

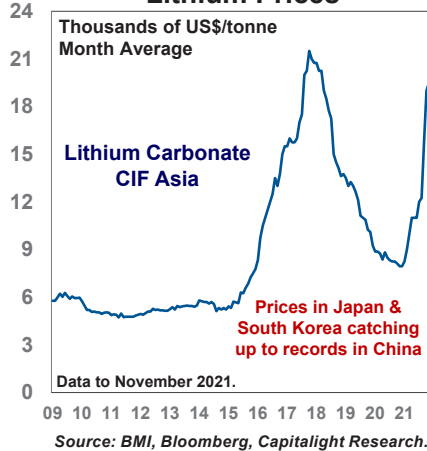
Critical Metals

For a Sustainable World 

December 13, 2021

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Lithium Prices



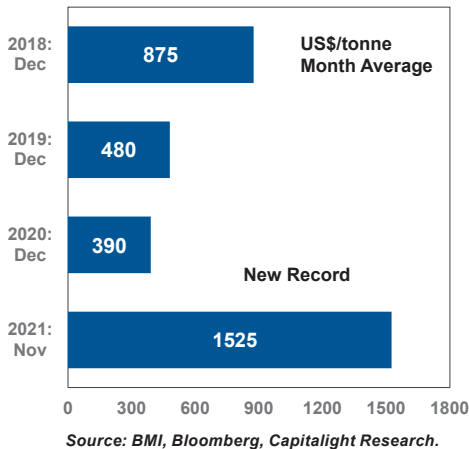
- Year-end Review & Outlook
- Lithium prices climb to new record highs amid strong Chinese battery demand; rare earth prices surge;
- Tight physical stocks underpin prices for copper & nickel, despite economic headwinds in China.

Strong EV Sales Outlook for 2022 – Driving Demand for ‘Critical Metals’

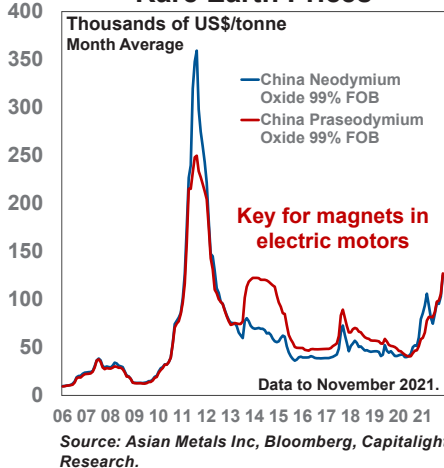
Global electric vehicle sales have climbed by more than 85% to an estimated 5.7 million units in 2021 – up from just over 3 million in 2020 (passenger vehicles only). Electric vehicles are the biggest ‘new energy market’ for many ‘critical metals’ such as copper. EV sales rose in all three major markets – China, Europe and the United States, with particularly strong gains in China and Europe. Sales were not noticeably constrained by the world semi-conductor shortage or the recent easing in economic conditions in China and the Eurozone (unlike traditional vehicles).

Electric vehicle sales should advance further in 2022 to 7-8 million – spurred by government sales incentives, industrial

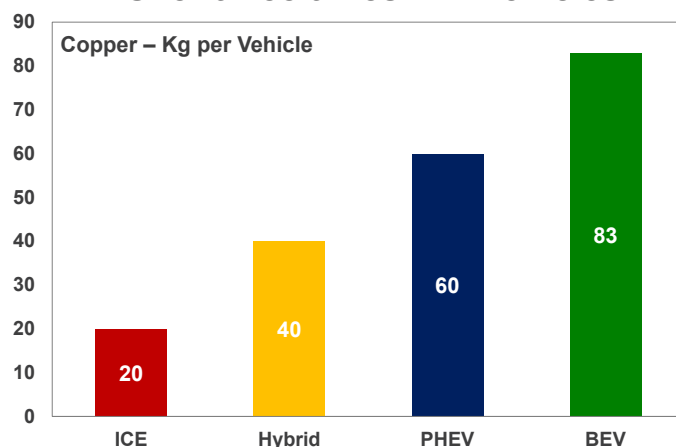
Spodumene Concentrates 6% FOB Australia



Rare Earth Prices



EV Copper Use – Over three times ICE Vehicles



ICE: Vehicle with Internal Combustion Engine

PHEV: Plug-in Hybrid Electric Vehicle

BEV: Battery Electric Vehicle

Source: International Copper Study Group 2021, Copper Development Association Inc.

policy favouring 'clean energy development', fuel economy & emissions reduction regulations and investment in EV charging infrastructure (included in the U.S. 'Infrastructure Investment and Jobs Act').

