

COMMODITIES

2022 REVIEW AND 2023 OUTLOOK

A market disrupted by the energy transition



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2022 was an eventful year, with many factors influencing the metals and fossil fuel markets. Most metal prices have corrected after being driven upward early in the year by the post-Covid recovery and higher inflation, and then by the Ukrainian crisis. There are two reasons for this: 1/ stronger and more resilient-than-expected inflation has pushed central banks to tighten credit conditions and raise interest rates. This pushed down metal prices, as investors anticipated a slowdown in economic activity; and 2/ demand was squeezed by the toughening of the “zero-Covid” policy in China and the collapse of its real-estate market.

However, industrial metals rallied aggressively on announcements since November of an easing of lockdown measures in China. Some of them gained more than 10% in December.

2022 was also a year of heightened awareness of dependence on fossil fuels and the need to speed up the energy transition. Against this backdrop, massive demand is now emerging for metals that hold up to cyclical slowdowns.

2023 is therefore shaping up to be another busy year on the commodities markets, with many influencing factors. The energy crisis caused by the war in Ukraine is likely to drag on, thus stressing the need to diversify energy sources and to ratchet up efforts in making the transition. China, the world’s largest consumer of metals and its second-largest consumer of oil, is likely to recover a positive influence on the market in 2023, following the shutdown of its “zero-Covid” policy and the rebound of its real-estate market from very low levels. Trade tensions and geopolitical conflicts could continue to steer commodity prices. And, lastly inflation and real interest rates could have an impact on precious metals such as gold and silver.

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Oil has once again brushed up against highs last seen prior to the 2008 financial crisis, while metals such as palladium and nickel set records during the year. The reason? The Ukrainian crisis and the risks that it could pose to fossil fuel and metal supplies from Russia. **Below we take a look back at the eventful year of 2022 and look ahead to the 2023 outlook for metals and fossil fuels.**

2022 Review

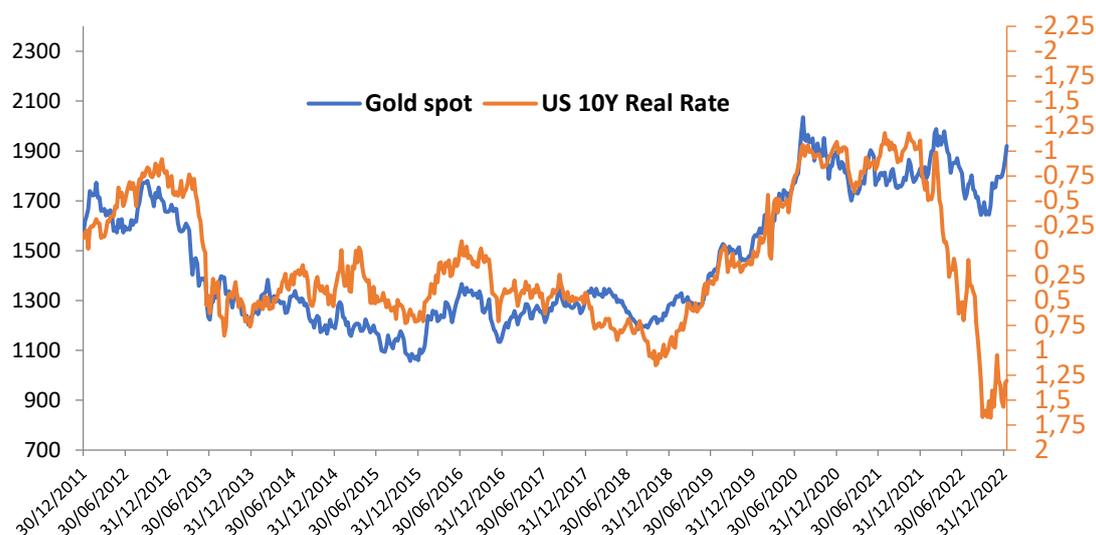
Precious metals

After an already strong start to the year, driven by the ongoing post-Covid recovery, metals and oil spiked in late February. Gold and silver also rose steeply, driven by a big run-up in inflation that pushed real interest rates ever lower.

Prices moved even higher in early March with the announcement of Russia's invasion of Ukraine. The resulting conflict with the West raised fears of a sudden cut-off of resources from Russia, one of the main producers and exporters of oil, gas, nickel, palladium and aluminium.

Gold and silver prices then corrected when central banks changed course. After more than a decade of accommodative monetary policies, they decided to tighten credit conditions and raise interest rates to combat the inflation generated by the post-Covid recovery and the Ukrainian crisis – inflation that ended up being less transitory than previously expected.

Investors then turned away from gold, which, unlike traditional asset classes, does not generate income. This pushed gold to as low as \$1630/ounce in early November.

Chart 1 - Gold price and US 10-year real rate

Sources: Bloomberg, OFI Invest AM, December 2022

However, based on the historical relationship between the gold price and US 10 years real interest rates (see chart above), gold has actually held up far better to the rebound in real interest rates than might have been expected. This is due in no small part to the geopolitical situation, which has pushed some investors to seek out assets regarded as “safe havens”. Moreover, some market participants seem to doubt that the US central bank will be able to quickly bring inflation under control.

Silver also took a hit and stuck to its historical correlation with gold by correcting almost twice as much. Even so, this may seem surprising, given the trend in consumption of silver, whose physical properties of electrical conduction make it increasingly in demand for low-carbon technologies.

Meanwhile, palladium, a metal that is essential for producing catalytic converters and of which Russia is the world’s largest producer and exporter, spiked by 70% on the year to new highs of more than \$3400 per ounce! As palladium is hauled on commercial airlines, market participants feared at one point that it could not be moved to international markets because of Western countries’ suspension of flights to and from Russia. The market nonetheless found a workaround by transiting through countries whose airspace remained open, and that brought prices back down.

The “zero-Covid” policy in China and monetary tightening then dragged down economic growth, hitting auto sales in particular, especially in China. Palladium and platinum, both of which are heavily used in vehicle production, then suffered a severe correction. Platinum did get something of a lifeline, as it is used in producing “green” hydrogen (through water electrolysis). Green hydrogen is still relatively rare but did see its installed capacities rose by 450% this year!

Industrial metals

Industrial metal prices also spiked early in the year, driven by the post-Covid economic recovery and by fears over supplies from Russia, particularly of aluminium, nickel and palladium. But prices then receded as no sanctions were forthcoming on metals traded with Russia.

There was one exception, however: nickel. Trading in nickel, which is nicknamed the “devil’s metal”, was suspended for an entire week on the London Metal Exchange. The reason? Tsingshan, a Chinese market participant and nickel producer, was forced to unwind its short positions at fire-sale prices after having taken on very heavy over-the-counter exposure. This sent nickel prices soaring by 250% in two days, forcing market authorities to suspend trading. The position has since been fully unwound by its holder, but the market still carries scars from this event. First of all, several market participants have given up on London after the clearinghouse’s historically unprecedented decision to cancel trades that were not the result of a clear error. Liquidity on this market has been clearly affected.

The other consequence is that after this suspension, the London Metal Exchange decided to introduce daily trading limits to reduce volatility and keep such situations from occurring again. This complicated the market reopening, but the rather wide limits set (+/-15% vs. the previous day’s close) have not been activated again during trading sessions.

Like other metals, nickel has since suffered a steep correction, driven at first by concerns over China’s real-estate sector, then by lockdowns there to rein in a new wave of Covid. This did indeed limit economic activity, with more than 300 million Chinese people at times locked down! Prices were also driven down by fears of European and US economic growth. The energy crisis-related closing of metal refining capacities in Europe (for aluminium and zinc, in particular) was unable to keep prices from falling.

