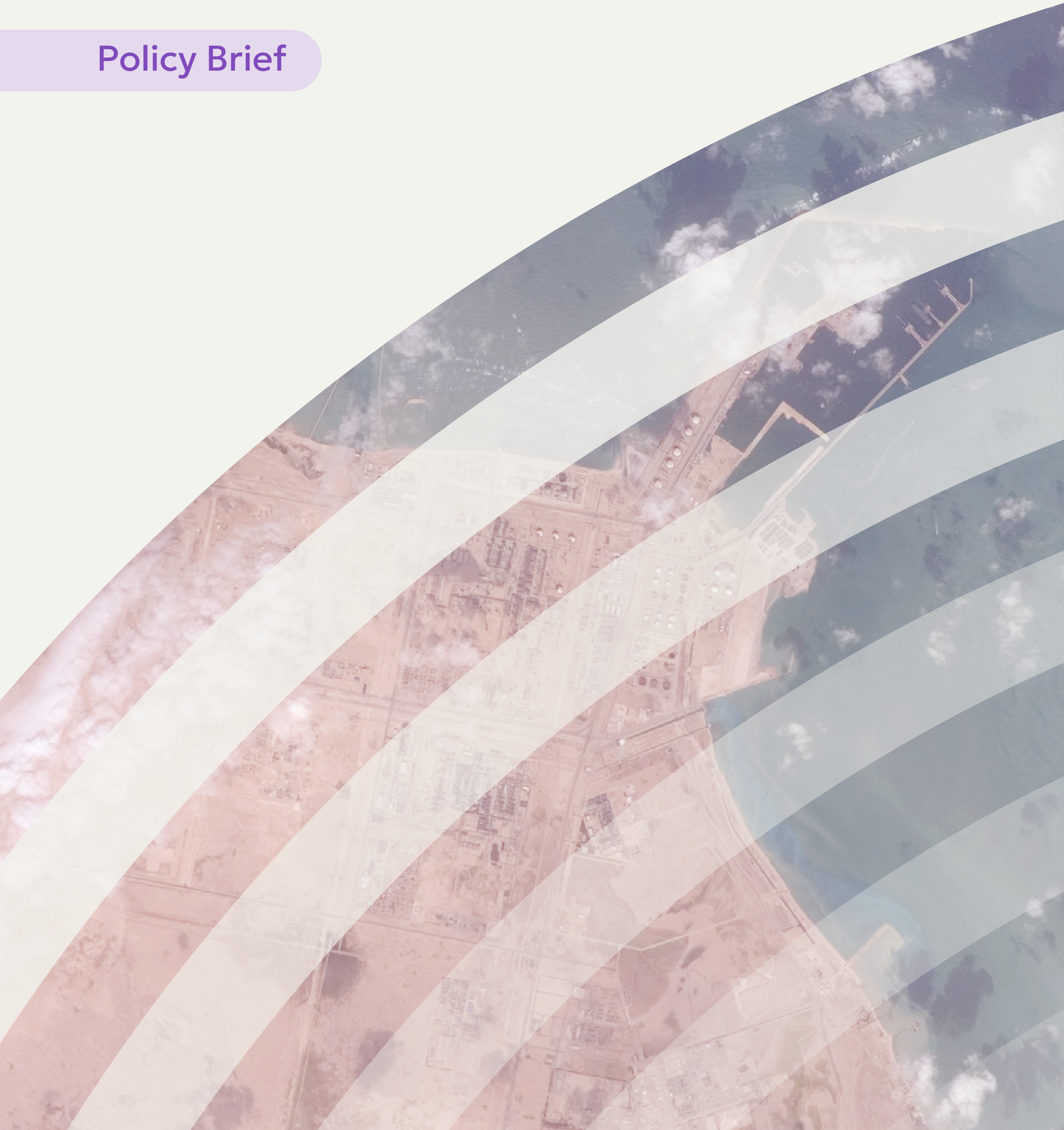
CENTRE FOR MATERIALS & RESILIENCE

Helium Supply and the Strait of Hormuz Crisis

A CRITICAL RAW MATERIAL UNDER PRESSURE

Policy Brief



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CENTRE FOR MATERIALS & RESILIENCE

