

Gas processing plants





Biomethane from biogas

Biomethane is an attractive alternative to fossil fuels. Its production is environmentally-friendly, efficient and reliable.

Supplies of fossil fuels, such as coal, oil and natural gas will eventually run out and, in the long term, must be replaced with renewable alternatives. Biogas plays an important role in the regenerative energy introduction phase. It can be produced from a variety of organic waste materials. Nowadays, landfills, wastewater treatment plants and organic wastes from restaurants and food production facilities are important sources for the generation of biogas.

The processing of biogas to natural gas quality is an important prerequisite for efficient energy provision. Processing biogas allows it to be transported and injected into the existing natural gas networks; it can also be transported in gas bottles and cooled into a liquid.

This makes the gas suitable for a wide range of uses:

- in highly-efficient, decentralised, combined heat and power units
- as fuel in the form of Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG)
- for the generation of heat
- as a raw material in the chemical industry

Carbotech is a pioneer

Carbotech is acknowledged as the biogas processing pioneer in Europe and is one of the leading manufacturers of turnkey plants for biogas injection projects. The company has been active for over 30 years in the biogas sector.

Carbotech also has extensive experience in the field of industrial gas cleaning and generation such as the generation of nitrogen from atmospheric air. Carbotech set up its first gas processing plants in Sweden and Switzerland in the early 90s. Nowadays, reliable, highly-efficient, and environmentally conserving biogas is being processed to natural gas quality in many countries throughout Europe.

The pressure swing adsorption (PSA) process developed and patented by Carbotech is simple and has low energy requirements. On-going development of plants over the past three decades has resulted in PSA becoming one of the most efficient processing techniques currently on the market.

Processing plant for biomethane production installed in standard, space-saving containers



Biogas upgrading plant in Aiterhofen



Efficient and environmentally-friendly generation of biomethane

Carbotech's pressure swing adsorption process allows biogas to be processed into high-quality biomethane.

Simple and reliable technology

Pressure swing adsorption provides a simple biogas upgrading process. The biogas is compressed, catalytically cleaned of hydrogen sulphide (H_2S) and other trace gases using activated carbon and cooled to remove as much water as possible.

The biogas is then passed through an adsorber filled with carbon molecular siever, in which carbon dioxide (CO_2) and other contaminants (H_2O , remnant H_2S , siloxanes, NH_3 , odorants and fractions of N_2 , O_2 , etc.) are removed from the gas prior to the production of biomethane.

In order to make the process continuous, production is switched to a second adsorber after a predetermined interval, allowing the first adsorber to be fully vacuum regenerated. Programmable logic control (PLC) and on-line gas analysis make plant operation automatic, safe and reliable.

Low processing costs

Carbotech's pressure swing adsorption technique is a dry process, characterized by the deployment of minimal operating resources. This means:

- low electrical power requirement
- no thermal power requirement
- no process water and, therefore, no process water treatment requirement
- no wastewater and, therefore, no wastewater treatment
- no toxic chemicals
- no contaminated wastes

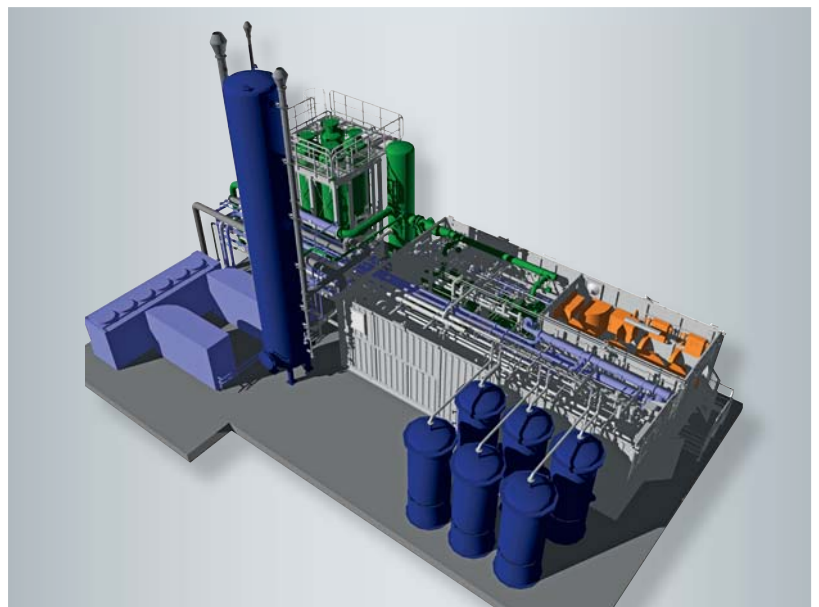
Economic planning and safe investment in future-proof regenerative energy

