Large to Mega-scale LNG plant capabilities for capacity >2 MTPA

Benefit from economies of scale and proven technology

Air Products' natural gas liquefaction processes and main cryogenic heat exchangers are the world's standard for baseload LNG.

Liquefaction capabilities and support:

We provide a complete range of products and services for the successful design, construction, start-up, and operation of your LNG facility:

- Feasibility studies
- Project development studies
- Detailed liquefaction process designs
- Coil wound heat exchanger design and fabrication
- Installation and start-up advisory services
- Technical support services during plant operations
- Debottlenecking studies

Benefits to our customers:

Economical Production

- Readily available refrigerants
- Large train sizes for economies of scale
- High efficiency/low feed gas consumption

High Reliability

- Fewer process components
- Proven performance, demonstrated by plant onstream records
- Robust CWHE (Coil Wound Heat Exchanger) design and construction

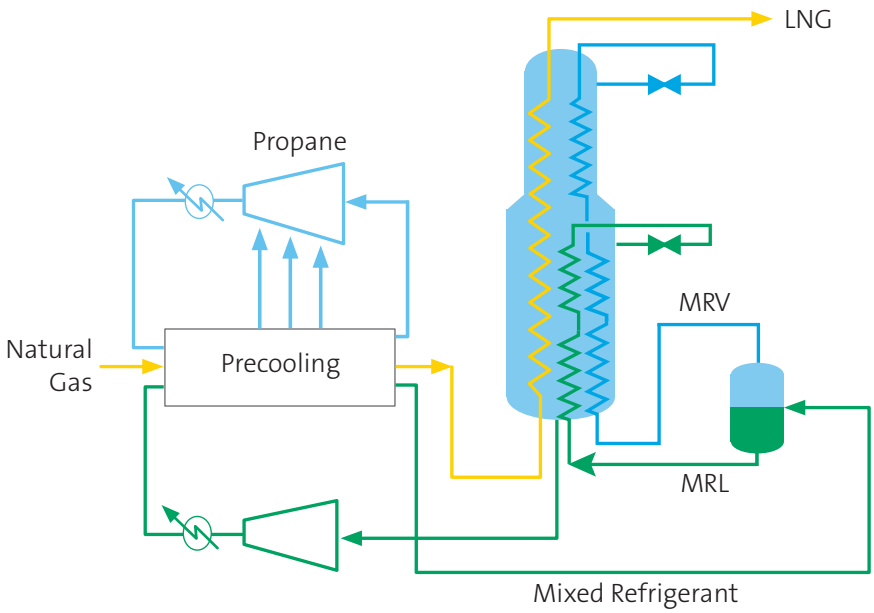
Improved Operation

- Ease of start-up to minimize the time to achieve full capacity
- Flexibility to operate at high efficiency over a wide range of feed gas compositions and conditions
- Efficient and stable turndown even at very low feed rates

The result is improved profitability due to faster project completion, higher availability of the process, and maximum efficiency.

The bundle winding process for each coil wound heat exchanger manufactured by Air Products.

The most prevalent liquefaction technology used today is Air Products' AP-C3MR™ LNG Process



MCR® LNG Processes:

Maximum production with high efficiency and low CAPEX/MTPA

More LNG is produced using Air Products' mixed component refrigerant and liquefaction processes than any other processes in the world. They have proven to be the highly reliable, flexible, and easy to operate. Air Products invented propane precooled mixed refrigerant process (AP-C3MR™), which has become the industry standard. To meet specific liquefaction requirements, we also offer several variations, including dual mixed-refrigerant (AP-DMR™) processes and the AP-X® LNG Process utilized by the industry's largest LNG trains in Qatar.

MCR® Cryogenic Heat Exchangers (MCHEs):

Flexible and Robust

The typical exchanger may be as large as 5 meters (16.5 feet) in diameter and 55 meters (180 feet) high and weigh 450 metric tonnes (500 tons). The large size of the individual heat exchanger tube bundles facilitates the design of large process trains. In addition to providing economies of scale, this leads to simple piping and control systems and, consequently, to reductions in installation, operation, and maintenance costs. Heat exchangers we supplied more than 45 years ago are still operating, many at production rates well in excess of their original design capacity.

Integrated Manufacturing

Air Products is the world's leading supplier of large coil wound heat exchangers (CWHEs). Each CWHE is manufactured by skilled craftspeople at our state-of-the-art facilities in the United States, convenient to U.S. ports for shipping to site. We fabricate the units with internal piping and components, and complete with transition joints or flanged connections so that no aluminum welding is required once the unit reaches the LNG plant site.

