

Comprehensive supplier of biogas technologies





## Biogas in general





# Biogas – a natural source of energy

Schmack Biogas – sustainable energy for a future worth living

A significant rise in global population, combined with the rapid development of industrialisation worldwide, has resulted in a substantial increase in energy consumption, consumption that is largely based on fossil fuel. As a result, large amounts of carbon dioxide now enter the Earth's atmosphere resulting in substantial, long term damage to our climate and environment.

Today, Germany is up to 70 percent dependent for its energy supply on imports of oil, gas, coal and uranium. World-wide, fossil fuel is becoming ever more scarce and expensive. The question of how to secure an affordable energy supply has now become a central political issue around the world.

Given our concerns regarding climate change, we need a fundamental review; energy politics must take a lead and positively demonstrate how it is possible to consistently develop CO<sub>2</sub> neutral forms of energy.

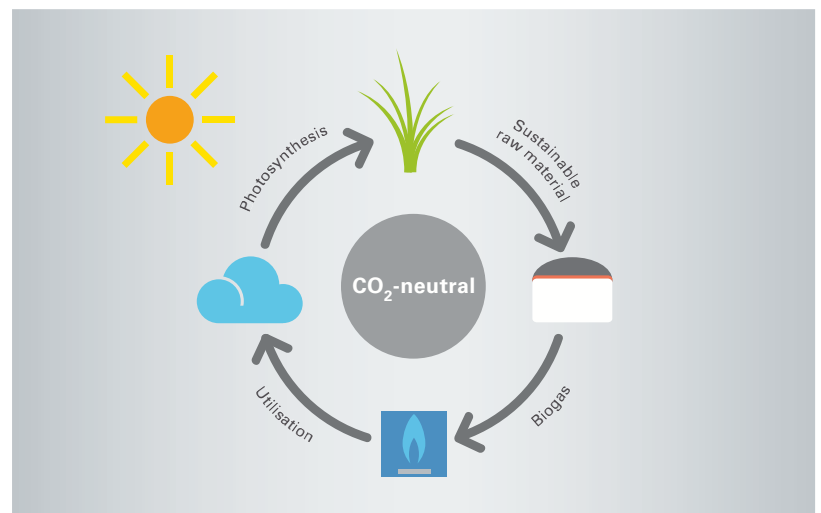
## Biogas provides lasting environmental protection

Biogas is one of the key renewable sources of energy next to solar and wind. After all, biogas can be produced in a particularly environmentally responsible and CO<sub>2</sub> neutral way from sustainable raw and energy-rich waste materials that are available at a regional level. Biogas utilises the natural energy present in organic matter.

### The major benefits of biogas are:

- It supplies power, heat, cooling and gas in one
- It is available all year round – 24/7 – and can be stored
- It is independent of the weather and can, therefore, be made available on demand
- Processed biogas can be used in all vehicles converted to natural gas without problems, and it can be filled in tanks and transported in bottles or pipelines

When it comes to the potential of renewables, biogas is right out in front. According to a UN report, biomass and combined heat and power generation are reckoned to be amongst the key technologies in the endeavour to control climate change.



When burning biogas, only as much CO<sub>2</sub> is released as was absorbed during the growing phase of the plants.

## Biogas in general



# From biomass to biogas

## How is biogas produced?

Biogas plants predominantly process energy-rich vegetation, such as grass silage, maize and sugar beet, as well as solid manure and slurry. In addition, organic residues, such as lawn cuttings, food leftovers or by-products from the food processing industry can be fermented.

Biomass is broken down by special bacteria under the exclusion of oxygen. In this process, approximately two thirds of the total amount of gas produced by the bacteria is methane; carbon dioxide, nitrogen and a small number of other gases are also produced.

The methane can be used as fuel in CHP modules, where it generates power and heat. If the biogas is scrubbed, it can also be fed into the gas mains to supply decentralised CHP modules with biogas. One cubic meter of methane contains a calorific value of 10 kWh. The fermented plant residues can be reused in agriculture as a high grade fertiliser.



Biomass turns into energy.

- 1 Fermenting materials (such as, for example, sustainable raw materials, slurry, solid manure and biowaste)
- 2 Silos for storage
- 3 Digester
- 4 Residual digestion store/ Discharge as fertiliser
- 5 Gas treatment
- 6 Combined heat and power units (CHP)



System solutions/  
Products



## Schmack Biogas – everything from a single source

An investment in a biogas plant is a positive decision for the future.  
A future that demands security of supply.

