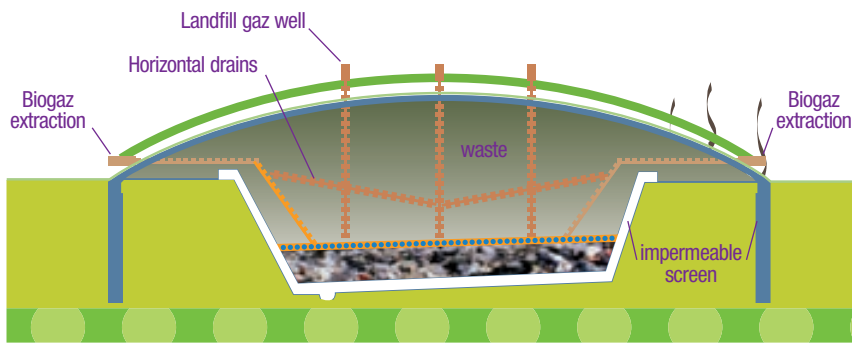


Biogas recovery system

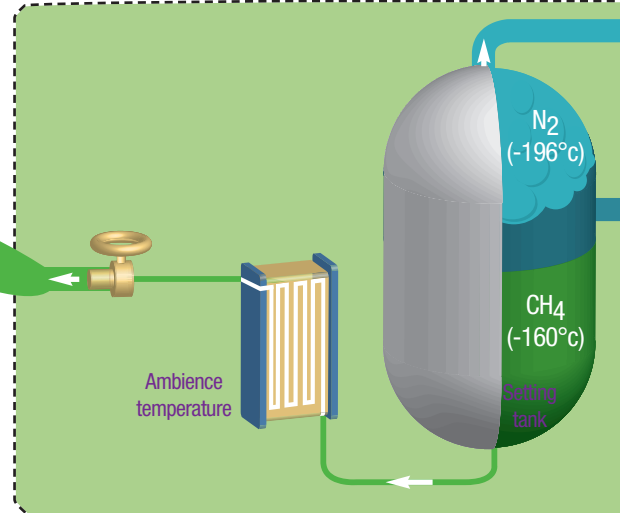
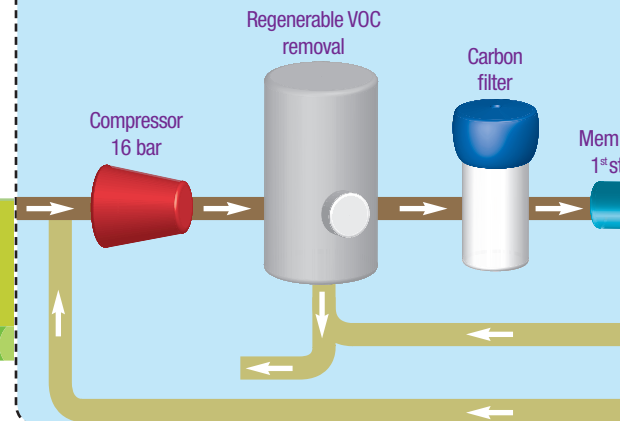
From the landfill to the bus thanks to the membrane and cryogenic technology



