

Global Rare Earths

Rare earths call takeaways: NdPr price bottomed and expected to recover

Industry Overview

NdPr price bottomed; recovery expected from 2Q24

We hosted a global rare earths outlook conference call with Adamas Intelligence, an independent research and advisory firm specializing in critical metals and minerals, including rare earths. Our guest speaker, Ryan Castilloux, founded Adamas Intelligence and led its rare earth research and analysis. Overall, we think Adamas Intelligence's views are similar to ours published recently in [2024 appears the year of recovery](#), in which we stated a belief that NdPr prices had bottomed in 1Q24 and how we expected a rebound given cost support and demand recovery. The spot price of US\$49/kg is below the marginal cost of the first-quartile rare-earth producers in China.

NdPr price to average at US\$60-70/kg in 2024

The speaker believes the weakness in NdPr price is a function of excess supply from China through mining and separation quota, subdued global electronics consumption despite robust demand from EV and wind turbines, and negative geopolitical influence to discourage Ex-China rare earths projects. The speaker believes little fundamental support exists for the prices to slump below the marginal cost producers. The speaker expects a slow restart and restocking from magnet producers in the next two months. Adamas expects NdPr prices to average at US\$60-US\$70/kg in 2024 (BofAe: US\$66/kg), before rising to US\$80-90/kg in 2025 (BofAe: US\$83/kg) and above US\$100/kg from 2027 (BofAe long-term nominal: US\$85/kg).

Wind turbines + EV = two-third of the demand in 2035

Similar to our estimate of NdPr demand growing by a 7.4% CAGR over 2023-30, largely driven by growth in wind turbines and EVs, Adamas Intel forecasts an 8.4% CAGR NdFeb magnet demand growth over 2023-35, led by double-digit demand growth from EV and wind turbines. Our guest speaker believes that EV, wind, and other energy-efficient motors will drive nearly two-thirds of demand in 2035, which was one-third of demand five years ago. Technology development using NdFeB magnet is a tailwind, and not a headwind (i.e. use less rare earths) for OEMs to achieve the maximum energy efficiency. The end users from EV and wind turbines are less sensitive to prices over the long term because REE-free alternatives are not economically justified.

China's RE dominance from Mine to Magnet value chain

China dominates 67% of the global rare earths mining, 88% of global NdPr oxide production, 92% of global rare earths metals and alloys and 89% of the global produced NdFeb magnets. The rare-earths value chain from mining to permanent magnets that OEMs use are dominated by China. Similar to our views published in 'Theoretical LYC-MP combination unlikely to reset NdPr price-setting' (6 February 2024), the speaker believes that China will continue to dominate the global rare earths value chain in the next few years. NdPr prices set by China rare earths supply and demand will not easily be changed toward the end of this decade.

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Timestamp: 19 March 2024 05:42AM EDT

19 March 2024

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Global
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REO: Rare earths oxide

NdPr: Neodymium and Praseodymium

CAGR: Compound annual growth rate

OEMs: Original Equipment Manufacturer

NdFeB: Neodymium iron boron (Magnet)

EV: Electric Vehicle

LYC: Lynas Rare Earths Ltd

MP: MP Materials Corp

BofA rare earths supply and demand

Overall we think Adamas Intelligence views are similar to our views published on 12th Mar 2024 '[2024 appears the year of recovery](#)' in which we stated a belief that NdPr prices had bottomed in 1Q-24 and how we expected a rebound given cost support and demand recovery. Spot US\$49/kg is below the marginal cost of the first quartile rare earths producers in China.

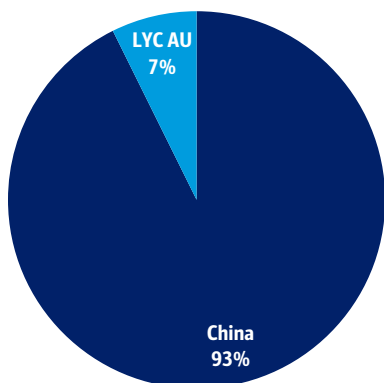
[Global Rare Earths: Lowering rare earths price forecasts, yet 2024 appears the year of recovery](#)

Global rare earths supply

90% of global NdPr capacity is in China while the other 10% is with Lynas operating in Australia and Malaysia. MP will gradually ramp up of its NdPr production from 2024 after the completion of the light rare earths' separation facility in 2023. Combining MP and Lynas' NdPr production of 19ktpa, we expect China's dominance in NdPr production to reduce to 80% in 2026. We are forecasting an average of 10% increase every year from 2023 to 2030 for China's mining and refining quota. Around one quarter of NdPr supply coming from scrap in China. We continue to forecast close to 25% of NdPr supply from scrap in the next few years.