However, industrial metals rallied robustly on the early November announcement of a possible easing in lockdown measures and other announcements that went increasingly in this direction late in the month. Several markets even gained more than 10% on the month!

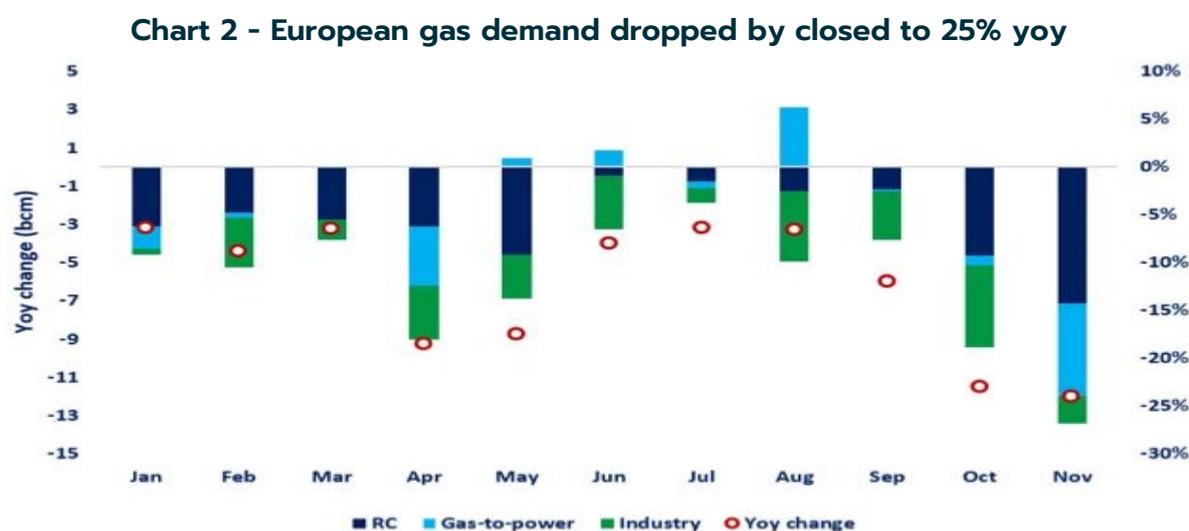
Oil & gas

In the wake of the outbreak of the war in Ukraine and given Russia’s prominence as a global supplier, oil prices spiked by more than 30% in a few days, briefly surpassing

\$130/bbl before rapidly pulling back when it looked as though the conflict would be rapidly resolved. Such hopes were quickly dashed, and oil prices then “settled” into a wide range between \$100 and \$120/bbl, tracking various announcements. Prices then receded on the concerted action of Western countries, which released some of their strategic reserves to keep prices from rising too high, and OPEC, which raised its pace of production. But it was especially central banks’ shift in monetary policy and its impact on expectations of an economic slowdown that sent oil prices back down below \$100/bbl during the summer. China’s “zero-Covid” policy also drove down oil prices by reducing growth and, hence, energy consumption. Prices have ultimately levelled off at about \$80/bbl currently.

Natural gas has also been greatly affected. The gas market is far more local, and repercussions have varied from one region to another, but interconnexions between those regions caused prices to at least double. In Europe, 40% of whose supplies came from Russia prior to the crisis, prices more than tripled in just a few days from already high levels, triggering an energy crisis throughout Europe.

Prices pulled back on mitigation measures by European governments, particularly the increased use of seaborne supplies, while gas continued to arrive from Russia, albeit at a slower pace. But Vladimir Putin’s decision to use various pretexts to gradually cut off almost all exports of gas to Europe once again pushed prices to record levels of €340/MWh, up from hardly €15 just a few months before! Prices have since stabilised at about €125, as Europe managed to react rapidly by building reserves back up before winter to more than 93% of capacity in all European countries, thanks in particular to liquified natural gas (LNG). Moreover, relatively mild weather sent consumption down by more than 20% in Europe in October and November, and reserves could reach record levels by the end of winter.



Source: IEA - RC: residential & commercial, November 2022

2023 Outlook

2023 is likely to be another busy year on the commodities markets. The energy crisis triggered by the invasion of Ukraine and sanctions levelled against Russia, a large producer of fossil fuels, is likely to spill over into the new year. Rebuilding natural gas reserves will be a major challenge for winter 2023-2024 to go off well, as will the availability of oil, as Europe has just imposed an embargo on oil from Russia, and as G7 countries have tried to impose a price cap on it. Given the link between natural gas and electricity prices, particularly in Europe, this issue will also be decisive in combatting inflation, and could also speed up the deindustrialisation of Europe. In particular, energy-intensive metal production could see its capacities in Europe continue to decline, even as the European Union has made this a key component in its policy.

The crisis with Russia has also made us realise how energy-dependent we are on unreliable partners and that we need to free ourselves of that dependence in short order. This realisation is likely to accelerate the energy transition – an energy transition that will have an inevitable impact on our energy dependence and on energy and metals costs.

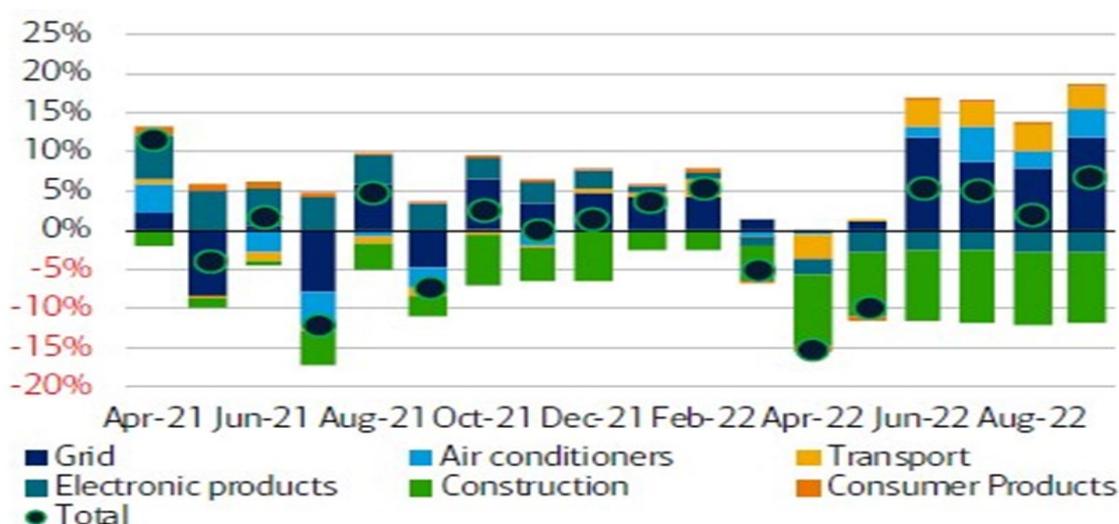
The public-health situation in China will also be one of the major focuses, if not the most important one. China, the world's top metal consumer and second-largest oil consumer, and whose 2022 slowdown squeezed demand, could once again have a positive impact on the market as early as next year. After a year marked by its severe "zero-Covid" restrictions and the collapse in its real-estate market, the situation is indeed likely to improve within the next few months, for two main reasons.

First, it is now almost certain that the "zero-Covid" policy will be set aside in 2023. The government of Xi Jinping, which has realised the policy's heavy economic consequences, has been preparing the Chinese for this for several weeks by expanding the vaccination campaign and access to healthcare. The recent demonstrations throughout China show the political cost of this lockdown strategy and increase the likelihood that the government will go ahead and continue gradually easing restrictions until a full reopening, perhaps as early as spring 2023. A caveat, however: the reopening could at first drag down economic activity before providing a boost. And if a new wave of the epidemic should occur, the possibility cannot be ruled out of a temporary resumption of restrictions, or even a slowing of mobility initiated by the people themselves.

