Gts
Gastreatment Services bv

Future energy

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Gastreatment Services (GtS)

Gastreatment Services (GtS)

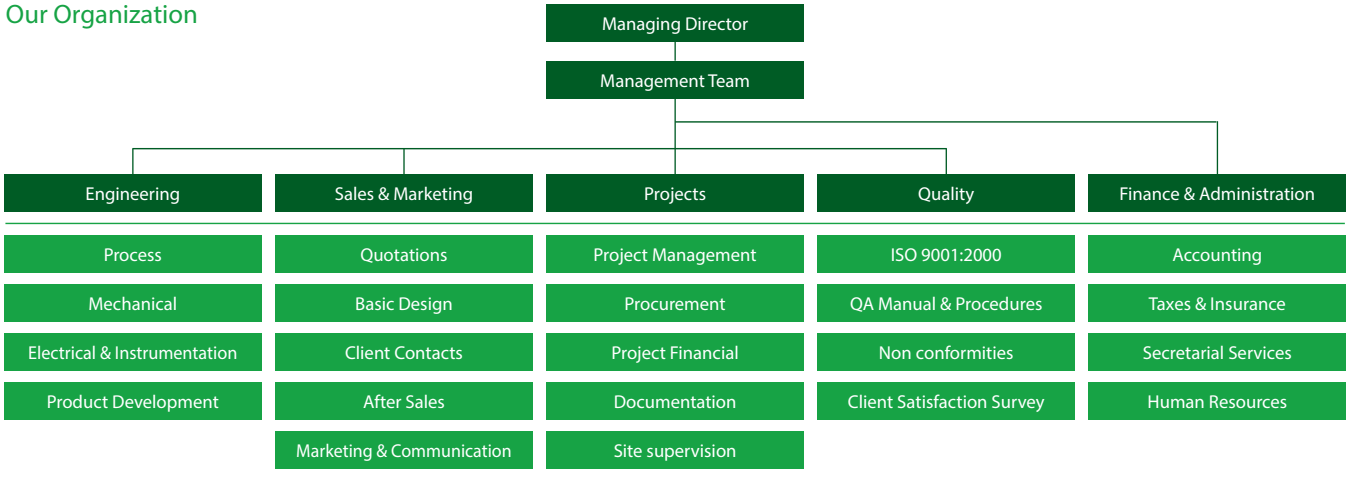
Gastreatment Services (GtS) is an engineering firm engaged in gas treatment in the broadest sense of the word. GtS has more than 50 years of in-house experience in the field of the natural gas and biogas processing and utilization. This enables us to design, build and put into operation both standard and complex, custom-made installations. GtS has developed unique purification systems for the treatment of landfill gas, digester gas and biogas.

Our services

GtS provides advice, project management, procurement and the realization of projects in the petrochemical and environmental field. Using utilization and purification methods such as the Total Contaminant Removal (TCR) and the Gastreatment Power Package (GPP®), GtS provides a wider scope for low-caloric gas. The added value of the purification process is essential in this respect, e.g. for reusing residual heat, recovering CO_2 and upgrading biogas to natural gas quality. Aside from gas treatment systems, GtS offers the choice from different flare installations, from open to closed flare systems in line with the NER regulations.

GtS is a member of FME, VLM and the American GPSA. Since 2005, GtS is ISO 9001:2000 certified by KIWA.

Our Organization



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Our processes

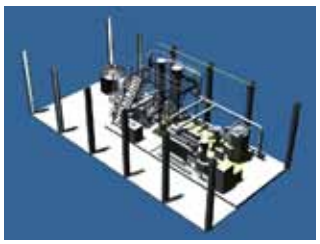
- Gas extraction
- Gas treatment, including:
  - removal of siloxanes
  - desulphurization of biogas
  - gas drying
- Gas utilization, including:
  - heating biogas (hot-water) boiler systems
  - electricity production
  - natural gas production

Our products

- Landfill gas extraction installations
- Open flare installations
- Closed flare installations
- Total Contaminant Removal (TCR)
- Gastreatment Power Package (GPP®)
- Soxsia® catalyst for removal of H_2S and siloxanes
- Biogas dryers
- Measuring and regulation stations

Our services

- Feasibility studies
- Consultancy
- Contract Engineering & Design
- Service, maintenance and after sales
- Remote process operations
- Turn-key projects



