

China Rare Earths

Early-to-Mid Upcycle: Initiate NRE at Buy and CRE at Neutral



CITI'S TAKE

The rare earths industry has emerged as a strategic sector underpinning the global transition to green energy, advanced manufacturing, and defense. We believe the sector is in an early-to-mid upcycle, supported by disciplined Chinese supply, favorable policy momentum, and its strategic role in the energy transition, though downstream demand remains uneven. Prices should stay firm short term amid tight supply and geopolitical risks, with a higher but more stable range expected midterm as new capacity ramps up. We initiate NRE (600111.SS) with Buy and Rmb72 target price for its leading resource position, secure quota access, and integrated product chain. We initiate CRE (000831.SZ) with Neutral and Rmb61.6 target price given its smaller scale, limited integration, heavy exposure to HREEs, and limited expected valuation upside.

Cycle View — We think the rare earths market is in the early-to-mid upcycle, supported by disciplined Chinese supply, favorable policy momentum, and resilient magnet demand from EVs and renewables. LREE prices have eased from 2022 peaks but stayed above prior troughs, while HREEs remain firm on tight supply.

Price View — Short term, we expect prices to stay firm with an upward bias amid tight supply and geopolitical risks. Mid-term, structural demand growth and gradual capacity expansion suggest a higher but more stable price range. LREEs may see milder (e.g. NdPr) or more subdued (e.g. La, Ce) moves. HREE (e.g. Dy/Tb) may see sharper price moves since supply is more constrained and substitution harder.

Valuation — We value NRE & CRE at +2sd/+1.5sd above their historical average P/B multiples, reflecting the sector's early-to-mid upcycle supported by policy tailwinds, supply discipline, and rare earths' growing strategic importance in electrification and supply-chain security. While we do not expect this cycle to match the intensity of the prior 2021 peak – when valuations reached over +4.5SD above mean – we believe structural demand growth, tighter resource control, and stronger policy tailwinds justify valuations toward the upper end of the historical range. We assign a +2sd to NRE vs. +1.5sd to CRE, and rate NRE shares Buy, reflecting NRE's consistent profitability across cycles, vertically integrated value chain, and strong quota-backed supply position.

Buy on China Northern Rare Earth (NRE) — Benefitting from captive access to Bayan Obo resources, NRE is China's largest LREE producer with a vertically aligned value chain from processing to downstream products. Its scale and diversified product mix underpin relatively stable margins and low earnings cyclicality, positioning it as the preferred vehicle to capture sector tailwinds. Our Rmb72 TP is based on 9.5x target 2026E P/B, set at +2sd premium to its historical P/B average since 2013. Shares currently trade at 54.9x 2026E P/E and 7x 2026E P/B.

Neutral on China Rare Earth (CRE) — While strategically important for HREEs, CRE trades at a significantly higher multiple than NRE, a premium we see as excessive given its smaller scale and more volatile earnings, leading to our Neutral call. Our Rmb61.6 TP is based on 12x target '26E P/B, at +1.5sd prem. to stock's historical P/B average since 2013. Shares now trade at 90.5x 2026E P/E and 11.1x 2026E P/B.

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Data Summary

Company	Ticker	Ccy	Price	Mkt Cap (M)	Date & Time	Rating		Short-Term	Target Price		ESPR (%)	Div Yld (%)	ETR (%)	Last Rpt Yr	Current Fiscal Year		Next Fiscal Year	
						Old	New	View	Old	New					EPS		EPS	
						Old	New	Old	New	Old					New	Old	New	
NRE	600111.SS	Rmb	52.480	189,719	10 Oct 15:00		1	-	-	72.000	37.2	0.2	37.3	Dec-24	-	0.601	-	0.967
CRE	000831.SZ	Rmb	54.670	58,017	10 Oct 15:00		2	-	-	61.600	12.7	0.1	12.8	Dec-24	-	0.317	-	0.629

1 = Buy, 2 = Neutral, 3 = Sell, H = High Risk
 Source: Citi Research

ESPR = Expected Share Price Return, ETR = Expected Total Return, nc = no change
 ^Catalyst Watch

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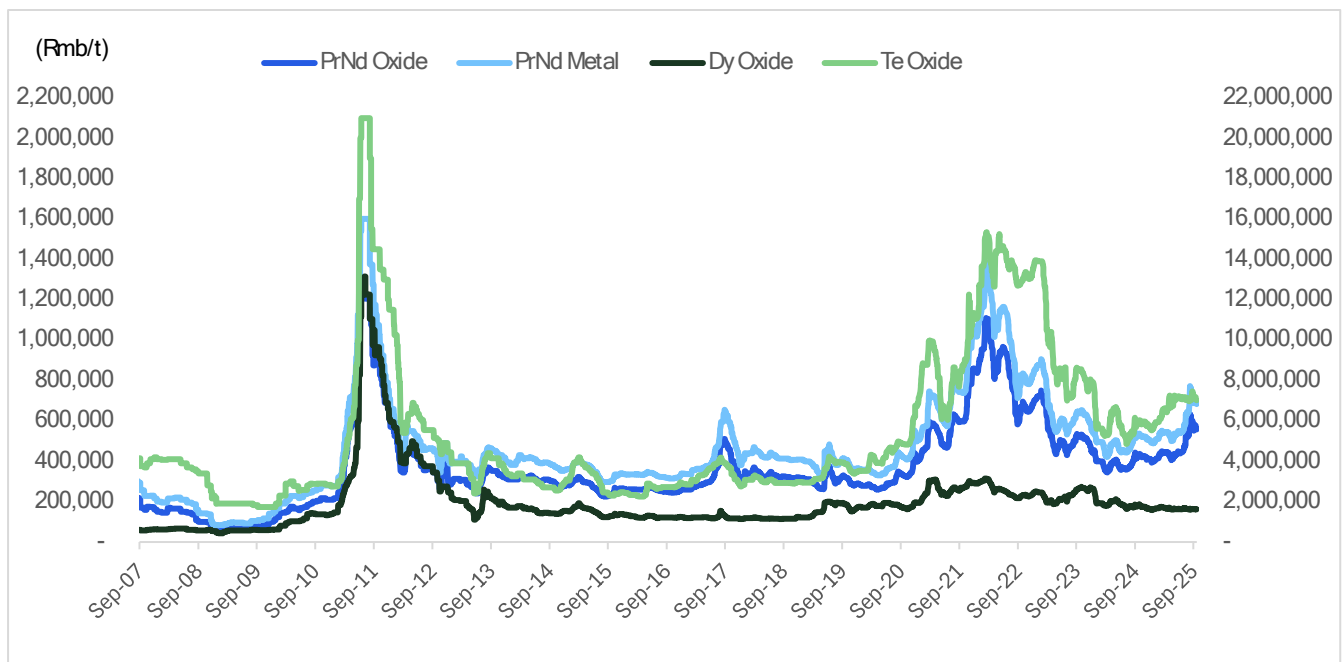
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Investment Thesis

Where are we in the cycle?