Executive summary

Helium has no practical substitute at industrial scale for cryogenic cooling in MRI scanners and particle accelerators, or for semiconductor fabrication. On 2 March 2026, Iran's blockade of the Strait of Hormuz shut down Qatar's helium plants, removing approximately 64 Mm^3/year (roughly 35% of global supply) in a single day. No alternative supplier can fill a gap of this magnitude: the United States, the largest producer at 81 Mm^3/year, is seemingly near capacity, and EU sanctions ban Russian helium imports. No new projects exist that can ramp fast enough to close the gap in 2026. If the disruption holds, many industrial users will not face price increases but the question of whether helium will be available at all. This is the fifth global helium shortage in two decades. Despite structural vulnerabilities (high producer concentration, minimal strategic storage, and a single maritime chokepoint for one third of supply), helium is not given specific thought in most critical raw materials policy. Given the frequently occuring shortages, the EU and major importing countries should make haste with establishing strategic helium reserves with pre-agreed emergency allocation rules and treat helium explicitly in resource-related legislation. Accelerating recycling and procurement preference for helium-efficient technologies would reduce structural dependence on a relatively short timeframe. Development of novel cooling systems that reduce or eliminate reliance on continuous liquid helium supply would enable a structurally lower dependence on global helium supply chains.

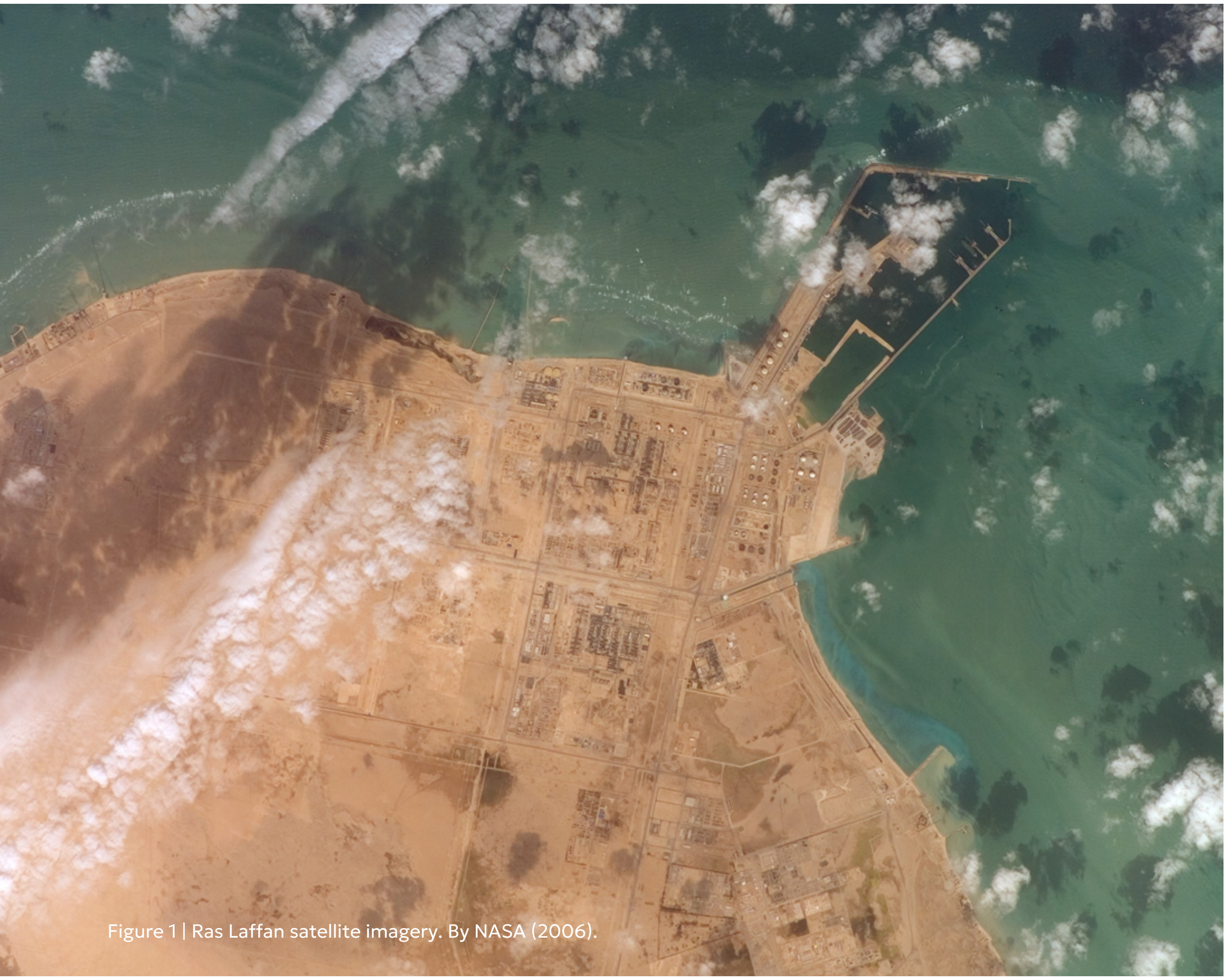


Figure 1 | Ras Laffan satellite imagery. By NASA (2006).

HELIUM SUPPLY UNDER PRESSURE