Gas treatment under construction at AEB Amsterdam

NER Flare Installations in operation

Design oil water separator

Design biogas utilization

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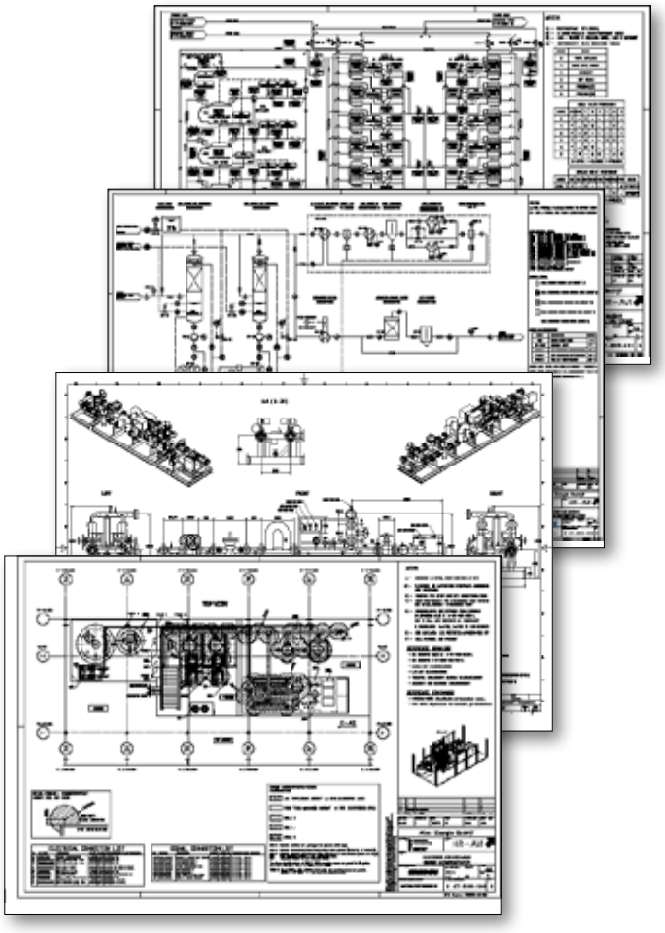
Engineering and consultancy

The extensive experience and know-how within Gastreatment Services (GtS) enables us to compile a comprehensive, detailed engineering package for gas or oil treatment installation based on the information provided by the client. Such packages are prepared by means of state of the art software packages, such as Autodesk Inventor Professional, Autocad 2007, Caddy ++, ANSYS and MATHCAD and implemented in line with European Directives and international standards, including ATEX, PED, ANSI, ASME and ISO.

Gas treatment is our specialization, but we also provide the engineering of installations for moistures, such as CO_2, kerosene, oil, LPG, propane, butane etc.



The list below summarizes some of the standard engineering documents we supply:

- Piping & Instrument Diagram
- Process Flow Diagram
- Process description
- Process calculations, including mass and heat balances
- List of components
- List of instrumentation
- Component Data Sheets
- Procurement specifications
- Lay-out drawings
- Construction drawings
- Block diagrams for electrical installations
- Danger zone division drawings according to ATEX
- HAZOP, RAM and FMECA studies
- PED selection and risk assessment
- Operation and Maintenance instructions
- Description of operating systems

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Results of GtS engineering and consultancy

1

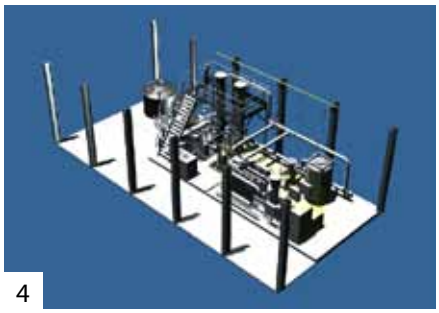
Process design and mechanical design of measuring stations for custody transfer of fuel, oil, diesel, natural gas and high purification chemicals such as hexane, butane and synthesis gases.

2

Design of a standard product for the air filter industry, as a result of which a mass production line could be developed.

3

Detail engineering of CO_2, measuring and regulation stations which led to standard sales contracts for a major CO_2 distribution network in the Netherlands.

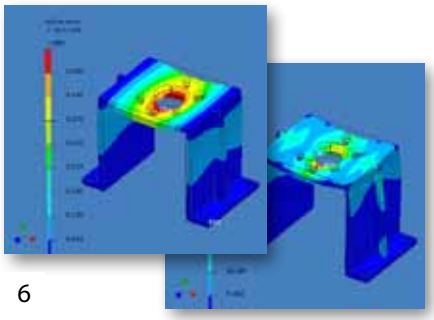


4

Consultancy for ATEX classification at a water purification installation in the Netherlands.