The rare earths sector is in an early-to-mid stage of an upcycle after the 2022 peak, per our analysis. PrNd oxide jumped ~40% from early July to late-August peak of Rmb633k/t (~\$88/kg) and then eased to ~Rmb600k/t (~\$84/kg) in early September, leaving higher lows intact. Dy oxide remains resilient around Rmb1.65m/t (\$230/kg). A higher floor is supported by China's tighter quota regime that now covers imported feedstock in smelting/separation, Myanmar feedstock volatility, and new pricing backstops like US DoD's NdPr price floor of \$110/kg. Overall, fundamentals suggest gradual price recovery with upside bias, driven by tightening Chinese supply discipline, steady demand from EVs and wind power, and policy support for supply-chain diversification in the U.S. and allied countries.

Figure 1. Prices of Major Rare Earth Products



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Source: Citi Research, SMM

Sector view & key drivers

Our short-term (3-12 month) view: NdPr is likely to stay firm and trend upward with volatility around quota cadence, Myanmar/ionic-clay headlines, and ex-China qualification timing; HREE, e.g. Dy/Tb are more likely to see sharper price moves since their supply is more constrained and substitution is harder. LREEs may see milder (e.g. Nd, Pr) or more subdued (e.g. La, Ce) moves.

Our medium-term (2025-27E) outlook: The structural outlook remains positive, underpinned by sustained magnet demand growth from EVs, wind turbines, and industrial automation, etc. Global policy efforts to diversify away from China and ex-China refining capacity will likely keep supply additions gradual, reinforcing a higher price floor versus the prior cycle. Medium term, rare earths are expected to trade in a higher but more stable range, with moderate upside potential rather than a runaway rally. HREE supply remains the swing risks: Myanmar's conflict-driven disruptions periodically tighten Dy/Tb and can trigger spikes. La/Ce track industrial cycles and remain relatively oversupplied.

Figure 2. Key Milestones in China Rare Earths Policy Development (2014–2025)

Year	Policy Phase	Details
2014	WTO-driven reset	WTO ruled China's rare-earth export quotas/duties illegal, forcing a policy overhaul.
2015	Liberalization of exports	China abolished rare-earth export quotas and duties, moving away from headline volume caps.
2020	Framework export-control law	Export Control Law effective Dec 2020-unified lists, licensing, end-use/end-user checks, and extraterritorial reach.
2023	Technology controls	Export ban on key REE processing & magnet-making technologies; leverage shifts from materials to know-how.
2024	Full-chain regulation	Rare Earths Regulations(effective Oct) codify mining-separation-metal-circulation-import/export with a traceability system.
Apr-25	Licensing tightening	Export licensing tightened on selected REEs and rare-earth magnets (license+end-user certification).
Jul-25	Stricter quota mgmt	Authorities maintained a tighter export-control posture; production quotas issued non-publicly, signaling stricter oversight of cross-border flows.

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Source: Citi Research, The Ministry of Commerce

Stock positioning and rationale

Against this mid-cycle backdrop, we prefer downstream high-performance magnet producers over upstream miners/separators. We see greater long-term value capture in technology-intensive segments with higher entry barriers, strong customer stickiness, and direct exposure to structural demand from electrification, wind power, and robotics. Among upstream players, we favor those with integrated resources access, pricing influence, and scale advantages to smooth earning through the cycle, while avoiding names where valuations already priced in optimistic scenarios without clear catalysts.

While the rare earths price upcycle typically benefits upstream producers, we believe the earnings quality and valuation appeal now lie downstream. JL Mag (6680.HK) is our preferred pick for its integrated magnet business, higher margins, and stronger linkage to long-term structural drivers such as EV motors, wind turbines, and industrial automation. Meanwhile, NRE and CRE remain the core strategic national assets — the only two listed quota holders, enjoying strong policy backing and long-term resource value. NRE operates mainly as a high-efficiency separator under the BaoTou system, with part of its mining profits captured by Baotou Steel, while CRE provides heavier exposure to HREEs. Overall, we favor JL Mag for structural growth and NRE for cyclical upside, while staying selective on CRE given limited valuation upside.

Valuation methodology

We value NRE and CRE using +2sd / +1.5sd above their historical average P/B multiples, reflecting the sector's early-to-mid upcycle, supported by policy tailwinds, supply discipline, and the growing strategic importance of rare earths in electrification and supply-chain security. While we do not expect this cycle to match the intensity of the prior peak in 2021 – when valuations briefly reached over +4.5SD above historical mean – we believe structural demand growth, tighter resource control, and stronger policy tailwinds justify valuations toward the upper end of the historical range.

We apply different valuation premia to NRE and CRE to reflect their distinct business fundamentals and risk profiles. We believe NRE merits a higher +2sd multiple given its consistent profitability across cycles and vertically integrated operations. By contrast, CRE's +1.5SD multiple reflects its smaller scale, lack of downstream integration, and a more volatile earnings track record, including loss-making years in past downcycles.

Initiating Northern Rare Earth (NRE) with Buy

Benefitting from captive access to Bayan Obo resources, NRE is China's largest LREE producer with a vertically aligned value chain from processing to downstream products. NRE is the largest REO producer globally with integrated mining-separation-downstream capabilities, benefiting from captive access to Bayan Obo resources. Its scale, technological capabilities, and diversified product mix underpin relatively stable margins and relatively low earnings cyclicality, positioning it as the best vehicle to capture sector tailwinds, in our view.

Our Rmb72 target price is based on 9.5x target 2026E P/B, set at +2sd premium to its historical P/B average since 2013, reflecting our sector-wide re-rating view. Shares are currently trading at 54.9x 2026E P/E and 7x 2026E P/B. NRE's rising ROE profile of 9.3%/13.5%/16.6% for 2025E/26E/27E is well above its historical downcycle averages.

