

WE TRANSFORM YOUR IDEAS INTO THE ENERGY OF THE FUTURE

5,5 kWh/Nm³

$PV=nRT$

PCS

PCI=3,5 kWh/kg

$V = h r^2$

PCI

$Q = m C_p \Delta T$

80 bar(g)

$C_p=4,18 \text{ kJ/kgK}$

 **genia**
bioenergy

PCS=10,7 kWh/Nm³

800.000 kWh

25°



Genia Bioenergy is a **company dedicated to bioengineering, specialising in renewable gases**, biogas, biomethane and waste2energy, with experience in every aspect of energy business.

Our strongest competitive advantage lies in our ability to integrate within one company the expertise we possess as technologists in the bioenergy sector and our capacity to undertake the design, construction and operation of plants, which is done by developing, structuring and comprehensively promoting renewable gas projects. Clear examples are the structuring of investment vehicles, environmental and administrative processing, waste management regulations, gas regulations and/or BPA negotiations.

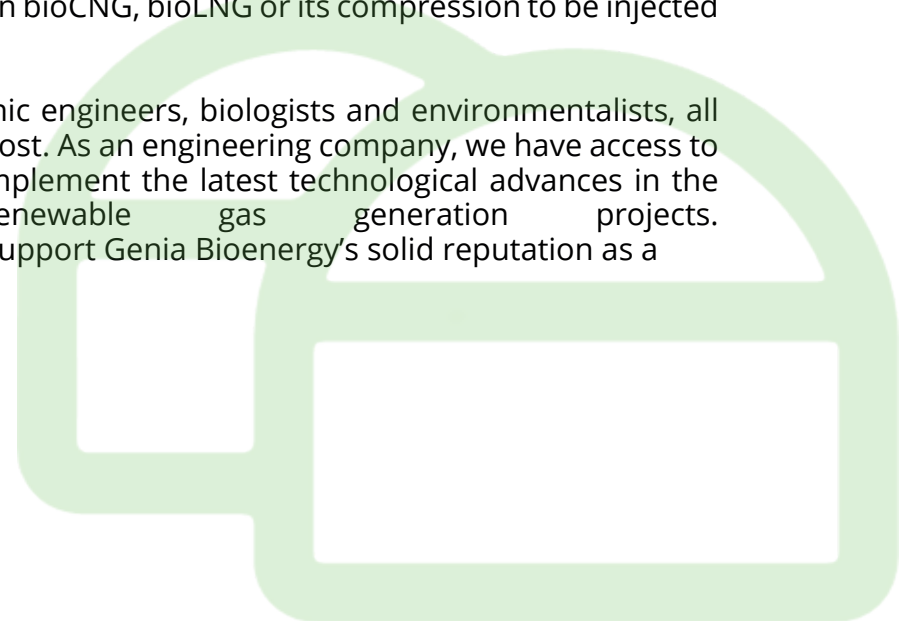
We have the experience, the technical and material resources and the team to comprehensively develop renewable gas projects and have especially gained expertise in start-up, design and biogas and biomethane projects for large national and international clients. We also focus on several R+D+i projects associated with waste valorisation, digestates and bioenergy.

We provide excellent quality comprehensive service, utilising the most cutting-edge technologies on the market to determine the technical and economic viability of your project.

The experience we have gained makes us a strategic partner when developing valorisation projects in the biogas and biomethane spheres. We always adapt the project design to the clients' objectives and needs to achieve optimal results.

We offer services that include everything from opportunity localisation and development using waste valorisation, to biogas purification to obtain biomethane and its subsequent transformation resulting in bioCNG, bioLNG or its compression to be injected into the grid.

Our internationally trained team is made up of chemical, electric and electronic engineers, biologists and environmentalists, all experts in processes, management and valorisation of organic waste and compost. As an engineering company, we have access to the most advanced tools for calculating, simulating and modelling, and we implement the latest technological advances in the sector, designing and comprehensively managing renewable gas generation projects. Our clients and our professional team with more than 15 years of experience support Genia Bioenergy's solid reputation as a partner for the development, design, construction and operation of projects.



WE DESIGN THE #FUTUREtogether

Projects



Biogas plants

Upgrading technologies:

- Chemical absorption (amines, alkaline salts)
- PSA (pressure swing adsorption)
- Cryogenic separation
- Membrane separation
- PWS (pressurized water scrubbing)



Biomethane plants

Green Hydrogen Projects

Engineering



Engineering and Project Development:

- Feasibility studies and profit analysis
- Conceptual engineering development
- Process engineering
- Sizing, calculations, layout, P&ID, schematics, mass and energy balances, etc.
- Comprehensive project permits and approvals
- Cost engineering
- Purchasing and supplier management
- Investment and management



Construction and Executions of Works:

- Planning and coordination
- Site management
- Permit and legislations processing
- Specific and speciality chemical analysis



Plant Operation and Maintenance (O&M):

- Start-up assistance
- Process monitoring
- SCADA development
- Process optimisation
- Corrective and preventive maintenance
- Comprehensive plant management and operation



Asset Management Process Improvement:

- Consulting
- Plant auditing



Biogas

Biogas is a renewable gas primarily composed of methane and carbon dioxide obtained through anaerobic digestion of organic waste

Biogas plants **contribute to the correct management and valorisation of organic waste from sectors such as** agro-food, farming, industry, and/or urban solid wastes (brown waste containers found in Spain).

Anaerobic digestion, also called biomethanisation, is a biological process that takes place in the absence of oxygen, in which part of the organic waste's organic material is transformed by microorganisms into a mix of gases (biogas), primarily constituted of methane and carbon dioxide and other gases in small quantities (ammonia, hydrogen, hydrogen sulphide, etc).

