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**Quintessentially
Nickel**

Market research team

E-Mail: marketing@nornik.ru

KEY TAKEAWAYS

Since the beginning of the year, the LME nickel price has risen from \$16,000/t only to over \$20,000/t. This was caused by many factors. Firstly, several high-cost nickel producers, mainly in Australia and New Caledonia, have suspended production due to the low-price environment and negative margins. Secondly, there have been ongoing delays with mining permit renewals in Indonesia. And thirdly, the scale of the nickel market surplus appeared to be lower than expected because of considerable underestimation of primary nickel use in China, and the market surplus in 2024 is estimated now to be only 100 kt Ni or 3% of primary nickel use.

These were coupled with positive macroeconomic developments and softening of the US dollar index, although the nickel price proved to be less macro-driven than copper, being more sensitive to supply-based news rather than unemployment and inflation data. As a result, LME nickel jumped by ~25% since the beginning of the year. Compared with our December issue conclusions, the current price environment is more beneficial for nickel producers across the globe, with over 90% of all companies seeming to be cash-positive as of now. However, as around 400 kt Ni of capacities are currently idled or being at risk of closure, we see the present supply risk as still underappreciated. As we expect nickel use growing at a healthy pace this year, we think a combination of robust

nickel demand and supply curtailments could provide a further impetus to the nickel price.

In April, the US and the UK introduced some further restrictions prohibiting its citizens and residents from engaging in global commodity exchange transactions with Russian nickel, copper and aluminium. This decision is most regrettable as it will further increase price volatility and supply uncertainty as well as lead to higher premiums, all of which will negatively affect users of these metals across the globe and in the West in particular. As it was already established during the 2022 LME's public consultation on the matter, the majority of the market participants voted against the ban of Russian metal. This clearly indicates that the market is very much reliant on the Russian brands. Overall, this continuous self-harming trend of Western isolationism and unilateral abandonment of the free trade principles severely undermine the centuries-old position of the LME as a globally recognised price-discovery mechanism and raises conceptual questions about how sustainable and representative of the actual global markets its pricing becomes.

Nornickel would like to reiterate that notwithstanding the challenges of the past couple of years, we remain a reliable supplier of products and honour all our existing contractual obligations with customers.

MARKET BALANCE

Since our last report, we have revised the 2023 market surplus from the initially forecasted 250+ kt Ni to 164 kt Ni.

This was caused by significant underestimation of nickel use in the Chinese stainless steel, alloy and special steel sectors, as well as higher stainless production in Indonesia. At the same time, nickel sulphate output in China was downgraded as there was a partial double-counting since some sulphate was used to produce Class 1 Ni.

Nickel	2023	2024E	2025E
Use	3.25 Mt <i>+7%</i>	3.48 Mt <i>+7%</i>	3.71 Mt <i>+7%</i>
Supply	3.42 Mt <i>+9%</i>	3.59 Mt <i>+5%</i>	3.83 Mt <i>+7%</i>
Market Balance	164 kt	~100 kt	~100 kt
Low-grade Ni	29 kt	70+ kt	60+ kt
High-grade Ni	135 kt	30+ kt	40+ kt

In 2024, we expect the nickel market to sustain a surplus of around 100 kt Ni (vs 190+ kt expected previously), with the most of it still represented by low-grade nickel.

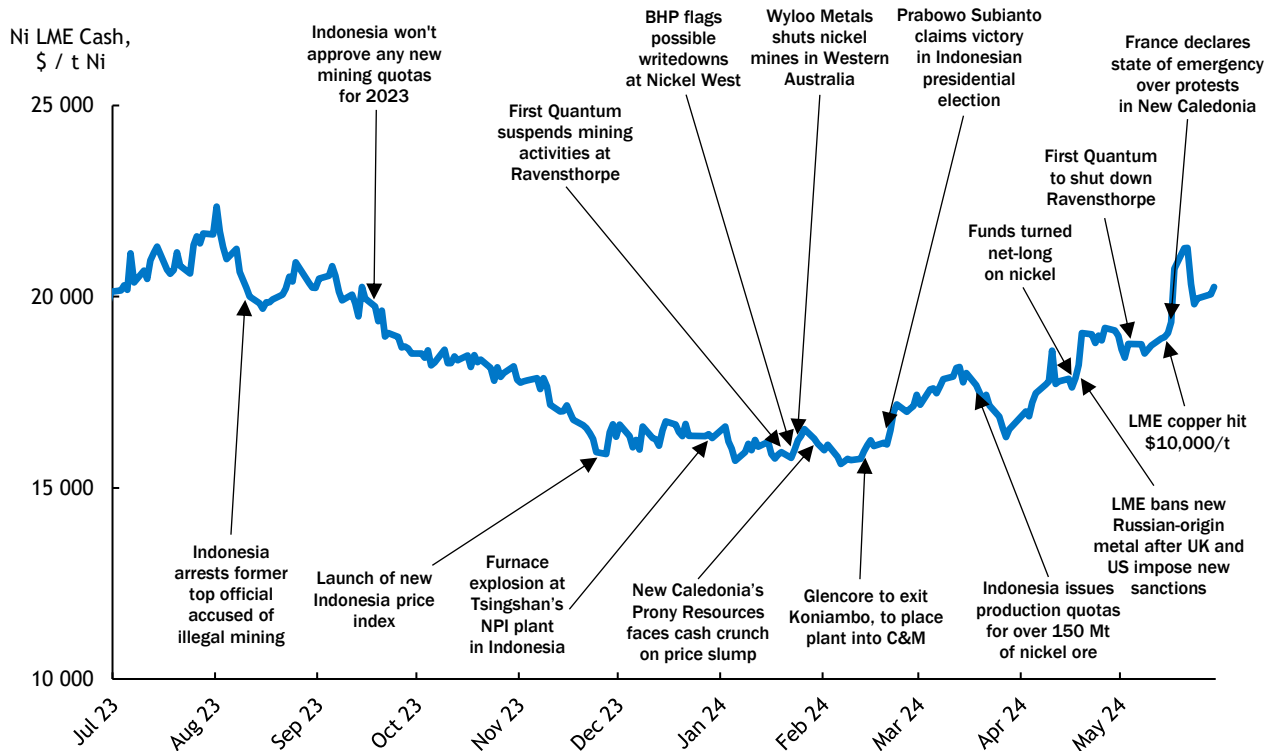
The commissioning of the Indonesian NPI, NPI-to-matte conversion capacities and HPAL projects is expected to continue at a high pace, although lower than initially expected due to delays with issuing new mining quotas in Indonesia and a decline in NPI grades, alongside the ramp-up of new Class 1 operations in China and Indonesia.

It will be accompanied by a moderate increase of nickel use in stainless (+6% YoY), alloys (+9% YoY) and special steel (+10% YoY) as well as a steady growth from the EV batteries (+11% YoY) driven by an anticipated restocking cycle in the battery supply chain to emerge during 2024. We believe that the restocking has already started as China's nickel use in PCAM grew by 15% in 2024 YTD.

In 2025, we expect the market to remain in a surplus of circa 100 kt Ni, unchanged from the current year, as the rising nickel demand from the melting applications (stainless steel, alloys, special steel) and batteries will be offset by new nickel capacities' commissioning in Indonesia and the growing production of Class 1 Ni and chemicals.

However, higher stainless steel output and production of nickel-containing alloys could lead to even stronger nickel use, while the ramp-up of Indonesian nickel capacities could underperform due to the ongoing issues with mining permit renewals, decreasing NPI grades and a potential moratorium to build new RKEFs. As a result, we have considered a disruption allowance of around 100 kt Ni, affecting both low-grade and high-grade nickel markets. Additionally, there is a risk of significant underperformance of some projects producing other forms of low-grade nickel, particularly FeNi and NPI in China, which is mostly loss-making, as well as potential operational constraints across other Class 1 nickel producers all over the globe.

MARKET SENTIMENT



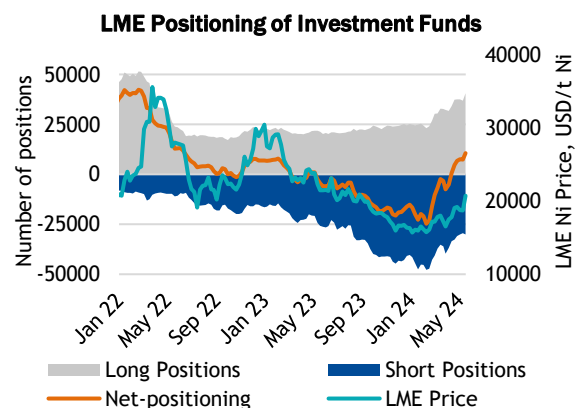
Sources: LME, NN Analysis

After trading mostly in the \$16,000-16,500/t range during January-February, the LME nickel price climbed to over \$18,000/t by mid-March. This was prompted by the closures of several nickel assets in Australia, concerns over potential disruptions in Indonesian supply amid delays in providing new mining quotas and a combination of short-covering and new long positioning of investment funds at the LME. However, news that the Indonesian government intends to approve more quotas by the end of March eased concerns about Indonesian supply disruptions, so the price declined to \$16,500/t by the end of the month.

In April, LME nickel rose from \$17,000/t to almost \$19,000/t on the back of strong industrial production data in China, rumours of potential stockpiling of NPI and Class 1 nickel from China's SRB, as well as generally positive investor sentiment towards the LME base metals complex. The LME's ban on Russian nickel produced on or after 13 April 2024 has also provided some stimulus to the price. In May, the nickel rally continued, with the price briefly reaching \$21,000/t in the second half of the month. This was caused by the unrest in New Caledonia, which was the world's third-biggest producer of nickel after Indonesia and the Philippines and accounted for 6% of the mined nickel output last year, and a broad-based price rally across the LME metals, particularly in copper.

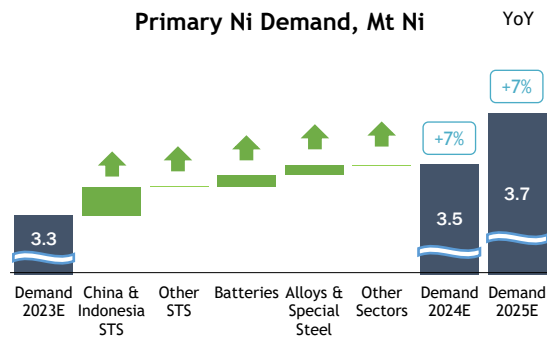
The LME's COTR (Commitments of Traders Report) shows that, for the first time since May 2023, the positioning of investment funds shifted from record net shorts in February to net longs in April. This indicates a dramatic change in investor sentiment with new long positions established across the LME base metals.