Initiating China Rare Earth (CRE) with Neutral

As a central SOE controlling medium-to-heavy rare earth resources, CRE holds a strategically vital position in supplying high-tech and defense sectors. Its core business currently centers on mining and primary separation, with limited downstream processing and value-added activities. While strategically important for HREEs, CRE trades at a significantly higher multiple than NRE, a premium we see as excessive given its smaller scale and more volatile earnings – leading to our Neutral call.

Our Rmb61.6 target price is based on 12x target 2026E P/B, set at +1.5sd premium to the stock's historical P/B average since 2013, reflecting our sector-wide re-rating view. We forecast 7%/12%/15% ROE for 2025E/26E/27E, implying a sustained normalization toward double-digit returns. Nevertheless, the stock is currently trading at 90.5x 2026E P/E and 11.1x 2026E P/B, leaving limited valuation upside despite cycle tailwinds.

Key risks

Key risks for the Chinese companies in the sector include:

- Slower- or faster-than-expected downstream applications demand growth, including demand uncertainty from adoption trends in NEVs, wind power, or other applications.
- Greater- or less-than-expected rare earths mining or processing capacity expansion outside of China, including global supply-chain diversification efforts that could erode the market share of China enterprises, changes in Myanmar export capacity, etc.
- Tariffs and other trade barriers, including those imposed by the US or China, as well as other key global economies.
- Rare earths price volatility from various factors including cyclical swings in rare earth oxide and magnet markets.

- Policy and quota adjustments in China affecting supply, costs, and profitability.
- Emergence of alternate materials or technologies that could substitute for rare earth elements in key end-user applications.
- Rare earth sector M&A and consolidation activity in China or in other global markets.

Rare Earths – Industry Backdrop

I. Industry Fundamentals & Structure

Definition, classification and applications

Rare earths refer to a group of 17 metallic elements on the periodic table, including the 15 lanthanides along with scandium and yttrium. These elements are typically divided into two categories based on their atomic weights and abundance:

- **Light Rare Earths Elements (LREEs):** Lanthanum (La), Cerium (Ce), Praseodymium (Pr), Neodymium (Nd), Promethium (Pm), Samarium (Sm), and Europium (Eu). These are relatively more abundant and have higher concentrations in the Earth’s crust.

Light rare earths are primarily used in NdFeB permanent magnets, polishing powders, catalysts.

- **Heavy Rare Earth Elements (HREEs):** Gadolinium (Gd), Terbium (Tb), Dysprosium (Dy), Holmium (Ho), Erbium (Er), Thulium (Tm), Ytterbium (Yb), Lutetium (Lu), Scandium (Sc), and Yttrium (Y). These are scarcer and less concentrated in the crust.

Heavy rare earths are applied in high-performance magnets (heat-resistant, demagnetization-resistant), phosphors, and lasers.

Their unique magnetic, luminescent, and catalytic properties make them indispensable in permanent magnets, catalysts, batteries, and optics. While each REE is used in different applications, four elements – neodymium, dysprosium, praseodymium and terbium – are of particular importance to the clean-energy sector.

Figure 3. Classification and Major Applications of 17 Rare Earth Elements

Type	Element	Symbol	Chinese	Pinyin	Major Applications
Light Rare Earths	Scandium	Sc	钪	kàng	Lightweight alloys, semiconductors, computer chips, SOFCs, high-efficiency catalysts, optical fibers
	Yttrium	Y	钇	yí	Alloy additives, aerospace ceramics, high-temperature superconductors, phosphors
	Lanthanum	La	镧	lán	Piezoelectric materials, catalysts, optical glass, hydrogen storage alloys
	Cerium	Ce	铈	shì	Polishing powder, auto glass additives, catalysts, rare earth fluorescent materials
	Praseodymium	Pr	镨	pǔ	Magnetic materials, pigments, aerospace alloys, capacitors
	Neodymium	Nd	钕	nǐ	High-strength magnets, EV motors, wind turbines, data storage devices
	Promethium	Pm	钷	pǐ	Nuclear batteries, satellites, luminescent coatings, space research
	Samarium	Sm	钐	shān	Samarium-cobalt magnets, neutron absorbers, high-temperature permanent magnets
	Europium	Eu	铕	yōu	Red phosphors, anti-counterfeit materials, medical diagnostics, neutron capture
Heavy Rare Earths	Gadolinium	Gd	钆	gá	MRI contrast agents, neutron absorbers, phosphors, special alloy additives
	Terbium	Tb	铽	tè	Green phosphors, magnetic refrigeration materials, magneto-optical materials
	Dysprosium	Dy	镝	dí	Enhances coercivity of magnets (for wind/EV), radiation shielding, energy storage
	Holmium	Ho	铥	huǐ	Magnetic alloys, laser crystals, MRI contrast, nuclear control rods
	Erbium	Er	铒	ěr	Optical communication, laser amplifiers, pink glass coloring
	Thulium	Tm	铥	diū	X-ray generators, portable lasers, anti-counterfeit markers
	Ytterbium	Yb	铽	yì	Infrared lasers, magnetic materials, pressure sensors
	Lutetium	Lu	镥	lǔ	PET scan contrast agents, catalysts, crystal doping, battery electrodes

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Source: Citi Research, Asian Metals

Figure 4. Rare Earth Elements in the Periodic Table (Red-framed Highlighted)

		Alkali metals										Alkaline-earth metals						Transition metals						Rare-earth elements (21, 39, 57-71) and lanthanoid elements (57-71 only)						Actinoid elements						Other metals						Metalloids						Halogens						Noble gases						Other nonmetals					
period	group																																																																
1 ^s	1 ^s																																																																
1	1	H																																																															
2	2	Li	Be																	B	C	N	O	F	Ne																																								
3	3	Na	Mg	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr																																														
4	4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr																																														
5	5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe																																														
6	6	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn																																														
7	7	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og																																														
lanthanoid series 6		58	59	60	61	62	63	64	65	66	67	68	69	70	71																																																		
actinoid series 7		90	91	92	93	94	95	96	97	98	99	100	101	102	103																																																		

