

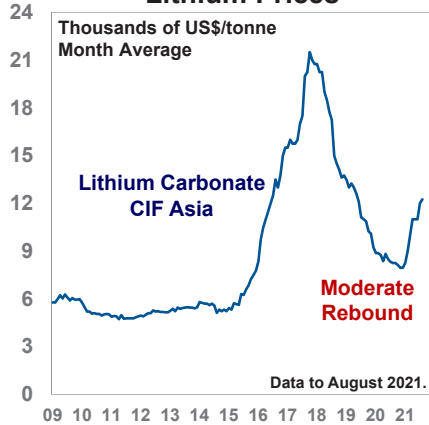
# Critical Metals

For a Sustainable World 

September 9, 2021

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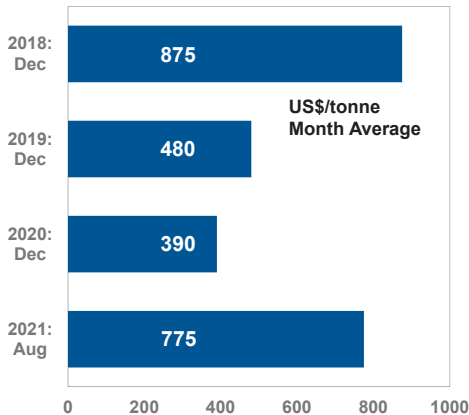
## Lithium Prices



Source: BMI, Bloomberg, Capitalight Research.

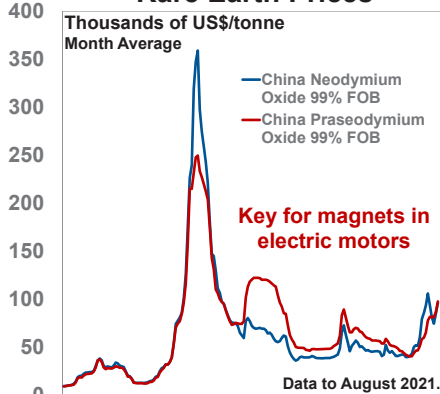
## Spodumene Concentrates

6% FOB Australia



Source: BMI, Bloomberg, Capitalight Research.

## Rare Earth Prices



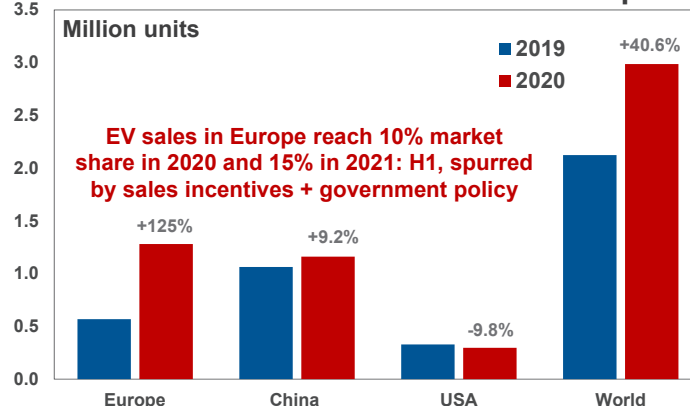
Source: Asian Metals Inc, Bloomberg, Capitalight Research.

- President Biden targets 50% market share for electric vehicles by 2030.
- Most 'lithium hydroxide & carbonate' producers are sold out through year end, with strong demand in China.
- Copper prices consolidate, but physical supplies are tight in Shanghai.

## United States joins China & Europe with a target for EV Sales

Global sales of electric passenger vehicles climbed by a robust 40.6% in 2020 to 3 million units, despite a -14.8% plunge in overall car sales during the pandemic. The gain in EV sales was led by Europe (+125%), where purchases of 1.28 million units just surpassed sales in China at 1.16 million for the first time (based on IEA data). China is the world's largest auto market – accounting for 29% of overall sales in 2019 (the United States 23%). However, large government incentives – offered as fiscal stimulus to lift economies out of the pandemic – buoyed European orders in 2020. Sales incentives were as high as US\$10,000 in Germany, US\$8,000 in France and about US\$7,000 in Italy for battery electric vehicles (BEVs).

