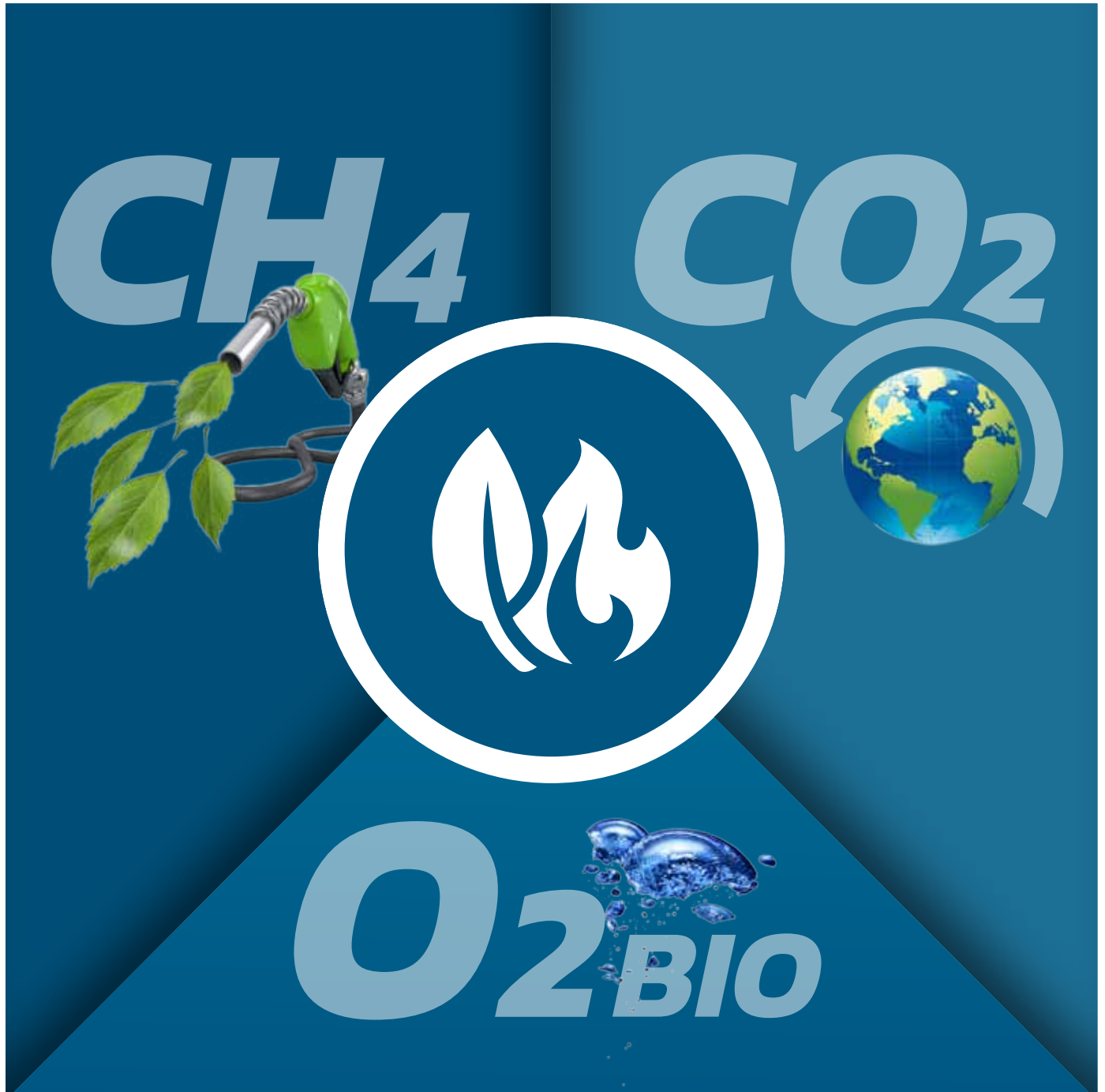


SYSADVANCE

SHAPING THE FUTURE OF TECHNOLOGY



N₂ | O₂ | O₂ VSA | MEDICAL O₂ GENERATORS | BIOGAS | H_e | H₂ | SF₆ PURIFICATION



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THE COMPANY

SYSADVANCE is a technology company founded in 2002.

Today we develop and manufacture on-site gas generators and gas purifiers, as well as integrated solutions for compressed air and technical gases.