Biomethane

Biomethane is one of the cleanest fuels that exists. As a driving force in the circular economy, its great potential lies in its existence as an energy source with no carbon footprint, allowing it to decarbonise the uses of natural gas fossil fuel.

Biomethane is **obtained through a process of biogas purification**, called Upgrading. This process consists of cleaning the biogas and eliminating the carbon dioxide and other elements from its composition in a way that increases the percentage of methane gas to 98% CH₄, converting it into a decarbonised renewable gas. It offers the same possibilities for use and potential energy equivalent to those of natural gas fossil fuel.

Hydrogen

The characteristics of hydrogen impart it with properties that will allow it to **be a predominate vector energy in the future**.

It is being developed to become a completely safe energy that is economically competitive and free of carbon dioxide emissions.

Hydrogen represents a solution to achieve a new energy model that, in the future, may be able to displace fossil fuels in the primary spheres of energy consumption: electric and heat for residential, industrial and transport use.



BIOGAS

A biogas plant is an industrial facility designed to treat and reclaim different organic wastes, for the purpose of producing renewable gases, organic soil amendments and other by-products of value such as nutrients, humic and fulvic acids, CO₂ and more.

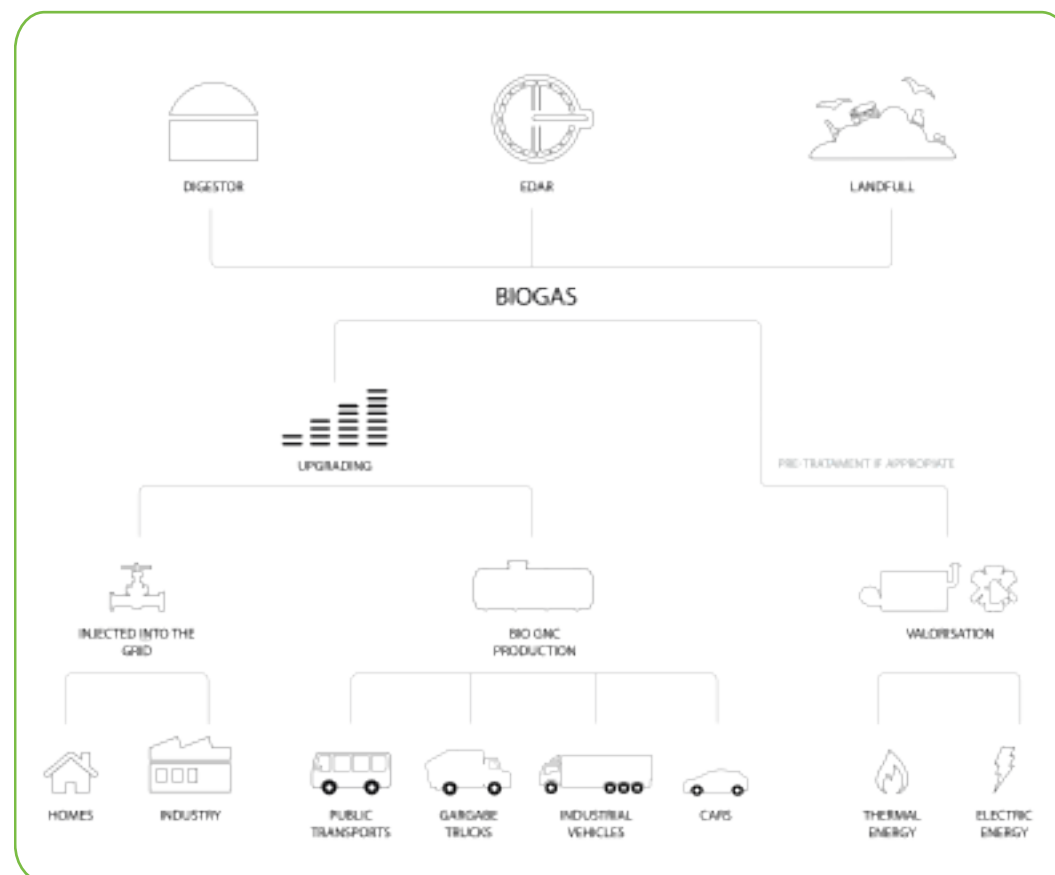
The **primary advantages** of this type of plant are:

- It is a **mature technology** widely implemented in Europe.
- It enables renewable gases generation, such as biogas **through anaerobic digestion** of different streams of organic waste.
- It offers a **sustainable solution for the management and valorisation of organic waste**. Both to generate renewable gases for self-supply in the biogas boiler or CHP biogas: power-heat, to produce biomethane for its use in mobility or connection to the gas network.

It can offer a solution for managing and treating **complex wastes** such as sewage sludge and those with high concentrations of nitrogen and ammonium, like purines.

- It solves the problem of managing waste from landfills, **facilitating correct compliance with regulations and legislation** of waste management, treatment and control. Reduces costs and entries to the landfill. Bringing an end to the state of waste.
- **legislation** of waste management, treatment and control. Reduces costs and entries to the landfill. Bringing an end to the state of waste.

We are the Comprehensive partner that will provide a solution to any problem you may have with **waste valorisation and management** for the production renewable gases.





Digesters

Energy for self-supply

Producing **biogas for self-supply utilising organic waste** may be profitable for industry and farming, **if the project is well designed, built and operated.**

The advantage of biogas for self-supply is that it makes it possible to obtain economic value from generated organic waste, and therefore ceases to be an expense and becomes a resource itself. The biogas produced by the plant is to be used for self-supply, whilst the “digestate” such as organic soil amendments can be utilised in the production of compost and as a precursor to fertilisers.

With these plants, waste that involved a threat to the environment and an extra expense to companies because of the need to be treated is incorporated into the circular economy, generating sustainable energy and high-quality organic fertilisers.