Our core business concerns the development and construction of plants for the production and economic use of biogas. We are not only one of the leading suppliers of biogas plants in Germany, but also one of the few comprehensive suppliers in our sector. Next to building systems, we also offer services covering engineering and development, as well as service and system management.

Biogas systems will only operate efficiently and economically if their system technology and microbiology are perfectly matched. Consequently, we follow the maxim „Everything from a single source“. To safeguard a high level of plant availability, our customers are supported by a competent team of specialists, covering planning, permits, process technology, biology and system construction.

The conversion of biogenous waste matter into biogas has become an important subject internationally. In many countries, the necessary political conditions and terms for subsidies are currently being created as a basis for the development of the biogas market. In future, we will concentrate even more on selected export markets, although Germany will continue to be our most important core market.

In Italy, Schmack Biogas S.r.l. in Bolzano has been representing our interests since 2006. In the 1 megawatt segment, we are the market leaders. Benetton, amongst others, is happy to rely on our technology. Apart from Italy, other markets that are particularly attractive to us include Great Britain, the Benelux countries, the Czech Republic, Slovakia, as well as Poland and Croatia.

### Our services around biogas

- Engineering and planning
- Plant construction and commissioning
- Service and operational management
- Biogas treatment and feed into the natural gas mains
- Services covering technical and micro-biological aspects
- Components
- Harvest logistics and raw material management

To improve and optimise the entire process chain, every year has seen substantial investment in R & D.

### Awards

Schmack Biogas has received numerous awards for its innovative developments and for its commitment to its sector. These include the German Solar Prize, the Cleantech Award and the Prize for Innovation, awarded by the Initiative Mittelstand.

Schmack Biogas – a member of the  
Viessmann Group

### VIESSMANN Group

- Sales
- Development of the main site
- Engineering and planning
- Plant construction
- Commissioning

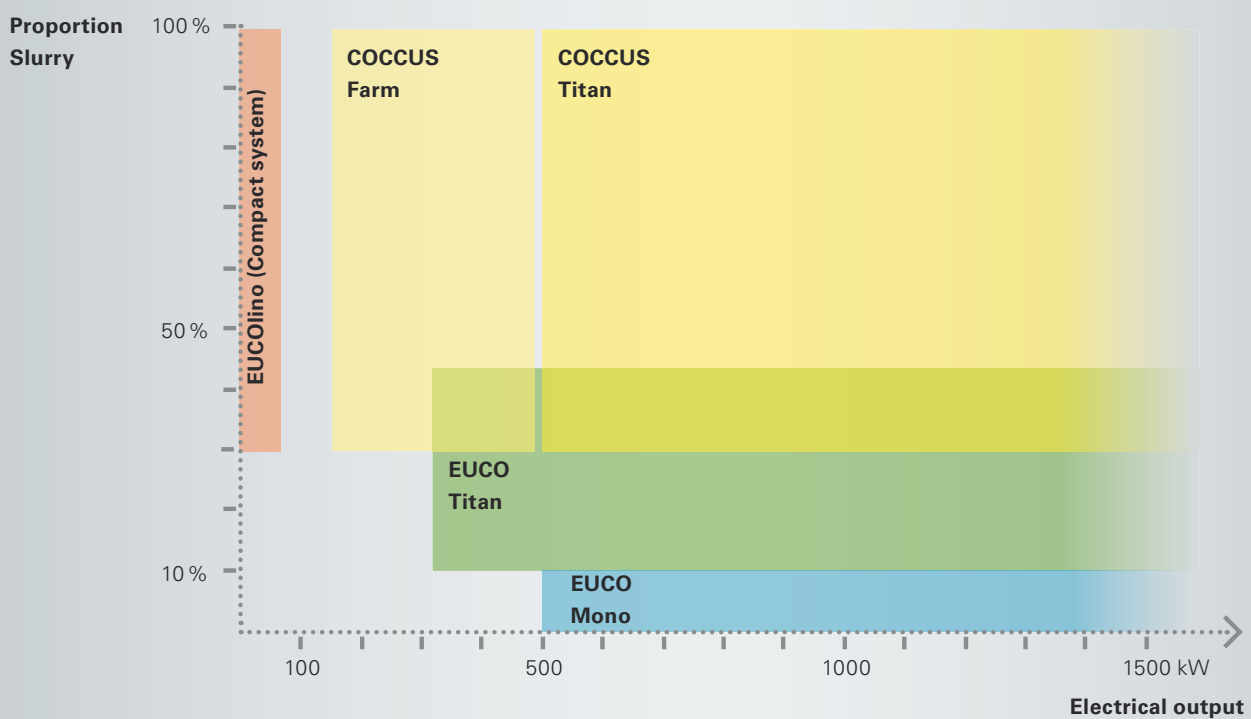
- Operational management
- Technical service
- Biological service
- Raw material management

