

*Plants for the production of
Biomethane and CO₂ from Biogas*



Biogas upgrading:
Biomethane, BioCO₂ e BioLNG

From Biogas to Biomethane an eco-friendly and effective purification process

Tecno Project Industriale (TPI) offers a comprehensive range of systems to cover each stage of the Biogas treatment process:

- ✓ **Biogas and Biomethane compressors**
- ✓ **Biomethane dryers**
- ✓ **CO₂ recovery and liquefaction**
- ✓ **Biogas upgrading plants with membrane or selective solvent.**

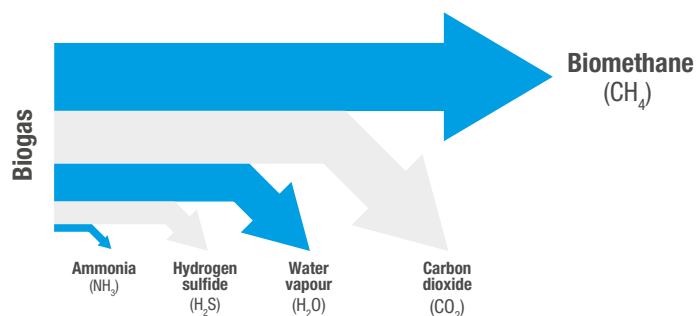
TPI's Biogas upgrading plants **purify and refine Biogas** produced from OFMSW (Organic Fraction Municipal Solid Waste), processing scrap and by-products, effluent from livestock farming, crop wastes and other biomass.

The international renown of TPI, with its more than three decades of experience in plant production, is built on the company's consolidated ability to treat gas mixtures and recover CO₂ of exceptionally high quality with optimal operating costs.

TPI offers expertise and know-how which, backed by solid experience in the sectors of gas compression, purification, deoxidation, production and recovery, is equivalent to a guarantee of absolute reliability.

Technology and know-how

The advanced technology built into the Biogas upgrading plants allows the separation of a large number of different components that are appropriately filtered and removed allowing the Biomethane obtained to gain advanced biofuel certification in compliance with the network code and also further specific market requirements.



Biogas upgrading with 3-stage HPSM membrane systems

Several technologies exist for Biogas treatment and refinement.

Tecno Project Industriale proposes exclusively the solutions it deems to be the most valid.

One such solution involves the use of ultra-high selectivity polymeric refinement membranes (HPSM) that allow the achievement of high refined gas flow rates and high yields without using chemical agents.

Efficiency and versatility

The HPSM plants developed and industrialised by TPI make it possible to obtain high levels of purity with recovery efficiency in excess of 99%, thus making the pure Biomethane suitable for distribution in national gas networks.

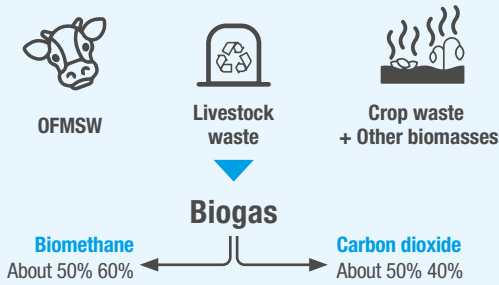
Characteristics

- ✓ High pressure operating system
- ✓ The CO₂ can be easily recovered with a suitable TPI plant, also making it possible to eliminate the small loss of methane completely
- ✓ Simple and innovative system
- ✓ Biomethane delivery pressure from 10 to 20 bar
- ✓ Biogas flow rate from 50 Nm³/h to 3,000 Nm³/h.



THE BENEFITS OF BIOMETHANE PRODUCTION

- ✓ Economic exploitation of agricultural biomass, processing scrap and OFMSW (Organic Fraction of Municipal Solid Waste)
- ✓ Reduction of environmental impact to promote the creation of a circular economy
- ✓ Opportunity to boost business income thanks to the use of Biomethane for injection into the network, for the permitted uses, or for sale as an automotive fuel (LNG or CNG system).