Waste2energy

Waste2energy is a process that takes advantage of organic material and different waste and/or by-products to generate energy. **This organic material and its by-products primarily come from OFMSW, organic fraction** of municipal solid waste (MSW) or industrial solid waste.

One of the concepts considered in the **circular economy model** is the utilisation of waste to provide it with new applications; waste valorisation takes waste that cannot be recycled and converts it into energy for domestic or industrial use.

Waste valorisation and management

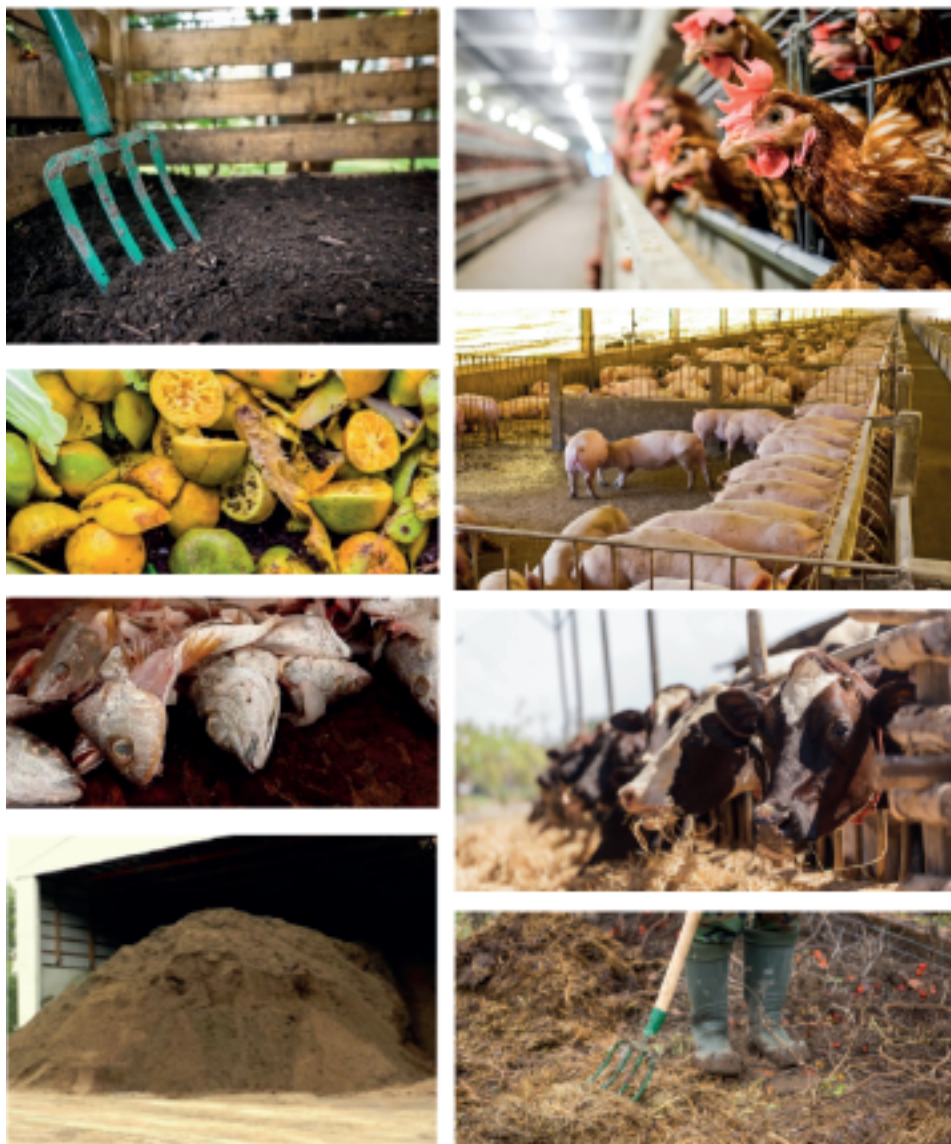
Organic waste valorisation may be done through **two different biological treatments:** anaerobic composting and anaerobic digestion, or biomethanisation, through a biological treatment.

Composting is **an aerobic biological process in which this organic waste is transformed into compost or organic fertiliser** that is stable and sanitised, allowing for its use on crops. Through the process of biomethanisation, or anaerobic digestion, biogas is obtained, which is a renewable gas that can be used as a biofuel for residential, industrial or mobility applications.



Gas treatment

WASTE MANAGEMENT



Organic waste from the industrial and agro-food sectors and from the organic fraction of municipal solid wastes (MSW).

Waste Management

Circularity and valorisation of organic waste is a challenge for today's society. The new regulations require complete valorisation and traceability of waste until its final treatment.

The entire value chain is responsible for reducing and preventing the environmental impact of waste generating processes and it has a legal obligation to manage them correctly. Converting a waste into a new resource is the best way to do it.

At Genia Bioenergy, we help you confront environmental concerns and current and future regulations:

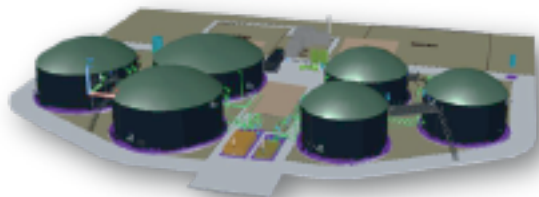
- We help you **comply with regulations** and stay informed about European requirements.
- We help you **understand environmental legislation** and assist you with all the requirements in the Integrated Environmental Authorisation.
- We help you with the **treatment of all classes** of waste, providing you with the most suitable technological solution.
- We help you achieve your objectives, with the introduction of environmental management systems
- We help you **widen your scope of business**, developing activities founded on the circular economy, future land laws, EC laws, Green Deal, etc.

