

Medium Term Challenges and Opportunities for Zinc

DESK STRATEGY

April 2023

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Zinc Market snapshot – Prices under pressure

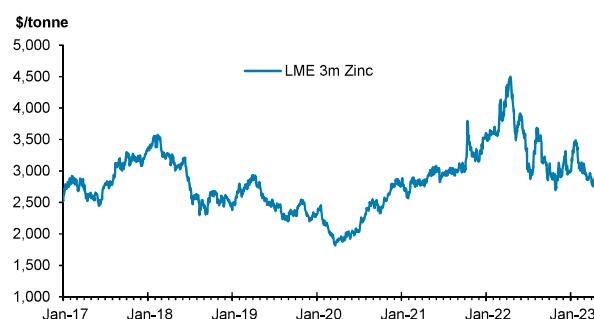
Zinc prices surged to record highs of USD4,896/t in March 2022: A combination of European smelter capacity closure announcements and physical trader driven cancellations of LME zinc inventory drove zinc prices to record highs on March 8th last year.

On-warrant LME zinc inventory have fallen from c.265 kt in April 2021 to 8,075 t in early February 2023

Zinc price has subsequently struggled, falling to 2-year lows of USD2,769/t in April: Zinc prices are now underperforming versus the LME base metals basket (bar nickel).

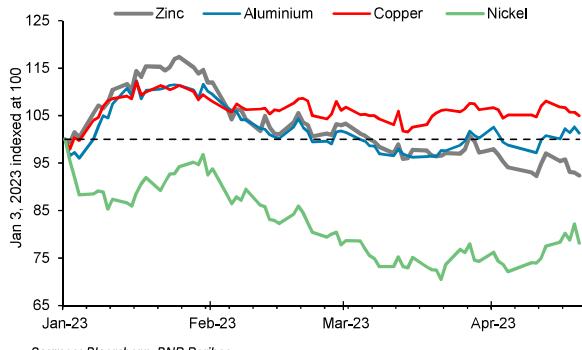
Investor exposure to LME zinc is now at its lowest level since July 2020. A key question is why?

Zinc recovered strongly from recent March 2020 lows, recovery helped by European smelter closures, plus rapid declines in visible inventory



Sources: Bloomberg, BNP Paribas

However, in 2023 zinc has slipped from outperformer to underperformer as weakening fundamentals have weighed on price levels

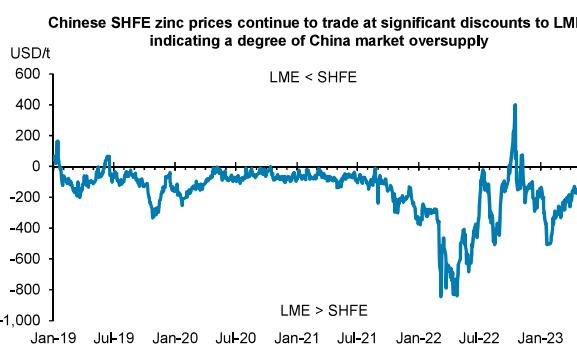
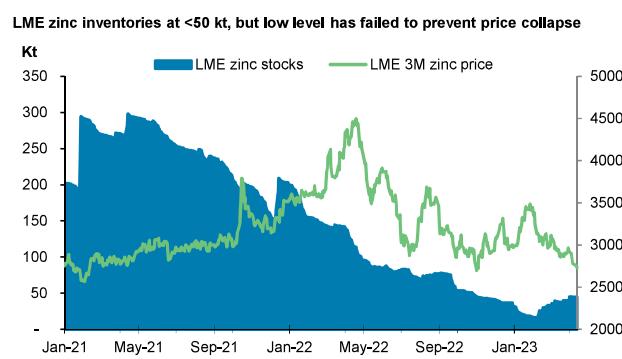
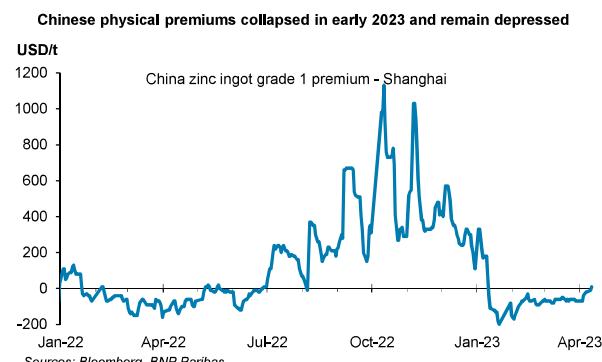
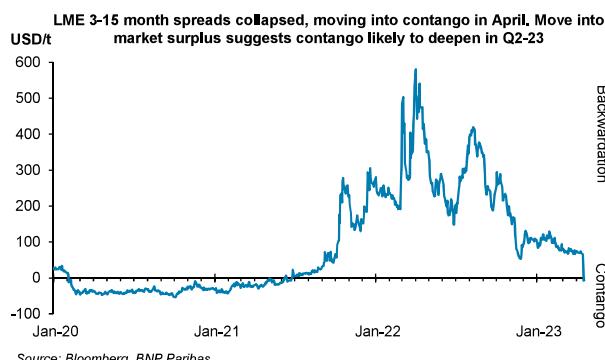