Cross section of Landfill biogaz

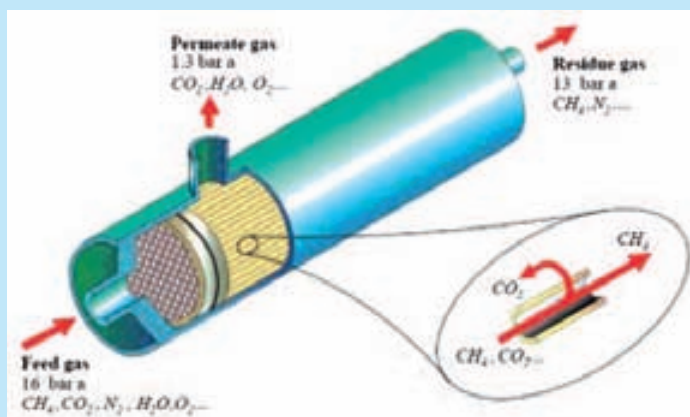


Membrane system



Membrane solutions

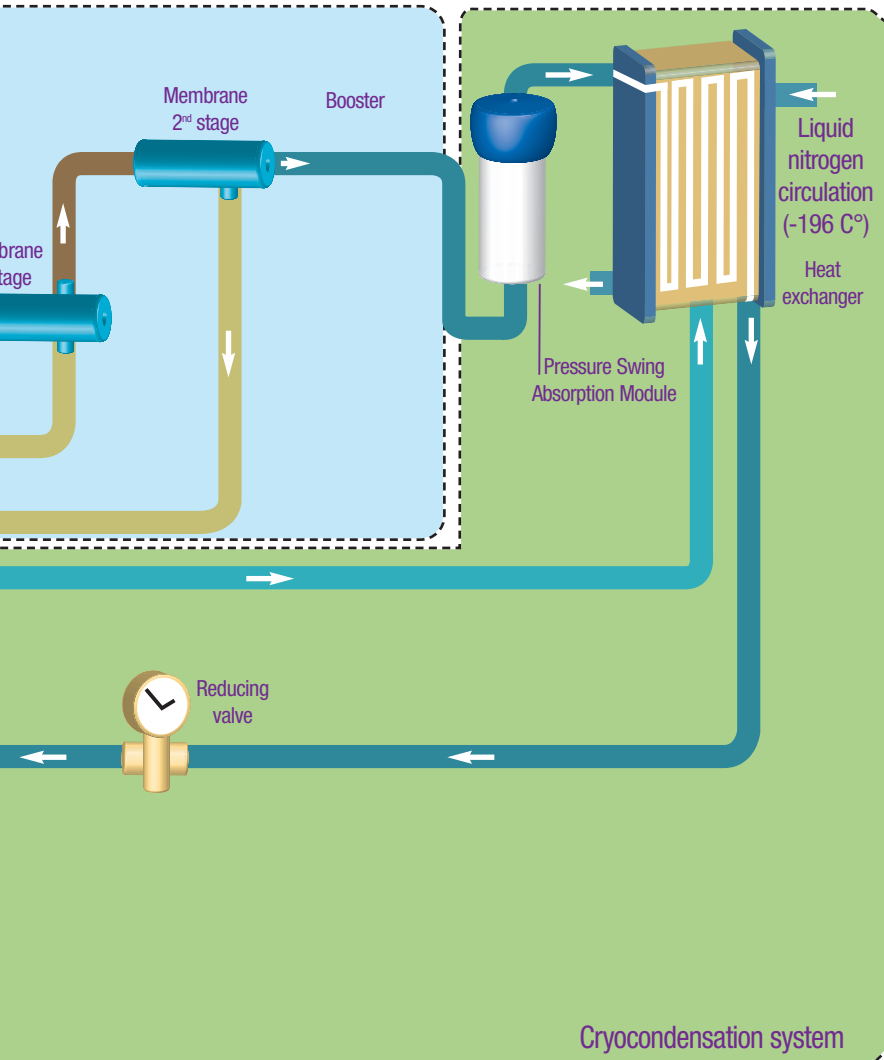
Air Liquide membrane systems deal with landfill gas, or biogas, which is a mixture of gases (typically 45% CO₂ and 54% CH₄). After being collected and compressed, medium pressure Biogas passes through a pre-treatment unit. Before being used, the CO₂ content must be reduced below 2%. The Air Liquide membrane systems will selectively separate the methane from the CO₂. High selectivity makes 90%+ methane recovery available with a two-stage membrane system.



CO₂ is selectively separated from methane (CH₄) by permeation through a hollow polymeric-fibre membrane (see the illustration). The driving force for the CO₂, CH₄ and other gas components is the partial pressure difference across the membrane.

Key benefits

- Membranes can generate methane at purities up to 90%
- Significant efficiency versus other technologies
- Small space requirement
- Low maintenance
- Fast start up / shutdown
- Low cost operating expense



Cryocondensation system

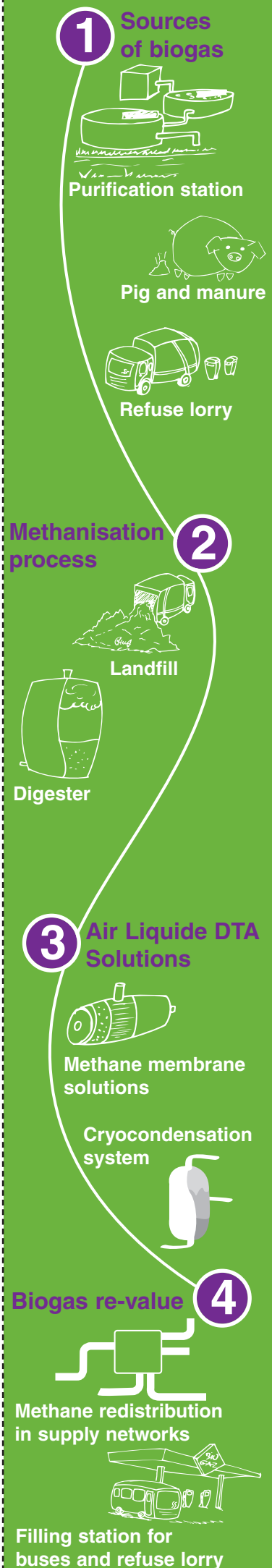
The cryocondensation reduces the nitrogen rate still remaining. In the cold box, the biogas is cooled down up to its dew point, then the cold gaseous nitrogen is vented to the atmosphere and methane is recovered at the outlet.

The process is composed of 5 steps

- Adsorbent bed in order to remove the residual CO₂
- Cooling down of the biogas in cryogenic heat exchanger
- Expansion Joule-Thompson at 1,5 barg, in order to perform a liquid state mixture
- Separation of the N₂ from CH₄ in a cryogenic separator
- Vaporisation of the liquid nitrogen and re used of the cold power in the cold box

Key benefits

- Methane purity up to 96% depending of biogas quality
- Compactness of the equipment
- Low maintenance
- Low consumption of liquid nitrogen
- Safety and reliability of the equipment





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