

## Global Metals Weekly

## Aluminium smelters not powering ahead

**Aluminium supply growth remains patchy**

Concerns over the health of the global economy have been hanging over the base metals, pushing down prices in recent weeks. Despite this, the global aluminium market remains in deficit, predominantly on supply constraints. Indeed, hydro power generation is contracting in China YoY, an issue for around 20% of the country's smelters. In Europe, the immediacy of the energy crisis has subsided, but many operators remain marginal: AldeI recently decided to permanently shut its 120kt smelter in the Netherlands. Our projections currently embed 2Mt more aluminium supply in 2023 than the annualised YTD run rates published by the International Aluminium Institute, partially because we see output increasing gradually throughout the year. If we are wrong about these assumptions, the global aluminium supply shortfall may be bigger than we currently factor in. Aluminium should remain in a holding pattern, until there is more visibility on how strong metals demand will be, likely later in 3Q23.

**LME inventories a concern**

The global market may lose some of Rusal's 4.2Mt aluminium units. If consumers do not renew contracts later this year (Glencore already said that its marketing agreement will not be renewed), this could increase pressure on the Russian company. LME inventories have been falling, and 45% of what is left has already been earmarked for removal; most of those tonnages are likely non-Russian material. With 52% of the tonnages left in the warehouses of Russian origin, the status quo is concerning. While volatility in time spreads and prices has so far been relatively muted, this may change if the London Metals Exchange is clogged with Russian tonnages consumers do not want to own.

**Scrap to the rescue? Not quite**

Scrap is often seen as a saviour. We agree that secondary material is increasing and see the potential for another 11Mt supply increase by 2030 under current recycling rates; if recycling rates were maximised, this figure could rise to 18Mt. Yet, given the lack of primary supply growth, this is unlikely to be sufficient to balance the market.

**Demand has been disappointing**

China's economy has been slow to take off after reopening in December, and an initial rebound of apparent demand (production + imports - exports + stock changes) growth has been fading. A silver lining: domestic metal purchases have been high enough to cap China's aluminium exports. Indeed, exports are now running at roughly half the level a year ago, when smelter restarts met sharply lower metal purchases and excess units exported then sank the global aluminium market. Destocking through the supply chain has also reduced metals demand. Meanwhile, in Europe and the US, demand has been resilient, notwithstanding concerns over an economic slowdown.

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DM: developed market

kt: thousand tons

LME: London Metal Exchange

Mt: million tons

# Aluminium smelters not powering ahead

## Aluminium remains in deficit

Persistent concerns over the health of the global economy have been hanging over the base metals, pushing prices lower in recent weeks. Notwithstanding this, Exhibit 1 highlights that the global aluminium market remains in deficit on supply constraints.

### Exhibit 1: Aluminium supply and demand balance

The aluminium market remains in deficit

| '000 tonnes           | 2020  | 2021  | 2022  | 2023E | 2024E | 2025E |
|-----------------------|-------|-------|-------|-------|-------|-------|
| Global production     | 65441 | 67563 | 68550 | 69770 | 73505 | 74274 |
| YoY change            | 2.6%  | 3.2%  | 1.5%  | 1.8%  | 5.4%  | 1.0%  |
| Global consumption    | 63811 | 68595 | 69118 | 70136 | 73643 | 77325 |
| YoY change            | -2.7% | 7.5%  | 0.8%  | 1.5%  | 5.0%  | 5.0%  |
| Balance               | 1630  | -1031 | -568  | -366  | -138  | -3051 |
| Market inventories    | 9956  | 9142  | 8574  | 8208  | 8070  | 5019  |
| Weeks of world demand | 8     | 7     | 6     | 6     | 6     | 3     |
| LME Cash (\$/t)       | 1704  | 2474  | 2706  | 2661  | 3500  | 3668  |
| LME Cash (c/lb)       | 77    | 112   | 123   | 121   | 159   | 166   |

Source: Platts, Woodmac, CRU, Metal Bulletin, Reuters, Bloomberg, company reports, IAI, BofA Global Research

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## Aluminium supply is underperforming

### Run rate is lower than we have in our model

Digging deeper into fundamentals, uncertainty over aluminium production has been a focus in recent months, partly because Europe's energy crisis led to smelter closures; China's aluminium smelters have also been affected by electricity shortages. Exhibit 2 picks up on this, confirming that global aluminium production has risen by 2% YoY, although trends have diverged regionally, with output falling in Africa and Europe, for instance.

### Exhibit 2: Global aluminium production

Aluminium smelters in Europe and Asia have been under pressure

|                       | YTD 2023      | YTD 2022      | YoY change  | Annualised Apr-23 | Annualised Apr-22 | YoY change  | Annualised Mar-23 | MoM change  | YTD 2023 Annualised | 2023 S/D model | Model v YTD Delta |
|-----------------------|---------------|---------------|-------------|-------------------|-------------------|-------------|-------------------|-------------|---------------------|----------------|-------------------|
| Africa                | 520           | 528           | -1.5%       | 1,557             | 1,594             | -2.3%       | 1,542             | 1.0%        | 1,560               | 1,646          | 86                |
| North America         | 1,259         | 1,252         | 0.6%        | 3,893             | 3,833             | 1.6%        | 3,838             | 1.4%        | 3,777               | 4,058          | 281               |
| Latin America         | 474           | 382           | 24.1%       | 1,436             | 1,144             | 25.5%       | 1,436             | -0.1%       | 1,422               | 1,689          | 267               |
| Asia                  | 1,532         | 1,514         | 1.2%        | 4,684             | 4,587             | 2.1%        | 4,686             | -0.0%       | 4,596               | 5,930          | 1,334             |
| West Europe           | 893           | 989           | -9.7%       | 2,725             | 2,969             | -8.2%       | 2,708             | 0.6%        | 2,679               | 3,130          | 451               |
| E. Europe             | 1,326         | 1,346         | -1.5%       | 4,003             | 4,052             | -1.2%       | 4,039             | -0.9%       | 3,978               | 4,049          | 71                |
| Oceania               | 616           | 611           | 0.8%        | 1,862             | 1,801             | 3.4%        | 1,860             | 0.1%        | 1,848               | 1,958          | 110               |
| Middle East           | 2,015         | 1,995         | 1.0%        | 6,108             | 6,083             | 0.4%        | 6,111             | -0.1%       | 6,045               | 6,710          | 665               |
| Other non-IAI nations | 616           | 616           | 0.0%        | 1,874             | 1,874             | 0.0%        | 1,884             | -0.5%       | 1,848               | 0              | -1,848            |
| IAI ex-China          | 9,251         | 9,233         | 0.2%        | 28,142            | 27,935            | 0.7%        | 28,105            | 0.1%        | 27,753              | 29,170         | 1,417             |
| China                 | 13,331        | 12,903        | 3.3%        | 40,333            | 40,308            | 0.1%        | 40,338            | -0.0%       | 39,993              | 40,601         | 608               |
| <b>IAI Total</b>      | <b>22,582</b> | <b>22,136</b> | <b>2.0%</b> | <b>68,474</b>     | <b>68,243</b>     | <b>0.3%</b> | <b>68,443</b>     | <b>0.0%</b> | <b>67,746</b>       | <b>69,770</b>  | <b>2,024</b>      |