## Electric Vehicle Sales Climb in Europe



### Passenger vehicles: Cars + SUVs.

World EV auto sales were 3 million units in 2020 & vans (light commercial vehicles) another 95,000 units. Europe: EU27, U.K., Norway, Iceland and Switzerland. Canadian EV sales: 51,000 units in 2019-20 = 3.3% market share.

Source: IEA, April 2021; Capitalight Research.

In the EU, lower CO<sub>2</sub> tailpipe emission limits for new cars and vans also encouraged EV sales last year; the average for corporate fleets will fall below 95 grams of CO<sub>2</sub> per kilometre in 2021 and is scheduled to drop further in 2025 and 2030. Interestingly, the market share of EVs in Europe rose to a significant 10% in 2020 and 15% in 2021:H1.

In a major policy development – likely adding momentum to the EV sector – President Biden signed an Executive Order on August 5, 2021 targeting a 50% market share for electric vehicles by 2030. In our view, government policy in the United States and China promoting the ‘transition’ from vehicles with conventional Internal Combustion Engines to EVs reflects as much a desire to achieve global leadership in a new, high-growth industry as it does environmental mitigation. The United States is coming relatively late to this game, with China identifying electric vehicles and their supply chains as new ‘strategic’ industries back in 2016, when it unveiled its ‘Made in China 2025’ growth strategy.

The United States was barely in the game with just over 300,000 EV sales in 2020 (a market share of 2%). However, even if the U.S. auto market fails to grow through 2030, given its maturity (the average household already owns 2-3 cars on average), a 50% market share for EVs implies hypothetical sales of more than 8 million vehicles. U.S. auto sales totalled 17 million in 2019 (pre-pandemic) and are forecast at 16.4 million in 2021.

Government policy will also spur significant EV deployment in China and Europe through

### World EV Sales in 2020

*Passenger Vehicles 2,986,659 units  
(4.6% world market share)*

*Vans (light commercial vehicles) 95,315 units*

*Medium + Heavy Trucks 7,476 units*

*Buses 1,182 units*

*Source: IEA, April 2021.*

2025 and 2030. China announced a new NEV development strategy for 2021-2035 on November 2, 2020 – adopted in the new Five-Year Plan in March 2021. Under this Plan, NEV sales are to account for 20% of passenger vehicle sales by 2025 – up from 6% in 2020 and only 2% in 2016. The Plan emphasizes R&D – for example, for intelligent-connected vehicle systems as well as the construction of EV charging and battery swapping networks. A target of 20% of sales by 2025 implies EV purchases of at least 4.5 million units by that date. The China Society of Automotive Engineers has a goal of 50% EVs by 2035 – consistent with China’s economy-wide carbon neutrality goal by 2060.

NEV sales targets have recently been achieved in China through a combination of consumer sales incentives from the central government and mandated requirements to achieve NEV credits by manufacturers. Auto companies with annual production or import volumes of at least 30,000 conventional passenger cars have been required to hit targets for both NEV credits and Corporate Average Fuel Consumption (CAFC) credits since 2018. The second phase of these requirements from 2021 will last through 2023. Major city governments such as Shanghai, Beijing & Tianjin provide significant ‘carrots’ and ‘sticks’ promoting EV adoption (NEV waivers on traffic restrictions, lower-cost parking, subsidies for the use of EV chargers, fewer licence restrictions and electrification of buses in most cities).

The European Union also plans 30 million EVs to be on European roads by 2030 – 12 times the current level. This goal for the transport sector was set out in the December 2020 ‘EU Sustainable and Smart Mobility Strategy and Action Plan’. The United Kingdom will ban the sale of ICE vehicles in 2030.

In Canada, the federal government has set a mandatory requirement that all new cars and light duty truck sales will be zero-emission by 2035. An interim goal of 50% may be set for 2030, depending upon the election outcome.