SYSADVANCE product portfolio comprised Nitrogen Generators, Oxygen Generators, including Medical Oxygen 93 and VSA Oxygen Generators, solutions for purification of biogas, Helium, Hydrogen and SF6, as well as a wide range of "turn-key" customized engineering solutions.

SYSADVANCE successful projects are the reflection of the quality and dedication of our highly specialized human resources.

Today, SYSADVANCE offers solutions for several industries and sectors such as: chemical and pharmaceutical, electronic components, metal works, aquaculture, water treatment, engineering, automotive, food, wine, aviation, marine, energy, medical, oil and gas, among others.

SYSADVANCE is present today in more than 40 countries, rendering a solid growth as result of a strategy oriented for creating value to our clients, based on superior technology, quality and reliability of our products, as well as continuous innovation.



ENERGY

The world is changing and together with such move, a multitude of challenges arise. Within those, the search of renewable sources of energy. These new pathways to energy should be able to provide the necessary power to keep the pace of development without endangering the environment.

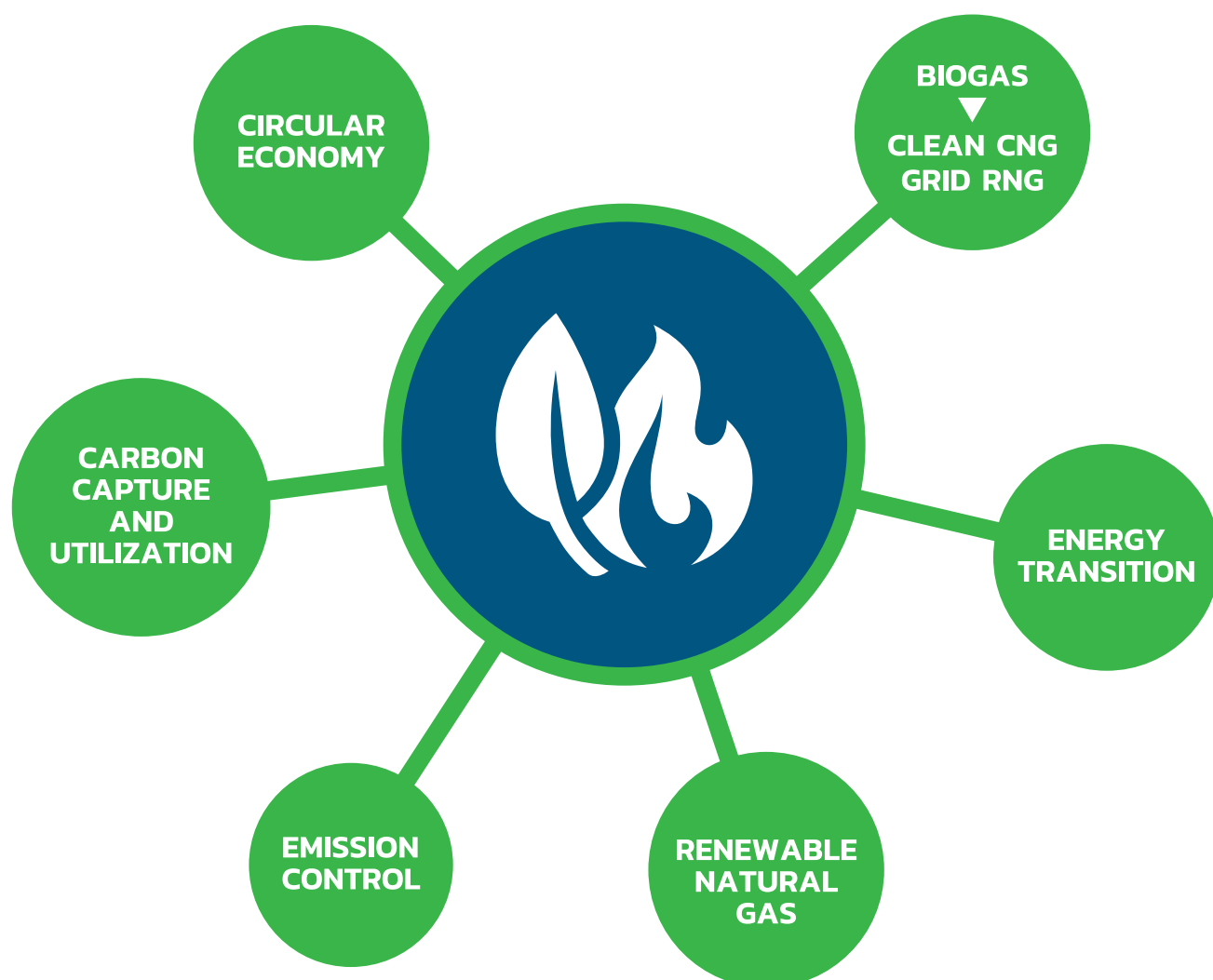
SYSADVANCE's technology draws the path towards a circular economy and energy transition, thus contributing to a sustainable growth.