The second potential boost to commodities demand, metals in particular, is the Chinese real-estate sector. After probably bottoming out in 2022, with a drop of about 50% in construction activity, government stimulus is likely to stabilise construction and probably restart it slightly in 2023. The sector is likely to remain very sluggish and deleveraging may require several years of adjustments. That being said, it should have less of a negative impact on metals demand in 2023. Moreover, this slowdown will be offset in part by the accelerated starting of infrastructure projects, a sector that was subject to a massive investment plan in 2022.

In addition to temporary factors, Chinese metals demand is being driven by another source of growth – China’s ambitious process of decarbonising its economy, including expanded electrification of transport, a massive rollout of the power grid, and installation of extensive renewable energies capacities. China alone accounted for about half of renewable power capacities installed worldwide in 2022! These transformations are big consumers of metals. For example, in 2022, despite serious difficulties in the real-estate sector, there was positive growth in demand for copper. In short, the energy transition has made up for weaker demand for copper in the construction sector, one of its largest consumers.

Chart 3 - Change in copper demand in China, by sector



Source: BofA, November 2022

The energy transition is expected to speed up, consuming more and more metals from one year to the next. For example, in the electric vehicle (EV) sector, Goldman Sachs forecasts* annual sales growth in China of 80% from 2022 to 2030 (“The beginning of a demand transition, a potential positive start”, Goldman Sachs, 23 November 2022). Renewable energy capacities are likely to more than double over

the same period. This would raise Chinese demand for copper and aluminium by, respectively, 55% and 91% over that period. Energy transition-related demand for lithium, cobalt and nickel in China will also expand 2.5-fold to 4.3-fold in the meantime.

This factor is essential in assessing the outlook for metal prices. The growing awareness of the urgent need for an energy transition is likely to give some resiliency to metals consumption in the coming years. Regardless of the economic situation, installing decarbonated capacities must go forth!

The last factor likely to impact the markets next year is, of course, the monetary policy orientations of the main central banks. There are many feedback loops here with commodities. For example, a restarting of China or a new spike in energy prices could make inflation more persistent than expected and force central banks to react accordingly. But the opposite is also possible: in pushing part of the global economy into recession, overly restrictive monetary policy could limit demand for commodities and exert downward pressure on their prices.

Precious metals

Gold

The main factor that will guide gold's trajectory in 2023 will once again be financial demand. As we already mentioned in the 2022 assessment, financial demand is closely tied to other asset classes and, in particular, to the level of real interest rates. Opinion is sharply divided regarding their 2023 trend. While central banks, led by the US Federal Reserve, seem determined to get inflation under control, it will nonetheless be a very challenging task.

Beyond the constraint of government debt (in the US's case equal to 120% of its GDP), the very nature of current inflation is quite different from the inflation that we have known in the past. At least 40% of it is due to supply-side issues. Rate hikes by the Fed and other central banks have raised borrowing costs and undermined demand. While this is likely to ease supply-side constraints by reducing demand, it could only be temporary and may require widespread demand destruction, i.e., plunging the US economy into a recession.

In any case, the Fed now has few options. Based on its public statements, the most likely of these is that it will stick to monetary tightening for as long as it takes to bring inflation under control. Given the inflationary risks arising from natural resource prices and the inelasticity of metal demand owing to the need to conduct

the energy transition whatever the cost, this could very well force central banks to raise nominal rates beyond levels currently anticipated by the market. This could lead to a revision in investor allocations, who would reduce their risk exposure by lowering their investments in equities and bonds. Such a trend generally comes with a move into assets regarded as “safe havens”, such as gold and precious metals, alongside the dollar and bank deposits.

Another Fed option is to assume that inflation is more inelastic than expected and probably longer-lasting. If so, it could revise its inflation target, for example to between 3 and 3.5%. It could do so without undermining its credibility by arguing, for example, that more and more studies are pointing out the inflationary character of the energy transition, which will affect us in the coming decades. Such a decision would force investors to revise their inflation targets, and that would exert downward pressure on real rates. This would provide the best support for gold and precious metal prices.

The lack of investment in the oil & gas and metals sectors (mining investments are currently about 80 billion dollars per year, whereas double that would be necessary) argue for a scenario of revising inflation anchors. Likewise, considerable investments are needed in the electrical grid, at 4300 billion dollars per year vs. 1200 billion currently, according to the IEA. Such levels of investment will inevitably require government intervention. And their fiscal standing require that real interest rates stay low for their debt to remain sustainable.

This is apparently investors’ take of the situation. The central banks themselves this year made their heaviest purchases of gold since 1967. In the first three quarters, they acquired almost 700 tonnes of gold. This exceeds the record purchases of 2018 (about 650 tonnes) and the year is not even over. Central banks, which, remember, set monetary policies, have served notice of their determination to continue buying gold. Some 25% of the 56 central banks surveyed in mid-year by the World Gold Council (WGC) said they wanted to expand their gold allocations in the coming 12 months. None of them reported wanting to reduce their precious metals allocation. The reasons they cited for these purchases are precisely the aforementioned points. First of all, they said they expected real rates to remain low for a long time to come. Their second reason was the lack of counterparty risk on gold. In other words, gold is not the debt of anyone who could potentially default...

For all these reasons, we expect gold to end 2023 in positive territory, at a price once again above \$2000/ounce and possibly above its all-time high of \$2070, set during the public-health crisis.

Silver

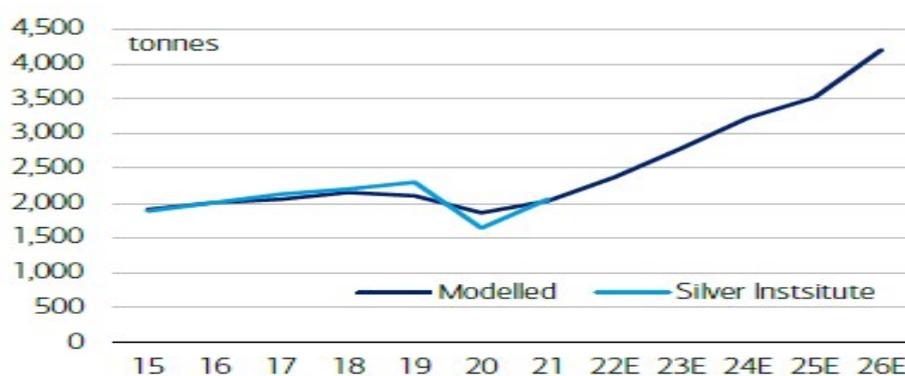
Silver is likely to be driven in 2023 by two main factors. First of all, it is still regarded by many investors as a precious metal. Its performance is therefore historically closely correlated to gold, but with greater volatility.

Second, industrial demand for silver has risen sharply in recent years, owing to its physical properties. As an electrical-conducting metal, it is used, among others, in low-carbon technologies, development of which is accelerating with the energy transition.

This is the case in particular of the photovoltaic sector. Almost non-existent 10 years ago, this industry installed 130 GW of capacities in 2020, consuming 3142 tonnes of silver, or 12% of annual global silver output. Since then, installed capacity has expanded constantly (and is likely to reach 200 GW in 2022). Based on the IEA's latest forecasts, the pace could accelerate, given that as many solar panels are expected to be installed in the next five years as in the past 20 years, i.e., almost 2400 GW. This is likely to boost the photovoltaic industry's demand for silver.