**Global EV Sales Will Climb Towards 28 million by 2030**

In addition to strong government support, the following developments point to substantial EV growth in coming years:

1) Worldwide, 18 of the 20 largest auto manufacturers – accounting for 90% of global sales – plan significant offerings of EV models through 2030. In fact, ten OEMs have pledged that at least 25% of their sales and models will be EVs by 2025-26 – four are Chinese companies (including Dongfeng Motor Co., FAW and SAIC Motor). Ten major OEMs have set even higher EV targets for 2030.

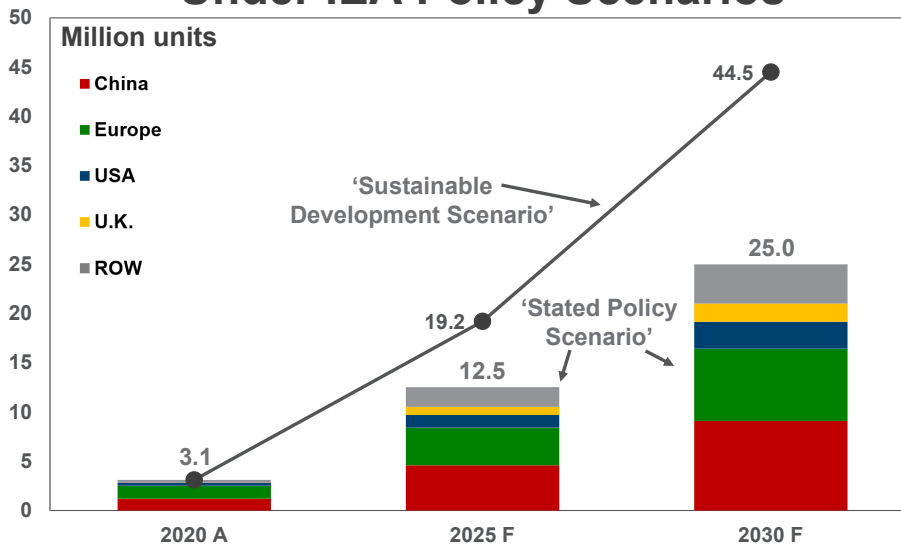
For example, Ford will only sell EVs in the European market by 2026 (40% worldwide by 2030); Volkswagen has a target of 20% EVs

by 2025 (70% in Europe & 50% in China & the United States by 2030); and Stellantis – the merger of Fiat Chrysler Automobiles NV with France’s PSA Group – has a goal of 38% in Europe and 31% in China & the USA by 2025 (70% in Europe and 35% in China and the USA in 2030). Toyota (known for the Prius) plans 70% of sales from EVs and fuel cell electric vehicles (FCEVs) by 2030.

General Motors will offer only electric ‘light duty vehicles’ by 2035.

2) To satisfy consumer preference, manufacturers are rapidly expanding the number of available EV models – especially popular SUVs, for which profit margins also tend to be the highest. We note that orders for the electric version of Ford’s F-150 pickup truck –

**Global EV Sales Outlook Under IEA Policy Scenarios**



Light duty vehicles: cars + vans (light duty commercial vehicles)

Europe: EU27, U.K., Norway, Iceland + Switzerland

IEA Policy Scenarios:

- 'Stated Policy Scenario' – Baseline projection with existing government policy + industry plans as of April 2021; Impact of U.S. President's order, targeting 50% EV market share by 2030, not included.
- 'Sustainable Development Scenario' – EV deployment to achieve Paris Accord and net-zero carbon economy in long run.

**EV Market Share In Cars (% Of Total Sales)**

	2020A	2025F	2030F
Stated Policy	4.6	10.4	17.3
Sustainable Policy	4.6	18.9	36.0

Source: IEA, April 2021; Capitalight Research.

the 'Lightning' – have been strong (available in 2022). An electric Mustang is also available – the 'Mach-E'.

3) The average price of an EV was still relatively expensive at US\$55,000 in the U.S. last year, but should come down over time. Battery packs are a significant cost factor – around a quarter of production costs – but have been dropping (by 85% over the past decade and 13% last year, according to Bloomberg NEF). The same source suggests price parity with conventional engine vehicles within five years, though the strong 'critical metal' prices likely in the second half of the decade will pose a cost challenge.