5

Mechanical and electrical detail design of a natural gas mixing station with a safety system for offshore gas turbine application.



6

Mechanical design detail parts.

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Total Contaminant Removal (TCR)

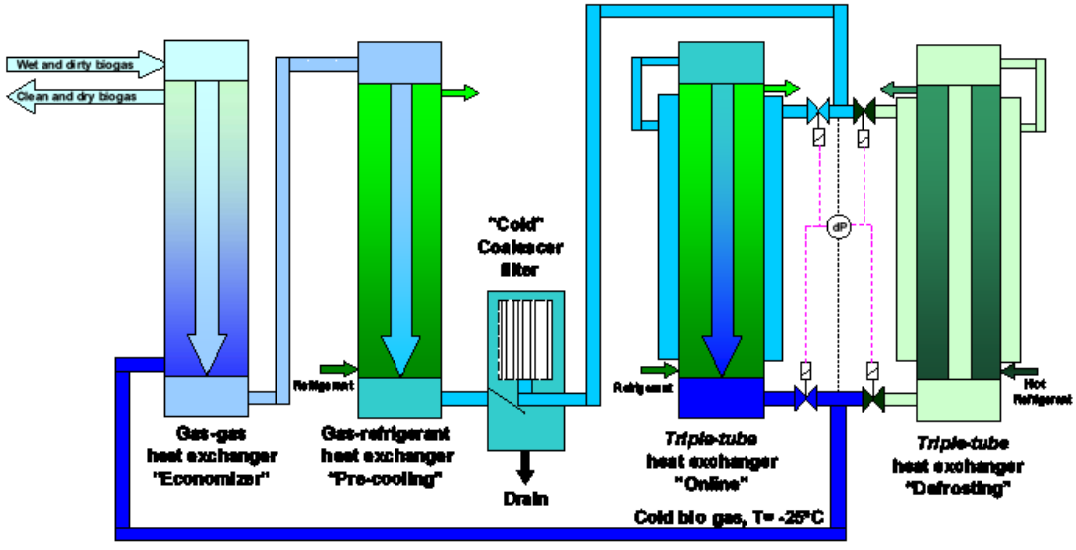
The gas released in landfill processing is increasingly often used for the production of electricity. However, this biogas cannot be used immediately for application in utilizing equipment as it is often too wet and contains various contaminants such as siloxanes. To resolve this problem, Gastreatment Services (GtS) has developed the TCR system to remove all contaminants from the biogas.

Siloxanes end up at landfill sites and in water-purification systems through industrial and residential waste discharges. Siloxanes break down into a white, abrasive powder which damages utilizing equipment such as boilers, gas motors and (micro) turbines. Landfill gas, digester gas and biogas also contain substantial quantities of moisture, H_2S, SO_2, halogens and other contaminants.

At present, these contaminants are mainly removed by active-coal filters. Although this method filters most contaminants, active coal is expensive and the costs of carbon regeneration and disposal are high.

Operation

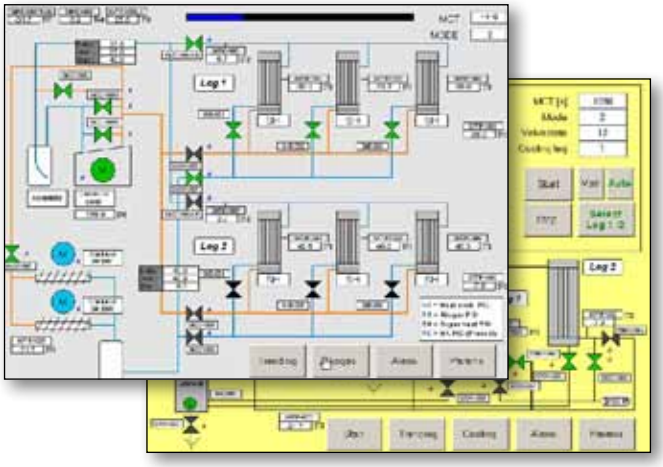
The picture below illustrates the operation of the TCR system:



With its TCR system GtS provides the perfect solution for removing all contaminants from biogas. GtS' unique approach differs from the customary method by chilling the gas to around -25ºC. This means that most contaminants condense together with the moisture. Moreover, many remaining contaminants dissolve in the condensed moisture. Optionally, a SOXSIA® catalyst may remove the remaining traces of contaminants to provide a virtually contaminant-free energy-rich gas.