As we pointed out in our latest issue, in case of any disruptions of nickel supply, either Class 1 or Class 2, we could see a short-covering rally taking the LME prices higher, and this is exactly what eventually happened in early 2024. Overall, the current positioning is supportive for the nickel price, but the general investor sentiment towards the nickel price environment remains to be extremely volatile.



Source: LME

DEMAND



Source: NN Analysis

STAINLESS STEEL

China. In 2023, Chinese production of 300 series stainless steel experienced significant growth, although we need to admit that assessing the actual Chinese production volumes is rather challenging since most of the stainless steel producers are not public. For instance, following an announcement by the company's head, it was recently revealed that Tsingshan's actual production in 2023 exceeded market estimates by as much as 500 kt. This major discrepancy suggests that other large-scale producers might also be underreporting their production figures. It is supported by the fact that the actual inventories of NPI are significantly lower than the estimates based on the available industry data of stainless steel production.

For 2023, the estimated production of 300 series stainless steel in China was 20.2 Mt, resulting in the use of approximately 1,500 kt of primary nickel in the stainless steel sector. This robust growth trend has continued into early 2024.

At the same time, stainless steel stocks remain at moderate levels, providing a certain degree of short-term optimism as far as sustainability of the current production expansion is concerned.

A crucial factor contributing to the rapid production increase is the commissioning of new capacities. Between 2022 and 2023, Tsingshan and Delong launched 6.4 Mt of new stainless steel capacities, primarily focusing on the 300 series. Delong plans to expand its capacity further by additional 1.8 Mt in 2024. Furthermore, various Chinese companies have announced plans to build over 5 Mt of additional capacity, although the exact timing of these projects remains uncertain.

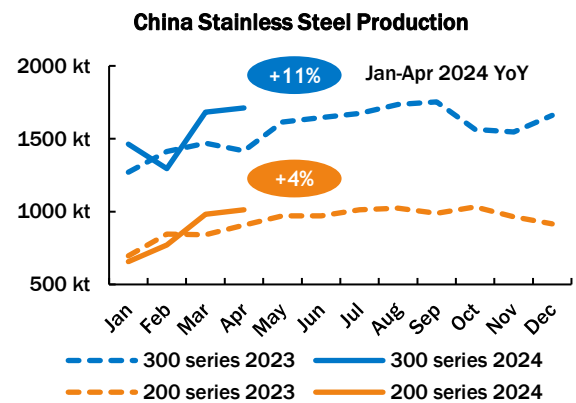
In our previous releases, we discussed how the end-use industries were driving stainless steel demand, with the chemical and petrochemical as well as food processing, pulp & paper industries being at the forefront.

Chinese stainless steel trade. Apart from the domestic use, a healthy increase in stainless steel exports provides

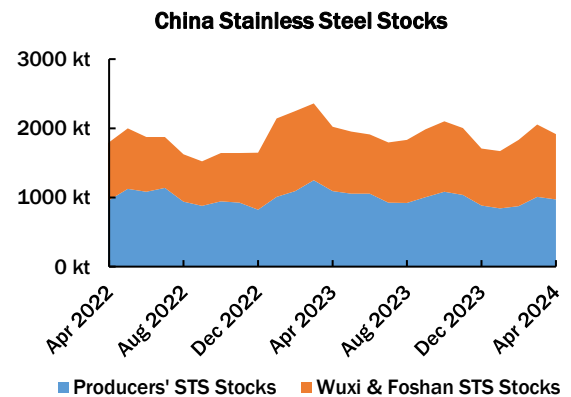
confidence in the steady industry growth in the future. In 3M 2024, stainless steel exports from China reached 1.1 Mt, increasing by 0.2 Mt (+17% YoY), with exports to India rising by 54 kt (+57% YoY), UAE by 12 kt (+44%) and Taiwan by 11 kt (+31% YoY).

Stainless steel imports into China were at 0.6 Mt, rising by 0.1 Mt (+32%) mainly due to an increase of imports from Indonesia by 0.2 Mt (+55% YoY).

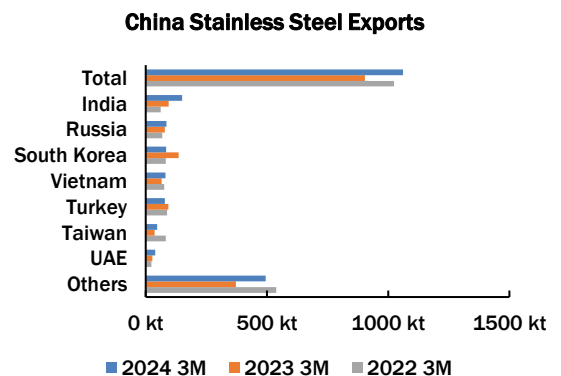
For the full 2024, we expect the 300 series production in China to grow by +7% YoY, which translates into 1,592 kt of Ni use in stainless. In 2025, we expect it to rise by 5% to 1,645 kt of primary nickel demand.



Source: Zljsteel



Source: Zljsteel



Source: Trade Data

Indonesia

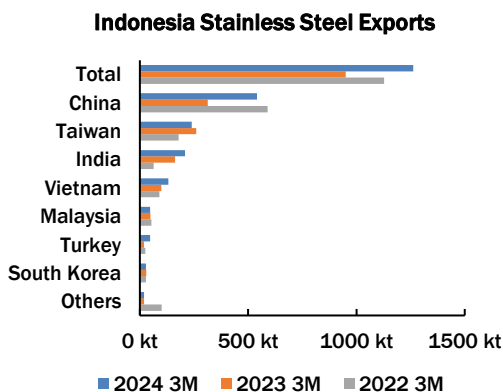
Indonesian stainless steel industry registered a 10% decline in production in 2023, with Delong experiencing a plummet of 62% YoY while Tsingshan saw a modest increase of 10% during the same period. In 2024, although Delong started the year with some signs of growth, its production began to decline from March onwards, hinting at a potentially prolonged recovery period. However, the anticipated surge in demand within the Chinese market is expected to bolster Delong, facilitating a resurgence in production. Meanwhile, Tsingshan's positive trajectory persists, with a 9% increase in the stainless steel output in the first four months of 2024.

In 3M 2024, stainless steel exports from Indonesia amounted to 1.3 Mt, increasing by 312 kt (+33% YoY) with China and other East and Southeast Asia countries being the key importers.

We anticipate the Indonesian production to be 4.8Mt in 2024 (+11% YoY), which translates into 361 kt of primary nickel demand. In 2025, we expect their output to amount to 5.2 Mt with the nickel use rising to 410 kt Ni.



Source: Zljsteel



Source: Trade Data

Europe

Despite the challenging conditions faced by the European stainless-steel sector throughout the previous year and into the early months of 2024, some notable indications of revitalisation have emerged within the market. Nonetheless, the persistent volatility across the European economic and political landscape poses a significant risk, potentially impeding the nascent recovery efforts.

Despite a recent uptick in sentiment within the European market, especially given the prolonged downturn in both demand and production over the past two years, caution persists regarding the extent of this recovery. Strikes and economic instability have erupted as additional blows to some European producers, warranting prudent navigation by the manufacturers.

Fresh hurdles in the form of strikes have intensified pressure on the European recovery. Most notably, Spanish steelmaker Acerinox has been unable to produce or ship any material from its Cadiz site since February 5th. At the same time, Outokumpu has also been affected by strikes, which lasted until April 7th, significantly hampering local manufacturing. Considering the lower levels of inventories, especially in Southern Europe, it has also been widely reported that European stainless mills are experiencing delivery delays due to ongoing issues in the Eurozone, with some orders now slated for late summer.

Additionally, if we look at the HCOB Eurozone PMI Index, compiled by S&P Global, manufacturing output within the Eurozone has sustained a thirteen-month consecutive decline in April, exerting further downward pressure on the overall economy. However, it is important to note that the rate of decline in factory output has eased to the weakest for twelve months, which could be another sign of the impending recovery.

European stainless steel output has been showing some signs of rejuvenation since August 2023, coinciding with the EU's announcement of an anti-circumvention investigation that same month. Although current data show a year-on-year decline of 1% in European Stainless production in January-February 2024, it is important to note that the decline could mainly be attributed to the protests in Spain and Finland. In contrast, other major producers, such as Belgium and Italy, have experienced increases of 10% and 1%, respectively, in the first two months of 2024. On another positive note, Deutsche Bank recently predicted that in June 2024, the ECB is expected to cut interest rates for the first time. Considering the negative impact of high interest rates and inflation on stainless demand in 2023, this could be a positive sign for the economic recovery.

Low order books were one of the key issues in 2023 in Europe and the US. However, currently, many European

producers have found themselves under pressure to deliver on time due to a surge in orders resulting from protests in Outokumpu's Tornio and Acerinox's Cadiz sites. Despite this increase, most orders are still related to the domestic supply issues rather than a rise in end-user demand.

Ever since September 2023, the stainless steel cold rolled coil spot prices have been on a constant rise. While the prices are still significantly lower than the peak price of ~€5,150/t in April 2022, current prices are at the highest level since May 2023 and stand at ~€2,615/t. One of the most significant factors behind this price rise was the tightening of the European trade policies rather than a genuine uptick in demand. In May 2024, the European Commission concluded its investigation regarding new anti-dumping measures against Vietnam, Turkey and Taiwan. As a result, the Commission has extended its anti-dumping and anti-subsidy measures to cold-rolled flat stainless steel products originating from Indonesia, which found their way into the EU after some nominal processing in Vietnam, Turkey and Taiwan. Some producers will now be hit by the rates of up to 40% in some cases, inflicting a significant cost on importers. However, this measure won't apply to other domestic producers of the countries in question.

While the European markets are still struggling to navigate through geopolitical uncertainties and supply constraints, we believe that 2024 will finally be the year of the long-awaited reduction of the negative momentum and may even bring a recovery in some European markets. In our baseline scenario, we expect European production to stay flat and anticipate only a slight year-on-year increase in 2024.

However, our optimism is somewhat subdued since our proprietary end-use model shows that in Jan-May 2024, the demand for nickel by the downstream sectors in Germany, which is the locomotive of the European economy and accounts for approximately 24% of the total EU nickel use, has continued to plummet. According to the latest data from the Deutsche Bundesbank, nickel end-use has fallen significantly by 11% YoY. The construction sector, the second biggest end-use sector in Germany, is the only sector showing some signs of recovery and has increased by 1% since the start of 2024. At the same time, the machinery sector, which is the largest end-use sector for nickel by a mile and accounts for roughly 70% of all demand, has continued to drop by almost 12% since January 2024.