In its annual 'Global EV Outlook 2021', dated April 2021, the International Energy Agency (IEA) developed two 'scenarios' to assess the effectiveness of government policy to curb CO<sub>2</sub> emissions and mitigate climate change: the 'Stated Policy Scenario' – providing a baseline projection of EV sales to 2025 and 2030 – achievable with existing government policy; and the 'Sustainable Development Scenario' – EV deployment aligned with the Paris Accord and a 'net-zero carbon economy' globally in the long run.

It is important to note that the ambitious EV plans of OEMs (noted above) are consistent with the 'Stated Policy Scenario' in 2021-22, but are more aligned with the higher EV projections in the 'Sustainable Development Scenario' in 2025 and 2030. In other words, if the OEMs are successful in enticing consumers to EVs, electric vehicle sales could climb to 12.5 million units in 2025 and more than 25 million in 2030. Please see the chart on page 3.

Our own conclusion – using conservative assumptions on overall auto sales growth in key markets (China and the more mature markets of the United States and Europe) and a rough estimate of the impact of OEM targets, global EV sales could approach 12 million in 2025 and 28 million in 2030 (excluding light duty vans, such

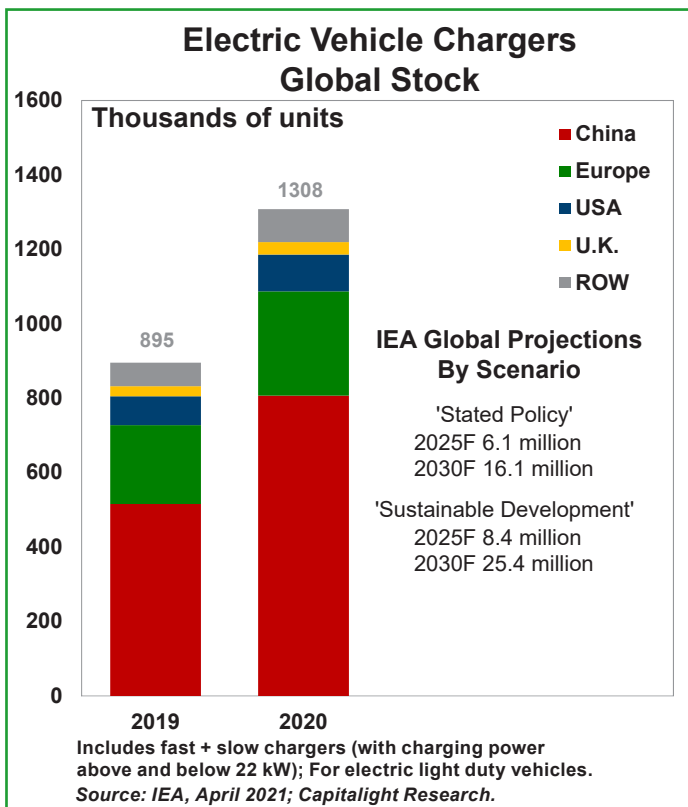
as those used by FedEx or Amazon). Though these estimates appear high, there is upside if consumers adopt EVs faster than assumed. U.S. EV sales are assumed at 6 million by 2030 instead of the 8 million implied by President Biden's target. EV adoption will probably be fastest in China (with the most effective industrial strategy) and Europe (where climate change concern is probably greatest) and slower in the United States, due to the impact of a large and economically-important oil industry.

A key constraint on EV sales is the 'range anxiety' of many consumers and concern over 'access to fast-charging infrastructure', noted in survey after survey. The Canadian Vehicle Manufacturers' Association has noted this concern. Huge government and private-sector investment in charging infrastructure will be needed to resolve this issue (please see the chart on page 5). The U.S. bipartisan infrastructure bill – recently passed by Congress – will fund another 500,000 chargers across the United States – adding to the roughly 99,000 currently available.