Electrical mobility is another silver-intensive sector that is growing fast. Silver is not used in the composition of batteries but it is used in the design of battery packs. Indeed, an EV battery is quite different from monobloc lead batteries found in internal combustion cars. It is a set of individual accumulators that look like ordinary batteries put together in a casing. To connect them, automakers use silver. As a result, in 2020, when EVs still accounted for only about 5% of the auto market, automaker demand already accounted for almost 7% of global silver output. According Bank of America forecasts, the auto industry could therefore double its needs by 2025. The IEA even reported in its roadmap that to comply with the Paris Agreement and achieve carbon neutrality by 2050, EVs' market share would have to reach 60% in 2030. What's more, as battery size is increasing, needs could also expand.

Chart 4 - Silver demand from the auto sector, modelled and real



Source: Silver Institute, BofA Global Research, November 2022

Meanwhile, silver output seems to be plateauing and has still not returned, and may not be able to return, to its pre-Covid levels. With production constrained and demand rising fast in industry, silver could trend upward for a long time beginning in 2023. Depending on the pace of the energy transition, silver prices could, as early as next year, exceed the \$27-28/ounce reached during the post-Covid recovery.

PGMs (platinum and palladium)

Platinum is another metal on a disrupted market. On the demand side, two major changes are occurring. First of all, as it is priced well below palladium, some automakers appear to have substituted it for palladium in making catalytic converters.

So far it has been hard to obtain precise statistics on the volumes entailed. We nonetheless believe that they could be small-scaled, as automakers are running a considerable risk, given the other trends at work in platinum demand. Platinum is a metal whose physical properties have made it essential to developing the fast-growing low-carbon industry of green hydrogen.

Platinum is one of the metals used in making electrolyzers that make low-carbon hydrogen for proton-exchange membrane (PEM) type electrolyzers, which now account for about half of installed capacities and whose capacities have expanded by 460% since 2019!

Platinum is also essential to using hydrogen (H₂) to generate electricity. Hydrogen is regarded in some quarters as a way to store energy, a task made necessary by the intermittence of renewable energies. Electricity is produced from H₂ through a fuel cell. Here again, several technologies exist, but PEM has the advantage of being compact, which means that it could be used for electrical mobility. And it is also a heavy consumer of platinum. About one ounce (about 31 grammes) of platinum is needed for each vehicle fuel cell.

For all these reasons, platinum demand is expected to expand greatly in coming years. According to Anglo American Platinum, the world's largest producer, platinum demand by the hydrogen industry could reach 25 tonnes by 2025, or 10% of the annual output of 250 tonnes, and 100 tonnes by 2030!

The hydrogen industry could therefore effect profound changes in the prevailing supply-demand balance. Even so, some questions remain on how relevant hydrogen could be for energy storage, given the heavy waste entailed in making H₂, and likewise for reconversion into electricity. All in all, more than half of the energy stored is wasted. The French Academy of Technologies, for example, stated in a report released in 2021 that H₂ should be set aside for very specific uses.

But this is unlikely to undermine the hydrogen industry in the next five to 10 years, as more than 30 countries have already announced plans to support its development through major investments. The latest announcement is that the US, under its Inflation Reduction Act, has granted a 10-year tax break of \$3 per kilogramme of green H₂, which could almost make the gas free if production costs continue to trend as expected!

Investments will multiply in this sector in the coming decade, generating very heavy demand for platinum.

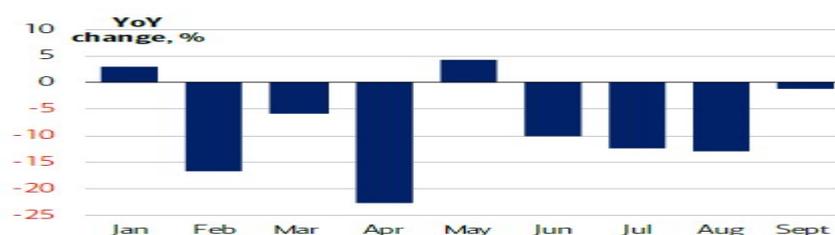
The situation is less clear-cut for palladium. After several years of soaring prices, driven by its use in making catalytic converters for petrol-powered vehicles, which moved ahead of diesel engines after the Volkswagen scandal in 2015, the switch to EVs is threatening to send the palladium market into surplus. Almost 80% of palladium demand is from catalytic converter makers.

In addition, its spiking price is now threatening its substitution by the aforementioned platinum, which is almost half as expensive. As mentioned, we expect substitution of palladium by platinum will nonetheless remain limited.

Meanwhile, further toughening of environmental standards for thermal engines is likely to maintain demand for catalytic metals. Moreover, although electrical mobility is expanding rapidly, it is unlikely to disrupt the supply-demand balance in the short term, as production of catalytic converters for hybrid vehicles require 10% to 15% more platinoids than internal-combustion cars (source: Johnson Matthey, the world's largest maker of catalytic converters). At least in the coming years, this should offset most of the volumes lost in vehicle electrification.

Alongside this trend in demand, supply could also be constrained in the short and medium term for both platinum and palladium. South Africa, which accounts for three quarters of global output of platinum and about half of palladium output, is currently being hit by severe electricity difficulties by Eskom, the national utility. This is restricting South Africa's mining activity, particularly of platinoids (which include both platinum and palladium).

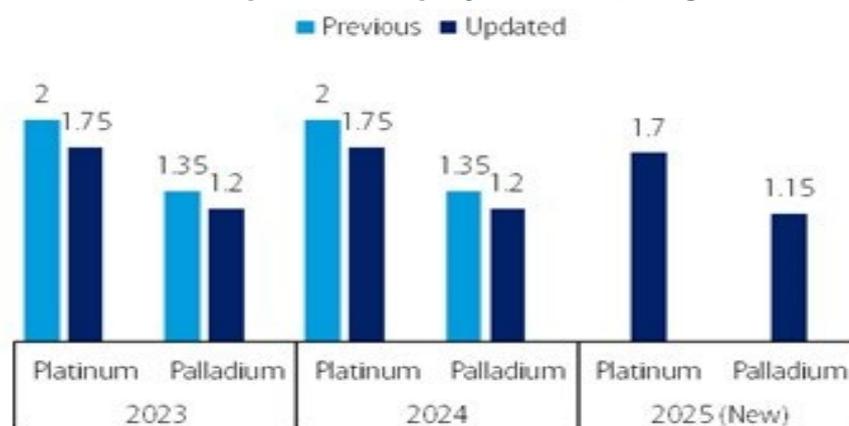
Chart 5 - Change in platinoid output, 2022 vs. 2021, in %



Source: Bloomberg, Bank of America Research, November 2022

This is what led Anglo American Platinum in particular to lower its output projections for the next two years. Weaker investment, lower ore content, and inflated production costs also led the company to lower its 2025 production targets, below the figures expected for the next two years.

Chart 6 - Revision of PGM production projections by Anglo American Platinum



Source: Anglo American Platinum, December 2022

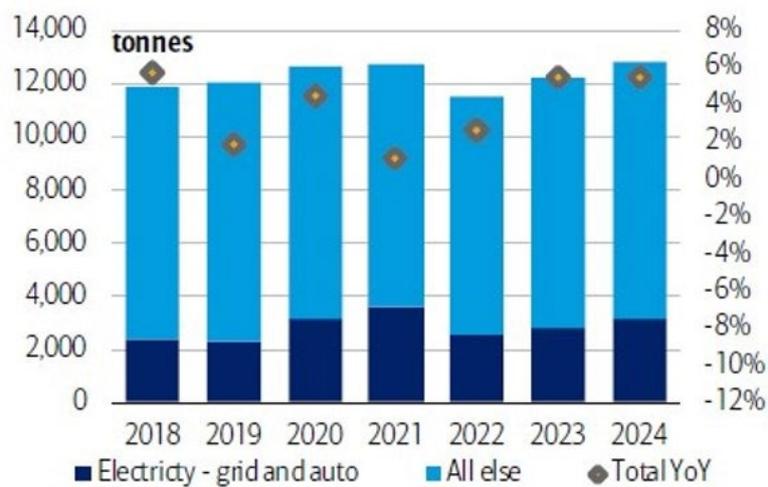
Industrial Metals

Copper

Copper had a rough year. After rising in March in the wake of the invasion of Ukraine, prices were squeezed the rest of the year. The reason? The slowdown in China, the world's top copper consumer with more than 50% market share. The slowdown and difficulties of the main property developers, in particular, led to lower consumption.