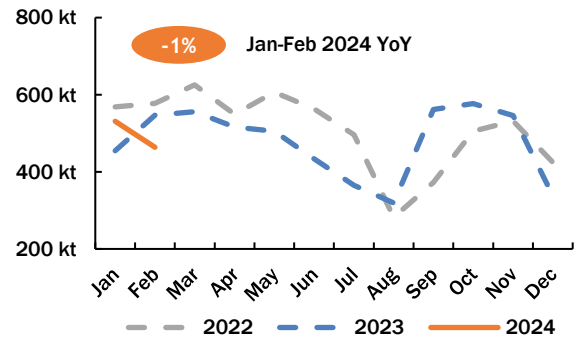
In 2023, the stainless steel output in Europe dropped by about 7% YoY, putting the total melt output at about 5.7 Mt and the nickel demand at 125 kt Ni.

Considering the adverse effect of the political unrest in the European markets, we expect the stainless steel output in 2024 in Europe to stay flat. While some EU countries are

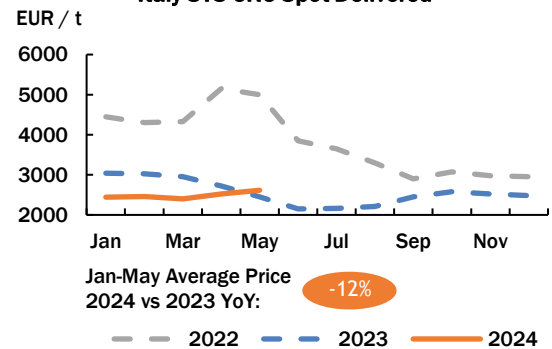
currently experiencing positive dynamics, idle production in Spain, as well as partially in Finland, will have a major impact on the overall production figures, making it quite challenging to achieve a significant recovery.

For 2024, we forecast that European markets will experience a negligible growth of only 0.5%, which will put its total output at 5.8 Mt with the nickel demand remaining flat at 125 kt Ni in 2024. In 2025, we expect a recovery of nickel use in stainless to 132 kt Ni.

European Stainless Steel Production



Italy STS CRC Spot Delivered



Source: Kallanish

USA

Contrary to Europe, the US stainless steel sector has been going through a positive phase for the past four months. Moreover, in February 2024, the US experienced a double-digit year-on-year growth for the first time since July 2021. While Europe has experienced a major setback due to strikes, the market outlook for the US remains mostly positive. However, domestic mill bookings are reported to be relatively low, with some stainless products being shipped internationally to compensate for the absent flow of the materials from Southern Europe resulting from strikes at Acerinox's Cadiz site.

The US has continued to enjoy positive dynamics in nickel end-use sectors and has already achieved a double-digit growth not once but twice, which did not happen at all last year. In January-May 2024, the overall nickel use increased by 7% YoY. The current positive trend of nickel end use is mainly driven by the Oil and Gas (+47% YTD), Power

Generation (+11% YTD) and Construction (+10% YTD) sectors.

In 2023, we revised our USA's stainless steel nickel use forecast downwards to 29 kt, with the total melt output amounting to 1.8 Mt.

We believe that in 2024, the US melt output will keep its strong momentum, which began at the end of last year. However, the scale of it largely depends on the reduction of interest rates, which have continued to put significant pressure on the global industrial and construction sectors.

Thus, we expect that the US total melt output in 2024 will grow by 6%, which amounts to 2.0 Mt in 2024, with the nickel use increasing to 30 kt Ni. In 2025, we forecast a further growth to 31 kt Ni.

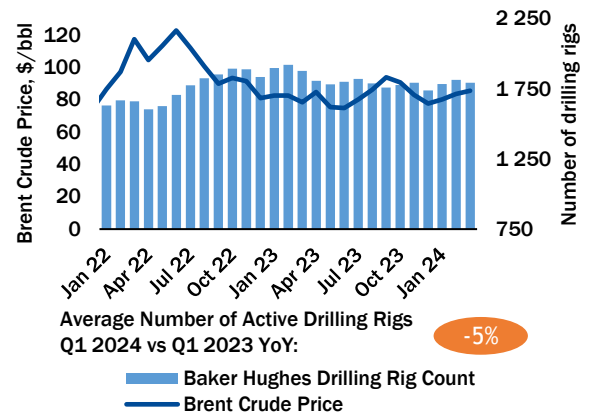
ALLOYS & SUPERALLOYS

In 2023, the demand for nickel alloys exceeded our expectations. We expect a similarly positive trend to continue throughout 2024 and into 2025 with aviation being the main driver. On the negative side, the liquefied natural gas (LNG) sector, which also uses nickel alloys, has been experiencing sluggish demand growth. On the back of the record increase in the global export capacity, LNG is expected to be in oversupply within the next two years, according to the latest report by the Institute for Energy Economics and Financial Analysis, which could be a negative factor for the longer-term growth of nickel alloys.

At the same time, according to BloombergNEF, LNG is expected to see limited growth this summer. On the plus side, it will likely surge in the upcoming winter and the summer of 2025, provided the new US projects come to fruition, and the planned production ramp-up comes along as initially expected. Nickel alloys are essential for this application because of the strict safety regulation of LNG storage at temperatures of -162°C, further boosting the demand for alloys.

If we compare year-on-year data, project development in the oil & gas industry was in a continuous decline from Q3 2023 to Q1 2024. However, in Q1 2024, the total number of active drilling rigs was only 1% lower than the average number of active rigs in 2023.

The five largest international oil companies plan to increase their 2024 CAPEX by 5% YoY, which is lower than the year before (+9% YoY in 2023). In 2025, the planned investment growth is expected to continue at the same pace of 5% YoY. Considering the ever-growing number of project bids won by the European and US mills and the solid financial performance of the oil & gas industry, we expect the use of nickel, especially in Inconel 625, to keep the momentum well into 2025.



Source: Baker Hughes

In 2023, new orders for jet engines rose significantly, with commercial engine sales increasing by 15% YoY. However, military engine shipments have dropped by 10% YoY, which equals to about 15% of all the engines delivered in 2023. So far, the positive trend was maintained in Q1 2024, with commercial engine sales rising by about 10%, further boosting the demand for nickel in superalloys. Military jet engines have also increased, however, only by 2% YoY. Additionally, deliveries of new aeroplanes from Boeing and Airbus have kept rising and increased by around 11% YoY in 2023. Boeing also expects to boost its production to approximately 50 jets per month in 2025/2026 – a figure comparable with the pre-pandemic rate of 52 jets per month. However, the head of the US Federal Aviation Administration has recently said that Boeing must improve its safety culture and address quality issues before the agency approves the new production plan.

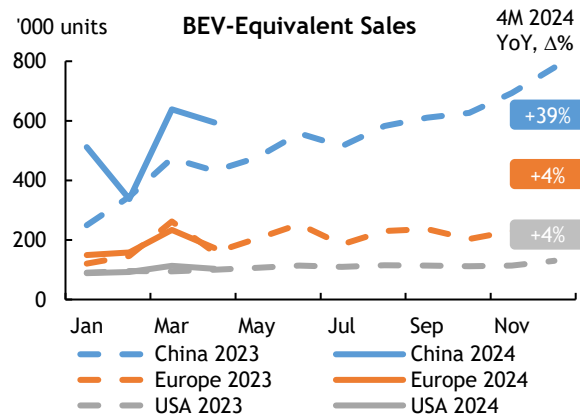
When it comes to China, in 2023, COMAC introduced its C919 jets, which have now successfully entered commercial operation under China Eastern Airlines. As orders grew, COMAC reportedly decided to expand its Shanghai C919 plane factory and is now aiming to reach an annual production of 150 C919 in five years. Additionally, based on the success of C919, COMAC has also started designing C939, a new twin-aisle airliner, which is expected to be the largest aircraft to date with a total seating capacity of up to 400 passengers.

Regarding the jet engines, currently, all of them are imported; however, from 2025 onwards, China will have domestically produced jet engines, further boosting the production of superalloys. Furthermore, China has also been experiencing a boost in the construction of nuclear power plants, and according to the chairman of China National Nuclear Corp., it is expected to approve as many as 10 new reactors each year. Nickel-based high-performance alloys are irreplaceable by other materials in the nuclear power sector, the demand for which is expected to soar even further with the ever-increasing pace of construction of nuclear power plants in China.

Overall, we expect the alloys sector demand to increase in 2024 to 193 kt (+9% YoY), while that of the superalloys sector to grow in 2023 to 77 kt (+11% YoY). In 2025, nickel use in alloys and superalloys is expected to maintain its strong momentum and reach 205 kt and 85 kt Ni, respectively.

BATTERIES

In January-April 2024, nickel use in the battery sector has been growing at a healthy pace, with nickel demand by China's PCAM production rising by 15% YoY. We expect the current dynamics to continue throughout the year as a restocking cycle has likely commenced in the EV battery supply chain, with *the nickel demand in batteries to increase by 11% YoY to 517 kt Ni. In 2025, we forecast it to rise further to 587 kt Ni* amid wider EV penetration and EV cost reduction due to lower vehicle prices and increasing model availability in a highly competitive environment.



Source: SNE Research

In Jan-Apr 2024, global BEV-equivalent sales¹ increased by +23% YoY. Sales in China grew by 39% YoY, primarily driven by rising PHEV sales, which surged by 91% YoY, while the growth rate of BEV sales was materially smaller (+34% YoY only).

In Europe and the US, BEV sales grew by only 1% and 2% YoY, respectively. European sales were negatively affected by an unexpected removal of EV subsidies in Germany in December 2023 and more stringent eligibility conditions to access EV government incentives in France from January 2024. The US sales were constrained by the stricter 2024 regulations as the number of vehicles eligible for federal tax benefits was reduced.

On the other hand, combined sales of HEV and PHEV surged by 32% in Europe and 34% in the US. HEVs and PHEVs gained wide acceptance by consumers given lower initial costs (comparing to BEVs), considerations of range,

total cost of ownership, as well as high confidence in used car prices, especially for HEVs. Overall, this shift in trends is likely to be more positive for OEMs that offer multiple powertrain options, including BEVs, PHEVs and HEVs.

China, the epicentre of the current EV growth, has recently upgraded its NEV share target. In 2020, the government set a goal of 50% by 2035, with intermediate targets of 20% by 2025 and 40% by 2030. However, it now aims to raise NEV share to 45% by 2027 as NEV sales accounted for over 30% of total sales last year, already achieving the 2025 target ahead of time.

