2023 US air gases market report

There is clear evidence that plant builds are slowing, signaling a weakened economy

By **Maura D. Garvey**

Right now the world is facing global economic struggles that have been driven by geopolitical energy issues brought on by the Russian war on Ukraine, alongside prolonged supply chain issues from the pandemic and the knock-on effects on the US economy and business markets. It is a testing moment, make no mistake, but the US is stronger than most.

Air gases supply is the bread-and-butter of the industrial gas (IG) business. It has been impacted in some markets more than others by supply chain and labor issues. These issues caused some planned plant startups during the past few years to be delayed – and it has slowed new plant builds due to lack of demand. But US economic data points to some markets being more resilient than others. Markets that have fared better included healthcare, electronics, and food processing, while the greatest negative impact was on manufacturing and on metals.

So we begin 2023 with hopes that the economy will normalize, and that the Fed has done enough to ward off further economic downturns. This past year has seen the economy hampered by inflation, rising energy prices, and lack of labor.

What's the landscape like in air gases? Announcements of domestic air separation units (ASUs) and liquefaction builds and expansions for startup through 2028 have slowed from the prior year, reflecting the impact of the economy on the US air gases business. At the end of 2022, three new and two replacement ASUs with liquefaction came on-line and an additional eight new or expansion or replacement ASUs are projected to come on-stream between 2023 and 2028.

The economic landscape in 2023 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, for example, has always depended on large volume oxygen production at ASUs.

This report will primarily review news on ASU growth or expansions.

ASU activity – builds, expansions, replacements

Investments in new or expanded capacity cost many millions of dollars and are based on large and long-term demand drivers for industrial gas products in regional markets. Announcements for ASU builds slowed in 2022 compared with 2021, indicating that this staple business for our industry is moving beyond the pandemic but is hampered by the economy across a number of sectors. The distribution supply chain is one important factor, as it 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.

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In general, when the economy improves we anticipate an increase in oxygen demand to serve the steel, chemicals and energy markets, while an increase in nitrogen demand is to serve the energy and merchant markets such as food. Next to this, an increase in argon is to serve the stainless steel

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and specialty steel markets, electronics, and welding/construction markets, plus some niche science needs. If the US economy slows, as we are seeing now, we will see a comparable decline in air gases demand, lagging by several quarters.

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

Air Liquide/Airgas

Air Liquide/Airgas brought on-line two ASUs in 2022 on it 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.

Air Liquide announced the agreement with Methanex Corporation in September 2019 to supply oxygen, nitrogen and utilities to its upcoming methanol plant expansion project in Geismar, Louisiana. To serve Methanex and its other customers in the industrial basin that encompasses Geismar and Baton Rouge, Air Liquide invested in two new large ASUs, each with a capacity of 2,500 tpd, and infrastructure assets connected to its Mississippi River Pipeline, which increased the company's Mississippi River Pipeline's supply capacity by more than 25%. At Intelligas Consulting we estimate that argon recovery will be added to these plants given the ongoing regional tightness of argon supply.

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. Air Liquide is considering alternate locations in both Texas and Louisiana from which to serve its industrial, medical and energy customers. The expected start date for the construction of the ASU is 2026, with an expected completion date in 2028.

Air Products

Air Products brought onstream two new ASUs in Kingsport, TN to 2022. In January 2020, it announced plans to build a new ASU to supply nitrogen to Gulf Coast Ammonia (GCA) in Texas City, TX to be on-line in early 2023.

The Kingsport, TN ASUs replaced Air Products' 35-year-old ASUs operating at the Kingsport facility. The new ASUs will continue to serve Air Products' established merchant customer base and growing merchant markets including metals processing, medical, chemicals and food with liquid oxygen, liquid nitrogen and liquid argon. Eastman's Kingsport facility is one of the largest chemical facilities in North America.

Air Products also 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 will build a new ASU to supply 3,250 tpd of nitrogen to GCA. The ASU will be at the Texas City site on property leased from Eastman and will be on-line in early 2023. The investment also includes a steam methane reformer (SMR) to produce hydrogen and a steam turbine generator to supply power and other utilities to GCA's ammonia plant.

Linde plc

Linde plc is the company formed from the merger of Praxair and Linde on 1 March 2019. After the divestiture of the Linde US ASU assets to Messer, Linde plc has about 50 ASUs across the US. Linde plc is in the process of expanding the Mims, FL ASU, has plans to build several ASUs in Phoenix, AZ for the semiconductor industry, and recently announced an expansion to double the liquid production at its La Porte, TX facility.