However, things have improved since the authorities announced a likely reopening in November. Beyond that, monthly figures have revealed a more challenging situation for copper demand in China. For while demand has declined sharply in the traditional sectors of infrastructure, real-estate and transport, it has increased sharply in low-carbon technologies, led by solar and wind power and electric vehicles, and in the electrical grid (which will have to evolve to adjust to changes in generation facilities particularly the addition of renewable energies)! China is now the fastest-growing country in low-carbon energies, and accounted for almost half of capacities installed worldwide in 2022! All this ultimately caused China's copper consumption to rise by almost 2.5% this year.

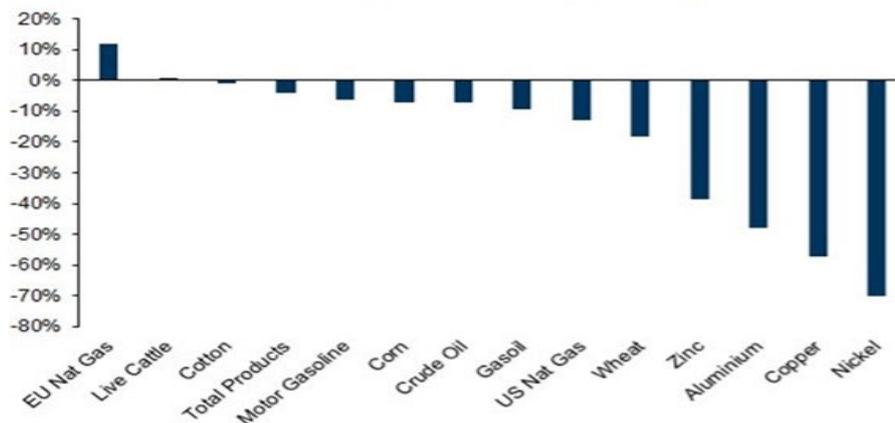
Chart 7 - Copper demand in China, in thousands of tonnes



Sources: Woodmac, CRU, ICSG, Bloomberg, BofA Global Research, OFI AM, November 2022

This trend doesn't stop at China. The head of Trafigura, a commodities trading firm, pointed out a few weeks ago that there was also very heavy demand for copper in Europe. This has been confirmed by inventories, which are at 14-month lows. In fact, inventories are down in most commodities and below the median figure of the past five years.

Chart 8 - Commodities inventories vs. the five-year median



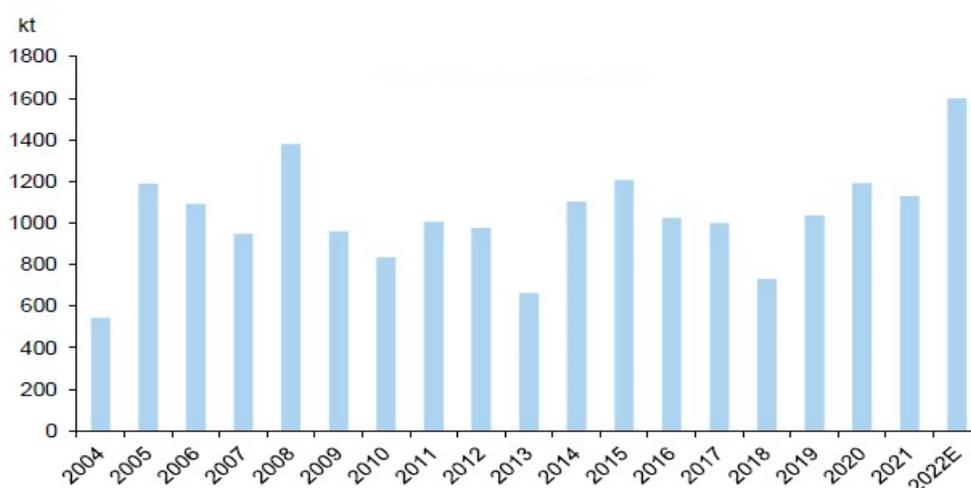
Source: Goldman Sachs, November 2022

The accelerated rollout of renewable energies in coming years is likely to boost metal needs even more, copper in particular. The energy transition is thus profoundly changing metals demand by boosting consumption in Western countries, which must also alter their electricity generation mix. But, beyond that, as the energy transition must now happen at a faster pace, whatever happens to the economy, it is likely to

ensure resilience in metals demand even during economic slowdowns. This is likely to provide a downward cushion on metals demand and, hence, prices.

On the supply side, mining output has been relatively constrained this year. In particular, South America, and Chile in particular, have suffered difficulties, including lower returns, more labour unrest and increasingly left-wing governments seeking to obtain an ever-greater slice of the mining pie. This has increased the frequency of work stoppages.

Chart 9 - Impact des interruptions de production, in thousands of tonnes



Source: Woodmac, Goldman Sachs Global Investment Research

The risks of reduced output in Chile are still great, as they are in Peru, where the president was recently impeached. Panama, which is not a very large producer, is in negotiations with First Quantum Minerals, the operator of its largest mine, Cobre Panamá, to try to raise its revenues. As negotiations are going nowhere, the mine may have to suspend its activities.

Chart 10 - Copper output in Chile, in thousands of tonnes



Source: BofA Global Research

All of these constraints have pushed the market into deficit this year. For 2023, a surplus of almost 1 million tonnes had been forecast just recently, but the most optimistic forecasts now put that at 350,000 to 400,000 tonnes. Any production incident could therefore push the market very quickly into deficit.

And yet, 2023 and 2024 are the last two years in which large new mining projects are expected to be delivered. But with the delays that have occurred, increased output is likely to be spread out much further over time. Be that as it may, most operators now believe that 2024 will be the year of peak copper output. But demand, meanwhile, is expected to be pushed sustainably upward, with growth ranging from 2.5% to more than 4% annually for the next five years. Everything is therefore in place for copper prices to turn steeply upward as early as 2023. A 20% increase in copper prices next year and a return of copper prices beyond \$10,000 per tonne can therefore not be ruled out.

Lead

Lead is widely used in the construction industry and, more recently, in the auto industry to make EV batteries, lead-acid batteries in particular.

According to the International Lead and Zinc Study Group (ILZSG), global lead and zinc markets are likely to be in deficit in both 2022 and 2023, with global demand of refined lead surpassing supply by 83,000 tonnes in 2022, and by 42,000 tonnes in 2023.

Despite the global economic slowdown, demand for lead is expected to expand by 0.8% this year, to 12.42 million tonnes and by 1.4% in 2023, to 12.60 million tonnes.

Aluminium

Aluminium is one of the most widely used metals and plays a key role in the construction and transport sectors. It is another metal used widely in low-carbon technologies, including photovoltaic panels, magnets, turbine blades, the electricity grid, and lithium battery casings, and in making vehicles more lightweight. As an essential element in the energy transition, demand for it will expand massively in the coming years (see Chart 11).

Chart 11 - An example of greater demand for aluminium from the electrification of transports.