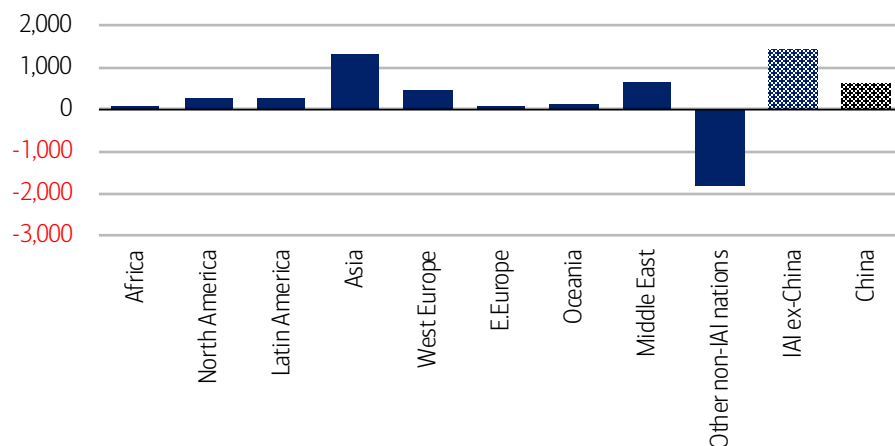
Source: IAI, BofA Global Research. S/D = supply/demand.

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Exhibit 3 takes this a step further, comparing the production run rates reported by the International Aluminium Institute (IAI) with the figures in our supply and demand model (it is worth noting that IAI data is not comprehensive, with the institute noting that it relies on voluntary reports of IAI member and non-member companies. It also includes estimates of unreported production, providing a figure as close as possible to total global annual production; this, to some extent, explains the large discrepancy in the "Other non-IAI nations" reported in the chart). Either way, the data highlights that, compared to what the IAI has been reporting YTD, we factor in around 2Mt of additional supply in CY23. While some supply increases (e.g., in China) are still in the pipeline, this raises the risk that this year's deficit may end up bigger than we currently assume.

**Exhibit 3: CY23 aluminium supply in our models, versus annualised YTD IAI production**

We factor in almost 2Mt more aluminium supply than the run rate YTD



Source: Platts, Woodmac, CRU, Metal Bulletin, Reuters, Bloomberg, company reports, IAI, BofA Global Research

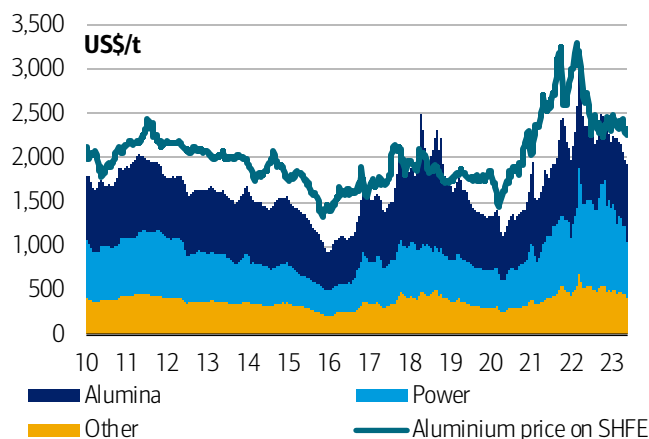
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**China's aluminium smelters are hurting**

Taking a closer look into the dynamics in China, Exhibit 4 shows our ready-reckoner of operating costs at an "average" aluminium smelter purchasing spot coal and alumina. The data suggests that margins are positive. Yet Exhibit 5 highlights that hydro power has made steady inroads into the aluminium industry. Indeed, partially because market leaders, including Hongqiao and Chalco, have relocated to Yunnan province, around one-fifth of China's smelting capacity relies on electricity generated with water.

**Exhibit 4: China, costs for smelters procuring spot coal/alumina**

Smelter margins are positive

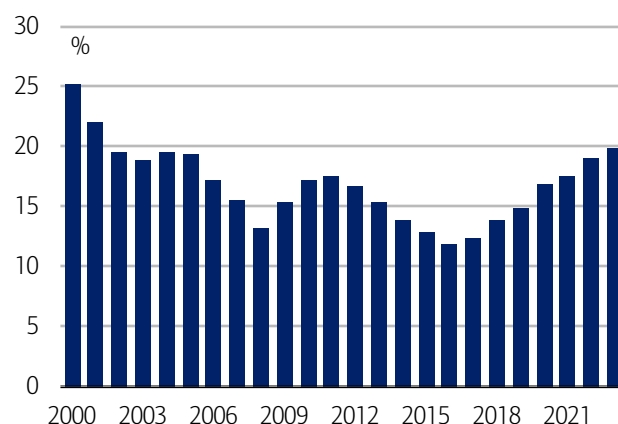


Source: Bloomberg, BofA Global Research

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**Exhibit 5: China, aluminium smelters using hydro power**

Around one-fifth of China's aluminium smelters run on hydro power



Source: Woodmac, BofA Global Research

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Exhibit 6 outlines that China's hydro power generation is currently hovering around multi-year lows, one reason operators in Yunnan have idled 1.9Mt of capacity since September 2022. While smelters are anecdotally preparing to restart some of those potlines, there is uncertainty over how much power will ultimately be available. As such, China may run well short of the government-imposed 45Mt capacity cap this year.

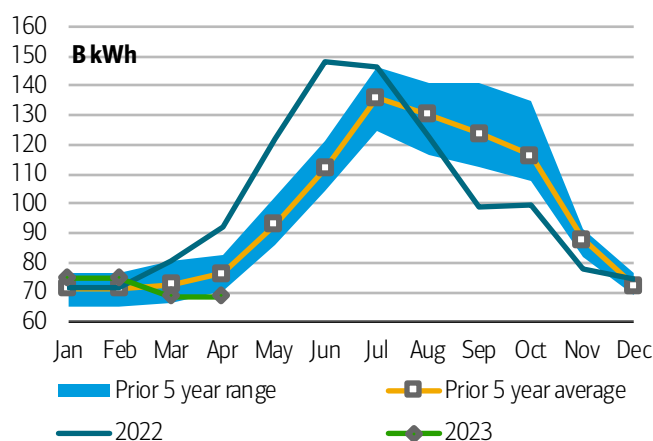
**Europe is not out of the woods yet**

While the immediacy of the energy crisis in Europe has subsided, an average smelter purchasing electricity on the spot market would still be marginal (Exhibit 7). Highlighting the difficulties for energy-intensive industries in Europe, Aldel recently took the decision to shutter permanently its 120Kt site in Delfzijl/the Netherlands. Norsk Hydro has not

yet confirmed a timeline to restart capacity at its 250kt Karmoy and 180kt Husnes smelters either, although these closures were more influenced by weak demand.