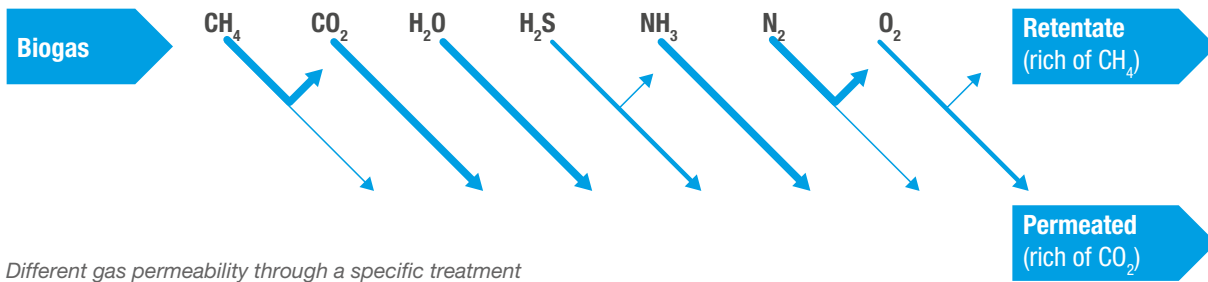


Biogas upgrading with selective solvent plants

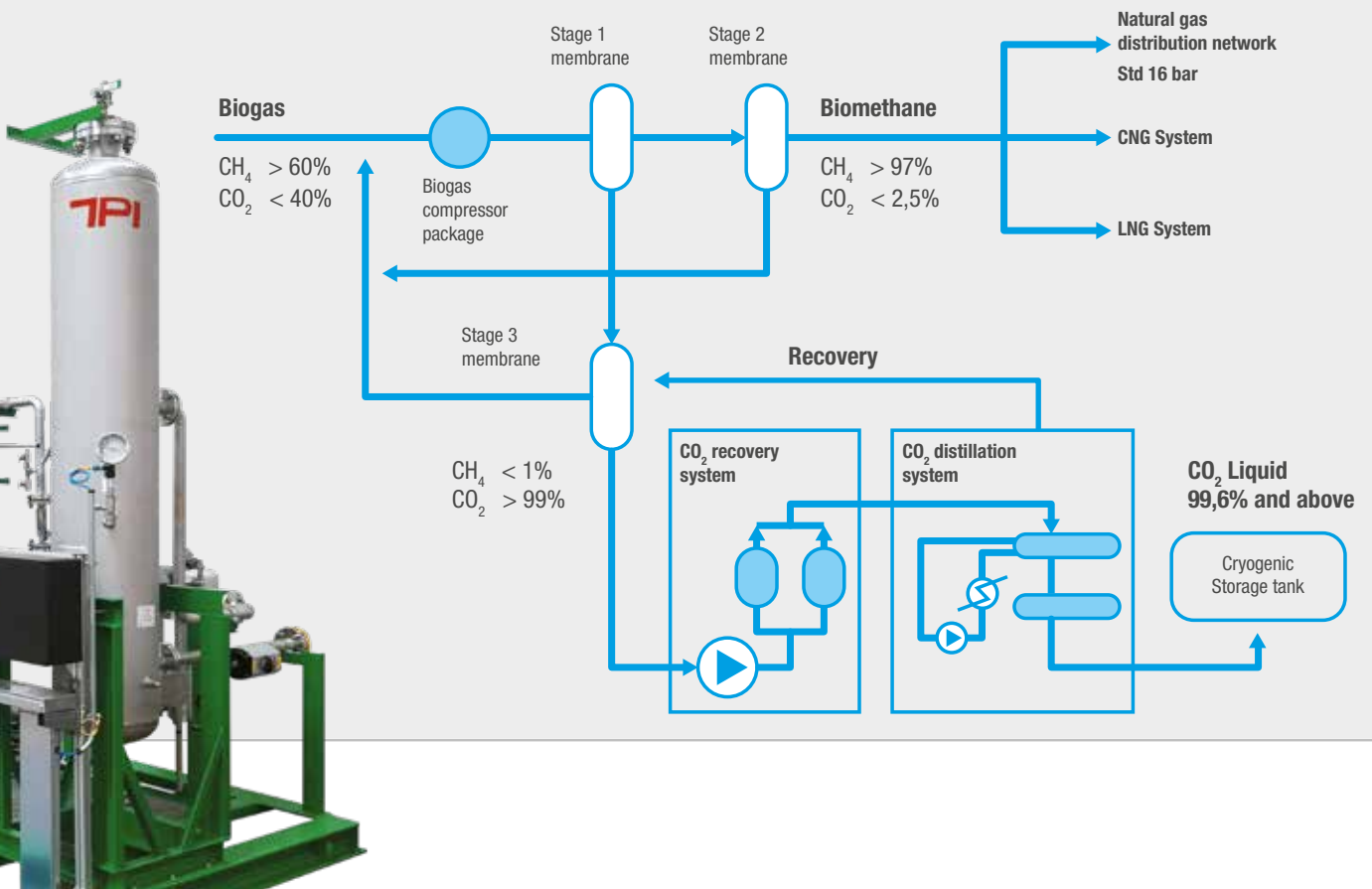
The selective solvents system operates at low pressure and requires heat in the form of steam for solvent regeneration. Separation achieved by means of this process is extremely efficient. This solution is also ideal for use in situations where network injection occurs at low pressure.