Carbotech assists investors from the planning stage through construction and commissioning, and into the servicing of biogas upgrading systems and injection units. Assistance is provided regardless of whether the investor opts to produce the raw biogas through dry or wet fermentation systems.

Biogas production, processing and injection technology from a single source

Schmack Biogas and Bioferm, sister companies of Schmack Carbotech, offer a very wide spectrum of individual customer solutions. These include, for example, biogas generation from the full range of raw material options and the use of biomethane for injection into the natural gas grid.

Complete plant schematic



A glimpse into the workings of a biogas upgrading plant from Carbotech

Performance
spectrum



Overview of gas upgrading systems and injection units

Performance spectrum

The input spectrum for Carbotech systems ranges from just a few hundred to many thousand cubic meters of biogas per hour. Standardised containers and modular arrangement ensure that the number of interfaces is kept to a minimum and that installation and commissioning costs are kept as low as possible.

Modular design also allows a wide range of biogas upgrading plant sizes to be built. It is possible to process large amounts of biogas, in excess of 3000 m³/h, within individually-designed plants.

Generation of biomethane from biogenic gases by means of the pressure swing adsorption principle is highly efficient, reliable, environmentally-friendly and sustainable. As an advantage over washing and membrane processes, the pressure swing adsorption also removes water, siloxanes, hydrogen sulphide and VOCs parallel to the removal of CO₂.

Biogas upgrading plant (BUP)

The BUP series offers all features expected from a biogas processing plant: safety, reliability and compactness. The units are also simple to operate and maintenance-friendly. The ready-to-operate containers are designed to ensure installation costs are kept low and practicable and to keep the number of interfaces at a minimum. Only gas and electrical power connections are required.

Biomethane injection units

In accordance with customer and project requirements, Carbotech is also able to deliver the necessary biomethane injection units. The injection units are designed, built and tested in accordance with all relevant norms, standards and regulations. To ensure the containers are installed and connected in the shortest possible time, they are pre-assembled and tested prior to site delivery.

Depending on client's requirements injection units can be equipped with the following system modules:

- Booster compressor station
- Oxygen-removal unit
- LPG mixing unit
- Air mixing unit
- Odourising unit
- Gas quality measuring unit

The costs

Thanks to a highly-efficient process, minimal operating resources and durable plant technology designed to comply with industry standards, plant specific processing and life-cycle costs are very low. Processing costs of less than one euro cent per kilowatt-hour are possible with the larger gas processing units.

Plant type (BUP)		BUP250	BUP350	BUP500	BUP750	BUP1000	BUP1400	BUP2000	BUP3000
Nominal capacity	m ³ /h	250	350	500	750	1000	1400	2000	3000
Biomethane¹⁾	m ³ /h	155	217	309	464	619	866	1238	1856
Electrical requirements	kW	58	81	110	165	215	301	420	630
Activated carbon requirements²⁾	kg/a	525	735	1050	1575	2100	2940	4200	6300
Other operating resources	kg/a	–	–	–	–	–	–	–	–
Installation area									
Length	m	20	20	22	22	24	24	26	28
Width	m	8	8	10	10	12	12	15	18

Note: This data is provided solely for information purposes. Project-specific alterations may be necessary.

