

The 2024 US air gases market report

Plant builds remain neutral,
with independent newcomers on the scene

By Maura D. Garvey

The US industrial gas industry continues to face challenges and uncertainties brought by global economic struggles, which have been driven by geopolitical energy issues and the wars in Ukraine and now Israel–Gaza.

Supply chain issues that began during the pandemic have yet to be resolved and the effects on the US economy and business markets continue. Like other parts of the industrial gas business, US air gases production and investment, the bread and butter of the industrial gas (IG) business, has been impacted in some markets more than others by supply chain and labor issues.

These issues have caused some planned plant startups to be delayed and in general slowed new plant builds due to a lack of demand. At the same time, US economic data points to some markets being more resilient than others. Markets that have fared better include healthcare, electronics, and food processing while the greatest negative impact has been on general manufacturing and the metals sector.

This past year, remember, the economy has been hampered by inflation, rising energy prices, and

lack of labor, though these issues have started to turn around. We begin 2024, then, with the US economy headed for growth, yet that growth is unlikely to be any better than before the pandemic hit.

In 2023, announcements of domestic air separation unit (ASU) and liquefaction builds and expansions for startup through 2028 were similar to the prior year, reflecting the impact of the slow recovery to the economy on the US air gases business. At the end of 2023, five new or ASU expansions with liquefaction came on-line and an additional seven new ASUs are expected to come on-stream between now and 2028. The economic landscape in 2024 will drive how demand develops for oxygen, nitrogen, and argon across sectors, especially in fabricated metals and automotive, and stainless steel and electronics for argon. Production of argon has always relied on large-volume oxygen production at ASUs. We last reported on the US air gases market in February 2023 (see “2023 US air gases market report” *gasworld US Edition*, February 2023, p34).

ASU builds, expansion, and replacement

Investments in new or expanded capacity represent millions of dollars and are based on large and long-term demand drivers for industrial gas products in regional markets. Announcements for ASU builds continued into 2023, indicating that this staple business for our industry is moving beyond the economic slowdown across a number of sectors. The distribution supply chain substantially drives where new capacity is needed to support growth in demand for oxygen and nitrogen. Growth in oxygen and nitrogen has been slow but steady, but

growth in argon has fared better, causing supply to be tight in some regions.

In general, when the economy improves, we anticipate an increase in oxygen demand to serve the steel, chemicals, and energy markets; an increase in nitrogen demand to serve the energy and merchant markets such as food; and an increase in argon to serve the stainless steel and specialty steel markets, electronics, and welding/construction markets. Two of the new plants brought on-line by Linde plc in 2023 were to serve the semiconductor market in Arizona.

New ASUs, expansions, and replacement activity results from a need to remedy regional supply issues or replace aging and inefficient plants. Most producers, including several independents, announced plans to increase capacity over the past year specifically to remedy these situations. Details on these independent companies are provided in the next section.

Air Liquide/Airgas brought on-line two ASUs in 2022 on its Mississippi River pipeline to serve Methanex Corporation. In August 2022, Air Liquide proposed a \$550m project to build a new world-scale ASU in Baytown, TX for distribution to customers in the Gulf Coast area. Currently, Air Liquide/Airgas operates over 85 ASUs in the US. Completion is not expected until 2028.

The proposed production facility in Baytown, Texas, will consist of a new industrial gas facility to produce argon, oxygen, and nitrogen for distribution to customers in the Gulf Coast area. The proposed industrial gas facility will be constructed along Air Liquide industrial gas pipelines that run from Lake Charles, Louisiana, to the south of Corpus Christi, Texas, through Harris County. Products from this plant will be distributed via pipelines to Air Liquide's gas customers along these pipelines, by truck to Air Liquide's customers throughout the Texas and Louisiana Gulf Coast, and by rail to customers outside this region. The expected start date for the construction of the ASU is 2026, with an expected end date in 2028.

In May 2023, Air Liquide announced that it has invested nearly \$70m in state-of-the-art plants in North Texas to supply ultra-high-purity nitrogen and oxygen to the electronics industry. These investments will support the expansion of two existing manufacturing facilities and also be used to build,

“The distribution supply chain substantially drives where new capacity is needed to support growth in demand for oxygen and nitrogen”

own, and operate onsite plants and systems at a new manufacturing site in the region. Operations and supply are expected to begin in the second quarter of 2023 at the existing facilities and to start in the first half of 2025 at the new manufacturing site.

