CARBTECH

Biomethane

Deutsch

English

Español

Français

B

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 longterm, 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, while mainting high methane recovery.
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, spacesaving containers I **BUP** 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, 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 sieve, 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 online gas analysis make plant operation automatic, safe and reliable.

Low processing costs

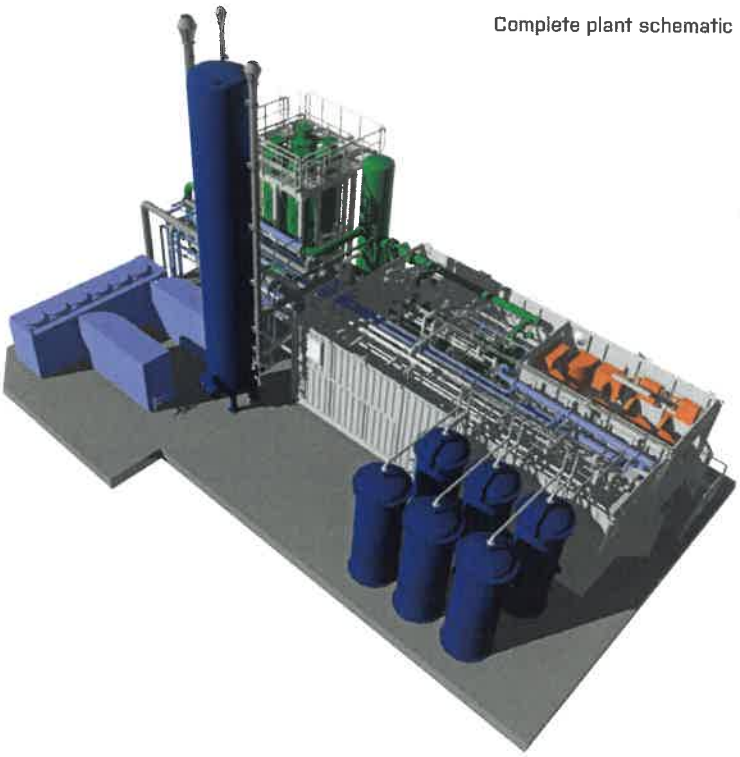
Carbotech's pressure swing adsorption technique is a dry process, characterized by the deployment of minimal operating resources. This means:

- lowest electrical power requirement high
- methane recovery
- no thermal power requirement
- no process water and, therefore, no process water treatment requirement
- no wastewater and, therefore, no wastewater treatment
- no toxic chemicals
- high efficiency throughout a wide part load range

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.

Complete plant schematic



View of a Carbotech Biogas Uprading Plant | BUP

Overview of gas upgrading sytems 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 modules 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 m^3/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 CO_2.

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 systems 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 relevant norms, standards and regulations. To ensure the systems are installed and connected in the shortest possible time, they are pre-assembled and tested prior to site delivery.