#### Exhibit 6: China, hydro power generation

Hydro power generation has been under pressure

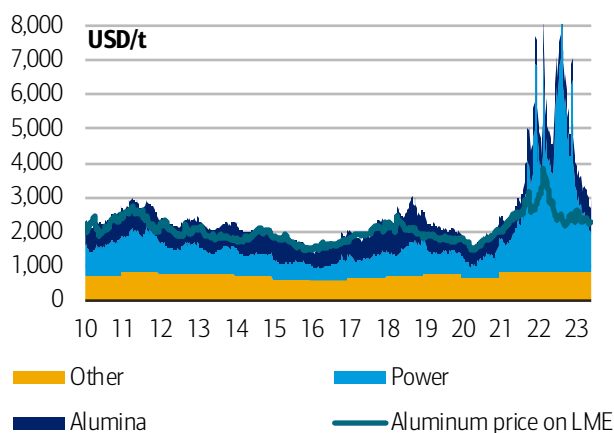


Source: Bloomberg, BofA Global Research

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#### Exhibit 7: Europe, costs for smelters procuring spot power/alumina

The immediacy of the energy crisis has subsided, but average operations in Europe are still marginal



Source: Bloomberg, BofA Global Research

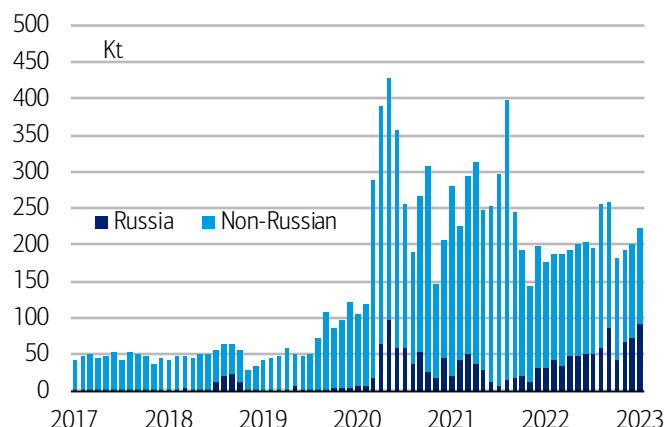
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#### Rusal keeps hurting

Meanwhile, there is some uncertainty over the state of affairs with Rusal's 4.2Mt of aluminium production, partially because consumers have been self-sanctioning. Exhibit 8 picks up on this, highlighting that the company has been looking to diversify its sales, shipping more metal to China. Yet aluminium produced in Russia and held at LME warehouses is also higher now than at the beginning of the year, as Exhibit 9 outlines. In our view, this dynamic is worth following, and there is a risk that manufacturers may not renew annual contracts with Rusal towards the end of the year (Glencore, which had been marketing the Rusal metal, said in March that contracts would not be renewed). This may leave some of the output stranded, which in turn should increase the pressure to cut output.

#### Exhibit 8: China, aluminium imports by origin

China imports more aluminium from Russia

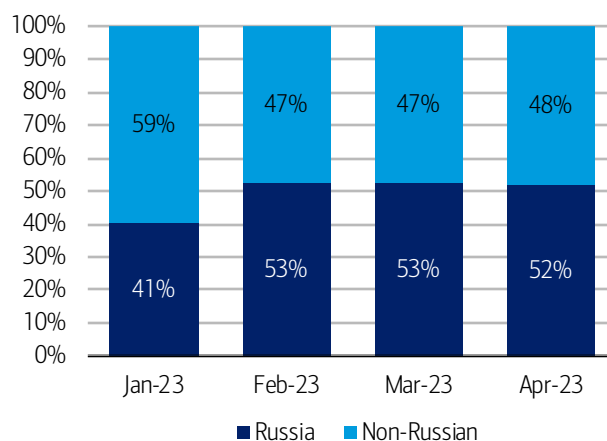


Source: Bloomberg, BofA Global Research

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#### Exhibit 9: Breakdown of metal in LME warehouses by origin

Russian aluminium accounts for over 50% of metal stored in LME warehouses



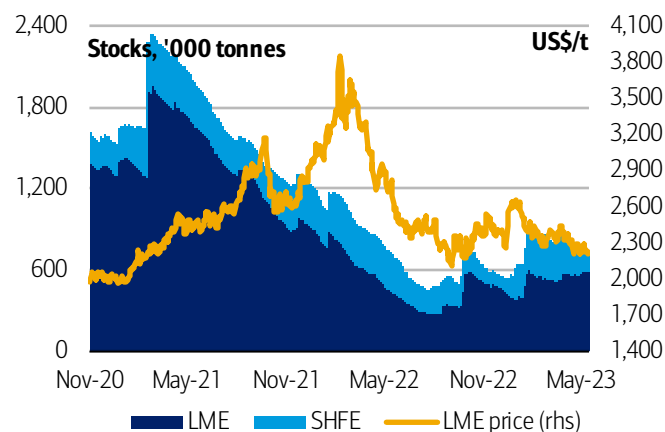
Source: Bloomberg, BofA Global Research

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The inventory dynamic is also worth following, keeping in mind that stocks in LME warehouses are already low (Exhibit 10). At the same time, 45% of metal in storage has been earmarked for removal, most of which is likely non-Russian material (Exhibit 11).

#### Exhibit 10: Aluminium inventories on London Metals Exchange (LME) and Shanghai Futures Exchange (SHFE)

LME inventories have declined steadily



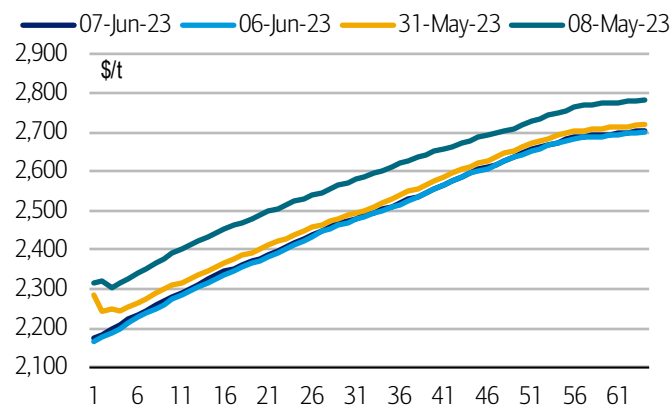
Source: Bloomberg, BofA Global Research

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While volatility in time spreads and prices has so far been relatively muted, this may change if the London Metal Exchange is clogged with Russian tonnages consumers that do not want to own.