The dynamic growth of the electronics industry globally has been boosted by the rapid adoption of the Internet of Things (IoT), big data, artificial intelligence, advancements in smartphones, and 5G technology and automotive electronics components. After the rapid growth ►



- ▶ over the last five years, the electronics industry is expected to keep enjoying structural expansion over the long term.

Michael J. Graff, Executive Vice-President and Executive Committee Member of the Air Liquide Group, said: “Air Liquide is proud to support the structural long-term growth of electronics manufacturing in the United States. We are pleased to support our electronics industry customers as they endeavor to expand their manufacturing footprint in Texas, a state where Air Liquide has an established presence and significant infrastructure.”

Airgas has installed two strategically located argon storage nodes to further strengthen the argon supply chain for its customers, which use argon in automotive and aeronautical, electronic, manufacturing, and metal fabrication applications. Airgas’ investment in new argon nodes will strengthen links in the rail and trucking supply chain, resulting in improved argon reliability and delivery for customers. These storage relays provide more flexibility in argon distribution by moving more Airgas product inventory closer to

customers and were added to address recent rail transportation delays and logistics challenges.

The argon nodes were completed in early 2023, and are in Moraine, Ohio and Guilderland, NY. Both store enough argon to fill around 40 tanker trucks each. Airgas is currently installing a third argon node, operational for early 2024.

Air Products brought onstream a new ASU in Texas City, TX in early 2023 to supply nitrogen to Gulf Coast Ammonia (GCA). The company had announced plans to make its largest US investment ever, \$500m, in January 2021, after winning a long-term supply contract to supply GCA’s new world-scale production plant in Texas City, TX. As part of that agreement, Air Products built a new ASU to supply 3,250 tpd of nitrogen to GCA. The ASU is located at the Texas City site on property leased from Eastman. The investment also includes a steam methane reformer to produce hydrogen and a steam turbine generator to supply power and other utilities to GCA’s ammonia plant.

Linde plc has over 50 ASUs across the US following the merger with Praxair in 2019 and the divestiture of the Linde US ASU assets to Messer. In 2023, Linde plc started up the Mims, Florida ASU expansion plant and brought onstream two ASUs in Phoenix, AZ for Taiwan Semiconductor Manufacturing Company (TSMC). Linde will increase capacity at Mims by almost 50% to supply its contracted customers across all end markets, including aerospace, healthcare, manufacturing, food processing and water treatment.

The Phoenix ASUs supply ultra-high-purity nitrogen, oxygen, and argon to TSMC. The gaseous products are supplied to the TSMC factory while the liquid products produced are distributed via truck to customers in the Phoenix metro market and nearby states.

A year ago, Linde plc also announced plans to expand its La Porte, TX facility to double the facility’s merchant liquid production capacity. The increased capacity is planned to be onstream in 2024 to meet the growing demand from petrochemicals, clean energy, manufacturing, food, and aerospace sectors in the Gulf Coast. The facility will also supply Linde’s existing Gulf Coast pipeline system to Freeport, TX.

On February 6, 2023, Linde announced that it has signed a long-term agreement to supply clean hydrogen and other industrial gases to OCI’s new world-scale blue ammonia plant in Beaumont, TX. Linde will build, own, and operate an on-site complex which will include autothermal reforming with carbon capture, plus a large ASU. The new complex will be integrated into Linde’s extensive Gulf Coast industrial gas infrastructure. It will supply clean hydrogen and nitrogen to OCI’s 1.1 million ton-per-annum blue ammonia plant, the first greenfield blue ammonia facility of this scale to come onstream in the US. Linde will supply OCI with clean hydrogen by sequestering more than 1.7 million metric tons of carbon dioxide emissions each year.

In addition to supplying OCI, Linde will also use its pipeline network to supply atmospheric and rare gases to

“Air Products brought onstream a new ASU in Texas City, TX in early 2023 to supply nitrogen to Gulf Coast Ammonia (GCA)”

existing and new customers. Linde's total investment will be approximately \$1.8bn and the project is expected to start up in 2025.

On February 15, 2023, Linde announced plans to build a new ASU in Charleston, TN to serve growth across multiple segments along the I-75 corridor. The new ASU will produce liquid oxygen, nitrogen, and argon serving customers in Knoxville, Chattanooga, and Nashville areas of eastern Tennessee, as well as in northern Alabama and Georgia. The plant is expected to start up in the second half of 2025.