In Europe, several projects were announced in 2023 with a total combined capacity of over 210 GWh. Those projects include the Romvolt battery factory in Galați, Romania, a JV between Gotion High-Tech and InoBat in Šurany, Slovakia, as well as a joint venture by Tata Group and Jaguar Land Rover in Somerset, UK. However, there have also been quite a few notable cancellations, such as Italtel's factory in Italy, which has moved its new factory to the UAE, and one of the battery plants of PowerCo initially planned for Eastern Europe, has been put on indefinite hold.

As we have covered in our previous issues, the European battery sector faces a high risk of the planned battery production being delayed, scaled down, or outright cancelled unless Europe introduces incentives similar to the US's IRA. However, 2023 and the beginning of 2024 have been marked so far by cuts in subsidies in some EU countries and industrial sectors, such as an abrupt end of the EV tax credits in Germany, mainly attributed to the budget cuts. While major OEMs have promised to compensate customers directly for the loss of subsidies, this added to the burden on the EV industry, which has already been under significant pressure since 2023.

As it stands, our forecast for the 57 announced factories is 1.6 TWh by 2030 in Europe, with over 45% of their output being furnished by Asian equipment. At the same time, the announced PCAM capacities in Europe make up 33% of the theoretical demand by the gigafactories, and CAM takes up about 45% of the demand.

Given the low available PCAM capacities in Europe and the limited pipeline of upcoming projects – which itself is heavily influenced by a limited material supply originating from within the region – we maintain our view that the required nickel will have to be exported from Asia primarily. There, it will be used to expand local PCAM capacities even further, thereby increasing China's influence over this market.

¹ Under this methodology, HEV and PHEV are re-calculated in BEV equivalents according to their relative battery capacity ratio: HEV 2 KWh vs PHEV 12 KWh vs BEV 55 KWh

When it comes to the US market, this year has also delivered some mixed signals. On the positive side, Ultium Cells, a JV between General Motors and LG Energy Solutions, has begun shipping its first battery cells to GM. The project's annual production capacity is estimated at 50 GWh. However, there have also been some setbacks. It has been recently reported that Ford started reducing its EV battery orders due to substantial losses on the technology, leading the company to scale back its electrification plans. Additionally, Bloomberg Intelligence reports that while the US is confronting now the reality of the reduction in the demand that falls short of expectations, battery makers in South Korea, China and other countries are also dealing with a backlog of unsold inventory.

Examining the US sales data reveals additional proof of a slower rate of electrification. Although HEV and PHEV sales in Jap-Apr 2024 have surged by 34% combined, BEV sales have fallen short of expectations, increasing by just 2%. Wood Mackenzie attributes this trend to weakening federal regulations on greenhouse gas (GHG) emissions and fuel economy, projecting that the total number of BEVs by 2050 will be 50% lower than their base case scenario.

Additionally, the US November elections could potentially slow down the current energy transition efforts, putting nearly \$1 trillion at stake. While it is unlikely that IRA would be revoked entirely, even small changes could cause delays or possibly lead to the abandonment of the short-term net zero goals.

One of the hot topics at the policy level in 2023 and 2024 has been the further abandonment of free trade principles by the West and the expansion of trade wars. In particular, it concerns a potential introduction of trade tariffs on cheap Chinese EVs flooding the European market. In May 2024, the US followed suit and announced a sharp rise in tariffs on Chinese imports, which included electric vehicles. Similarly, Canada has stated that its government is also exploring higher tariffs on the EVs of Chinese origin. While Europe has been considering a similar move since October 2023, following a launch of an investigation into Chinese EV imports, this decision carries more weight for the EU than for the US. According to the Centre for Strategic and International Studies (CSIS) think tank, only 2% of the US imports of EVs currently come from China. As mentioned earlier, the EU has a significant battery supply gap, which can only be filled by non-European companies or vehicle imports, many of which come from China.

Given the substantial investment required to reach the electrification targets, which also happen to come mostly from outside Europe, as well as Chinese dominance in material refining (Li, graphite, etc.) and technological know-how, Europe will need to introduce its own IRA-like alternative to avoid significant setbacks in achieving its current environmental goals.

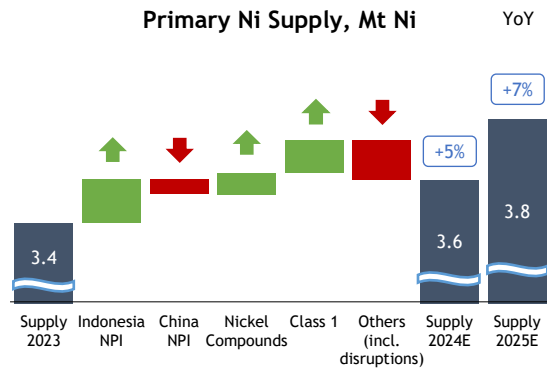
Recent innovations, such as cell-to-pack technology, have significantly enhanced the capacity of LFP batteries. The latest versions from CATL offer impressive performance, including a driving range of over 800 km and the ability to deliver 350 km of range with just a 10-minute charge. Moreover, the production cost of LFP batteries is approximately 20% lower than that of nickel-containing chemistries, contributing to their widespread adoption. As a result, since 2022, LFP batteries have achieved a market share of over 60% in China.

In the near term, this market dominance is expected to continue. However, the landscape may shift in the late 2020s with the expected mass adoption of solid-state batteries. These advanced batteries are projected to increase the energy density of high nickel content batteries from the current 300 Wh/kg to 500 Wh/kg. In comparison, LFP battery cells have reached an energy density of 180 Wh/kg only, with further improvements proving to be difficult.

The significant increase in battery capacity provided by the solid-state technology will enable smaller, lighter batteries while maintaining acceptable ranges. This reduction in battery size and weight will decrease the vehicles' energy consumption and enhance the competitive advantage of BEVs. Consequently, the anticipated advancements in solid-state batteries could reshape the market and potentially reduce the dominance of LFP batteries in the long term.

In summary, we maintain our view that the EV sector will continue its reliance on nickel demand in the long term. While the LFP share has been growing in recent years and is widely reported to claim a larger portion of the market in the future, geopolitical tensions with China may pose a significant obstacle to the Western OEMs' plans to adopt LFP or NA-ion batteries. Moreover, nickel batteries have a significantly better recyclability profile. Compared with LFP batteries, the higher value of active materials in NCM batteries provides greater potential margins for recycling companies, making NCM batteries more attractive from a critical life cycle assessment perspective.

SUPPLY



Source: NN Analysis

The nickel market ended 2023 in a state of surplus on the back of the persistent Indonesian and Chinese supply growth with a downward direction of supply in the most of other jurisdictions. This growth was primarily fuelled by the continued expansion of Indonesian NPI, NPI-made nickel matte and HPAL intermediates, which was partly offset by the decrease in Chinese NPI, global FeNi production curtailments as well as depressed non-Chinese & non-Indonesian Class 1 output.

Along with Class 2, the high-grade nickel market ended 2023 with a slight surplus resulting from a continued rise in the nickel metal supply from new refining capacities in China and Indonesia and soaring Chinese nickel compounds output. However, considering delays in new mining permits issuing, which translated into some ore shortage in Indonesia in 2024, as well as potential supply curtailments in Australia and New Caledonia, we expect the market surplus to decline from the previous year's level. **According to our latest estimates, the refined nickel production will grow further by 5% YoY, reaching 3.6 Mt Ni in 2024** (including disruption allowance of 100 kt Ni).

We expect that the ramp-up of the new Indonesian nickel projects will continue, which, coupled with the commissioning of new Class 1 operations in China and Indonesia, will make **primary nickel production grow further to 3.8 Mt Ni (+7% YoY) in 2025**.

LOW-GRADE NICKEL

NPI

The Indonesian government's decision to impose an early ban on nickel ore exports in 2020 was aimed at enhancing the value derived from resources' sales. This strategic move has resulted in the rapid establishment of sizeable production facilities within the country, solidifying Indonesia's status as the new global centre for nickel production. Notably, the production of NPI surged to 1.39 Mt Ni in 2023 (+21% YoY).

However, since the second half of 2023, the approval process for new ore mining quotas has encountered delays, prompting industry players to resort to importing ore from the Philippines. Delays in the approval of quotas continue into 2024. As a result, according to a report by Antam, one of the largest nickel ore producers, the production in Q1 2024 fell by 58% YoY and the average ore grade fell from 1.7-1.8% to 1.6%.

According to the latest updates, the government has reportedly issued mining quotas for 170 Mt, representing 65% of the targeted consumption of 260 Mt for 2024. Despite these ongoing challenges, new NPI production capacities continue to come online in Indonesia, though at a reduced pace. There are market rumours suggesting that later this year, the new government may introduce a ban on the construction of new NPI plants.

We expect Indonesian NPI production to reach 1.57 Mt Ni (+13% YoY) in 2024 and 1.7 Mt Ni (+9% YoY) in 2025.

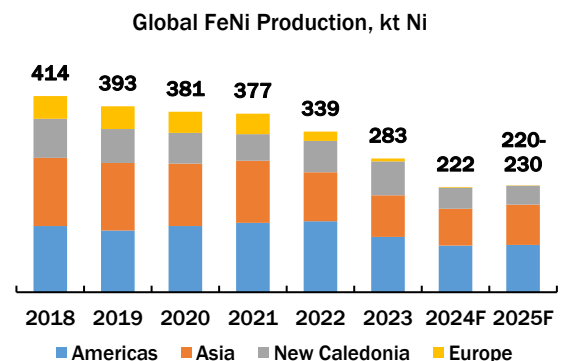
Chinese NPI output has been declining as a result of the growing production in Indonesia and negative production costs. **We expect Chinese NPI production to fall to 330 kt Ni (-15% YoY) in 2024 and to 270 kt Ni in 2025.**

NPI-to-matte

This year, we expect a higher NPI-to-matte conversion driven by the ramp-up of four projects commissioned in the Weda Bay Industrial Park in 2023. This increase will occur despite approximately 50 kt of nickel being allocated for nickel metal production through the Tsingshan and CNGR joint venture. **We estimate the NPI-to-matte conversion to reach 302 kt Ni and 427 kt Ni in 2024 and 2025, respectively.**

Ferronickel

Based on our latest estimates, the FeNi production in 2024 is projected to continue its decline to 222 kt Ni (-21% YoY), suffering from the low price environment (FeNi is traded at a discount to the LME, at a level close to the NPI prices) and high production costs, some major producers' capacity utilisation rates being low or even decreasing further.