The impact on 'critical metal' demand will be huge, requiring significant and timely new mine development and expansion in the coming decade. Canada can be a world leader in supplying these critical minerals and in developing secure and resilient supply chains for them. Keys to success – boosting competitiveness in the processing technology needed for critical minerals & 'specialty chemicals' development, speeding up the mine permitting process at all levels of government and facilitating the development of new 'strategic' business partnerships in Canada.

### **COPPER - Physical Supplies Are Tight in China**

LME copper prices edged down in August to US\$4.24 per pound from US\$4.28 in July and are US\$4.23 on September 7th. Prices had



surged to an all-time intra-day record high of US\$4.88 on May 10 – buoyed by an expected 'deficit' in global supply & demand conditions in 2021 and prospects for a 'green' economic recovery.

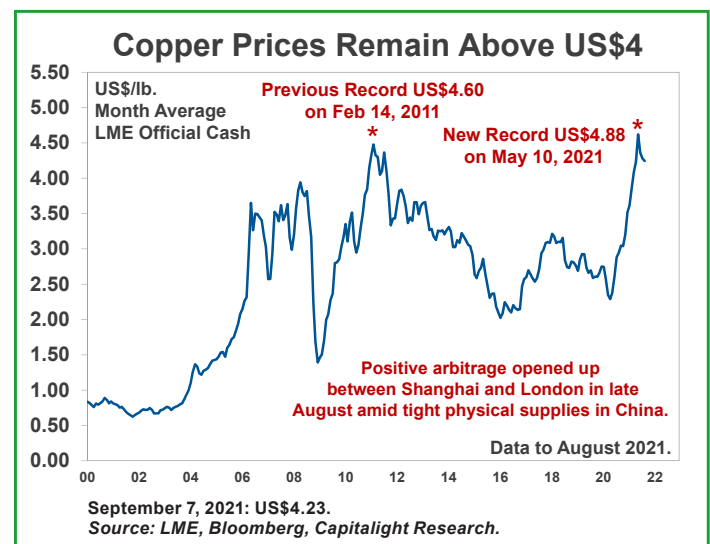
While underlying 'investor sentiment' remains positive for copper, economic momentum in China's economy – accounting for 53% of world demand – has been slowing. China's Caixin Purchasing Manager Index for Manufacturing (relevant for private-sector as well as large state-owned companies) has decelerated for three consecutive months and fell to 49.2 in August, pointing to the first contraction in manufacturing activity since April 2020. The PMI was dragged lower by containment measures to curb rising cases of the Delta variant, supply bottlenecks and high raw material prices.

Nevertheless, China is ramping up support again for the economy and the People's Bank of China has announced low-cost bank funding for

loans to small and medium-sized business. We remain optimistic that industrial orders will pick up again seasonally in the autumn and winter months, enabling China to achieve GDP growth well above its target of over 6% for 2021. GDP growth was robust at 12.7% in 2021:H1.

Copper retreated below the US\$4 mark for one day on August 19th, before quickly snapping back. The brief drop below US\$4 was caused by U.S. Federal Reserve Board minutes indicating the possibility of earlier-than-expected 'tapering' of the Fed's massive 'quantitative easing' program – the monthly purchase of US\$80 bn of Treasury and US\$40 bn of mortgage-backed securities – as soon as this year or in early 2022. At the 'Jackson Hole Economic Symposium', financial markets appeared to be comforted by comments from the Fed Chair that reduced asset purchases would not imply an immediate increase in the Fed funds target rate and that monetary policy would remain accommodative for some time. However, past experience indicates that longer-dated interest rates would probably back up and commodity prices ease.

China sold another 30,000 tonne batch of copper cathodes from the state reserve to domestic fabricators on September 1 – the third sale so far this year – intended to dampen



commodity prices. Nevertheless, supplies of copper appear fairly tight in China, given the recent sharp drop in SHFE stocks, high local price premiums and positive arbitrage opportunities in August between Shanghai and London (now reportedly closed).