- Charge technology
- Agitators
- Handling technology
- Digester heaters

- Gas treatment plants



## System solutions/ Products





## Standard plant systems

Plant systems from 185 kW<sub>el</sub> to 20 MW<sub>gas</sub>

Since 1995, Schmack Biogas has been setting benchmarks for highly efficient biogas plants. Our core competence lies with the fermentation of energy plants and agricultural waste products, such as slurry and solid manure. The cornerstone of our efficient biogas plants are our „standard plant systems“. Our broad-based product range covers from 185 kW<sub>el</sub> to 20 MW gas feed-in plants – all in the form of comprehensive systems.

### EUCO® plant system

#### EUCO® Titan

The EUCO® Titan plant system has experienced on-going development since the company's formation and has been optimised specifically for the fermentation of sustainable raw materials. Its high level of efficiency makes it attractive, not only to agricultural enterprises, but also to investors, energy suppliers and city departments of works, all of whom bank on this leading technology.

#### EUCO® MONO

The EUCO® Mono plant system was specifically developed to ferment substances with a high proportion of dry matter such as grass, maize and solid manure, for example. It is distinguished by its particularly compact design. Contrary to all other plant systems, no circular digester is used; instead a „horizontal“ digester (plug-flow digester) is employed.

### COCCUS® plant system

#### COCCUS® Titan

As a minimum, the COCCUS® Titan plant system comprises a classic circular digester. It is primarily recommended for large industrial plants, predominantly where substances with a low proportion of dry matter are fermented.

#### COCCUS® Farm

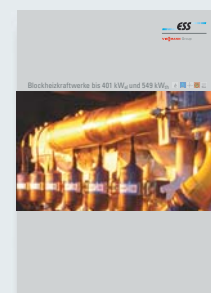
The Renewable Energy Sources Act (EEG), updated in 2009, encourages the construction of smaller biogas plants in the agricultural sector that utilise a minimum proportion of slurry as a fermentation substance. This prompted Schmack Biogas to develop the small COCCUS® Farm system. High industrial standards, usually applied by Schmack to larger system builds, were brought to bear in the development and realisation of this smaller system. The COCCUS® Farm plant system is the right choice where material of low energy density and low proportion of dry matter is usually available such as, for example, beef and pig slurry.

### Our advice

Combined heat and power units (CHP) are ideal for operating with biogas. For detailed information regarding CHP modules from ESS, the CHP expert in the Viessmann Group, see the brochure „Combined heat and power modules up to 401 kW<sub>el</sub> and 549 kW<sub>th</sub>“.

For further information see also

[www.viessmann.com](http://www.viessmann.com)



Top Fig.:  
EUCO® Titan plant system

Bottom Fig.:  
Schematic diagram – may vary depending on the fermented substance







## Standard plant systems

Plant systems from 185 kW<sub>el</sub> to 20 MW<sub>gas</sub>

### AIO

#### All-in-one container

All technical modules required for control and performance are housed inside the so-called „All-in-one container“ (AIO). This control container is pre-assembled at the factory, tested in all its safety aspects and is delivered ready for use. The standard modular design of the plant creates perfectly matched interfaces.

#### BIOWATCH management system

BIOWATCH is an integral scalable management system that takes care of all measuring, controlling and management functions. It is equipped with a control and monitoring unit for the efficient automation, supervision and operation of the biogas plant. Both the Visu L and the Visu XL options include an operator's log that automatically documents all statutory aspects concerning verifiability requirements.

#### Plant system benefits

- Low inherent power consumption and heat demand
- Industrial standard, even for the agricultural sector
- Demanding safety concept (TÜV approbation [Germany], CE declaration of conformity)
- Compact plant dimensions
- Efficient, well developed and reliable plant components

All operational units are perfectly matched. The uniform charging of the most diverse fermentation materials, robust agitator technology, extensive measuring and control systems, all combined with professional control technology ensure reliable plant operation and a stable fermentation process. The modular concept enables an upgrade to a higher performance level at any time.



All-in-one container



BIOWATCH management system



PASCO® 80 charger technology for solid matter

COCCUS® inside view: REMEX® agitators



## High grade components developed in-house

Our long experience in building and operating biogas plants enables us to readily identify the critical success factors of an efficient plant. This germinated the idea and identified the need to develop and build key components in-house.