Waste management in biogas plants

Organic waste is primarily produced in sectors such as industry and agro-food. Another source of waste is the organic fraction of municipal solid wastes (OFMSW).

Small-scale biogas plants may be profitable for the agro food industry. By optimally managing waste, they comply with regulations and promote new business models founded on the circular economy.

Small-scale biogas plants may be profitable for the agro-food industry.



Biogas plant for self-supply



BIOMETHANE

Biomethane is pure methane, 98-99% CH₄, **a gas which has characteristics and properties very similar to those of natural gas fossil fuel, but is totally decarbonised, or carbon free.**

In Europe, **a large part of the industrial sector, worried about the reduction of its carbon footprint and of high costs associated with emission rights**, is utilising this renewable gas to drive CHP electric engines, producing thermal energy to operate high-power heating systems. It is also utilised as fuel for land and sea transport vehicles in the form of a compressed or liquified gas and in the form of raw material to generate other types of fuels.

Some **industries have installed infrastructures to generate biomethane using their own waste**, which enables a competitive increase through self supply at a very low cost as well as the reduction of their carbon footprint.



Biomethane and waste managers

With time, **waste managers have had to redouble their efforts to be able to comply with increasingly strict standards** and to achieve this sector's current objectives which are becoming more complex, restrictive and ambitious.

Agricultural waste is generated in natural environments and primarily comes from corn, rice and grain plantations, as well as orchards and vineyards. The production of biogas using plant waste also involves the significant reduction of costs associated with the disposal of organic waste, and other by-products with an added value may even be obtained, as in the case of silage or even rice straw.



Agro-food waste

Biomethane and valorisation

Correct waste management is considered truly satisfactory when it fulfils objectives such as: its transformation into different resource streams and by-products of added value for the community, the reutilisation, valorisation and recycling, as well as the use of methods and processes that allow the transformation into renewable energy supporting the circular economy model and industrial ecosystems. The primary sources of biomethane come from the livestock sector, the agro-food industry, and the retrieval of municipal waste and waste waters.

Biomethane offers the same advantages and characteristics of natural gas compared to other fossil fuels and is exceptional for its distinction as a much more sustainable gas, contributing to the decarbonisation of the gas sector and tackling environmental challenges. Biomethane is perfectly compatible with existing natural gas facilities. They do not require modifications nor is new equipment needed for its transport or use.

Biomethane and the circular economy

Today, numerous active projects are founded on the circular economy, primarily generating biomethane for the use of mobility in cars, lorries and buses, strengthening the circular economy in this way.

Biomethane is an environmentally friendly gas, whose greenhouse gas emissions are less than those of natural gas.

Uses of biomethane

Biomethane **may be used directly to generate energy in the industry sector** like use as fuel for vehicles as compressed or liquified gas or as a substitute for natural gas.

It is the global alternative for mobility, as it is also **efficient, sustainable and viable for the reduction of emissions** in maritime and land transports.

Biomethane helps decarbonise the economy, supplementing the rest of the renewable and clean energies.



UPGRADING TECHNIQUES

To generate biomethane through biogas, a percentage of methane higher than 90% must be obtained. Biogas undergoes a process of purification or cleaning to reduce the CO₂ and increase concentration of CH₄ (methane) from 54% to 98%.

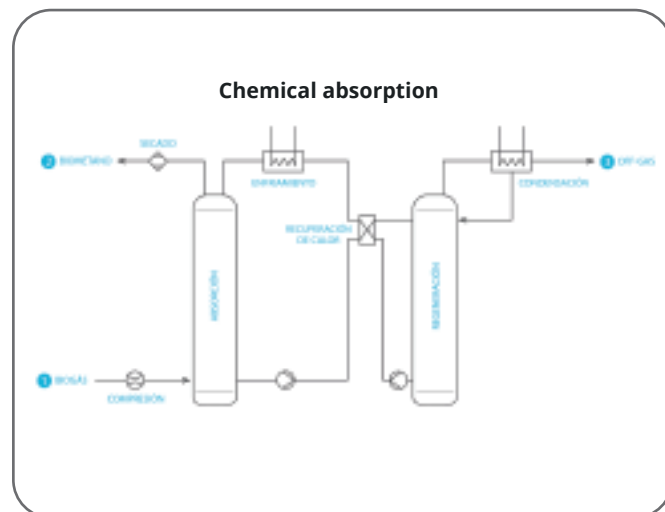
There are various technologies capable of treating biogas to obtain biomethane; each may be adapted to the different volumes, mixes of gases or energetic needs of the project

Primary biogas purification technologies to obtain biomethane

✓ Chemical absorption (amines, alkaline salts)

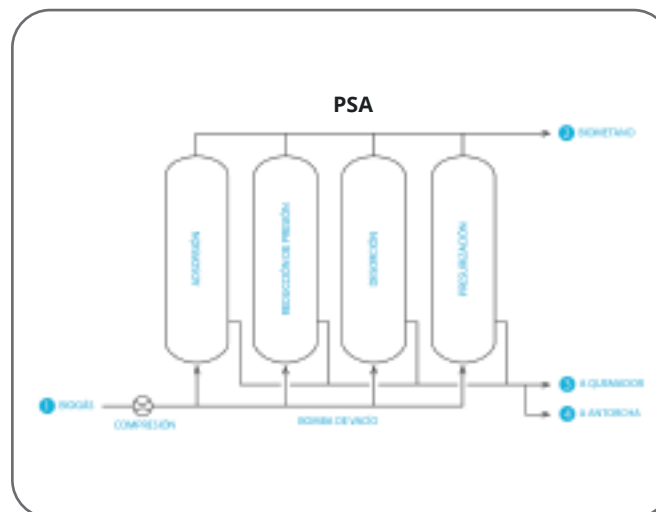
This technology is based on the chemical absorption of CO₂, H₂S and the volatile organic compounds by chemical compounds such as amines and aqueous solutions of alkaline salts.