Exhibit 1: 2023 NdPr split by country

We estimate around 93% of global NdPr is produced from China

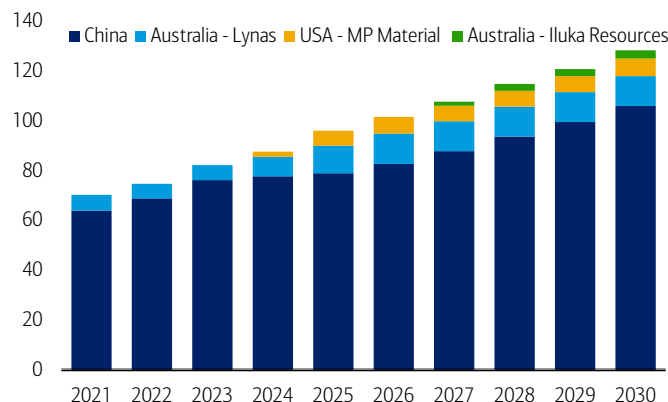


Source: BofA Global Research estimates

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Exhibit 2: Global NdPr supply by country (kt)

Combining MP and Lynas' NdPr production of 19ktpa, we expect China's dominance in NdPr production to reduce to 80% in 2026



Source: BofA Global Research estimates

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Global NdPr supply and demand model

We believe NdPr prices in the near and medium term will continue to be determined by China's rare earth supply and demand. However, in the long term, the price will be driven fundamentally by global supply and demand.

Exhibit 7: Global NdPr supply and demand

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Supply & Demand	NdPr Supply		2021	2022	2023	2024F	2025F	2026F	2027F	2028F	2029F	2030F
Total supply of NdPr by primary source	Lynas (Ex-China)	kt	6.3	6	6.0	7.8	11.0	12.2	12.0	12.0	12.0	12.0
	MP Materials (incl export to China)	kt	6.7	6.8	6.8	6.6	6.8	6.6	6.2	6.3	6.4	7.1
	ILU	kt	0	0	0	0	0	1.6	2.8	2.9	3.3	3.3
	China (Quota only)	kt	32	35	43	47	51	56	61	66	72	79
	Myanmar (Export to China)	kt	3	4	6	4	3	3	3	3	3	2
	Scrap (Recycling)	kt	22	24	20	22	23	24	24	24	25	24

Exhibit 7: Global NdPr supply and demand

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Supply & Demand	NdPr Supply		2021	2022	2023	2024F	2025F	2026F	2027F	2028F	2029F	2030F
	Other	kt	0	0	0	0	0	0	0	0	0	0
	Total	kt	70.2	74.6	82.1	87.5	95.9	103.0	108.7	114.7	121.0	128.1
NdPr demand												
Total demand of NdPr by end use	EVs	kt	5.6	8.6	10.4	14.4	17.9	21.2	24.6	28.4	31.3	34.3
		YoY%	92%	52%	21%	39%	24%	18%	16%	16%	10%	9%
		%total	8%	11%	13%	16%	18%	21%	23%	24%	26%	27%
	Wind	kt	9.0	7.1	10.0	13.5	16.9	17.3	18.6	21.1	22.4	23.7
		YoY%	30%	-21%	41%	35%	25%	3%	7%	13%	6%	6%
		%total	12%	9%	12%	15%	17%	17%	17%	18%	18%	18%
	Others (electronics, ICE cars, Industrials etc.)	kt	60	63	60	61	62	64	66	67	69	71
		YoY%	4%	4%	-4%	1%	2.5%	2.5%	2.5%	2.5%	2.5%	2.5%
		%total	80%	80%	75%	69%	64%	62%	60%	58%	56%	55%
	Total	kt	75.0	78.4	80.6	88.8	97.2	102.5	108.7	116.7	122.5	128.6
Surplus/(Deficit)	Surplus/deficit	kt	-4.8	-3.8	1.5	-1.3	-1.2	0.5	0.0	-1.9	-1.5	-0.5
Surplus/(Deficit)	Growth of NdPr	%	10%	5%	3%	10%	9%	5%	6%	7%	5%	5%
NdPr Price	NdPr price forecast	\$/kg	6	6	6.0	7.8	11.0	12.2	12.0	12.0	12.0	12.0

Source: BofA Global Research estimates

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Global Rare earths reserves and production

