

The 2023 worldwide helium market

Helium tightness relaxes – return to supply-demand balance remains uncertain

By Maura D. Garvey

Our assessment of the worldwide supply of helium is about 5.9 billion cubic feet (Bcf) for 2023, up from about 5.7 Bcf in 2022 – back where we were in 2021. We forecast that worldwide supply will be short of demand until late 2024 if the large new sources of helium come onstream. The shortage that began in early 2022 when Amur suffered explosions at its first two LNG trains is still having an impact. And history has taught those of us in the helium business that large plants typically incur delays due to unexpected technical issues. Plenty of uncertainty remains.

While 2022 was marked by shortage due to the series of unrelated events (see ‘The 2022 worldwide helium market’, August 2022, *gasworld* US Edition, p.30), so far 2023 has not experienced such disruptions at major sources – but several issues still linger, like reduced helium supply from Algeria and Amur having been down until recently.

Next to this, the Bureau of Land Management (BLM) has been operating well. It was down for planned maintenance mid-April and was back to normal production by May 1. ExxonMobil went down for planned maintenance for about a month beginning July 10. The global economic

weakness has dampened demand for helium, too, alleviating some supply challenges. But sometimes slower container shipping remains an issue. As helium suppliers work to deliver under these conditions, it is a reminder that the helium supply chain is fragile.

The economy impacts the demand for helium applications and the bringing on of new sources. We have sputtering economies in the rest of the world, while the surprising strength in the US endures. Around the world, there is new evidence of weak trade data from China and further signs that Germany’s industrial engine needs a major tune-up. How all this pans out over the remainder of the year and into 2024 will affect helium demand.

The BLM is serving as the flywheel and is allocating crude helium on the pipeline. Messer took over as the third-party operator of the helium production facilities (excluding the pipeline) at BLM back in June 2022 and production is flowing smoothly. BLM production in 2023 appears to be on track to produce about 680 million cubic feet (mmcf), up from 452 mmcf from 2022 due to the extended outage.

The sale of the BLM Federal Helium System assets was announced June 2022 by the General Services Administration

(GSA) which is handling the sale. Of note is that the sale excludes the Crude Helium Enrichment Unit (CHEU) that purifies the crude helium from the Federal Reserve and delivers it into the BLM Pipeline. It is owned by Cliffside Refiners Limited Partnership (CRLP) and leased to the BLM. The assets to be sold as the Federal Helium System include the mineral rights to the Bush Dome Reservoir, the remaining government-owned crude helium in the Federal Helium Reserve, the pipeline that connects the Federal Reserve to privately-owned natural gas processing plants and helium refining facilities, the Cliffside Plant facility, and a few other elements.

The sale had been presented as two opportunities. Opportunity one is about 1 Bcf of federally owned crude helium and opportunity two is approximately 800 mmcf of federally owned crude helium and the Federal Helium System.

The GSA expects the sales process will take between eight and nine months. Open house events at the Cliffside Facility took place or will take place September 10 and October 26. The GSA has a contractor, The Edelgas Group, to organize, promote and conduct a Bidder’s Conference. The Bidder’s Conference includes a forum

for prospective buyers to learn about the sale of the property. The one-day event is scheduled for October 10 at the Fairmont Hotel, Dallas, Texas. This sale will be a sealed-bid auction for both opportunities due November 13 at 11am CST. Bidders must register and provide a deposit for each bid. Sealed bid opening is Nov 15, 2023, 2pm CST.

In 2023, helium demand grew to take up available supply. For 2023, worldwide helium demand is estimated by Intelligas Consulting at 5.9 Bcf, flat over the past decade due to the three shortages that occurred during that time, including the impact of Covid-19. Natural demand is closer to 6.5 Bcf, we calculate.

Worldwide helium demand is forecast to grow at 3% to 5% per year once the global economies recover, the war in Ukraine ends, and new supplies come to fruition. Fastest growth will be in Asia, particularly China with industrialization growth. Slower growth is expected in the US, Europe, and Japan.

Intelligas Consulting, on behalf of *gasworld* (US Edition), spoke with the helium experts and managers at major industrial gas companies, market segment experts, and distributorships throughout the year to get the insider's view of this critical market. Those views and opinions are reflected here.