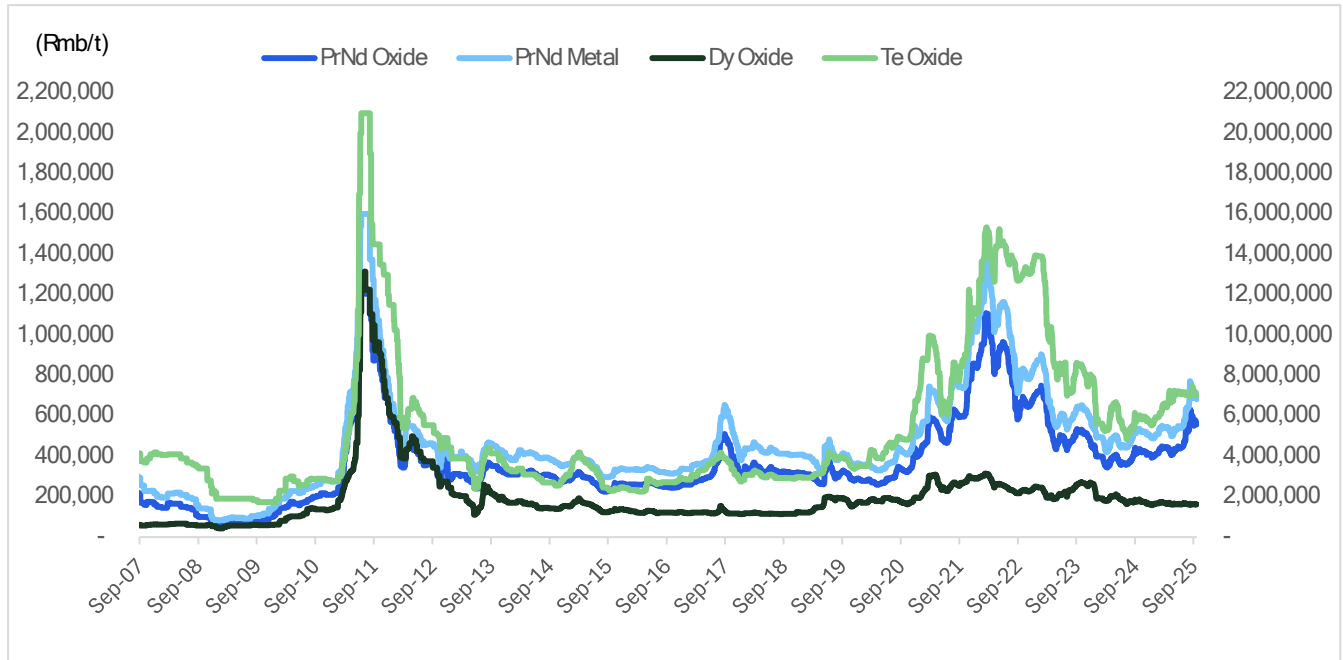
*Numbering system adopted by the International Union of Pure and Applied Chemistry (IUPAC).

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Source: Citi Research, Britannica

Price trends

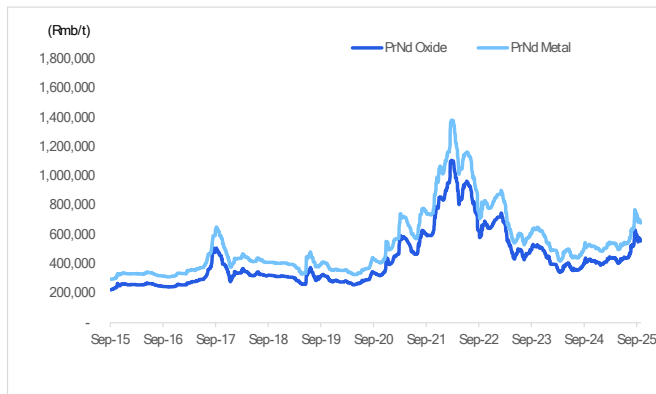
Figure 5. Major Rare Earth Products – Prices



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Source: Citi Research, SMM

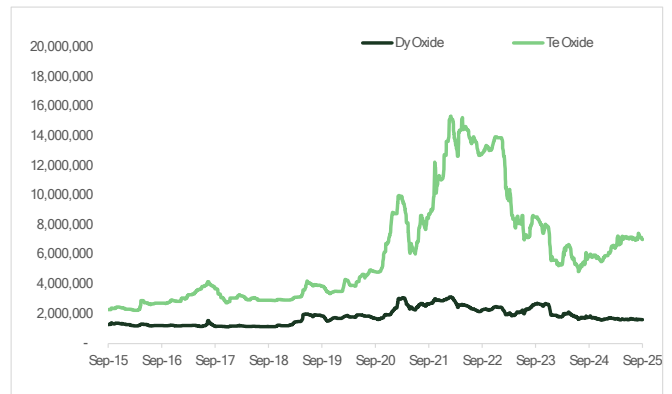
Figure 6. Major LREE – Prices



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Source: Citi Research, SMM

Figure 7. Major HREE – Prices



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Source: Citi Research, SMM

Figure 8. Rare Earth Price Cycle – Major Events

Period	Price Performance	Key Drivers
2010-2011	RE prices hit historical highs, reaching Rmb1.6m/t (in Jun 2011) for PrNd metals	China cracked down on illegal mining and smuggling; strict export quota regime; rising geopolitical frictions with US, Japan, EU
2017	PrNd rallied from Rmb330k/t to >650k/t, ~85% surge	Supply-side reform and nationwide environmental inspections; completion of consolidation into six major SOE-led groups; export quota tightening
2018-2019	PrNd metals increased from Rmb400k/t in FY2018 beginning to Rmb484k/t (~20% growth) in Jun 2019	PrNd fell as EV subsidies were cut and demand slowed down in 2018 but rebounded mid-year in 2019 amid U.S.-China trade tensions; stock valuation re-rated as a national strategic asset
2021-2022	PrNd metals jumped from ~Rmb360k/t (2020) to ~Rmb1.4m/t (early 2022) before retreating	Explosive demand growth from Evs and wind turbines; post-COVID monetary easing and broader commodity boom; supply-demand imbalance amplified
2024-2025	PrNd metals rebounded from ~Rmb420k/t (2024 trough) to above Rmb770k/t in Aug 2025)	New Rare Earth Regulation (total quota control, inclusion of imported ores); strong demand from Evs, robotics, AI servers; Myanmar political instability disrupted HREE supply

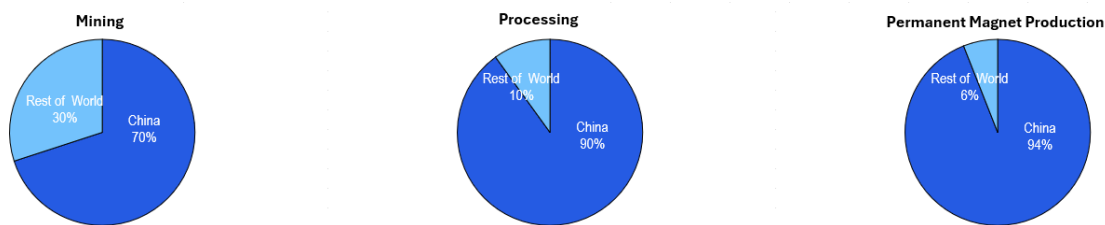
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Source: Citi Research

Global resource distribution

Global production is concentrated in China, the US, Myanmar, and Australia, while downstream refining and separation are heavily skewed toward China.