#### Exhibit 12: LME, aluminium forward curves

Movements in time spreads have by and large been muted



Source: Bloomberg, BofA Global Research

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#### Exhibit 11: Cancelled warrants<sup>1</sup>, of total stocks

45% of metal held within LME warehouses has been earmarked for removal

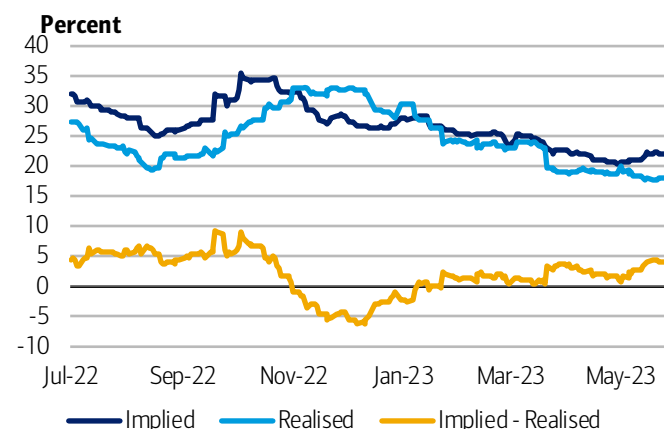


Source: Bloomberg, BofA Global Research

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#### Exhibit 13: LME, aluminium implied and realized vols

Volatility has been low



Source: Bloomberg, BofA Global Research

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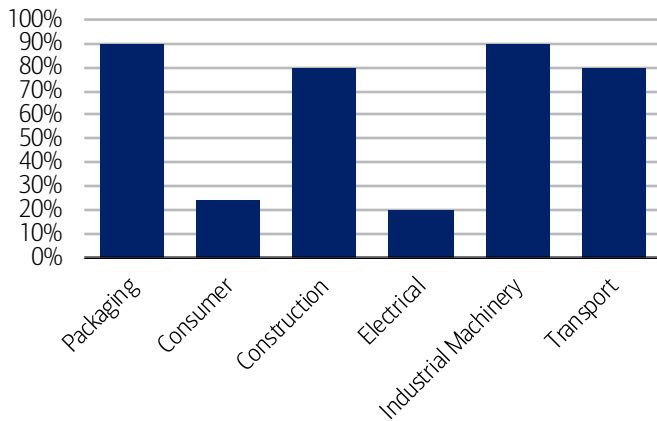
### Scrap to the rescue?

Scrap is often seen as a saviour of the aluminium market. We agree that secondary supply is increasing and see the potential for another 11Mt of aluminium coming to the market by 2030 under current recycling rates (Exhibit 14); if recycling rates were maximised, this could rise to 18Mt. Yet, given the lack of primary supply growth, this is unlikely to be sufficient to balance the market, as Exhibit 15 outlines.

<sup>1</sup> A warrant is a bearer document reflecting ownership of metal in an LME warehouse. If an owner intends to remove metal from an LME warehouse, the warrant is cancelled (i.e., off warrant). Life warrants are on-warrant.

**Exhibit 14: Recycling rates in different sectors**

Recycling rates for consumer and electrical waste are low

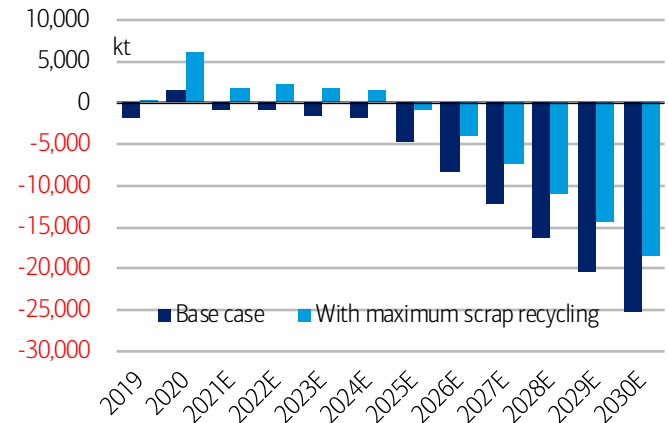


Source: OECD, BofA Global Research

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**Exhibit 15: Aluminum market balances under different scenarios**

The aluminum market would be in deficit, even if recycling rates were maximized



Source: Platts, Woodmac, CRU, Metal Bulletin, Reuters, Bloomberg, company reports, IAI, BofA Global Research

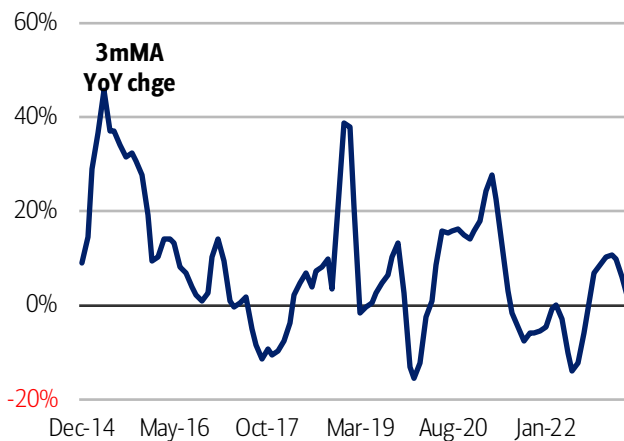
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**Demand has been holding up****China's aluminium exports have been contained**

Shifting focus to demand, China's economy has been slow to take off after the reopening in December. This is reflected in Exhibit 16, which shows that apparent demand (production + imports - exports + stock changes) growth initially rebounded, although this uptrend has been fading of late. A silver lining: domestic metal purchases have been high enough to cap China's aluminium exports (Exhibit 17). Indeed, exports are now running at roughly half the level of a year ago, when smelter restarts met sharply lower metal purchases and excess units shipped ex-China sank the global aluminium market.

**Exhibit 16: China, apparent aluminium demand**

Demand growth has been slowing

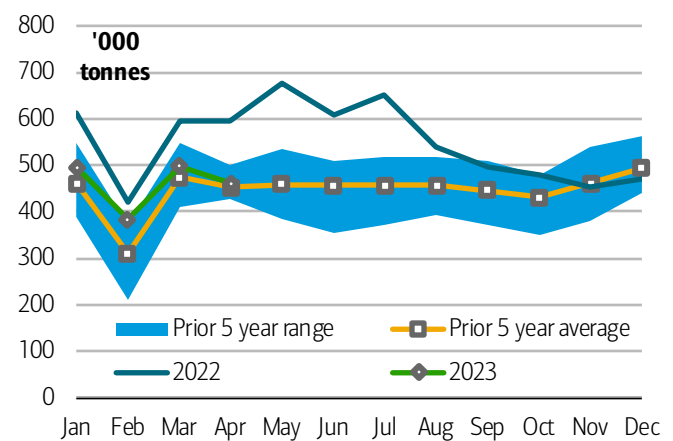


Source: Bloomberg, BofA Global Research

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**Exhibit 17: China, exports of unwrought aluminium and products**

China's aluminium exports remain within a range



Source: Bloomberg, BofA Global Research

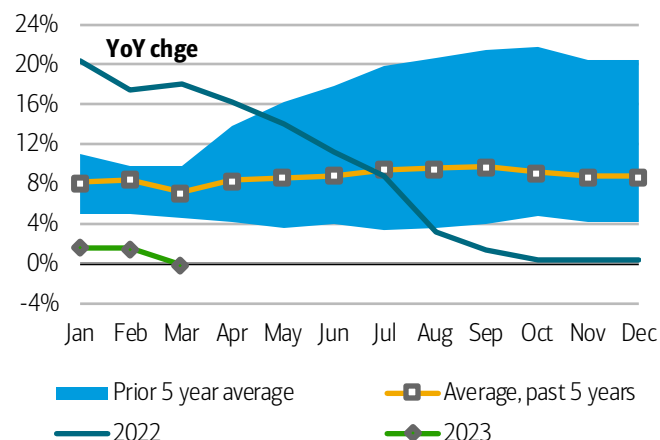
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**Inventories are a concern in China**

Digging deeper into China's demand, inventories through the supply chain rose massively during the COVID lockdowns, as Exhibit 18 and Exhibit 19 show, and destocking is now reducing metals demand.