'New Energy Vehicle' (NEV) sales in China – the world's biggest auto market – soared to 2.4 million units from January to October 2021 – up 189% YTD. NEVs (including BEVs and PHEVs) accounted for a 14.3% market share in the year-to-date and an even higher 18.2% in October, according to the China Association of Automobile Manufacturers. Judging from this year's strong performance, China's goal of a 20% market share for NEVs by 2025 will likely be achieved ahead of time – in the next two years. Beijing is also targeting a 40% share for NEVs by 2030 – double the objective for 2025 – according to a plan unveiled by the State Council in October.

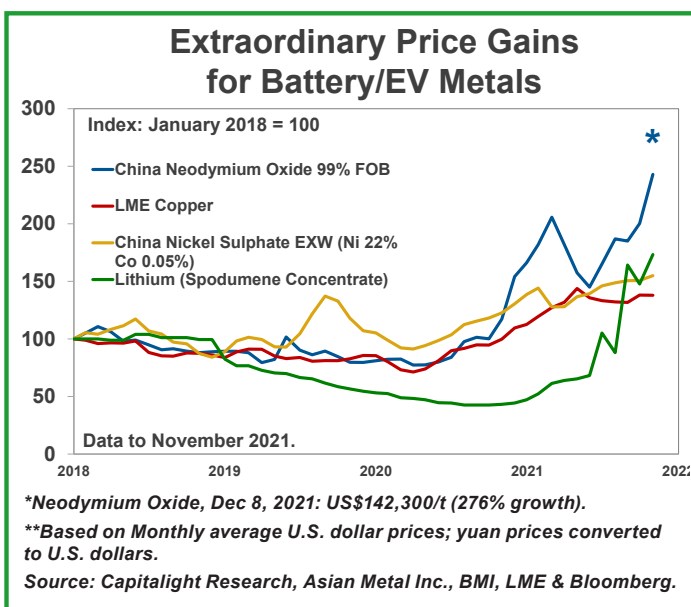
In Europe, a major, and quite rapid, transition appears to be underway from vehicles fuelled by petrol and diesel to electric vehicles. In the Eurozone, BEV & PHEV sales totalled 1.213 million units from 2021:Q1-to-Q3, with their market share rising to 16.2% (7.6% for BEVs and 8.6% for PHEVs). The market share of EVs was even bigger in the third quarter at 18.9% (9.8% for BEVs and 9.1% for PHEVs). In contrast, the

market share of petrol-driven vehicles dropped to 39.5% and diesel-fuelled cars to 17.6% (a total of 57.1%) compared with 47.6% and 27.8% respectively a year earlier (75.4%) – based on ACEA data. Proposed CO₂ emission regulations point to more than a 25% market share for EVs in the Eurozone by 2025. (EV sales in the U.K. & EFTA countries totalled an additional 365,954 units in 2021:Q1-to-Q3.)

An explanation – HEVs or 'Hybrid Electric Vehicles' (which can't be plugged in) are not considered part of the EV market. Nevertheless, HEVs are an important part of the European auto industry, with a market share of 20.7% in 2021:Q3. HEVs also use significantly more copper in their production than ICE vehicles.