Sources: Bloomberg, BNP Paribas



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Market indicators misaligned: LME inventory suggests tightness, price trends and other market indicators otherwise



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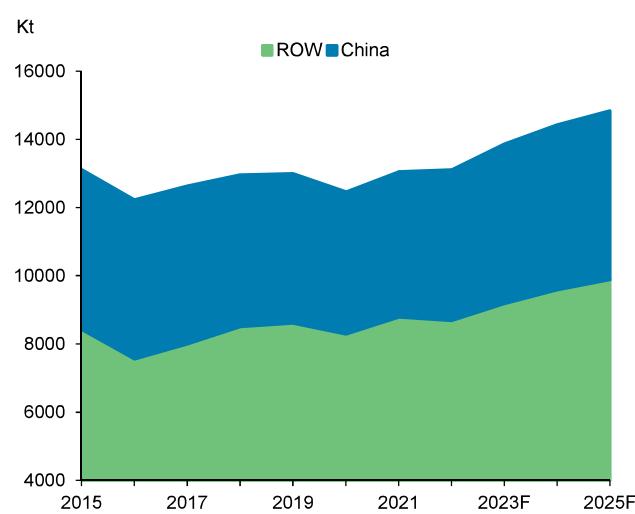
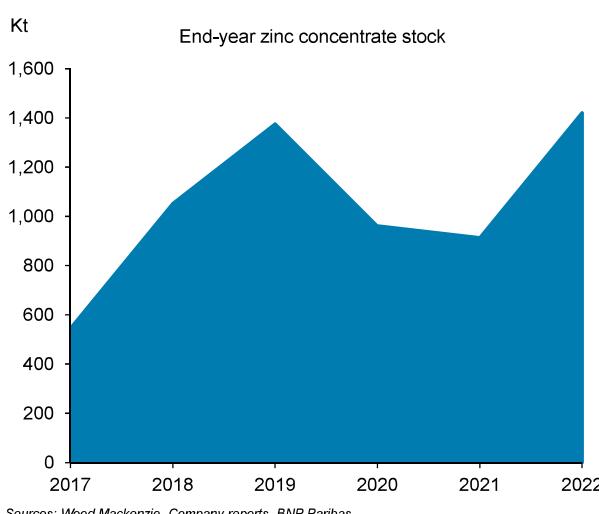
Supply a key short and medium term challenge for zinc pricing

Mine supply forecast to grow by 3.1% in 2023: After growing by only 0.2% in 2022, we expect mine supply to jump by 3.1% this year, largely due to continued ramp-ups at Gamsberg (South Africa), Zhairem (Kazakhstan) and Aripuana (Brazil), plus new projects including Buenavista (Mexico) and Korbalikhinsky (Russia), plus a number of small Chinese projects. Indeed, we expect Chinese mine supply to grow by c.300 kt this year to 4.6 Mt

High zinc concentrate availability driving high treatment charges (TCs): 2023 annual benchmark TCs settle at USD274/t, well above current spot TC levels, prompted by rising concentrate inventories built during 2022 due to European smelter closures.

Zinc concentrate inventories have been on the rise, notably in 2022 on the impact of smelter closures in Europe

China, well endowed with domestic zinc mine capacity, accounts for one-third of global mine supply



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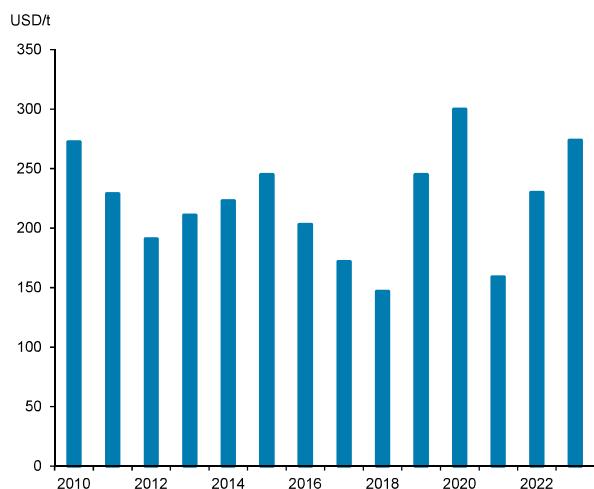
Treatment charges (TCs) set to rise further on accelerating mine supply

High levels of zinc concentrate inventory, plus accelerating mine supply have seen zinc TCs rally: Zinc smelters have locked in a 19% increase in concentrate processing fees for 2023 supply.