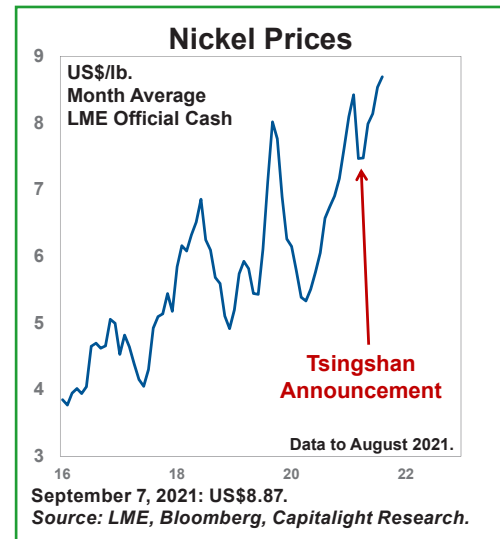
In Chile, potential supply challenges are easing, as new labour agreements are being concluded. A strike at Escondida was avoided, Codelco has reached wage deals with the five unions at El Teniente and the strike at Codelco's Andina mine was settled. However, a controversial copper royalty bill has cleared the Senate Mining Committee and has been sent to the Senate floor for more debate.

The net result, our copper price forecast remains largely unchanged at an average of US\$4.35 in 2021:Q4 and US\$4.22 for 2021 as a whole. Prices should average US\$3.96 in 2022 - just above US\$4 in the first half of 2022, before easing in the second half of the year to US\$3.85-3.90, as a wave of new mine development gradually comes on stream. Please see the tables on page 9 for further details. A robust medium-term outlook for copper is still expected.

### **NICKEL SULPHATE PRICES IN CHINA – At Record Highs**

LME nickel prices – the bottom line for the nickel industry – edged up to US\$8.69 per pound in August from US\$8.54 in July and are starting September on a strong note at US\$8.87 (Sept 7th). Nickel is in 'backwardation', with official cash settlement prices above futures – indicating tight near-term market conditions. LME Inventories have dropped significantly since late April.

Nickel prices continue to be higher than expected by many observers, with global supply & demand conditions in 'deficit' in 2021 and likely to remain largely balanced in 2022. The recovery in global stainless steel demand has been stronger than anticipated this year and leading



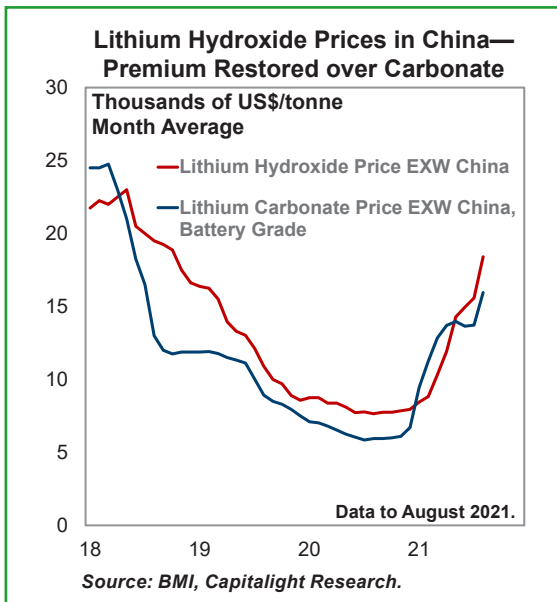
NCM cathode materials producers in China have been operating near capacity. Supply disruptions have also been significant.

Nickel sulphate prices (used in nickel-rich cathodes) at 40,250 CNY per tonne are at record highs in China in early September (in data back to April 2012, assessed by Asian Metal Inc.). Flooding in Henan province and Typhoon In-fa in eastern China in July negatively impacted nickel sulphate operations, contributing to price strength. Primary nickel stocks on the SHFE are critically low. Please see the tables on page 9 for our nickel price forecast.

### **LITHIUM – Prices Strengthen Across The Globe**

Exceptionally tight supply and increasing demand sustained the lithium hydroxide price rally in all regional markets in August. Most chemical producers reported sold-out order books through year end.

In China, hydroxide prices – key for nickel-rich cathodes – climbed to 119,500 CNY per tonne EXW China (US\$18,400) at the end of August, up from US\$15,575 in late July, with hydroxide's differential widening over carbonate. Prices for lithium carbonate EXW China also rose to US\$15,950 in late August. Please see the chart on page 7.



