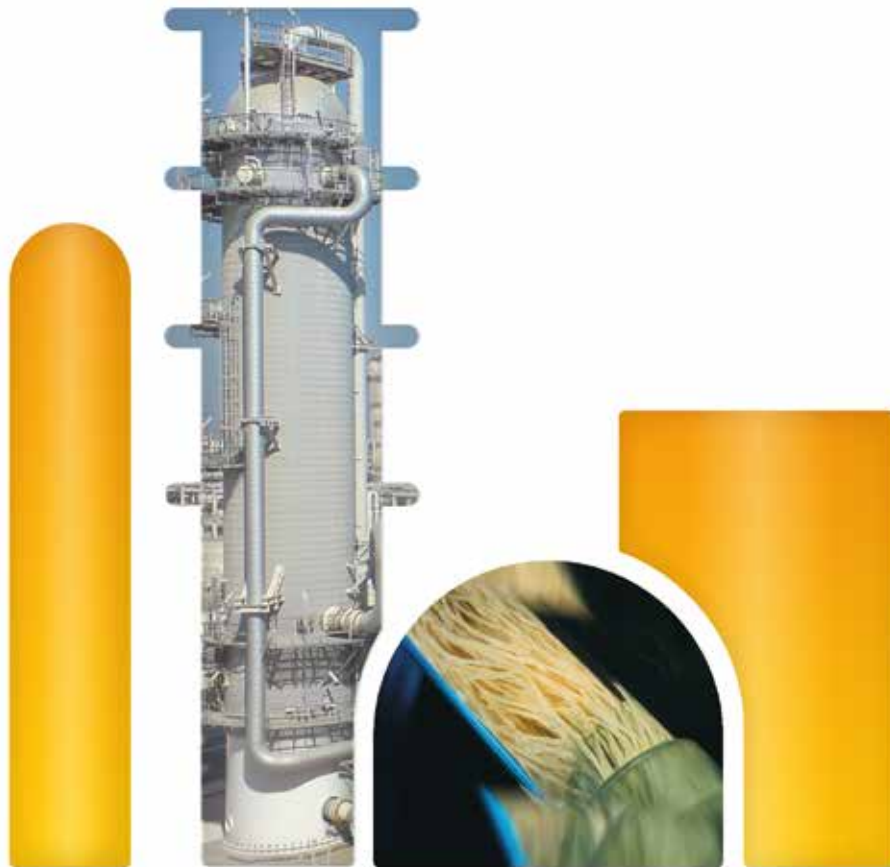


# CO<sub>2</sub> REMOVAL

## NATURAL GAS TREATMENT TECHNOLOGIES



# Air Liquide Group

## The world leader in gases, technologies and services for Industry and Health

Air Liquide is present in 80 countries with approximately 65,000 employees and serves more than 3 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 lead its industry, deliver long term performance and contribute to sustainability.

### Our full suite of technologies

- Liquefied Natural Gas
- Cryogenics
- Hydrogen
- Syngas
- Petrochemicals
- Natural Gas Treatment
- Sulfur
- Standard Plants
- Oleochemicals

# Air Liquide Engineering & Construction

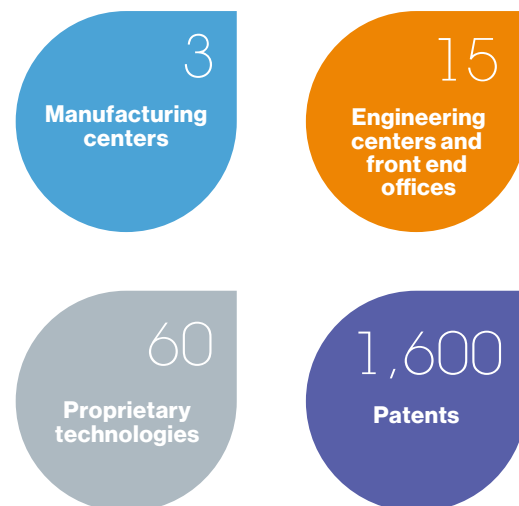
## A technology partner of choice

Air Liquide Engineering & Construction builds the Group's production units (mainly air gas separation and hydrogen production units) and provides external customers with efficient, sustainable, customized technology and process solutions.

