

# Mid-scale LNG capabilities for capacity from 0.25-2.0 MTPA

## Designed for simplicity while delivering lower unit costs



Ningxia Hanas Natural Gas Co. Ltd.,  
China utilizes Air Products' single  
mixed refrigerant (AP-SMR™)  
liquefaction process



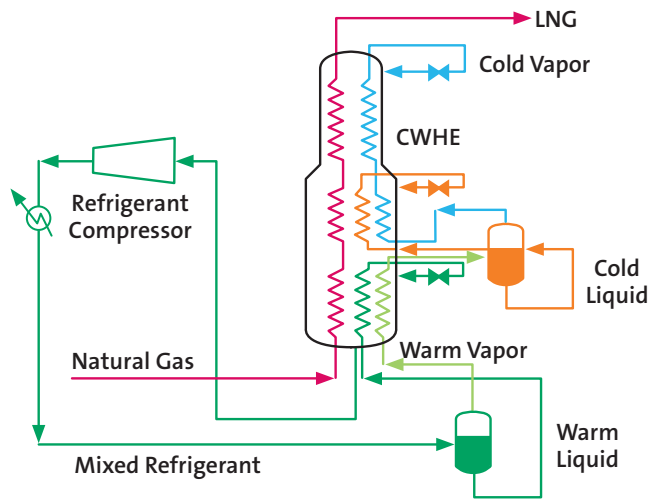
Mid-scale LNG plants nominally producing from 0.25–2.0 MTPA provide a means to serve LNG niche markets, to monetize smaller gas volumes at reduced ownership cost, and to allow for a staged investment of large LNG facilities. For all particular project requirements, Air Products offers a suite of liquefaction technologies and equipment.

### Track record of success

While the LNG industry trends in past years have been toward larger plants, it is important to recognize that a significant number of the operating LNG plants around the world today are in the capacity range of what is currently being categorized as the “mid-scale LNG market.” Notably, Air Products’ coil-wound heat exchangers have been successfully applied for more than 50 years and demonstrated high reliability, operability, turn-down stability, and productivity.

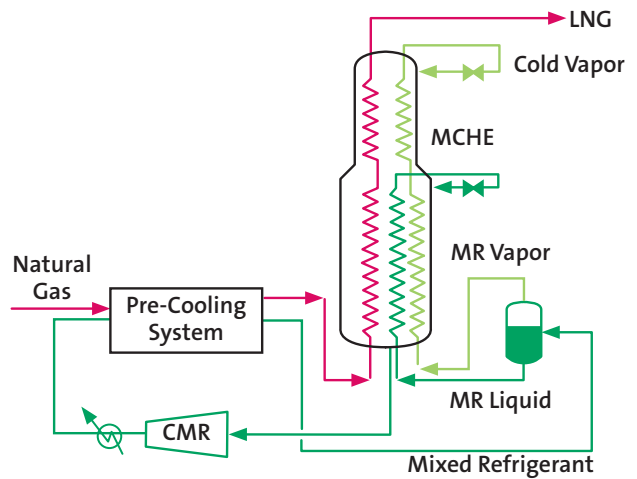
# A Suite of Liquefaction Process Technologies

## AP-SMR™ LNG Process

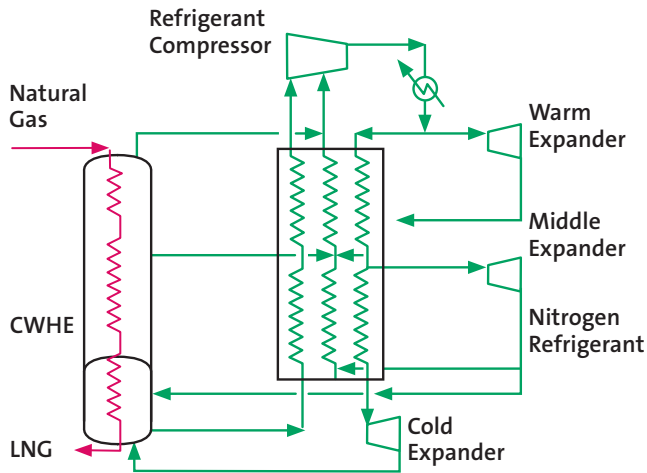


## AP-C3MR™ LNG Process

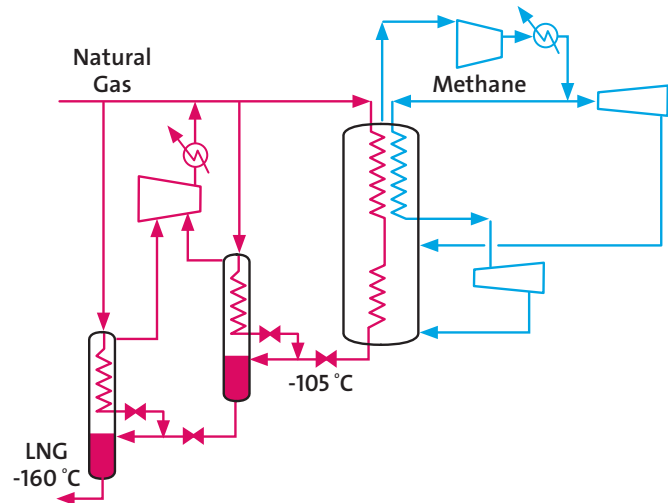
## AP-DMR™ LNG Process



## AP-N™ LNG Process



## AP-C1™ LNG Process



Donggi-Senoro LNG, Indonesia utilizes Air Products' propane pre-cooled mixed refrigerant (AP-C3MR™) LNG Process.