Schmack Biogas not only offers turn-key plants, but also individual components. For farmers who have planned their system on their own initiative or who want to replace a previous investment and don't want to miss out on high quality, we can supply the most important key components individually. These components stand out through their high grade, robust and durable materials that enable operators to enjoy a smooth and low maintenance plant operation for many years to come.

### **PASCO® charger technology for solid matter**

The PASCO® charger technology for solid matter is part of our product range. This charger system is able to process large amounts of solid manure and grass without problem and without consuming much power. The flexibility of this charger technology is remarkable: Many combinations can be accommodated, from 14 to 80 m<sup>3</sup> of all imaginable raw materials, including the most versatile discharge and handling technologies (moving floor, screw conveyor system, high level handling, delivery through the ceiling and soon, even feeding below fill level). Currently, the first plants are being equipped with concrete charger systems.

### **REMEX® agitator**

The REMEX® agitator, with its large blades, is ideally suited to the uniform mixing of fermentation matter and slurry inside the digester of the biogas plant. This continual mixing, which is kind to the hard-working bacteria, safeguards an optimum mixing of materials even with high viscosities through the low and constant agitation, thereby ensuring the highest possible biogas yield.

Compared to conventional paddle agitators, the REMEX® agitator stands out through its solid, low maintenance and trouble-free design and its extremely low power consumption. The flow-optimised paddle position enables a horizontal and vertical mixing of the matter, and simultaneously and reliably prevents the formation of floating or sinking layers. During operation, the agitator can be set to an optimum speed and minimum power consumption by the plant control system. The drive unit lies outside the digester, making it freely accessible at all times.

In-house manufacture of high grade components







## Schmack Biogas Service – this service covers all technical and biological aspects to safeguard maximum yields

We take care of ensuring that the intended output is always available at peak level at all of the plants that we look after.

Even after their biogas plant has been completed, Schmack Biogas customers can rely on an extensive range of services covering all technical and biological aspects.

With the elements that comprise the Schmack Service Concept, our customers safeguard the operational availability of their plant and keep it at peak performance.

### Technical service: Competent 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 department. Our service engineers, who of course have the use of company service vehicles, safeguard the function of your biogas plant through appropriate spare parts logistics.

### Laboratory service:

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

### Consultation: 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.

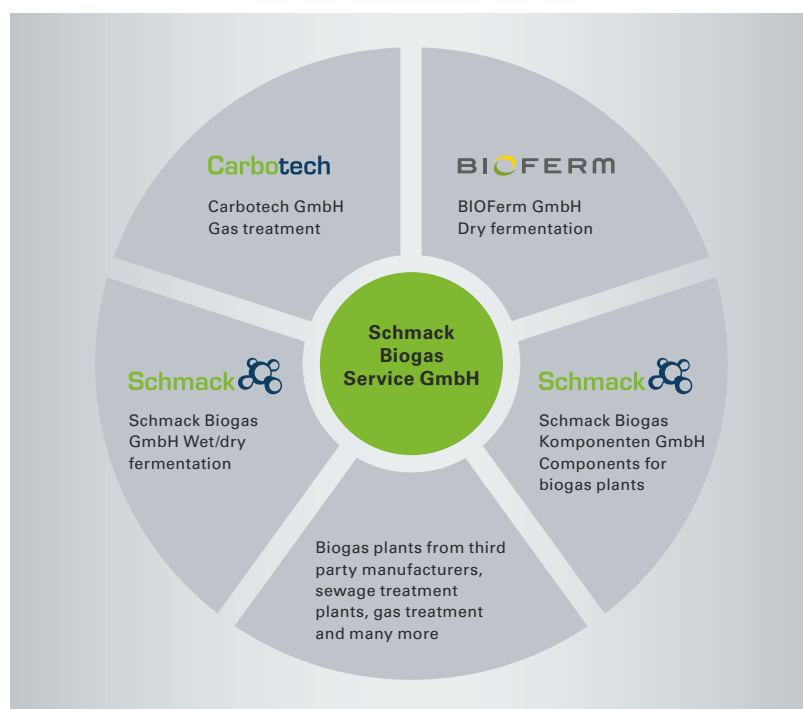
We also train our customers on an individual basis and tailor the training to the specific plant to enable optimum and economical operation.

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



Accreditation of the laboratory of Schmack Biogas Service GmbH

All-round service – not just for our system



Quality and  
Viability



Our specialists ensure a perfect result



## Expertise in biogas

The actual hours run under full load each year is the crucial dimension for checking the viability of a biogas plant.

Schmack Biogas is committed to standard plant technology and extensive process-biological know-how. Many years of experience in both sectors enable the company to guarantee above average utilisation to both investors and operators.