**Exhibit 18: China, inventories of metals products**

Inventories have risen massively during the COVID lockdowns

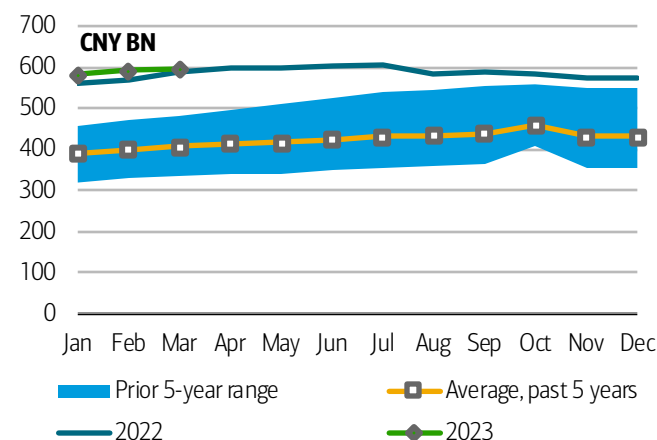


Source: Bloomberg, BofA Global Research

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**Exhibit 19: China, inventories of metals products**

Inventories remain close to record highs



Source: Bloomberg, BofA Global Research

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We agree that inventory changes have had a pronounced impact on purchases of the industrial commodities. Yet Exhibit 20 also highlights that, relative to production, stocks of metal products are not extraordinarily high. Exhibit 21 takes this a step further, outlining that the turnover of finished products in days of demand has also been peaking; if the economy continues to reaccelerate, this may bring down the ratio further.

**Exhibit 20: China, metal product inventories relative to production**

The inventories/production ratio is within longer-term ranges



Source: Bloomberg, BofA Global Research

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**Exhibit 21: Inventories of finished goods, turnover days**

Turnover days have started to decline



Source: Bloomberg, BofA Global Research

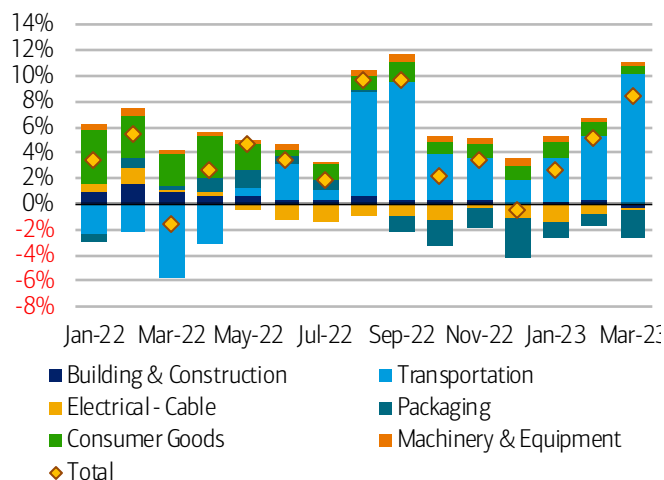
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**Offtake in Europe and the US has been very strong**

Shifting focus to Europe and the US, demand has been resilient, notwithstanding concerns over an economic slowdown. This is reflected in Exhibit 22, which highlights that Europe's underlying demand growth rates have been trending higher (this analysis weighs YoY growth rates per sector by the weight each sector has in metals demand), heavily influenced by transportation. As for the US, activity is slowing, but aluminium-consuming sectors have by and large been holding up (Exhibit 23).

**Exhibit 22: EU, underlying aluminium demand**

Activity in the transportation sector is accelerating

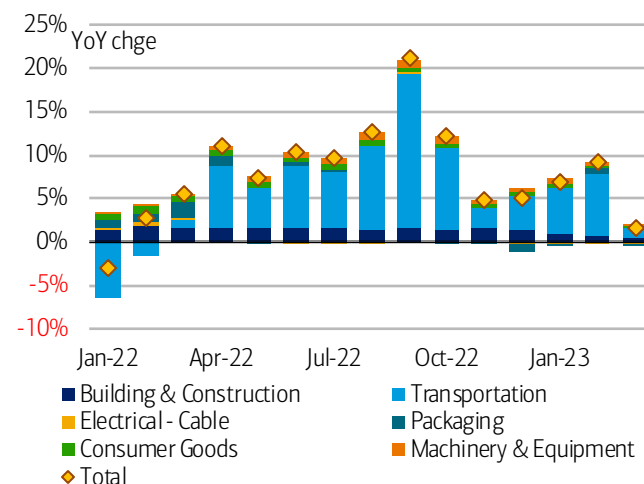


Source: Bloomberg, BofA Global Research

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**Exhibit 23: US, underlying aluminium demand**

While activity in the US is slowing, demand has been holding up



Source: Bloomberg, BofA Global Research

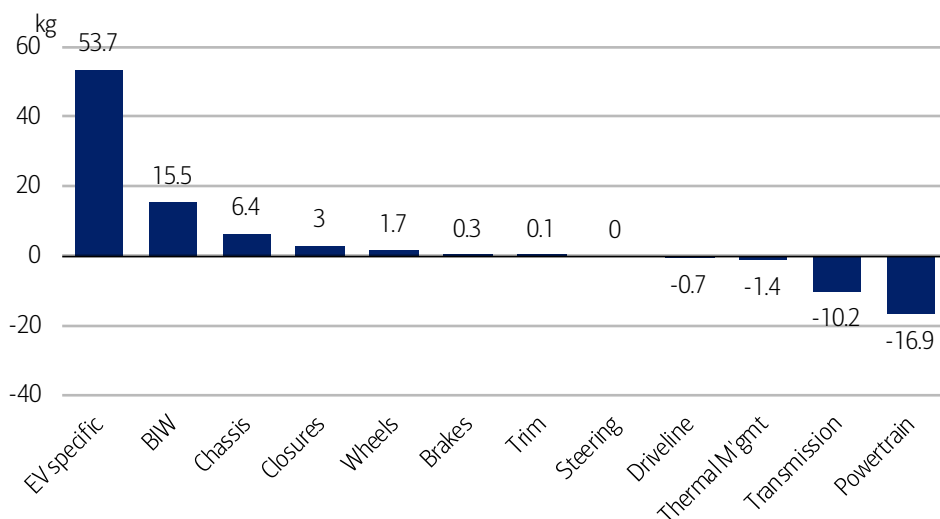
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**Outlook solid longer-term**

Aluminium demand should also be supported further out, as a recent report commissioned by the European Aluminium Association highlights. Indeed, the report notes that “the trend towards light-weighting and electrification in the automotive industry is driving a significant increase in aluminium content. Electric vehicles, in particular, are contributing to this growth, with a battery electric vehicle (BEV) produced in Europe in 2022 containing 283 kilograms (kg) of aluminium on average compared to just 169 kg in a petrol or diesel internal combustion engine (ICE)-only car. The average aluminium content in an electric vehicle is expected to increase further by 9.5%, to 310 kg, between 2022 and 2026. This tremendous growth in aluminium usage in BEVs is mainly attributed to its use in e-drive housing, battery pack housings, ballistic battery protection, and cooling plates. Additionally, aluminium plays a crucial role in electromobility infrastructure, including power cables and charging stations. The unique recyclability of aluminium also safeguards that the material put in cars today will be ready to be used again and again after the car has reached its end of life”.