Source: NN Analysis

After having been under the restrictions for 14 months, Solway's Fenix plant in **Guatemala**, was officially removed by the US Department of Treasury (OFAC) from its SDN sanctions list in January 2024. Solway's Guatemalan entities Pronico and CGN are still in the process of obtaining export permits from the Energy & Mining Ministry, which is a requirement to resume operations and rehire more than 1,000 workers employed by both companies. It is expected that the production volumes to remain at low levels in 2024.

The other Solway's facility – the Pobuzhsky plant in **Ukraine** is still mothballed almost 1.5 years after it halted production in November 2022 due to the ongoing military conflict in Ukraine.

The large South American producer Falcondo from **the Dominican Republic** was gradually reducing production last year until it announced a halt of production in November because of a 2023 price drop, which strongly impacted ferronickel producers worldwide. We presume that the Company will remain halted till the end of this year at the very least.

Brazilian ferronickel majors Barro Alto & Codemin, owned by Anglo American, reported flat output year-on-year in 2023. However, the latest production forecast has a downward trend for 2024-2026. Moreover, Anglo claimed in May that it is considering an option to either place its ferronickel operations on C&M or a potential divestment.

Another Brazilian producer Onça Puma owned by Vale has shown quite low production rates in 2023 and is expected to maintain its low operating rates this year both on the back of the challenging market situation and for operational reasons.

Following its volume-control policy to maintain profitability in depressed market conditions, the largest **Japanese** FeNi producer, PAMCO, has maintained a limited output level throughout 2023 and plans to keep it throughout 2024. The second largest Japanese facility – Hyuga plant, which is owned by Sumitomo Metal Mining, also reduced its FeNi output in 2023 and plans to decrease it further in 2024.

The only **Burmese** nickel producer – Tagaung Taung's plant, which was facing operational challenges after the military coup in Myanmar (Burma) and the sabotage of the electricity pylons in 2022, kept its 2023 output flat YoY, which was well below its nameplate capacity. The 2024 output might decrease further on the back of low FeNi prices and never-ending Burmese social unrest.

South Korean POSCO has started its switch into nickel sulphate production, which will lead to a corresponding decrease in their FeNi production from 2024 onwards.

In Europe, **Serbian**-based NewCo Ferronikeli plant owned by GSOL was placed on C&M in April 2021 and relaunched

in June 2023 after a 20-month hiatus caused by energy supply issues. NewCo Ferronikeli output in 2023 was well below its nameplate capacity and its perspectives for 2024 remain unclear.

Another GSOL-owned European producer from **Northern Macedonia** – Euronickel Industries Kavadarci plant, which was placed on C&M in 2022, relaunched in 2023 but was still operating at low rates because of high energy costs and a decline in orders. According to the local media reports, it is going through a bankruptcy procedure now, so any notable production in 2024 is unlikely.

Two **New Caledonian** ferronickel giants – Eramet's SLN Doniambo and Glencore's Koniambo – both showed strong production results in 2023. However, their 2024 production perspective seems to be quite gloomy. Despite the offered support from the French government to subsidise energy prices and some commitments to invest in energy infrastructure to boost supply for the benefit of the local nickel plants, Glencore announced its decision to stop funding its loss-making asset and put it on sale, placing it on C&M in February 2024. At the same time, despite reaching an agreement with the French government to preserve the Group's balance sheet, Eramet has reconfirmed its decision not to provide any further financing to its New Caledonian business. So, SLN's Doniambo continues to face major challenges and its financial situation remains critical. Besides, all mining activities in the Northern Province have been suspended since mid-April. Eramet claims that the administrative process for their resumption is underway. Considering the scale and brutality of civil unrest in New Caledonia, which started in the middle of May, we presume that the output of local nickel producers is currently at minimal levels, which puts additional pressure on the local nickel industry further impacting the likely 2024 ferronickel output figures.

We estimate that, depending on the market situation, the 2025 FeNi production could stay relatively flat YoY in a range between 220-230 kt Ni on the back of Brazilian Onça Puma's potential ramp-up after operational challenges and due to a scheduled start-up of the second furnace, Antam launching its facility in Halmahera while Solway's Fenix plant in Guatemala might raise its output after the lifting of sanctions as well.

At the same time, we understand that some probable cutbacks in the FeNi output could also emerge as South Korean POSCO has started its switch from the FeNi to nickel sulphate production, while Pobuzhsky plant as well as Larco, Euronickel Kavadarci and Falcondo facilities might stay on C&M indefinitely and New Caledonian Doniambo might reduce its output because of the financial pressure and the consequences of New Caledonia's rapid descent into civil chaos.

Taking into account the high costs of production as well as the remaining price pressure backed by the persisting oversupply (especially in Class 2 Ni products), a swift restoration of the previous output rates is not expected in the near term.

Nickel Oxide & Utility Nickel

We expect the nickel oxide and utility nickel production to grow to 31 kt Ni (+10% YoY) in 2024 after it decreased to 27 kt Ni last year.

The only intermediates' supplier of the **Japanese** Matsusaka refinery, Indonesian nickel matte producer PTVI, increased its output in 2023, benefiting from the improved mine grades and better furnace performance after the C&M was completed in 2022. Their 2024 production is expected to be flat year-on-year. However, despite the higher feed source availability from PTVI, Vale has reported a lower refined nickel production figure for 2023. Our understanding is that under the pressure of the unfavourable price environment and lower stainless output in Japan, Matsusaka produced less Tonimet in favour of a higher crude nickel oxide output, which was used as a feed source for Vale's Clydach refinery in the UK. We believe that Matsuzaka Tonimet production will stay more or less flat in 2024-2025 depending on the market situation.

Cuban Punta Gorda's crude nickel oxide output decreased in 2023 as the Cuban economic crisis ground on coupled with the US embargo, inflationary pressure, regular blackouts, food shortages and social unrest. We understand that the previously announced investment programme aiming at upgrading the production equipment to debottleneck the output either has not yet started or hasn't brought any results yet.

We expect the nickel oxide and utility nickel production to increase slightly in 2025.

We believe that Matsusaka's Tonimet production will remain flat year-on-year or slightly increase, depending on the situation in the Japanese stainless market, while Cuban Punta Gorda's plant production might also modestly increase depending on the results of their grappling with the ongoing economic crisis, the progress of their production equipment modernisation programme and the results of the governmental efforts to attract desirable foreign investors to the local mining sector. The results of the upcoming US Presidential elections in November could also be considered as yet another uncertainty for the future Cuban development.

HIGH-GRADE NICKEL

Class 1 Nickel

Our latest Class 1 production estimate for 2024 is at 1.0 Ni (+15% YoY). Nickel metal and powder production is expected to grow steadily in 2024 due to the launch of new Class 1 nickel capacities in China and Indonesia.

In **Canada**, Vale's Copper Cliff pellets and powder production is expected to stay relatively flat year-on-year as the finished nickel production from the Sudbury-sourced ore is not expected to grow in 2024 both due to a series of planned maintenance works in the mining operations, smelter and refinery, scheduled for Q2 and Q3, and plans for a lower 3rd party feed use. The latter might probably be substituted by the Thompson ore stream. Long Harbour rounds' output is forecast to grow in 2024 as a result of the continuing ramp-up of the underground VBME project and the projected growth of the Thompson concentrate flow to the refinery.

The **UK**-based Clydach refinery is anticipated to increase its carbonyl nickel output in 2024, given that PTVI matte production continues to benefit from the improved mine and furnace performance after the earlier completed maintenance works have achieved a more robust performance of the Indonesia-Matsusaka-Clydach flowsheet.

The major **Chinese** metal nickel producer Jinchuan has increased its cathodes & powder output by 7% YoY reaching a production level of over 160 kt in 2023. Furthermore, the company commissioned a new 30 ktpa Ni production capacity last year, which is expected to contribute to the 2024 growth.

Glencore's Nikkelverk refinery in **Norway** has substantially increased its output in 2023 to 95 kt largely due to a recovery from a low base of 2022 when the output was impacted by a lengthy strike at Raglan mine and a 10-day strike at Nikkelverk refinery.

Trade data shows that Glencore has increased the imports of carbon-intensive Indonesian matte significantly in 2023 (~18 kt Ni in 12M 2023, +358% YoY), which could affect the carbon footprint of its production. Although, based on the available trade data for Q1 2024, there were no identifiable nickel matte imports from Indonesia to Norway. Nikkelverk's 2024 output is expected to remain flat at around 95 kt Ni.

In **Australia**, Glencore demonstrated lower year-on-year production at the Murrin-Murrin refinery in 2023 due to the planned major maintenance and the subsequent phased ramp-up. We expect their production to increase in 2024 moving closer to its nameplate capacity.

BHP's Nickel West total refined nickel output was in 2023 due to a downtime at Kwinana refinery, bad weather conditions and the reported issues with the 3rd parties' ore quality, which was partly offset by inventory drawdowns. Nickel West production is expected to decrease in 2024 as a result of scheduled maintenance works at Kwinana refinery and a decision of BHP's partner Wyloo Metals to suspend its operations, which will consequently affect BHP's concentrate input. Moreover, BHP has recently reported that it continues to review its plans for Western

Australia nickel with a focus on preserving cash, which includes optimising operations and maintenance schedules, reviewing capital plans, and reducing contractor spending and equipment hire. The review also includes assessing the possibility of placing Nickel West into a prolonged C&M.

Japanese Sumitomo Metal Mining steadily increased its 2023 Class 1 nickel output after experiencing the weakest results over several years in 2022, caused by feed shortages from the Filipinos JV's HPAL operations and Indonesian PTVI. We believe that SMM's output will increase in 2024 further on the back of a stable supply of nickel matte from PTVI and MSP from the Philippines-based HPAL facilities Taganito & Coral Bay JV.

Ambatovy – a nickel producer from **Madagascar** – slightly increased its nickel briquette production in 2023 but didn't manage to reach a level of 40 kt Ni. Ambatovy started to face facility process issues, so in the second half of 2023, their nickel briquette production gradually reduced reaching in Q1 2024 the lowest recorded quarterly output level in the last couple of years. We expect Ambatovy's production to decrease in 2024 further while it battles with operational issues.

