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Ukraine war and the impact on industrial gas markets: What we know so far

By **Rob Cockerill** | 29 March 2022

Now more one full month into the war in Ukraine and with the conflict having escalated significantly in the last fortnight, the impact on trade, economies and the world as a whole is widespread.

A clearer picture is also emerging of the impact of this war – existing and potential – upon industrial gas markets.

Here we look at what we know so far, from the position of the industry's Tier One players to the knock-on effects of sanctions and squeezed commodity markets on the supply chains for helium and carbon dioxide (CO_2).

Impact: Helium

The geographic needle of global helium supply had been due to shift eastwards as a result of Gazprom's Amur plant coming on-stream in Eastern Siberia. Russia's emerging helium market had been expected to see its production jump from just 3% in 2021 to 26% by 2025, in the context of simultaneously decreasing (traditional) North American production.

Whilst this is thought to still be the case in the long-term, the short-term outlook is once again less certain as explosions and fires at the Amur plant in January had already taken its nascent supply off the table for the foreseeable future and, combined with other factors, triggered the latest big market crunch, Helium Shortage 4.0.

Read more: Helium markets now experiencing 'Helium Shortage 4.0'

With the Amur plant already offline, there is understood to be little additional impact of sanctions on Russia in the short-term, but long-term challenges may exist in doing business in the region.

Phil Kornbluth, helium expert and President of Kornbluth Helium Consulting, affirmed it is too early to know how things will turn out, how long the war will last, whether it will spread beyond Ukraine, whether additional sanctions will be implemented, or how long sanctions will last.

Read more: Russian invasion of Ukraine will impact future helium supply

Pondering the short-term impact scenarios, he explained that Ukraine does not produce any helium and Russia, at present, operates a relatively small plant in Orenburg, whose production is sold primarily within Russia. The relatively modest quantity that is exported from Orenburg, including occasional spot loads, has been cut off from its usual European market.

"Helium Shortage 4.0 is pretty bad right now, but the war in Ukraine is not going to make it noticeably worse..."

The modest quantity of helium that would normally flow from Orenburg to Europe will try to find markets in countries that are not participating in sanctions, Kornbluth explained.

“Helium Shortage 4.0 is pretty bad right now, but the war in Ukraine is not going to make it noticeably worse,” he summarised.

An immediate negative impact on the helium business does exist where a logistical issue is concerned. Kornbluth in his 4th March analysis that a large number of empty 11,000 gallon containers that were at Gazprom’s Helium Hub near Vladivostok were waiting to be filled when the Amur plant experienced an explosion and fire on 5th January.

At one point, there were over 100 containers in Russia waiting to be filled. While many of these containers have departed Russia, a significant number remain in the country.

Impact: Neon

With a significant percentage of the world's semiconductor-grade neon production derived from Ukraine and Eastern Europe as a whole, concerns have been raised for the stability of rare gases supply as the Russian invasion of Ukraine continues.

Ukraine has traditionally been one of the world's major krypton, xenon and neon exporters. The potential for market disruptions is, therefore, a growing concern, as Stephen B. Harrison, Managing Director of sbh4 consulting, affirmed to **gas**world in late February.

"Rare gas shortages in the past have been focused on krypton/xenon. Neon has generally not been an issue," he said. "It comes out of ASUs in a different place (with nitrogen and helium, not with oxygen/krypton/xenon) and different ASUs are fitted for neon recovery versus those that are fitted with krypton/xenon."

"The question will come around to which ASUs can be modified to extract neon and diversify the global rare gases supply chain," he explained, adding, "Large ASUs are favoured, and some have been fitted with special tappings that allow subsequent investment for neon extraction."

Any threat to neon supply could derive from three implications of the war between Ukraine and Russia: the very obvious danger of any production plants being caught in the crossfire of military escalations; any complications around power/energy supply to ASUs as a result of the conflict and assault on infrastructure; and the potential ramifications of increasing trade and economic sanctions on Russia, with logistical challenges in effect and most of the rare gases ASUs aligned to steel production and linked to Russia.