In April 2022, Linde announced it had signed another long-term agreement with a major space launch company in Florida for the supply of bulk industrial gases from its ASU in Mims, FL.

Linde had previously announced plans to increase production capacity at its ASU in Mims, FL to meet rapidly growing demand for industrial gases. 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 project to expand capacity is expected to be completed in 2023.

In September 2021, Linde announced it had signed a long-term agreement with Taiwan Semiconductor Manufacturing Company (TSMC) for the supply of industrial gases to a new multi-billion-dollar manufacturing facility in Phoenix, AZ. Linde will build a complex of on-site ASUs to supply ultra-high-purity nitrogen, oxygen, and argon to TSMC. The gaseous products will be supplied to the TSMC factory while the liquid products produced will be distributed via truck to Phoenix metro market customers and nearby states.

Linde anticipates building two ASUs. These plants are designed to meet the most stringent requirements of the semiconductor industry while maintaining reliability and operating efficiency. Linde's total investment will be approximately $600m. The first plants and supporting infrastructure started up in the second half of 2022.

In April 2022 Linde announced plans to expand its La Porte, TX facility, effectively doubling the facility's merchant liquid production capacity. The increased capacity will help 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. Startup is planned for 2024.

MATHESON

MATHESON currently operates over 35 ASUs across the US, including the 16 ASUs purchased from Air Liquide in 2016. Matheson completed construction of its latest 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

In 2022 Messer, which has over 30 ASUs in the US, brought on-line a new ASU in Indianapolis, MN. This state-of-the-art plant produces life-saving gases for hospitals and essential raw materials for manufacturers across Indiana and the Midwestern US. It also announced plans to build new ASUs in Delta, OH and central Texas to be on-stream in 2023 and 2024.

In March 2021, Messer announced plans to invest in expanding operations in Delta, OH to supply North Star BlueScope Steel (NSBS). Messer plans to build a new ASU to increase oxygen supply by up to 700 tpd. NSBS is a leading producer of hot-rolled coil for use in the automotive, construction, energy, and manufacturing industries. The company has embarked on a $700m expansion plan to increase its steel production from approximately 2.4 million tons per year by adding 950,000 tons annually. In addition to supplying NSBS, Messer's new ASU will increase 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 wide range of industries that are essential to the local and regional economy, including healthcare, chemistry, food processing, welding, glass, and metals fabrication.

In June 2021, Messer announced plans to build a large-scale ASU to manufacture liquid atmospheric products in central Texas. This plant was planned to extend its southwestern merchant gases supply network to meet growing customer demand in the region, which had been supplied from its existing plants in La Porte and Terrell, Texas, as well as Lewisville, Arkansas.

> "In September 2021, Linde announced it had signed a long-term agreement with Taiwan Semiconductor Manufacturing Company"

Then in February 2022 Messer further defined its plans for the ASU as an over $50m investment to build the large-scale ASU in McGregor, Texas. The new ASU will operate substantially from 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 the carbon footprint. This effort aligns with the company's core values of environmental protection and sustainability.

The new plant 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. The ASU is slated for completion in Q2 2024.

"With our expansion in Texas and the inclusion of solar energy, Messer is focused on sustainability and environmental protection," said Jens Luehring, President & CEO, Messer Americas. "As we move to a renewable-based future, this investment is integral to our green energy initiatives as we continue to serve our customers with a reliable source of supply."

Absolute Air, LLC

Absolute Air broke ground in Faribault, MN, about 50 miles south of Minneapolis, on September 19, 2019, executing on its announced plan to build a merchant ASU in the Minneapolis metropolitan area to serve its partners and customers. It went into plant startup in July and August 2022. Like all plant startups, it ran into a few problems that needed to be addressed, delaying the final startup to January 2023. President and Chairman of Absolute Air Ned Pontious said at the time, "We were delayed during plant startup because of high motor vibration which the manufacturer fixed. The plant was restarted the first week of January 2023 and we will finish validation over the next few weeks. We are looking forward to beginning to ship our product by the end of January."

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 that have invested in this project.

UIG

UIG is a division of Nucor Corporation. It focuses on 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's site, with the customer buying the gases produced.

UIG brought onstream an ASU and liquefier to supply oxygen, nitrogen, and argon to its new mill in Brandenburg, Kentucky in late 2022. The plant will also supply liquefied industrial gases to other wholesale partners in the area. The new ASU marks a significant investment for Nucor since acquiring UIG in 2019.