The largest end-uses of helium include liquid helium for Magnetic Resonance Imaging (MRI) manufacturing and service, gaseous helium for lifting (ie., balloons, airships, etc.), electronics (semiconductor and fiber optics for 5G), and aerospace. Fiber optics demand is expected to grow CAGR through 2030, while demand for semiconductor device manufacturing is expected to decline -2% to -3%. The decline looks less severe than the decline in usage expected for other materials used for chip manufacturing, because helium

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is used as a purge gas in lithography tools, according to Lita Shon-Roy, CEO of materials advisory TECHCET. According to analysis performed by TECHCET, semiconductor applications comprise around 20% of the global helium market. US semiconductor manufacturing is about 10% of the global market at present, expected to grow to >12% with announced fab expansions. US semiconductor helium demand will be growing an estimated 13% CAGR assuming all chip fabs that have been announced come about. Both the US and Europe worked to strengthen semiconductors in their regions and support growth through CHIPS Acts. It is finally looking like we will have the helium supply to support this growth.

Complex supply chain

Helium is a global commodity delivered through a complex global supply chain where industrial gas companies seek diversity of sourcing and reliability from sourcing operations.

Worldwide helium supply in 2023 is about 5.9 billion cubic feet (Bcf), in balance with demand, as shown in Figure 1. Despite Irkutsk and several new smaller non-hydrocarbons well sources coming on-stream late in the year, supply remains constrained. Several of the major industrial gas companies are still allocating helium to customers.

The supply disruptions have affected industrial gas producers to varying

degrees, depending on where they source their helium. There has been a measurable increase of supply flowing from the US into Europe, while at the same time supply from Europe into the US has increased, reflecting the complexity of various helium suppliers managing the logistics of supply to end-use customers under contract. European Commission (EC) helium export/import statistics reflect the flow of helium to and from the US and Europe.

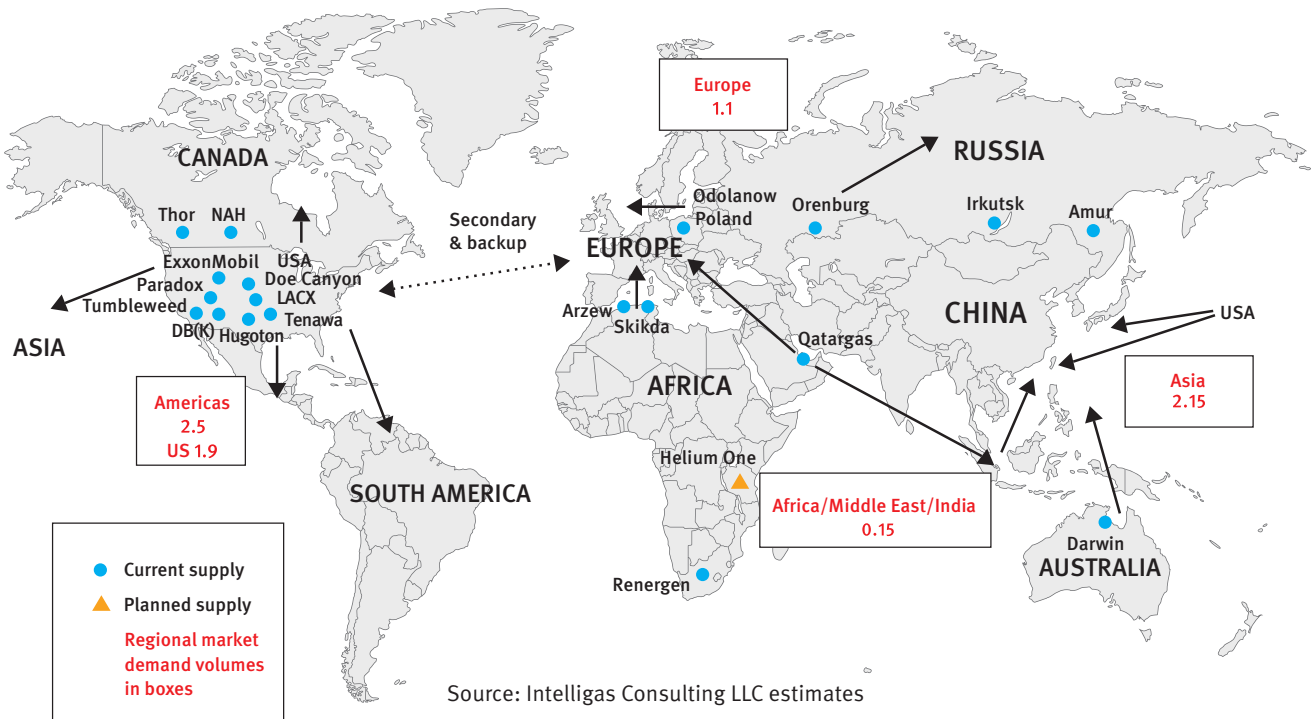
From Figure 1, you can see the complexity of supplying helium, which is perishable under very high vacuum at very cold temperatures, from a very few specialized companies with a few remotely located production plants for delivery to hundreds of thousands of customers all over the world. We predict global growth at 3% to 4% per year as supplies ramp up and come on-stream.