Source: Seneline / Shutterstock.com

Any of these scenarios, or any combination, could cause the market to tighten, while the effects of any diversion of the workforce to the war effort and away from non-essential sectors could also have an impact.

Karina Kocha, Business Intelligence Manager for gasworld, affirmed the effects of any conflict on products – and pricing – like neon. “Back in 2014, after the annexation of Crimea to Russia, neon prices soared by 600% in almost one day. After that, American [chip] companies began to look for other gas suppliers,” she said. “But Ukraine is still a key supplier for US companies. Some sources suggest up to 95% of neon supply to US chip producers comes from Ukraine.”

gasworld understands, however, leading supplier Linde derives the vast majority of its crude and refined neon from Germany and the US, for example.

Further still, an increasingly diversified market exists today, with new entrants bringing added capacity; one such example is South Korea-based TEMC, established as a specialty gas manufacturer in January 2015 and is understood to have assisted steelmaker POSCO with its neon recovery from steel production in recent years.

Impact: Semiconductor sector

As alluded to by Kocha, the link between neon markets is intrinsically linked to the semiconductor sector.

The semiconductor shortage has been a hot topic in the US since the start of the coronavirus pandemic (Covid-19), as demand for electronics saw incredible growth when families were restricted to their homes during lockdowns, resulting in the need for new forms of entertainment or new computers to support work from home advice.

However, as the world slowly begins to open up again, these strains are still being felt by the industry.

Any potential neon shortages would have a knock-on effect on the production of electronics chips for all manner of applications – from devices to automotive – and a sector still reeling from the effects of the pandemic. Earlier this year in fact, **gas**world published an online exclusive chronicling the frustration with ongoing chip shortages and how the start-up of new semiconductor

manufacturing plants 'cannot come soon enough'.

Read more: New semiconductor plants cannot come soon enough

In what could be described as one of many breakthroughs from the US semiconductor industry of late, Intel said it will invest more than $20bn in two new chip manufacturing facilities in Ohio to meet surging demand. Set to be a new epicentre for advanced chipmaking in the Midwest, the 1,000-acre site will mark the largest single private-sector investment in Ohio history.

Yet as Harrison explained, any investment in new fabs is only as good as the specialty/rare gases to supply them. "Neon is essential to produce excimer laser specialty gas mixtures that are used to make high-tech silicon chips. About 90% of US chip production has been reliant on Ukrainian semiconductor-grade neon, I believe. The new wafer fabs opening up in Nevada will add welcome capacity to US and global chip production, but if there are no gases available, they and the existing fabs will be at a standstill," he said.

"Car makers have curtailed production recently due to supply chain issues around chips. We could see many domino effects ripple through industry if there is a shortage of neon and other rare gases."

Kocha shared the view that further supply chain complications could be ahead. "Back in early February, chip makers began reviewing their supply chains to forestall the potential fallout from strained relations between Russia, Ukraine, and the US," she commented.

"They say cutting off supplies of materials from Russia/Ukraine will not stop semiconductor production, but will significantly increase its cost, besides, companies have some stocks of materials. However, this is still a serious problem, because the global supply of chips is limited, and orders for them are only growing."

It was only on 25th February that **gas**world reported how the semiconductor industry was among those already feeling the impact of tightening helium supply.

The US-based Compressed Gas Association (CGA) highlighted the struggle for these markets as a result of outages at the US Bureau of Land Management's (BLM) crude helium enrichment unit, along with other contributing factors.

Chemical plant for production of ammonia and nitrogen fertilisation at night time.

Impact: Ammonia and CO2 markets

We now know that crippled ammonia trade flows as a result of the war in Ukraine are placing further strain on the fertiliser supply chain and are expected to cause prices to skyrocket.

