Critical Metals
For a Sustainable World

Capitalight Research Inc.

September 7, 2022

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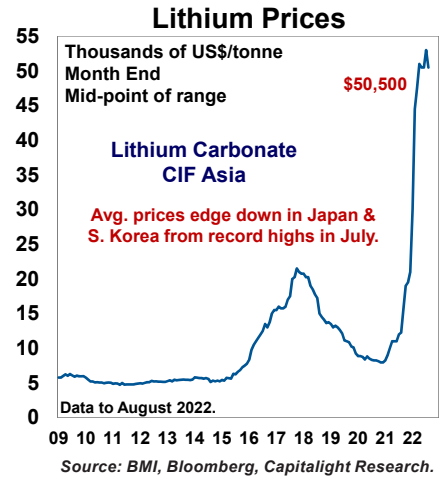
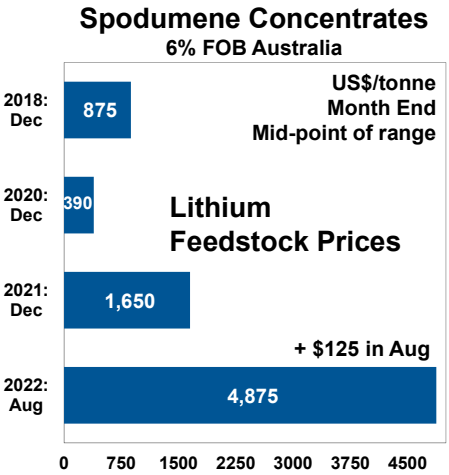


Source: BMI, Bloomberg, Capitalight Research.



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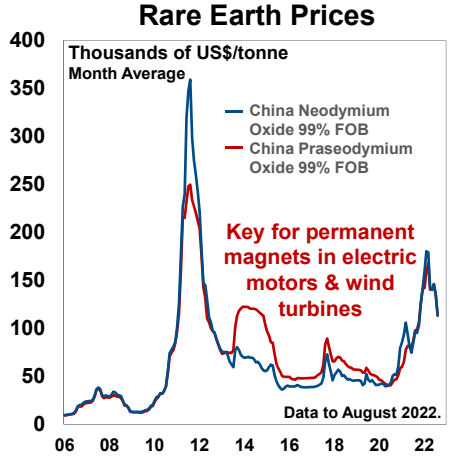


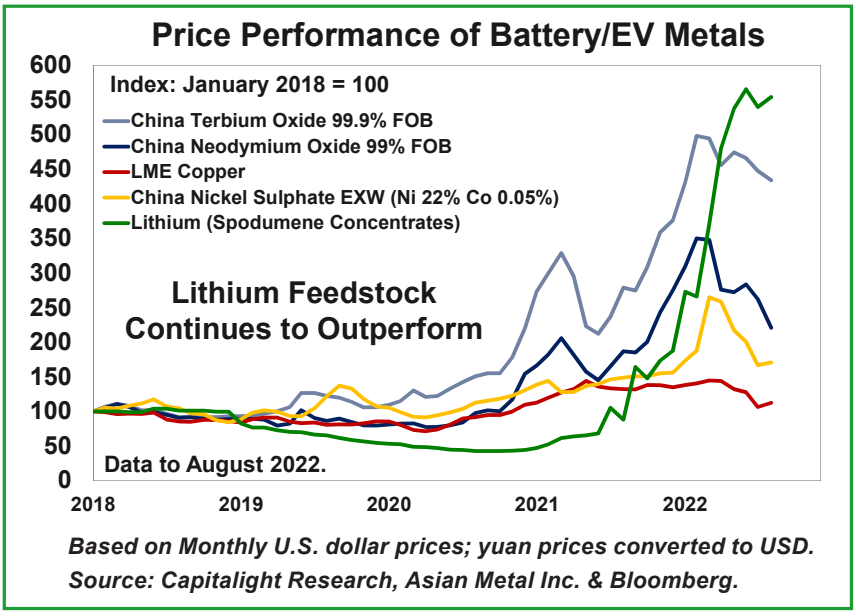
Source: Asian Metals Inc, Bloomberg, Capitalight Research.