This is a highly efficient separation process which achieves a high percentage of methane and a low presence of hydrogen sulphide in the renewable natural gas stream, therefore reducing losses of methane in off-gas. These systems offer high flexibility when faced with variations in the volume upon entry.



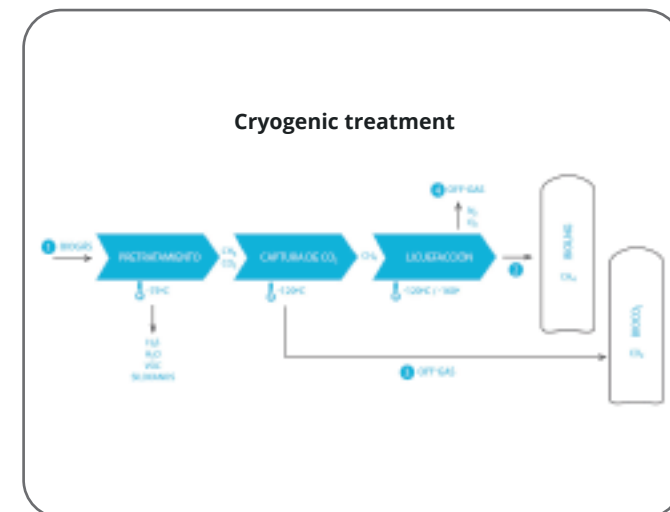
✓ PSA (pressure swing adsorption)

Certain materials, such as activated carbon or zeolites, have the ability to adsorb and desorb CO₂. This property is used in PSA systems to purify biogas. The system uses electric energy to obtain changes in pressure inherent to the process. This technology allows practically all the O₂ and N₂ to be separated from the methane, until a biomethane with high calorific power is obtained.



✓ Cryogenic treatment

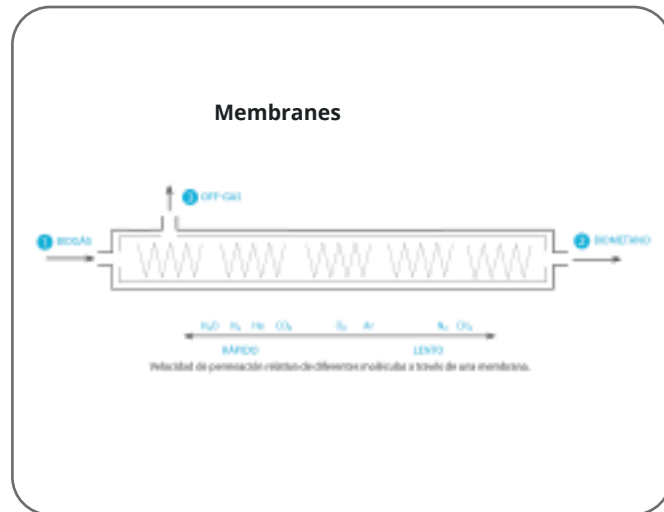
Thanks to the different boiling points of methane (-160°C) and carbon dioxide (-78°C), these compounds may be separated using cryogenic treatment, reclaiming the CO₂ in a liquid state. This system is particularly relevant for purposes of generating bioLNG owing to the state of biomethane when the process is finished.





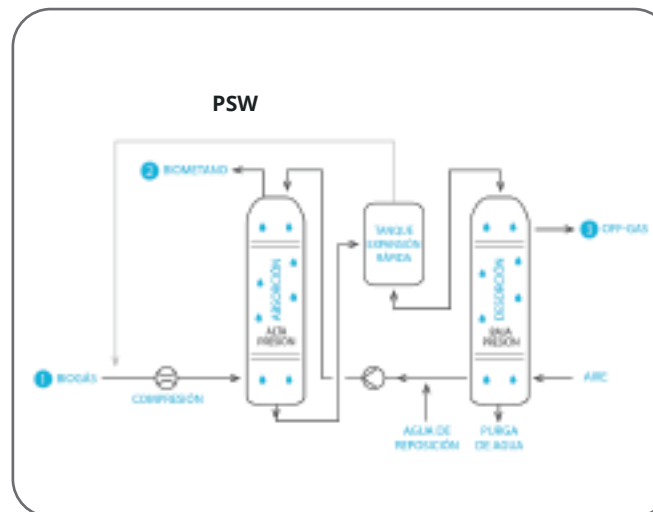
Membranes

When biogas is pressurised and sent through membranes, a highly purified biomethane is obtained, which may be optimised by linking various stages together to progressively purify it. Although there is no flexibility in throughput when treating, this robust technology is widely used.



PSW

The property employed by this technology to separate methane from CO_2 is the difference of their solubility in water. Biogas passes through a system of pressurised water, where the carbon dioxide is dissolved, and the gas exits the process with a high content of methane. However, this biomethane is saturated and a drying system is necessary.



We at Genia Bioenergy help you select the best option.

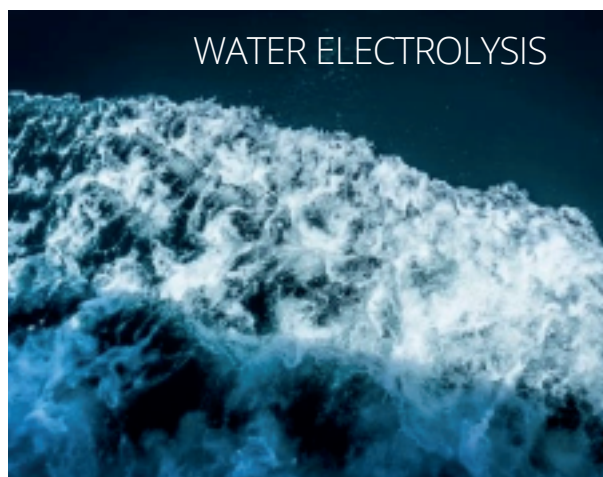
All these technologies are capable of treating biogas to obtain biomethane and may be adapted to the different throughput rates and needs of a project. No technology is more efficient than another, rather it depends on the characteristics of different projects.