Leaders in gas adsorption technology, SYSADVANCE makes Renewable Natural Gas a reality with our METHAGEN system, not only for anaerobic digestion projects but also for landfill gas with a proprietary double stage process.

In addition, the METHABOOST technology, an exclusive add-on to the METHAGEN system, deploys 3 in 1 unbeatable benefits – 100% Methane Recovery, Zero Emissions and the CO₂ total recovery on the process, delivered up to 99% purity.

The CARBOGEN series recovers and purifies CO₂ from biogas and flue gas processes, ensuring the most efficient Carbon Capture and Utilization (CCU) scheme.

SYSADVANCE, is fully committed towards a cleaner and more sustainable world, backing up with its global clients.



METHAGEN^{AD}

Anaerobic Digestion



CH₄

BIOGAS UPGRADING

METHAGEN^{AD}

Anaerobic Digestion

DESCRIPTION

METHAGEN is a system, based on VPSA (Vacuum Pressure Swing Adsorption) technology designed to purify biogas from Anaerobic Digestion feed-stock like:

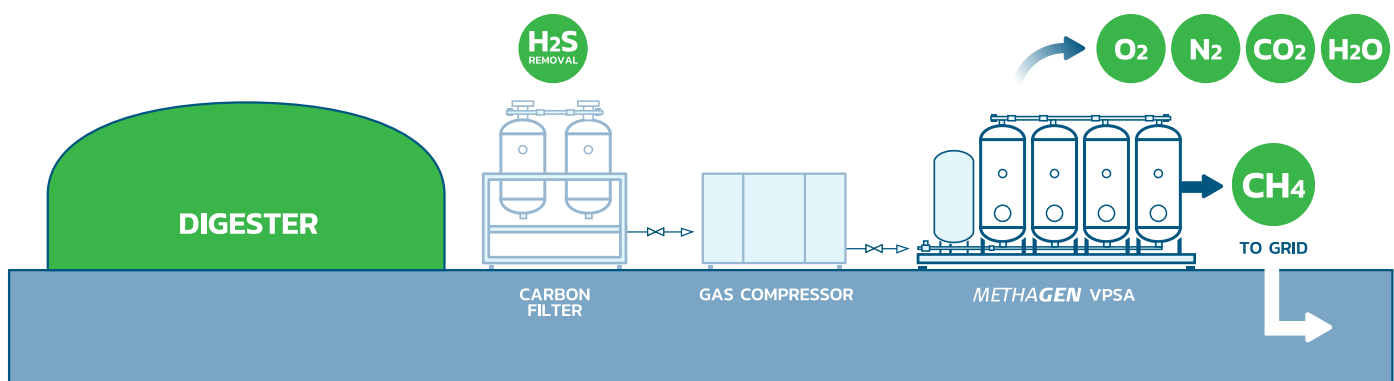
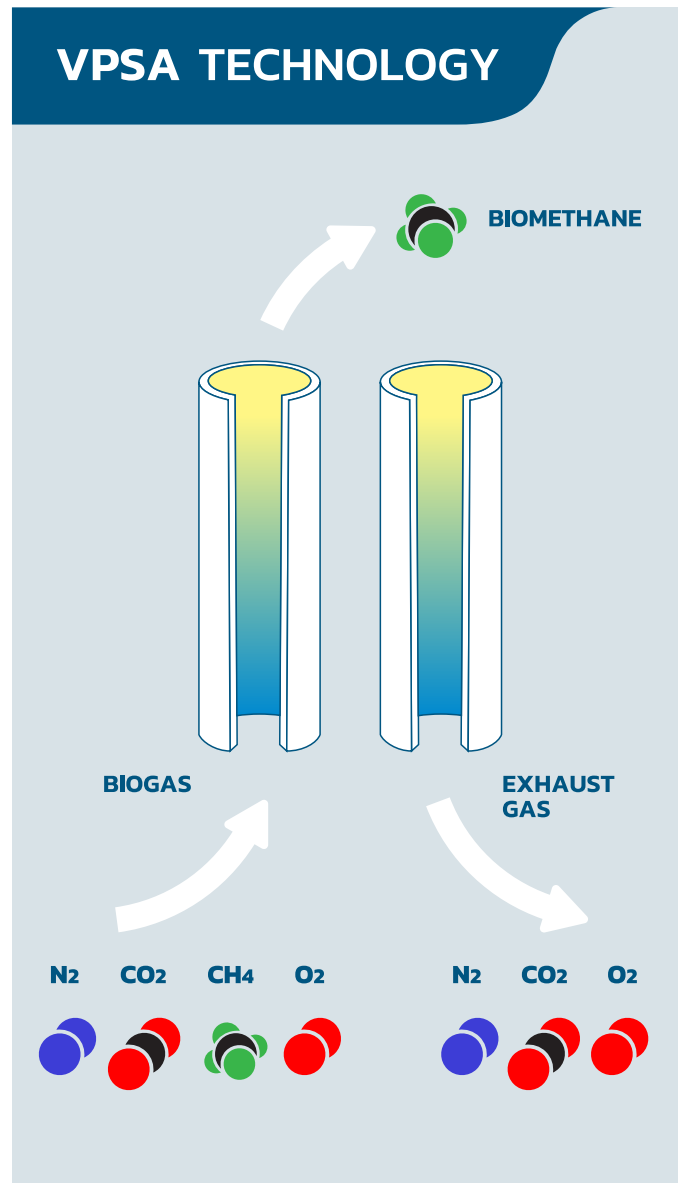
- Waste Water treatment plants
- Food and organic municipal waste
- Agricultural waste