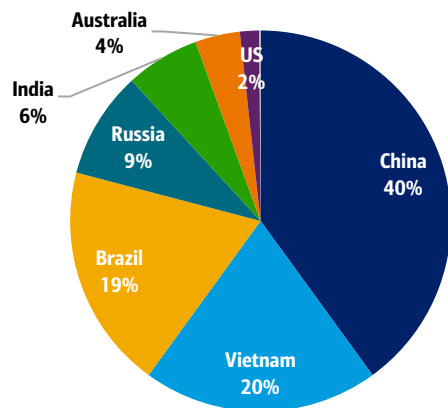
China's dominance in production – 70% of the world's unseparated REE

"The Middle East has oil. China has rare earth metals" said Deng Xiaoping, the architect of China's economic reform and development when Deng opened China in the 1980s. According to US Geological Survey, China accounts for 40% of the global REO reserves in 2023 while ~70% of the global REO production (unseparated) is from China.

From a downstream perspective, China is home to more than 80% of the world's capacity to process rare earth concentrate or carbonate into material manufacturers can use. It would take many years to build enough processing and separation plants to match China's processing capacity of 250kt (annualized 2024 separation quota at 254ktpa). China supplied 80% of the rare earths imported by the US from 2014 to 2017.

Exhibit 4: REO global reserves by country (2023)

China accounts for 40% of the global REO reserves in 2023 while US and Australia combined comprises 6.0%

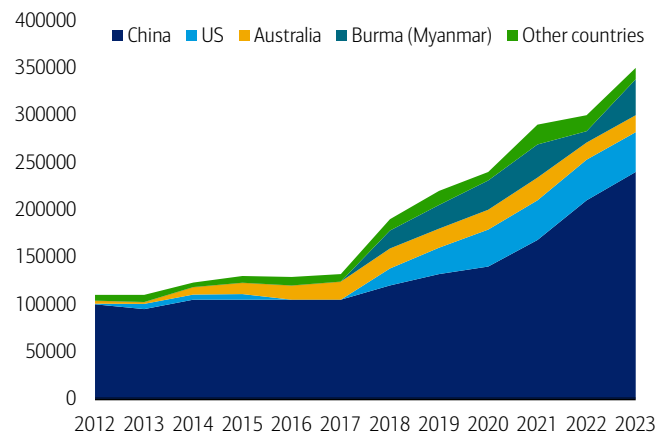


Source: BofA Global Research, US Geological Survey (USGS)

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Exhibit 5: Total REO (unseparated REE) 2023 production by country (tonnes)

~70% of the global REO production (unseparated) is produced from China



Source: BofA Global Research, US Geological Survey (USGS)

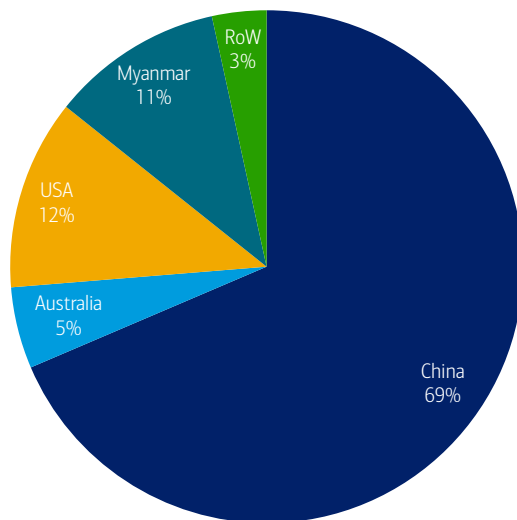
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US (MP) and Australia (LYC): 18% of global REO production

US and Australia combined comprise 5.0% of the global REO reserves and 18% of the global REO production (LYC AU is 5.0% and MP Material is 12%). However, either US or Australia has processing / separation plant to produce NdPr as separated REE product in 2022. Currently Australia's LYC ship rare earths concentrate and carbonate to Malaysia to process and separate. After several years of shipping rare earths concentrate from US to China to process into NdPr, MP has just completed construction of its own light REO US-based separation facility targeting NdPr production and sales from 2024.