Helium is the coldest liquid substance, boiling at 4.2 K (-269°C), and is entirely chemically inert. These two properties make it very difficult to replace in high-tech applications. Superconducting magnets in MRI scanners and particle accelerators use liquid helium cooling. Semiconductor fabrication uses helium as a carrier gas, for wafer cooling, and for leak detection in vacuum systems. In welding and deep-sea diving, argon or hydrogen can substitute for helium, but for cryogenic and semiconductor uses, no short-term substitute exists at industrial scale (Klitzke & Pein, 2025).

If the conflict is resolved quickly, Qatari helium production gradually resumes, as happened after previous disruptions. The main effects will be a temporary price spike and drawdown of existing inventories.

If the disruption extends into the second half of 2026, the consequences become more severe. Semiconductor fabs in South Korea and Taiwan could be forced to ration helium or halt production lines. Hospitals might need to defer MRI magnet refills, reducing diagnostic capacity. European and Asian research facilities operating superconducting magnets and cryogenic systems will face challenges. Emerging helium projects cannot ramp fast enough to compensate. Alternative transport routes such as the temporary exports via Oman during the 2017 crisis between Saudi Arabia and Qatar will not be an option as they also depend on the Strait of Hormuz (Reys & Bos, 2022). And the EU's import ban on Russian helium, adopted in September 2024, will come under increasing political pressure.

Regardless of how the current helium crisis resolves, recurring shortages – each caused by a different trigger but exposing the same structural vulnerabilities (high producer concentration, minimal strategic storage, and a single maritime chokepoint for one third of supply) – point to a policy problem. Nevertheless, the EU's Critical Raw Materials Act contains no helium-specific stockpiling or recycling requirements; the US has yet to re-list helium as a critical material; and no major importing country outside Japan has a dedicated helium contingency strategy.