VPSA TECHNOLOGY

After being previously dried and desulphurized, compressed biogas is fed to the METHAGEN Upgrading Unit that makes use of VPSA technology to remove CO₂, N₂, O₂ and residual H₂O from the gas stream.

The METHAGEN system contains a set of columns packed with selective adsorbents. Each adsorption column undergoes a cyclic sequence of pressure steps, to produce a continuous flow of high-purity, dry and pressurized biomethane.

The adsorbent regeneration step is assisted by a vacuum system to enhance the process efficiency. The residual methane desorbed during the regeneration step is recycled back to the biogas inlet reservoir, resulting in a methane recovery rate close to 99%. The METHAGEN operation is fully automated and controlled by a PLC. The bi-methane composition is continuously monitored by a multi-gas analysis system.



METHAGEN^{AD}

Anaerobic Digestion

100%
CH₄
RECOVERY

METHABOOST



METHAGEN^{AD}

ADVANTAGES

- 100% CH₄ recovery ► Zero emissions
 - METHABOOST option
- Lowest opex ► 0.22 kWh/Nm³ of biogas
- Lowest capex
- High CH₄ purity ► up to 99%
- High recovery ► up to 99,96%
- Efficient O₂ and CO₂ removal
- N₂ reduction capability
- Dry process
 - no water or chemicals
- Non-cryogenic tech
- Water removal
 - Dewpoint < 50 ppmv H₂O
- High reliability/ high availability
- Simple installation and operation
- Small footprint
- Fast plant operational readiness
- Quick start and stop
- 4.0 Enabled ► remote control & dynamic reporting
- Full turnkey upgrading solution
- CO₂ recovery option (CCU)

METHAGEN^{AD}

Anaerobic Digestion

PERFORMANCE

MODEL	Biogas inlet flow range	Biomethane flow range	Approx. Footprint (WxL)	Absorbed Power**
AD - XP1	50 - 100 Nm ³ /h	28 - 56 Nm ³ /h	13m x 9m	12 - 24 kW
AD - XP2	85 - 170 Nm ³ /h	45 - 95 Nm ³ /h	13m x 9m	21 - 41 kW
AD - XP3	125 - 250 Nm ³ /h	67 - 139 Nm ³ /h	13m x 9m	30 - 60 kW
AD - MP1	180 - 360 Nm ³ /h	100 - 200 Nm ³ /h	13m x 12m	43 - 86 kW
AD - MP2	250 - 500 Nm ³ /h	139 - 278 Nm ³ /h	13m x 12m	60 - 119 kW
AD - LP1	350 - 700 Nm ³ /h	195 - 390 Nm ³ /h	13m x 15m	83 - 166 kW
AD - LP2	425 - 850 Nm ³ /h	237 - 473 Nm ³ /h	13m x 15m	101 - 202 kW
AD - LP3	500 - 1000 Nm ³ /h	278 - 557 Nm ³ /h	13m x 15m	119 - 237 kW
AD - LP3+*	600 - 1200 Nm ³ /h	334 - 668 Nm ³ /h	13m x 17m	143 - 285 kW

* Larger capacities are available with a modular approach to the existing models.