Our core expertise in industrial gas, energy conversion and gas purification, enables customers to optimize natural resources.

We cover the entire project life-cycle: license engineering services / proprietary equipment, high-end engineering & design capabilities, project management & execution services. In addition we also offer efficient customer services through our worldwide set-up.

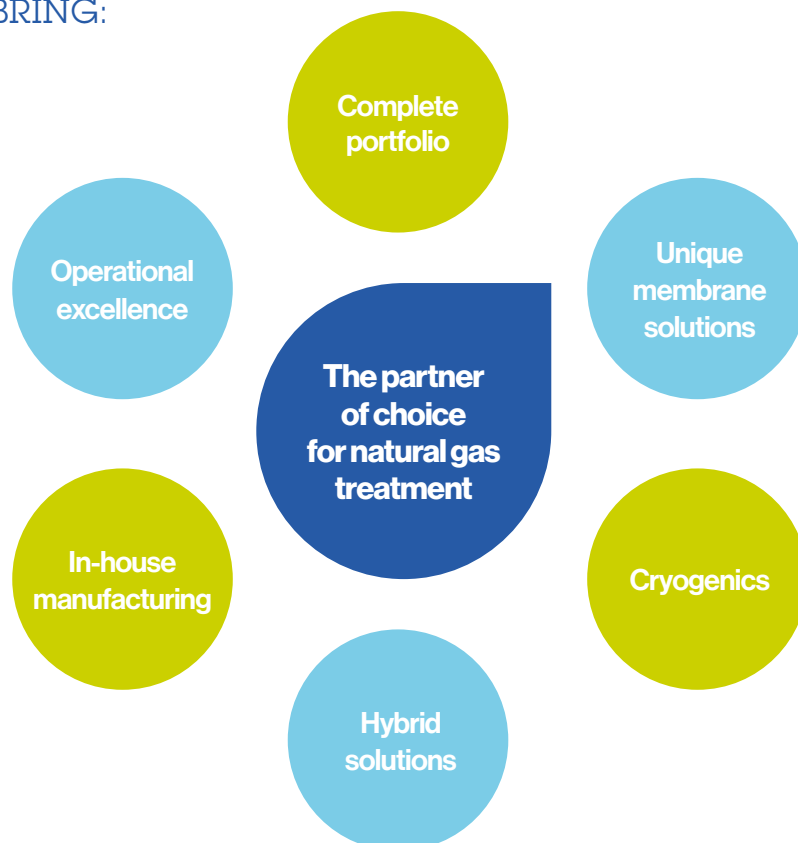
As a technology partner, customers benefit from our research and development to achieve energy transition goals.



# CO<sub>2</sub> removal from natural gas

Air Liquide Engineering & Construction offers a comprehensive range of CO<sub>2</sub> removal technologies that are underpinned by the Air Liquide group's expertise in cryogenic, amines and membranes separation technologies.

## VALUE WE BRING:



### **A complete portfolio**

A comprehensive technology portfolio for CO<sub>2</sub> removal from natural gas that includes membrane separation, cryogenic distillation, and absorption with amines.

### **Unique membrane solutions**

Two innovative and differentiating hollow fiber membrane products, Porogen PEEK-Sep and MEDAL NG2, that maximize the removal efficiency while minimizing hydrocarbon losses and reducing overall footprint and weight.

### **Cryogenic experience**

High CO<sub>2</sub> natural gas sweetening by cryogenic distillation supported by 100+ years of experience in designing and operating cryogenic units.

### **Hybrid solutions**

Tailored, hybrid solutions to handle a wide range of impurities as well as variable feed conditions, such as in EOR applications.

### **In-house manufacturing**

Two world-class manufacturing centers in the United States.

### **Operational excellence**

Engineering design that benefits from continuous feedback from operation of our own plants.

# CO<sub>2</sub> removal technologies

Air Liquide's proprietary technologies for CO<sub>2</sub> removal from natural gas cover a broad spectrum of applications ranging from small to large gas capacities, low to high CO<sub>2</sub> gases, bulk to deep CO<sub>2</sub> removal, and can be tailored to handle variable feed gas conditions.