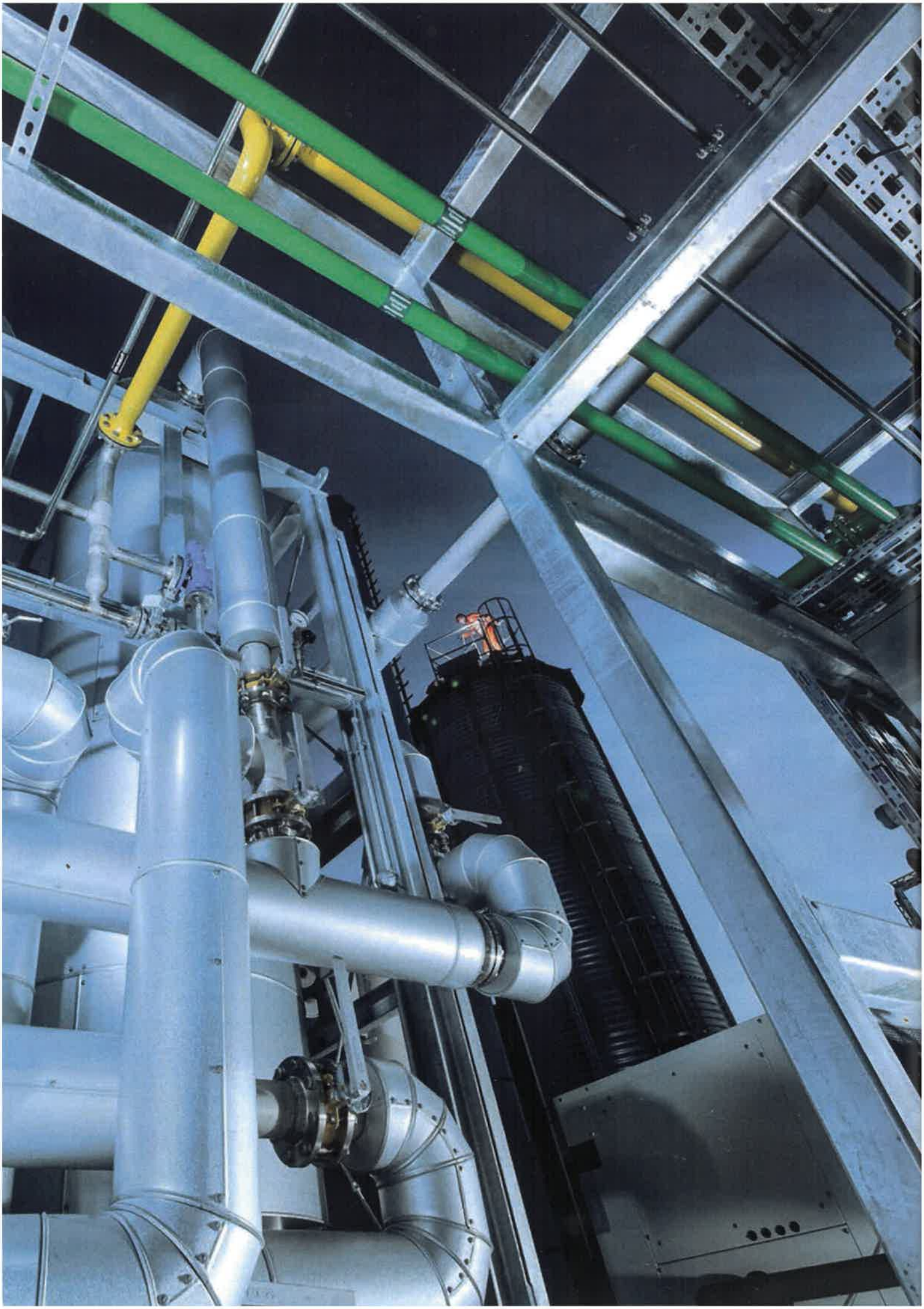
Depending on client's requirements injection units can be equipped with the following system modules:

- Booster compressor station
- Oxygen-removal unit
- LPG mixing unit
- Air mixing unit
- Odorising 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		**BUP 250**	**BUP 350**	**BUP 500**	**BUP 750**	**BUP 1000**	**BUP 1400**	**BUP 2000**	**BUP 3000**
Nominal biogas capacity	m^3/h	250	350	500	750	1000	1400	2000	3000
Electrical requirements	kW	50	68	95	140	175	240	320	480
Biomethane CH_4 quality	Vol.-%	up to 99	up to 99	up to 99	up to 99	up to 99	up to 99	up to 99	up to 99
Methane recovery	%	> 99	> 99	> 99	> 99	> 99	> 99	> 99	> 99
Export heat @ 70°C	kW	25	35	45	70	85	120	150	230
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.