Treatment charges are discounts to London Metal Exchange prices given to smelters for processing ores into refined metal. For 2023, the annual terms will be inflated by 6% if zinc prices trade above USD3,000/t

2023 benchmark TC lower than expected: The 2023 settlement represents the second highest on record, with 2020 levels being set at USD300/t. Given our expectation of 3.1% y/y this year, and 5.3% in 2024, we expect spot rates to find more upside

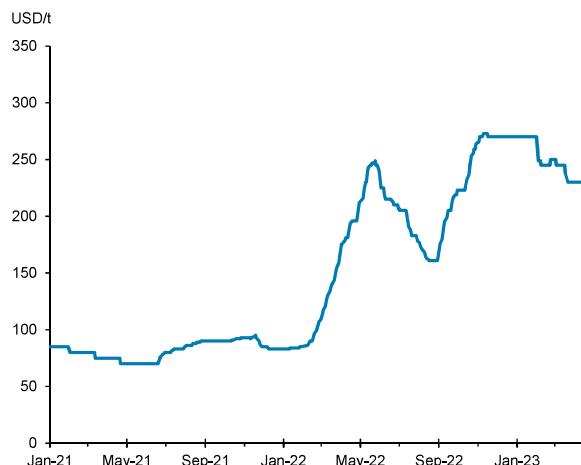
2023 bench zinc TCs set at 274/t, up 19% on 2022 benchmark levels of USD230/t



Sources: Bloomberg, BNP Paribas

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Current spot zinc TCs are c.USD250/t, below benchmark levels. We expect rising mine production to push spot towards benchmark levels, incentivizing more smelter output, particularly in Asia



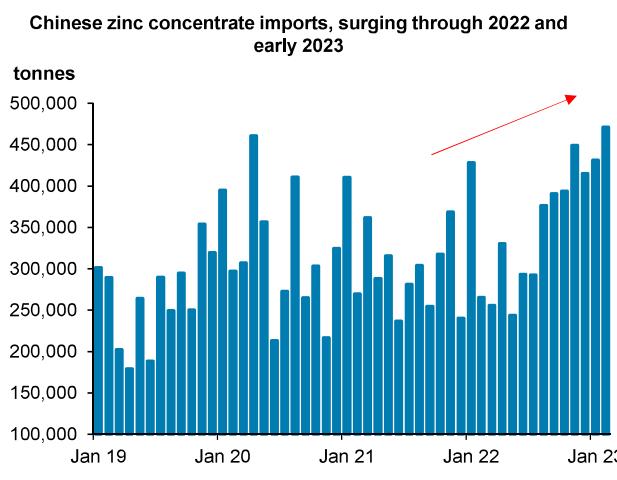
Sources: Bloomberg, BNP Paribas

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Asia smelter capacity growth, rising utilisation rates, negating western cuts

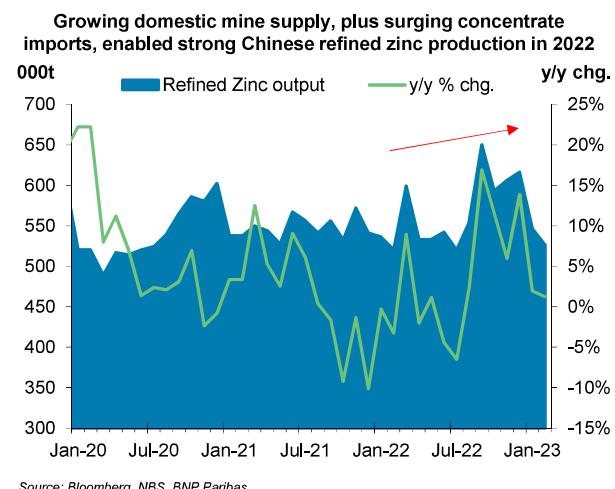
European smelter cuts in 2022 grabbed headlines, but failed to sustain price support: Closures of European smelter capacity operated by traders Glencore and Trafigura in 2022 only provided a brief boost to zinc prices last year. There was not a commensurate closure in mine capacity in 2021 and 2022, prompting a ballooning of zinc concentrate inventory to c.1.4 Mt on a zinc contained basis by the end of last year, we believe much of which has been diverted to Asia.

High zinc concentrate availability and high treatment charges (TCs) prompted Asian refining to surge in 2022: In particular Chinese refined zinc production surged by c.10.3% y/y in Q4 as spot TCs ramped to over USD250/t. Whilst Chinese smelter production was sluggish in Jan-Feb of this year, growing by only 1.6% y/y, we expect the settlement of annual benchmark TCs at USD274/t for this to prompt a renewed surge in smelter output. Indeed, we forecast 6% smelter output growth in China this year, the highest annual growth since 2014, and up from 3.7% growth last year.