Turning to the United States, EV sales have also strengthened to just under 500,000 units through October 2021 (550,000 through Nov.), though interest in EVs still lags other markets (Argonne National Laboratory). The market share of plug-in electrics has been about 7.3% for passenger cars and 3.7% for cars & light trucks this year. President Biden's proposed electric vehicle tax credits (up to US\$12,500 per vehicle) in the 'Build Back Better Act' will spur sales in coming years. However, Canada and Mexico are understandably lobbying for change, because of 'Buy American' provisions that will disrupt efficient North American trade in auto parts & assembled vehicles under the USMCA and will discourage the location of battery plants in Canada.

The 'Glasgow Climate Pact of COP26' cemented the pledges of vehicle manufacturers, countries and cities to speed up the transition to 100% Zero-Emission cars & vans (BEVs & hydrogen fuel cell vehicles). Auto manufacturers representing over 30% of the global market have now committed to phase out fossil-fuelled vehicles, up from almost zero two years ago. More than 110 companies have signed up to the EV100 pledge, committing to a fully Zero-Emission vehicle fleet by 2030.



COPPER – Transformative Demand, Slow Mine Development & Tight Stocks

LME cash prices for copper have edged up seasonally from US\$4.25 per pound in 2021:Q3 to US\$4.43 in October-November. Prices retreated in early December due to concern over the Omicron variant, but remain exceptionally lucrative at US\$4.33 on December 8 – yielding a 71% profit margin over average cash costs of US\$1.26 for six large producers in 2021:Q3 and roughly 52% over total costs including depreciation & interest expense. Despite COVID-19 uncertainties, we have raised the annual price forecast for copper slightly to US\$4.25 in 2021 and US\$4.20 in 2022, up from a pre-pandemic US\$2.72 in 2019, largely due to only a slow ramp-up of new mine capability.

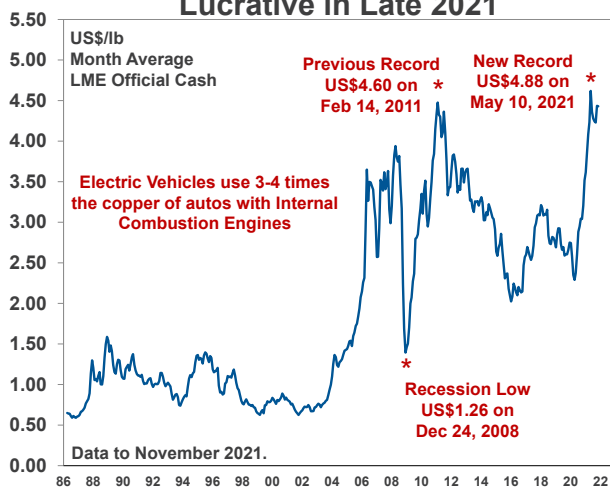
Copper prices have also been unusually resilient despite a marked slowing in China's economy since last September. After surging 15.4% y/y in the first eight months of 2021, Industrial production in China slowed to a mere 3.3% y/y pace in September and October – a development which normally would have cratered prices. The Caixin Purchasing Manager Index for manufacturing also eased below the 50 mark in November. Occasional surges of COVID-19, concern over China Evergrande's

default on certain offshore bonds, supply-chain bottlenecks and power shortages have all contributed to the slowdown. Despite the importance of China in the global copper market, accounting for 53% of consumption, positive investor sentiment linked to global decarbonization as well as very low 'visible' exchange stocks appear to be underpinning prices.

Power shortages in China reflected flooding earlier this year in key coal-producing provinces, resurgent demand for Chinese manufactured goods, an unofficial ban on Australian coal imports (some tonnage has recently been freed from customs) and conflicting CCP energy policies & market distortions caused by power rationing and price controls. On a more positive note, Beijing implemented electricity price liberalization in early October and ordered its two top coal regions (Shanxi and Inner Mongolia) to boost output by about 160 mt (note the conflicting goals with COP26). The net result, power constraints have recently eased.