Growth will be higher in Asia at 5% to 7% and lower in the mature economies of the US, Europe, and Japan. This could increase faster in the US and Europe as the CHIPS Acts support semiconductor growth in those regions. Regardless, the world's helium demand-supply relationship is predicted to move into surplus when the new large, planned helium sources come fully on-stream from 2025 to 2027.

As noted in last year's review of helium supply, several smaller US sources started up early in 2019. The Haven Midstream (formerly Tenawa) facility experienced an explosion and fire last year and the plant has yet to restart. NTEC Helium purchased the Tacitus Corporation facility in Navajo County, AZ late in 2021 and started off with less than anticipated production in 2022, but has drilled a new well and production is increasing.

New offshore sources include: 270 mmcf of nameplate capacity in Irkutsk ▶

Figure 1



► Russia, which started up the second half of 2023; the restart of Gazprom’s Amur plant in September this year with a nameplate capacity of 750 mmcf; an expansion of up to 300 mmcf/yr at the Arzew, Algeria plant (onstream and originally expected in 2022); and 10 mmcf at Renergen, South Africa (over two years behind the scheduled start).

The 2.1 Bcf at the Russia Amur project by Gazprom that was delayed following the two NG plant explosions has once again started up the first of three helium plants. Gazprom started helium shipments from the first process train for this product at the Amur Gas Processing Plant on September 5. Deputy CEO Vitaly Markelov said: “We have launched one process train for helium production. The first batch of helium left the plant on September 5 to the helium hub.”

The company also plans to launch two more process trains at the plant early next year. Design capacity is for six trains by 2025.

The ongoing sanctions on Russia

will constrain the delivery of helium into those markets without sanctions (ie., China and India) as most of the ISO container fleet is made up of US-based Gardner Cryogenic ISOs. Those containers are included in the US equipment list not allowed in the Russian Federation. Gardner began producing the 11,000 gallon containers 50 years ago while Linde Engineering began manufacturing helium ISO containers about 12 years ago. “The limited availability of non-US manufactured containers will limit the potential ISO fleet to deliver the Amur and Irkutsk helium product to market,” according to Phil Kornbluth, President of Kornbluth Helium Consulting. Also “Gazprom has been actively soliciting buyers for its helium in China and other countries not subject to US trade restrictions.”

