



**Industrial gases and advanced technologies for primary non-ferrous metals production**  
**tell me more**

# Experience, understanding and solutions

When a need for reliable gas supply or advanced technologies for your processes occurs, Air Products has the experience to help you be more successful. Working side-by-side with non-ferrous metals mining and refining facilities, we have developed in-depth knowledge and understanding of extractive and refining processes. You can leverage our experience to help increase yield, improve production, decrease harmful fugitive emissions, and reduce energy consumption and fuel cost throughout your operations.

As a leading global industrial gas supplier, we offer a full range of supply modes for industrial gases, including oxygen, nitrogen, argon and hydrogen for small and large volume users, state-of-the-art equipment and a broad range of technical services based on our comprehensive global engineering experience in many critical gas applications. Our products range from packaged gases, such as portable cryogenic dewars, all the way up to energy-efficient cryogenic air separation plants and enabling equipment, such as burners and flow controls.

Beyond products and services, customers count on us for over 60 years of technical knowledge and experience. As an owner and operator of over 800 air separation plants worldwide, with an understanding of current and future industry needs, we can develop and implement technical solutions that are right for your process and production challenges. It's our goal to match your needs with a comprehensive and cost-effective industrial gas system and innovative technologies.

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“By engaging Air Products at an early stage in our **Zambian [Kansanshi copper-gold mining]** project, we were able to explore oxygen supply options and determine what we believed to be the best system for our specific process requirements. Based on their prior work in the copper industry, Air Products was able to propose an effective plant design based on its other operating plants, and also meet our critical project schedule.”

Zenon Wozniak, Director Projects, First Quantum Minerals



## Gases and chemicals to meet your needs

### Cryogenic air separation plants up to 4000 tons per day and more

High-purity (95% to 99.5%) oxygen and nitrogen can be supplied from a dedicated plant located at or near your facility. You can own this plant and manage the day-to-day operations or let Air Products own, operate, and manage the plant and simply provide you the gas through a pipeline. We recognize each customer has unique requirements; thus our experienced engineering team will develop an energy-efficient, cost-effective design to integrate the plant with your process. Depending on your requirements, we can build a large air separation unit or a smaller plant with the flexibility of producing liquid product for backup and peak demand requirements. Cryogenic plants can be designed to supply primarily oxygen or nitrogen, or to supply both oxygen and nitrogen. Some plants can also provide argon.



### Noncryogenic oxygen and nitrogen on-site generation systems

On-site generators can provide an economical and reliable gas supply if you have fairly consistent usage patterns. These adsorption plants can produce products with the flexibility to meet most purity and pressure requirements.

- Oxygen—vacuum swing adsorption (VSA)
- Nitrogen—pressure swing adsorption (PSA)

### Hydrogen on-site generation systems

As a global leader in hydrogen gas supply, we can help you determine the most efficient supply mode to meet the needs of your reduction applications. Our hydrogen generation systems feature a compact modular design that facilitates easy installation and maintenance and delivers high reliability. Fully integrated backup systems can also be added to help maintain uninterrupted supply.



### Delivered cryogenic liquid supply

For smaller, higher purity requirements, Air Products can deliver bulk quantities of nitrogen, oxygen, argon, helium, and hydrogen from over 90 production facilities worldwide. Our teams work around the clock to maintain an outstanding global reliability record of over 99.9%—supplying product on time at the flow, purity and pressure our customers specify.



### Performance chemicals for economical mineral recovery

In addition to gases, Air Products produces an array of performance chemicals that serve the mining industry. Our Tomamine® product line of ether amines is designed for mineral flotation in mining applications. The reverse flotation process is used for the separation of a large range of sulfides, carbonates and oxides prior to further refinement.



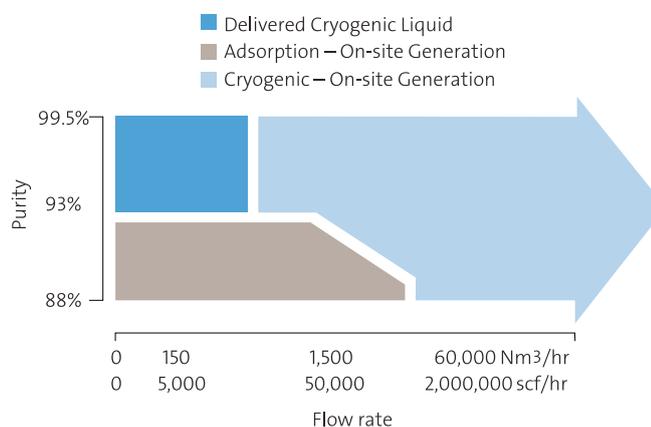
## A full range of oxygen supply options

We have sold, designed and built more than 2,200 air separation plants globally, and currently own and operate over 800 air separation plants in over 40 countries worldwide. Our team of engineers can leverage this experience and our understanding of your application to help you determine which of our modes of supply is the most cost-effective for your operation. The diagram to the right provides a general outline as to which oxygen supply mode may be best for you based upon your volume and purity requirements. A similar supply mode analysis is available for nitrogen applications.

## Technical services and solutions

Our experienced applications engineers can work closely with you to create customized industrial gas systems for your process and select our most efficient supply mode based on your desired usage patterns, pressure, and purity. We have also been developing innovative oxygen-based combustion technologies to help customers improve productivity, reduce energy consumption, and reduce emissions. In our world-class laboratories located at our headquarters in Allentown, Pennsylvania, we can quickly assess the performance of your combustion application in a controlled environment. Our newest combustion laboratory even features a remote video imaging system that enables real-time participation in testing from remote locations. We can also work with you to help optimize your hydrometallurgical processes—such as pressure oxidation, leaching, and flotation—to improve yield and reduce environmental impact.

Figure 1: Oxygen Solutions



And if you own and operate your oxygen or nitrogen plant and need after-market services or equipment, Air Products can help. We offer performance audits to help you identify areas for potential improvements within your operation that could increase production, improve reliability, and decrease energy consumption. We can also provide the equipment and support to implement these upgrades. And if you need help handling the day-to-day operations of your plant or periodic help with maintenance, you can turn to Air Products. With over seven decades of operations experience, we can help you get the most out of your industrial gas plant.

## Dedicated to safety and sustainability

At Air Products, nothing is more important than safety—a commitment to total safety means there is no room for error. Air Products has one of the best safety records in the industrial gas and chemical manufacturing industries. All our employees embody safety, not only within Air Products, but also to protect our contractors, customers, and the environment. Complementing our commitment to safety, Air Products is equally diligent about sustainability. Often, our offerings and applications experience can help you improve your sustainability efforts by reducing energy use, increasing productivity and product quality, and lowering emissions and waste.



## Working with you

When you start your planning process, remember to engage Air Products early. We can evaluate your process, explore various options, and tailor solutions to help your process operate as efficiently as possible.

### For more information:

Achieving a competitive edge is critical to your success. Air Products' knowledge and experience can help you achieve that edge through reliable, low-cost gas supply and proven, cost-effective technologies. Contact us today to see how we can help deliver success.

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