Advantages

- Chilling the gas to around -25ºC lowers the gas' dewpoint to -25ºC. Since the gas is heated after the cooling process, there is no downstream condensation.
- Downstream piping no longer has to be heated and isolated, resulting in additional cost savings.
- Since all contaminants and 2-4%mol water are removed, the caloric value of the gas increases by around 6%, as a result of which the electricity production per Nm^3 of gas increases.
- Since there is no downstream condensation due to the low dewpoint, low-quality materials, such as Stainless steel 304 or carbon steel may be used for the piping system of the downstream equipment of our TCR system.



Remote operation of TCR

Open model of TCR7

TCR under construction

TCR on location

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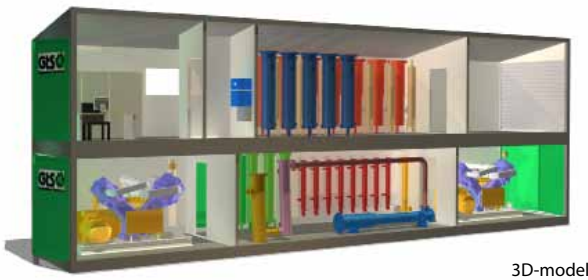
Gastreatment Power Package (GPP®)

The GPP® system upgrades biogas, released, for example, at landfill sites and in waste-water-purification installations, with a unique technology to ready-for-use natural gas. The applications are numerous: for example, the gas may serve as a fuel for industrial machines. In the private sector it may be used for cooking, as a fuel for cars or for heating houses.

Problem

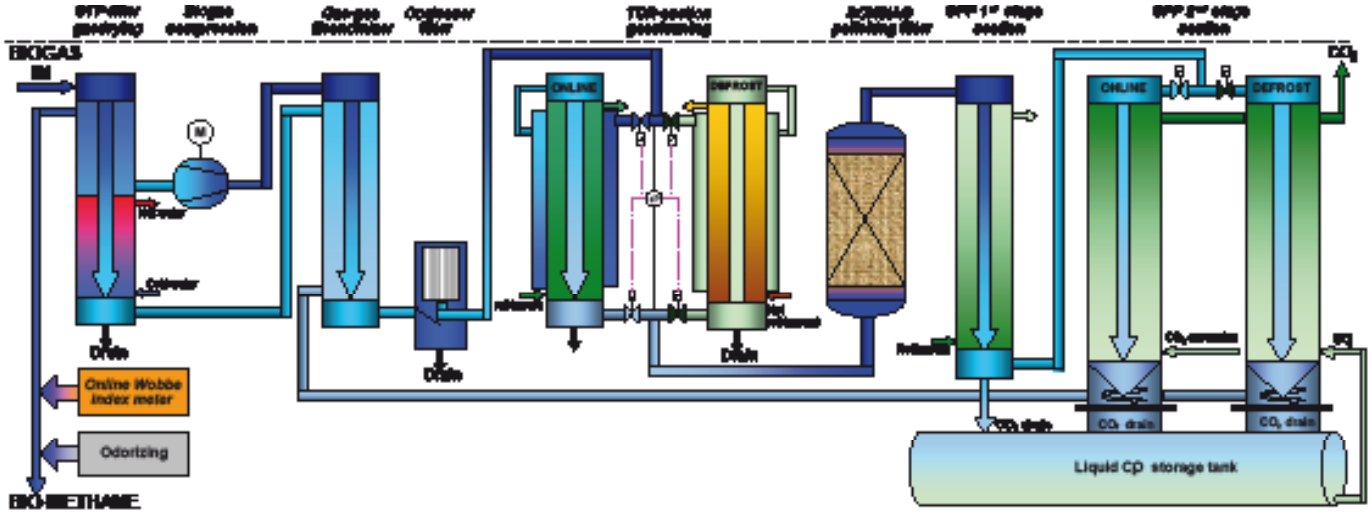
For some time now, biogas has served as a good alternative to traditional energy sources. The problem, however, is that this high-energy gas contains CO_2 and other contaminants. The contaminants harm the utilizing equipment, while the CO_2 not merely harms the environment, but also reduces the gas' caloric value. GtS has developed the GPP® system to resolve this problem.