**Exhibit 24: Aluminium demand in transportation**

The electrification of vehicles should boost aluminium demand



Source: Ducker, Aluminum Content in Passenger Vehicles (Europe), Assessment 2022 and Outlook 2026, 2030

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# Appendix

## Exhibit 25: Commodity prices, exchange rates, equity indices, yields and inventories

Metal prices have stabilized after the recent sell-off

| Base metals   | Cash, \$/t     | 3-month, \$/t | Cash, WoW change       | 3-month, WoW change    |
|---|----------------|---------------|------------------------|------------------------|
| Aluminium   | 2,216          | 2,255         | -4.3%                  | -1.2%                  |
| Copper  | 8,336          | 8,348         | 1.2%                   | 1.3%                   |
| Lead  | 2,052          | 2,038         | 2.8%                   | 1.9%                   |
| Nickel  | 21,011         | 21,132        | -0.8%                  | -0.9%                  |
| Tin   | 26,244         | 25,817        | 2.2%                   | 1.5%                   |
| Zinc  | 2,407          | 2,409         | 7.0%                   | 6.2%                   |
| LMEX  | 3,721          |               | 0.8%                   |                        |
|   | Cash, c/lb     | 3-month, c/lb |                        |                        |
| Aluminium   | 100            | 102           |                        |                        |
| Copper  | 378            | 379           |                        |                        |
| Lead  | 93             | 92            |                        |                        |
| Nickel  | 953            | 959           |                        |                        |
| Tin   | 1,190          | 1,171         |                        |                        |
| Zinc  | 109            | 109           |                        |                        |
| Other commodities, freight, exchange rates, equities and yields | Spot           | WoW change    |                        |                        |
| Gold, \$/oz   | 1,965          | -0.6%         |                        |                        |
| Silver, \$/oz   | 24             | 1.6%          |                        |                        |
| Platinum, \$/oz   | 1,015          | 0.5%          |                        |                        |
| Palladium, \$/oz  | 1,364          | -2.4%         |                        |                        |
| Iron ore, China fines cfr \$/dmt                                | 112            | 6.9%          |                        |                        |
| Brent, \$/bbl   | 76             | 2.3%          |                        |                        |
| Baltic Dry Index  | 1,040          | 11.0%         |                        |                        |
| EUR/USD   | 1.078          | 0.2%          |                        |                        |
| Dow Jones Industrial Average                                    | 33,834         | 2.3%          |                        |                        |
| 10-year US Treasury yield                                       | 3.720          | 3.4%          |                        |                        |
| ICE BofA Commodity index, ER                                    | 400            | 2.3%          |                        |                        |
| ICE BofA Commodity index Industrial Metals, ER                  | 180            | 0.4%          |                        |                        |
| ICE BofA Commodity index Precious Metals, ER                    | 221            | -0.6%         |                        |                        |
| ICE BofA Commodity index Energy, ER                             | 448            | 3.2%          |                        |                        |
| Exchange stocks and cancelled warrants                          | Stocks, tonnes | WoW change    | Canc. warrants, tonnes | Canc. warr., of stocks |
| Aluminium   |                |               |                        |                        |
| LME   | 589,450        | 1.8%          | 267,225                | 45.3%                  |
| Shanghai  | 147,039        | -5.0%         |                        |                        |
| Total aluminium   | 736,489        | 0.4%          |                        |                        |
| Copper  |                |               |                        |                        |
| LME   | 100,100        | 0.6%          | 56,350                 | 56.3%                  |
| Comex   | 25,399         | 1.1%          |                        |                        |
| Shanghai  | 86,648         | 0.5%          |                        |                        |
| Total copper  | 212,147        | 0.6%          |                        |                        |
| Lead  |                |               |                        |                        |
| LME   | 37,150         | 1.9%          | 2,875                  | 7.7%                   |
| Shanghai  | 34,087         | 20.2%         |                        |                        |
| Total lead  | 71,237         | 9.9%          |                        |                        |
| Nickel  |                |               |                        |                        |
| LME   | 37,386         | -0.8%         | 2,640                  | 7.1%                   |
| Shanghai  | 3,678          | 556.8%        |                        |                        |
| Total nickel  | 41,064         | 7.4%          |                        |                        |
| Tin   | 1,960          | -0.5%         | 60                     | 3.1%                   |
| Zinc  |                |               |                        |                        |
| LME   | 86,625         | -0.9%         | 12,750                 | 14.7%                  |
| Shanghai  | 47,011         | -1.2%         |                        |                        |
| Total zinc  | 133,636        | -1.0%         |                        |                        |

Source: BofA Global Research

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**Exhibit 26: Price forecasts, fundamental drivers and risks**