China is now moving to bolster its economy, with the People's Bank of China cutting the Required Reserve Ratio for banks by 50 basis points as of December 15 (the second cut this year). China's GDP growth will likely average

Copper Prices Are Exceptionally Lucrative in Late 2021

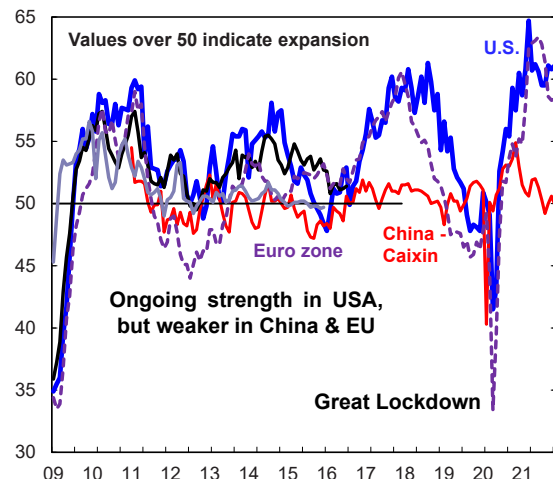


* Intra-day record high; Dec 8, 2021: US\$4.33.

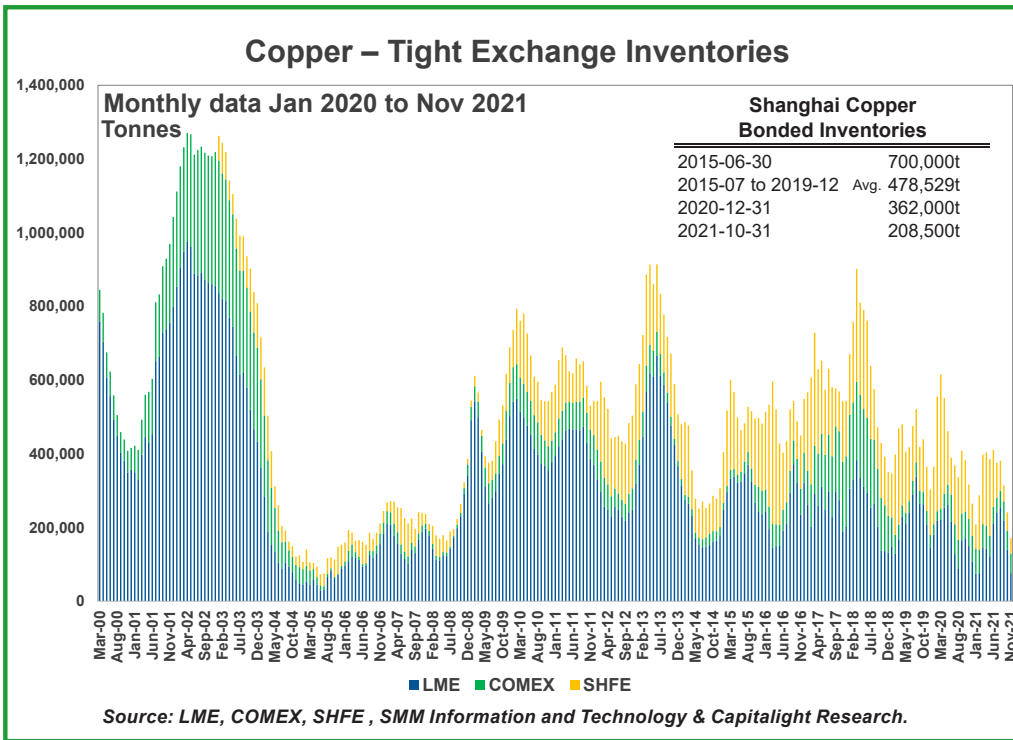
Source: LME, Bloomberg, Capitalight Research.

Global PMIs For Manufacturing

Drive Sentiment On Prospects For Commodity Markets



Source: Markit, ISM, Capitalight Research to Nov 2021. The 'reflation trade' has lifted overall commodity prices until recently.



Major mining companies also appear reluctant to rapidly commit capital, with investors seeking much higher returns than in the past ten years. Slow permitting will be a challenge in quickly ramping up new capability to meet rapidly growing demand. The net result, we would not be surprised to see copper prices moving up another notch to the US\$5 level.