High performance

The plant technology is based on the use of a dedicated solvent enriched with specific additives suitable for the treatment of Biogas, that also allow the removal of CO₂ without any special pre-treatment process. The Biomethane obtained by this process is of extremely high purity (more than 99%). With respect to traditional amines, solvent consumption is far lower.



BIOGAS SELECTIVE SOLVENTS TREATMENT PROCESS



BioCO₂ recovery



FIND OUT MORE



The Carbon Dioxide purity for beverage and food, shall be compliant with FOOD-Grade and ISBT specifications.

TPI, thanks to a research and development department, offers CO₂ and Biogas solutions especially dedicated to the food industry. Specialized in the design, production and installation of CO₂ recovery and purification systems, TPI over the years has achieved important goals boasting installations all over the world. TPI CO₂ recovery and liquefaction plants are optimized to guarantee a continuous production of high purity 99.998% CO₂, IBST and EIGA quality guidelines compliant.

Main features

- ✓ Complete tailor made design according to client request
- ✓ High flexibility
- ✓ Low consumptions
- ✓ Compact design and optimization
- ✓ 24/7 remote service.



PENTATEC

Pentatec company provides tools, carries out analyzes, monitoring and quality certification of gas streams. Pentatec analyser is designed to assure the highest accuracy and reliability with minimum cost to comply with the strictest CO₂ purity specifications.

Pentatec system can be combined with multiple sampling system.

Technical features

CO₂ Analysis system based on Mass Spectrometer.

Analysers

- Mass spectrometer CO₂ Sense
- Infrared purity analyser
- Gascromatograph FID-Methanizer
- Gascromatograph DID
- Fluorescence Total Sulfur Analyser
- Chemiluminiscent NO_x Analyser
- Electrochemical Moisture Analyser.

For more information: commerciale@pentatecsrl.com

Biomethane liquefaction

To complement its experience, in the biomethane supply chain, Tecno Project Industriale provides three proven technologies for liquefaction:

- ✓ **Pure LNG-LIN:** biomethane liquefaction achieved by the process of evaporating liquid nitrogen
- ✓ **Pure LNG-DCE:** biomethane liquefaction achieved directly by multistage compression, cooling and adiabatic expansion techniques
- ✓ **Pure LNG-TB:** liquefaction achieved by heat exchanger integrated in a closed cycle with expansion turbines and boosters.

Purpose

The application of the produced bio-LNG allows remote storage and transportation of a fully renewable fuel such as methane.