There had already been a number of major events in the ammonia market since the start of 2021 that came with 'significant and sustained' prices increases. A loss of capacity from Trinidad since February and the ongoing war in Ukraine has compounded an already tight market, as explained by *Fertiliser Week's* Jennifer Willis-Jones at **gas**world's Europe CO2 Summit in early March.

Trinidad has traditionally supplied between 20-25% of globally traded ammonia. A major power cut occurring on 16th February caused nearly all ammonia production to go offline.

"Exports will recommence in 2022, but it couldn't come at a worse time for a market that's already very tight," observed Willis-Jones.

"We need the Trinidad plants back in order to balance the market a little bit more but it still won't make up for this huge shortfall in ammonia by the closure – essentially – of ammonia exporters from the CIS."

The war in Ukraine has crippled ammonia trade flows from the region, she explained. "There are two ports, the Baltic Sea Port and the Black Sea ports. The Black Sea port is using the port in Ukraine, this is extremely important for ammonia."

The closure of that pipeline has caused gas flow to decrease and prices are set to increase further. "Ammonia prices are set to skyrocket further. There's a lot of upwards pressure on ammonia prices at the moment.," Willis-Jones affirmed.

"Exports will recommence in 2022, but it couldn't come at a worse time for a market that's already very tight…"

With as much as 46% of the merchant carbon dioxide (CO2) in the UK produced from ammonia – the raw material of the fertiliser industry – questions will remain over the security of the traditional CO2 supply chain in Europe and the UK in particular as a result. region over the last 12 months.

Willis-Jones did explain that additional ammonia could be provided from the Ma-aden – III project in Saudi Arabia, raising cautious hope that with new supply commissioning in 2022, the current shortage could be supplemented. "Limited relief could be available as Saudi Arabian mining giant Ma'aden launches the third Ras Al-Khair ammonia plant," she said.

Further blowback from the crisis in Ukraine is still expected, however (*see Impact: Sanction, below*).

Impact: Nord Stream 2

Whilst there may be some reprieve in the ammonia market from the Ma-aden – III project in Saudi Arabia, Willis-Jones noted that the halt applied to the Nord Stream 2 pipeline will also further limit any potential for gas prices to fall and easing of pressure on the fertilisers sector.

With global gas prices spiking over the past year, downstream ammonia prices have begun to catch

up with the new gas price environment, but the current conflict has intensified the situation. Any potential for falling gas prices were curtailed by the stopping of the Nord Stream 2 pipeline.

The effects of halting the Nord Stream 2 pipeline will also affect the European energy sector, as widely discussed in the media.

3D illustration of the Nord Stream 2 Project between Russia and Germany.

Impact: Sanctions

In addition to the immediate impact of the conflict, there are also concerns for the long-term ramifications of sanctions on Russia and the flow of international trade with the economically-embattled country.

Ammonia blowback: The ongoing events in Ukraine have caused a ripple effect in multiple sectors of industry, from crude oil and staples such as wheat, to rare gases such as neon, used in chips that power our phones, computers, and televisions. But how could sanctions continue to impact Europe's ammonia supply?

"We foresee continued volatility, especially because we've already factored in a lack of availability from the Black Sea, but we're also now looking at what's going to happen over in the Baltic Sea," explained Willis-Jones.

"We see continued issues and it's not just the capacity. While Trinidad is not exporting as much as it was previously that is going to cause problems as well."

In additional analysis provided to **gas**world in the last week, Chris Lawson, Head of Fertilisers at CRU Group, noted the deepening challenges facing the fertilisers business. "Sanctions in Belarus have huge implications for the potash market. Russia and Belarus combined contribute 40% of traded volumes annually," he said.

"Since the beginning of 2020, nitrogen fertiliser prices have increased four-fold, while phosphate and potash prices over threefold."

Although farmers in developed markets have benefitted from high agricultural commodity prices, helping to partly offset high input prices, Lawson stated that demand destruction is 'increasingly' likely due to high prices and supply shortfalls. The continued under-application of fertiliser is almost certain to impact longer term yields.

