

# Small plant and peak-shaving LNG processes:

## Designed for simplicity and delivering lower unit costs



Air Products' peak-shaving LNG plant on Long Island, New York.

Small and peak-shaving LNG plants producing up to 0.5 MTA are being promoted as the way to monetize stranded gas reserves at reduced cost, to replace inefficient aging assets, and to provide fuel for the mining and transportation industries. Air Products helped pioneer the LNG industry, and we have contributed to the success of more LNG operations around the world than any other liquefaction company. Today, we are meeting the need for smaller scale and peak-shaving plants.

### Air Products' LNG processes:

#### Proven design

No matter how small your capacity requirements, you want the ability to liquefy natural gas on demand. Air Products' efficient and reliable process designs have proven to be robust and reliable in natural gas liquefaction service. Small liquefaction plants that we manufactured more than 40 years ago are still in service today, with many producing well over their original design capacity.

### Nitrogen recycle:

#### Extensive experience

Air Products has used the nitrogen recycle refrigeration system as the primary liquefaction process in air separation for more than 50 years. These liquefaction systems cover a large range of plant capacities. Air Products also owns and operates over 100 nitrogen recycle (or air recycle) liquefiers. Year in and year out, our system-wide plant availability exceeds 99 percent, while operating and maintenance costs are the industry's lowest. The high reliability and low maintenance we build into the plants we own and operate carries over to the design practices and equipment selection in plants we build for natural gas liquefaction.

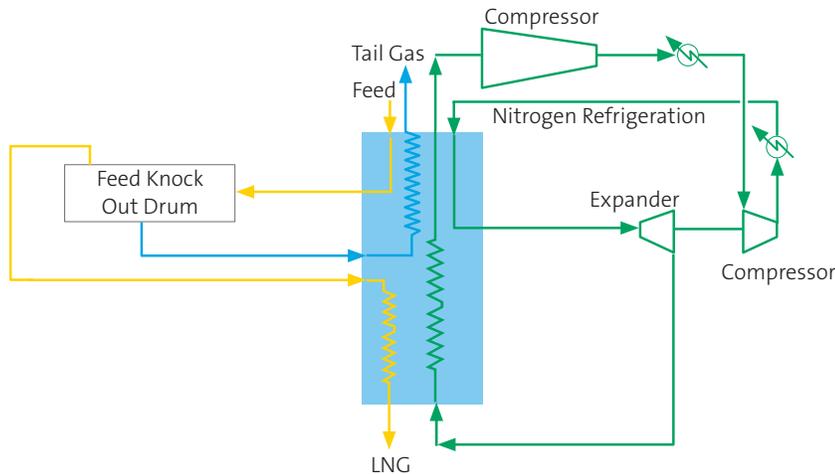
### Nitrogen recycle LNG liquefier:

#### Efficient process design and lower cost

As the world's leading supplier of LNG technology, Air Products designed and built the first LNG peak-shaving plant in 1965. We have designed and built all major types of LNG liquefaction plants, including cascade, mixed refrigerant, precooled mixed refrigerant, nitrogen recycle, and feed gas expander cycles. Our preferred product offering for LNG liquefaction applications at capacities of 5 MMSCFD to 30 MMSCFD is the nitrogen recycle liquefier. Nitrogen recycle plants in this size offer several benefits:

- Inherently lower capital cost than competing mixed refrigerant technologies while providing comparable energy efficiency
- Simple operation and superior turn-down efficiency
- Nonflammable and environmentally benign nitrogen refrigerant
- Low cost and ready availability of nitrogen
- Modularized design of nitrogen recycle liquefier, with three basic components, minimizes field construction cost

## Simple N<sub>2</sub> Recycle Process



Air Products cryogenic expander typically used in the production of a small LNG plant.

## Single mixed-refrigerant process:

### An option for enhanced performance

Depending on your project, Air Products' single mixed-refrigerant (SMR) LNG process may also be an option for your small plant. The AP-SMR process incorporates our unique coil-wound heat exchanger (CWHE), offering an attractive and straightforward solution that minimizes process equipment and provides enhanced performance and reliability. The CWHE can be fully modularized to minimize fieldwork. Air Products' mixed refrigerant process cycles with coil-wound heat exchangers benefit from years of experience and "know-how" gained in the LNG industry.

## Air Products' capabilities:

### Comprehensive resources

Air Products is the leader in supplying process technology and equipment to the LNG industry. Air Products has contributed to the success of more LNG operations than any other company and brings its full capabilities to LNG projects of any scale. From peak-shaving plants producing less than 0.1 MTA to the largest baseload facilities, on land or off-shore, our LNG team can help you get a plant up and running at the highest efficiency, on time, on budget, and in any climate. As an owner and operator of hundreds of process facilities worldwide, Air Products can provide full support to the LNG plant owner, including spare parts management, short and long term O&M services, plant optimization studies, and upgrades for existing facilities. If you need LNG production capacity—today or in the future—and you want to obtain it efficiently and cost-effectively, please contact us. We'd love to tell you more.

## About Air Products

Air Products provides atmospheric, process and specialty gases; performance materials; equipment; and technology. For over 70 years, the company has enabled customers to become more productive, energy-efficient and sustainable. More than 20,000 employees in over 50 countries supply innovative solutions to the energy, environmental and emerging markets. These include semiconductor materials, refinery hydrogen, coal gasification, natural gas liquefaction, and advanced coatings and adhesives. In fiscal 2012, Air Products had sales approaching \$10 billion.

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