- **New sources of finance for critical mineral development in Canada – commodity traders, off-takers and auto OEMs.**
- **German trade mission to Canada seeks 'secure' critical mineral supplies.**
- **Canada's biggest competitive advantage – hydropower & low CO_2 emissions.**

Financing Critical Mineral Development in Canada

In recent weeks, several developments point to a growing international interest in Canada's 'critical metal' resources and new avenues for mine finance in Canada. **Firstly, Germany's trade mission to Canada, led by Chancellor Scholz, during which executives from Volkswagen and Mercedes-Benz signed MOUs with Canada on critical minerals.**

In the case of Volkswagen, the MOU focuses on deepening cooperation with Canada on sustainable battery manufacturing, cathode active material production and critical mineral supply as well as setting up a Canadian office for PowerCo – Volkswagen's newly formed battery company; the firm intends to have 240 GWh of battery capacity in Europe alone.



Based on Monthly U.S. dollar prices; yuan prices converted to USD.
Source: Capitalight Research, Asian Metal Inc. & Bloomberg.

The MOU with Mercedes-Benz also focuses on enhancing collaboration with Canadian companies along the electric vehicle and battery supply chains, supporting the development of a sustainable critical mineral supply chain in Canada that is based on ESG principles, collaborating on R&D and identifying potential investments in Canada. Mercedes-Benz intends to sign an MOU with Vancouver-based Rock Tech Lithium to secure a supply of 10,000 tonnes of lithium hydroxide annually, with the spodumene produced at Georgia Lake, Ontario.

Both MOUs come in the context of growing supply chain vulnerabilities for materials & energy in Europe related to Russia as well as China. Volkswagen noted that the availability of Canadian electricity with low CO_2 emissions is a major attraction. Please see the chart on the opposite page.

The companies also have an interest in accessing the North American free trade zone for manufacturing autos & parts. The 'U.S. Inflation Reduction Act of 2022', signed into law by President Biden on August 16, has strengthened the advantages of critical mineral supplies & cathode materials production in Canada. For electric vehicles to qualify for the U.S. tax credit – intended to spur consumer purchases – the 'critical minerals' in batteries must contain a threshold value extracted or processed in a country with which the United States has a free trade agreement or recycled in North America (starting at 40% for vehicles placed in service through 2023), the percentage of a battery's components manufactured or assembled in North America must meet threshold amounts and final assembly of the vehicle must take place in North America. The threshold values increase over the ten year period of the tax credit and are significant. Please see the detailed discussion of the U.S. 'Inflation Reduction Act' in the August 15, 2022 Critical Metals report.

As a result, chances appear good that Volkswagen and Mercedes-Benz will soon invest in auto-related facilities in Canada and hopefully offer finance to 'secure' critical mineral supplies from Canada – for both their North American and global battery plants (in a similar fashion to Ford's debt financing & offtake agreement for lithium with Liontown Resources of Australia). Tesla signed an offtake agreement with Vale for low-carbon, high-purity Class 1 nickel from Vale's Canadian operations earlier this year, though no funding was reported.

The second development of note was the investment by Mitsubishi Corporation in the Turnagain Nickel-Cobalt Project of Vancouver-based Giga Metals Corporation (TSX Venture: GIGA). The company has formed a new joint venture company – Hard Creek Nickel Corp. – to pursue the development of the deposit. Mitsubishi has acquired a 15% equity interest in Hard Creek in exchange for $8 million – for use in completing a 'Pre-Feasibility Study'. Once the PFS is completed, further expenditures in the joint venture will be split in accordance with the equity interests of the partners. The project is located in the Liard Mining Division of Northern British Columbia.

The interest by Mitsubishi Corporation in the Turnagain Property probably reflects the solid engineering design & metallurgical work done by Giga Metals – specifically targeted at the Class 1 nickel market for electric vehicles (rather than stainless steel). Giga Metals intends to explore the possibility of producing MHP directly – used in making nickel sulphate for the cathode market. Low prospective CO_2 emissions and the planned treatment of tailings (involving CO_2 sequestration) were probably also very important in attracting finance.