3D-model of GPP26T, 800Nm³/hr biogas

Operation

The picture below illustrates how the GPP® works:



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Solution

The GPP® system upgrades biogas, such as landfill gas and digester gas, to natural gas quality in four steps. The biogas is first compressed to a pressure of 16 up to 25 barg, after which it is chilled to -25°C. During this step moisture, H_2S, SO_2, halogens, siloxanes and other contaminating parts are removed from the biogas. Then the purified gas is led first through a coalescer filter and then through a SOXSIA® catalyst to eliminate remaining contaminants from the gas mixture to acceptable levels.

Finally, the gas is further chilled to around -78°C, after which the liquefied CO_2 is extracted from the gas mixture and the caloric value is upgraded to natural-gas quality.

By removing the contaminants from the biogas and extracting liquefied CO_2 from the gas mixture during the process, the GPP® system is the ideal method for bio-methane production.

Advantages

The GPP® system has the following advantages:

- Moisture, H_2S, SO_2, halogens, siloxanes and other contaminants are removed from the biogas. Especially the removal of siloxanes produces further benefits, as siloxanes in utilizing equipment, such as boilers, gas motors and (micro) turbines break down into a harmful white abrasive powder which damages the equipment.
- CO_2 is extracted from the biogas producing liquefied CO_2 as a valuable side product.
- The system produces high-quality bio-methane as an end product.
- The system produces bio natural gas with a dew point of around -74°C at 16 up to 25 barg.
- By increasing the caloric value of the gas, the returns of the downstream equipment increase.
- Due to the excellent quality of the gas, lower maintenance costs of the downstream equipment are to be expected.
- The expanded field increases the profitability of the present downstream equipment. Landfill gas extraction at landfill sites may, for example, continue for years up to methane contents of less than 5%, as a result of which electricity may be produced longer.
- The use of the GPP® system makes the applicability of micro turbines or micro CHP most interesting (e.g. at landfill sites).

Please request a QUICKSCAN from us.
The QUICKSCAN provides your business with insight into:

- The energetic potential of biogas utilization
- The technical feasibility to realize biogas utilization
- The economic feasibility to realize biogas utilization
- The economic potential of the GPP® system
- The incentives facilitating biogas utilization

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Gas Treatment Package (GTP)

Gastreatment Services (GtS) is an engineering company active in the field of gas treatment systems. GtS develops and realizes cleaning systems for biogas, landfill gas and digester gas. Using gas treatment techniques like our Total Contaminant Removal (TCR) and Gastreatment Power Package (GPP®) we are extending the application of methane containing gasses.

One of our latest developments is the GTP (Gas Treatment Package). The GTP unit is an "All-in-one" package combining: gas cooling/drying, reheating and optional desulphurization and siloxane removal in one body. In this way we made it possible to protect your CHP (Combined Heating & Power) installations against the destructive effects of wet and sour Biogas, with only a minimum investment!

The warm and water-saturated biogas is cooled to a temperature of +6 ºC at which water/condensate is separated and drained from the bottom of the GTP unit. The cooled and dried biogas is reheated to almost the same temperature as the warm biogas inlet stream. The compact construction makes it possible to install the GTP as close as possible to the inlet of the CHP installation, reducing piping cost.

By including our SOXSIA® catalyst as a final cleaning step, also remaining traces of contaminants like H_2S, siloxanes, etc. are removed. This brings the treated biogas in optimal condition before it enters the CHP. Since the catalyst can be regenerated after it is saturated, the operational cost are limited to a required minimum.

Process conditions:

- Capacity range from 50 Nm³/hr to 2500 Nm³/hr at a maximum pressure drop of 15mbar.
- In standard delivery the maximum inlet temperature is +35°C.
- Cooling step 5° - 11°C using an air-cooled coldwater unit.
- Higher inlet temperatures are possible up to +55°C (upon request).

Model	Max Capacity	Cooling capacity / Adsorbed power	Connections gas inlet/outlet	Optional SOXSIA® catalyst
GtS-GTP-120-4V/H-2-(S)10	120 Nm³/hr	3.5 kWt / 1.0 kWe	DN50 PN10	Ø273mm, 140kg
GtS-GTP-280-6V/H-3-(S)12	280 Nm³/hr	7.9 kWt / 2.0 kWe	DN80 PN10	Ø323mm, 280kg
GtS-GTP-475-8V/H-4-(S)14	475 Nm³/hr	13.6 kWt / 3.5 kWe	DN100 PN10	Ø356mm, 560kg
GtS-GTP-1050-10V/H-6-(S)16	1050 Nm³/hr	30.0 kWt / 6.8 kWe	DN150 PN10	Ø406mm, 1120kg
GtS-GTP-1850-12V/H-8-(S)18	1850 Nm³/hr	52.8 kWt / 12.0 kWe	DN200 PN10	Ø456mm, 2100kg
GtS-GTP-2500-14V/H-10-(S)20	2500 Nm³/hr	71.5 kWt / 16.3 kWe	DN250 PN10	Ø508mm, 3200kg