Ammonia prices have been increasing at a significant and sustained rate since the start of 2021, reflected in the CRU fertiliser price index which jumped from 113.8 on the 7th January to 282.6 a year later before reaching the more recent price index of around 380.

Scenic capture of ammonia plant

Helium logistics: It was already challenging to secure bookings with ocean carriers to transport helium containers out of Russia before the invasion of Ukraine. Now, Kornbluth explained, with major carriers suspending their service to Russian ports, it has become even more challenging to move these containers.

"I expect that these containers will gradually be able to leave Russia using unconventional routes via carriers or countries that are not participating in the sanctions. This is a matter of extra cost and headaches for Gazprom's customers, but should not have much impact on the current shortage," he added.

Kornbluth noted the longer term impacts of the Ukraine invasion are likely to be more significant, however.

Gazprom's Amur project and Irkutsk Oil Company's (INK) Yaraktinsky and Markovsky projects have

significant reliance on foreign expertise and imported equipment from countries that are participants in the sanctions on Russia.

“Technical experts from Europe or the US will simply not be willing or able to travel to Russia while the sanctions remain in place. Specialised equipment that is not available from Russian sources may simply not be available for export to Russian customers. While the impact is difficult to quantify, and the outlook could improve if there is early resolution of the situation in Ukraine and sanctions are lifted, it is safe to say that the crisis in Ukraine could significantly delay the restart of Amur and the start-ups of INK’s Yaraktinsky and Markovsky projects.”

“I would be surprised if there is any production from Amur or Yaraktinsky in 2022,” Kornbluth continued. “Should severe sanctions remain in place for an extended period, it would raise questions about whether the helium sales and purchase agreements (SPA’s) between Gazprom, INK and their customers would remain viable. It is possible that customers based in countries that are participating in the sanctions would not be allowed to purchase helium produced in Russia. There could also be difficulties with making payments, obtaining carriers, import/export and things of that nature.”

It is important to note that, thus far, Gazprom and Russia’s exports of natural gas and oil have not been included in the sanctions. It is not clear yet, if helium exports would be treated similarly to oil and gas with respect to sanctions. Of course, it is also unknown if sanctions will be in place long enough to impact the performance of those SPA’s.

Another longer term impact observed by Kornbluth, is that gas companies and helium consumers will certainly give greater consideration to political risk when planning their helium supply portfolios. “The major gas companies had become quite relaxed about doing business in countries that bring an exposure to political risk, and this will undoubtedly be a greater factor in future decisions,” he said.

”It is possible that customers based in countries that are participating in the sanctions would not be allowed to purchase helium produced in Russia…”

Impact: Global majors in Russia

As the war in Ukraine has endured, the major or 'Tier One' industrial gas companies have now made their own positions clear when it comes to doing business in Russia.

Source: Air Liquide

Air Liquide: France-headquartered Air Liquide has said it is rigorously applying international sanctions against Russia and has halted all foreign investment and large development projects in the company.Announcing its decision in a social media post on 16th March, Air Liquide said, "The group's approach in Russia integrates a safety imperative, as its activity includes supplying hospitals with medical oxygen."

"As sanctions evolve, some clients are no longer supplied: others are undergoing a scaling-down process."

Whilst Air Liquide is suspending investments and developments, it is understood the group is not suspending its current operations in the country at this time. Showing further support for Ukraine, however, the group has said it will assist Ukrainian refugees.

"An immediate donation has been allocated to the Air Liquide Foundation which is working with NGOs. This measure is completed by local initiatives, notably from boarding countries," Air Liquide said. gasworld Business Intelligence understands that Air Liquide has €17m of investment in Russia.

Source: The Linde Group

Linde plc: Following reports in Germany the day prior revealing Linde's suspension of new business in Russia, the company confirmed on 17th March that it is 'safely winding down' affected projects in

Russia and has suspended all business development for new projects in the country.