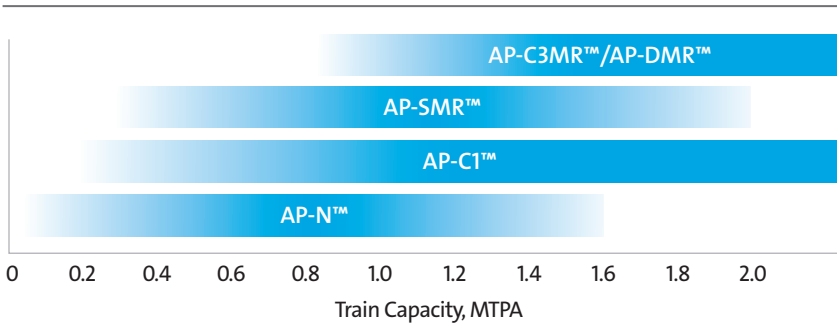


Petronas FLNG Satu, Malaysia utilizes Air Products' Nitrogen (AP-N™) LNG Process (Photo courtesy of Petronas)



Shaanxi LNG Investment Development Co. Ltd. Yangling, China plant utilizes Air Products' single mixed refrigerant (AP-SMR™) process.

### Mid-scale LNG Process Offerings



Process	Relative Efficiency
AP-C3MR™/AP-DMR™*	100
AP-SMR™	88
AP-C1™	85
AP-N™	72

\*Higher DMR efficiency achievable.



LNG heat exchanger bundle winding process.

### Air Products' coil wound heat exchanger technology and equipment: efficient and robust

Air Products offers proven natural gas liquefaction technologies to support customer-specific project requirements for both on-shore and off-shore mid-scale LNG market; most notably Air Products' proprietary single mixed refrigerant (AP-SMR™) and pre-cooled mixed refrigerant process cycles (AP-C3MR™ and AP-DMR™), and nitrogen (AP-N™) process cycles have been applied. Each liquefaction unit is delivered with performance guarantees on LNG production, specific power and quality. Each coil wound heat exchanger (CWHE) is custom designed by our engineers to address the full spectrum of economic factors, feed gas compositions, ambient conditions, and LNG product specifications.

Our CWHEs contain helically wound tube bundles housed within an aluminum or stainless steel pressure shell. The CWHE provides efficient liquefaction and containment of hydrocarbons, both LNG and refrigerants. The heat exchangers may consist of one-, two-, or three bundles, each made up of several tube circuits with the tube circuit areas being matched to the process requirements. The CWHE can be fully modularized to minimize fieldwork. Our dedicated experts work with clients from conceptual development through project execution, commissioning and start-up, and continue through the life of the LNG facility. The CWHE is designed and optimized together with Air Products' proprietary liquefaction technology to achieve superior process efficiency and contribute towards a lower carbon footprint.

## Selected Air Products mid-scale LNG plant experience

Location	Initial Start-Up	No. of Trains	LNG Capacity (MTPA)	Air Products' Process
Libya	1970	4	0.8	AP-SMR
Brunei	1972	5	1.3	AP-C3MR
Abu Dhabi	1977	2	1.7	AP-C3MR
<b>Algeria</b>				
Arzew GL1Z	1977	6	1.3	AP-C3MR
Arzew GL2Z	1981	6	1.4	AP-C3MR
<b>Indonesia</b>				
Arun	1978–1986	6	2.0	AP-C3MR
Donggi	2015	1	2.1	AP-C3MR
<b>China</b>				
Ningxia Hanas	2012	2	0.4	AP-SMR
ShaanXi Yangling	2015	1	0.5	AP-SMR
Fengzhen City Wanjie Gas	2024	1	0.3	AP-SMR
Xian Gaoling LNG	2025	1	0.8	AP-SMR
<b>Canada</b>				
Squamish	2027	1	2.1	AP-C3MR
<b>Total</b>		<b>38</b>		

## Experience you can trust

Air Products is the premier global LNG technology and equipment supplier, with over 120 LNG trains operating in 20 countries, all of which successfully passed their performance test the first time. No matter how small your capacity requirements, maintaining production is key to a profitable project. Air Products' proprietary liquefaction equipment is robust, reliable, compact and efficient with many CWHEs still in service today and producing well over their original design capacity.

## About Air Products

Air Products is a world-leading industrial gases company with over 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.

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