction started: September 2009

Commissioning : August 2010

### Fife (Scotland)

Installed output: 1.8 MW (electrical)  
 Throughput p.a.: 40000 t biowaste (brown bins) and 3000 t food waste  
 Number of digesters: 14  
 Digester size: 30 x 7 x 5 m  
 (Length x Width x Height)  
 Construction started: February 2012  
 Commissioning: July 2013



### Stausebach (Germany)

Installed output: 4 MW<sub>Gas</sub>  
 Throughput p.a.: 30000 t/a biowaste and 15000 t/a Energy crops (combi-plant)  
 Number of digesters: 8  
 Digester size: 35 x 6.75 x 5 m  
 (Length x Width x Height)  
 Construction started: May 2013  
 Commissioning: August 2014



## A comprehensive product range from the Viessmann Group



Oil boilers  
up to 116 MW heat or  
up to 120 t/h steam



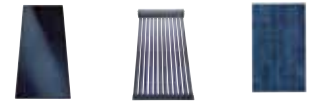
Gas boilers  
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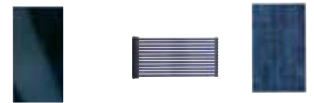
Solar thermal and  
photovoltaic



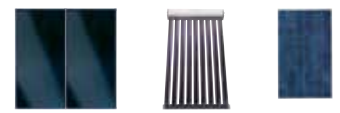
Residential buildings



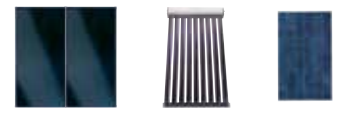
Commerce



Industry



Local authorities



## Individual solutions with efficient systems

The comprehensive range of products and services from Viessmann offers individual solutions with efficient systems for all fuel types and application areas. As one of the world's leading manufacturers, Viessmann offers intelligent, convenient and efficient systems for heating, cooling and decentralised power generation. Viessmann products and systems are synonymous with the very highest levels of efficiency and reliability.

Our comprehensive product range offers top technology and sets new benchmarks. By focusing on using energy efficiently, we can help cut costs, protect natural resources and the environment.

### Everything from a single source

You will find the right product and system for all your needs in the Viessmann range. Whether it's a wall mounted or floorstanding solution, for use in homes, businesses, industry or local authorities. Whether for modernisation or new build, Viessmann is always the right partner for providing heating, steam, power and cooling.

The wide ranging expertise we have at our disposal in the Group enables us to always offer the perfect system. Our product portfolio is rounded off with a full range of services.



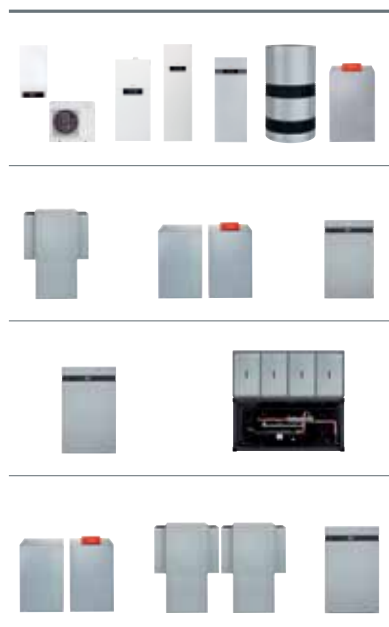
Wood combustion technology,  
CHP and biogas production  
up to 50 MW



Heat pumps for brine,  
water and air  
up to 2 MW

Accessories

Refrigeration technology



The comprehensive range of products and services from Viessmann offers individual system solutions for the generation of heating, cooling, steam and power.

### The complete product range for all energy sources and output ranges

- Boilers for oil or gas up to 116 MW heat or 120 t/h steam
- Combined heat and power generation up to 50 MW<sub>el</sub>
- Heat pumps up to 2 MW
- Wood combustion technology up to 50 MW
- Biogas production plants from 50 kW<sub>el</sub> to 20 MW<sub>gas</sub>
- Biogas upgrading plants up to 3000 m<sup>3</sup>/h
- Solar thermal systems
- Photovoltaics
- Accessories
- Refrigeration technology

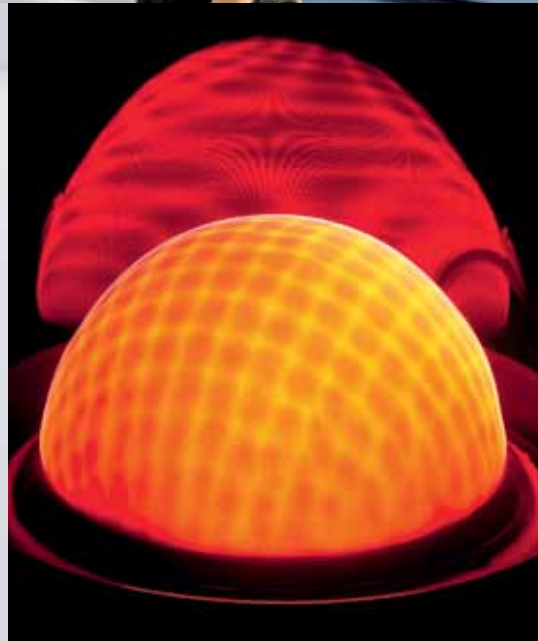
### Maintenance and service

Whether for commissioning, maintenance or service – our trade partners can always count on the Viessmann Group for professional support. Our online tools also offer valuable tips, and spare parts can be delivered the next morning if necessary.

### Training

The Viessmann Academy offers extensive knowledge in commercial seminars and technical training sessions. The continuing training that our trade partners receive ensures our mutual success.

## The company



## Viessmann – climate of innovation

Viessmann is one of the world's leading manufacturers of intelligent, convenient and efficient systems for heating, cooling and decentralised power generation.

As a third generation family run business, Viessmann has been supplying highly efficient and clean heating systems for many decades.

### A strong brand creates trust

Together with our brand label, our key brand message is an identifying feature throughout the world. "Climate of innovation" is a promise on three levels: It is a commitment to a culture of innovation. It is also a promise of enhanced product benefits and, at the same time, an obligation to protect the environment.

### Acting in a sustainable manner

For Viessmann, taking responsibility signifies a commitment to acting sustainably.

This means to harmonise ecology, economy and social responsibility so that the needs of

today are met without compromising the quality of life of future generations.

We consider climate protection, environmental responsibility and resource efficiency to be key priorities throughout our company, which has more than 11,400 employees worldwide.

### Example of Best Practice

With its strategic "Efficiency Plus" sustainability project, Viessmann demonstrates at its own head office in Allendorf (Eder) that the energy and climate policy goals set for 2050 can in fact be achieved today with commercially available technology. The results speak for themselves:

- Expansion of renewables to 60 percent
- CO<sub>2</sub> emissions reduced by 80 per cent

The long-term goal is for the company to sustainably meet all of its own heating energy requirements.



2009/2011/2013:  
German Sustainability Award  
for Production/Brand/Resource  
Efficiency



Energy Efficiency Award 2010

### Viessmann Group

#### Company details

- Established in: 1917
- Employees: 11,400
- Group turnover: 2.1 billion euros
- Export share: 55 percent
- 27 production companies in 11 countries
- 74 countries with sales companies and representation
- 120 sales offices worldwide

#### The comprehensive product range from the Viessmann Group for all energy sources and output ranges

- Boilers for oil or gas
- Combined heat and power units
- Heat pumps
- Wood combustion technology
- Biogas production plants
- Biogas upgrading plants
- Solar thermal systems
- Photovoltaics
- Accessories
- Refrigeration technology

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