

Biogas upgrading

The experience and expertise of Air Liquide at your service

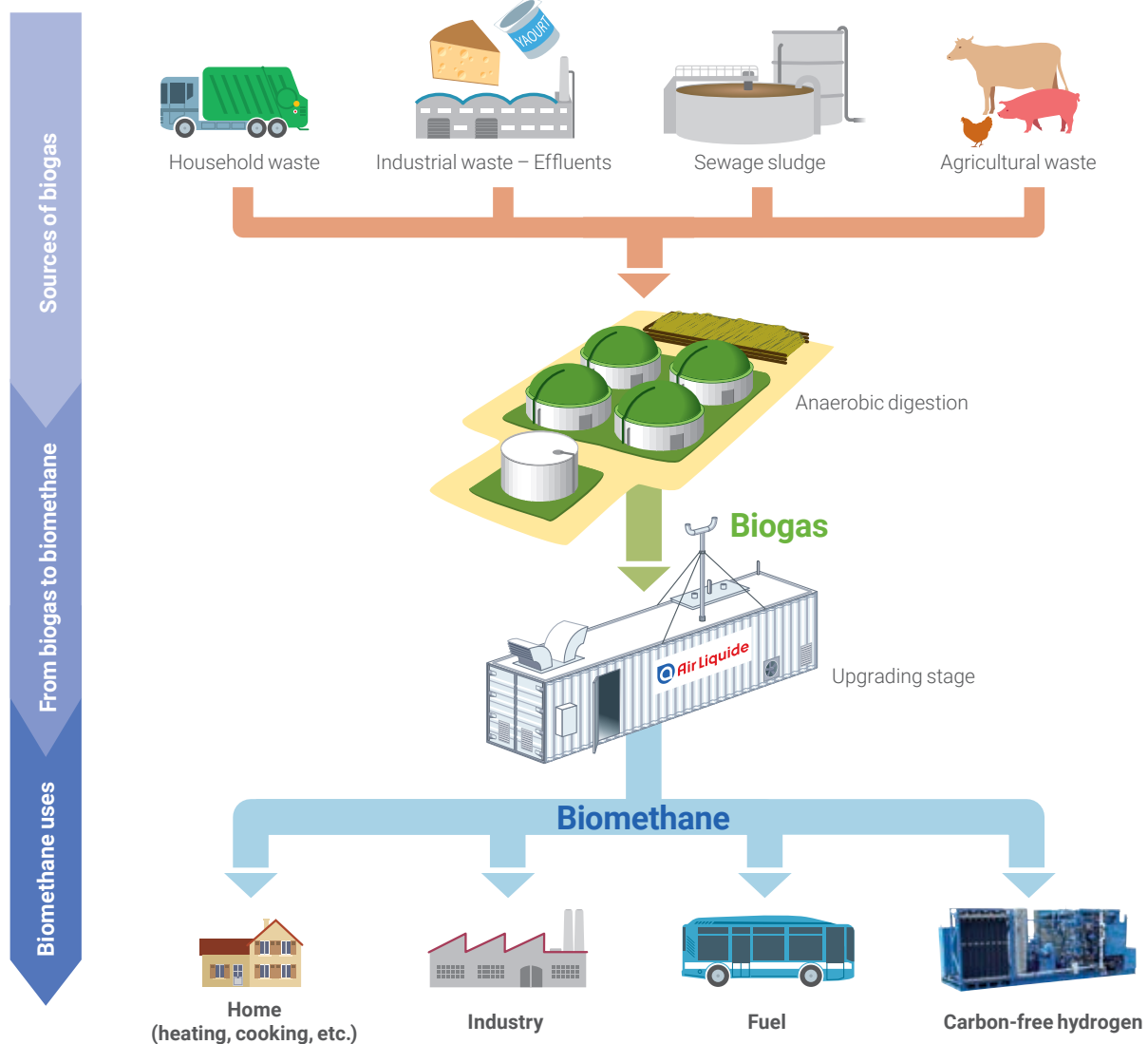


From biogas to biomethane

Biogas is a renewable energy produced during the anaerobic digestion of biomass. Composed primarily of methane and carbon dioxide, biogas is efficiently turned into biomethane through the process of purification.

Biomethane, a virtuous form of energy, can replace natural gas derived from fossil fuels.

From biogas to biomethane



Upgrading biogas into biomethane offers:

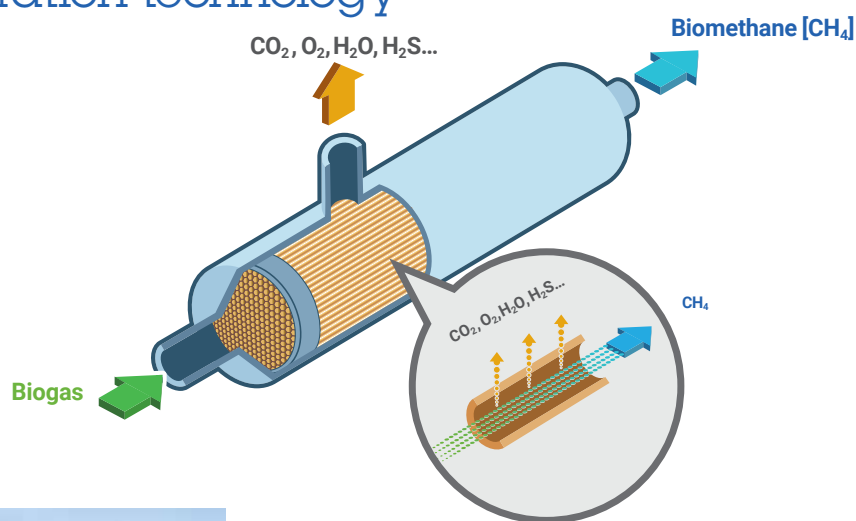
- **The best eco-friendly energy** conversion efficiency
- **An economically profitable** form of upgrading
- A **simple** solution



The Air Liquide gas separation technology

Membrane technology

Air Liquide's purification modules separate methane and carbon dioxide via an innovative process that uses polymeric hollow fiber membranes made by Air Liquide (Medal*). This efficient system generates high quality biomethane (CH_4 content from 96.5% to 99%). Combined with a process reaction event unit, all of the biogas is upgraded.