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.

When complete, the ASU 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.

What is air gas capacity right now?

Intelligas Consulting tracks and maps developments across industrial market sectors in the US. We have developed and maintained high quality estimates of US plant capacities for a variety of products, including oxygen, nitrogen, and argon from ASUs. Cestimates 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. The estimates presented also do not 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 more inefficient plants. Typically, ASUs do not operate at full capacity and reduce production further during slowing economic times or recessions. During 2022, the increase in new ASU build announcements and expansions reflected the diminishing impact of the pandemic but the increasing economic slowdown on the US air gases business. At the end of 2022, new or expanded ASU announcements were slowing compared with 2021.

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 piggyback and standalone merchant plants.

By the end of 2023, Intelligas Consulting projects NP oxygen capacity to be approximately 165,000 short tons per day (kstpd) and total merchant liquid (liquid oxygen (LOX), liquid nitrogen (LIN), and liquid argon (LAR)) at about 85 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 piggyback 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 outputs

Figure 1 shows the US share of total oxygen, nitrogen, and argon nameplate capacities by major gas producers. 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.

Like oxygen capacity, Air Liquide and Linde plc have 69% of all US nitrogen NP capacity, or 200 kstpd.

The three other majors – Air Products, Messer, and MATHESON (MTG) – have 30% of NP nitrogen capacity. Only 1% of capacity is operated by other independent players such as Norco, Nucor/UIG, and Absolute Air.

In 2023, total argon capacity is estimated to be 5.8 kstpd. As shown in Figure 1, Air Liquide and Linde plc currently have 63% of the total US argon capacity, with 34% and 29% 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 9%. The rest account for less than one percent.

US Player share of nameplate oxygen and nitrogen capacity – 2023

Total merchant liquid capacity, shown in Figure 2, is an important segment experiencing increases in demand from the food, electronics, and fabrication markets. The total US installed merchant liquid capacity by player is estimated at 85 kstpd. This figure constitutes all the merchant liquid that comes from the merchant liquid plants and ASUs (called piggyback ASUs) in the US that have merchant liquid capacity. Air Liquide and Linde plc have 24% share each and Air Products has a 23% share, followed by Messer with a 16% share and Matheson with a 12% share. The remainder account for 1%.

Total merchant liquid capacity – 2023

Air gases in 2023

The current economic slowdown will be challenging for the US air gases business and its customers, especially in the more cyclical sectors such as manufacturing, chemicals & energy, and metals. While macroeconomic conditions look to remain challenging through most of 2023, 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.

Driving recent builds and expansions of ASUs in the US is the higher demand for oxygen and nitrogen from big chemical on the US 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 recovers from the pandemic and navigates the current economic slowdown.

Among the three air gases, the argon market is currently tight in some regions. Growing demand in stainless steel, electronics, and manufacturing industries have driven argon demand and builds. We at Intelligas Consulting are optimistic that air gas-related markets will improve as the US economy improves in later 2023 and beyond. gw

ABOUT THE AUTHOR

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FIGURE 1. 2023 Total O_2 NP Capacity = 165 kstpd

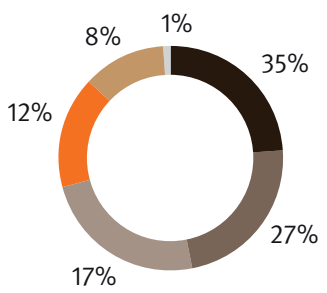

FIGURE 1. 2023 Total N_2 NP Capacity = 205 kstpd

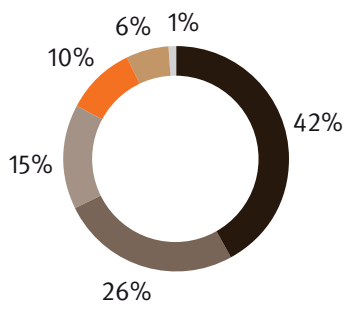

FIGURE 1. 2023 Total Ar NP Capacity = 5.8 kstpd

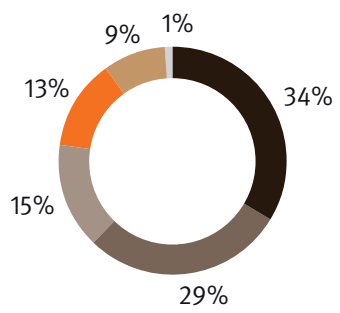

FIGURE 2. 2023 Merchant Liquid Capacity = 85 kstpd