NICKEL - Limited Supply In China Bolsters Prices

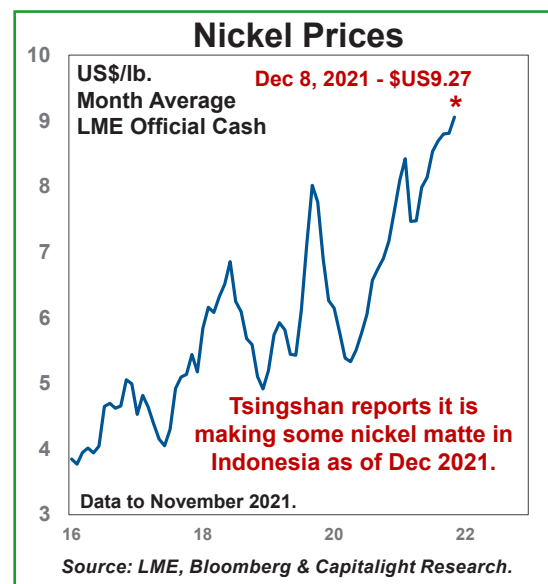
LME cash nickel prices rose to US\$9.06 per pound in November – up from

just over 8% in 2021, probably slowing further to ‘potential’ growth of 5 to 5 ½% in 2022.

Turning to copper’s supply & demand balance, after moving into ‘deficit’ in 2021, market conditions will likely remain finely balanced through the first half of 2022, before slipping into ‘surplus’ again in the second half of next year. A wave of new mine development – planned for some time – will finally start to come on stream. About 2.2-2.4 million tonnes of net new mine capability is set to be commissioned from 2021-2024 (3.65% p.a.) – including Teck’s Quebrada Blanca 2 project in Chile (300,000 t) and the further ramp-up of Ivanhoe Mine’s Kamoakakula in the D.R. Congo by mid-2022 as well as First Quantum’s Cobre Panama (252,000 t).

We have started to note new mine projects for the second half of the decade, when a large gap between supply and demand will open up. However, supply risks are considerable, with Peru’s National Society of Mining, Petroleum and Energy suggesting that 14 projects could be suspended due to social conflicts (4 of which involve copper projects scheduled to be developed between 2022 and 2027).

US\$8.81 in October – and remain at a profitable US\$9.27 on December 8. Nickel will average about US\$8.40 in 2021 and US\$9.25 in 2022 – a significant rally from only US\$6.25 in 2020 and US\$6.31 in 2019 (pre-pandemic). Based upon company guidance, Canadian production will be stable at Vale facilities and gains in Indonesian output may be slow to ramp up. Vale reports that it has a long-term offtake agreement with EV producers for its Class 1 nickel, which is



among the lowest carbon-intensive in the world (Sudbury, Long Harbour Newfoundland).

Nickel has been boosted in 2021 by a big turnaround in global stainless steel production – up 24.9% y/y in the first half of the year – after the ‘Great Lockdown’ of 2020, partly lifted by government infrastructure spending. While the positive impact of fiscal stimulus may be waning in some countries in late 2021, prices continue to be underpinned by stronger-than-expected nickel demand for batteries (up 400,000 t in 2021 instead of 215,000 t).

On the supply side, China has probably been curbing output of energy-intensive sectors – such as nickel pig iron (NPI) – to reduce power use as well as carbon emissions – contributing to concern over supplies and stronger refined nickel demand to feed stainless steel mills. Refined nickel stocks in SHFE warehouses, which are never very high, have dropped to only 6,147 tonnes in late November and bonded warehouse stocks at 10,200 tonnes are quite low. LME nickel inventories have plunged since May. The net result, total ‘visible’ stocks

worldwide at 124,000 tonnes are now -56.4% y/y and represent 18.6 days of global consumption.