In contrast, average spodumene concentrate prices FOB Australia (6% Li<sub>2</sub>O) retreated back to US\$775 per tonne in late August, after surging to US\$925 in late July. However, the strong advance in July reflected an unusual and exceptionally high auction bid of US\$1,250 for a 10,000 dmt cargo of spodumene from Pilbara's Pilgangoora Operation for August. While prices have normalized, the trend line remains up.

Electric vehicle sales and production continued to move ahead in China in July (+164% and +171% yr/yr respectively), achieving new record highs. China's battery output also climbed to an all-time high of 17.4 GWh in July, 53.8% of which consisted of LFP cells (using lithium iron-phosphate cathodes). While European EV sales eased month-over-month in July, sales were still up 37.1% yr/yr.

Taking advantage of the growth in downstream industries, Ganfeng Lithium – a major Chinese lithium producer – announced plans to set up an industrial park in Chongqing (via its cell manufacturing subsidiary Ganfeng LiEnergy) to locate a 10 GWh battery plant and advanced battery research institute – with a focus on solid

state battery research. Another 5 GWh battery plant will be constructed in Jiangxi province near Ganfeng's headquarters.

## **RARE EARTH ELEMENTS**

After losing some ground in the late spring and early summer, prices for key rare earth elements surged in July and August and remain elevated in early September. 'China Neodymium Oxide 99% FOB' – used in the permanent magnets driving electric vehicle motors and wind turbine generators – climbed to US\$96,336 per tonne in August and are assessed at US\$94,050 on September 7th – up 18% since last December.

'China Praseodymium Oxide 99% FOB' moved to a new high of US\$99,500 per tonne in late August and stands at US\$98,500 on September 7 (up 68% since December). 'China dysprosium oxide' has also leapt by 40% since late 2021.

A more in-depth review of the outlook and market dynamics for rare earths is planned for the next edition of the Critical Metals report.