### Wide-ranging services

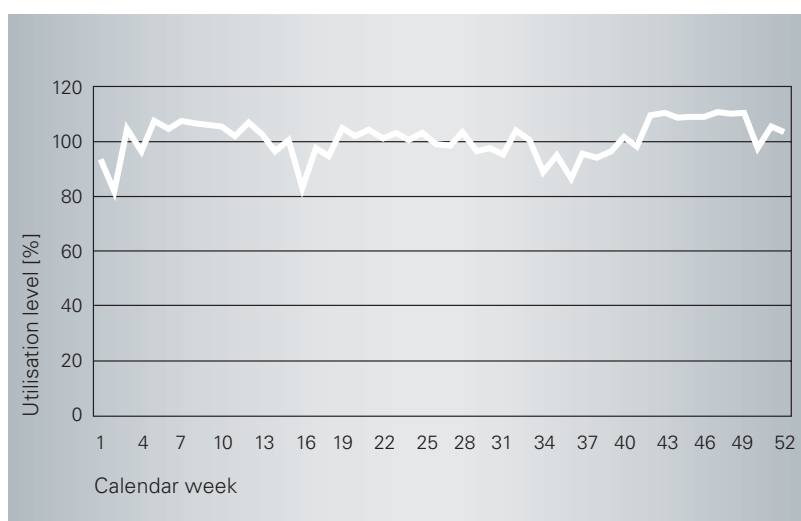
Those deciding in favour of Schmack Biogas can rely on professional support, right from the first consultation. Planning, obtaining permissions and the complete build are taken in hand by Schmack. As soon as the test run (for which an output certificate is issued) has been completed after commissioning, a further output commitment will be given. This assures you that your biogas plant will operate at a constantly high output level.

### Reliability

With round the clock supervision through the EUVIS control centre, downtime of supported plants can be reduced to a minimum. Prevention of idle times through scheduled and specific service and maintenance deployments result in a constant and reliable plant operation. The high standard of safety applied during construction and operation protects the plant as well as its operators and the environment.

### Benefits at a glance

- Professional support covering all technical and biological aspects
- Continuous supervision for reliable and profitable plant operation
- Assured output to safeguard your investment
- Minimised operating costs



Utilisation curve of a Schmack biogas plant

## Schmack Biogas plants

From agricultural yard installations to industrial gas feed-in plants.



**Biogas plant Fischbach**  
**COCCUS® Farm 185**  
**Agricultural plant**

- Installed electrical output: 185 kW
- Fermentation matter: Beef slurry, grass silage, maize silage, solid pig manure
- Commissioning: December 2009



**Biogas plant Stoke Bardolph**  
**EUCO® Titan 2000**  
**Biogas plant Severn Trent Water Ltd.,**  
**England**

- Installed electrical output:  $2 \times 1063 \text{ kW}_{\text{el}}$
- Fermentation matter: Maize silage, whole plant silage
- Commissioning: May 2010
- Utilisation: The generated electrical and thermal energy is used for a neighbouring sewerage treatment plant operated by Severn Trent Water Ltd. Excess electrical energy is fed into the public grid.



**Biomethane plant, Aiterhofen**  
**EUCO® TITAN 11400G 11,4 MW Gas**  
**Plant for feeding into the natural gas mains**

- Plant size: 4.4 MW<sub>el</sub> or 11,4 MW gas output (net cv)
- Crude biogas processing: 2000 m<sup>3</sup>/h
- Treatment capacity p.a.: approx. 8 M m<sup>3</sup> biomethane of natural gas quality
- Feed-in capacity p.a.: approx. 100 M kWh into the natural gas mains (incl. LPG)
- Owner: E.ON Bioerdgas GmbH
- Utilisation: Marketing the fed-in biomethane by E.ON through the operation of decentralised CHP modules
- Fermentation matter: Whole maize plants and grass silage plus catch crops
- Commissioning: Second half of 2009



**Biomethane plant, Mühlacker**  
**EUCO® TITAN 5.7 MW Gas**  
**Plant for feeding into the natural gas mains**

- Plant size: 2.2 MW<sub>el</sub> or 5.7 MW gas output (net cv)
- Crude biogas processing: 1000 m<sup>3</sup>/h
- Treatment capacity p.a.: approx. 4 M m<sup>3</sup> biomethane of natural gas quality
- Feed-in capacity p.a.: approx. 50 M kWh into the natural gas mains (incl. LPG)
- Owner: Biomethane plant, Mühlacker GmbH & Co. KG
- Utilisation: The treated biogas is fed into the gas mains operated by the Mühlacker city department of works. For this department of works it means that approximately one third of the gas demand is produced by the city's own plant.
- Fermentation matter: Maize, grass, Sudan grass, waste cereals
- Commissioning: December 2009





Pressure Swing Adsorption plant,  
Schwandorf





## Carbotech – market leader in gas treatment and gas feed-in

The treatment and scrubbing of biogas is a key function if biogas is to be fed into the gas mains on an industrial scale, i.e. where it is to substitute imported natural gas.