¹⁾ relates to raw biogas generated from waste material and containing 60 % methane, 3 % CO₂ and 1 % air following its production

²⁾ relates to an annual mean average value of 100 ppm H₂S in the raw biogas



BGAA Fulda

Proprietor: Biothan GmbH, Fulda
 Location: Fulda/Hessen
 Commissioned into service: 2012
 Plant type: BUP1000
 Raw biogas source: communal waste, liquid manure
 Raw biogas: 1000 Nm³/h
 Biomethane: 580 Nm³/h
 Scheduled maintenance: twice annually



BGAA Genf

Proprietor: ACRONA Systems AG, Aarau
 Location: Geneva, Switzerland
 Commissioned into service: 2013
 Plant type: BUP350
 Raw biogas source: purification plant gas
 Raw biogas: 350 Nm³/h
 Biomethane: 214 Nm³/h
 Scheduled maintenance: twice annually



BGA Wüstring

Proprietor: EWE AG
 Location: Wüstring/Oldenburg (East Frisia)
 Commissioned into service: 08/2009
 Plant type: BUP1200
 Raw biogas source: renewable raw materials
 Raw biogas: 1200 Nm³/h
 Biomethane: 635 Nm³/h
 Scheduled maintenance: twice annually



References



BGAA Pohlsche Heide

Proprietor:	AML Immobilien GmbH
Location:	Hille, Minden-Lübeck area
Commissioned into service:	09/2009
Plant type:	BUP500
Raw biogas source:	communal waste
Raw biogas:	500 Nm ³ /h
Biomethane:	258 Nm ³ /h
Scheduled maintenance:	twice annually



BGAA Schwandorf II

Proprietor:	Feldgas GmbH & Co. KG (E.ON)
Location:	Schwandorf
Commissioned into service:	01/2008
Plant type:	2 x BUP1000
Raw biogas source:	renewable raw materials
Raw biogas:	2000 Nm ³ /h
Biomethane:	1087 Nm ³ /h
Scheduled maintenance:	twice annually



BGAA Güterglück

Proprietor:	RWE AG
Location:	Güterglück/Sachsen-Anhalt
Commissioned into service:	07/2009
Plant type:	BUP1200
Raw biogas source:	renewable raw materials
Raw biogas:	1200 Nm ³ /h
Biomethane:	635 Nm ³ /h
Scheduled maintenance:	twice annually

BGAA Emmertsbühl

Proprietor: EnBW Gas GmbH
 Location: Emmertsbühl/Blaufelden
 Commissioned into service: 10/2010
 Plant type: BUP500
 Raw biogas source: liquid manure, renewable raw materials
 Raw biogas: 500 Nm³/h
 Biomethane: 255 Nm³/h
 Scheduled maintenance: twice annually



BGAA Wrams

Proprietor: E.ON Gas Sverige AB
 Location: Wrams/Sweden
 Commissioned into service: 10/2006
 Plant type: BUP500
 Raw biogas source: waste food, abattoir wastes
 Raw biogas: 500 Nm³/h
 Biomethane: 324 Nm³/h
 Scheduled maintenance: twice annually



BGAA Werlte

Proprietor: EWE AG
 Location: Werlte
 Commissioned into service: 08/2007
 Plant type: BUP500
 Raw biogas source: liquid manure, abattoir wastes
 Raw biogas: 500 Nm³/h
 Biomethane: 305 Nm³/h
 Scheduled maintenance: twice annually



Complete solutions for biogas generation and energy usage

Carbotech and its global network of cooperation partners develop and construct turnkey gas processing plants worldwide



Prior to installation and in the context of engineering detail, all plants undergo in-depth three-dimensional computer simulation testing.

Carbotech has roots in research for the German hard coal industry. Since then, the company has accumulated more than 50 years' experience in the development, engineering and manufacture of turnkey plants for gas processing and generation.