Pure LNG-LIN
Biomethane liquefaction plant

Technologies and advantages

- ✓ Consolidated technologies enhanced by the strong cryogenic expertise of TPI and SIAD Macchine Impianti
- ✓ Highly reliable and efficient machines for the treatment of nitrogen (compressors and turbines)
- ✓ Simple plant management process and control system in all stages of operation
- ✓ Integration with upgrading systems and maximum productivity and efficiency
- ✓ Safe plants with a low environmental impact.



Pure LNG-DCE
Biomethane liquefaction plant

RANGE OF "PURE LNG" PLANTS	BIO-LNG PRODUCTION DI BIO-LNG		
	Nm ³ /h	TPD	kg/h
Pure LNG-LIN Plant involving the use of liquid nitrogen (LIN) as the cooling factor	50 ÷ 280	1 ÷ 5	40 ÷ 208
Pure LNG-DCE Direct compression, cooling, expansion and liquefaction bio-methane	280 ÷ 560	5 ÷ 10	208 ÷ 415
Pure LNG-TB Nitrogen recycling plant with expansion turbine and booster	560 ÷ 1 400	10 ÷ 25	415 ÷ 1 040

Individual capacities are considered indicative and increased depending on conditions

Pure LNG

For further information: info@tecnoproject.com

SIAD Group solutions and expertise in the Biomethane industry

Biomethane production from biomass e from organic waste (*including the OFMSW - Fraction Organic Solid Waste*) combines the **reduction of the environmental impact with the generation of clean, self-produced and renewable energy.**

Technological innovation is the watchword that daily guides the choices and evolutionary processes of the SIAD Group in a more current and cutting-edge context: the production of Biomethane from biomass and organic waste. Thanks to the experience gained over the years and the versatility of the skills acquired, the SIAD Group offers processes, plants and products for each section of the “Waste to Biomethane” supply chain.

Complete the service the ability to recover the high purity BioCO₂ for its market use.



Biogas upgrading plant of Snam 4 Environment (capital 100% Snam S.p.A.), 3-stage HPSM membrane system for the production of Biomethane

SIAD GROUP'S CHAIN AND AREAS OF EXPERTISE

- **Tecno Project Industriale**
Tecno Project Industriale is the company within the group specialized not only in recovery, extraction and CO₂ liquefaction but also in Biogas upgrading with Biomethane or food-grade CO₂ recovery.
- **SIAD Macchine Impianti**
SIAD Macchine Impianti has developed the SMART LNG series, a new and innovative type of plant for treating and liquefying methane on a small-to-medium scale using nitrogen as a refrigerant.
The company also offers a range of compressors for managing all gas flows in the upgrading and liquefaction process including Biogas, Biomethane, carbon dioxide and nitrogen.
- **Tecnoservizi Ambientali**
In partnership with the world's leading supplier of activated carbons, Tecnoservizi Ambientali offers a targeted service for the purification of Biogas from different sources. Its services include the supply and handling of active carbon and the reactivation of spent active carbon. Furthermore, Tecnoservizi Ambientali deals with the recovery and disposal of critical raw material from industrial waste.
- **Pentatec**
Pentatec is the gas analysis division of the SIAD Group in the Biomethane production chain, offering advanced solutions for the analysis and quality certification of gases generated by Biogas upgrading plants.
- **SIAD**
The parent company SIAD supplies proprietary gases, technologies and services for all stages of the Biomethane production chain, from micro-oxygenation with oxygen, to nitrogen for methane liquefaction and inertisation, from oxygen for wastewater treatment to certified mixtures for calibrating analysis tools.