MATHESON currently operates over 35 ASUs across the US, including the 16 ASUs purchased from Air Liquide in 2016. Matheson completed construction of its last ASU in 2019 when it built a new large-scale ASU to supply Lotte Chemical Louisiana LLC with tonnage oxygen and nitrogen to its world-scale monoethylene glycol (MEG) plant in Lake Charles, LA.

Messer, which has over 30 ASUs in the US, brought on-line a new ASU in Delta, OH in 2023. It also announced plans to build a new ASU in McGregor, Texas to be on-stream in 2024. Messer expanded operations in Delta, OH to supply North Star BlueScope Steel (NSBS). The new ASU in Delta, OH increases oxygen supply by up to 700 tpd. NSBS is a producer of hot-rolled coil for use in the automotive, construction, energy, and manufacturing industries. In addition to supplying NSBS, Messer's ASU increases the company's own liquid capacity in Delta,

supporting growth and supply reliability for merchant customers in the growing Midwestern market. Messer supplies liquid products to a range of industries that are essential to the local and regional economy, including healthcare, chemistry, food processing, welding, glass, and metals fabrication.

The new large-scale ASU in McGregor, Texas will substantially use energy supplied from an onsite solar panel array. It is the first Messer plant to be powered by a co-located renewable energy source, helping to reduce carbon footprint.

The new plant, slated for completion in Q2, 2024, will produce gases that fuel growth in central Texas, supporting burgeoning industries in the area including aerospace, chemical, electronics, food and beverage as well as healthcare, metals, and oil and gas. This plant was planned to extend its southwestern merchant gases supply network to meet growing customer demand in the region which has been supplied from existing plants in La Porte and Terrell, Texas, as well as Lewisville, Arkansas.

Absolute Air, LLC broke ground in Faribault, MN, about 50 miles south of Minneapolis, on September 19, 2019 executing its plan to build a merchant ASU in the Minneapolis metropolitan area to serve its partners and customers. The plant started up in January 2023. The five distributors involved in the project are Mississippi Welders Supply, Toll Company, Minneapolis Oxygen, A-OX Welding Supply, and Huber Supply. The location, Faribault, is in the

heart of the five partners' operations.

UIG, a division of Nucor Corporation, focuses on the middle market nitrogen and oxygen gas users. UIG, and its plant operations affiliate Universal Cryo Gas (UCG), works with customers by building a customer's plant to produce their own gases, or by UIG building, owning, and operating an ASU at the customer site where the customer is buying the gases produced.

UIG brought onstream an ASU and liquefier to supply oxygen, nitrogen, and argon to Nucor's new steel mill in Brandenburg, Kentucky in late 2022. In August 2022, Nucor announced that it will invest \$200m over a five-year period in mill modernization projects at its Nucor Steel Berkeley division located in Huger, South Carolina. A portion of the capital investment will include the construction of a new ASU for the purpose of supplying industrial gases for the mill's steelmaking operations.

That ASU will start up in 2024 and will be operated by UIG LLC. Nucor Steel Berkeley is currently supplied with industrial gases under a long-term supply agreement with an industrial gas company. This project will allow Nucor through UIG to produce and supply all the gases needed for the steel mill from the new Nucor-owned facility, both now and into the future.

Air Water Gas Solutions, a subsidiary of Air Water Americas (a subsidiary of Air Water Inc. of Japan), has signed a 20-year agreement to supply RED-Rochester, LLC (RED) with nitrogen for its Eastman Business Park (EBP) pipeline in Rochester, N.Y. ►

► Air Water will deliver high-purity nitrogen gas from a new ASU plant located within EBP in Rochester. The ASU will meet RED's clients' needs for nitrogen, oxygen, and argon.

The ASU will be built, owned, and operated by Air Water. The plant will also serve the wider New York and northeastern US merchant liquid market areas with nitrogen, argon, and oxygen.

The new ASU will commence operations in 2025 to meet RED's industrial gas demands and local liquid gases market needs. Air Water

currently supplies merchant liquid products to clients in the Midwest and Southeast US.

In May 2022, Air Water acquired independent industrial gas and welding products distributor Noble Gas Solutions in Albany, NY. It also acquired Phoenix Welding Supply of Pheonix, AZ in August 2023.