Source: General Administration of Chinese Customs, BNP Paribas

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Source: Bloomberg, NBS, BNP Paribas

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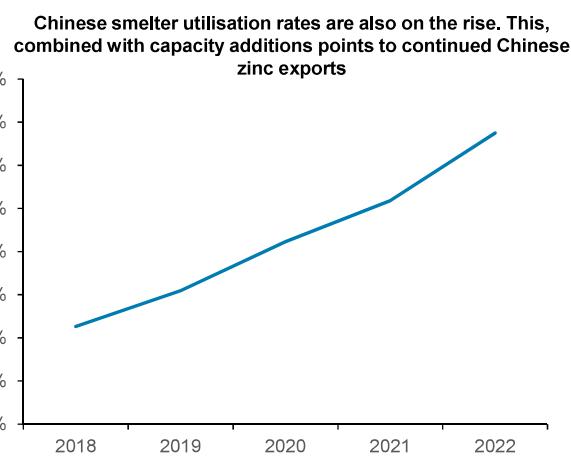
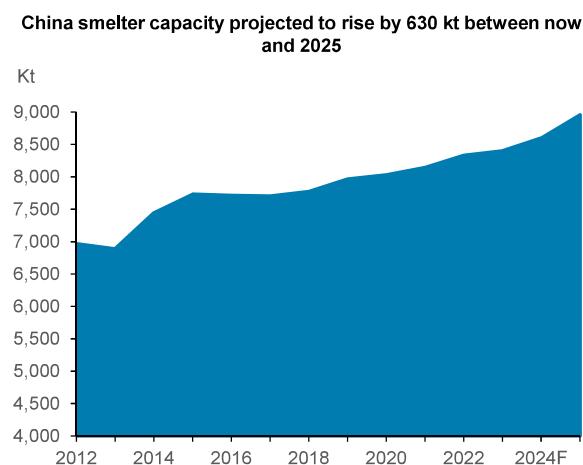
China is driving smelter capacity growth

Global zinc smelter is projected to rise c930 kt to 17.7 Mt by 2025, driven largely by China: Smelter capacity is expected to grow globally by c.930 kt over the next 2 years, with much of this growth occurring in China.

Probable Chinese projects including green field projects in Hebei, Henan, Hunan, and Sichuan, plus a brownfield expansion in Sichuan will add c.630 kt of new capacity.

In addition to increasing capacity, we expect average utilisation rates at smelters to improve going forward, enabled by high zinc concentrate stockpiles, and growing mine supply. Average utilisation rates fell to 79.9% in 2022, due to capacity closures in Europe. However, we expect average rates to recover to 83.4% by 2025.

Chinese capacity utilisation rates to rise to close to 82% by 2025, combined with capacity growth will, we expect, sustain China as a net zinc exporter



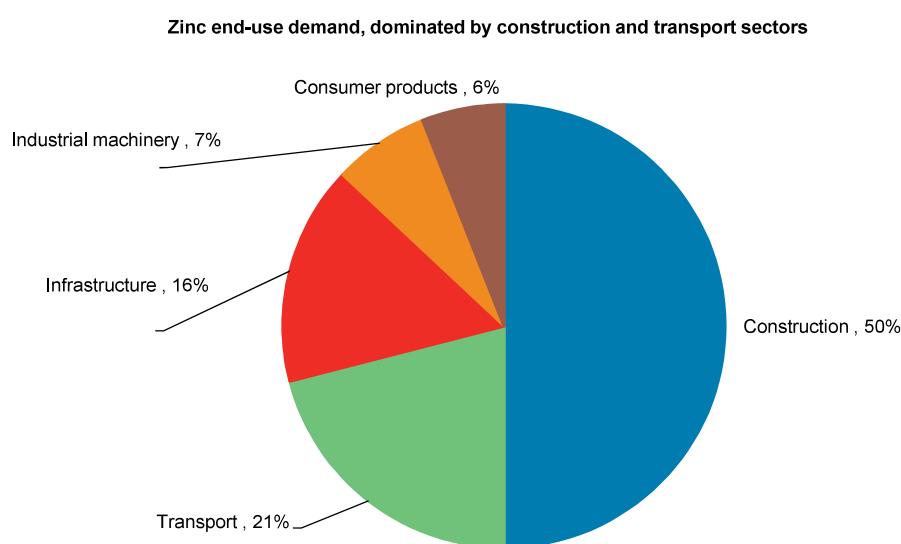
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Zinc demand dominated by construction and auto sectors

Zinc demand from the construction and automotive/transport sector account for c.71% of global zinc demand. Both sectors represent challenges for zinc demand in the medium term.

In terms of geographic split, China dominates demand, accounting for c.50% of demand annually. In comparison, the US accounts for c.7%. China remains key to the medium term demand outlook for zinc



Source: Wood Mackenzie, BNP Paribas

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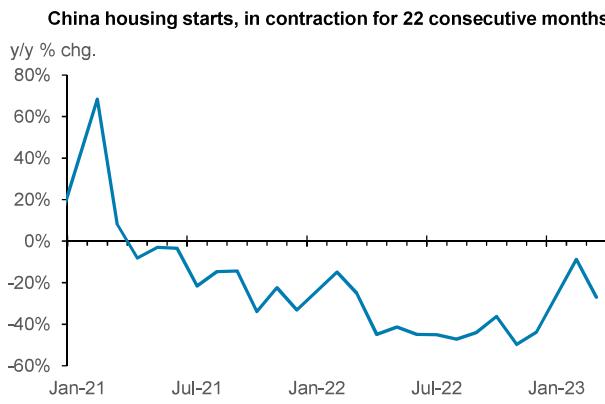
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Construction activity is slowing in all key regions