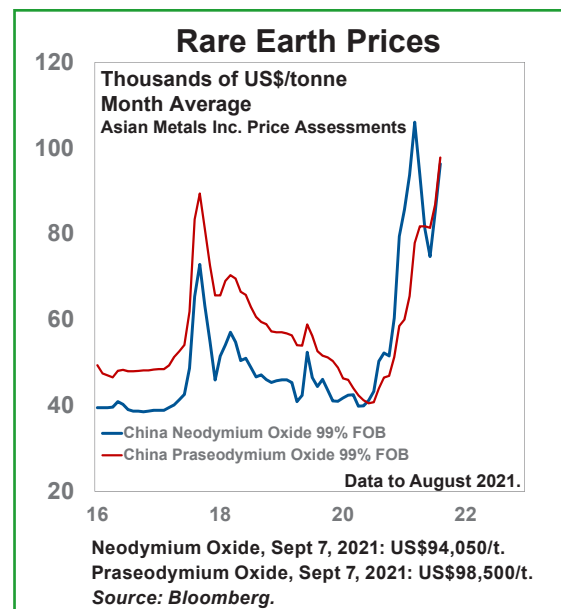


Table 1

### Critical Metals - Price Trends

	2018 Annual	2019 Annual	2020 Annual	Q4	Q1	2021 Q2	2021 August	Latest September 7
<b>Copper</b>								
LME Copper Official Cash Settlement <sup>1</sup> (US\$/lb)	2.96	2.72	2.80	3.25	3.85	4.40	4.24	4.23
<b>Nickel</b>								
LME Nickel Official Cash Settlement <sup>2</sup> (US\$/lb)	5.95	6.31	6.25	7.23	7.99	7.87	8.69	8.87
SHFE Nickel, Generic First Contract <sup>2</sup> (CNY/tonne)	102,916	110,746	109,054	120,402	131,120	128,570	144,044	146,730
China Nickel Sulphate EXW > 22% Ni, 0.05% Co <sup>2</sup> (CNY/tonne)	28,411	30,487	29,874	30,338	35,766	35,714	39,636	40,250
<b>Lithium</b>								
Lithium Carbonate, CIF Asia ≥ 99.2% Li <sub>2</sub> CO <sub>3</sub> <sup>3</sup> (US\$/tonne)	17,063	11,675	8,421	8,008	9,083	11,000	12,250	12,250 <i>(Data to Aug 31)</i>
Lithium Carbonate, CIF North America ≥ 99.0% Li <sub>2</sub> CO <sub>3</sub> <sup>3</sup> (US\$/tonne)	14,833	11,215	7,746	7,183	8,083	9,750	12,125	12,125 <i>(to Aug 31)</i>
Lithium Hydroxide, FOB North America ≥ 55.0% LiOH <sup>3</sup> (US\$/tonne)	16,771	13,521	10,629	10,183	10,458	11,750	14,250	14,250 <i>(to Aug 31)</i>
Spodumene Concentrate, FOB Australia 6% Li <sub>2</sub> O, Lithium Feedstock <sup>3</sup> (US\$/tonne)	886	595	406	382	472	579	775	775 <i>(to Aug 31)</i>
<b>Rare Earth Elements</b>								
China Neodymium Oxide 99%, FOB <sup>4</sup> (US\$/tonne)	49,918	44,655	48,757	63,810	95,147	83,222	96,336	94,050
China Neodymium Metal 99% FOB <sup>4</sup> (US\$/kilogram)	64	57	62	80	116	102	120	119
China Praseodymium Oxide 99%, FOB <sup>4</sup> (US\$/tonne)	63,627	54,024	45,725	52,274	67,818	81,665	97,804	98,500
China Praseodymium Metal 99% FOB <sup>4</sup> (US\$/kilogram)	114	103	91	92	96	104	111	112
China Dysprosium Oxide 99%, FOB <sup>4</sup> (US\$/kilogram)	177	234	259	266	384	398	409	394
China Dysprosium Metal 99% FOB <sup>4</sup> (US\$/kilogram)	262	307	341	348	497	516	532	505

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
2.96	2.72	2.80	4.22	3.96

### Copper Quarterly Averages

		Actual						Forecast					
		20-1	20-2	20-3	20-4	21-1	21-2	21-3	21-4	22-1	22-2	22-3	22-4
		2.56	2.42	2.96	3.25	3.85	4.40						
Sensitivities	High							4.35	4.55	4.20	4.30	4.00	4.05
	Base							4.26	4.35	4.00	4.10	3.85	3.90
	Low							4.15	4.10	3.80	3.90	3.70	3.75
Probability	High							0.15	0.15	0.20	0.20	0.20	0.20
	Base							0.70	0.70	0.60	0.60	0.60	0.60
	Low							0.15	0.15	0.20	0.20	0.20	0.20
<b>Probability-Weighted Forecast</b>								<b>4.26</b>	<b>4.35</b>	<b>4.00</b>	<b>4.10</b>	<b>3.85</b>	<b>3.90</b>

LME official cash settlement, US\$/lb., quarterly averages.

### Nickel Price Outlook - Annual Averages

pre-pandemic				
2018	2019	2020	2021F	2022F
5.95	6.31	6.25	8.46	8.88

### Nickel Quarterly Averages

		Actual						Forecast					
		20-1	20-2	20-3	20-4	21-1	21-2	21-3	21-4	22-1	22-2	22-3	22-4
		5.77	5.53	6.46	7.23	7.99	7.87						
Sensitivities	High							9.00	10.25	10.25	10.50	9.70	8.95
	Base							8.71	9.25	9.25	9.50	8.75	8.00
	Low							8.40	8.25	8.25	8.50	7.75	7.00
Probability	High							20	20	21	21	23	23
	Base							60	60	58	58	55	55
	Low							20	20	21	21	22	22
<b>Probability-Weighted Forecast</b>								<b>8.71</b>	<b>9.25</b>	<b>9.25</b>	<b>9.50</b>	<b>8.75</b>	<b>8.00</b>

LME official cash settlement, US\$/lb., quarterly averages.

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