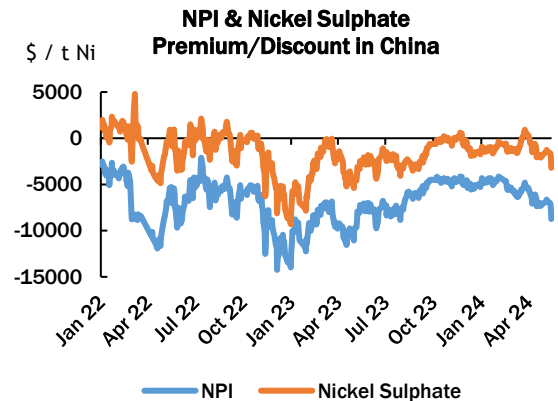
In 2023, Anglo American's **South African** Rustenburg plant's production of nickel cathodes modestly increased despite a ramp-up period after the Polokwane smelter rebuild and an impact of Eskom load curtailments. We expect their nickel cathodes production to increase in 2024 if no major operational challenges or electricity supply disruptions take place. Implats – the second biggest South African nickel producer – decreased its nickel briquettes output in 2023 mainly due to maintenance and the continuous power constraints impacting operations. We understand their nickel briquette output will increase in 2024 reverting to its normal levels, provided there are no major operational disruptions.

Sibanye-Stillwater's Sandouville plant in **France** recorded an almost flat total nickel production in 2023, meeting the guidance despite being constrained by operational issues and unfavourable weather conditions. Nickel cathode production was prioritised over nickel salts due to weaker plating markets.

Sibanye is planning to increase total nickel production at their Sandouville refinery further to 7.5-8.5kt Ni in 2024 benefiting from the improved operating performance and production stability following repairs to the cathode units in the electro-winning circuit in mid-2023 and other improvements to the plant. As a result of a build-up in nickel salts inventory and anticipated lower demand for salts, Sibanye is maximising its nickel metal output.

New Class 1 Capacities in China and Indonesia

As discussed in our earlier issues, the overproduction of nickel in Indonesia has resulted in significant discounts to the LME price. Considering that the cost of converting NPI to sulphate is approximately \$3,000, with an additional \$1,500 required to produce Class 1 nickel, a number of industry players have opted to capitalise on these discounts.



Source: SMM

In 2023, due to the commissioning of new capacities by GEM, Huayou, CNGR, Jinchuan and other industry players, China's Class 1 nickel production increased to 249 kt (+39% YoY). We project that China's Class 1 output will reach 341 kt (+37% YoY) in 2024 and 378 kt (+11% YoY) in 2025, driven by the continued ramp-up of the new capacities. Additionally, in 2024, 46 kt of Class 1 nickel is expected to be produced at the new Tsingshan and CNGR JV facility in Indonesia. Furthermore, Tsingshan plans to commence operations at another 50 ktpa plant in Indonesia, potentially increasing their total output to 68 kt by 2025.

Russia

The 2023 consolidated nickel output decreased by 5% YoY to 209 kt (practically all of which were produced from the Company's own Russian feed), which was in the middle of the production guidance range of 204-214 kt. Lower production volumes in 2023 were owing to the decrease in mined ore volumes due to the testing of the mining machinery from new suppliers and the planned phased replacement of the existing equipment fleet.

In 2023, furnaces at Nadezhda Smelter and a grinding mill at Talnakh Concentrator in our Norilsk Division were successfully serviced following the regular annual maintenance schedule.

In our Kola Division, technological processes were optimised leading to an improvement in the quality of nickel cathodes and a reduction of cobalt and zinc impurities by 50%.

In addition, in line with our diversification strategy, Nornickel produced and supplied a trial batch of premium-quality nickel for the electroplating sector.

Last year marked a major milestone in our environmental strategy with the launch of the Sulphur Program at Norilsk's Nadezhda Smelter, aimed at a drastic reduction of sulphur dioxide emissions in the Norilsk Industrial District and improving the quality of life in the city of Norilsk. The project construction was carried out 24/7 and took more than three years to complete. When the project reaches its full capacity, it will help meet the new legal requirements for reducing pollutant emissions in Norilsk by at least 20% in 2024, and by 45% in 2025, from a 2015 baseline.

Last year, the Company also focussed on joint business diversification projects to support technology innovation. Polar Lithium, a joint venture between Nornickel and ROSATOM, has been awarded a licence to develop Russia's largest lithium deposit Kolmozerskoye. The development of this deposit will enable us to become Russia's first-ever producer of lithium-bearing raw materials and eventually high-tech products such as lithium-ion batteries.

In Q1 2024, Nornickel decreased its nickel production by 10% YoY because of the accumulation of work-in-progress inventory, which will be processed in the second quarter.

The Company's mines continued to increase ore production after testing and putting into operational commissioning the equipment from new suppliers at the end of the last year.

In 2024, we expect that the risks related to the adverse geopolitical situation will continue to impact our operations. Nornickel continues its assets' modernisation and repairs programme aimed at improving industrial safety. As previously announced, we are planning a major reconstruction of the flash smelting furnace #2 at Nadezhda Metallurgical Plant, which was rescheduled from 2023 to 2024. The construction works has already begun. Complete replacement of the flash smelting furnace and modernization of peripheral equipment will improve the reliability of the technological process and increase the plant's capacity. It is expected to affect the 2024 output of finished products. During the demolition of the old smelter and the launch of the new one, the main processing load will be redirected to furnace #1. The decrease in the 2024 finished nickel output will lead to nickel concentrate inventory growth, which will be further processed in 2025 and will boost our 2025 refined nickel output accordingly.

The earlier announced plans to move our copper metallurgy production to China will not have any significant impact on the Company's nickel production.

The Company re-confirms its earlier-announced 2024 production guidance from its own Russian feed at 184-194 kt.

Overall, we expect the 2025 global nickel metal production to keep growing to over 1.1 Mt Ni (+8% YoY), on the back of the ramp-up of the new Class 1 nickel capacities in China and Indonesia.

Nickel Compounds

EV's battery sector, which is a major user of nickel sulphate, continues to expand while also keeping its lead as the fastest-growing industry for the primary nickel demand. Nickel sulphate production is largely determined by the availability of feed sources. Nickel sulphate can be produced from various feed sources using different production routes either directly from such intermediates as MHP, MSP, nickel matte, crude nickel sulphate, or by Class 1 nickel dissolution as well as by processing recycled materials (e.g. battery scrap).

In 2023, we reduced the nickel sulphate output in China as there was a partial double-counting since some sulphate was used to produce Class 1 Ni. Our new estimate of global nickel chemicals production in 2023 is 446 kt Ni (+18% YoY). *In 2024, we expect the production of nickel compounds from the primary sources, excluding Class 1 nickel dissolution, to increase to 531 kt Ni (+19% YoY).*

Despite the ongoing depressed price environment, nickel sulphate production keeps growing although at a pace lower than earlier expected. The output growth is backed by planned launches and ramp-ups of the new & existing Indonesian HPAL and NPI-to-matte conversion capacities. A number of non-Indonesian producers are also contributing to this growth.

So, despite all the recent financial challenges, New Caledonian Prony's Goro plant remarkably increased its 2023 MHP output by 21% YoY, reaching the biggest historical output in Q1 2024.

PNG-based Ramu plant continued to demonstrate transcendent operational stability in 2023: it has kept producing at a rate of over 100% of its nameplate capacity for several years in a row now. We believe that their stable production will continue in 2024 onwards.

Australian-based FQM with its Ravensthorpe plant appears to be on the opposite side of the coin. The facility managed to increase its YoY output in 2023 slightly despite the operational challenges that continued to impact their production. Despite various efforts to keep operations afloat by transitioning to a new operating strategy that involved ceasing mining activities, processing stockpiles and altering its approach to production, the site was still incurring significant current and projected losses accompanied by weak nickel prices, lower payability and high operating costs. All that resulted in a significant margin compression, which made FQM to place their

Ravensthorpe facility into care & maintenance from May 1st, 2024.

Major Chinese NiSO₄ producers, including Zoomwe, Huayou and GEM, demonstrated steady growth in 2023 with a combined result of around 40% YoY. It is expected that they will keep growing further in 2024 and onwards.

One of the oldest Chinese state-owned nickel producers Jinchuan also increased its nickel salts output by almost 47% YoY to around 40 kt Ni in 2023 as a result of a gradual expansion of its capacities in recent years. The output is expected to grow in 2024 and beyond on the back of the previously announced JV with Halu Heavy Industry to build a two-staged 280 ktpa NiSO₄ project. Its 1st stage (140 ktpa NiSO₄ designed capacity) is expected to be commissioned in 2024.

Other non-Chinese nickel sulphate producers show a different picture with either flat or even decreasing YoY output in 2023

Australian BHP has shown a 14% YoY 2023 growth of its NiSO₄ production at Kwinana, which still remained well below its designed capacity. Finland-based Terrafame's Talvivaara battery chemicals plant was placed on C&M in May-August 2023 in response to the declining prices for nickel sulphate. We believe their NiSO₄ production remained flat YoY in 2023. Terrafame recently claimed the declined delivery volumes of the battery chemicals plant were caused by the strikes in Finland in Q1 2024. In early April 2024, Terrafame announced that it had decided to bring its battery chemicals plant to a halt for approximately four weeks. The decision arose from the nation-wide strikes in Finland that had continued for several weeks and were affecting the logistical chain. The shutdown of the battery chemicals plant should not affect Terrafame's intermediates' production. Taking all that into account, we don't expect that Terrafame's nickel sulphate production may grow in 2024.

South Korean POSCO's Gwangyang plant is slowly moving forward the conversion of their 20 ktpa FeNi line into

making nickel matte, which is to be used as a feed source for their sulphate production. Initially planned to be launched in 2023, it is currently scheduled to produce its first NiSO₄ in late 2024.

The first Indonesian nickel sulphate producer Lygend Harita launched its NiSO₄ production line on the Obi Island in 2023 and finished the year with approximately 15 kt Ni output. Harita is aiming to expand its nickel sulphate production further and plans to double its production in 2024 at the very least.