Canada's Big Competitive Advantage – Electricity with Low GHG Emissions

The availability of 'green' hydropower with low CO_2 emissions – especially in British Columbia, Québec and the Yukon – represents a huge competitive advantage in a decarbonizing world. The writer also notes the emphasis by many Canadian mining companies on achieving low CO_2 emissions in their operations – particularly

noticeable in the technical reports of the six nickel deposits currently being advanced by junior mining companies.

As an indication, the GHG emission intensity of power from the grid in B.C. and Québec is among the lowest in the world and competes favourably with Sweden, Norway and Finland (also countries with a high proportion of hydro in their power mix, but also nuclear & wind in the case of Sweden). Québec's CO_2 emission intensity of only 29 grams CO_2 per KWh on August 29, 2022 compares well with 467 g in Germany and 652 g in Indonesia (based on estimates from the Electricity Map). In Indonesia – today's largest nickel producer – almost 65% of power (supplied through the grid) is generated by coal and only 13% from renewable sources.

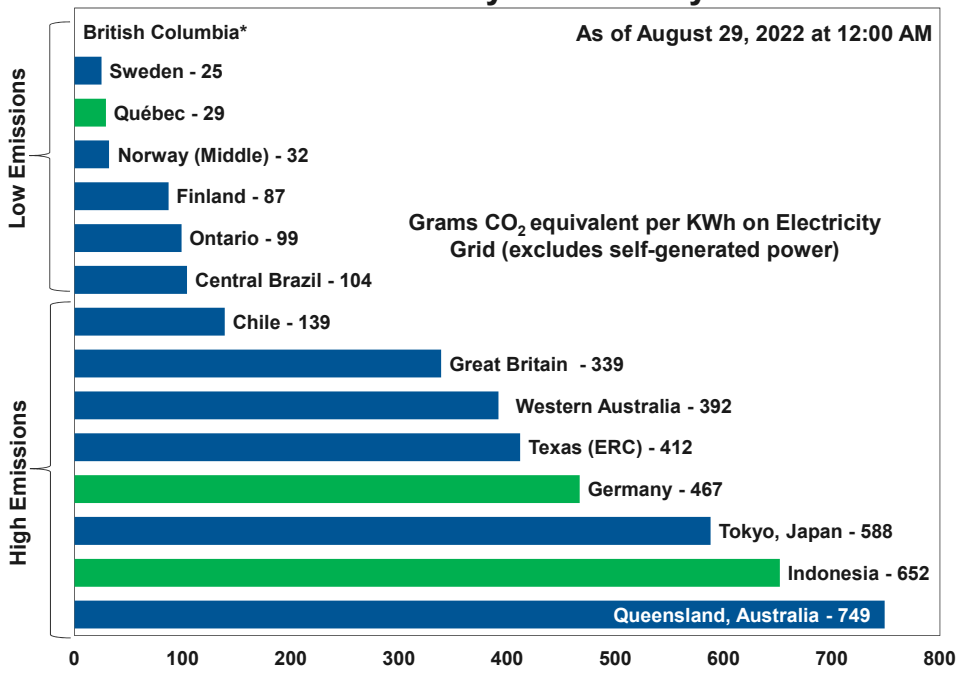
With Indonesia likely to dominate nickel mine & smelter expansion in the next five years, global nickel markets will likely become increasingly bifurcated – with higher prices for nickel produced from low carbon sources and lower prices for material coming from higher carbon sources. Auto OEMs will be challenged to purchase nickel from Indonesia for EV markets outside of China.

Backward Integration from Magnets to Mines by Neo Performance Materials

The news in mid-August was also dominated by several announcements involving Neo Performance Materials Inc. of Toronto (TSX: NEO.TO) – a leading global producer of rare earth materials and permanent magnets (NdFeB). Neo intends to effectively integrate backwards into mining rare earths to diversify feed for its 'rare earth separation' plant in Estonia – the ONLY commercially operating 'separation' plant in Europe (separating mixed rare earth oxides into individual oxides such as neodymium oxide). The plant continues to source feed from its Russian supplier, while recently supplementing feed from Energy Fuels of the United States.