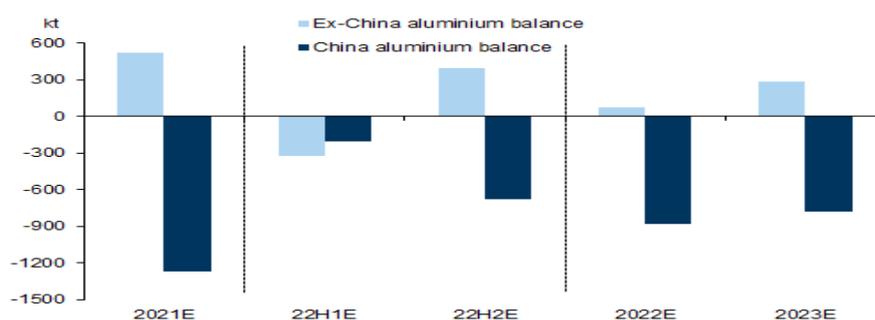


Source: Wood Mackenzie, BMO, November 2022

In parallel, aluminium production is being constrained by limited amounts of bauxite, which is essential to making aluminium. The French Institute of Oil and New Energies (IFPEN), which has modelled trends in aluminium demand amidst the energy transition, has found that, under a scenario aiming to limit global warming to 2 degrees by the end of the century, aluminium production will have consumed between 64% and 87% of bauxite resources in 2050.

In the shorter term, aluminium has been hit by a synchronised slowdown – both in China, because of its “zero-Covid” policy and its sluggish real-estate sector; and in the rest of the world, where economic activity has been hit by higher energy prices and central banks’ monetary tightening.

However, the outlook is quite likely to improve in the coming months. In 2023, like a large portion of the asset class, aluminium is expected to benefit from China’s reopening, which is expected to help restart industrial activity that had been slowed in 2022 by various lockdown measures that have recently been lifted. It is also likely to benefit from real-estate support measures. For, while the sector is expected to remain weakened for some time to come, 2023 could see more construction sites completed and, hence, a rebound in economic activity. Note that even in 2022, China continued to consume far more aluminium than it produced (see Chart 12), due to robust demand in infrastructures and autos, both sectors supported by the government, and to increasingly tough constraints on production capacities in the country.

Chart 12 - Supply-demand equilibrium

Source: Goldman Sachs estimates, December 2022

So, while things have improved on the demand side, production has been hit by new constraints. In Europe, while the energy crisis has indeed caused a decline in industrial activity, it has also raised production costs to untenable levels, particularly in the metal smelter sector. Announcements of shutdowns have come one after the other, halving production capacities in Europe (see Chart 13). Note that it is technically challenging and very costly to restart a smelter once it has been shut down. So the reduction in capacity will be long-lasting if not permanent.

Chart 13 - Shutdown of aluminium production capacities in Europe

Country	Company	Smelter	Capacity	Closed	Date
Netherlands	Aldel	Delfzijl	150	150	Jan-21
Slovakia	Hydro	Slovalco	170	136	Oct-21
Germany	Trimet	Hamburg	135	41	Oct-21
Germany	Trimet	Voerde	95	29	Oct-21
Montenegro	Uniprom	KAP	40	40	Dec-21
Spain	Alcoa	San Ciprian	250	250	Jan-22
France	Alvance	Dunkerque	290	11	Jan-22
Romania	Alro	Slatina	290	174	Jan-22
Germany	Trimet	Essen	165	83	Mar-22
Slovenia	Kidricevo	Talum	100	11	Aug-22
Norway	Alcoa	Lista	75	31	Aug-22
Slovakia	Slovalco	Ziar and Hronom	100	34	Sep-22
France	Aluminium Dunkerque Industries France	Dunkerke	290	64	Oct-22
Total			2150	1052	

Source: Bank of America, November 2022

More broadly, making aluminium is electricity-intensive. As a result, production capacities are threatened wherever energy prices are likely to rise in the coming years or where production is exposed to the risk of droughts. This is the case of China in particular, which in recent years has had to scale back its aluminium output as a water shortage has lessened hydroelectric power generation. On several occasions, China has also scaled back its aluminium production activities in order to reduce its CO₂ emissions, as much of China's electricity is from coal-fired power plants. China has introduced ambitious emissions-reduction targets, and these environmental constraints are likely to reduce domestic metals output structurally.

These persistent constraints on aluminium production, combined with a gradual restarting in demand, should gradually lead to higher prices in 2023.

Nickel

In 2022, the nickel market was subject to steep volatility caused by various factors. Early in the year, the reopening of economies came with a sudden restarting of economic activity, which pushed up demand, particularly of commodities, and exerted upward pressure on metal prices. Geopolitical tensions were also ratcheted up early in the year in Europe, culminating in war in Ukraine. This conflict has raised fears of restrictions on nickel imports from Russia, the world's third-largest producer with more than 7% of total output in 2021*. Although sanctions against Russia have so far spared the metals market, some nickel consumers have avoided sourcing from Russia, which de facto has eliminated some of the available supply.

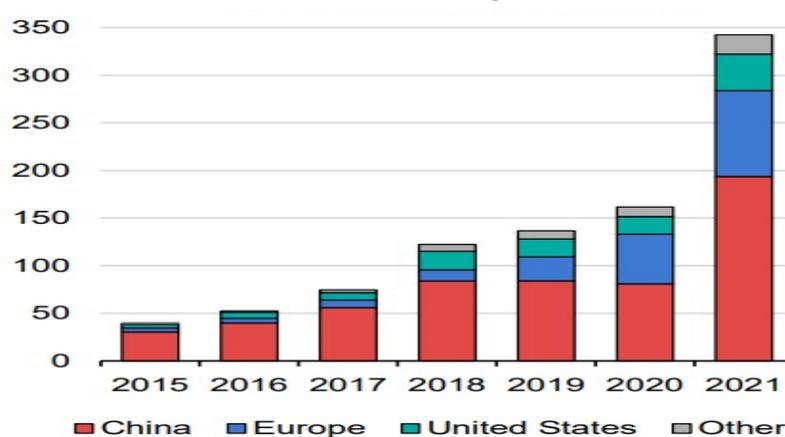
*Source: S&P Global

This "geopolitical" premium is part of the reason for solid nickel prices in 2022, whereas other industrial metals have been hit by the slowdown in China and fears of recession worldwide.

Meanwhile, its key role in the energy transition, and particularly the gradual increase in demand for electrical batteries production is increasingly evident.

Driven by massive government support and by automakers' technological advances, the EV market has expanded exponentially. In China, the world's top auto market, sales of electric vehicles have taken off in recent years: from 1.2 million EVs sold in 2020 to 3.2 million in 2021, and more than 6 million in 2022, based on the latest estimates!

And there is still room for further expansion. On top of the huge Chinese market, EVs account for 12% of the auto market in Europe and just 6% in the United States. But because of government measures to accelerate the energy transition, their market share will rise strongly in the coming years. To address this demand, production of batteries and demand for related materials are accelerating (see Chart 14).

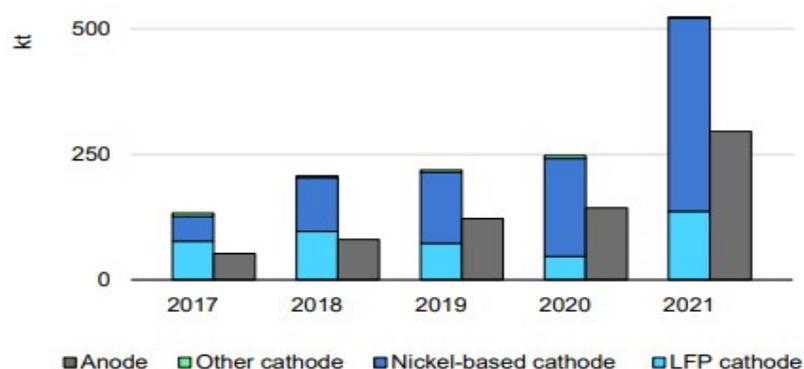
Chart 14 - Increase in EV battery demand, 2015-2021

Source International Energy Agency, *Global Supply Chains of EV Batteries*, July 2022

In a recent report, the European Commission estimated nickel demand at 2.6 million tonnes per year in 2040 just for battery production. Current production is about 2 million tonnes, 70% of which is to make galvanised steel. Moreover, battery production requires class 1 nickel, its purest form, of which only 1 million tonnes is now produced annually, 17% of which is from Russia*.