** Total absorbed power including pre-treatment.

Please contact SYSADVANCE for further information. Models and specifications are subject to change without notice.

METHABOOST



METHABOOST option is a post-treatment stage based on Vacuum Swing Adsorption (VSA) technology enabling the recovery of residual methane from the off-gas stream of the METHAGEN process.

METHABOOST is an efficient alternative to expensive catalytic oxidation systems, RTO (Regenerative Thermo Oxidation) or low PCI boilers.

METHABOOST enables near 100% recovery, zero methane loss/emission and pure CO₂ production.

METHABOOST is specially recommended for CO₂ inertization of batch digesters.



METHAGEN^{LF}

Landfill Gas Upgrading



LANDFILL GAS UPGRADING

METHAGEN^{LF}

Landfill Gas Upgrading

DESCRIPTION

METHAGEN LF is a proprietary technology developed by SYSADVANCE to purify biogas with high contents of N₂ and O₂.

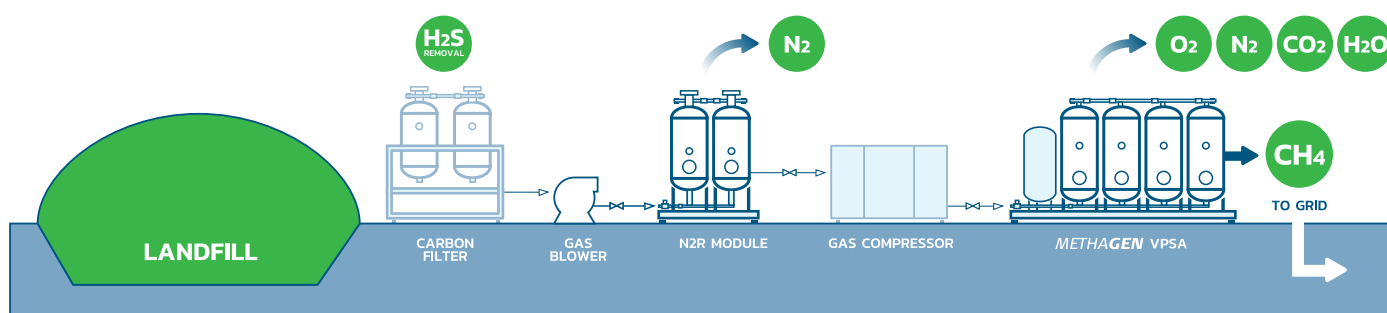
This system was designed specifically to Landfill sites wanting to produce High BTU/HHV Renewable Natural Gas.

This system can also be utilized in Oil&Gas industry, to purify contaminated Natural gas (with N₂/O₂/CO₂).