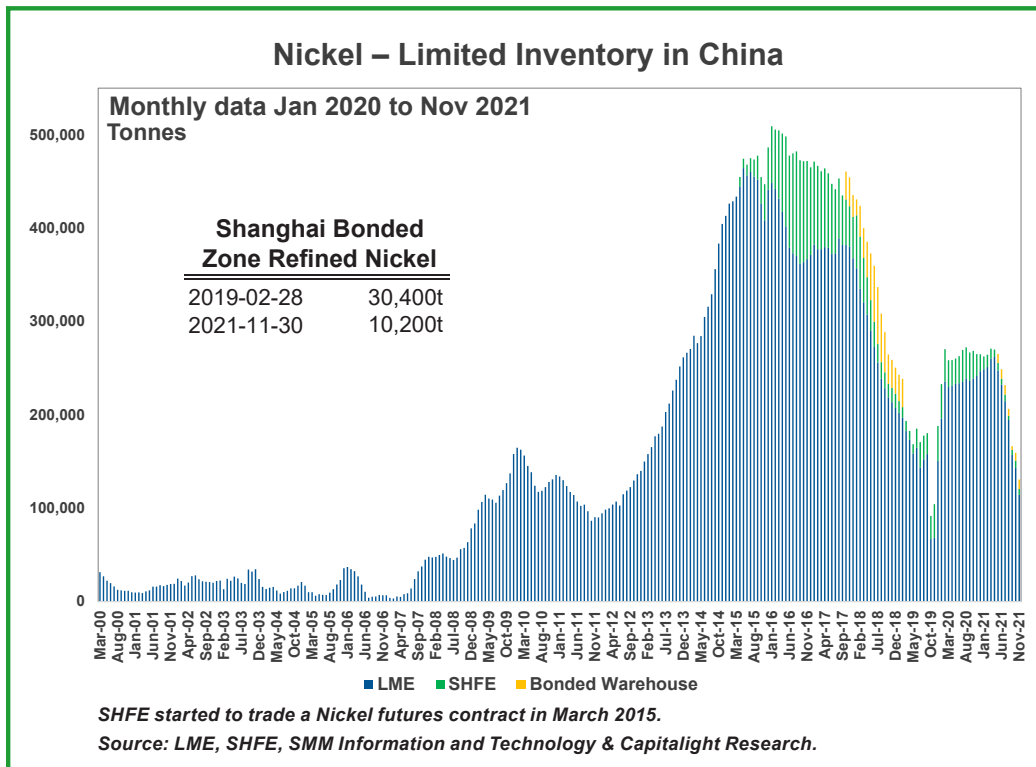
LITHIUM – A Growth Market For Canadian E&P Miners

Prices of ‘lithium carbonate and hydroxide EXW China’ both edged up in November, reaching new record highs of US\$31,400 and US\$30,300 per tonne – surpassing the strength during the last upswing in 2017-18 (based on BMI price assessments). Battery-grade carbonate continued to hold a slight premium over hydroxide in the Chinese domestic market (normally carbonate trades below hydroxide) due to the dominant market share of LFP batteries in China (53.1% in the year to date). Lithium price strength reflects strong battery cell production in China (+8.4% m/m in October to 25.1 GWh) in the face of tight feedstock & chemical supplies as well as some stocking ahead of China’s Spring Festival in early 2022. Further price gains are expected in 2022.

Internationally, hydroxide prices continued to play catch up with the Chinese spot market, with both European and North American prices

increasing by 5.4% in November. Lithium hydroxide is currently US\$19,500 in North America – higher than carbonate at US\$16,500 – reflecting a greater market share for nickel-rich battery chemicals (NCA & NCM).

Turning to feedstock, spodumene concentrate prices (6% Li2O) FOB Australia jumped from US\$1,300 per tonne in October to a new record US\$1,525 in November, with mining companies largely sold out. The height of the market back



in June-July 2018 was US\$915. Recognizing tight supplies, Liontown Resources of Australia has increased its planned output of spodumene concentrates from 295,000 t to 500,000 t (possibly ramping up to a very large 700,000 t), though this project will not start until 2024:H1.