*Sources: GlobalData, Mining Technology

The battery sector has been at the heart of major economic and strategic challenges and is changing quickly. The number of battery technologies available has increased in recent years, as lithium-iron-phosphate (LIP) cathode batteries have developed alongside nickel-rich nickel-manganese-cobalt (NMC) batteries. However, far from competing with one another, these technologies are all developing on a very fast-growing market (see Chart 15).

Chart 15 - Trend in demand for battery components, 2017-2021

Source: International Energy Agency, *Global Supply Chains of EV Batteries*, July 2022

The IEA wrote in a recent report (Securing Clean Energy Technology Supply Chains, July 2022) that by 2030, nickel will face the largest increase in demand, due to the dominance of high-nickel-content cathodes, a dominance that is expected to last. “Li-ion” batteries require far more nickel than lithium; for example, producing a NMC811 battery consumes seven times more nickel than lithium, by weight.

*Li-ion: batterie with a lithium-ion electrolyser that runs through an exchange of lithium ions between the electrodes.

Moreover, the electrification of the auto sector and expansion of renewable energies requires large quantities of nickel, and demand will therefore take off in coming years. For example, making a wind turbine requires 500kg of nickel per megawatt; a geothermal device, 1400kg per MW; solar energy, 1270kg per MW; carbon capture 1150 kg per MW, hydrogen production, 300kg per MW, etc.

In the shorter term, the reopening and restarting of China could have an impact on nickel demand. Production of electrical cars and the rollout of renewable energies have held up well to the economic slowdown and the “zero-Covid” policy, thanks to Chinese government subsidies and investment plans. But the rebound in the construction market in particular, could be a source of additional demand; output of galvanised steel had dropped sharply in China in 2022 owing to weakness in the sector, and its trend improvement should boost demand.

Zinc

Zinc will be a crucial material in the energy transition, owing to its ability to protect metals from corrosion (see Chart 16). Its main use is in making galvanised steel. It extends the lifespan of steel constructions significantly, thus reducing the need for primary resources.

Chart 16 - Use of zinc in “green” technologies

Application	Zinc usage	Units
Offshore wind	400	kg/MWh
Onshore wind	40	kg/MWh
PV	2400	kg/MWh
Electric vehicles	15	per vehicle

Source: Bank of America, Nov 2022

According to the World Bank, 98% of zinc used in renewable energies is for the wind power sector. The IEA estimates that zinc demand will almost triple by 2040, due solely to the expansion of wind power.

However, zinc is also used to make solar panels, photovoltaic cells in particular, and for protection from corrosion in the structure of solar panels, which is another source of higher demand.

Chart 17 - Projection of growth in zinc demand for wind and solar power

Zinc demand, tonnes	2020	2030E	2050E
From solar	3,480,000	16,480,000	42,560,000
From Wind			
Onshore	55100	109867	283733
Offshore	29,000	274,667	709,333
Total, cumulative	3,564,100	16,864,533	43,553,067
Zinc demand annually, tonnes		1,330,043	1,334,427

Source Bank of America, Nov 2022

And, lastly, zinc demand for storing energy could expand rapidly. Researchers are working on a new type of battery, called zinc-ion, as a low-cost, long-lived alternative to lithium-ion with enhanced safety as it is non-inflammable.

On the supply side, the physical market is already very tight. Inventories are at a low (see Chart 18). For example, in 2012 there was more than 1.2 million tonnes of metallic zinc in the US in London Metal Exchange warehouses. Today, LME inventories in the US are below 10,000 tonnes. This has sent physical premiums to record levels.

Supply is even tighter as the energy crisis in Europe has caused the shutdown of more than half of zinc and aluminium production capacities. The very likely persistence of high energy prices could very well make these capacity constraints long-lasting.

Chart 18 - Zinc inventories in thousands of tonnes



Sources: Wood Mackenzie, S&P Global, October 2022

Oil

Many had counted on the 2020 global pandemic to alter our consumer habits and wean us off fossil fuels more rapidly. Nothing of the sort occurred. According to the latest figures from the International Energy Agency (IEA), global oil demand continued to catch up in 2022, with an increase of 2.1 million bbl/d, despite the economic slowdown in China, and economic growth reined in by the tightening of credit conditions in Europe and the US. This increase is expected to slow but could very well continue into 2023, with growth in demand expected at 1.7 million bbl./d.

This would raise global oil consumption to a new all-time high, even higher than its 2019 peak, at more than 101 million bbl/d! Production would have a hard time keeping up. The lack of investment in conventional oil in recent years has made it more difficult to maintain output. Natural depletion (including the natural decline of an oilwell's output over time due oilfield pressure lessens) is no longer being fully offset, and it would be hard to make up this lack of investment. Keep in mind that, according to the IEA, output of conventional oil peaked in 2008.

Since then, the world has been able to count on expanded output of non-conventional oil, led by US shale oil. But, here again, supply is having a hard time expanding. Shareholders of these producers are now calling more for profitability than productivity, and environmental constraints are also limiting investors' interest. Hence, whereas at the start of the year, an increase of 900,000 to 1,000,000 bbl./d was expected in North American output, it is ultimately likely to be no more than 450,000. And the increase forecast for next year has just been revised downward to 480,000 bbl/d. The causes cited are higher production costs and labour shortages. But the Norwegian consultancy Rystad Energy has mentioned another cause – most of the best fields have been tapped out, requiring producers to reduce their growth to less than 5% if they want to last.

All in all, supply will remain constrained, even without the Russia supply risk, which could remove almost 1.5 million bbl/d from the market by the end of the first quarter of 2023, according to the IEA. As a recovery in the Chinese economy is more than plausible as it lifts its lockdown measures, oil prices could rise very quickly. This is what Amin Nasser, the CEO of Saudi Aramco, the national oil company, had in mind in pointing out that the world was far too focused on the risk of shrinking demand in the event of a recession and not at all enough on the shallowness of reserves of production in the event of a recovery.

Oil prices are therefore likely to remain high next year, even though they have corrected in the short term. They could level off at between \$90 and \$100/bbl, but

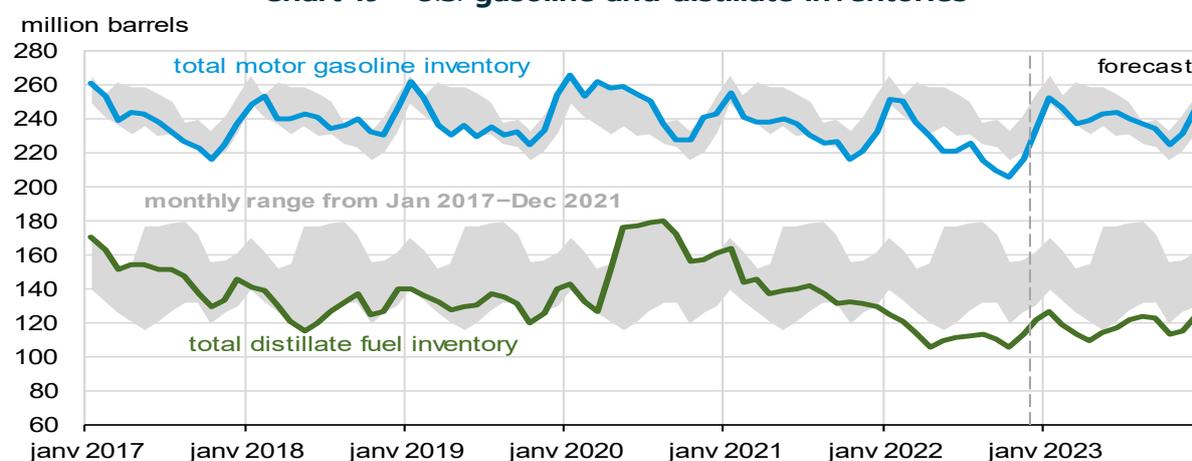
the risks are clearly on the upside, in our view, given that some Russian output could be lost to the European embargo and to the introduction of a price cap with its still uncertain impacts, and given that a recession in the West has already been more than priced in and that the Chinese economy is expected to accelerate rapidly.