TECHNOLOGY

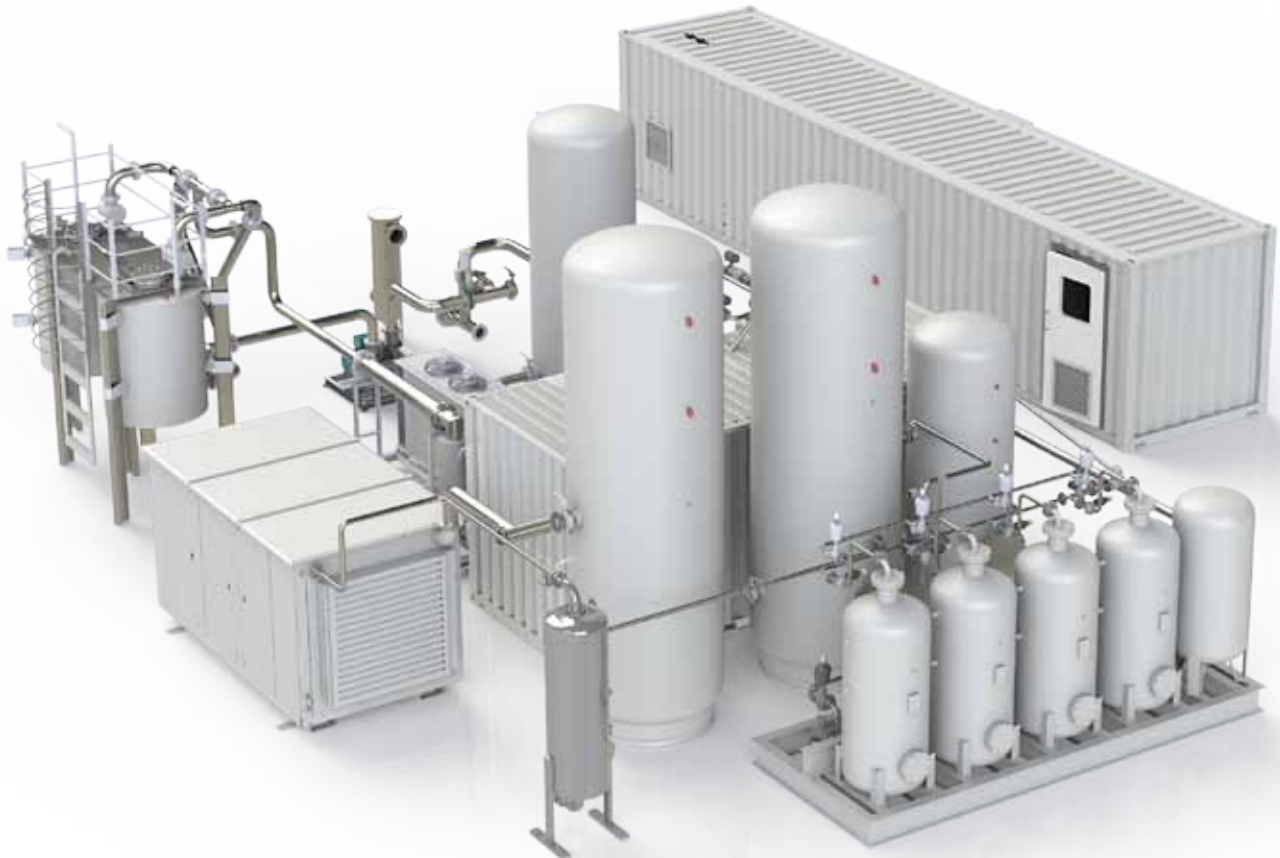
METHAGEN LF is a 2 stage VPSA, where the first stage is optimized to remove N₂ and the second stage promotes the separation of CO₂ and O₂ from CH₄.

This approach allows the process to adapt to the steep variations on feed stream contaminant concentrations without compromising the output gas quality.



METHAGEN^{LF}

Landfill Gas Upgrading



METHAGEN^{LF}

ADVANTAGES

- High Nitrogen removal capacity from 20% of air down to 3%
- Lowest opex ► 0.30 kWh/Nm³ of biogas
- Lowest capex
- Efficient O₂ and CO₂ removal
- Dry process – no water or chemicals
- Water removal
 - dewpoint < 50 ppmv H₂O
- Non-Cryogenic
 - no need for liquid N₂
- High reliability/ high availability
- Fast plant operational readiness
- Excellent process response to air (N₂ + O₂) steep variance
- Quick start and stop
- 4.0 Enabled
 - remote control and dynamic reporting
- Full turnkey upgrading solution

METHAGEN^{LF}

Landfill Gas Upgrading



CARBOGEN

CO₂



CO₂ CAPTURE AND PURIFICATION

CARBOGEN

CO₂ Capture and Purification

DESCRIPTION

Vacuum Pressure Swing Adsorption (VPSA) system engineered for capture and purification of CO₂ from biogas upgrading waste gas, flue gas streams as well as CO₂ – rich industrial streams.

In a context of Carbon Capture and Utilization (CCU), CARBOGEN is a cleantech enabling the reduction of CO₂ emissions.