Linde does, however, intend to fulfil existing contracts if permitted under sanctions, gasworld understands. This would include existing contracts with Gazprom, for example, a major customer of Linde which only placed two major orders with the company last autumn worth a reported $6bn.

Linde has now confirmed in an official statement, sent to **gas**world, that it "continues to closely monitor the situation in Ukraine and has taken steps to ensure the safety of its employees and the continuous delivery of critical medical oxygen."

"Linde is working with the relevant governments and authorities to ensure the company fully complies with international sanctions and is safely winding down affected projects in Russia. In addition, Linde has suspended all business development for new projects in Russia."

"The invasion of Ukraine has led to a humanitarian crisis and Linde is supporting an international crisis relief charity to help ensure access to urgently needed medicine, supplies and aid for families at risk. Our thoughts and prayers are with all those whose lives are threatened or disrupted by this conflict," the statement concluded.

According to **gas**world Business Intelligence's country dashboard on the Russian market, Linde plc is the largest industrial gas company in the country with a market share of around 39%.

Air Products: Having previously remained tight-lipped slightly longer than its peers, Air Products has more recently (21stMarch) announced it will implement the safe and responsible divestiture of its business in Russia and will not pursue any new business development activities in the country.

A statement on social media explained, "Air Products operates a very small industrial gas business in Russia, which has less than $25m in sales, or approximately one quarter of 1% of our annual revenue. We are developing plans and will implement the safe and responsible divestiture of our business in Russia, recognising that our products and important for the safe operations of several industries, including food, amongst others."

"We also decided not to pursue any new business development activities in the country. As always, we continue to review developing and applicable sanctions to ensure our ongoing compliance."

Recognising its employees who may be affected by its decision, the statement continued, "For our people in Russia, we fully understand and recognise these actions will cause concern. As we move to divest our business in the country, we will continue to give them the support we can during this difficult period and put assistance programmes in place."

In addition to announcing the divesture of its business in Russia, the statement also confirmed that Air Products is further supporting humanitarian efforts, providing financial support to the International Committee of the Red Cross from the Air Products Foundation.

Russia market: According to **gas**world Business Intelligence, the industrial market in Russia has been one of the fastest growing gas markets in Europe since 2000. The average annual growth was about 11% per year in local currency. The largest market falls in US$ value occurred in 2009 (-20%), as well as in 2015-2016 (-26% and -11%, respectively).

gasworld Business Intelligence believes that Air Liquide and Linde, each occupying a quarter of the Russian market, were leaders until Linde and Praxair, merged took about 40%. Air Products hold about 5% in 2021. The remaining 30% belonged to other, local and international companies.

The question now is, what will the Russian industrial gas market look like with the suspension of new business development from these international majors, at the very least, and the implementation of suffocating sanctions on its economy?

Impact: Medical oxygen in Ukraine

The longer the crisis in Ukraine endures, the deeper concerns will grow for the provision of critical medical oxygen into the country.

The World Health Organisation (WHO) warned on 28th February that the country was running dangerously low on its supplies of medical oxygen – essential for treating a range of conditions from Covid-19 to pneumonia, sepsis and COPD to pregnancy complications and childbirth.

Due to the inability of trucks to transport oxygen supplies from plants to hospitals across Ukraine, hospitals across the country could exhaust oxygen reserves within 24 hours, with some already having run out. The threat of continuous electricity and power shortages could also result in heightened risk for patients as critical hospital services are likely to be impacted.

Shortages were being compounded by a scarcity of zeolite – a key mineral used to separate gases when generating oxygen through pressure-swing adsorption (PSA) systems.