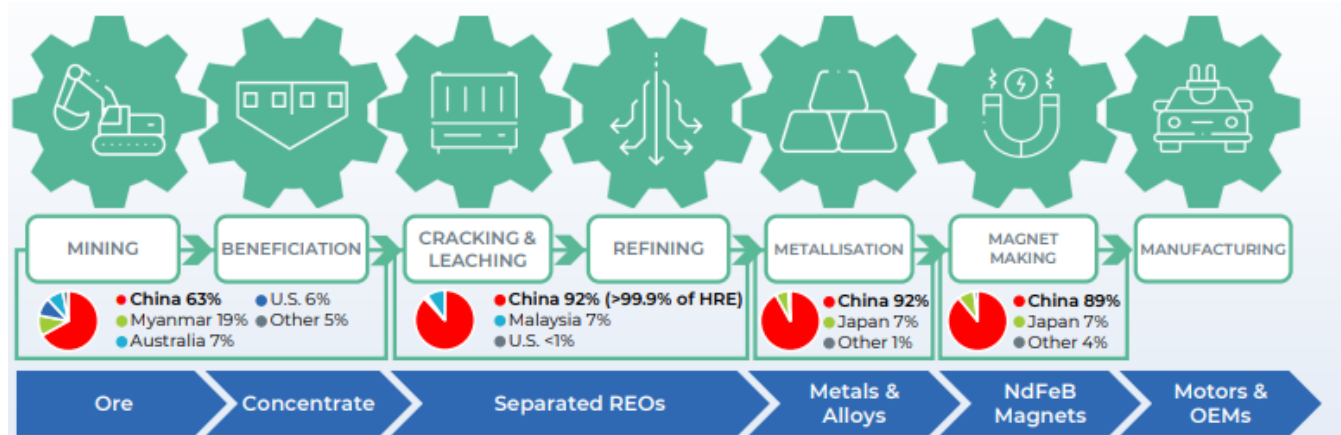
- **Reserves (~90mt as of FY2024):** China 49%, India 8%, Australia 6%, Russia 4%, Vietnam 4%, U.S. 2%
- **Production (~390kt as of FY2024):** China 69%, USA 12%, Myanmar 8%, Australia 3%, Thailand 3%, Russia 1%
- **Refining & Separation:** China holds ~90% of global capacity.

Figure 9. Global Rare Earths Supply Chain



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Source: Citi Research, American Rare Earth Ltd

Figure 10. Global Magnet Value Chain



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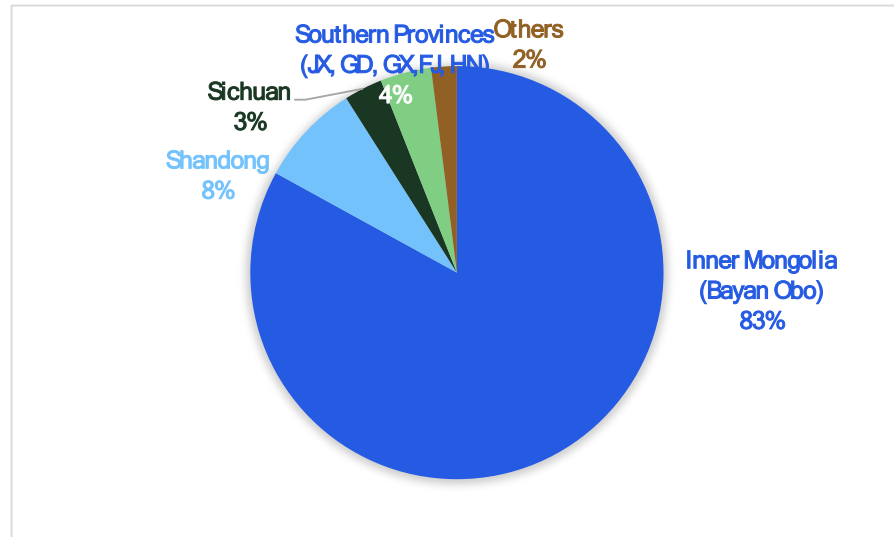
Source: Citi Research, Northern Minerals

China's resource characteristics & strategic significance

China's rare earth resources are highly concentrated, with a clear geographic dichotomy: Inner Mongolia's Bayan Obo in the north dominates light REEs, while southern provinces (Jiangxi, Guangdong, Guangxi) lead in medium and heavy REEs.

- Bayan Obo (Northern LREE)
 - With ~40mt of proven reserves, Bayan Obo leads global LREE supply.
 - LREEs like neodymium and praseodymium sourced here from the foundation of key magnet alloys and high-tech applications.
 - Detailed geological estimates suggest additional potential at deeper strata, further reinforcing its global dominance.
- Southern Ion-Adsorption HREE
 - Deposits are typically shallow clay beds, easier to mine environmentally but lower in grade.
 - HREEs like Dy and Tb are critical inputs for high-temperature, high-coercivity magnets in EVs, wind turbines, and military systems.