Neo is acquiring an exploration license from Hudson Resources Inc. of Vancouver (TSX Venture: HUD) for the Sarfartoq Carbonatite Complex in southwest Greenland (Total Rare Earth Oxide content of 25-40%). Neo will assign its rights to a 'Special Purpose Entity' that will hold the license and continue exploration (subject to approval by Greenland).

GHG Emission Intensity – Electricity Generation



Further details: Yukon: 24g; S. W. Norway 27g; North Norway: 51g; Nevada: 378g: Arizona: 573g; France: 119g; Russian Urals: 337g; Siberia: 379g and Southern Australia: 103g. The carbon intensity of power in South Korea is high.

*In British Columbia, the Ministry of Environment and Climate Change Strategy estimates emissions from the integrated grid (southern and western B.C., excluding the Nelson Grid and grids for isolated communities) was very low in 2021 at 9.7g CO_2 per kWh, down from 40.1g in 2020 and 29.9g in 2019 due partly to a change in methodology (using 'net imports' rather than 'gross imports' and a 4-year rolling average instead of 3). Irrespective of methodology, the GHG intensity of B.C.'s electricity system is very competitive due to the large role of hydro-power.

Source: Electricity Map, August 29, 2022 at 12:00 am and Capitalight Research.

In addition, Neo also intends to build a 'greenfield' magnet plant at the site of its 'separation' plant in Estonia to supply the growing European EV market. Europe is very 'short' of magnet production, with only a limited number of magnet plants.

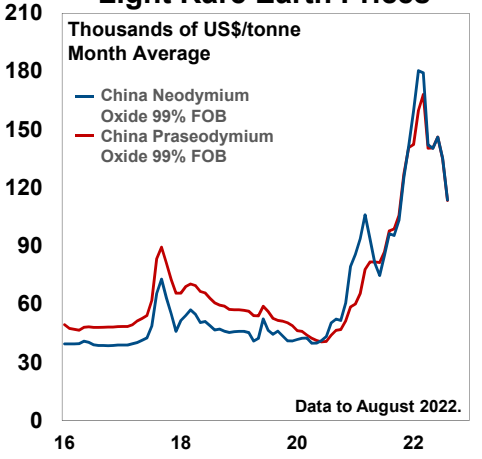
Meanwhile, Hastings Technology Metals Ltd. of Australia (ASX: HAS) – a rare earth developer – is set to acquire a 22.1% equity interest in Neo, with Wyloo Metals (involved with the Ring of Fire in Ontario) indirectly funding the share purchase from Oaktree Capital Management, L.P. Hastings could potentially help to further diversify Neo's rare earth feedstock supply in coming years, as the company continues to advance its Yangibana Rare Earths project in Western Australia.

China Rare Earth Prices Ease Back Further in August

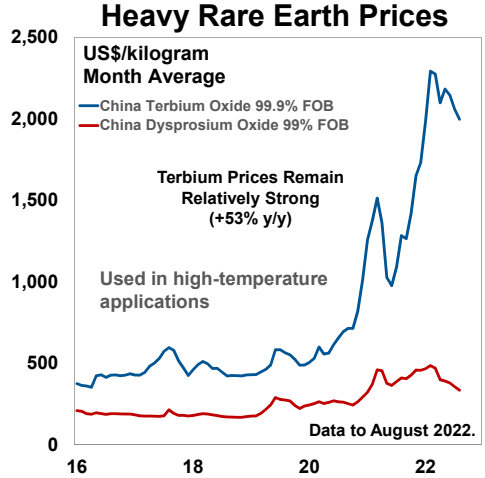
Light rare earth prices – key to producing the permanent magnets needed for electric vehicle drive trains and wind turbine generators – continued to ease in early September, after dropping from near-term peaks last February-March. The price of 'China neodymium oxide' fell from an average of US$135,167 per tonne in July to US$113,739 in August, with prices slipping further to US$94,200 on September 6 – down a substantial 50.4% from the mid-February high of US$190,000 and now just above a year earlier. China praseodymium oxide also fell from an average of US$134,905 per tonne in July to US$113,435 in August and retreated further to US$95,000 on September 6 (-45% from the peak in February/March and now 3.6% below a year earlier).