Air Products' experience: leadership in mid-scale and large to mega-scale LNG plant projects

Country	Location/Project	Initial Start-Up	Trains	LNG Capacity per Train (MTPA)	LNG Process
Abu Dhabi (UAE)	Das Island	1977	2	1.7	AP-C3MR™
		1994	1	2.6	AP-C3MR
Algeria	Arzew	1977	6	1.3	AP-C3MR
		1981	6	1.4	AP-C3MR
		2014	1	4.7	AP-C3MR/SplitMR®
	Skikda	2013	1	4.5	AP-C3MR/SplitMR
Australia	NWS	1989–1992	3	2.5	AP-C3MR
	Gorgon	2016	3	5.2	AP-C3MR/SplitMR
	Prelude (FLNG)	2019	1	3.6	DMR
	Ichthys	2018	2	4.45	AP-C3MR/SplitMR
Brunei	Lumut	1972–1974	5	1.3	AP-C3MR
Canada	Squamish	2023	1	2.1	AP-C3MR
China	Ningxia Hanas	2012	2	0.4	AP-SMR™
	Shaanxi Yangling	2015	1	0.5	AP-SMR
	FengZhen	2019	1	0.3	AP-SMR
Egypt	SEGAS	2004	1	5	AP-C3MR/SplitMR
Indonesia	Bontang	1977–1997	7	2.8	AP-C3MR
		1999	1	3	AP-C3MR
	Arun	1978–1986	6	2	AP-C3MR
	Tangguh	2009, 2021	3	3.8	AP-C3MR/SplitMR
	Donggi	2015	1	2.1	AP-C3MR
Libya	Marsa el Brega	1970	4	0.8	AP-SMR
Malaysia	Satu	1982	3	2.8	AP-C3MR
	Dua	1995	3	3.2	AP-C3MR
	Tiga	2003	2	3.8	AP-C3MR
	Petronas 9	2016	1	3.6	AP-C3MR/SplitMR
	PFLNG Satu	2016	1	1.2	AP-N™
	PFLNG Dua	2021	1	1.5	AP-N
Mexico	Energia Costa Azul	2023	1	3.25	AP-DMR™
Mozambique	South Coral (FLNG)	2022	1	3.4	AP-DMR
	Mozambique LNG	2024	2	6.4	AP-C3MR
Nigeria	Bonny Island	1999–2002	3	3.2	AP-C3MR
		2005–2007	3	4.1	AP-C3MR
		2023+	2	8	AP-C3MR
Oman	Oman LNG	2000	2	3.3	AP-C3MR
		2006	1	3.7	AP-C3MR
Papua New Guinea	PNG LNG	2014	2	4	AP-C3MR
Peru	Peru LNG	2010	1	4.5	AP-C3MR/SplitMR
Qatar	Qatargas	1996–1999	3	3.3	AP-C3MR
		2009–2011	4	7.8	AP-X®
	Rasgas	2025	4	7.8	AP-X
		1999–2000	2	3.3	AP-C3MR
		2004–2006	3	4.7	AP-C3MR/SplitMR
		2009–2010	2	7.8	AP-X®
Russia	Yamal	2017	3	5.5	AP-C3MR
United States	Cove Point	2018	1	5.25	AP-C3MR
	Freeport	2019	3	5	AP-C3MR
	Cameron	2019	3	4.4	AP-C3MR/SplitMR
	Golden Pass	2024	3	5.2	AP-C3MR/SplitMR
Yemen	Bal-Haf	2009	2	3.4	AP-C3MR/SplitMR
Total Trains			121		

Air Products experience: Industry leader

We helped pioneer the LNG industry, supplying our first LNG process and equipment over 50 years ago. Today, we are on the leading edge of LNG technology and provide quality, reliability, performance, and the best return on capital.

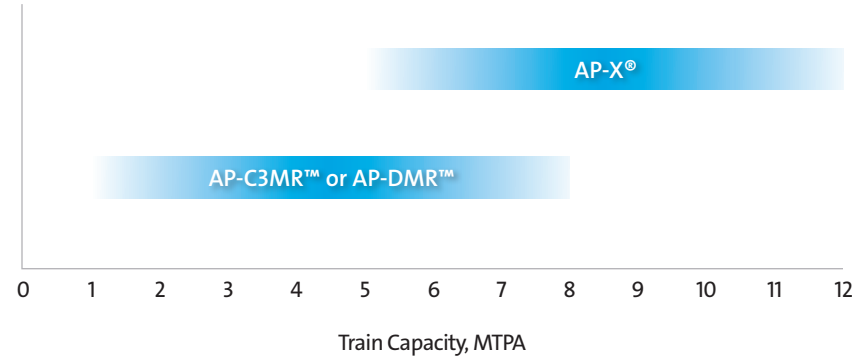
About Air Products

Air Products is a world-leading Industrial Gases company celebrating 80 years of operation. The company's core Industrial Gases business provides atmospheric and process gases and related equipment to manufacturing markets, including refining and petrochemical, metals, electronics, and food and beverage. Air Products is also the world's leading supplier of liquefied natural gas process technology and equipment.

For more information, please contact us at:

Corporate Headquarters
Air Products and Chemicals, Inc.
1940 Air Products Blvd.
Allentown, PA 18106-5500
T 610-481-4861
info@airproducts.com

Large to mega-scale LNG plant liquefaction process capacities



For the AP-X® LNG Process, in addition to liquefaction process design and CWHEs (Coil Wound Heat Exchangers), Air Products designs and manufactures cryogenic nitrogen companders (compressor turbo-expander machinery), and nitrogen economizer heat exchanger cold boxes.

A large Air Products' custom designed coil wound heat exchanger.

AIR PRODUCTS

tell me more
airproducts.com/LNG