We are bullish on a range of cyclical commodities

| Metal                   | 2023E                    | 2024E                    | Fundamental drivers   |   | Risks (D = downside; U = upside) |  |
|-------------------------|--------------------------|--------------------------|---|---|----------------------------------|--|
| Aluminium               | \$2,661/t<br>121c/lb     | \$3,500/t<br>159c/lb     | <ul style="list-style-type: none"><li>China is reaching for a 45mt capacity cap and smelters ex-China have closed capacity</li><li>China's smelters remain under pressure on hydro power shortages. At the same time, demand should pick up, so exports will likely remain capped.</li><li>We expect rising <b>deficits</b> going forward</li></ul>   | <ul style="list-style-type: none"><li>D: No production discipline in China/ World ex-China</li><li>D: China exports more</li><li>U: Smelter restraint and/or production disruptions reduce output</li><li>U: Stronger than anticipated demand growth</li></ul>  |                                  |  |
| Copper                  | \$9,427/t<br>428c/lb     | \$9,875/t<br>448c/lb     | <ul style="list-style-type: none"><li>Copper rallied as China re-opened. Yet, fundamentals need to catch up on seasonalities and a rebound of the economy</li><li>Demand in China has been patchy, but grid spending has completely offset weakness in housing. Demand may be more balanced in 2023, but it should hold up</li><li>Inventories are low, which is supportive, but could also increase volatility</li><li>We expect a small <b>surplus</b> for 2023</li></ul>   | <ul style="list-style-type: none"><li>D: China re-exports metal</li><li>D: Global demand slows sharply into next year</li><li>U: Strong restocking through the supply chain on improved confidence</li><li>U: Continued production disruptions in coming quarters</li></ul>   |                                  |  |
| Lead                    | \$2,108t<br>96c/lb       | \$2,000/t<br>91c/lb      | <ul style="list-style-type: none"><li>There are no immediate scrap and concentrates shortages, suggesting the market could flip back into surplus</li><li>China's demand has slowed structurally, as the ebike market has matured</li></ul>   | <ul style="list-style-type: none"><li>D: Destocking in China or higher lead exports from the country.</li><li>U: Strong seasonal demand for replacement batteries after cold/ hot winter/ summer months</li></ul>   |                                  |  |
| Nickel                  | \$23,222/t<br>1053c/lb   | \$21,250/t<br>964c/lb    | <ul style="list-style-type: none"><li>Nickel demand from electric vehicle producers should rise in the coming years, yet more NPI is being converted to nickel sulphate</li><li>China has built conversion capacity, which should take about 100Kt of Indonesian units into the refined market</li><li>Indonesian supply may prevent shortages near-term, but further out, more material is required</li><li>We expect a <b>surplus</b> for 2023, but <b>deficits</b> beyond</li></ul>  | <ul style="list-style-type: none"><li>D: NPI producers don't close shop; ore inventories last for longer and more ores are imported from the Philippines.</li><li>D: Faster ramp-up of Indonesian NPI production</li><li>D: Stainless steel demand remains subdued</li></ul>  |                                  |  |
| Zinc                    | \$2,905/t<br>132c/lb     | \$2,500/t<br>113c/lb     | <ul style="list-style-type: none"><li>The project pipeline is not well filled with high quality operations</li><li>Zinc may remain an underperformer, but immediate downside more limited, also because smelter closures in Europe have not been offset by supply additions elsewhere</li></ul>   | <ul style="list-style-type: none"><li>D: Unreported inventories exist on the zinc market. More metal could become available</li><li>D: The zinc market is fragmented. There is evidence that miners, especially in China, could consider further output increases</li></ul>   |                                  |  |
| Gold                    | \$2,009/oz               | \$2,061/oz               | <ul style="list-style-type: none"><li>Gold has been a trade on US rates. Banking volatility is not the same as a banking crisis. Yet, it may accelerate an end to the hiking cycle. This is bullish because gold is a trade on rates.</li><li>Central bank buying has been strong, but not sufficient; a Fed pivot may bring more investors into the market</li><li>Gold to rally into year-end 2023.</li></ul>   | <ul style="list-style-type: none"><li>D: Deterioration of investor sentiment</li><li>D: Real rates become more positive; sustained USD rally</li><li>D: High gold prices deter buyers of physical gold; increased scrap supply</li></ul>  |                                  |  |
| Silver                  | \$24.55/oz               | \$25.75/oz               | <ul style="list-style-type: none"><li>The silver market has rebalanced on production discipline and demand from new applications including solar panels</li><li>As more spending on solar panels come through, silver should rally</li></ul>  | <ul style="list-style-type: none"><li>U: Investors returning to the market</li><li>U: China's imports to rise</li><li>D: ETF liquidation</li><li>D: More supply</li></ul>   |                                  |  |
| Platinum<br>Palladium   | \$1,186/oz<br>\$1,520/oz | \$1,465/oz<br>\$1,632/oz | <ul style="list-style-type: none"><li>Palladium is slowly moving into surplus, likely keeping prices capped.</li><li>Supply problems in South Africa have reduced platinum supply. The hydrogen economy and substitution should push the metal up</li></ul>   | <ul style="list-style-type: none"><li>D: Jewellery demand suffers due to rising prices.</li><li>D: In palladium, the risk of deliveries from Russian stockpiles has not gone away</li><li>D: Demand from key buyers like Europe not increasing</li><li>U: Production disruptions reduce availability of PT and PD</li></ul> |                                  |  |
| Iron Ore                | \$118/t CIF              | \$79/t CIF               | <ul style="list-style-type: none"><li>The iron ore market will likely be oversupplied in 2023. Yet, seasonal supply losses over La Nina in 1Q has already pushed prices above \$120/t.</li><li>A restocking by mills may take them to \$150/t by mid-year</li></ul>   | <ul style="list-style-type: none"><li>D: China's steel production slowing sharply</li><li>U: Mine closures/slowdown in production increases</li></ul>   |                                  |  |
| HCC<br>Thermal coal     | \$281/t<br>\$199t        | \$249/t<br>\$160/t       | <ul style="list-style-type: none"><li>Thermal coal prices to come under pressure as supply is increasing and the energy emergency normalises</li><li>A normalisation of supply should also contribute to lower met coal prices</li></ul>  | <ul style="list-style-type: none"><li>D: Lack of supply discipline</li><li>U: Chinese steel production stronger (HCC)</li><li>U: mine closures</li></ul>  |                                  |  |
| Brent and WTI crude oil | \$88/bbl<br>\$82/bbl     | \$90/bbl<br>\$84/bbl     | <ul style="list-style-type: none"><li>We project Brent and WTI to average \$88/bbl and \$82/bbl, respectively, in 2023.</li><li>The global oil balance should stay tight in 2023, supported by rebounding Asia demand, slower non-OPEC growth, and OPEC+ mopping up excesses.</li><li>We forecast global demand growth to slow to 1.8mn barrels/day (b/d) YoY in 2023 from 2.3mn b/d in 2022.</li><li>Non-OPEC supply should grow roughly 1.6mn b/d YoY in 2023 from 1.9mn b/d in 2022.</li><li>We project total US crude and NGL supply to rise 1mn b/d in 2023 and 600k b/d in 2024.</li><li>OPEC crude oil supplies are set to rise 300k b/d in 2023 and remain about flat in 2024 as OPEC+ actively manages balances.</li></ul> |   |                                  |  |

Colours indicate our stance on each commodity: Green = bullish, Yellow = neutral, Red = cautious. 2020E/2024E = period averages. bbl = barrel. b/d = barrels/day. c/lb = cents/pound. oz = ounce.

Source: BofA Global Research estimates

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## Supply and demand balances

## Exhibit 27: Aluminium supply and demand balance

Deficits set to increase

| '000 tonnes           | 2021  | 2022  | 2023E | 2024E | 2025E |
|-----------------------|-------|-------|-------|-------|-------|
| Global production     | 67563 | 68550 | 69770 | 73505 | 74274 |
| YoY change            | 3.2%  | 1.5%  | 1.8%  | 5.4%  | 1.0%  |
| Global consumption    | 68595 | 69118 | 70136 | 73643 | 77325 |
| YoY change            | 7.5%  | 0.8%  | 1.5%  | 5.0%  | 5.0%  |
| Balance               | -1031 | -568  | -366  | -138  | -3051 |
| Market inventories    | 9142  | 8574  | 8208  | 8070  | 5019  |
| Weeks of world demand | 7     | 6     | 6     | 6     | 3     |
| LME Cash (\$/t)       | 2474  | 2706  | 2661  | 3500  | 3668  |
| LME Cash (c/lb)       | 112   | 123   | 121   | 159   | 166   |

Source: SNL, Woodmac, CRU, Bloomberg, company reports, IAI, BofA Global Research  
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## Exhibit 29: Lead supply and demand balance