Figure 11. China Rare Earth Resource Distribution by Region (2024)



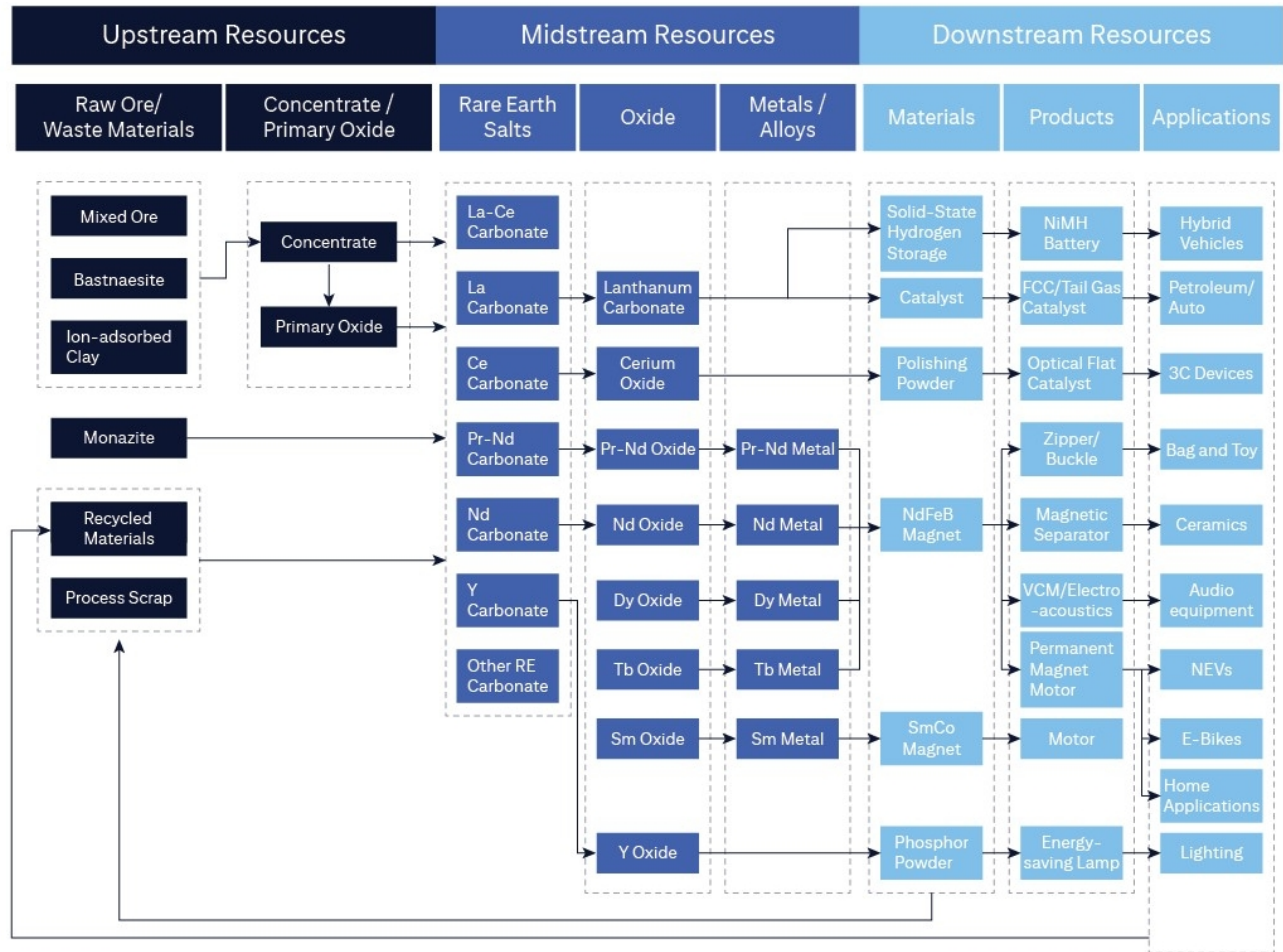
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Source: Citi Research, MIIT

Industry chain structure

Rare earths production includes stages such as mining, beneficiation, concentrate decomposition, extraction, solvent separation, and purification. After mining, raw ore is upgraded into rare earth concentrate through beneficiation. The concentrate is then processed via hydrometallurgy or pyrometallurgy into oxides. These oxides are subsequently refined into metals through advanced metallurgical processes such as molten salt electrolysis or vacuum thermal reduction. Due to the extremely similar physical and chemical properties among the 17 rare earth elements, and the presence of accompanying impurities, separation is highly intricate. These processes require precise control and advanced technical know-how, forming a strong entry barrier.

- **Upstream:** Mining and separation (highly concentrated in China, subject to quotas)
- **Midstream:** Magnet production (NdFeB), hydrogen storage alloys, phosphor materials
- **Downstream:** NEVs (drive motors), wind power, electronics, home appliances, defense, etc.

Figure 12. Full Rare Earths Industry Value Chain



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Source: Citi Research, Company Reports

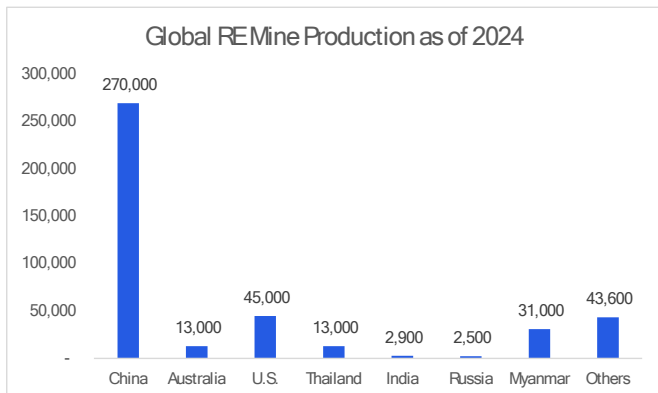
II. Industry Supply Landscape

Rare earth supply overview

Global rare earth oxide (REO) reserves were estimated at >90mt in 2024, with China holding the largest share at 44mt, followed by Brazil (21mt) and India (6.9mt), per USGS data. Worldwide REO production reached approximately 390kt in 2024, marking a ~4% YoY increase. China remains overwhelmingly dominant, supplying ~70% of global REO in 2024, reinforcing its controlling position.

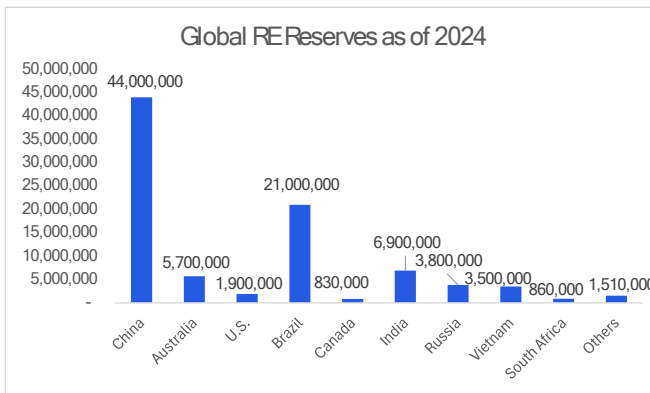
Other notable producers include Australia, the United States, Myanmar, and Russia. US progress has been modest, with Mountain Pass's 45,000t output improving the US position, but refining and downstream capabilities still lag. Emerging players such as Myanmar, Nigeria, and Thailand are increasing production, though often facing environmental and governance challenges. Australia's output stagnation indicates that developing separation and refining capacity remains a hurdle, despite its rich reserves.