In a major development, lithium buyers are starting to join forces with Chinese chemical producers to ensure adequate supplies. Chinese lithium major Ganfeng announced in early November that it has signed a contract with Tesla to supply battery-grade lithium hydroxide products over three years, starting in January 2022. Ganfeng also has offtake deals with BMW and Volkswagen. The Tesla contract highlights Tesla's commitment to nickel-rich cathodes for its longer-range vehicle segment, despite the company's previous statement that it would switch to cheaper LFP cathodes for standard-range models.

Canadian mining company **Lithium Americas** announced in mid-November that it has entered into a definitive agreement to acquire all of the outstanding shares in Vancouver-based **Millennial Lithium**, which owns the Pastos Grandes brine project in Argentina

(24,000 tpa LCE). Lithium Americas reportedly outbid Ganfeng and CATL for the acquisition, highlighting fierce competition for lithium assets given the projected supply deficit.

Lithium will likely represent a growth market for the Canadian mining industry in coming years, with 13 Canadian E&P companies active in the space.

Rare Earth Prices Outperform

The price of rare earth elements – used in magnets to drive electric vehicles and in generators for wind turbines – have outperformed in 2021 (see charts). 'China neodymium oxide 99%, FOB' advanced to US\$125,255 per tonne in November and spiked to US\$142,300 on December 8 – 79% above December 2020 and the highest price since May 11, 2012 (based on Asian Metal Inc. price assessments). As with other 'critical metals', strong demand in the EV, renewable energy and electronic industries – combined with possible supply disruptions at Chinese processing plants due to power shortages last Fall – have caused the surge in 'light' REE prices. China dominates world processing of REEs. A similar pattern is occurring with praseodymium.