Lead should not be in short supply

| '000 tonnes           | 2021  | 2022  | 2023E | 2024E | 2025E |
|-----------------------|-------|-------|-------|-------|-------|
| Global production     | 13183 | 13472 | 13712 | 13837 | 13908 |
| YoY change            | 4.5%  | 2.2%  | 1.8%  | 0.9%  | 0.5%  |
| Global consumption    | 13127 | 13343 | 13631 | 13938 | 14070 |
| YoY change            | 4.5%  | 1.6%  | 2.2%  | 2.3%  | 0.9%  |
| Balance               | 56    | 129   | 81    | -102  | -162  |
| Market inventories    | 706   | 834   | 916   | 814   | 652   |
| Weeks of world demand | 2.8   | 3.3   | 3.5   | 3.0   | 2.4   |
| LME Cash (\$/t)       | 2200  | 2149  | 2108  | 2000  | 1750  |
| LME Cash (c/lb)       | 100   | 97    | 96    | 91    | 79    |

Source: SNL, Woodmac, CRU, Bloomberg, company reports, ILZSG, BofA Global Research  
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## Exhibit 31: Zinc supply and demand balance

Project pipeline not a significant risk

| '000 tonnes           | 2021  | 2022  | 2023E | 2024E | 2025E |
|-----------------------|-------|-------|-------|-------|-------|
| Global production     | 14412 | 13500 | 14000 | 15150 | 15900 |
| YoY change            | 1.9%  | -6.3% | 3.7%  | 8.2%  | 5.0%  |
| Global consumption    | 13984 | 13837 | 14039 | 14334 | 14635 |
| YoY change            | 6.2%  | -1.1% | 1.5%  | 2.1%  | 2.1%  |
| Balance               | 427   | -337  | -39   | 816   | 1265  |
| Market inventories    | 1185  | 848   | 808   | 1624  | 2889  |
| Weeks of world demand | 4.4   | 3.2   | 3.0   | 5.9   | 10.3  |
| LME Cash (\$/t)       | 3003  | 3482  | 2905  | 2500  | 2250  |
| LME Cash (c/lb)       | 136   | 158   | 132   | 113   | 102   |

Source: SNL, Woodmac, CRU, Bloomberg, company reports, ILZSG, BofA Global Research  
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## Exhibit 33: Platinum supply and demand balance

Substitution, a rebound of auto and hydrogen are all bullish

| '000 ounces        | 2021  | 2022   | 2023E | 2024E | 2025E |
|--------------------|-------|--------|-------|-------|-------|
| Global production  | 7767  | 7054   | 7054  | 8023  | 8220  |
| YoY change         | 21.4% | -9.2%  | 0.0%  | 13.7% | 2.5%  |
| Global consumption | 8282  | 6138   | 7489  | 7608  | 7962  |
| YoY change         | 11.5% | -17.2% | 14.2% | 2.0%  | 4.7%  |
| Balance            | -121  | 522    | -404  | 416   | 258   |
| Spot (\$/oz)       | 1092  | 964    | 1186  | 1465  | 1453  |

Source: Matthey, company reports, BofA Global Research estimates

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## Exhibit 28: Copper supply and demand balance

Balanced market in 2023E

| '000 tonnes           | 2021  | 2022  | 2023E | 2024E | 2025E |
|-----------------------|-------|-------|-------|-------|-------|
| Global production     | 24611 | 24918 | 25863 | 27184 | 27834 |
| YoY change            | 5.0%  | 1.2%  | 3.8%  | 5.1%  | 2.4%  |
| Global consumption    | 24825 | 25019 | 25811 | 26844 | 27918 |
| YoY change            | 3.6%  | 0.8%  | 3.2%  | 4.0%  | 4.0%  |
| Balance               | -214  | -101  | 52    | 340   | -84   |
| Market inventories    | 1164  | 1063  | 1114  | 1454  | 1370  |
| Weeks of world demand | 2.4   | 2.2   | 2.2   | 2.8   | 2.6   |
| LME Cash (\$/t)       | 9321  | 8822  | 9427  | 9875  | 10500 |
| LME Cash (c/lb)       | 423   | 400   | 428   | 448   | 476   |

Source: SNL, Woodmac, CRU, Bloomberg, company reports, ICSG, BofA Global Research  
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## Exhibit 30: Nickel supply and demand balance

Class 1 nickel may remain tight

| '000 tonnes                   | 2021  | 2022  | 2023E | 2024E | 2025E |
|-------------------------------|-------|-------|-------|-------|-------|
| Global production             | 2799  | 3264  | 3521  | 3794  | 3970  |
| YoY change                    | 8.1%  | 16.6% | 7.9%  | 7.7%  | 8.9%  |
| Global consumption            | 2675  | 2670  | 3317  | 3779  | 3857  |
| YoY change                    | 14.0% | -0.2% | 24.2% | 13.9% | 10.5% |
| Balance, incl. NPI oversupply | 124   | 594   | 204   | 15    | 113   |
| Balance, excl. NPI oversupply | 4     | 145   | 62    | -255  | -236  |
| Market inventories            | 392   | 537   | 598   | 343   | 108   |
| Weeks of world demand         | 7.6   | 10.4  | 9.4   | 4.7   | 1.5   |
| LME price (\$/t)              | 18455 | 25707 | 23222 | 21250 | 25000 |
| LME price (c/lb)              | 837   | 1166  | 1053  | 964   | 1134  |

Source: SNL, Woodmac, CRU, Bloomberg, company reports, INSG, BofA Global Research  
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## Exhibit 32: Iron ore supply and demand balance

Flipping back into surplus

| Wet Mt                  | 2021  | 2022E | 2023E | 2024E | 2025E |
|-------------------------|-------|-------|-------|-------|-------|
| Global production       | 2,270 | 2,302 | 2,331 | 2,472 | 2,576 |
| YoY change              | 0.5%  | 1.4%  | 1.2%  | 6.1%  | 4.2%  |
| Global consumption      | 2,301 | 2,223 | 2,292 | 2,344 | 2,361 |
| YoY change              | -0.5% | -3.4% | 3.1%  | 2.3%  | 0.7%  |
| Balance                 | -32   | 79    | 39    | 128   | 215   |
| Iron ore price (US\$/t) | 160   | 117   | 98    | 79    | 82    |

Source: Company reports, CRU, Bloomberg, BofA Global Research estimates

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## Exhibit 34: Palladium supply and demand balance

Palladium will likely be oversupplied in the medium term

| '000 ounces        | 2021   | 2022  | 2023E | 2024E  | 2025E  |
|--------------------|--------|-------|-------|--------|--------|
| Global production  | 10,010 | 9,686 | 9,651 | 10,515 | 10,899 |
| YoY change         | 9.5%   | -3.2% | -0.4% | 8.9%   | 3.7%   |
| Global consumption | 10,149 | 9,829 | 9,107 | 9,114  | 8,865  |
| YoY change         | 0.6%   | -3.2% | -7.3% | 0.1%   | -2.7%  |
| Balance            | -139   | -143  | 545   | 1,401  | 2,034  |
| Spot (\$/oz)       | 2,399  | 2,110 | 1,520 | 1,632  | 1,564  |

Source: Matthey, company reports, BofA Global Research estimates

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