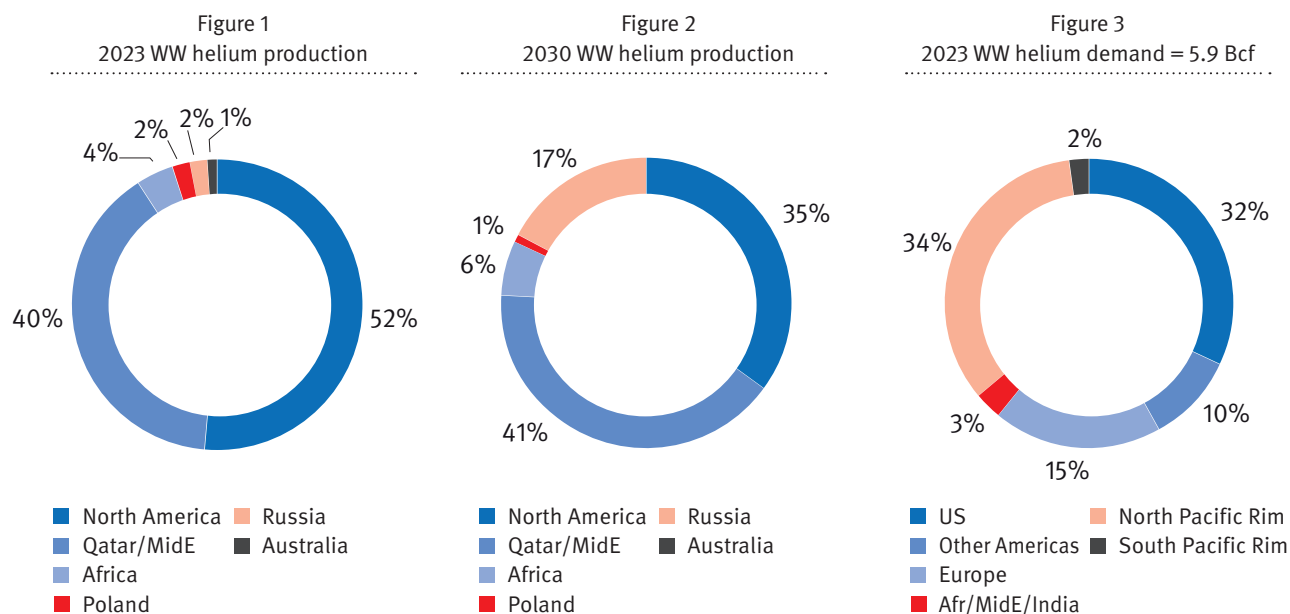
Another reason for the probability of a slow build-up in production is the extent of the repairs that had to be made and access to equipment due to the international sanctions because of

the Ukraine war. Also, the volumes going into China are already under longer term contracts with some of the Tier 1 helium suppliers like Air Products, Linde, and Air Liquide and Tier 2 suppliers such as Matheson and Messer. One or more of these suppliers may terminate their agreement with Gazprom. Finding replacement buyers with many helium ISO containers to ship Russian volumes into China or other markets will likely hamper the ramp-up of production.

Qatar Petroleum announced the Qatar 4 project at the gasworld helium summit in December 2021 in Houston, TX. The new helium plant is planned to be onstream in 2027 with a nameplate capacity of 1.3 Bcf of helium. No other new large plants have been announced.

Worldwide helium supply now

Worldwide helium supply for 2023 is estimated at about 5.9 Bcf, as shown in Figure 2. Production is estimated to grow about 6% per year through 2030 should Gazprom continue to ramp up



Source: Intelligas Consulting LLC estimates

Amur helium production methodically. This rate of production outstrips the pace of global demand growth. Some helium will need to be stored.

North America, once the largest producer of helium globally, will shrink from 52% of supply to 35% of supply by 2030. Qatar will increase slightly from 40% of supply to 41% of supply as Russia ramps up from 2% of supply today to 17% of supply by 2030.

We forecast that worldwide supply will be short of demand until at least 2024/5, when new large sources of

“Continued tight helium supply and rising prices driven by the ongoing helium supply disruptions have caused helium demand to remain constrained”

helium begin to come onstream. The BLM disposal complicates this picture as that volume is needed to keep up with demand. Much of new supply will be absorbed by the global increase in demand over that period, making up for demand not satisfied during the past two shortages.

Worldwide regional helium demand and supply now

In the Americas (US, Canada, Mexico, and Latin America), the US is the second-largest market for helium worldwide, after Asia, consuming about 32% of the total volume, or about 1.9 Bcf/yr, as shown in Figure 3.

Continued tight helium supply and rising prices driven by the ongoing helium supply disruptions have caused helium demand to remain constrained. End-users seek cost-effective solutions to the situation by employing conservation, substitution, recovery, and recycling, although most of what could be done in this area was done over the past decade of shortages.

Growth over the past few years has been fastest in balloons, electronics, leak detection, airbags, and welding. The space program in the US, including NASA and SpaceX, saw increased helium demand driven by a record number of launches. Once the current economic conditions and supply issues lighten, the US demand growth is estimated at 2% per year as supplies allow.