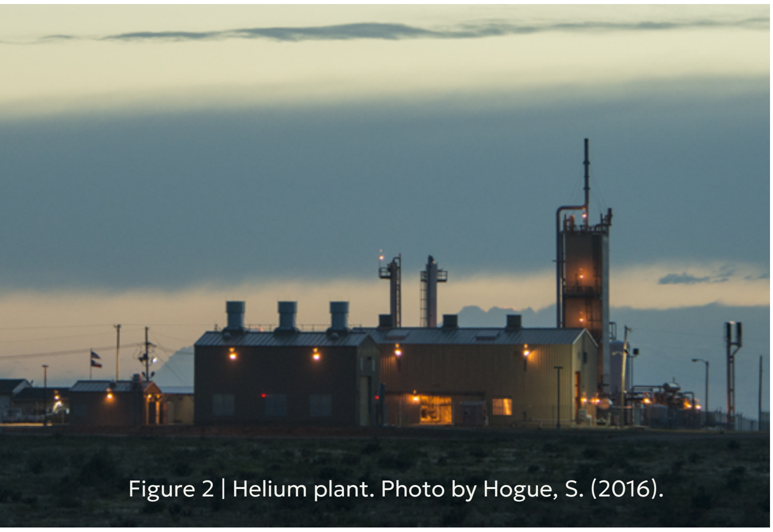


Figure 2 | Helium plant. Photo by Hogue, S. (2016).

Helium as a critical material

Helium is a non-renewable on any human timescale. It forms through the radioactive decay of uranium and thorium in the Earth's crust, a process that takes hundreds of millions of years. Once released, helium is too light to be held by gravity and escapes to space. Global helium resources total approximately 51.9 billion cubic meters, concentrated in four countries: the United States (20.6 Bcm), Qatar (10.1 Bcm), Algeria (8.2 Bcm), and Russia (6.8 Bcm), which together hold 88% of the known total (Cao et al., 2022). Using the GeoPolRisk methodology, Siddhantakar et al. (2023) find helium's supply risk comparable to cobalt and rare earth elements.

In Western Europe, helium consumption is spread across medical technology (21%), controlled atmospheres for fiber optics and electronics manufacturing (19%), lifting gas (15%), semiconductor fabrication (7.4%), welding (8.3%), and analytical and leak detection applications (16%) (Klitzke & Pein, 2025). Semiconductor demand is the fastest-growing segment: IDTechEx (2025) projects total helium demand to nearly double by 2035, driven by AI capacity expansion and the shift to sub-5nm fabrication.

THE STRUCTURE OF THE SUPPLY CHAIN

World helium production in 2024 was approximately 180 to 185 million cubic meters, depending on the source (USGS reports ~180 Mm^3; BGR reports 185 Mm^3). The United States produced 81 Mm^3 (45%), Qatar 64 Mm^3 (36%), and Russia 17 Mm^3 (9.4%), and Algeria 11 Mm^3 (6.1)%. These four countries account for 96% of global output (USGS, 2025).

Helium is extracted as a byproduct of natural gas processing. The economics of extraction require natural gas with at least 0.3% helium by volume, a threshold met by few fields worldwide (Klitzke & Pein, 2025). This means helium production is tied to LNG operations: when LNG plants shut down, helium production also stops. We note that helium stockpiles are not tied to LNG storage.

Liquid helium is transported internationally in specialised cryogenic ISO containers and semitrailers. Gardner Cryogenics and Linde have long been the dominant established suppliers of this equipment. Only four dedicated underground helium storage facilities are publicly documented worldwide: the Cliffside field porous-reservoir in Texas (1,472 Mm^3 capacity), and salt cavern fascilities at Beaumont, Texas (commissioned by Linde in 2025, capacity over 85 Mm^3), Gronau-Epe in Germany (47.5 Mm^3), and Orenburg in Russia (Chen et al., 2024; Klitzke & Pein, 2025; Linde, 2025). The absence of European pipeline alternatives and the scarcity of storage mean that production outages translate rapidly into regional shortages and price spikes (Klitzke & Pein, 2025; DeCarlo & Goodman, 2022). European helium prices rose from roughly 2-4 EUR/m^3 in 2010 to over 12 EUR/m^3 by 2023, with each shortage period producing a visible spike (Klitzke & Pein, 2025).

The exposure to supply disruption is not uniform across regions. Siddhantakar et al. (2023) identify three distinct patterns. Countries in the Americas depend almost entirely on US domestic production. European importers (the UK, France, Germany) rely on a diversified mix routed through European transit ports, with France and Germany benefiting from geographic proximity to Algeria. East Asian importers (China, Japan, South Korea) source primarily from Qatar and the US. China imports from both major producers. The current crisis hits East Asia and Europe hardest because there is not enough domestic production to replace lost Qatari volume, nor can the problem be solved by reallocating US production, which is largely consumed domestically.