DISCOVER THE BIOMETHANE
SUPPLY CHAIN

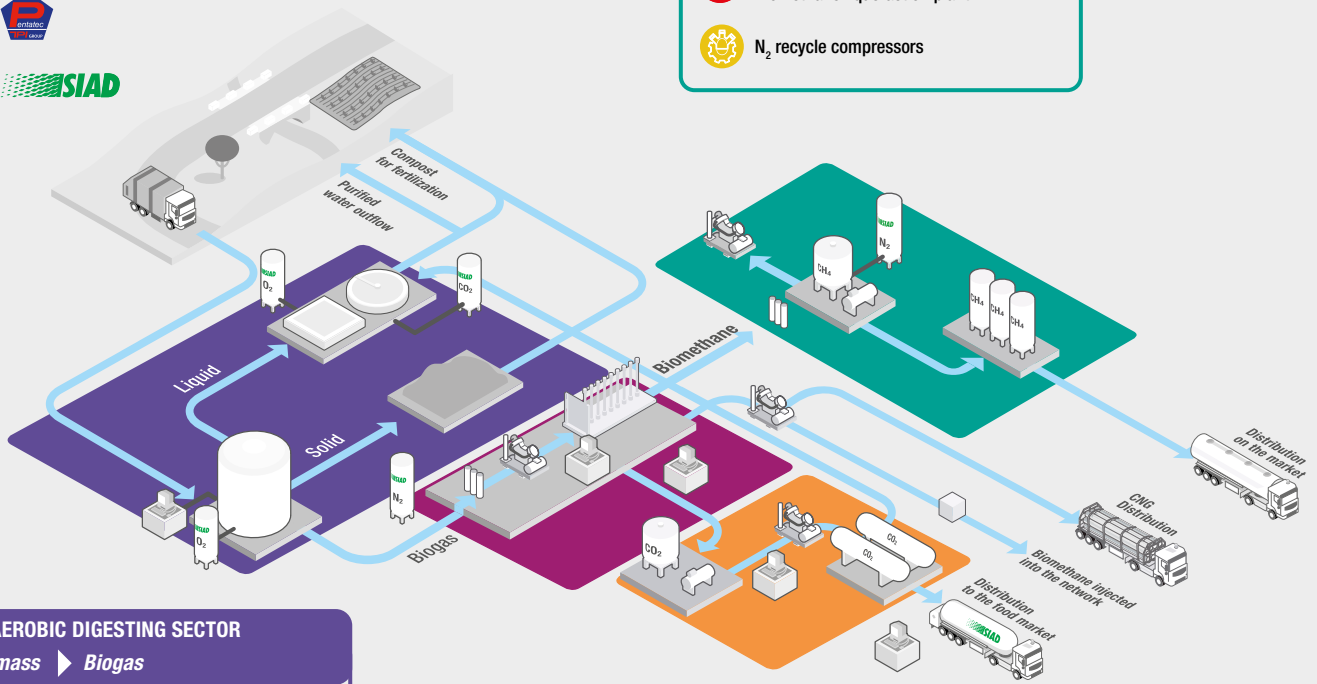


SUPPLY CHAIN OF BIOMETHANE AND BIO-LNG



BIOMETHANE LIQUEFACTION SECTOR
Biomethane ▶ *Liquid Biomethane*

- ❄️ Pure LNG-LIN / DCE / TB
Biomethane liquefaction plant
- 🔧 N₂ recycle compressors



ANAEROBIC DIGESTING SECTOR
Biomass ▶ *Biogas*

- 🔍 Analysis (gases and calibration mixtures)
- 🌬️ Micro-oxygenation to remove sulphides
- 🌬️ O₂ and O₃ for water treatment
- 🌬️ N₂ for inerting digesters in the starting phase

CO₂ PURIFICATION AND LIQUEFACTION SECTOR
Impure CO₂ ▶ *Liquid food-grade CO₂*

- 🌬️ CO₂ recovery, purification, liquefaction
- 🔧 CO₂ compressors
- 🔍 CO₂ analysis
- 🚚 CO₂ distribution

UPGRADING SECTOR *Biogas* ▶ *Biomethane*

- 🔍 Activated carbons for the removal of H₂S and VOC
- 🌬️ N₂ for carbon management, inerting and backwashing
- 🔍 Biogas analysis
- 🔧 Biogas upgrading systems to Biomethane
- 🌬️ CO₂ / CH₄ separation systems
- 🔧 Biogas compressors
- 🔧 Biomethane compressors

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