China terbium oxide – a heavy rare earth – has performed better than light REEs. Average prices eased from US$2,060 per kg in July to US$1,998 in August and US$1,840 in early September (down 22.4% from the near-term peak, but remaining 53% above a year ago). Stronger terbium prices reflect tight supplies of this relatively 'rare' heavy REE in China.

Lower prices for rare earths reflect weak domestic demand for permanent magnets in China, given the slump in China's economy due to COVID-19 lockdowns (the latest in Chengdu, Sichuan Province), poor real estate activity and power rationing over the summer (linked to drought conditions in Sichuan). While China's 'New Energy Vehicle' sales rebounded strongly in June and July (to a new record high) after the April-May lockdown in Shanghai, NEVs probably represent less than 10% of overall permanent magnet demand in China (7.1% of total domestic consumption in 2021). Demand from the



Neodymium Oxide, Sept 6, 2022: US$94,200/t.
Praseodymium Oxide, Sept 6, 2022: US$95,000/t.
Source: Asian Metals Inc., Bloomberg, Capitalight Research.



*Terbium Oxide, Sept 6, 2022: US$1,840/kg.
Dysprosium Oxide, Sept 6, 2022: US$316/kg.
Source: Asian Metals Inc., Bloomberg, Capitalight Research.

'inverter air conditioner' & consumer electronics sectors has likely been hurt by poor residential construction and weak consumer confidence.

In addition, China's installation of wind turbine capacity from January to May 2022 at 10.8 GW was much less than the cumulative bid volume of 53.46 GW in the first half of 2022, according to SMM. This may reflect poor industry profitability and an end to the FIT (Feed-in Tariffs) subsidy programme for 'offshore wind projects' at the end of 2021. Under FIT, producers of renewable energy were given a long-term contract of around 20 years that guaranteed rates that were above market for electricity supplied to the grid (financed from the 'Renewable Energy Development Fund' or REDF). With the cost of power produced through 'offshore wind' now more competitive with power on the grid, Beijing has phased out new FIT subsidies. China's wind energy installation was at a record in 2021, with capacity expanding by 16.9 GW from only 9.49 GW in 2020, contributing to the surge in REE prices at that time. FIT subsidies for 'onshore wind' and solar power stations were also phased out in August 2021. Generous subsidies have contributed to the speed of China's ascent in renewable energy over the past ten years – now accounting for 54% of global wind-turbine assembly capacity and 70% of solar module manufacturing. This year is a transition year to a more market-based system.

Beijing's recent announcement of the second batch of rare earth quotas (for its domestic 'mining' and 'smelting & separation' production) has apparently also hurt market sentiment. China's full-year rare earth 'mining' quota for 2022 was set at 210,000 tonnes (+25% from 168,000 tonnes in 2021), with the second batch at 109,000 tonnes slightly higher than the first batch at 100,800 tonnes. The 'smelting & separation' quota for 2022 was set at 202,000 tonnes (+24.7%). Interestingly, the mining quota for 'ion rare earths' (heavy REES produced from clays mostly in the South) was unchanged at 19,150 tonnes for the third year in a row, contributing to the price strength of terbium. All of the increased mining quota for 2022 involves light REEs – mostly produced in the North. Quotas are announced twice a year by the Ministry of Industry and Information Technology (MIIT) and the Ministry of Natural Resources.

Despite weak current sentiment in China, we expect a pick-up in domestic orders for REEs and permanent magnets over the next six months. China's recent 1 trillion yuan economic stimulus package – on top of previous stimulus – will allow 'policy banks' and local governments to lend more to 'infrastructure projects – likely targeting ultra-high voltage power lines, high-speed rail, energy, urban infrastructure and a massive underground water tunnel (the South-North Water Transfer project). Wind turbine construction should also rebound.

Lithium Prices Plateau at High Levels

The price of lithium continues to outperform other critical metals. Lithium carbonate prices EXW China (battery grade) edged up from US$69,700 per tonne in late July to US$70,700 at the end of August. Prices remain at historically high levels, after easing back from a record in March - still 80% above late 2021 levels. While NEV demand has picked up for lithium carbonate

Lithium Hydroxide EXW China, Aug 31, 2022: US$69,025/t.
Lithium Carbonate Battery Grade EXW China, Aug 31: US$70,700/t.
Prices in China are the key determinant of prices globally.
Source: BMI, Capitalight Research.