The Viessmann Group companies offer comprehensive gas separation solutions. Core competence is characterized by innovative, efficient processes and technology for the generation, cleaning and processing of technical and biogenic gases.

Competent and customer-oriented through a network of partners

With its Essen-based engineering centre and its global network of cooperation partners, Carbotech is able to offer a broad variety of delivery and performance options for plant construction and marketing, including test and demonstration units designed for process optimisation.

This guarantees product quality and customer satisfaction, based on client-specific, application-orientated process design and engineering supported by experience, specialists and flexibility. Prior to installation and in the context of engineering detail, all plants undergo an in depth three-dimensional computer simulation testing.

Hydrogen and nitrogen generating units for a wide range of industrial sectors

Carbotech has extensive experience in the industrial gas cleaning and processing sector, including the cleaning of hydrogen and generation of nitrogen.

Hydrogen gas recovery from hydrogen-rich raw gases

Carbotech's pressure swing adsorption plants recovering hydrogen from a range of hydrogen-rich feed gases are deployed worldwide. The feed gases used are reformed gases processed from natural gas, ammonia or naphthalene, but also from other sources, including coke oven gases, remnant ammonia gas, etc.

Carbotech has been involved in the design and optimisation of such plants for over 40 years and has significantly influenced the development of this technology. It is possible to design and build hydrogen processing plants in volumes of up to 30,000 Nm³/h. These are specially designed for the individual application with a view to minimising both the investment and operating costs.

Nitrogen increases the longevity of many products

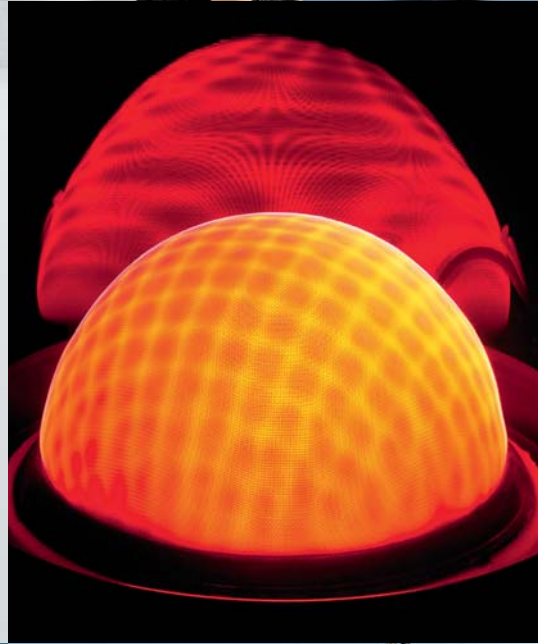
Nitrogen is deployed as a protective or flushing gas in the areas where product quality and longevity may be compromised by unwanted contact with oxygen. Carbotech plants make the sustainable generation of nitrogen a cost-effective option and allow customers to influence the quality and price of the nitrogen gas produced.

Carbotech plants are found both on land and sea (ships' on-board equipment) and are used in a variety of applications of applications linked with the metal, chemical and food industries. The plants demonstrate a very high level of technical reliability and can be used both as „stand alone“ units and as "base load" facilities in the tank systems of industrial gas providers.



Units for hydrogen (above) and nitrogen generation are designed and built by Carbotech on the basis of individual application requirements.

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 harmonising ecology, economic concerns 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 11,500 employees worldwide.

Example of Best Practice

With its strategic 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
- CO₂ emissions reduced by 80 percent

The long term goal is for the company to meet all its own heating energy requirements by sustainable means.



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



Energy Efficiency Award 2010

Viessmann Group

Company details

- Established in: 1917
- Employees: 11,500
- Group turnover: 2.2 billion euros
- Export share: 56 percent
- 22 production companies in 11 countries
- 74 countries with sales companies and branches
- 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 generation
- Hybrid appliances
- Heat pumps
- Wood combustion technology
- Biogas production plants
- Biogas upgrading plants
- Solar thermal
- Photovoltaics
- Accessories
- Refrigeration systems

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