Hollow fiber bundle 0.5 – 1.2 million fibers per 12-inch bundle  
Laid end to end, contains 1,200 km of fiber



## MEDAL membranes

- Hollow fiber type (most compact technology)
- Higher and constant selectivity
- Lower hydrocarbon losses
- Greater resistance to heavy hydrocarbons



## Cryocap™ NG

**Cryogenic distillation + membranes:  
the best of both worlds**

- Hybrid, self-refrigerated process
- Suited for natural gas with high CO<sub>2</sub> levels (>35%)
- Compact and simple cold box
- High methane recovery (99%+), pipeline spec product
- CO<sub>2</sub> produced at nearly feed pressure
- Co-production of NGL possible



## Porogen PEEK-Sep membranes

- Hollow fiber type (most compact technology)
- Minimal or no pretreatment
- Best-in-class thermo-mechanical and chemical resistance
- Liquid-tolerant
- Applications include CO<sub>2</sub> and H<sub>2</sub>S removal, hydrocarbon dew point control, dehydration, fuel gas conditioning...
- Onshore and offshore applications: highly reduced weight and footprint

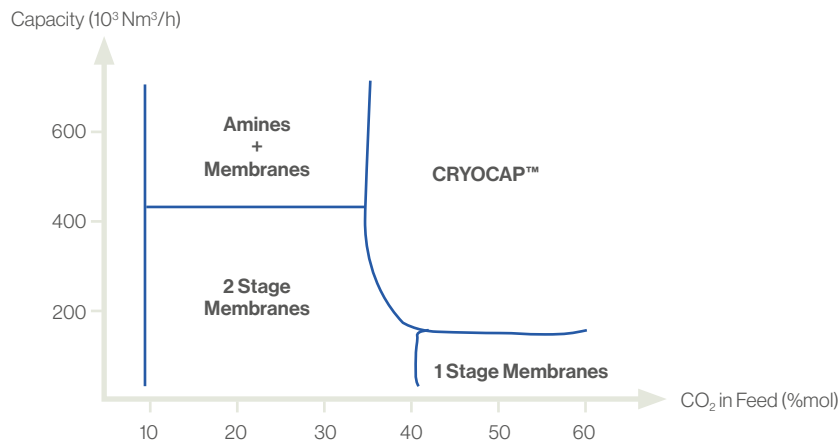


## Absorption with amines

- Formulated or generic solvents
- Can be combined with H<sub>2</sub>S and mercaptans removal, and sulfur recovery
- Omnisulf™: a one-stop integrated solution for acid gas removal and sulfur recovery

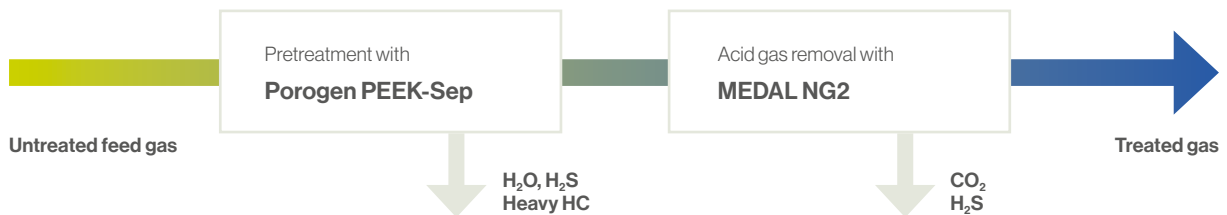
# Optimized solutions for CO<sub>2</sub> removal

Depending on the feed gas flow rate, pressure, and CO<sub>2</sub> content, we can offer hybrid solutions that minimize the unit's life cycle cost.



## All-Membrane Solution™: Porogen PEEK-Sep membranes provide efficient and cost-effective pretreatment for MEDAL NG2 membranes

- Compact systems capable to remove CO<sub>2</sub>, H<sub>2</sub>S, and water
- Reduction in topsides weight and floating production storage and offloading cost or possible enabler to increase plant capacity



## MEDAL membranes combined with amines

- Bulk CO<sub>2</sub> removal with membranes
- Deep CO<sub>2</sub> removal with amines
- Onshore and offshore applications





● Engineering Centers and front-end offices    ● Manufacturing centers



Contact us

gas-treatment@airliquide.com

[www.engineering-airliquide.com](http://www.engineering-airliquide.com)