Other Americas is estimated at 10% of worldwide helium demand with growth similar to the US. Helium supply to Other Americas is from the US.

Asia represents the largest market for helium, with 36% of worldwide demand. Where the US is a mature economy, many regions in Asia are also undergoing infrastructure development.

In 2022, full-year statistics show China is the largest market in Asia (39%), followed by South Korea (23%), Taiwan (19%), Japan (13%) and India (6%). First-half 2023 data appears to ▶

▶ show demand in Asia is down by over 2% and could worsen.

Asian demand growth going forward is estimated to be 5% to 7% CAGR coming out of the economic downturn with the exception of Japan. Japan is a more mature market where demand growth has been steady for the past few years and is expected to demonstrate this pattern in the future. Helium demand in Asia is being driven by the space program, significant investments in MRI, and expanded electronics manufacturing in semiconductor and fiber optics.

Qatar and the US are the primary suppliers of helium for Asia. Australia production tapered off in 2022 and ended in early 2023. The exports from the US have been declining since Qatar 1 and 2 began operations, and now Qatar 3, and as the US BLM production has dropped off. The cost to ship from the US historically was lower due to favorable distribution economics from western US sourcing and fast container shipping from Long Beach, California. However, since the pandemic and issues with container traffic on the East and West coasts of the US, container shipping rates from China to the US increased, making Qatar helium more favorable. As the new Russian Amur supply comes on-stream, we can expect to see exports from the US continue to decline due to the proximity of Russian supply to the Asia market.

Europe comprises about 19%, or 1.1 Bcf, of worldwide helium demand.

“Qatar and the US are the primary suppliers of helium for Asia. Australia production tapered off in 2022 and ended in early 2023”

Demand growth is expected to be 1% to 2% per year going forward, similar to the US, once the economic conditions in the region improve following the energy impacts of the Ukraine war.

Helium applications are as saturated in Europe as they are in the US.

Currently, Qatar, Algeria, and the US are the primary suppliers to Europe, with some imports from the small Polish helium plant in Odolanow. The backup imports from the US are seen in the European Commission import statistics. However, Algeria via Europe also ships volumes of helium to the US.

Rest of the World (ROW) – Africa/Middle East/India together represent 3% of the global market. These regions traditionally have contributed to strong demand growth from infrastructure development and are expected to grow moderately the next few years, as supplies allow, at about 2.5% to 3.5% per year. Supply to ROW is primarily from Qatar and Algeria, reflecting proximity.

Future worldwide helium supply and demand

Future projections are based on modeling by Intelligas of supply and demand data and how helium markets are expected to recover.

Our assessment of the 2023 worldwide market for helium sets demand at about 5.9 Bcf, back in the range of 2021 levels prior to the severe shortage that began in 2022. We can expect worldwide growth of around 3% to 4% CAGR over the next five years, coming out of the global economic situation and recovering suppressed demand given no major supply chain disruptions, keeping demand and supply in balance. 2024 is the earliest we project new sources will come online to alleviate the current tightness.

Qatar 3 (400 mmcf/yr) was not sufficient to end the shortage. The smaller Irkutsk Oil Company supply

“The BLM system is in decline and is on track to produce 680 mmcf in 2023”

did not come on until late 2023 (270 mmcf/yr), but it is clear Russian sanctions could impact ramping up production as the non-US ISOs are critical as mentioned earlier. The Russian Amur far east project (2.1 Bcf/yr once fully loaded) has begun ramping up in September and could put supply in surplus within a couple years depending on the availability of non-US ISOs. Helium demand could take longer to expand after the shortage depending on the global economic conditions. The industry should plan for the risk that tightness could extend into 2024/25.

Prospects for North American supply

The BLM system is in decline and is on track to produce 680 mmcf in 2023. There are also other crude plants supplying helium to process plants on the BLM pipeline such as Rock Creek (IACX), DCP Midstream, and Linn Energy. Outside of the Hugoton in the US, the largest helium production source in the US is the ExxonMobil plant in LaBarge, Wyoming, which is projected to produce 1.35 Bcf in 2023. Other smaller sources account for about an additional 675 mmcf of supply and include Doe Canyon (AP), DBK Helium, IACX, NTEC, Tumbleweed, and recently Proton Green. Paradox resources has filed for bankruptcy and the status of the plant is unknown currently. There are Canadian sources such as North American Helium listed below that contribute to this volume.