Having scaled-up oxygen therapy capacity for severely ill patients in Ukraine during the Covid-19 pandemic, WHO could see the current crisis derailing the progress made thus far.

gasworld's Business Intelligence department – cited in Forbes – revealed that Ukraine's medical oxygen demand more than doubled during the pandemic, increasing from between 140-150 metric tonnes per day to 350-380 metric tonnes per day. The country's usual unaffected rate of production stands at between 450 and 460 metric tonnes per day. Along with Ukrainian health authorities, WHO has identified an approximate 20-25% increase over previous pre-crisis medical oxygen needs.

Impact: Minerals and materials

While discussing the impact on neon markets, Kocha also noted that Russia is a 'crucial' source of C4F6 (hexafluorobutadiene), an organofluorine compound gas which has grown in prominence as an etchant in microelectronics production, as well as a supplier of more than 45% of global palladium production.

This is where the effects of the crisis in Ukraine on wider minerals and materials is pulled into focus. A recent report from *Reuters*[1] also described the ramifications on palladium supply, a material used by automakers in catalytic converters, citing a similar figure of 40% for palladium production.

Palladium mining and processing of ore, piles of ore rock being moved and stored.

And the impact on nickel production is of major interest too, which could be detrimental to fuel cells and the market for hybrid and battery-powered vehicles. As reported by *Sky News*[2], the price of copper had recently hit an all-time high of $10,070 per tonne on the London Metal Exchange, while aluminium also reached record high prices, but no commodity has moved as spectacularly as nickel.

The metal, which with its very high melting point has a wide range of applications including stainless steel, coins, wires, gas turbines and coatings, more than doubled in price at one point and caused its benchmark three-month contract trading on the London Metal Exchange to be suspended.

Russia is the world's third-largest producer of nickel, after Indonesia and the Philippines, accounting for just under 10% of global production on its own, the report highlighted. While it is not the biggest producer of nickel globally, it is the biggest supplier worldwide of high-grade nickel, a key component in the manufacture of batteries for electric vehicles.

Nearly all of it is supplied by Norilsk Nickel, or Nornickel, which is Russia's largest metals and mining company.

Any impact on nickel from the Ukraine conflict might, then, have an impact on the vehicle market and the clean energies transition as a whole, to mention just one end-user example. The production of hybrid and battery-powered vehicles is expected to exceed 25 million units by 2025, with the nickel requirements for a hybrid vehicle between 2.5-3.75 times higher than a standard gasoline or diesel car. **gas**world understands a fossil-fuel based car requires 2-4kg of nickel whereas a hybrid needs 5-15kg and a standard electric car will utilise 30-110kg of nickel – up to 27.5 times more than a conventional car in a high usage scenario.

Research from *Fitch Solutions* shows estimated nickel growth rates of 4% year-on-year from 2021 to 2030, with Indonesia leading the way with a production rate of 1.29m tonnes by 2030.

gasworld Asia-Pacific previously reported in January that international mining company Transasia Minerals (Transasia) is set to boost Indonesia's nickel production with a $2bn processing facility in Morowali, Central Sulawesi, Indonesia. With a focus on the production of ferronickel and EV (electric vehicle) battery grade nickel sulphate – a raw material used to produce EV batteries – the project also intends to boost Indonesia's economic growth in addition to attracting foreign investment.

It will provide an opportunity for the country to capitalise on its status as one of the world's leading nickel ore extractors, but it is unlikely to contribute to the prospect of constrained nickel markets in the short-term as the impact of the Ukraine war continues.

Macro shoot of piece of nickel metal ore isolated on a white background.

Although not strictly used in the production of fuel cell batteries (platinum is the metal of choice) for hydrogen-powered vehicles, nickel could also help advance the energy transition as a component of hydrogen fuel production. Researchers from POSTECH have proposed a way to produce hydrogen fuel via water-electrolysis using nickel as an electrocatalyst.

Source

1. *https://www.reuters.com/markets/europe/palladium-scales-record-high-gold-hits-2000-russia-ukraine-war-2022-03-07/*

2. *https://news.sky.com/story/ukraine-war-why-nickels-spectacular-surge-could-put-the-brakes-on-carmakers-electric-plans-12560634*