BUP Fulda

Location:	Fulda, Hessen | Germany
Commissioned into service:	2012
Plant type:	BUP 1000
Raw biogas source:	communal waste, liquid manure
Raw biogas:	1000 Nm^3/h
Biomethane:	580 Nm^3/h

BUP Geneva

Location:	Geneva | Switzerland
Commissioned into service:	2013
Plant type:	BUP 350
Raw biogas source:	purification plant gas
Raw biogas:	350 Nm^3/h
Biomethane:	214 Nm^3/h

BUP Wüsting

Location:	Wüsting, Oldenburg | Germany
Commissioned into service:	2009
Plant type:	BUP 1200
Raw biogas source:	renewable raw materials 1200
Raw biogas:	Nm^3/h
Biomethane:	635 Nm^3/h

BUP Pohlsche Heide

Location:	Hille, Minden | Germany
Commissioned into service:	2009
Plant type:	BUP 500
Raw biogas source:	communal waste
Raw biogas:	500 Nm^3/h
Biomethane:	258 Nm^3/h

BUP Schwandorf

Location:	Schwandorf | Germany
Commissioned into service:	2008
Plant type:	2 x BUP 1000
Raw biogas source:	renewable raw materials
Raw biogas:	2000 Nm^3/h
Biomethane:	1087 Nm^3/h

BUP Sofielund

Location:	Södertörn | Sweden
Commissioned into service:	2014
Plant type:	BUP 2000
Raw biogas source:	food and green waste
Raw biogas:	2000 Nm^3/h
Biomethane:	1410 Nm^3/h

BUP Hendriksdal

Location:	Hendriksdal | Sweden
Commissioned into service:	2015
Plant type:	BUP 3000
Raw biogas source:	sewage treatment
Raw biogas:	3000 Nm^3/h
Biomethane:	2056 Nm^3/h

BUP Guymon

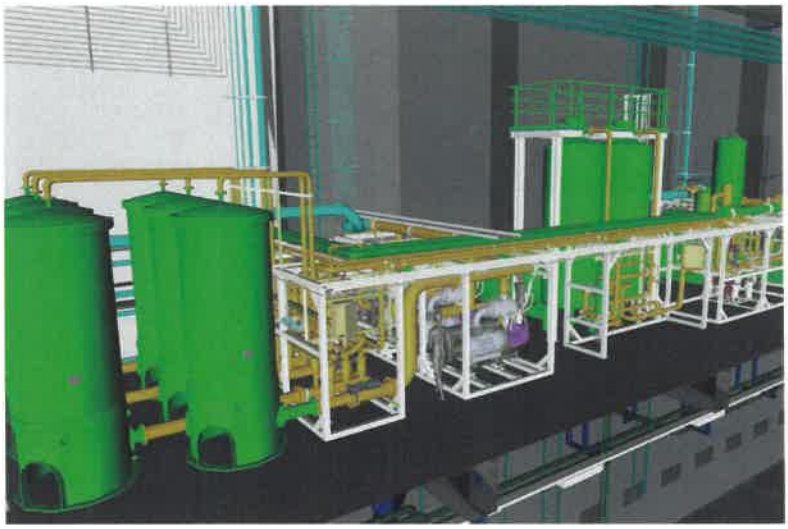
Location:	Guymon, OK | USA
Commissioned into service:	2017
Plant type:	BUP 2000
Raw biogas source:	slaughter house waste
Raw biogas:	2000 Nm^3/h
Biomethane:	1370 Nm^3/h

BUP Dane County

Location:	Madison, WI | USA
Commissioned into service:	2019
Plant type:	BUP 4000
Raw biogas source:	landfill waste
Raw biogas:	4000 Nm^3/h
Biomethane:	2150 Nm^3/h

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 manufac-ture of turnkey plants for gas processing and generation.

The company offers 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 sec-tor, 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 traditionally are reformed gases processed from natural gas, ammonia or naphthalene, but also from other sources, including biomass gasification, 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 significantlyin fl uenced the development of this technology. It is possible to design and build hydrogen processing plants in volumes of up to 50,000 Nm^3/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-effec-tive option and allow customers to infl uence 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 meta 1, 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.

CARBOTECH

Carbotech Gas Systems GmbH
Kronprinzenstrasse 30
45128 Essen, Germany

Phone +49 201 50709 300
Fax +49 201 50709 500
Mail mail@ctgs.com

www.ct-gs.com