Four shortages in twenty years

The helium market has experienced four global shortages since 2005. Shortage I (2005-2007) was the first significant disruption to global supply. Shortage II (2011-2013) led to long-term contracts being filled at only 70–80% of contracted volumes (Anderson, 2018). Shortage III (2018-2020) began when the Saudi-led blockade of Qatar in June 2017 cut off 30% of global supply, was worsened by simultaneous plant shutdowns in Wyoming and Algeria, and only abated when COVID-19 reduced demand in 2020. Shortage IV (2021-2023) started with unexpected shutdowns at the BLM Crude Helium Enrichment plant and fires at Russia's newly completed Amur-1 facility, compounded by scheduled maintenance in Qatar (DeCarlo & Goodman, 2022). Each crisis was resolved as capacity returned but the underlying vulnerabilities (high producer concentration, minimal storage, no short-term substitutes for the most important applications) remain unchanged.

THE MARCH 2026 DISRUPTION

Following US-Israeli strikes on Iranian military infrastructure on 28 February 2026, Iran launched retaliatory attacks across the Persian Gulf and declared a blockade of the Strait of Hormuz. A drone strike on QatarEnergy's Ras Laffan Industrial City on 2 March forced the suspension of LNG and helium operations. Ras Laffan houses three helium plants with a combined nameplate capacity of approximately 67.5 Mm^3/year: Helium-1 (19.4 Mm^3), Helium-2 (36.1 Mm^3), and Helium-3 (12 Mm^3) (Klitzke & Pein, 2025). A fourth plant (Helium-4, 48.6 Mm^3/year), planned for commissioning around 2027 as part of the North Field expansion. All Qatari helium exports transit the Strait in cryogenic ISO containers. Roughly one third of global helium supply went offline in a single day (CNBC, 2026; Frost & Sullivan, 2026).

European exposure to the Qatari shutdown is partially offset by Algerian and US supply, but spot prices have approximately doubled since early March (Reuters, 2026). However, rather than price, the fundamental concern is physical availability: with no producer able to replace Qatari volumes at scale, some users will face shortfalls regardless of their willingness to pay. Industry analysts expect that if the disruption extends beyond a few weeks, helium shortages could persist for months (Frost & Sullivan, 2026).

South Korea imports almost two-thirds of its helium from Qatar. Korean chipmakers reportedly have stockpiles that are expected to last about six months (Korea Times, 2026).

This crisis is both larger in scale and different in cause from its predecessors. The four previous shortages were caused by coinciding plant-level outages and maintenance schedules. The volume of supply now removed – approximately 64 Mm^3/year, or 36% of global output – exceeds any previous single-event disruption.

ALTERNATIVE SUPPLY AND ITS LIMITS

The United States is seemingly producing near capacity at 81 Mm^3/year. To increase production and diversification, four new helium operations came online in 2023 and 2024 in Colorado, Montana, New Mexico, and Texas, but their combined output is limited (USGS, 2025). The Federal Helium System, long the anchor of US production, was sold and transferred to private ownership in June 2024; the Crude Helium Enrichment Unit at Cliffside remains in legal limbo over its lease (USGS, 2025).

Russia's helium sector has its own problems. Before the Amur Gas Processing Plant (GPP) began ramping, Russia's only producing facility was the Orenburg Helium Plant, with an output of roughly 5 Mm^3/year (Tremaskin & Golubeva, 2022). In August 2025, Ukrainian military intelligence drones reportedly struck the Orenburg plant, disrupting operations at what was then still Russia's primary helium source (UNITED24 Media, 2025). The Amur GPP is designed for a total helium capacity of 60 Mm^3/year from three purification units (Tremaskin & Golubeva, 2022), but the facility has been plagued by fires and delays and is still ramping its first production line (Klitzke & Pein, 2025). Russia also lacks helium logistics infrastructure necessary for large-scale international export (Tremaskin & Golubeva, 2022). The output that does reach the market is directed toward Asian buyers. The EU imposed an import ban on Russian helium effective September 2024, further limiting European options (USGS, 2025).