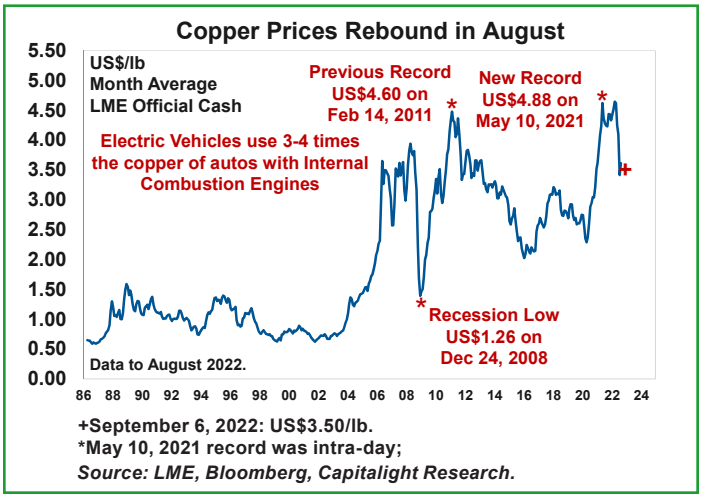
in China, production of both mined lithium and lithium carbonate was probably hurt in August by severe drought in Sichuan Province, causing hydro-electricity shortages and mandated plant closures. While the drought is over, the Province has now been hit with an earthquake. A quarter of China's lithium production capacity is located in Sichuan (northwest of Chongqing on the Yangtze River). The Province is also an important producer of polysilicon for solar panels.

In addition, significant new feedstock capacity has yet to come on stream in Western Australia. The net result, spodumene prices (6% Li_2O) FOB Western Australia climbed back to US$4,875 per tonne in late August from US$4,750 in July and remain near the US$4,975 record high in June (based on BMI price assessments). The lower end of pricing increased to US$3,400, while the higher end rose to US$6,350 alongside an increase in the auction price set by the Pilbara Minerals' Battery Material Exchange. The auction price for 5,000 tonnes of SC5.5 (FOB Australia) was US$162 more than the US$6,188 pre-auction offer accepted in July 2022. (Please see Table 1 for further details on regional lithium prices.)

Copper: Peru Abandons Plans To Increase Mining Taxes

LME cash copper prices edged up from US$3.42 per pound in July to US$3.61 in August, as 'risk-on' sentiment returned, given the moderation in U.S. inflation in July. However, prices retreated back to US$3.44 on September 2, following the 'Jackson Hole Jolt'. Chairman Jerome Powell – in his speech at the Jackson Hole conference on August 26 – reiterated the Fed's intention of tightening monetary policy to prevent inflation from becoming entrenched, as in the late 1970s, when consumers & businesses came to expect accelerating inflation. The Fed Chairman stated that reducing inflation to the 2% target is likely to require a 'sustained period of below-trend growth' and probably some softening of today's tight labour market conditions. The net result, financial markets now expect the target Fed funds rate to climb to about 3.75% by year-end 2022 – up 125 basis points from today's 2.50% (please see the chart). While these levels remain historically low, financial markets have become accustomed to ultra-low interest rates over the past decade and have been riled as rates move higher. The S&P 500 Index has dropped 17.7 % since late 2021 and the 'ICE U.S. BofA 10+ year Treasury Index' is on track for its worst annual performance on record (the Index measures the total return performance of U.S. Treasury bonds with a maturity greater than 10 years).