Figure 13. Global RE Mine Production (2024)



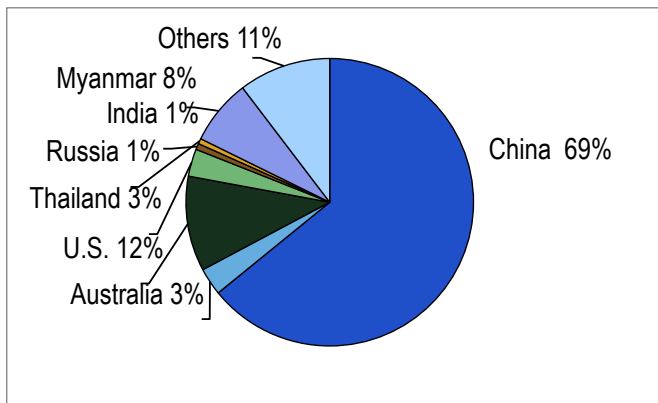
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Source: Citi Research, USGS

Figure 14. Global RE Reserves (2024)



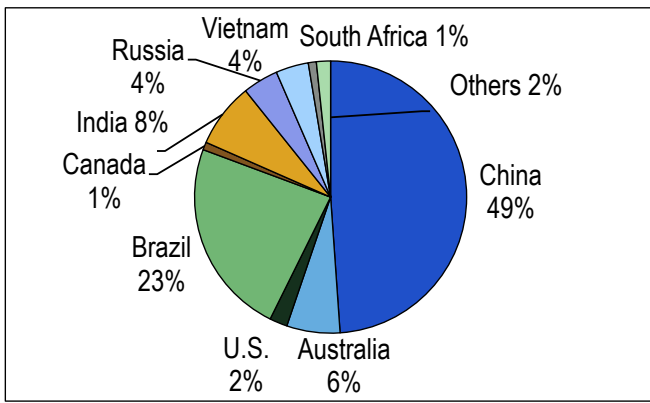
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Source: Citi Research, USGS

Figure 15. Global RE Mine Production (2024)



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Source: Citi Research, USGS

Figure 16. Global RE Reserves (2024)



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Source: Citi Research, USGS

The extraction and processing of rare earths involve complex operations, with China not only being the largest miner, but also a key player in the refining and processing stages. China dominates the REE refining chain with an estimated ~85-90% of total capacity, especially for HREEs (>95% refined in China), thanks to decades of process optimization, large-scale wet separation infrastructure, and integrated magnet material production capacity. Non-Chinese capacity remains fragmented (<15% combined) and LREE biased.

Figure 17. Global Rare Earths Mine Production and Reserves

Global Supply (ton)	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E	19-24 CAGR	24-27E CAGR	Reserves
China	132,000	140,000	168,000	210,000	255,000	270,000	310,500	357,075	410,636	15%	15%	44,000,000
YoY	10%	6%	20%	25%	21%	6%	15%	15%	15%			
USA	26,000	38,000	43,000	43,000	41,600	45,000	54,000	64,800	84,240	12%	23%	1,900,000
YoY	44%	46%	13%	0%	-3%	8%	20%	20%	30%			
Mountain Pass	27,620	38,503	42,413	42,499	41,557	45,455						
Halleck Creek	-	-	-	-	-	-						
Bear Lodge	-	-	-	-	-	-						
La Paz	-	-	-	-	-	-						
Australia	21,000	17,000	22,000	18,000	16,000	13,000	15,600	18,720	24,336	-9%	23%	5,700,000
YoY	17%	-19%	29%	-18%	-11%	-19%	20%	20%	30%			
Mountain Weld	19,737	14,562	15,761	15,970	16,780	10,908						
Iluka Resources	-	-	-	-	-	-						17,400,000
Kalgoorlie Plant	-	-	-	-	-	-						
Australian Strategic Materials												
Pensana Rare Earths												
Burma (Myanmar)	22,000	30,000	26,000	12,000	43,000	31,000	31,000	31,000	31,000	7%	0%	21,000,000
Canada	0	0	0	0	0	0	-	-	-	-	-	830,000
India	3,000	3,000	2,900	2,900	2,900	2,900	3,480	4,176	5,011	-1%	20%	6,900,000
Russia	2,700	2,700	2,700	2,600	2,500	2,500	3,000	3,600	4,320	-2%	20%	3,800,000
Thailand	1,800	2,000	8,000	7,100	3,600	13,000	15,600	18,720	22,464	49%	20%	4,500
Vietnam	900	1,000	400	4,300	300	300	1,000	1,200	1,440	-20%	69%	3,500,000
Others	10,600	6,300	7,000	100	11,100	12,300	14,760	17,712	21,254	3%	20%	2,365,500
Overseas players	88,000	100,000	112,000	90,000	121,000	120,000	138,440	159,928	194,066			
Global total	220,000	240,000	280,000	300,000	376,000	390,000	448,940	517,003	604,702	12%	16%	90,000,000
YoY		9%	17%	7%	25%	4%	15%	15%	17%			

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Source: Citi Research, USGS

Figure 18. Global Rare Earth Refining Capacity Landscape

	China	Malaysia	U.S.	Australia	EU
Estimated Share	~87%	~7-8%	<2%, though rising		
Facility	key provinces include Jiangxi (HREEs), Inner Mongolia (LREEs)	Lynas Advanced Materials Plant (LAMP), Kuantan	MP Materials's Mountain Pass & intermediate separation; lacks full domestic oxide-to-metal chain	Lynas' Kalgoorlie plant (ramp-up in 2025-2026)	projects include Solvay (France), NeoPerformance Materials (Estonia), REEtec (Norway)
Capabilities	full vertical integration from mining- separation -alloying- magnet production	focus on LREE separation(Nd, Pr, Ce, La)	public-private partnerships aiming for refining autonomy by 2026-2027	initial LREE processing; HREEs and magnet-grade alloying not yet fully localized	Minor pilot-scale projects in Estonia, France, and Germany
Notes/ Challenges	China possesses the only fully scaled commercial solvent extraction chains for complex REE separation. High environmental tolerance and technological maturity sustain its dominance.	Public opposition over radioactive waste; HREE separation done in China until Kalgoorlie facility in Australia becomes fully operational.	Currently sends concentrates to China for final separation and magnet production	Strong geological reserves but still developing mid/downstream capabilities	Industrial scale remains years away; reliant on China on oxides and magnet feedstock

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Source: Citi Research, USGS, Company Reports, IEA

China's dominant positions

China holds a uniquely monopolistic role in the rare earth value chain, accounting for ~70% of global rare earth ore production, over 85-90% of separation/refining capacity, and ~90% of NdFeB magnet manufacturing.