Iwatani Corporation of America acquired Aspen Air US, LLC, with a small ASU located in Billings, Montana on January 4, 2023, entering the US industrial air gases market. Aspen Air is a leading manufacturer and

distributor of bulk liquid industrial gases in Montana and the surrounding states. Aspen Air supports a diverse industrial and medical base of customers, including those in the energy and chemicals sectors, hospitals, and the very important packaged gases and independent distributor network. The acquisition reflects Iwatani's focus on supporting customers in underserved markets.

Iwatani has operated in the US for more than 40 years. In recent years the company has broadened its business platform to include hydrogen, helium, specialty gases, and now air gases.

US player share of nameplate oxygen and nitrogen capacity – 2024

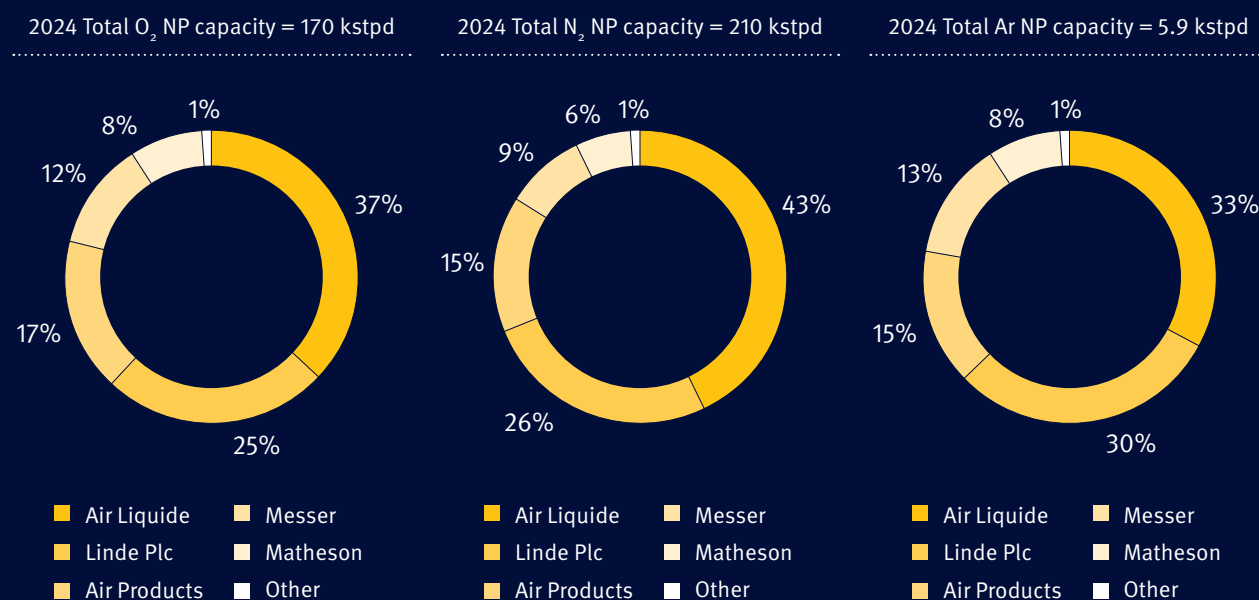


FIGURE 1. Source: Intelligas Consulting

Air gas capacity

Intelligas Consulting LLC proactively follows developments across industrial market sectors in the US and has developed and maintained high quality estimates of US plant capacities for a variety of products, including oxygen, nitrogen, and argon from ASUs. Intelligas capacity estimates are based on publicly announced capacity data, discussions among players, and estimates of continual improvements to those capacities from de-bottlenecking and reaming out of nameplate capacities. The plant capacity estimates that follow do not include non-cryogenic capacity or include any customer-owned and -operated capacity.

As mentioned earlier, US producers build or expand capacity to meet rising demand for air gases or to replace older, less efficient plants. Typically, ASUs do not operate at full capacity and reduce production further during slowing economic times or recessions. The increase in new ASU build announcements and expansions in 2023 was very like prior year and reflects the impact of the slowly recovering US economy on the US air gases business.

Key US installed nameplate (NP) capacities for total oxygen, nitrogen, and argon molecules are produced from large, on-site (OSP) complexes. These complexes feed into dedicated pipeline networks and the primary markets supporting each piggyback and standalone merchant plants.

By the end of 2024, Intelligas projects NP oxygen capacity to be approximately 170,000 short tons per day (kstpd) and

total merchant liquid (liquid oxygen (LOX), liquid nitrogen (LIN), and liquid argon (LAR)) at about 86 kstpd.