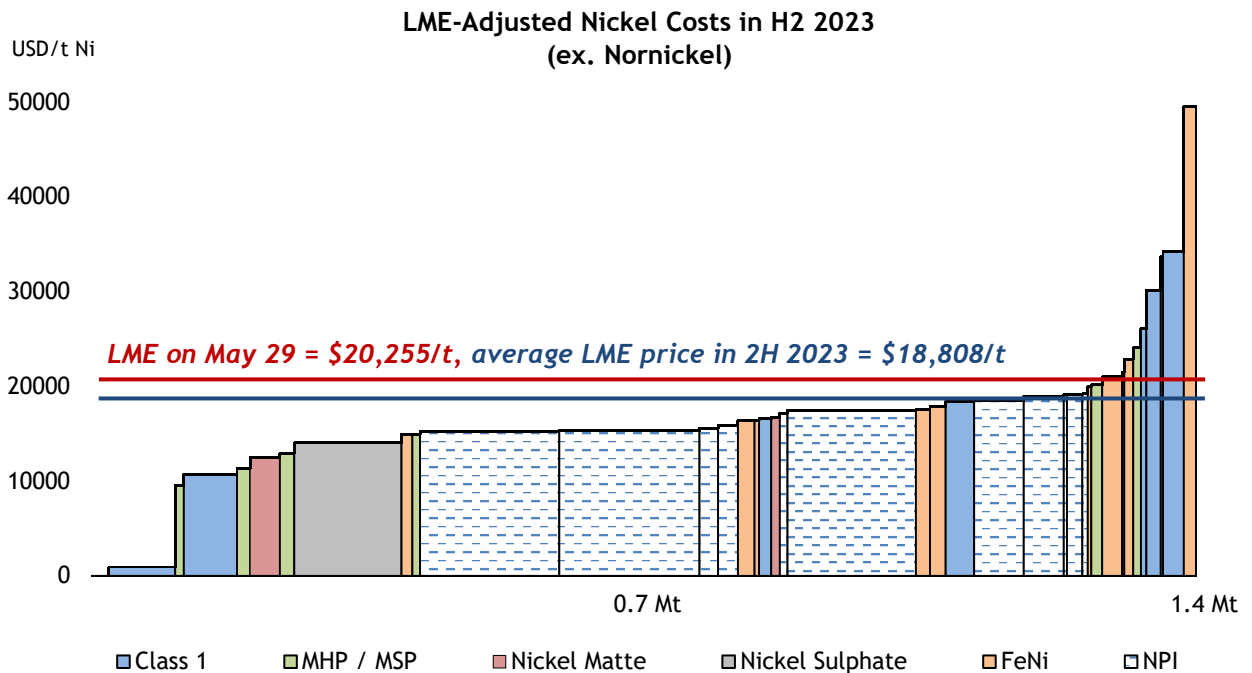
Despite the turbulent market conditions, we expect the 2024 nickel compounds' production to be at around 0.6 Mt Ni. The major contributors to the 2025 growth should be the expected launches and ramp-ups of the new & existing NPI-to-matte conversion lines and HPAL capacities in Indonesia as well as a number of other projects around the world.

HPAL

The growing trajectory of the output ramp-up and capacity expansion within Indonesia's HPAL projects persists in 2024. Lygend's Obi Island project launched its third phase in April, augmenting its capacity by 65 kt of nickel and elevating its total capacity to 120 kt. Similarly, GEM plans to bolster operations at Morowali Industrial Park with the addition of three lines, collectively contributing 43 kt of nickel capacity by the end of the year.

Meanwhile, the Huafei project, launched in Weda Bay Industrial Park in 2023 with an annual capacity of 120 kt of nickel, has demonstrated robust production growth, achieving a monthly nickel output of 8 kt by April. Concurrently, Nickel Industries has initiated the construction of the Excelsior project, designed to produce 72 ktpa of nickel, slated for commissioning in 2025. *Cumulatively, these endeavours are anticipated to drive Indonesian HPAL nickel production to 323 kt Ni in 2024 and 419 kt Ni in 2025.*

PRODUCTION COSTS



Sources: Company reports, SMM, LME, NN Analysis

2023 turned out to be a complicated year for the global nickel industry. The depressed price environment had badly affected pretty much all the producers around the globe. A large number of producers were facing lower profitability or even losses on the background of lower output, high production costs caused by lower by-product credits, growing mining inflation rates, rising labour and contractor services costs, higher consumables, electricity & fuel costs, logistical and operational constraints. However, the situation with the rising costs somewhat improved in Q1 2024.

According the producers' reports, many Class 1 nickel producers experienced an increase in cash costs in 2023. For example, Vale's VB & LH operations reported elevated costs at \$21,393/t in Q4 2023 (+20% YoY) due to higher 3rd party feed consumption, which remained high at \$21,323/t in Q1 2024 but slightly decreased (-10% YoY) because of the lower 3rd party feed purchase costs. Vale's Sudbury division costs slightly decreased to \$16,007/t in Q4 2023 (-3% YoY) supported by the higher fixed cost dilution in Clydach and keep falling to \$10,638/t in Q1 2024 (-26% YoY) benefiting from the higher availability of the own source feed and lower purchase costs. Vale's average realised nickel price was \$21,840/t in 2023 (-8% YoY), but it further decreased to \$16,848/t in Q1 2024, down by 33% YoY, mainly due to the 36% lower LME nickel average price (from \$ 25,983/t to \$ 16,589/t).

Glencore has not provided a costs split between its metal nickel and ferronickel facilities but, based on the previously provided guidance and according to the recently reported

actual total unit cash costs (incl. Koniambo), we expect that the costs of its Class 1 operations (Integrated Nickel Operations & Murrin Murrin) grew by approximately 45% YoY to around \$13,500/t in 2023. This cash cost growth was attributed to the decrease in the own source nickel production, reflecting the impact of the 2022 Raglan strike and Murrin Murrin's planned shutdown during the period. Glencore expects to improve its unit cash cost in 2024 benefiting from a higher own-source production in Canada/Norway and Australia.

Another Class 1 Ni producer, Sherritt, reported a substantial growth in its unit operating costs for nickel by 40% YoY to \$15,917/t in 2023 as a result of higher mining, processing and refining costs and lower fertiliser and cobalt by-product credits. In Q1 2024, Sherritt costs were 12% higher YoY at \$15,961/t impacted by a higher-cost opening inventory sold in addition to lower cobalt and fertiliser by-product credits.

Sherritt's net direct cash cost is expected to decrease year-on-year in 2024 to \$12,125-13,228/t due to an expected lower maintenance activity, cost optimisation, and expected higher production and sales, including increased fertiliser by-product sales.

Ambatovy demonstrated a slight 4% YoY reduction in its nickel breakeven costs in FY 2023, benefiting from lower coal & sulphur prices. This was partly offset by the decrease in production constrained by the facility process issues and lower cobalt by-product credits. However, the costs remained well above the current nickel price reaching \$28,880/t Ni. Ambatovy has reported continuing its efforts

to decrease its costs further, aiming to reach a level of \$26,235/t Ni in FY2024 which could be a 9% YoY decrease.

A European high-grade nickel producer Sandouville, which belongs to Sibanye-Stillwater, has reported a very high nickel-equivalent sustaining cost, which increased by 10% YoY to \$35,474/t in 2023. It was primarily affected by the higher costs relating to the plant's maintenance and an increase in variable costs (reagents and energy, including electricity and gas).

The operating performance substantially improved in Q1 2024 with the nickel-equivalent sustaining cost decreasing by 40% YoY to \$23,294/t, primarily due to the reduced feedstock purchase costs, lower reagent & overhead costs, lower demand and lower prices of energy. Sibanye is aiming to decrease its Sandouville costs further in 2024 achieving a range of €21,000-23,000/t.

Ferronickel producers are considered to be among the market participants who are the most sensitive to the price environment.

The owners of New Caledonian ferronickel giants, Eramet and Glencore, are following their plans to cease funding of their Doniambo and Koniambo facilities.

As we have already said, Glencore has not provided a cost split between its metal nickel and ferronickel facilities, but based on the previously provided guidance and according to the recently reported actual total unit cash costs, we presume that the costs for its Koniambo facility grew by approximately 30% YoY to around \$46,000/t in 2023. The higher cost partly reflects the expensing of Koniambo capex in 2023. Even with the French government's possible assistance, high operating costs and weak nickel market conditions mean that Koniambo remains an unprofitable operation. Unsurprisingly, Glencore placed it on C&M in Q1 2024, in parallel initiating a process to find a buyer for this asset. It was reported that since 2013, more than \$4 billion has been poured into the project by Glencore, and a total of \$9 billion since the project's inception. For more than ten years, Glencore has been the primary funder of KNS without ever realising a profit.

Eramet reported a slight 1% growth in the cash cost of its FeNi production to \$18,298/t Ni. This slight increase was attributed to the higher energy costs, negative price effect on nickel ore and an unfavourable FX impact, which was offset by the record output supported by consistent electricity supply from the Temporary Offshore Power Plant, improved mining efficiency and lower fixed costs. Eramet reported a further increase in cash cost of its ferronickel production by 6% YoY to \$19,400/t Ni in Q1 2024, reflecting the impact of the decline in the production volumes as well as an unfavourable price and FX effects, partly offset by a decrease in energy prices.

South 32 increased its operating unit costs at Cerro Matoso by 13% YoY to \$12,280/t Ni in H2 2023 partly due to lower ferronickel output following the completion of the planned maintenance and a temporary reduction in 3rd party gas supply. South32 cash cost is expected to decrease year-on-year in FY 2024 to approximately \$11,460/t on the back of improved cost efficiencies and higher nickel grades expected in H1 2024.

South32 has also reported that within its Group-wide cost review, it has commenced a strategic review of Cerro Matoso to evaluate options to enhance the operation's competitive position.

Anglo American's facilities (Barro Alto & Codemin) have reported a modestly increased C1 cost by 5% YoY at \$11,927/t Ni, impacted by grade declines and reflecting the inflationary pressure and unfavourable exchange rates. Anglo American is forecasting a further cost increase in 2024 by 11% YoY to \$13,228/t Ni, which is continuously impacted by declining grades. The Company has recently reported that C&M or potential divestment are considered as viable options.

The major global low-grade nickel product – NPI – demonstrated a year-on-year decrease in costs in 2023. Based on the publicly available data, the weighted average cost of the Chinese NPI producers decreased by 18% YoY in 2023 to around \$14,000/t Ni, presumably due to lower YoY ore prices. The Chinese weighted average NPI producers' cost decreased further by the same 18% to around \$11,400/t Ni in Q1 2024. At the same time, Indonesian NPI producers experienced a lower decrease of 7% YoY in their weighted average cost in 2023, amounting to around \$10,800/t, as nickel ore prices were supported by their direct pegging to the LME price through the state price formula and a delay in mining license issue. The Indonesian weighted average NPI producers' costs slightly decreased further by just 1% to around \$10,750/t Ni in Q1 2024.

Intermediate nickel producers have reported an increase in production costs. FQM reported an increase in costs in its Australian-based Ravensthorpe facility by 13% YoY to \$21,936/t Ni in 2023, reflecting payability and lower by-product credits, offset by lower sulphur and diesel prices and favourable foreign exchange. FQM reported a further huge increase in cash cost of MHP production by 34% YoY to \$27,580/t Ni in Q1 2024, as maintenance challenges impacted the production coupled with lower payabilities and high operating cost, which continues to lead to significant margin compression. As a result, FQM placed its Ravensthorpe plant into C&M from May 1st, 2024.