Processing biogas into biomethane gives it almost the same physical/chemical properties as conventional natural gas, enabling it to be fed into the existing gas mains. It can be stored in the same way as natural gas, transported over great distances and can be converted into other fuels, as required. Consequently, biomethane is available for all conventional types of use such as, for example, in CHP modules for the combined generation of heat and power; in industrial boilers and those in private homes; as raw material for the chemical industry, as well as fuel for motor vehicles. Biogas is a local and environmentally compatible sustainable fuel that offers flexible application and a high utilisation efficiency through the fact that it can be fed into the mains.

### Highest efficiency of energy conversion through combined heat and power generation

One major benefit of feeding in biogas into the gas mains is the separation of biogas production and its utilisation. Biogas is produced where the raw material is available and is used on a decentralised basis where it is required as useful energy, i.e. power and heat, offering high conversion efficiency and low emissions.

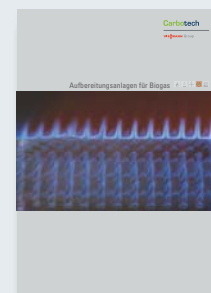
Schmack was the first company in Germany to feed in biogas into the natural gas mains. When it comes to gas treatment, we bank on the technology and the many years of experience of Carbotech. This company is also a member of the Viessmann Group and is a specialist in the technology and processes concerning the treatment, scrubbing and production of technical gases – it is recognised as a pioneer for biogas treatment and mains feed-in. The pressure swing adsorption process (PSA) developed by Carbotech has been used in renowned feed-in projects in Germany and wider Europe for many years; today it represents one of the leading industrial standards for gas treatment.

#### Our advice

Carbotech is a recognised pioneer in biogas treatment in Europe. For further information, see the brochure entitled „Biogas treatment plants“.

For further information see also

**[www.viessmann.com](http://www.viessmann.com)**










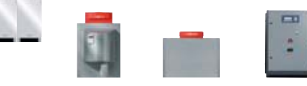











Pressure Swing Adsorption plant,  
Aiterhofen



Conditioning untreated biogas  
Aiterhofen

## The comprehensive Viessmann product range

	 Oil low temperature and condensing technology 13 – 20,000 kW	 Gas low temperature and condensing technology 4 – 20,000 kW	 Solar thermal and photovoltaics
 Detached houses			
 Apartment buildings			
 Commerce / Industry			
 Local heating networks			

## Individual solutions with efficient systems

### The comprehensive Viessmann product range

The comprehensive product range from Viessmann offers individual solutions with efficient systems for all applications and all energy sources. As environmental pioneers, the company has, for decades, been supplying particularly efficient and clean heating systems for oil and gas, as well as solar thermal systems along with heat generators for sustainable fuels and heat pumps.

The comprehensive product range from Viessmann offers top technology and sets new benchmarks. With its high energy efficiency, this range helps to save heating costs and is always the right choice where ecology is concerned.

At Viessmann, protecting the environment and natural resources has already been enshrined in the company's principles.

Viessmann develops and produces innovative heating systems, which demonstrate top quality, energy efficiency and a long service life. Many of these products have become milestones of heating technology.

### Individual and efficient

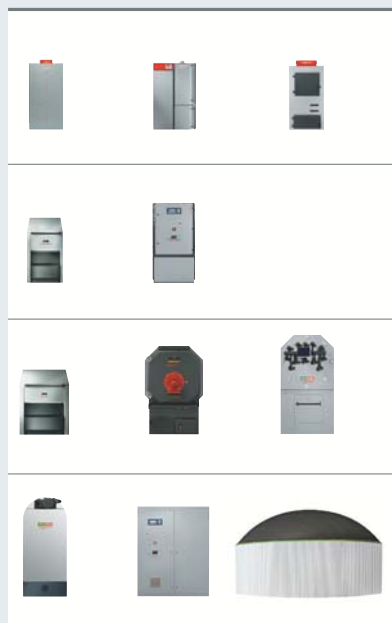
Viessmann offers the right heating system for any demand – wall mounted or floorstanding, in individual combinations – all are futureproof and economical. And whether for detached houses or two-family homes, large residential buildings, commercial/industrial use or for local heating networks; for modernising existing properties or new build – they are always the right choice.