On the other hand, there seems to be little downside potential. First of all, OPEC and its OPEC+ allies, including Russia, have served clear notice of their determination to keep oil prices relatively high. While in the short term they have kept oil output unchanged despite the recent decline in prices, they have done so solely to better judge the combined effects of the reopening of China and potential lost output from Russia. However, we mustn't lose sight of the reason for this increase, which some view as a means of taking advantage of the difficulties of the West and Europe in particular. OPEC's secretary-general pointed this out in a recent interview, stating that "energy security has a price". The world is increasingly counting on Gulf countries to provide a secure source of oil in the coming decades that will lead us to a decarbonised economy. And what the Kuwaiti minister meant is that the main producers need high prices as an incentive to make the necessary capital expenditure.

Meanwhile, oil prices were kept partly under control in 2022 by several countries' use their strategic reserves, including OECD countries. Their reserves are now at 18-year lows and sooner or later will probably have to be refilled. The US, for example, has said that it will refill its reserves once prices have fallen below \$70/bbl. US reserves (commercial and strategic combined) are at 36-year lows!

Note also the very low inventories of refined products, and in particular diesel, which may keep fuel prices high and thus make inflation sustained.

Chart 19 - U.S. gasoline and distillate inventories



Data source: U.S. Energy Information Administration, Short-Term Energy Outlook, December 2022



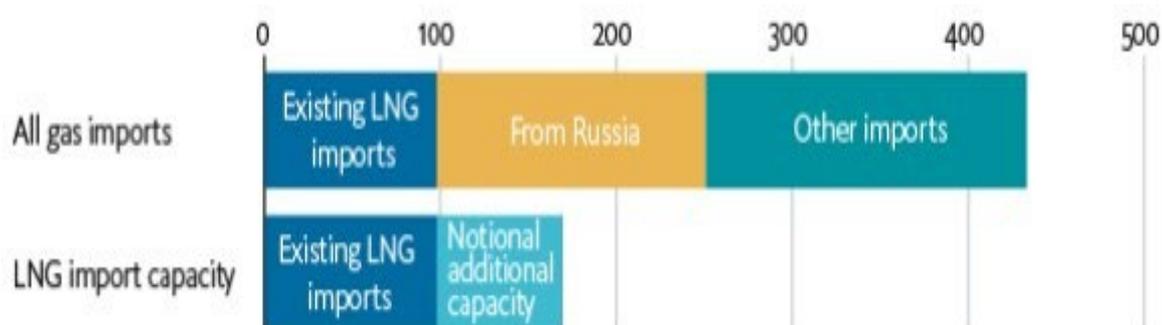
Natural gas

The natural gas market could have a highly volatile year, at least in Europe. Remember that, unlike oil, gas is a far more local market, given how difficult it is to transport.

Winter 2022/2023 should, on the whole, go off well, given that Europe managed to take advantage of the period when Russian supplies had not yet been shut off completely to top off its storage tanks as much as possible. In addition, there was a very steep increase in imports of seaborne liquified natural gas (LNG). From January to October, seaborne imports rose by 70%, to 111 bcm (billion cubic meters). This is still far below the 155 bcm that Europe bought last year from Russia, especially as almost 18 bcm of the year's LNG imports came from... Russia. That being said, we took on winter with inventories almost 95% full everywhere in Europe.

All this should make it possible to get through winter intact, barring major outages of dispatchable sources (French nuclear reactors, for example) or long windless periods during severe cold spells. However, in 2023, once winter is over, inventories will have to be refilled for yearend and the following winter (2023/2024) without being able to count on Russian oil, which until the start of 2022 accounted for 40% of our imports. Although this year's record inventories should get us through winter 2022/2023 with historically high reserves, finding the necessary additional gas could be quite challenging. As it is impossible to build new gas pipelines in so little time, we will have to rely on LNG imports. But even LNG requires suitable infrastructures, as the gas must first be liquefied before being shipped and regasified at its arrival point before distribution. We currently possess surplus regasification capacities but they are far from being enough to replace in volume terms the loss of pipeline-supplied Russian gas.

Chart 20 - Gas imports into the EU, 2021 and LNG import capacity

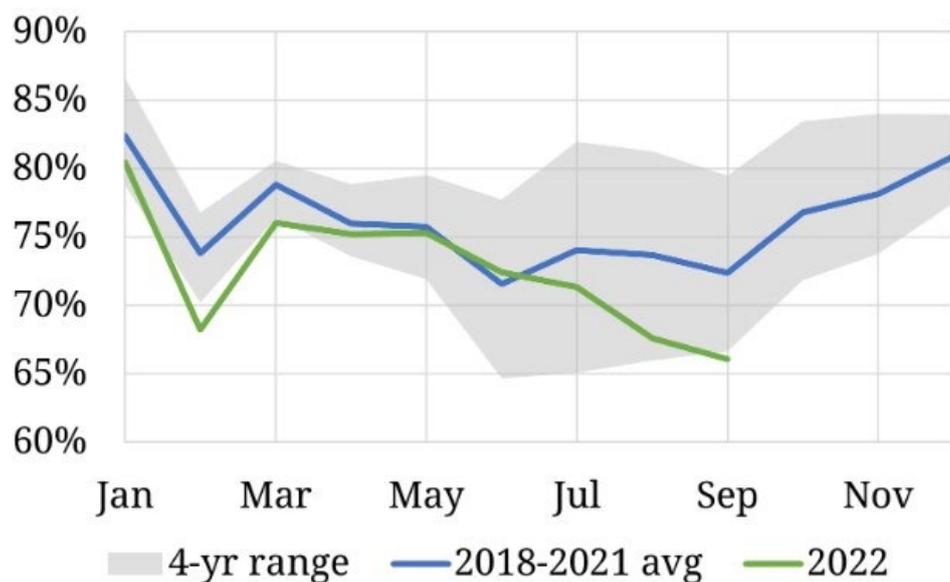


Sources: Gas Infrastructure Europe, Gazprom, EIU, February 2022

But it's mainly liquefaction capacities that are very insufficient. Supply is unable to meet demand in full, due to very heavy Japanese and Chinese demand, especially as

production facilities have been hit by many incidents this year, lowering liquefaction capacity utilisation to less than 70% in September. One such incident hit the Freeport liquefaction facility in the US, which has reduced the US's export capacity by almost 15% for several months now.

Chart 21 - Use of liquefaction capacities, in %



Source: LNG Unlimited, Timera Energy, November 2022

Monopolising part of output will come at a cost, especially as an increasingly large portion of our supplies are obtained at spot prices, given that long-term contractualisation capacities are now booked up until 2026, according to statements from Japan. Terminating existing contracts with Russia has thus raised the share of our supplies based on the spot price from 20% in 2021 to almost 40% this year and potentially to as much as 50% next year.

Natural gas prices are therefore likely to remain highly volatile in 2023, with real risks of prices' being driven upward by international jockeying for LNG supplies. We will also be subject to the availability of other means of production in an attempt to lower our use of gas. While winter 2023/2024 is likely to be challenging, this year's disruptions may have only been the precursor of a more serious situation.

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