HYDROGEN

Renewable hydrogen, or green hydrogen, is obtained through water electrolysis, powered by renewable energy. The water is split into oxygen (O_2) and hydrogen (H_2) through a continuous electrical current that is connected to the water through electrodes.

The **biggest advantage of this renewable gas is the flexibility in its uses and its ability to be stored** and transported in different ways. This enables it, when needed, to be channelled towards a fuel cell or into motors, turbines or boilers, both in its pure form or mixed with CH_4 .

Green, or renewable, hydrogen **may be converted into electricity or into fuel** to meet commercial, transport, industrial or even residential needs.



The **process of generating green hydrogen through water** is called electrolysis. Electrolysis is when water (H_2O) is broken down into oxygen (O_2) and hydrogen (H_2) using electrical power. This hydrogen may then be transformed into electric energy using fuel cells, electrochemical devices capable of converting the chemical energy contained within them into fuel and, when necessary, into electric energy.



Producing hydrogen through biogas or biomethane is an interesting alternative to water electrolysis. This green hydrogen may be produced in the place where it will be consumed: in ports, supply points, refineries and fertiliser plants. Not only this, but it can be done at a more competitive cost, with a carbon footprint cap, and through the correct waste management of agro-industry, MSW, and livestock farming and agriculture sectors.

Hidrógeno Green hydrogen is a key piece in the energy transition

The energy transition is one of the policy catalysts that has been included in the **Recovery, Transformation and Resilience Plan introduced by the Spanish Government in October of 2020**. Decarbonisation of the economy is one of the central issues in the 2030 Agenda, and to achieve it, an effective energy transition is necessary.

This involves a **transformation toward an inclusive, sustainable, accessible and safe energy system** that provides solutions to global challenges related to energy and that creates value for companies and the community.

And in this process, **green hydrogen is becoming a key piece** as an energy carrier.

Green hydrogen will be utilised as fuel in the transport sector, primarily in heavy load and long-distance transport. In the case of industry, **its application will be directed at substituting polluting fuels** such as natural gas or coal in the processes of generating heat



Green hydrogen may be obtained through a renewable source such as biomass. Cellulose may be converted into H₂ through many thermochemical processes such as combustion, liquification, pyrolysis and gasification. Biomass gasification in the presence of O₂ generates a gaseous stream rich in hydrogen that reforms with water vapor upon exiting the gasifier, with the aim of producing additional hydrogen.

At **Genia Bioenergy**, our experience developing renewable energy projects can be adapted to the needs of a project generating renewable hydrogen.

In the value chain of a project that is producing green hydrogen, we have capabilities to generate energy, whether it is electric for the process of electrolysis or biogas to be converted into hydrogen. In the field of electrolysis, we integrate the most suitable equipment into the renewable plant chain depending on the needs for hydrogen use that the client requires.

PROJECT ENGINEERING AND DEVELOPMENT

As an engineering company, we have access to **the latest advancements in the sector, designing and directing projects for renewable gas generation**, which support Genia Bioenergy's solid reputation as a partner for the development, design, construction and operation of projects.

We offer **services that include everything from opportunity localisation and development through waste valorisation**, to biogas purification for biomethane acquisition to be injected into the grid.



- Project engineering and development
- Construction and execution of works
- Comprehensive plant management: Operation, maintenance
- Improvement processes

We add
value
to every
of
your
project

SUCCESS STORIES

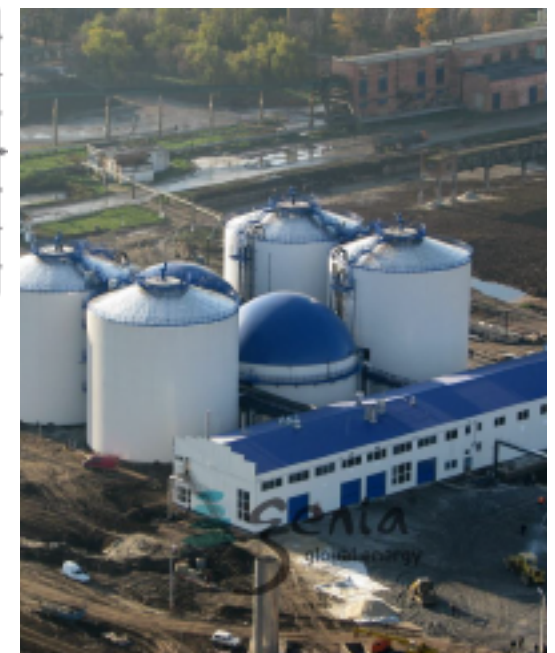
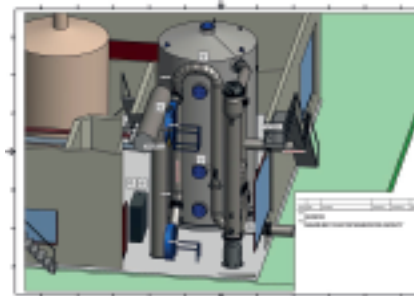
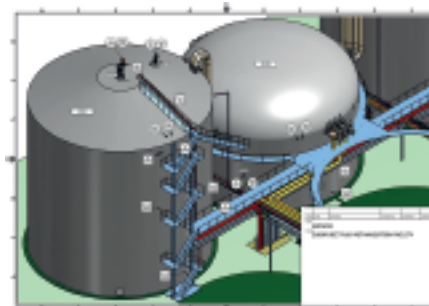
Our success stories endorse us. We provide comprehensive service, and our team seeks out the most cutting-edge technology on the market, evaluating both its technical and economic viability.