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SOXSIA®
Sulphur Oxidation and Siloxane Adsorption

SOXSIA® (Sulphur Oxidation and Siloxane Adsorption) is a catalyst, for the adsorption of siloxanes from biogas in combination with H_2S removal from dry gas. The favourable adsorption properties result in high-adsorption capacity and removal efficiency for contaminants present at moderate concentrations in gas flows. The selected extruded particle shape allows a low pressure drop over the adsorber. SOXSIA® is designed to hold 40% more siloxanes per unit of volume and is able to convert H_2S to elementary sulphur.

SOXSIA® can operate at low temperatures, atmospheric pressure and at relatively high-feed gas flows. The catalyst removes up to 2000 ppm H_2S effectively at 40°C, atmospheric pressure and space velocity of 1000 (Nm^3 gas/hour) / m^3 SOXSIA® .
Low space velocities enhance the H_2S absorption capacity. SOXSIA® can hold up to 26% of it's own weight on elementary sulphur.

Process description:

The desulphurizing agent in SOXSIA® is iron oxide, Fe_2O_3. It removes H_2S by the chemical reaction:

$Fe_2O_3(s) + 3H_2S(g) \rightarrow Fe_2S_3(s) + 3H_2O(g)$

The regeneration procedure is as follows:

The absorber is purged with inert gas at 20°C to 50°C. Then, a small amount of air is added to the inert gas, up to oxygen content of 0,2%. The absorbent is allowed to react with the oxygen for a number of hours.

If small amounts of oxygen are present in the biogas, regeneration takes place automatically. After saturation of the catalyst, before replacement, the above described steps need to be taken, to avoid spontaneous reaction while opening the vessel.

The regenerative action of oxygen is due to the reaction:

$Fe_2S_3(s) + 3/2O_2(g) \rightarrow Fe_2O_3(s) + 3S(s)$

The sulphur that is formed is retained in the pores of the adsorbent. Its regenerability makes it possible to use SOXSIA® under conditions which would otherwise not allow for an effective use of the potentially available adsorption capacity. Since regeneration takes place at very low temperature side reactions/contaminants in the gas are minimised.

PACKAGING

SOXSIA® is available in following forms:

- Polyethylene bags of 25 kg, 30 bag per pallet, stretch wrapped on 120 x 120 x 100 cm pallets (750 kg net weight per pallet)
- Bulk bags of 700 kg net weight on a 120 x 120 x 100 cm pallet
- Drums with 140 kg, 4 drums per pallet, stretch wrapped on 120 x 120 x 80 cm pallets (700 kg net weight per pallet)

For technical details about SOXSIA® we refer to our "Material Safety Data Sheet (MSDS)".

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GPP® *plus*

When upgrading low-calorific gasses, such as biogas and landfill gas, delivery of gas with required quality to the network can give rise to problems. One cause can be the high concentration of nitrogen in the biogas. Another cause is the physical connection to the natural-gas network, which connection is a restrictive factor that determines the maximum capacity of an upgrading installation.

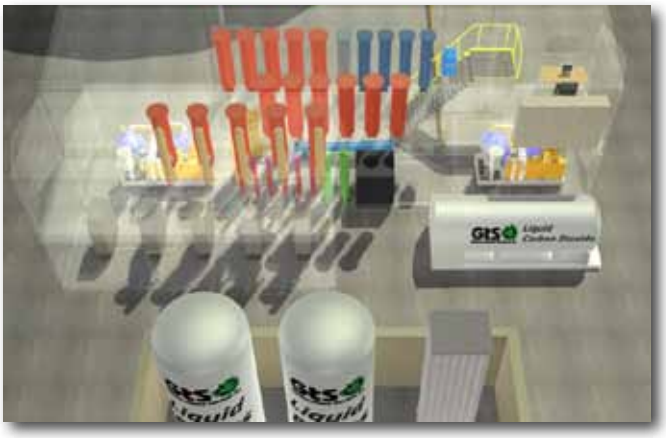
GtS has developed the GPP®plus system to solve the above-mentioned problems. The gas upgraded by the GPP® system is then liquefied and inert components, such as nitrogen and oxygen, are separated from the biogas. As a result, Liquefied BioGas (LBG) is obtained with a methane purity higher than 98%.