Argon production is tied to oxygen production at ASUs and large increases in oxygen capacity are needed to get significant increases in argon capacity. The most efficient way to produce argon is to piggy-back pure argon capacity on large, on-site oxygen plants of 1,000 tpd capacity and larger.

Argon production has struggled in some regions to keep up with demand and producers have windmilled plants (a process where argon is captured while the oxygen is vented) and made efficiency improvements to improve supply. Even with these efforts, supplies of argon can be tight in some regions.

Player share of capacity

Figure 1 shows the US share of total oxygen, nitrogen, and argon nameplate capacities by major gas producer. Included in the oxygen chart are molecules that feed OSP customers and merchant liquid plants, whether piggyback or standalone. Of the five major producers, Air Liquide and Linde plc have 62% of all US oxygen capacity. The shares do not change significantly each year as the new added volumes added each year are very small compared with installed plant volumes in the US.

Like oxygen capacity, Air Liquide and Linde plc have 69% of all US nitrogen NP capacity, or 210 kstpd. The three other majors, Air Products, Messer, and MATHESON (MTG) have 30% of NP nitrogen capacity. The remaining 1% of capacity is operated by other

independent players such as Norco, Nucor/UGI, Absolute Air, and Aspen Air (Iwatani).

In 2024, total argon capacity is estimated to be 5.9 kstpd. As shown in Figure 1, Air Liquide and Linde plc currently have 63% of the total US argon capacity, with 33% and 30% respectively. Air Products holds 15% while Messer, the new player last year, holds 13% share of this capacity from the acquisition of 32 divested Linde US ASU. This is followed by MATHESON with 8%, and others with 1%.

Total merchant liquid capacity, shown in Figure 2, is an important segment experiencing increases in demand from the food, electronics, and fabrication ►

2024 Total merchant liquid capacity = 86 kstpd

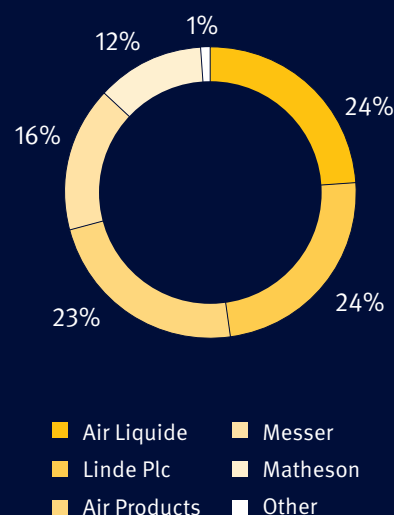


FIGURE 2. Source: Intelligas Consulting



► markets. The total US installed merchant liquid capacity by player is estimated at 86 kstpd. This figure constitutes all the merchant liquid that comes from the merchant liquid plants and ASUs (called piggy-back ASUs) in the US that have merchant liquid capacity. Air Liquide and Linde plc have 24% share each, Air Products has a 23% share followed by Messer with a 16% and Matheson with a 12%. Others account for the remaining 1%.

Air gases and the year ahead

The air gases business continues to feel the effects of the US economy and business markets, as do other industrial gas product sectors. The current slow economic recovery will bring challenges, especially in the more

cyclical sectors such as manufacturing, chemicals & energy, and metals. Players that serve a variety of markets will pursue growth in less-cyclical end-markets, such as electronics, healthcare, and food and beverage: the markets that were more resilient in 2022 and 2023.

New ASUs, expansions, and replacement activity result from a need to remedy regional supply issues or replace aging plants. Most producers and several independents announced plans to increase capacity over the past year specifically to remedy these situations.

Driving recent builds and expansions of ASUs in the US is the higher demand for oxygen and nitrogen from big chemical operations on the Gulf Coast, electronics for new semiconductor

fabs, and merchant liquid customers, and increased argon demand from electronics and stainless-steel sectors. These continued new builds and expansions reflect continued growth of the industrial gas business as it navigates the slow economic recovery. Intelligas is optimistic that air gas-related markets will improve as the US economy improves into 2024. **gw**

ABOUT THE AUTHOR

Maura D. Garvey is President of Intelligas Consulting LLC, an international consultancy specializing in strategic analysis and forecasting in the industrial gas industry. She can be reached at mdgarvey@intelligasconsulting.com

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