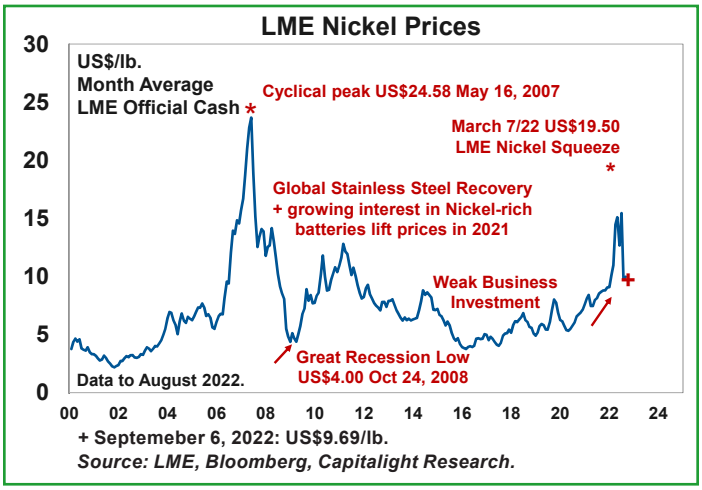
Turning to events in Latin America, Peru's Finance Minister on August 25th officially abandoned plans to hike mining taxes amid the recent fall in base metal prices, high inflation



and uncertain global economic growth. The country's GDP forecast was lowered moderately to 3.3% for 2022. Peru expects Anglo American's Quellaveco copper mine to come on stream in 2023 and boost copper production, after a 10% drop so far this year – linked to community protests affecting two large mines owned by MMG Ltd and Southern Copper Corp.

In Chile, a proposed reform of the Constitution – currently a market-friendly document from the Pinochet era that favours the private sector over the state – was solidly rejected by voters on September 4. Chile and Peru are the world's number 1 and 2 copper-producing countries.

Turning to nickel, LME cash nickel prices strengthened from US$9.75 per pound in July to US$9.98 in August, before easing back to US$9.16 on September 2 (US$9.69 on the 6th) – also impacted by tightening international monetary policy and fear of a global recession. Stocks of refined, Class 1 nickel on the LME and SHFE were 66,000 tonnes as of September 6 (-49.5% ytd and -67.9% y/y).