Operation

The GPP®plus system combines the power of the GTP, TCR, SOXSIA® and GPP® technology.

The upgrading procedure begins at the GTP filter where the biogas is dried. This is followed by two-stage compressions. The first step uses a 'roots' blower (frequency-controlled compression) and an oil-free piston compressor, in a second step, compresses the biogas up to the GPP® working pressure.

After the compression, the biogas is treated in the TCR section, where most of the contaminants, such as siloxanes and H_2S, are removed. As a result, the gas exits the section with a dew point of -25ºC.



After the TCR section, the gas flows through the 1st stage of the GPP®. Here, the biogas is cooled further to -50°C and the first CO_2 separation takes place. The 2nd stage of the GPP® cools the gas further to -74°C and separates solid CO_2. The CO_2 is thawed and then stored in a cryogenic tank.
The 3rd stage of the GPP® uses a cascade-cooling system, especially developed by GtS, to lower the biogas temperature to -95ºC lowering the CO_2 content even further.

The separated liquid CO_2 is used as an internal cooling agent in 2nd stage GPP and contributes to energy efficiency.

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GPP®*plus* section

At first the biogas, which is upgraded in the GPP®plus section, is compressed any further. Then the gas is cooled down to -95ºC. At this stage the whole gas flow will be liquefied. Next the LBG is "flashed" at which the definite quality of the LBG will be reached. At the same time a high-caloric, clean gas flow is created, which can be used as fuel for a gas engine for the power supply of the GPP®plus system. Separation of nitrogen and recirculation of the methane is also a possibility. The maximum use of electricity per Nm^3 is 0.42 kWh/Nm^3. GtS designed cascade cooling systems will be used for deep cooling the 3rd stage GPP and the GtS LBG-Liquefier.

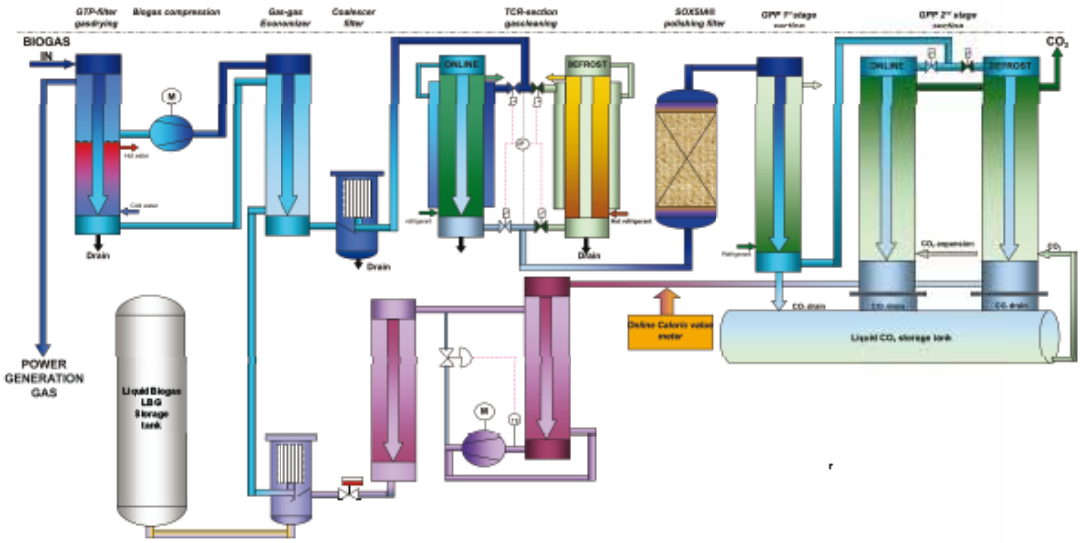
CO_2 storage

The storage capacity of the liquid CO_2 is designed for a maximum of 10 hours production capacity. The CO_2 is stored at 20 bar(g) and approximately -30 ºC.

LBG storage

Because the LBG storage pressure is flexible, it is possible to vary the quality of the LBG during operation. Therefore one or more 25 m^3 storage tanks with a design pressure of 19.2 bar(g) are used The storage pressure of these tanks can be varied from atmospheric to a maximum pressure of 12 bar(g). Each storage tank has an automatic supply valve and level measurement. When a tank is full, it is automatically closed and is ready for sampling and analysis. The LBG can then be transferred to a transport storage.