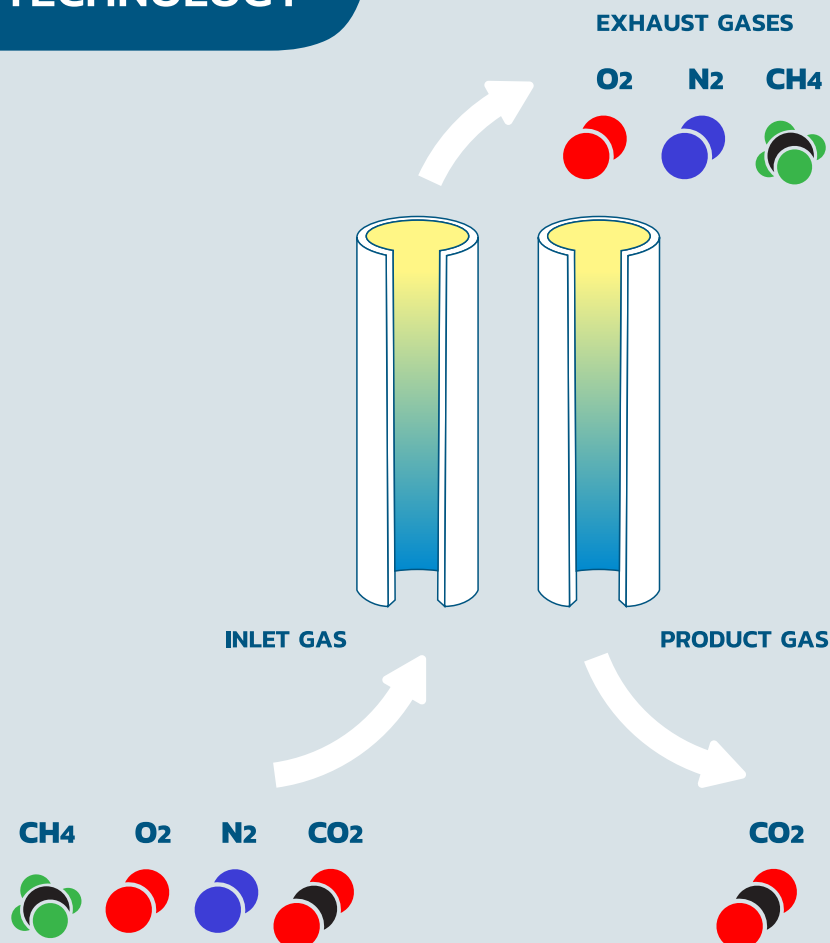
CARBOGEN systems are available with capacities ranging from 100Nm³/h to 1000 Nm³/h of CO₂ – rich gas.

TECHNOLOGY

The CO₂ enriched gas is fed to the VPSA at low pressure. On the recovery unit, the adsorbent media starts capturing the CO₂ that is further recovered by vacuum.

The adsorbents used in the process are specially selected due to their highest CO₂ adsorption capacity and fast kinetics.

VPSA TECHNOLOGY



CARBOGEN

CO₂ Capture and Purification



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CARBOGEN

ADVANTAGES

- High CO₂ purity ► up to 99,9%
- Low OPEX < 150kWh/ton of CO₂ recovered
- Dry process ► no water or chemicals
- Liquefaction option available
- Final polishing for food grade available
- High reliability/high availability
- Simple installation and operation
- Small footprint
- Fast plant operational readiness
- Quick start and stop
- 4.0 Enabled ► remote control and dynamic reporting

CARBOGEN

CO₂ Capture and Purification

APPLICATIONS

- GREENHOUSE FARMING
- FOOD AND BEVERAGE
- PURGING OF BATCH ANAEROBIC DIGESTER
- CONTROL OF PH ON WWT FOR PAPER INDUSTRY
- ALGAE PRODUCTION
- CARBONATE PRODUCTION
- CONCRETE CURING
- STEEL MANUFACTURING
- METHANATION FOR PtG (Power to gas)



BiOXYGEN



advance®

Oxygen

O₂BIO

GENERATORS

BiOXYGEN

H₂S REDUCTION

Hydrogen sulphide is formed during the anaerobic digestion of organic material containing Sulphur. Its presence in the biogas significantly reduces the lifetime of pipework, instrumentation, analytical equipment, CHP, blowers, compressors or even the adsorbent material from biogas upgrading processes.

Hydrogen sulphide can be removed from biogas by different chemical, physical, and biological procedures. Most of them require small amounts of O₂ to be effective.

Air injection with blower is currently the method

used to supply O₂ into the different H₂S reduction processes. The major inconvenient is that Nitrogen (N₂) – which corresponds to 79% of the air content – is introduced into the biogas as contaminant reducing its heating value.