Nickel 28 has reported a decrease of 3% YoY in the actual 2023 cash cost to \$7,187/t Ni at its Ramu plant in Papua New Guinea as it continued stable operations despite

a depressed nickel and cobalt price environment. Ramu decreased its actual cash costs further in Q1 2024 by 4% YoY to \$6,614/t Ni by working on reducing its input and operational cost, which resulted in improved production cost.

Indonesian MHP producer PT HPL reported a decrease in YoY cash cost in Q1 2024 by 18% to \$6,346/t Ni.

Indonesian nickel matte producer PTVI reported a decrease in its cash costs in Q1 2024 by 15% YoY to \$9,371/t Ni due to lower maintenance costs and higher fixed cost dilution.

Nickel Industries' Hengjaya nickel matte producer said its Q1 2024 operating cash cost declined by 39% YoY to \$10,320/t Ni. However, the Company has decided to switch HNI's production from nickel matte back to NPI in Q1 due to declining matte margins compared to NPI and an improving demand outlook for STS globally, which is believed to translate eventually into strengthening NPI prices.

On the cash cost curve graph, we have shown our estimates of the LME-adjusted costs of various nickel products' producers in H2 2023 based on the publicly available data, their own reports and our in-house calculations. LME-

adjusted costs refer to the production cost adjusted to the LME deliverable Class 1 by adding an assessed product premium or discount for each form of nickel for the corresponding period.

With the average nickel price in 2H 2023 being \$18,808/t, around 15% of global nickel producers were making losses. Since the beginning of 2024, the LME nickel price has risen from \$16,000/t to the current level of \$20,000/t. Consequently, the number of loss-making producers decreased and they now account for even less than 10% of the global nickel supply. Considering the LME nickel price of \$17,448/t in 2024 YTD, around 35% of producers will be cash-negative.

Although the current price environment seems to be more favourable to nickel producers than in 2023, we still estimate that around 400 kt Ni of capacities are either halted, on C&M, in a state of bankruptcy or experiencing pressure from various factors influencing operational stability and production rates. All that makes the current supply risk still essential, which could provide a further impetus to the nickel price.

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GLOSSARY OF TERMS

Abbreviation	Term
BEV	Battery electric vehicle
CAGR	Compound annual growth rate
CAM	Cathode active material
COTR	Commitments of traders report
C&M	Care and maintenance
ESG	Environmental, social, governance
EV	Electric vehicle
FAI	Fixed asset investment
FeNi	Ferronickel
FX	Foreign exchange
GWh	Gigawatt-hours
HCOB	Hamburg Commercial Bank
HEV	Hybrid electric vehicle
HPAL	High-pressure acid leaching
JV	Joint venture
kt	Thousand tonnes
ktpa	Thousand tonnes per annum
KWh	Kilowatt-hours
LFP	Lithium iron phosphate battery
LME	London Metal Exchange
MHP	Mixed hydroxide precipitate
MSP	Mixed sulphide precipitate
Mt	Million tonnes
Mtpa	Million tonnes per annum
NCM	Nickel cobalt manganese battery
NEV	New energy vehicle (battery electric and plug-in)
Ni	Nickel
NiSO ₄	Nickel sulphate
NPI	Nickel pig iron
OFAC	The Office of Foreign Assets Control
PCAM	Precursor cathode active material
PHEV	Plug-in hybrid
PMI	Purchasing managers index
QoQ	Quarter-on-quarter
RKEF	Rotary kiln-electric furnace
SHFE	Shanghai Futures Exchange
TWh	Terawatt-hours
YoY	Year-on-year
YTD	Year-to-date

SUPPLEMENTARY MATERIALS

Ni End Use in China (YoY % Change)

Industry	Ni End Use*	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24
Chemical, Petrochemical	152 kt	17%	17%	21%	9%	17%	9%	13%	10%	15%	13%	13%	14%	14%	14%	10%	18%
Building & Construction	117 kt	-9%	-9%	-29%	-28%	-28%	-31%	-26%	-23%	-15%	-21%	5%	-12%	-31%	-31%	-26%	-12%
NCM Batteries Installed in Chinese NEV	80 kt	-26%	15%	6%	83%	9%	-13%	7%	3%	9%	14%	42%	46%	132%	3%	30%	24%
Industrial boilers	63 kt	23%	23%	-3%	-11%	4%	-1%	-16%	-3%	-7%	-6%	-31%	-19%	-30%	-30%	10%	11%
Food Processing	55 kt	5%	5%	6%	-10%	2%	3%	5%	8%	36%	18%	19%	35%	23%	23%	17%	46%
Automotive	47 kt	-14%	-14%	11%	60%	17%	1%	-4%	5%	3%	9%	24%	25%	5%	5%	7%	16%
Wire	44 kt	3%	3%	10%	0%	-13%	-1%	11%	-3%	-3%	-5%	3%	0%	-3%	-3%	-12%	-11%
Air Conditioning	42 kt	14%	14%	13%	12%	18%	25%	29%	6%	-10%	-1%	13%	27%	13%	13%	13%	20%
Integrated circuit	38 kt	-23%	-23%	-3%	4%	7%	6%	4%	21%	14%	35%	28%	34%	59%	59%	28%	32%
Pulp & Paper	37 kt	23%	23%	-3%	-1%	-1%	6%	8%	13%	33%	15%	27%	-5%	23%	23%	12%	34%
Catering	31 kt	7%	7%	-2%	-2%	-6%	5%	7%	14%	19%	11%	23%	11%	19%	19%	31%	37%
Washing Machines	16 kt	2%	2%	19%	42%	29%	26%	16%	41%	24%	15%	13%	12%	15%	15%	6%	2%
Textile	14 kt	-11%	-11%	2%	-14%	6%	3%	-4%	3%	-7%	7%	1%	5%	15%	15%	10%	24%
Shipbuilding	8 kt	-24%	-24%	14%	19%	-4%	7%	-10%	20%	14%	22%	4%	-3%	74%	74%	1%	-1%
Lifts	7 kt	12%	12%	10%	70%	10%	-9%	-14%	-7%	-4%	-3%	-3%	9%	3%	3%	-12%	-9%
Container	3 kt	-64%	-64%	-58%	-44%	-50%	-51%	-48%	-41%	-30%	11%	33%	46%	171%	171%	107%	139%
Total	753 kt	-7%	4%	5%	16%	7%	1%	6%	6%	11%	10%	18%	16%	31%	3%	13%	20%

Ni End Use in China	1327 kt
Indicator Coverage in China	57%

Ni End Use in Germany (YoY % Change)

Industry	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Estimated Yearly Ni Consumption 2023	YoY Change	Jan-24	Feb-24	Mar-24	Apr-24	May-24	YTD Change
Automotive	2%	0%	-5%	-12%	-4%	-6%	3%	0%	-7%	-7%	-10%	-8%	5 kt	▼ -5%	-13%	-7%	-9%	-5%	-15%	▼ -10%
Machinery	-9%	-14%	-12%	-15%	-8%	-10%	-18%	-13%	-9%	-13%	-16%	-7%	40 kt	▼ -12%	-16%	-9%	-15%	-14%	-5%	▼ -12%
Electronics	-1%	-8%	-1%	-3%	5%	-22%	-15%	2%	16%	-13%	12%	-7%	1 kt	▼ -3%	-4%	0%	-9%	-5%	-12%	▼ -6%
Appliances	6%	0%	24%	-1%	-3%	-8%	1%	-14%	-5%	-33%	-16%	-10%	4 kt	▼ -5%	-15%	-16%	-7%	-22%	-20%	▼ -15%
Construction	-13%	-12%	-24%	-22%	-16%	-20%	-10%	-5%	-2%	2%	18%	13%	6 kt	▼ -9%	1%	-3%	4%	2%	1%	▬ 1%
Total	-8%	-12%	-10%	-14%	-8%	-11%	-15%	-11%	-7%	-13%	-12%	-5%	56 kt	▼ -11%	-13%	-8%	-12%	-12%	-6%	▼ -10%

Ni End Use in 2020

Ni End Use in EU27	315 kt
Ni End Use in Germany	75 kt
Germany Coverage in EU27	24%
Ni End Use in Germany for Selected I	58 kt
Indicator Coverage in Germany	78%

Ni End Use in USA (YoY % Change)

Industry	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Estimated Yearly Ni Consumption 2023	YoY Change	Jan-24	Feb-24	Mar-24	Apr-24	May-24	YTD Change
Automotive	1%	3%	2%	4%	6%	3%	1%	2%	4%	2%	3%	5%	28 kt	▲ 3%	1%	0%	1%	0%	-2%	▬ 0%
Shipbuilding	-19%	-30%	21%	115%	111%	-4%	-18%	17%	61%	-14%	-32%	-36%	1 kt	▲ 3%	67%	33%	-20%	-13%	-45%	▼ -3%
Oil & Gas	7%	6%	6%	0%	18%	17%	23%	48%	8%	19%	12%	-1%	10 kt	▲ 12%	17%	65%	82%	9%	62%	▲ 47%
Power Generation	-8%	-4%	1%	-1%	-4%	5%	-3%	5%	-3%	10%	19%	17%	10 kt	▲ 5%	19%	13%	10%	5%	10%	▲ 11%
Machinery	1%	1%	-1%	0%	0%	0%	0%	0%	0%	0%	0%	1%	15 kt	▬ 0%	-1%	-1%	0%	-1%	1%	▬ 0%
Electronics	4%	0%	1%	0%	1%	3%	0%	2%	2%	1%	2%	3%	5 kt	▬ 1%	4%	4%	4%	5%	1%	▲ 4%
Appliances	11%	8%	5%	12%	2%	1%	-1%	9%	-2%	12%	8%	-1%	7 kt	▲ 5%	-3%	-3%	-4%	2%	-3%	▼ -2%
Construction	18%	23%	15%	16%	2%	16%	14%	12%	7%	6%	8%	37%	8 kt	▲ 14%	6%	8%	10%	8%	20%	▲ 10%
Total	3%	3%	3%	4%	5%	8%	3%	6%	6%	4%	5%	6%	83 kt	▲ 5%	5%	10%	11%	2%	8%	▲ 7%

Ni End Use in 2020

Ni End Use in Americas	174 kt
Ni End Use in USA	122 kt
USA Coverage in Americas	70%
Ni End Use in USA for Selected Indic	77.8 kt