Schematically, the GPP®plus system looks as follows:



LBG Type	Biogas capacity (max. Nm^3/hr)	LBG production (max. ton/day)	CO^2 production (max. ton/day)	Total Energy Demand (kWe)
GPP®*plus*2T	120	1.1	2.3	51
GPP®*plus*4T	280	2.4	5.3	118
GPP®*plus*7T	475	4.1	9.0	200
GPP®*plus*15T	1050	9.0	20	442
GPP®*plus*24T	1850	16	35	778
GPP®*plus*41T	2500	22	47	1050

Note: the values are based on biogas with 50% CH_4, 40% CO_2, 9% N_2 and 1% O_2

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Flares

By flaring biogas, for example from landfill sites and waste water treatment plants, large quantities of methane will not be released into the atmosphere. Methane is most harmful to the environment and increases the greenhouse effect.

Supply programme

Gastreatment Services (GtS) has three kinds of flare systems that we export worldwide.
Our different flares are designed towards the capacity indicated by the Dutch emission regulations (NER). Standard procedure is that the ATEX, CE and PED regulations are observed.Due to the modular composition of the flare installations we can quickly construct our flares and put them into operation. We provide all our flares with our own pilot burner which, due to reliability, we have developed ourselves.

Due to the own design and manufacturing, GtS is able to deliver most spare parts from stock.

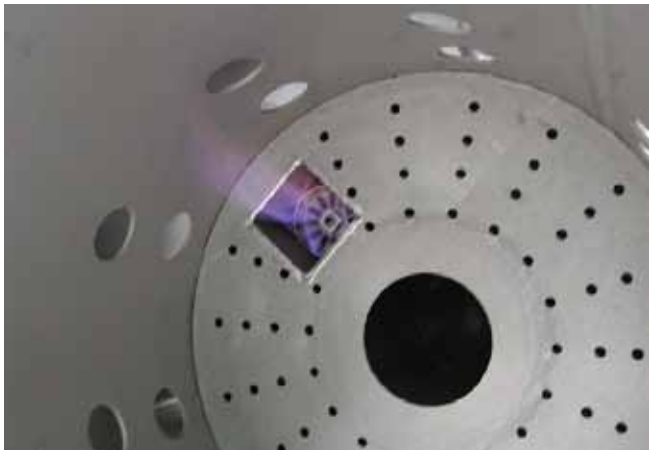
Test opportunities

- GtS is able to mix all biogases and to adapt the burners to the mixture.
- All flares plus the operating and ancillary systems are tested in the plant.
- The pilot burner and the related security measures have been tested under operational conditions.
- GtS flares may be equipped with a flow meter showing the current volume flow and the overall flow.

Open flare

NER flare

ECO flare



Plant test

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GtS/NER/0811/EN

The following flares are part of the range offered by Gastreatment Services:

Open flare

This type of flare serves as an emergency flare which only burns biogas in emergency situations, such as break-downs of or maintenance to the utilizing equipment. Unlike the other types, the flame of this flare is visible at all times.

GtS Type *	Connection	Flow (Nm^3/hr)
GtS-OF-1	DN50	100
GtS-OF-2	DN80	230
GtS-OF-3	DN100	400
GtS-OF-4	DN150	900
GtS-OF-5	DN200	1500

NER flare

This type of flare offers a permanent solution at locations within the Netherlands whereby the Dutch emission regulations (NER) must be satisfied, e.g. in the event that the flare due to low capacity of the utilizing equipment is in operation full time. This flare must comply with the requirement that the minimum retention time for the flue gases is 0.3 sec at a temperature of at least 900°C.

GtS Type *	Connection	Flow (Nm^3/hr)
GtS-CF-NER-1	DN50	100
GtS-CF-NER-2	DN80	230
GtS-CF-NER-3	DN100	400
GtS-CF-NER-4	DN150	900
GtS-CF-NER-5	DN200	1500

Closed ECO flare

This flare is used mostly outside the Netherlands, e.g. in the event that the utilizing equipment is not used enough or the gas is of poor quality. The flame is not visible.

GtS Type *	Connection	Flow (Nm^3/hr)
GtS-CF-ECO-1	DN50	100
GtS-CF-ECO-2	DN80	230
GtS-CF-ECO-3	DN100	400
GtS-CF-ECO-4	DN150	900

*Larger or smaller models are available upon request, the ECO flare is limited to a maximum of 900 Nm^3/hr.

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