Algeria produced 11 Mm^3 in 2024, but its helium output has been constrained by the redirection of natural gas to European pipeline exports without intervening liquefaction, a process step necessary for helium extraction (DeCarlo & Goodman, 2022).

Several exploration projects target helium-rich deposits that are not tied to hydrocarbon extraction. Examples include ventures in Tanzania, South Africa (Renergen's Virginia Gas project, with a planned capacity of 11 Mm^3/year), and Canada, where several new facilities began operations in 2023-2024 (USGS, 2025). No single project is yet producing at a scale that could offset the Qatari shortfall. BGR projections indicate that even with all planned new capacity online, global technical helium capacity will not exceed 400 Mm^3/year before 2028 at the earliest (Klitzke & Pein, 2025).

THE POLICY CONTEXT

The EU dropped helium from its critical raw materials list in 2020, then re-listed it in the 2023 assessment (European Commission, 2023). The Critical Raw Materials Act (Regulation 2024/1252, in force since May 2024) establishes a framework for monitoring and securing supply of critical materials, but contains no helium-specific stockpiling or recycling requirements. The United States removed helium from its critical minerals list in 2021; as of 13 March 2026, industry groups are publicly calling for re-inclusion (Avanti Helium, 2026). Neither jurisdiction had a dedicated helium contingency framework in place when the crisis hit. The IFRI noted in 2022 that European diversification of helium supply, while real, remained insufficient to keep the resource at a reasonable distance from the criticality threshold (Reys & Bos, 2022).

Helium recycling can recover up to 90% of used helium in closed-loop systems such as MRI magnets and semiconductor fabs (Li et al., 2025). Adoption varies widely: according to Frost & Sullivan (2026), over 70% of fabs in Japan and Taiwan have recycling systems installed, compared with under 50% in Singapore. Philips has developed sealed-magnet MRI systems that use 99% less helium (Philips, 2025), and entirely Helium-free MRI systems are being considered. Widespread deployment of recycling and helium-lean equipment takes years. Neither is relevant to an acute supply shock. Japanese companies have signed long-term supply contracts covering approximately 8% of global helium output from both the US and Qatar. In December 2020, the Physical Society of Japan and the Chemical Society of Japan jointly called for increased recycling investment and the establishment of a national helium gas reserve. Japan's geopolitical risk for helium (as calculated in Siddhantakar et al., 2023) declined between 2015 and 2019 as a result of these measures. No European country has pursued a comparable strategy.

Figure 3 | Helium tanks. Photo by United States Department of Energy (2014).

POLICY RECOMMENDATIONS

The current helium crisis is the fifth supply shortage in twenty years. This pattern is clear enough that it should not require a sixth crisis before governments are prompted to action.

Establish strategic helium reserves with pre-agreed emergency allocation rules

Since sufficient domestic production to cover essential needs is not feasible, European countries should achieve strategic autonomy by creating strategic helium reserves for essential uses, with accompanying release mechanisms. These reserves would protect high-priority users such as hospitals, semiconductor fabrication plants, and critical research infrastructure.