Wood combustion technology,  
CHP and biogas production

4 – 13,000 kW

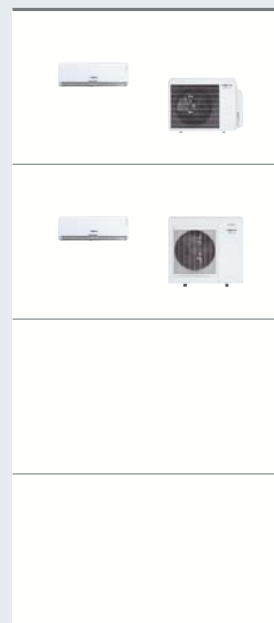


Heat pumps for  
brine, water and air

1.5 – 1500 kW



Air conditioning technology



System components



The comprehensive product range from Viessmann:  
Individual solutions with efficient systems for all energy  
sources and applications

### Key performers

The Viessmann Group sets the technological pace for the heating industry. This is what the Viessmann name represents, and also what the names of the subsidiaries in the Group represent, as they are founded on the same pioneering spirit and power of innovation.

The company offers the following:

- Condensing technology for oil and gas
- Solar thermal systems
- Heat pumps
- Wood combustion systems
- CHP modules
- Biogas plants
- Services

Viessmann is extremely highly specialised in all these market segments, yet at the same time the company has a crucial advantage over specialist suppliers: Viessmann understands heating technology as a systematic whole and offers unbiased advice on technology and fuel type. This guarantees the best solution for every application.

### Viessmann Group

**VIESSMANN**

**KWT**

**KOB**

**MAWERA**

**ESS**

**BIOFERM**

**Schmack**

**Carbotech**

# The comprehensive Viessmann product range



Detached houses



Apartment buildings



Commerce / Industry



Local heating networks



Oil low temperature and  
condensing technology  
13 – 20,000 kW



Architect's own home, Bad Füssing,  
Germany



Residential development Zi Wei  
Garden Xi'an, China



Ameco A380 Hangar Beijing,  
China



European Parliament, Strasbourg,  
France



Gas low temperature and  
condensing technology  
4 – 20,000 kW



Detached house, Kevelaer,  
Germany



„Wohnoase“ residential park in  
Regensburg, Germany



Porsche Leipzig,  
Germany



European Parliament, Brussels,  
Belgium



Solar thermal and  
photovoltaics



Heliotrop Freiburg,  
Germany



HafenCity Hamburg,  
Germany



City of Tomorrow, Malmö,  
Sweden



The Palm Jumeirah,  
Dubai



Wood combustion  
technology,  
CHP and biogas  
production  
4 – 13,000 kW



Detached house, Wiesloch,  
Germany



Hotel Lagorai Cavalese,  
Italy



Congressional Centre, Brunstad,  
Norway



Monastery St. Ottilien,  
Germany



Heat pumps for  
brine, water and air  
1.5 – 1500 kW



Loftcube Regional Garden Show,  
Neu-Ulm, Germany



Studio flats, Brandenburg,  
Germany



University library, Bamberg,  
Germany



Residential estate, Pfäffikon,  
Switzerland

The comprehensive product range from Viessmann: Individual solutions with efficient systems for all energy sources and applications