The **experience we have gained makes us a strategic partner when developing** projects in the biogas, biomethane and hydrogen (renewable gases) spheres. These are some of the projects developed by Genia Bioenergy

Industrial **Biogas Plant** in sugar refinery

This plant is located in the Poltava region of Ukraine and is the **largest monosubstrate biogas plant in Europe**. The agriculture-based regional economy relies primarily on the production of sugar beet.

he plant can accept up to 45 tonnes of sugar beet pulp per hour, producing 7,000 m³/hour of biogas, generating heat for self-supply, which covers 75% of the factory's thermal demand. A biogas plant of this type, affiliated with a factory that produces a high volume of organic waste and has onsite waste treatment, **offers important operational and logistical savings in energy and waste management**, making activity sustainable and creating a project founded on the circular economy.



Design, engineering, site management and start-up in Palestine

Self-supplying plant for the agro-food sector, cattle farm in Hebron.

A biogas plant of this type, affiliated with a factory that produces a large volume of organic waste and has onsite waste treatment, offers important operation and logistical savings in energy and waste management, making activity sustainable and eco-friendly.



Design, engineering, site management and start-up in Honduras

Development, design, feasibility study, engineering, site management, EPCM and start-up of the MSW treatment plant with anaerobic digestion of the organic fraction and recovery of inorganics.



Design, engineering, site management and start-up in the Netherlands

Design and Engineering and simulation of plug-flow reactor with four phases for the anaerobic digestions. This plant can process lignocellulose waste, such as wood chips and cellulose for the first time on an industrial scale.



Design, engineering of anaerobic digestion plant

Design of renewable gas plant in Evercreech. This large facility with 5 biodigesters will process 35,300 tonnes of agricultural waste every year and 60,500 tonnes of waste from more than 400 local food industries producing dairy, beer and baked goods, as well as MSW.

From **rice straw** to generating biogas or fertiliser products



At Genia Bioenergy **we have developed a pilot plant capable of converting rice straw into biogas** through anaerobic biodigestion. This action is part of a project founded on the circular economy that seeks to offer a solution to problems presented by rice straw, a waste that is difficult to treat: it is not a suitable ingredient in animal feed, and it has a high content of lignocellulose fibres that make it difficult to be cut down. The plant has been able to valorise other by-products of difficult biodigestion, such as lignocellulose.

First European plant with technology capable of biodigesting this waste, converting it into biogas and organic fertilising components. This knowledge has been applied in seeking a sustainable solution to rice straw waste founded on the circular economy.

Renewable energy for **an isolated rural community** in Honduras



Installation of a micro-grid of renewable energies, combining 52kWp solar photovoltaic and 25kW biomass gasification systems. **The community of El Santuario will be supplied with renewable resources such as solar energy and surplus timber from the forest.**

The **project aims to provide reliable and clean energy to the small rural community**, which is located in one of the regions most exposed to climatological extremes (long droughts alternating with torrential downpours). Here, 3.5 million people live in a state of humanitarian risk, 40% of the total of those living in Honduras (FAO, 2016).

Industrial, agro-food and MSW waste management

We work designing projects that are sustainable by building biogas plants for the valorisation of the organic fraction of urban waste, obtaining biomethane, fertiliser and protein as a result. This way, the waste is converted into new resources, preventing them from ending up in landfills or incinerators.

The **Valuewaste project seeks to resolve the problem of municipal organic waste** to prevent it from ultimately ending in landfills or being incinerated without harnessing its value. The City Hall of Lliria, in the Region of Valencia in Spain, has introduced the start-up of an organic waste management project with the construction of a plant that will produce gas sustainably through the work of anaerobic bacteria, which live in the absence of oxygen, from the waste that is produced in the community.



The circular economy in the agro-food sector



This plant, acquired in 2020 by a company with expertise in raising Iberian pigs and the production of quality ham and cured meats, aims to create a project founded on the circular economy.

It is capable of digesting 30,000 tonnes/year. This is enough to manage all the meat waste from the company's abattoir and cutting rooms, the purines from its farms and the sewage from its treatment plant, as well as to accept other waste from the area's agricultural and livestock industries such as beet scraps or grain and tobacco dust. 25,000 m³ of liquid and solid digestates are obtained annually as a result of this process, which are then utilised on the company's own farm

projects by
Genia Bioenergy

Genia Bioenergy also oversees **operations at three** anaerobic digestion facilities

- Facility which includes a plant that treats up to 35,000 tonnes of organic waste per year to produce **biogas for thermal energy for self supply**. The digestate is integrated into the fodder production process and is utilised for fertigation and to provide grain farms with organic material.
- **Biogas plant that manages purines from livestock farms**, as well as waste and organic by-products from the environment, capable thanks to its versatility. In this project, the digestate is used on the client's farms to produce corn and other fodder.
- R+D facility to **develop new applications of anaerobic digestion** in the framework of the European Valuwaste project.



New Biogas plant, 150,000 t/year

Administration and comprehensive operating management of the plant overseen by Genia Bioenergy

“Sustainable and efficient organic waste management offers the **self-procurement of energy, whilst introducing circular** economy processes into the agro-food industry.”

OUR CLIENTS

Our clients make up each part of the entire chain of **energy generation**, from leading renewable gas companies to those in the agro-food sector, universities, city halls, and more.

We collaborate with all the businesses and players involved in generating energy through renewable gases:

- Agro-food industry
- Crop and livestock farmers
- Compost businesses
- Waste managers
- Waste producers
- City halls
- Government
- Natural gas, biogas and biomethane consumers
- Utilities: gas, electricity, transportation companies, distributors
- Investment funds
- Suppliers and offtakers



Clients that have placed their trust in us to develop projects founded on renewable gases

ASSOCIATIONS

Genia Bioenergy **participates in the most relevant associations and events** in the sector

Spanish representative of World Biogas Association Global trade association for the biogas, landfill gases and anaerobic digestion sectors.

Member of Gasnam, **an association that promotes the use of renewable natural gas** in mobility.

Member of the Fundación Empresa y Clima (business and climate), **actively participating in the LIFE Soria ForestAdapt project** which aims to increase resilience of southern Europe's forests to climate change, including adaptive measures in public and private plans for forest management.

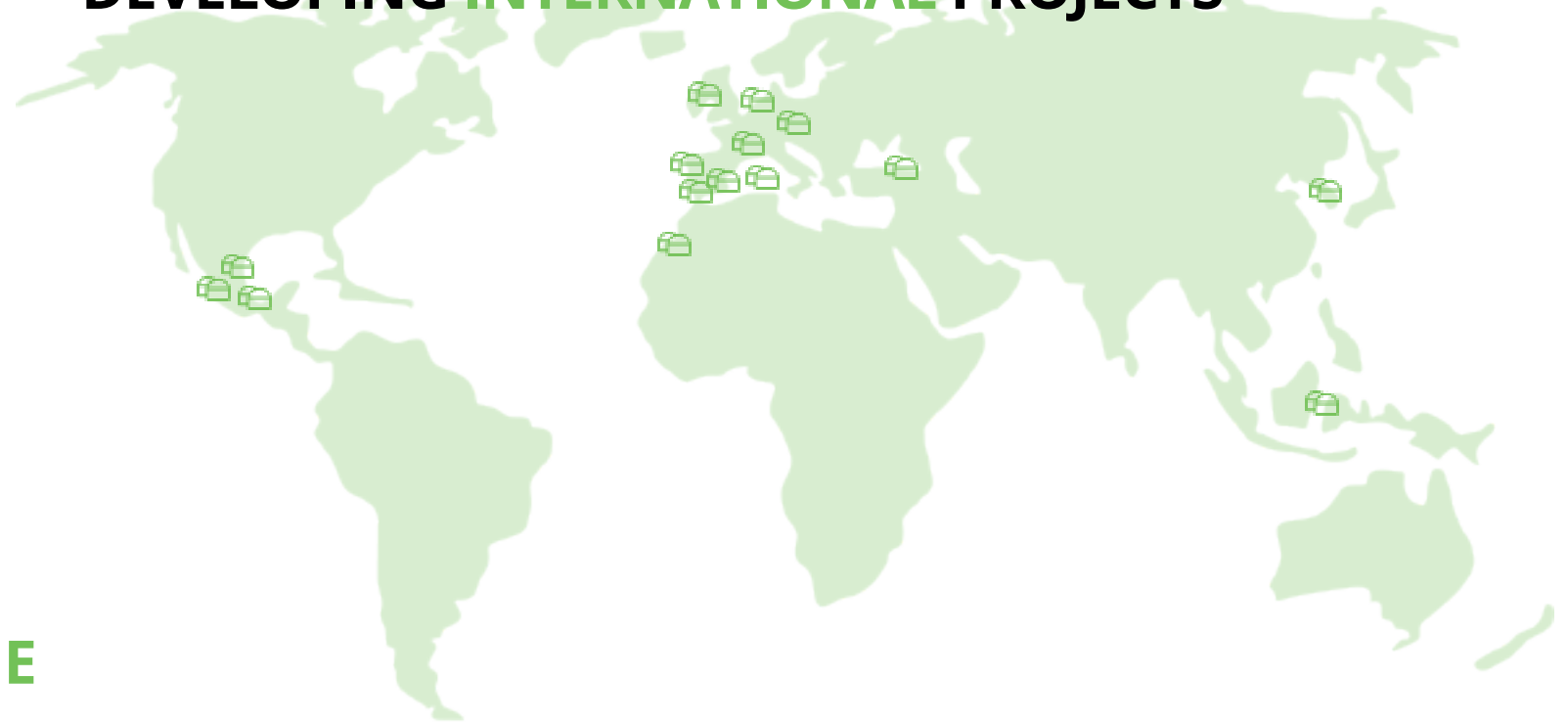
Members of **Energy Cluster** of the Region of Valencia.

Partner of the **AVAESEN** (Association of Companies related to the Energy Sector) of the Region of Valencia.



Genia Bioenergy participates in the most relevant **associations and events** events in our sector.

DEVELOPING INTERNATIONAL PROJECTS



+CREATER VALUE

Thanks to our **experience and know-how in the sector**, we can provide the national and international market with a series of technological solutions that offer greater value to our projects

- ✓ Production of thermal energy for self-supply.
- ✓ Agronomic valorisation of organic by-products.
- ✓ Valorisation from by-products of difficult biodigestion.
- ✓ Sustainable solutions for managing urban waste.
- ✓ R+D+i in all engineering projects.
- ✓ Valuable multidisciplinary team.
- ✓ Sustainability and environment, considered in every project.



Genia Bioenergy

Avd. Ronda Nazaret nº 9
46024 Valencia - España
+34 963 636 147
info@geniabioenergy.com

Follow us:



Genia Bioenergy is the renewable gases division of Genia Global Energy.

We put forward new models and technologies for the energy generation, use and management that allow us to evolve sustainably as a society. Learn more about Genia Global Group at www.geniaglobal.com

GB-ES-ref.01/21©
Copyright Genia Bioenergy.2021
Todos los derechos reservados