This is even more problematic if the target is to upgrade biogas to biomethane due to the fact that most part of the upgrading technologies is not able to remove N₂ from CH₄ (e.g., scrubbing with amines, water or chemical solvent), except for Vacuum-Pressure Swing Adsorption (VPSA) which can remove approximately half of the N₂ content.



BiOXYGEN

DESCRIPTION

BiOXYGEN by SYSADVANCE makes use of the PSA technology to produce pure oxygen from air by selective adsorption of N₂ on a special molecular sieve material. As a result, only O₂ is injected in your bioprocess for H₂S reduction avoiding the biogas dilution with contaminants.

A special O₂ injection system developed by SYSADVANCE use proportional valves injecting O₂ as a function of external process variable such as the H₂S content in the raw biogas, raw biogas flow or even a combination of both is available.

Oxygen production cost per Nm³ of biogas treated is extremely low ranging from 0,0005€ to 0,0010€.

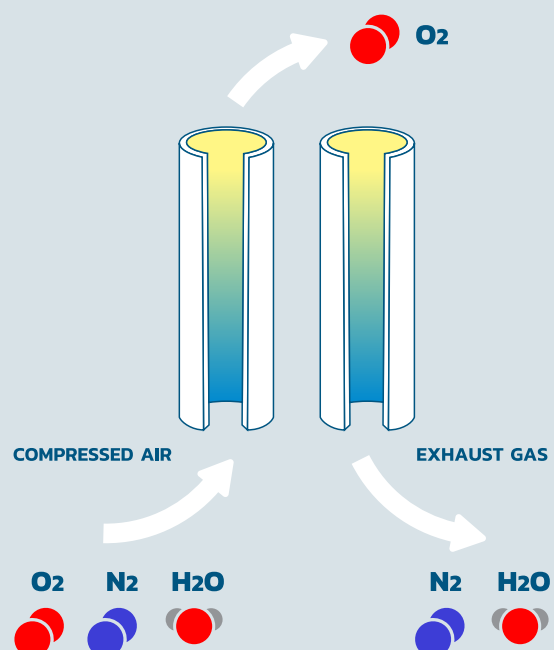
SYSADVANCE offers a wide range of O₂ injection systems (PSA and VSA) covering the needs for anaerobic digestion plants with production capacities between 20 Nm³/h and 2000 Nm³/h of raw biogas.



ADSORPTION TECHNOLOGY

Oxygen generators incorporate sets of columns filled with molecular sieve. Under pressure these columns retain all compounds present in air (Nitrogen, Carbon Dioxide and Water), which tie to the molecular sieve during the building of pressure, with the exception of the Oxygen. This process is known as PSA (*Pressure Swing Adsorption*) or VSA (*Vacuum Swing Adsorption*).

A modular system allows synchronized operation of several parallel units, in order to ensure a constant flow at the required purity.



BIOXYGEN

ADVANTAGES

- Safe delivery and independence from external gas suppliers and from fluctuation of the Oxygen market price;
- Suppression of logistic operations like handling of cylinders or liquid Oxygen and supplier management;
- Modular, flexible and low maintenance units;
- Low power demand
 - $<0,5 \text{ kWh/Nm}^3$ @ 90% O₂;
- O₂ purity up to 93% (dew point $< -50^\circ\text{C}$ @ 0 barg);
- Compression up to 8 barg available;
- O₂ sensor & output signal for remote monitoring;
- Skid or container mounted for mobility;
- VSA for larger flows and lower power demand.

PSA



VSA



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APPLICATIONS

• O₂ INJECTION INTO THE HEADSPACE OF THE DIGESTER

Reduction to sulphate (H₂SO₄) by O₂ injection into the headspace of the digester (a rate of O₂ corresponding 1% of the biogas is required);

• O₂ SUPPLY TO BIOLOGICAL SCRUBBER

Approximately 1% of O₂ is charged to the column containing the immobilized microorganisms responsible for the degradation of the H₂S to sodium sulphate (NaHSO₄). Sulphuric acid is formed if the rate of air injected is reduced (also suitable for trickling filters);

• O₂ INJECTION INTO ACTIVATED CARBON FILTERS

H₂S adsorption on catalyst impregnated activated carbon requires the presence of 0.5 – 1.0% of O₂ in the presence of humidity to oxidizes H₂S to elementary sulphur that binds to the adsorbent surface (also suitable for iron sponge filters).

GLOBAL PRESENCE



PUBLICATIONS



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