Support the transition to helium-independent and closed-cycle cooling technologies

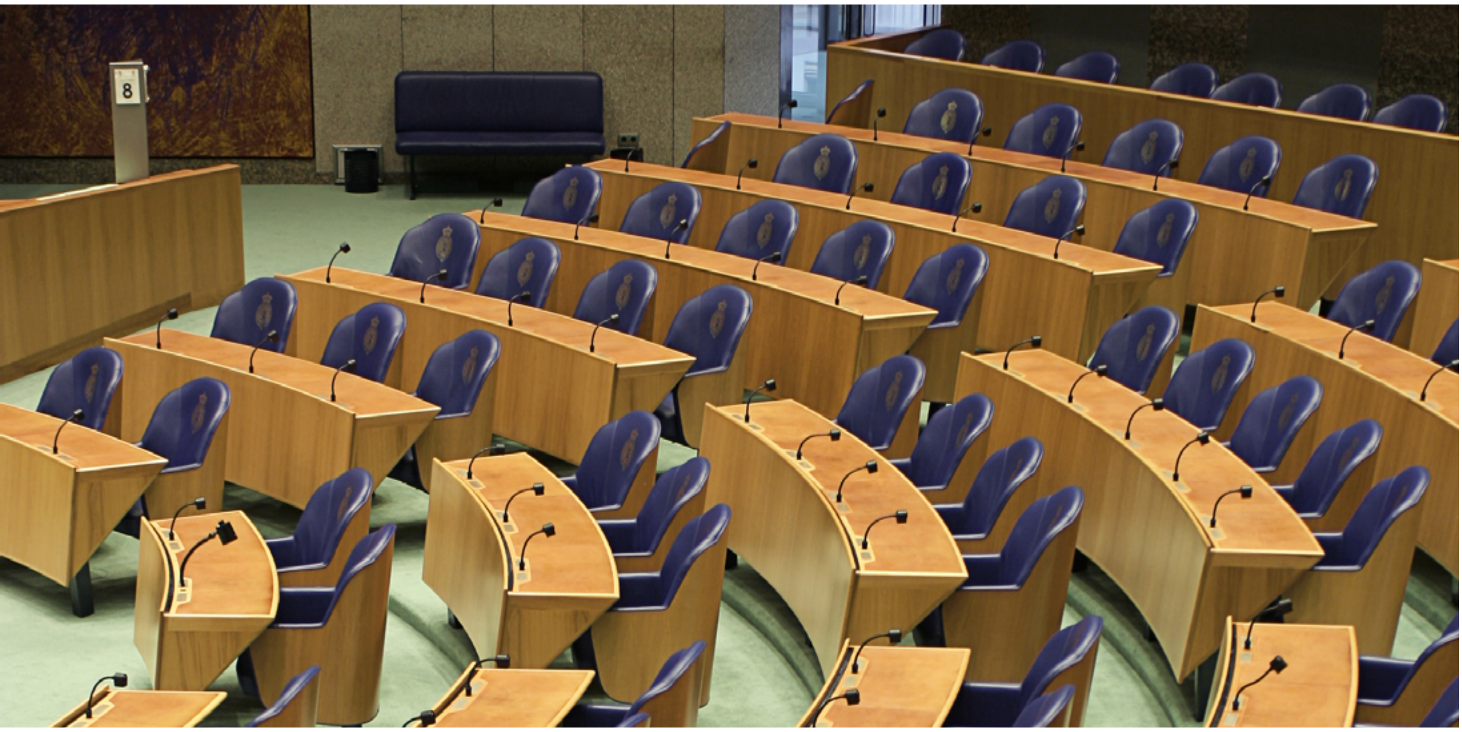
Governments should support the development and deployment of novel cooling systems that reduce or eliminate reliance on continuous liquid helium supply. Support for pilot and demonstration projects would accelerate industrial adoption and enable a structurally lower dependence on global helium supply chains.

Accelerate recycling and helium-efficient procurement

Governments should explicitly support helium conservation measures. Public procurement rules for hospitals, laboratories, and publicly supported industrial facilities should favour equipment that minimizes helium consumption and, where feasible, incorporates helium recovery systems. Financial support for retrofitting MRI installations, semiconductor facilities, and research infrastructure with helium recycling technologies would lower structural demand over time and reduce exposure to future supply shocks.

Treat helium explicitly as a critical raw material in implementation and contingency planning

Helium should be addressed explicitly in resource-related legislation such as the EU Critical Raw Materials Act. Measures could include dedicated monitoring, supply-risk stress testing, and resilience planning.



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