Key benefits

- **Guaranteed quality** for injection into the network
- **Methane recovery rate > 98%**
(up to 99.5% with additional solution package)
- **High energy and environmental performances** (no utility other than electricity)
- **Simple and reliable system** (run time > 98%)
- **Economical and highly efficient**



* Medal is a Group subsidiary integrated with Air Liquide advanced Business & Technologies Americas

Air Liquide membranes (second stage)

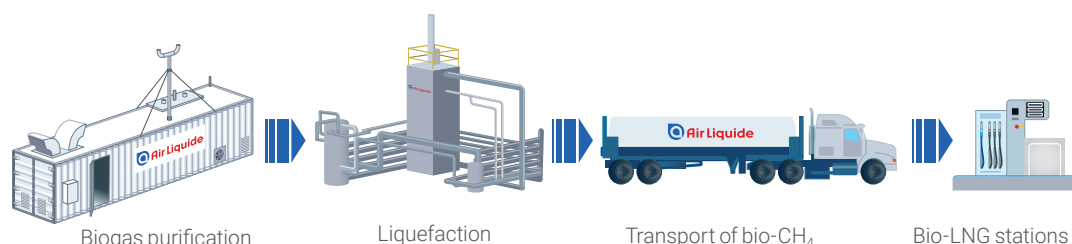


The liquefaction of biomethane

Liquefaction opens up other avenues for biomethane recovery

The liquefaction of biomethane appears to be an appropriate solution in cases where logistical constraints arise due to the absence of a transportation network.

In liquid form, biomethane is easy to transport to its point of use. Air Liquide offers industrial liquefaction units that are adapted to your needs.



Key benefits

- Energy consumption is **optimal**
- Process is **reliable** and **efficient**
- Technology is **well-understood** and **well-managed**

Services related to our biogas solutions



The range of Air Liquide services offers can be tailored to the needs of each customer:

- **Training in routine operations and maintenance**, plus special sessions on safety in addition to basic training to raise staff awareness
- **Inspection and adjustment of settings** of the purification unit in order to optimize the production of biomethane while reducing your operating costs
- **Preventive maintenance** that includes the replacement of worn out parts and related labor
- Back-up spare parts can be made available to you directly onsite
- **Technical assistance year-round 24/7** via a hotline and service within 4 hours where required

Air Liquide biogas solutions

Squarely focused on the challenges and dynamic of new energies, Air Liquide devises global solutions dedicated to biogas upgrading. Our biogas offering responds to your specific needs, whether you are a farm operator, a waste treatment manager or a food-processing industry professional.

Thanks to the development of several technological bricks, including the CO₂ separation membranes our solutions enable you to upgrade all biogases for injection into the natural gas grid, the production of vehicle fuel, liquid biomethane, and the production of renewable hydrogen.

The modular systems designed and developed by Air Liquide are upgradeable biogas processing units with processing capacities that range from a hundred to several thousand m³ an hour (100 to 10,000 Nm³/h).

The recognized expertise of Air Liquide in the area of industrial gases, combined with the experience we have acquired in biogas purification, are major strengths that ensure the success of your projects.

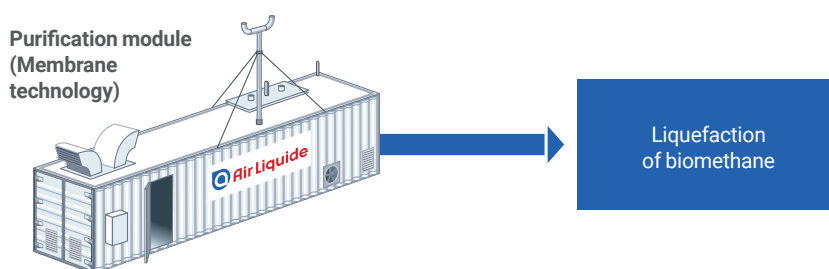
Turnkey biogas upgrading solutions

Air Liquide offers you turnkey solutions for biogas upgrading suited to your needs: **purification, injection, cryogenic distillation, liquefaction.**

Our experts support you every step of the way, from the design phase to the delivery of the operational unit.

From standard...

... to customized

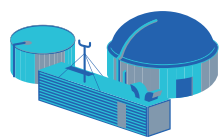


Raw biogas processing capacities (Nm³/h)

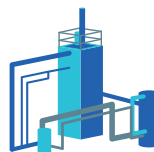
100 - 300	Standard modules
300 - 500	
500 - 750	
750 - 1,000	
1,000 - 1,500	
> 1,500	On-demand modules



Key figures



25 biomethane
production
units
in operation worldwide



~1.7 terawatt-
hour
of biomethane production
capacity per year



15+ years
of experience
in biogas upgrading



30+ years
of experience
in membrane production



100+ years
of experience
in gas separation

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A world leader in gases, technologies and services for Industry and Health, Air Liquide is present in 73 countries with approximately 67,100 employees and serves more than 3.9 million customers and patients.