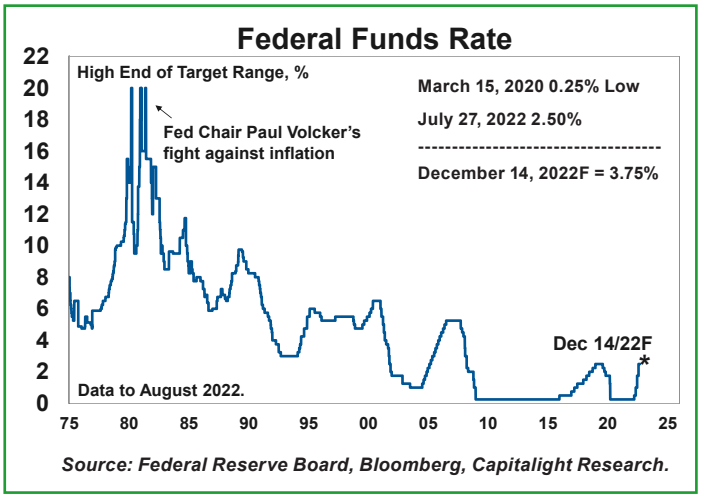


Table 1

Critical Metals - Price Trends

	2018 Annual	2019 Annual	2020 Annual	2021 Q1	2021 Q2	2021 Q3	2021 Q4	2022 Q1	2022 August	Latest September 6
Copper										
LME Copper Official Cash Settlement[1] (US$/lb)	2.96	2.72	2.80	3.85	4.40	4.25	4.40	4.53	3.61	3.50
Nickel										
LME Nickel Official Cash Settlement[2] (US$/lb)	5.95	6.31	6.25	7.99	7.87	8.68	8.99	11.85	9.98	9.69
SHFE Nickel, Generic First Contract[2] (CNY/tonne)	102,916	110,746	109,054	131,120	128,570	143,708	147,198	185,946	176,163	176,820
China Nickel Sulphate EXW > 22% Ni, 0.05% Co[2] (CNY/tonne)	28,411	30,487	29,874	35,766	35,714	39,276	39,720	41,250	40,880	42,250
Lithium										
Lithium Carbonate, CIF Asia ≥ 99.2% Li_2CO_3[3] (US$/tonne)	17,063	11,675	8,421	9,083	11,000	13,333	19,833	40,667	50,500	50,500 *(Data to end August)*
Lithium Carbonate, CIF North America ≥ 99.0% Li_2CO_3[3] (US$/tonne)	14,833	11,215	7,746	8,083	9,750	12,375	17,000	38,333	47,500	47,500 *(end August)*
Lithium Hydroxide, FOB North America ≥ 55.0% LiOH[3] (US$/tonne)	16,771	13,521	10,629	10,458	11,750	14,333	19,333	37,750	54,000	54,000 *(end August)*
Spodumene Concentrate, FOB Australia 6% Li_2O, Lithium Feedstock[3] (US$/tonne)	886	595	406	472	579	1,048	1,492	2,668	4,875	4,875 *(end August)*
Rare Earth Elements										
China Neodymium Oxide 99%, FOB[4] (US$/tonne)	49,918	44,655	48,757	95,147	83,222	92,267	123,356	173,087	113,739	94,200
China Neodymium Metal 99% FOB[4] (US$/kilogram)	64	57	62	116	102	115	153	210	142	116
China Praseodymium Oxide 99%, FOB[4] (US$/tonne)	63,627	54,024	45,725	67,818	81,665	94,484	124,540	156,774	113,435	95,000
China Praseodymium Metal 99% FOB[4] (US$/kilogram)	114	103	91	96	104	110	139	178	171	156
China Dysprosium Oxide 99%, FOB[4] (US$/kilogram)	177	234	259	384	398	400	447	474	335	316
China Dysprosium Metal 99% FOB[4] (US$/kilogram)	262	307	341	497	516	516	554	583	431	399
China Terbium Oxide 99.9% FOB[4] (US$/kilogram)	455	503	664	1,382	1,121	1,213	1,600	2,185	1,998	1,840
China Terbium Metal 99% FOB[4] (US$/kilogram)	604	655	849	1753	1,430	1,534	2,038	2,761	2,527	2,333

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							Medium Term
2018	2019	2020	2021A	2022F	2023F	...	(2025+)
2.96	2.72	2.80	4.23	4.00	3.70		5.00

Copper Quarterly Averages

		Actual															
		20-1	20-2	20-3	20-4	21-1	21-2	21-3	21-4	22-1	22-2	22-3	22-4	23-1	23-2	23-3	23-4
		2.56	2.42	2.96	3.25	3.85	4.40	4.25	4.40	4.53	4.32						
Sensitivities	High											3.80	4.00	3.80	4.00	4.20	4.30
	Base											**3.50**	**3.65**	**3.40**	**3.60**	**3.80**	4.00
	Low											3.20	3.30	3.00	3.20	3.40	3.70
Probability	High											0.20	0.20	0.20	0.20	0.20	0.20
	Base											0.60	0.60	0.60	0.60	0.60	0.60
	Low											0.20	0.20	0.20	0.20	0.20	0.20
Probability-Weighted Forecast												**3.50**	**3.65**	**3.40**	**3.60**	**3.80**	**4.00**

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

Nickel Price Outlook - Annual Averages

pre-pandemic					
2018	2019	2020	2021A	2022F	2023F
5.95	6.31	6.25	8.38	11.10	9.50

Nickel Quarterly Averages

		Actual															
		20-1	20-2	20-3	20-4	21-1	21-2	21-3	21-4	22-1	22-2	22-3	22-4	23-1	23-2	23-3	23-4
		5.77	5.53	6.46	7.23	7.99	7.87	8.68	8.99	11.85	13.17						
Sensitivities	High											11.00	11.50	11.00	11.00	11.00	11.00
	Base											**9.64**	**9.75**	**9.50**	**9.50**	**9.50**	**9.50**
	Low											8.28	8.00	8.00	8.00	8.00	8.00
Probability	High											0.20	0.20	0.20	0.20	0.20	0.20
	Base											0.60	0.60	0.60	0.60	0.60	0.60
	Low											0.20	0.20	0.20	0.20	0.20	0.20
Probability-Weighted Forecast												**9.64**	**9.75**	**9.50**	**9.50**	**9.50**	**9.50**

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

Note: The above forecasts assume a significant slowdown in global growth and the possibility of a mild recession, but not a severe recession as occurred in 2008-09.

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