

Air Liquide: a record year for contracts with a solution for reducing greenhouse gas emissions in the maritime industry

Air Liquide has signed more than 20 contracts worth a total of €100 million thanks to a solution that reduces greenhouse gas emissions for the maritime industry. The technology developed, based on the Turbo-Brayton physical principle, reliquefies natural gas boil-off in LNG (Liquefied Natural Gas) vessels in order to significantly reduce greenhouse emissions during transport. This application illustrates the capacity of Air Liquide's teams to develop sustainable new solutions to support their customers' business.

In the maritime industry, LNG carriers transport LNG from methane-producing countries to consumer countries over very long distances. This natural gas, which is cold in its liquid state, tends to reheat and in part evaporates during transport. Air Liquide has developed a **refrigeration and liquefaction technology based on the Turbo-Brayton physical principle**, which reliquefies the evaporated natural gas and keeps it in the container in liquid form.

The cryogenic equipment that uses this technology enables shipping companies and freight forwarders to comply with maritime industry regulations on greenhouse gas emission. With these contracts, more than 20, Air Liquide is helping to prevent more than 120,000 tonnes of CO₂-equivalent emissions per year¹.

This Air Liquide technology was first used in the space industry to preserve at very low temperatures biological samples on the International Space Station (ISS), before being adapted by Air Liquide's teams for the maritime industry. It can also be adapted to other sectors and other gases, for example to liquefy biomethane for road freight.

François Darchis, Senior Vice-President and member of the Air Liquide group Executive Committee, supervising Innovation, said: ***"This commercial success illustrates the capacity of the Group's teams to develop innovative technological solutions that create new market opportunities while taking into account our customers' environmental needs, and thus reduce global greenhouse gas emissions of the planet. These new technologies are helping to meet the challenge of climate change, in line with our climate objectives, which are the most ambitious in our industry."***

Cryogenic systems based on the Turbo-Brayton technology

Air Liquide's offer is based on innovative and efficient cryogenic solutions for the refrigeration and liquefaction of various gases from 20K (minus to 53°C) to 200K (-73°C) based on the inverted Brayton cycle: gas is compressed, cooled at constant pressure, and then expanded, which makes it liquid.

The Global Markets and Technologies business (GM&T)

The Global Markets and Technologies business (GM&T) provides technological solutions (molecules, equipment, and services) to support the development of new energy transition markets in the maritime industry and deep tech, in order to ramp up Air Liquide's sustainable growth. GM&T has 1,900 employees around the world, generating revenue of €474 million in 2018.

¹ The global warming potential of methane is 32 times greater than that of CO₂.

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A world leader in gases, technologies and services for Industry and Health, Air Liquide is present in 80 countries with approximately 66,000 employees and serves more than 3.6 million customers and patients. Oxygen, nitrogen and hydrogen are essential small molecules for life, matter and energy. They embody Air Liquide's scientific territory and have been at the core of the company's activities since its creation in 1902.

Air Liquide's ambition is to be a leader in its industry, deliver long term performance and contribute to sustainability. The company's customer-centric transformation strategy aims at profitable growth over the long term. It relies on operational excellence, selective investments, open innovation and a network organization implemented by the Group worldwide. Through the commitment and inventiveness of its people, Air Liquide leverages energy and environment transition, changes in healthcare and digitization, and delivers greater value to all its stakeholders.

Air Liquide's revenue amounted to 21 billion euros in 2018 and its solutions that protect life and the environment represented more than 40% of sales. Air Liquide is listed on the Euronext Paris stock exchange (compartment A) and belongs to the CAC 40, EURO STOXX 50 and FTSE4Good indexes.