

Air Liquide Engineering & Construction

Air Liquide is a world leader in gases, technologies and services for Industry and Health, with a presence in 78 countries, with approximately 64,500 employees, and serving more than 3.8 million customers and patients.

In the Middle East, the company draws on the expertise of more than 1,100 employees, operates 34 sites and serves customers in sectors including oil & gas, refining & petrochemicals, metal fabrication, construction, electronics, food and beverage and healthcare.

This year, the Air Liquide Group has made significant new commitments to sustainability with a focus on the abatement of CO₂ emissions. This new commitment focuses on inventing clean technologies for industries and clean mobility, working on the frontline of environmental progress, and playing a decisive role in the transition to a low-carbon society and the development of a hydrogen economy. For more than 50 years, Air Liquide has been developing unique expertise in the mastery of the entire hydrogen chain (production, storage, and distribution).

In the Middle East today, Air Liquide oversees its growing operations and investments, including the group's largest single industrial investment and most significant 'over the fence' Hydrogen contract -- Air Liquide's Yanbu Hydrogen Production Site in Saudi Arabia, providing hydrogen to the Yanbu Aramco Sinopec Refining Company (Yasref) as well as a growing number of large and small scale industries in Yanbu and Jubail (Saudi Arabia's leading industrial cities). This is delivered via Air Liquide's hydrogen pipeline networks, representing in the region a combined length of 37kilometres, and a total hydrogen transport capacity of over 200,000 Nm³/hr each.

Air Liquide's hydrogen infrastructure in Yanbu consists of two global-scale hydrogen production units and one purification unit, which together boast a 340,000 Nm³/hour production capacity, connected to its hydrogen pipeline network.

Today, the majority of hydrogen is produced from natural gas through the steam methane reforming (SMR) process. Air Liquide has developed an innovative cold capture system (Cryocap™) that can capture up to 90% of the CO₂ released during this hydrogen production through a cryogenic process. A world-first in this field, this technology can also improve efficiency, increasing hydrogen production by up to 20%. After purification, the captured CO₂ can be used to meet a variety of industrial needs for carbonic gas (carbonation of sparkling beverages, food preservation, freezing, etc.).

Air Liquide's suite of carbon capture technologies and solutions is expanding, to support its customers. Various new projects are already underway.

Air Liquide is participating in Kairos@Sea, Porthos CCS projects that support the capture of CO₂ from hydrogen producers and refineries. In France, Air Liquide and TotalEnergies are joining forces to decarbonize hydrogen production at TotalEnergies' Normandy



platform. In time, the project will enable the supply of low-carbon hydrogen to TotalEnergies from Air Liquide's hydrogen network in Normandy and the implementation of a large-scale CO₂ capture and storage solution.

More recently, Air Liquide signed a contract with Zeeland Refinery, a joint venture between TotalEnergies and Lukoil, to provide carbon capture and liquefaction solution in the Netherlands. Cryocap™ FG is a new unique solvent-free technology solution developed by Air Liquide that allows the capture and liquefaction of carbon dioxide contained in concentrated flue gases from a combination of adsorption and cryogenics technologies.

This new solution will support the Zeeland Refinery in reducing its CO₂ emissions at the Vlissingen site by more than 800,000 tonnes per year and allows the pure and liquefied carbon dioxide to be transported for storage in the Dutch North Sea. Clean hydrogen can also be produced through water electrolysis.

In 2021, Air Liquide completed the integration of the world's largest PEM (Proton Exchange Membrane) electrolyser to supply carbon-free hydrogen at its Liquid Hydrogen plant in Becancour, Canada, which has been operating for more than 30 years.

The group has also signed a memorandum of understanding with Siemens Energy to combine expertise in PEM electrolysis technology and will focus on the co-creation of large industrial-scale hydrogen projects in collaboration with customers. This initiative will lay the grounds for the mass manufacture of electrolysers in Europe and R&D activities to co-develop next-generation electrolyser technologies.

At Air Liquide Engineering & Construction, we are delivering state-of-the-art technology solutions to customers to support the decarbonisation of industries and society at large. Our suite of low carbon hydrogen and carbon capture technologies and excellence in process experience, combined with decades of operational experience, ensures the competitiveness, safety, reliability and sustainability of solutions for customers.

Working towards a decarbonized industry with innovative technologies

Air Liquide's state-of-the-art technologies are helping customers worldwide to reduce their carbon footprint.

Cryocap™: a complete suite of innovative proprietary technologies, unique in the world, for the capture and management of CO₂ combining cryogenic, adsorption and membrane technologies:

- Cryocap™ H₂ for Hydrogen plants
- Cryocap™ FG for Flue Gas
- Cryocap™ Oxy for Oxycombustion
- Cryocap™ XLL for CO₂ Liquefaction
- Recticap™ downstream Auto-Thermal Reforming

Air Liquide's highly efficient and robust technology, Cryocap™, operating at large scale for more than 5 years in Port Jerome, France, enables the capture of CO₂ from a hydrogen production unit via a combination of cryogenic and membrane processes.

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