Exhibit 6: REO global production by producers (2023)

70% of global REO is mined from China, while USA (MP) and Australia (LYC) comprise 18%

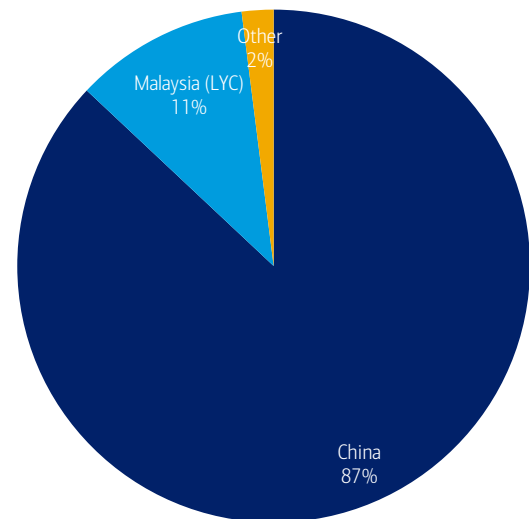


Source: BofA Global Research estimates, US Geological Survey (USGS)

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Exhibit 7: Rare earths processing capacity from mined to separated

China dominates 80-90% of rare earths processing capacity



Source: BofA Global Research estimates

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China's rare earths quota and oligopolies

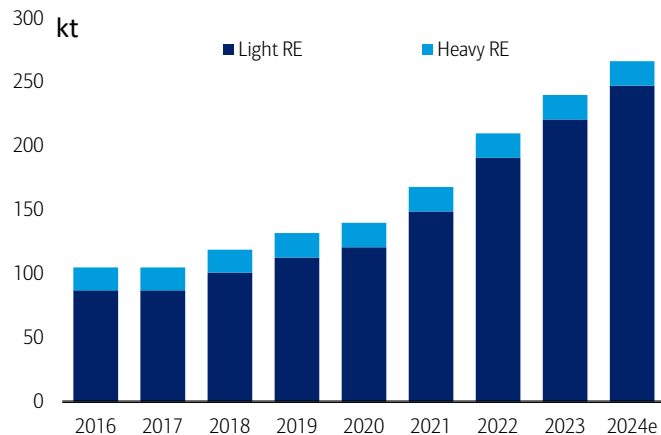
China's mining quota for rare earths is an indication for China's domestic production of rare earths. China's RE mining quota more than doubled in the last 5 years from 105kt of

REO in 2017 to 240kt in 2023. For the first 6 months of 2024 China's guided quota was 135kt that annualizes to 270ktpa, another 12.5% increase YoY. We expect the pace of growth to continue at an average of 10% YoY increase over the next 10 years.

China's rare earths quota used to be occupied by a few major players. However, consolidation in the last few years has led to the quota being shared by the two major rare earths companies. 70% of 1HCY24's mining quota allocated to China Northern Rare Earths, the rest 30% to China Rare Earths.

Exhibit 8: China RE mining quota

China's RE mining quota more than doubled in the last 5 years from 105kt of REO in 2017 to 240ktpa in 2023. The first 6 months 1HCY24 China guided quota was 135kt that is annualized at 270ktpa.

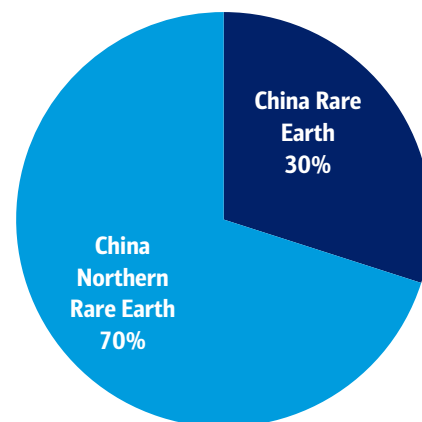


Source: BofA Global Research estimates

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Exhibit 9: China's RE quota allocated to two RE producers in 1HCY24

70% of quota allocated to China Northern Rare Earths, 30% to China Rare Earths



Source: BofA Global Research

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Rare earths prices

Exhibit 10: NdPr price US\$/kg (incl VAT)

Spot NdPr US\$49/kg below 10 years average



Source: BofA Global Research, Bloomberg

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Exhibit 11: Terbium oxide price US\$/kg

Spot terbium price at US\$785/kg



Source: BofA Global Research, Bloomberg

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Appendix - rare earths glossary

RE – Rare earth.

REE – Rare earth element.

LRE – Light rare earth.

HRE – Heavy rare earth.

REO – Rare earth oxide.

Ce – Cerium, a LRE element.

La – Lanthanum, a LRE element.

Nd – Neodymium, a LRE element.

Pr – Praseodymium, a LRE element.

NdPr – Neodymium & Praseodymium, LRE elements.

Dy – Dysprosium, a HRE element.

Tb – Terbium, a HRE element.

NdFeB – Neodymium iron boron

EV Electric Vehicle

ICE Internal Combustion Engine

NdFeB Neodymium Iron Boron (Magnet)

BEV Battery Electric Vehicle

PHEV Plug in Hybrid Vehicle

REO Rare Earth Oxide

HRE: heavy rare earth

LRE: Light rare earth

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