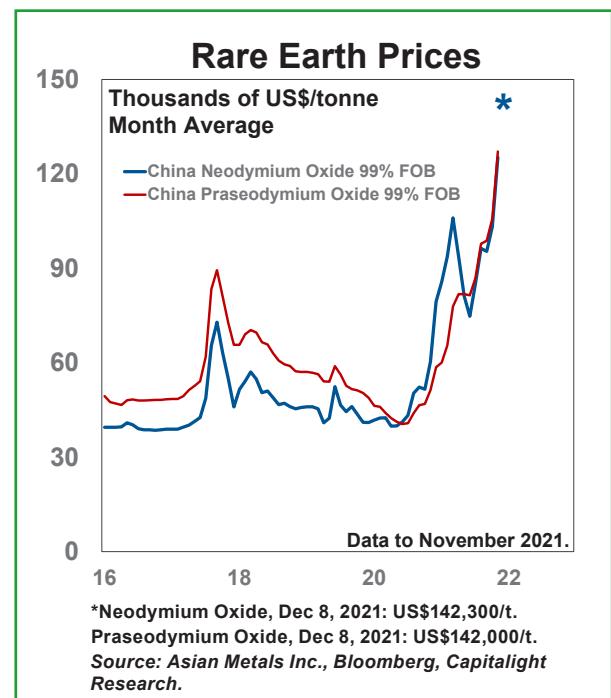


Table 1

Critical Metals - Price Trends

	2018 Annual	2019 Annual	2020 Annual	2020 Q4	Q1	Q2	2021 Q3	November	Latest Dec 8
Copper									
LME Copper Official Cash Settlement ¹ (US\$/lb)	2.96	2.72	2.80	3.25	3.85	4.40	4.25	4.43	4.33
Nickel									
LME Nickel Official Cash Settlement ² (US\$/lb)	5.95	6.31	6.25	7.23	7.99	7.87	8.68	9.06	9.27
SHFE Nickel, Generic First Contract ² (CNY/tonne)	102,916	110,746	109,054	120,402	131,120	128,570	143,708	146,275	148,590
China Nickel Sulphate EXW > 22% Ni, 0.05% Co ² (CNY/tonne)	28,411	30,487	29,874	30,338	35,766	35,714	39,276	40,114	38,750
Lithium									
Lithium Carbonate, CIF Asia ≥ 99.2% Li ₂ CO ₃ ³ (US\$/tonne)	17,063	11,675	8,421	8,008	9,083	11,000	13,333	19,500	19,500 <i>(Data to Nov 30)</i>
Lithium Carbonate, CIF North America ≥ 99.0% Li ₂ CO ₃ ³ (US\$/tonne)	14,833	11,215	7,746	7,183	8,083	9,750	12,375	16,500	16,500 <i>(to Nov 30)</i>
Lithium Hydroxide, FOB North America ≥ 55.0% LiOH ³ (US\$/tonne)	16,771	13,521	10,629	10,183	10,458	11,750	14,333	19,500	19,500 <i>(to Nov 30)</i>
Spodumene Concentrate, FOB Australia 6% Li ₂ O, Lithium Feedstock ³ (US\$/tonne)	886	595	406	382	472	579	1,048	1,525	1,525 <i>(to Nov 30)</i>
Rare Earth Elements									
China Neodymium Oxide 99%, FOB ⁴ (US\$/tonne)	49,918	44,655	48,757	63,810	95,147	83,222	92,267	125,255	142,300
China Neodymium Metal 99% FOB ⁴ (US\$/kilogram)	64	57	62	80	116	102	115	156	175
China Praseodymium Oxide 99%, FOB ⁴ (US\$/tonne)	63,627	54,024	45,725	52,274	67,818	81,665	94,484	127,109	142,000
China Praseodymium Metal 99% FOB ⁴ (US\$/kilogram)	114	103	91	92	96	104	110	140	162
China Dysprosium Oxide 99%, FOB ⁴ (US\$/kilogram)	177	234	259	266	384	398	400	458	459
China Dysprosium Metal 99% FOB ⁴ (US\$/kilogram)	262	307	341	348	497	516	516	566	565
China Terbium Oxide 99.9% FOB ⁴ (US\$/kilogram)	455	503	664	848	1,382	1,121	1,213	1,651	1,730
China Terbium Metal 99% FOB ⁴ (US\$/kilogram)	604	655	849	1,079	1,753	1,430	1,534	2,094	2,223

Sources:

1) LME, Bloomberg. 2) LME, SHFE, Asian Metal Inc., Bloomberg. 3) BMI, Bloomberg. 4) Asian Metal Inc., Bloomberg.

Table 2

Copper Price Outlook - Annual Averages

pre-pandemic

2018	2019	2020	2021F	2022F
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2.96	2.72	2.80	4.25	4.20
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Copper Quarterly Averages

Actual

20-1	20-2	20-3	20-4	21-1	21-2	21-3	Forecast					
21-4	22-1	22-2	22-3	22-4	23-1							

2.56	2.42	2.96	3.25	3.85	4.40	4.25								
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Sensitivities	High						4.65	4.55	4.75	4.30	4.00	4.00
	Base						4.48	4.35	4.50	4.10	3.85	3.85
	Low						4.30	4.15	4.25	3.90	3.70	3.70
Probability	High						0.08	0.15	0.15	0.20	0.20	0.20
	Base						0.85	0.70	0.70	0.60	0.60	0.60
	Low						0.07	0.15	0.15	0.20	0.20	0.20

Probability-Weighted Forecast							4.48	4.35	4.50	4.10	3.85	3.85
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LME official cash settlement, US\$/lb., quarterly averages.

Nickel Price Outlook - Annual Averages

pre-pandemic

2018	2019	2020	2021F	2022F
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5.95	6.31	6.25	8.40	9.25
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Nickel Quarterly Averages

Actual

20-1	20-2	20-3	20-4	21-1	21-2	21-3	Forecast					
21-4	22-1	22-2	22-3	22-4	23-1							

5.77	5.53	6.46	7.23	7.99	7.87	8.68								
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Sensitivities	High						9.20	10.25	10.50	10.25	10.00	9.00
	Base						9.05	9.25	9.50	9.25	9.00	8.75
	Low						8.90	8.25	8.50	8.25	8.00	8.50
Probability	High						10	21	21	21	22	23
	Base						80	58	58	58	55	55
	Low						10	21	21	21	23	22

Probability-Weighted Forecast							9.05	9.25	9.50	9.25	9.00	8.75
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LME official cash settlement, US\$/lb., quarterly averages.

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