In the US and Canada there continues to be a lot of activity in non-hydrocarbon sourcing, especially as the shortage has caused prices to increase. ▶

GSA

▶ These are smaller projects to recover helium as the primary product from small gas fields in North America, with higher concentrations of helium. Many of these companies are actively seeking capital to fund their exploration and production.

Companies like IACX, NTEC, North American Helium, Thor Resources, and Canadian Helium were among the first of the older investors to bring product to market. This year there were several newcomers bringing supply on between late 2023 and mid-2024. Among those newcomers are Proton Green from St. John's field in AZ, Blue Star Helium in Colorado, New Era in NM in 2Q24, Avanti Energy in Alberta in 4Q23, Royal Helium in Alberta in 3Q23, and First Helium in Alberta in 1Q24. There are many others still exploring and seeking investors to produce helium. Most individual projects are small, in the 30 mmcf/yr and under range.

In April 2022 Linde signed a new long-term helium off-take agreement to recover the helium contained in Freeport LNG's production site in Texas. Freeport LNG first proposed to construct, own, and operate a helium extraction and purification plant co-located at the existing Pretreatment Facility in 2020. As part of the agreement, Linde has been constructing a new helium processing plant in Freeport to purify and liquify the recovered helium, securing an additional source of liquid helium in the US. The project is on track to start up in 2024 and provide nearly 200 million cubic feet of helium into Linde's supply portfolio.

Offshore supply

As mentioned earlier, helium was shut down in Arzew as a result of high natural-gas demand in Europe. Algeria normally compresses NG into liquid form (LNG) at Arzew for global transport by ship and that plant has yet

“This year there were several newcomers bringing supply on between late 2023 and mid-2024”

to begin producing helium.

Air Products first announced their Arzew expansion projects in late 2018. Sonatrach will recover helium from two existing liquefied natural gas (LNG) facilities, and deliver the gas to Helios's plant in Arzew, increasing capacity for liquid helium. Air Products expected their expansion projects to on-stream soon. However, the expansion has yet to produce increased supply from Algeria.

The Linde and Renergen project to recover helium (20 mmcf) from natural gas in South Africa has also yet to come on-stream. There are plans for a phase II helium production to bring on 390 mmcf/yr. No on-stream time has been announced.

The Helium One project began drilling its maiden well in June 2021 to develop large scale helium production from gas in Tanzania. In July 2022 it confirmed a notable helium gas show in the Tai-1 well, which is now being sidetracked due to an unspecified setback to the program in Tanzania.

Outlook

Intelligas estimates future worldwide helium demand growth overall will be 3% to 4% over the next five years as the global economy recovers and new larger supplies come on-stream. The US needs new sources to be developed to avoid becoming an importer of helium to meet demand after 2030. Important geopolitical supply chain risks remain, including the Russian war in Ukraine, Middle East stability, and US-Chinese tariffs.

The world's helium demand-supply relationship is expected to return to balance and foster demand growth beginning in 2024 as the Amur and Irkutsk sources ramp up production. The uncertainty of access to non-US ISO containers to move that supply while US restrictions are in place points to a slower ramp-up in production. The status of the BLM Federal Helium System, split into two opportunities, depends on bids for the assets on November 15 and buyer validation by the DOJ following the sale.

The intensity of helium usage will be greatest in Asia, barring any supply chain disruptions. Future demand for helium will grow the fastest in China, where MRI infrastructure development, electronics, lifting, and space program usage will drive growth. Future demand growth in the mature economies of North America, Europe, and Japan will be slower, about 1% to 2% per year. However, this could be higher with the CHIP Acts being pursued to support semiconductor growth within the US and Europe. The uncertainty in future economic conditions in all geographies will affect overall growth in helium demand.

Supply reliability has come at a price for end-users. The helium business is never short of uncertainties relating to demand destruction from tight supply, reliability of helium sources, the complicated supply chain, and the timing and reliability of future supply sources beyond 2023. [gw](#)

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