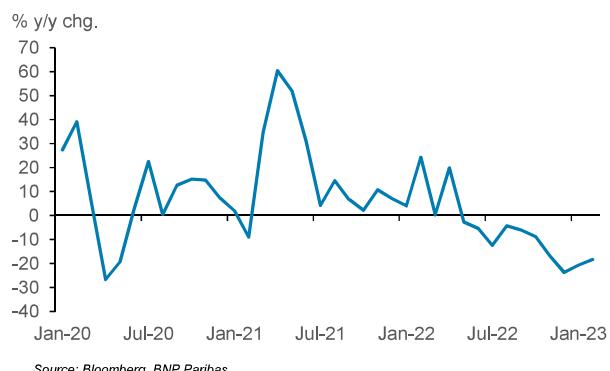
Chinese construction activity, still in decline: Chinese housing starts have been in contraction for 21 consecutive months. Some optimism has been sparked by the return of positive property prices in China's top 70 cities in January and February. However, we believe the price uptrend is more a reflection of the opening up to China's property markets to private equity investors, rather than an uptick in real Chinese consumer property demand.

China's construction downtrend is, we believe, in part due to sharply slowing population growth trends, combined with policy measures to shift the engine of economic growth towards domestic consumption, and away from construction and manufactured exports

US construction activity turning down: US housing construction activity, in terms of building starts, has been in decline for nine consecutive months, and we expect this downtrend to continue through 2023 as housing sales slide. Indeed, over the first two months of this year, sales of new and existing property has fallen by 21% y/y and 30% y/y respectively, whilst the issuance of building permits for new construction has fallen by 27% ytd, such indicators suggests



US construction starts in contraction since May 2022



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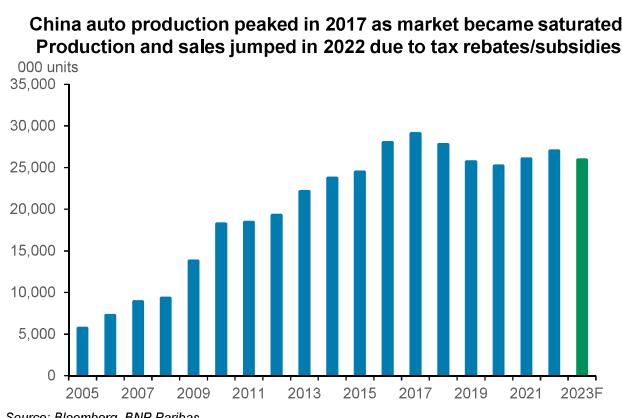
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Auto sales/production also slowing globally

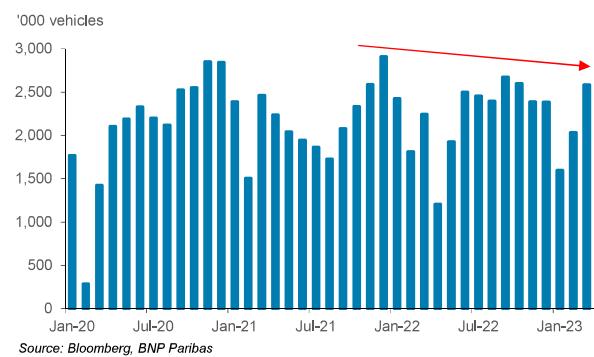
Auto production accounts for c.21% of global zinc demand via galvanised steel, but usage is US/European producer focussed: Steel-bodied cars produced in US, Europe, Japan, and South Korea are fully galvanised, but in China galvanising is has traditionally been limited to a small number of domestic luxury models. Typically Western auto production tends to have a greater impact on automotive zinc demand, however we do expect to see greater use going forward in China across more auto models as product quality improves.

Chinese auto production and sales peaked in 2017: We believe the Chinese auto market reached saturation point in 2017, prompting production and sales growth to stall. The improvement in

China auto production growth likely to stall in 2023 on tax break/subsidy removal: The ending of the decade long EV subsidy programme and the six month tax break for petrol powered vehicles prompted a sharp drop in Jan-Feb 2023 Vehicle production. March has seen some degree of rebound, with output levels up 15% y/y to 2.5 M units, taking YTD growth to -4% y/y. For 2023, we expect to see a modest growth pick up in H2-23 under the possibility of the reintroduction of sales support, but sales and production to revert to a downtrend in 2024 and 2025 as the auto market matures



Removal of ICE tax breaks at end-2022 points to a stalling of China auto production growth in 2023



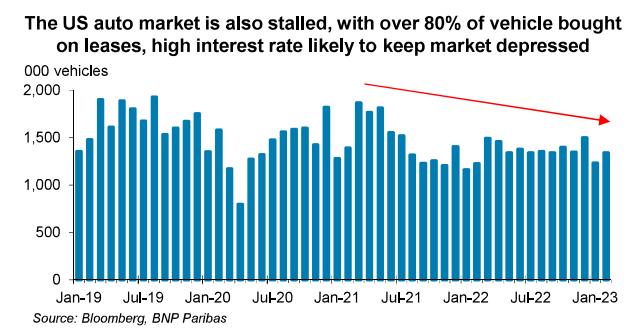
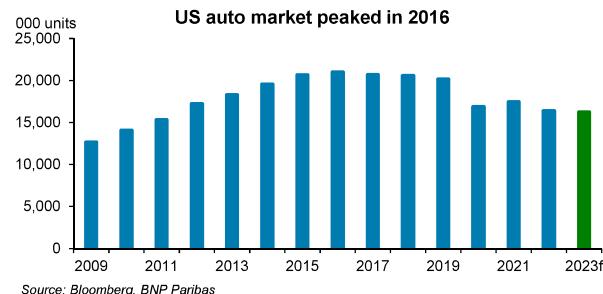
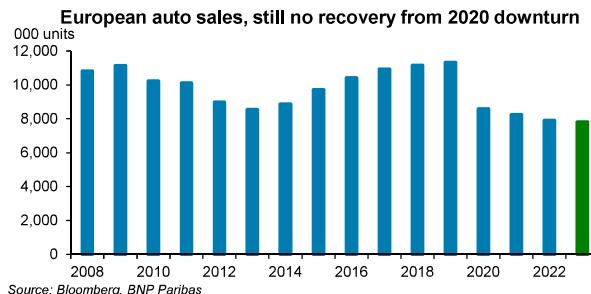
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Auto sales/production also slowing globally

US / Europe auto sales positive in Q1-23, but headwinds mounting: US auto sales rose by 7.5% in Q1-23, as production rates improved with easing microchip supply constraints. However, reported dealer inventory also jumped, suggesting end sales to consumers are not rising to the same extent. With lease rates now at 7%, we expect to see headwinds for US production and sales in H2-23.

Europe, following US trends: We strong Q1-23 sales growth on higher production rates to stall in H2-23, as higher interest rates slow leasing rated sales.



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Growing EV market penetration, a threat to automotive zinc demand?

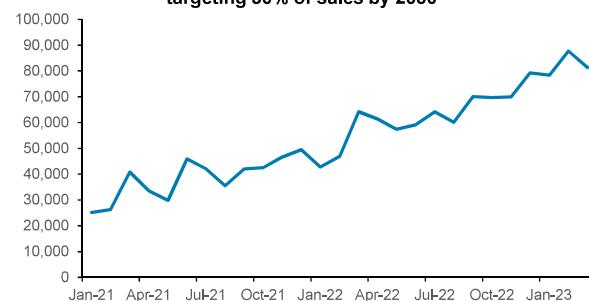
Total Electric Vehicles (BEV + PHEV) sales are expected to account for c.25% of auto sales by 2025: Increasing EV penetration is not necessarily a positive for automotive zinc demand.

EVs are typically more aluminium intensive in terms of structure and body panels in order to counter battery pack weight.

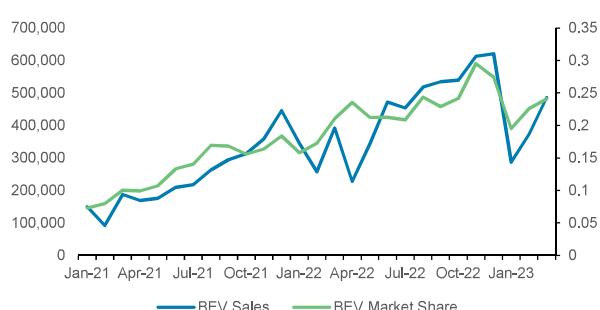
On average, a typical EV will contain between 15-27% more aluminium content compared to similar combustion engine vehicles, most notably for Body in White (BIW) and closures (doors, boot lid, bonnet etc).

Aluminium demand from growing EV penetration expected to reach 10 Mt per annum by 2030

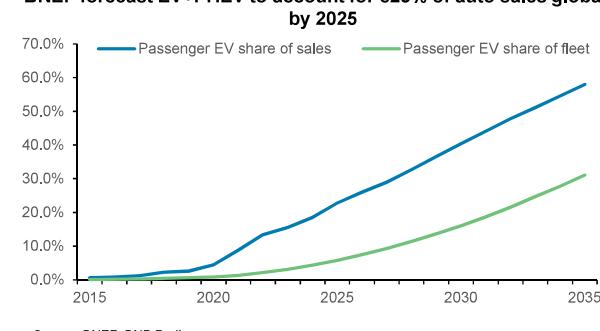
US BEV sales growing from a low base. US Govt. policy is targeting 50% of sales by 2030



China is now the World's largest BEV market, targeting EV sales to account for 50% of sales by 2035



BNEF forecast EV+PHEV to account for c25% of auto sales globally by 2025



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Energy transition presents longer-term demand possibilities, but impact limited in the medium term

Renewable energy is zinc intensive, thus the longer term demand: Galvanized steel is used in the structural supports for solar panels, in the transmission towers linking solar fields to grids, and similarly for the tower structure of on and off-shore wind turbines plus grid connections.

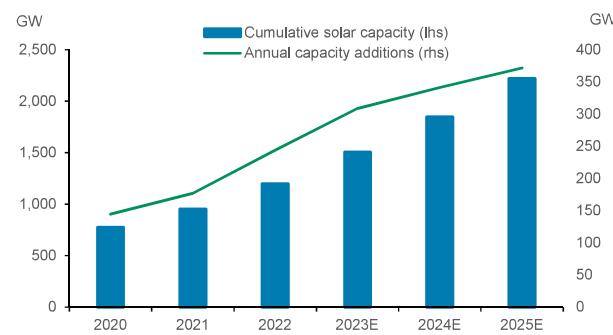
Around 50-55t of galvanised steel used per MW of ground based solar capacity installed, equivalent c3.1 tonnes of zinc per MW: The amount of galvanized steel used per MW of installed generation capacity varies significantly depending on whether the installation is on the ground or a rooftop, and whether it is stationary or a solar tracker variety (PV cells change angle to follow the sun). Traditionally most large, stationary ground-based systems use c.50-55 tonnes of galvanized steel per MW of capacity, and typically account for 60-70% of solar installations.

We believe this zinc intensity is falling and is likely to fall to c.2t/MW by the end of this decade as structural fabrication increasingly shifts to using pre-galvanised steel sheet. We estimate that zinc demand exposure will rise from c.500 kt in 2022, to 670 kt by 2025, not sufficient to be an important demand driver yet, particularly in an environment of slowing construction demand globally.

Rising global solar generation capacity additions, will account for c.670 kt of annual zinc demand by 2025



Source: NiSoft



Source: Bloomberg, BNP Paribas

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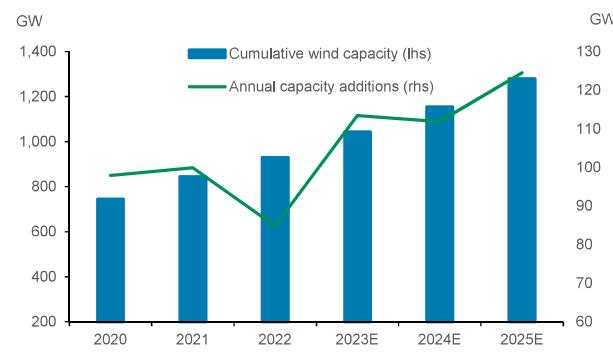
Energy transition presents longer-term demand possibilities, but impact limited near-term

Offshore installations dominate zinc exposure for wind generation, but resulting zinc demand volumes still relatively small: Zinc's intensity is typically much higher for offshore windfarms than onshore. For large scale coastal and off-shore wind tower installations, towers are wholly metallised and the process typically consumes around 350kg of zinc per MW of installed capacity. On this basis, annual zinc consumption in wind farm application is, in our estimation, likely to rise from c.30 kt in 2022, to c.45 kt by 2025. As with the projections for solar, we would argue that the growth in demand volumes is not significant enough to materially impact zinc supply-demand balances over the next two years.

Energy storage – also presenting new zinc demand opportunities: Currently the US dominates demand for battery storage capacity, with c.8 GW of utility scale storage installed at the end of 2022. The EIA expects this capacity to grow by c.21 GW to just under 30 GW of total installed capacity by 2025, with annualised zinc demand growth from such storage systems reaching 15 kt by 2025.

As with other metals, we believe the increasing demand impact of energy transition will be seen in the second half of this decade.

Zinc is used notably in off-shore wind generation, we expect zinc demand in this sector increase by 50% between 2022 and 2023



Source: Bloomberg, BNP Paribas

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Zinc Market Balance: Strong supply growth meets weak demand

Zinc market to flip into surplus in 2023 on slow demand, improving supply: After two years of deficits, we expect the zinc market to move into surplus in 2023 and 2024,

Weak construction demand a key headwind: We expect only a modest demand pick up in 2023, as energy infrastructure related demand and an expected bottoming out in H2-23 of China construction downturn provide some limited support. We expect construction activity to remain subdued in Europe and North America, as high interest rates undermine property demand. As a result we forecast total 2023 zinc demand to be 1% up on 2022 levels, but remain below 2021 consumption.

Zinc concentrate market remains very well supplied on accelerating mine supply: Annual benchmark treatment charge negotiations for 2023 contract levels finally concluded in April, with levels set between zinc miner Teck and smelter Korea Zinc at USD274/t, a 19% increase both on 2022 benchmark levels and current spot levels. Treatment Change (TCs) levels have surged due to a mismatch between mine supply and operating smelter capacity driven by the temporary closure of physical trader owned smelter capacity in Europe last year.

Zinc supply-demand balance

Kt	2020	2021	2022	2023F	2024F	2025F
Mine production/capability	12,396	12,997	13,104	13,817	14,384	14,791
Mine project allowance (probable and possible)	0	0	0	50	228	326
Mine disruption allowance	0	0	0	-361	-395	-408
Actual/forecast mine production	12,396	12,997	13,104	13,507	14,217	14,709
Total mined Zn % change	-4.2%	4.9%	0.8%	3.1%	5.3%	3.5%
Concentrate needed by smelters	12,807	13,039	12,594	13,182	13,706	13,798
Smelter recovery rates (%)	95.1%	95.1%	95.1%	95.1%	95.0%	94.9%
Zinc in residues & secondaries	1,507	1,497	1,487	1,477	1,477	1,477
Zinc from secondary plants	60	60	60	75	85	95
Actual/forecast smelter production	13,671	13,888	13,456	14,016	14,514	14,592
% change	1.7%	1.6%	-3.1%	4.2%	3.5%	0.5%
Zinc consumption	13,176	13,971	13,627	13,765	14,223	14,740
% change	-4.1%	6.0%	-2.5%	1.0%	3.3%	3.6%
Surplus/deficit	495	-83	-172	252	291	-148
Total metal stocks (Implied)	2,015	1,932	1,760	2,012	2,303	2,155
- in days of consumption	56	50	47	53	59	53

Source: Wood Mackenzie, company reports, BNP Paribas

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2023/24 surpluses dampens medium term zinc price outlook

KEY MESSAGES

We forecast the zinc market to move into surplus in 2023 and 2024: Strong smelter output growth in Asia, plus a return of some European capacity, is facing of weakening global construction demand. As a result we expect zinc prices to continue to underperform all base metals bar nickel.

Construction demand in long term decline on slowing urbanisation trends globally: Global zinc consumption is driven by the urbanisation and industrialisation of the developing world.

Rising EV penetration represents a potential threat to automotive zinc demand: The need to lightweight auto structures to counter back pack weight is driving greater aluminium penetration, we believe this is likely to be at the expense of galvanised steel demand

Zinc and energy transition demand – little material impact before 2025: We estimate that zinc demand from the build out of solar capacity will rise from c.500 kt in 2022, to 670 kt by 2025. In addition, we forecast zinc demand from largely offshore windfarms to rise by 50% from 2022 levels to 45 kt in 2025. As a result, we do not expect energy transition related zinc demand growth to materially impact supply-demand balances over the next two years.

BNP Zinc 2-year forecasts

LME 3-month	Spot (21 April)	Period	2022	Q2 '23	Q3 '23	Q4 '23	2023	Q1 '24	Q2 '24	Q3 '24	Q4 '24	2024
Zinc	2,764	Average End	3,442	2,745 2,700	2,740 2,780	2,815 2,850	2,810	2,885 2,920	2,950 2,980	3,015 3,050	3,075 3,100	2,980

Source: BNP Paribas



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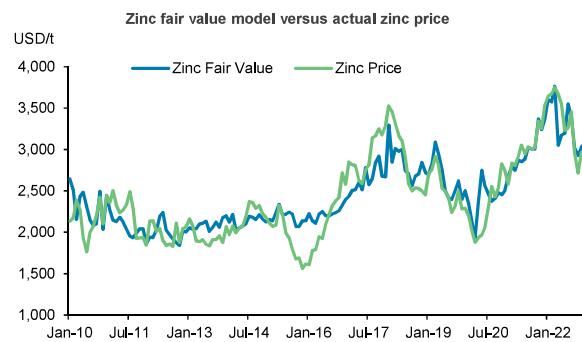
BNP Paribas zinc fair value model

The zinc fair value model is based on monthly data from 2009 until 2022.

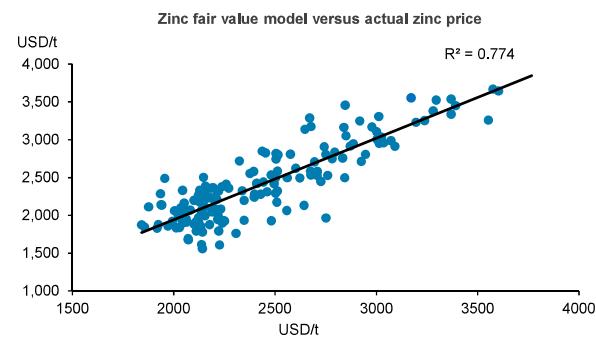
The explanatory variables are:

- EURUSD (forecast based on BNP Paribas EUR/USD forecast)
- Chinese manufacturing PMI (Indicator for Chinese domestic demand)
- Chinese net refined zinc imports (indicator for Chinese domestic refined zinc production)
- Zinc spot treatment charges (proxy for overall mined zinc supply and concentrate availability, forecasts based on BNP Paribas forecasts on annualised mine supply trends)
- London Metal Exchange (LME) on-warrant stocks (forecasts based on BNP Paribas market balance projections)

Overall, we estimate the model explains 77.4% of the price variability of zinc on a monthly basis (see Figures 3 and 4). The model has suffered from tracking errors in late H2-2015 due the combined impact of a surprise devaluation of the Chinese Yuan in August and speculation that physical traders would be forced to sell zinc metal inventory.



Source: BNP Paribas



Source: BNP Paribas

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