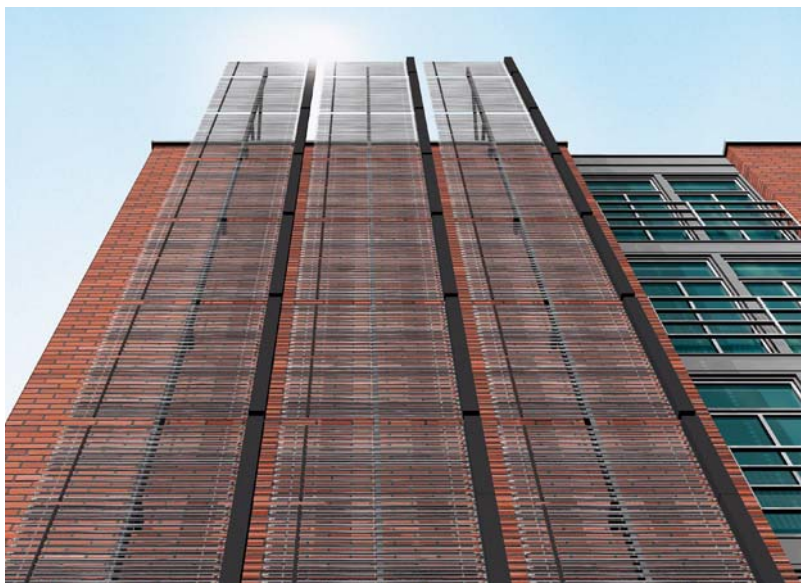


## Futureproof heating technology for all requirements

Energy consumption worldwide has doubled since 1970 and will triple by 2030. The result: The fossil fuels, oil and gas, are dwindling, energy prices are on the rise and excessive CO<sub>2</sub> emissions continue to affect our environment. Energy efficiency is a must if we want our future to be secure.

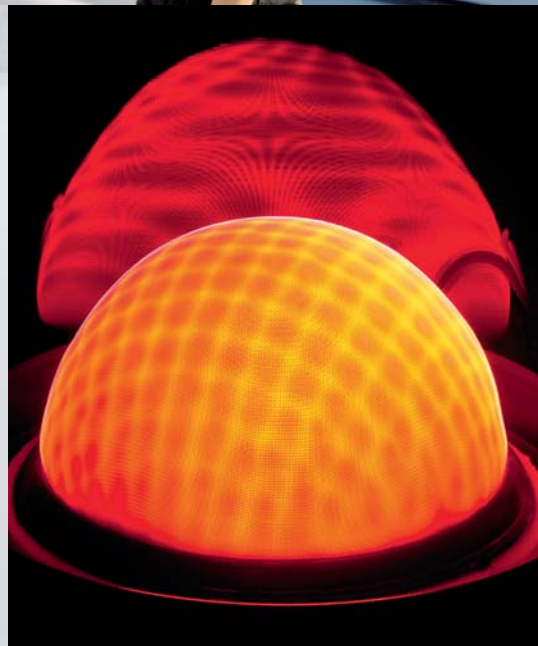
In almost every industrial nation, supplying heat to residential and commercial buildings accounts for the largest share of energy consumption – consequently it also offers the greatest savings potential. Advanced efficient heating systems from Viessmann are in use around the world, not only in many private households, but also in numerous major international projects, where they make a sizeable contribution to the efficient use of energy resources.

In these projects, Viessmann again and again faces up to the most varied challenges to supply efficient heating technology by offering innovative solutions – in historical listed buildings as well as in modern industrial complexes or in the large-scale residential and industrial arena.



City of Tomorrow, Malmö, Sweden

## The company





## Viessmann – climate of innovation

The Viessmann brand promise concisely expresses all that we hope to achieve. It is our key brand message and, together with our brand label, 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 a promise of high product utilisation and, at the same time, an obligation to protect the environment.

### Comprehensive range for all fuel types

Viessmann is one of the leading international manufacturers of heating systems and, with its comprehensive product range, offers individual solutions in the shape of efficient systems for all applications and types of fuel. As an environmental pioneer, the company has been supplying particularly efficient and clean heating systems.

### Acting in a sustainable manner

For Viessmann, to take responsibility, means a commitment to act in a sustainable way. This means bringing ecology, economy and

social aspects into harmony with each other, ensuring that current needs are satisfied without limiting the basis for life for the generations to come. Economic success represents the foundation for our independence as a family business and our commitment to:

- Environmental protection
- Efficiency with resources
- and securing manufacturing sites for the future

This is represented by sustainability project.

### Efficiency Plus

With the sustainability project „Efficiency Plus“ Viessmann shows at its Allendorf site, that the political goals set for 2020 with regard to climate and energy can already be achieved today. The result: Energy efficiency improved by 22 percent; the proportion of renewables extended to 18 percent and CO<sub>2</sub> emissions cut by a third.



Viessmann won the German Sustainability Award 2009 for its commitment to climate protection and efficient use of resources.



For the particularly efficient utilisation of energy through the innovative heat recovery centre at the company's main site in Allendorf/Eder, Viessmann was rewarded with the Energy Efficiency Award 2010.

### Viessmann Werke GmbH & Co. KG

#### Company details

- Established in: 1917
- Employees: 8900
- Group turnover 2009: €1.6 billion
- Export share: 50 percent
- 16 factories in Germany, France, Canada, Poland, Hungary, Austria, Switzerland and China
- Sales organisation in 37 countries
- 120 sales offices worldwide
- 3 service providers

#### Performance spectrum

- Condensing technology for oil and gas
- Solar thermal systems
- Heat pumps
- Wood combustion systems
- CHP modules
- Biogas plants
- Services

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Your heating contractor: