- Renewable energies
- Biogas

Lighting, heating, transport... thanks to our waste? It’s possible! Obtained via the fermentation of organic matter, biogas can be used to produce electricity, heat and even fertilizer. Purified biogas, known as biomethane, which has equivalent characteristics to those of natural gas, can be used in natural gas networks or as engine fuel. A renewable energy source as promising as it is virtuous… but the costs of which remain relatively high, thereby requiring government support.

What is biogas?

Biogas is **usually derived from the fermentation of organic matter** under the action of microorganisms. This fermentation process, which occurs spontaneously in natural ecosystems (marshland, paddy fields, soil, intestines of mammals, etc.), is known as **methanization**. Now, humans are able to harness the process and use it to convert our waste, replacing some fossil energy sources. The objective: to **reduce our greenhouse gas emissions**.

Other production options?
New biogas production methods based on the gasification of lignocellulosic resources (straw, plant stems, wood chips, etc.) or methanization (production of synthetic methane via the conversion of bio-carbon monoxide or dioxide in the presence of hydrogen) are currently in the experimental or demonstration phases. The methanization of microalgae is also being considered as a longer-term option.

How is biogas produced?

All organic matter, whether of animal or plant origin, **can be methanized to convert it into biogas**. At present, the following types of waste are most frequently used:

- agricultural waste (animal excrement, harvest residues such as straw, etc.),
- green waste (grass clippings, etc.),
- agrifood industry waste (abattoirs, vines, dairies, etc.),
- water treatment plant sludge.

Methanization must take place in a confined facility known as a digester, in the absence of oxygen. Microorganisms naturally present in organic matter break this matter down and produce biogas, as well as a residue known as digestate.

Biogas is a mixture of:

- 50 to 70% methane,
- 20 to 50% carbon dioxide (CO_2),
- traces of nitrogen, ammonia and hydrogen sulfide.

Only the methane is used, once it has been separated from the other gases (depending on its degree of purity, the CO_2 could also be used).

??????**The different types of methanization units**
Methanization can be implemented on several scales. Smaller units tend to be agricultural (“farm” methanization), operated by a farmer or a group of farmers.
Bigger, collective facilities also exist, mainly converting urban or industrial waste:
- **centralized units** (waste of varying origin depending on the location of the facility),
- **industrial units** (agrifood, chemical or paper industry waste),
- **units specializing in the conversion of water treatment** plant sludge,
- **uhousehold waste methanization units** (managed by local authorities or specialist companies).

Biogas, a renewable energy source

Biogas can have several uses:

- **Heat production**: biogas is burned in a boiler to produce heat. The latter must be used close to the production source to limit heat dissipation / loss,

- **Electricity production**: biogas is burned and the energy produced powers a generator that in turn produces electricity,

- **Cogeneration**: this involves the combined generation of electricity and heat. This is the most frequent application of biogas. Electricity is produced by a generator, while heat is recovered in the cooling system and exhaust gases and used locally,

- **Vehicle fuel production**: before it can be used as a fuel in a vehicle, the biogas must be purified (to remove carbon dioxide, water and hydrogen sulfide, which are corrosive for engines). The biomethane obtained is almost identical to NGV (natural gas for vehicles). This type of conversion has yet to be widely developed and primarily concerns captive fleets (urban transport, etc.).

In France, for example, buses in the northern city of Lille have been running on biomethane since 2006.

- **Injection into the natural gas network**: as for fuel production, the biogas must first of all be purified to give biomethane. The matter can then be injected into existing natural gas networks. This type of conversion is most frequent in Sweden, Germany, Switzerland and the Netherlands. In France, 76 methanization sites injected 0.7 Twh of biomethane into the natural gas networks in 2018. The cumulative total from the 660 projects waiting for the biomethane injection facilities to be linked up is estimated to be 14 Twh/year (source GRDF). In 2017, total natural gas consumption in France was 465 Twh.

- **Residue not digested by the bacteria** (**digestate**) can be processed (in particular, to remove pathogens) before being used as agricultural fertilizer, i.e., as a substitute for chemical fertilizers.

Biogas, benefits for the environment

Methanization is a solution that makes it possible to **convert organic matter** (thereby reducing the quantity of organic waste that has to be processed by other sectors) **and produce energy**.

As such, **it contributes to the reduction in greenhouse gases** enabling the use of biogas rather than fossil energies to produce heat, electricity or fuel. Moreover, its managed production and use avoid the uncontrolled release into the atmosphere of methane, a greenhouse gas with a warming potential 28 times greater than CO_2 over a period of 100 years according to the IPCC.

Lastly, the use of digestate (residue that is not converted into biogas) avoids t**he use of chemical fertilizers, the manufacture of which requires fossil resources**.

Public support required to develop the biogas sector

In 2016 in Europe, biogas accounted for around 8% of renewable energy production and the equivalent of 4% of natural gas consumption. Germany is the principal producer (half of European production), followed by the United Kingdom and Italy. These three countries alone account for 80% of the European total.

France is ranked 5th in Europe in terms of biogas production. The development of methanization in the country is more recent and the focus has very much been on the use of biowaste, particularly livestock effluent, unlike in other countries, where production depends mainly on dedicated crops (corn, sugar or fodder beet, grassland, sorghum, etc.). In order to reconcile biogas development with challenges related to land use requirements, **a 2016 decree limits the use of food crops for methanization to 15%**.

European production is set to double by 2030. But **financial support remains necessary to achieve this objective, since the price of biogas is not yet competitive compared to fossil energies. Feed-in tariffs for electricity or biomethane are the most widely employed measure**. The possible reduction in production costs and, above all, the increase in the price of CO_2, are also likely to improve the competitiveness of biogas.

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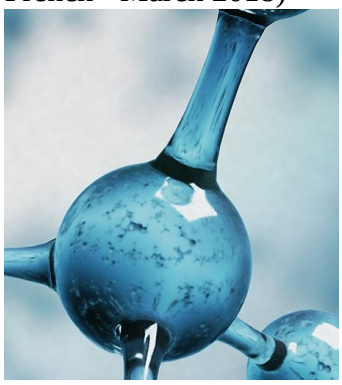
Objective for France: 10% of gas of renewable origin by 2030

The objective set by the 2015 French energy transition law is for renewable gas to account for 10% of total gas within the distribution network by 2030. The French long-term energy program presented by the French Ministry for the Ecological and Inclusive Transition in November 2018 confirms the objective of a 10% share of biogas in total gas consumption in France by 2030, provided costs fall.

The fermentation of agricultural waste, currently the best way of producing renewable gas in France, is the favored approach. At the start of 2018, France had 405 methanization facilities, of which 230 were farm-based.

Source: Ministry for the Ecological and Inclusive Transition > "Methanization" working group conclusions (in French - March 2018)



Our expertise > Biogas

Biogas and biomethane: turning our waste into energy

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