Figure 19. China's Rare Earth Monopoly

Segment	China's global share (2024)	Remarks
Reserves	~49%	Largest single-country reserves; particularly rich in heavy rare earths
Mining output	~70% of global production	Production dominated by Inner Mongolia (LREE) and Jiangxi (HREE)
Refining capacity	>85-90% of global capacity	World-leading separation technologies and infrastructure
Magnet production	~90% of NdFeB global output	China controls most downstream rare earth magnet manufacturing
Export capacity	~80% of global refined REE trade	Export policies tightly controlled by quotas and licensing

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Source: Citi Research

Key global players

- **MP Materials (USA):** Vertically integrating from mine to magnet production; Operates Mountain Pass mine (~12% of global output) and has begun producing separated NdPr oxide and magnets in Texas.
- **Lynas (Australia/Malaysia):** First commercial heavy rare earths producer outside of China, now separating heavy REEs like dysprosium-making a pivotal milestone at its Malaysia plant in 2025. Lynas also has a rare earths processing facility in Kalgoorlie, Western Australia, and is building a new rare earths processing facility in Texas, US.
- **Myanmar:** Myanmar's rare earths industry faces challenges. Mining is reportedly carried out by unregulated small-scale miners and sometimes linked with armed militia groups with no environmental best practices or remediation plans in place.

Figure 20. Overview of Major Rare Earth Projects (Excluding China)

Project	Country	Lead Company	RE Type	Resource Volume & Grade	Latest update	Strategic meaning	Development Stage (1-5)	Geopolitical Weight (1-5)	Overlap with China
Mount Weld	Australia	Lynas	Mainly Nd, Pr	32mt TREO, 7.3% grade	targeting ~12kt p.a. NdPr finished product	Largest ex-China NdPr cornerstone; mine-to-separation across AU + MY	5- Full commercial	5- Key non-China supplier	World's only commercial producer of sererate light and heavy RE materials outside China
Kalgoorlie Plant	Australia	Lynas	Separation & Refining	Processing capacity ~ 9kt p.a.	Commissioned in 2024	Non-China refining capacity buildout	4- Commissioning	4- Strategic refinery hub	Process supply from Mt Weld mine
Kuantan Plant	Malaysia	Lynas	Separation (HREE focus)	nameplate capacity of 10.5ktpa NdPr finished product	first Dy & Tb oxide produced in Malaysia; Record NdPr production in June quarter (2,080t); equity raise A\$750m; MoU signed with Korea's JS Link to develop a magnet supply chain in Malaysia	Global largest single RE processing plant; the only commercial producer of separated Dy&Tb ex-China	4- Commissioning	5- Strategic refinery hub	Largest ex-China separator; first ex-China commercial Dy/Tb oxide producer
Seadrift	USA (Texas)	Lynas	Separation (HREE focus)	HREE/LREE separation using Mt Weld feed; design for Dy/Tb + NdPr oxides	Company flagged uncertainty on proceeding; negotiating DoD offtake	Potential first large-scale U.S. HREE separation	3- Construction	4- Strategic refinery hub	Low; ex-China flowsheet; relies on Lynas supply chain
Mountain Pass	USA (California)	MP Materials	Mainly light REEs (Nd, Pr)	~18mt TREO, 6% grade	Stable operation; downstream magnet plant to start in 2025	Only commercially operating RE mine in the U.S.; anchor for U.S. mine-to-magnet independence; DoD price-floor & Apple deals	4- Commercial expansion	5- U.S. production base	Halted China shipments under U.S. deal; prior oxide sales to China curtailed
Bear Lodge	USA (Wyoming)	Rare Element Resources	Nd, Pr	~18mt, rich in NdPr	Supported by DoE; pilot separation plant launched	Anchor U.S. NdPr oxide source with federal backing signals	3- Pilot development	4- U.S. reserve	Low; U.S. centric offtake strategy
Halleck Creek	USA (Wyoming)	American Rare Earths	High-grade NdPr	~2.6bt, high NdPr ratio	PFS on track; first Wyoming oxides produced in testwork; Secured \$7.1m Wyoming grant; EXIM indicative debt financing	Very large-scale U.S. LREE resource candidate; potential long-life supply	2- Pre-feasibility	4- U.S. reserve	Low; targeting U.S./allied processing hubs
La Paz	USA (Arizona)	American Rare Earths	Nd, Pr	1.7mt TREO (targeting 9.28mt)	ongoing testwork & studies	Diversifying domestic RE sources in the U.S.	2- Scoping/early PFS workstreams	3- Emerging U.S. asset	Low
Eneabba	Australia	Iluka Resources	Refinery	Designed for LREE + HREE separation; feed incl. monazite & external concentrates	target commissioning ~2027	First ex-China integrated LREE + HREE refinery at scale in West	2- Under construction	4- Strategic refinery hub	Low; Australia-based; multi-feed strategy
Browns Range	Australia	Northern Minerals	HREE focus	11.7mt, Dy/Tb: TREO ratio ~10.1%	ongoing funding & regulatory matters	Key non-China HREE (Dy/Tb) source candidate; key feedstock to Iluka's Eneabba refinery	2- Feasibility	4- Strategic Dy/Tb supply	Low; subject to Aust. FIRB oversight; aiming Western supply chains
Silmet + Narva magnets	Estonia	Neo Performance Materials	processor	magnet ~2,000t in Phase I, with a plant to scale to >5,000t in Phase 2	magnet factory is to start production in 2H25 with a second plant expected in 2026	Only operational REE separation facility in Europe; First RE permanent magnet manufacturing facility in Europe	4- Commissioning	4- EU separation + magnets hub	Medium; diversified sourcing; some supply partnerships
Sokli	Finland	Finnish Minerals Group	Mixed REEs	High-grade resource, rich in NdPr	Studies progressing; feasibility phase 2026	EU domestic REE tied to fertilizer chain	2- Feasibility	4- EU resource project	Low
Fen Carbonatite	Norway	Rare Earth Norway	carbonatite type	~8.8mt TREO, 1.57%	Drilling	Potentially Europe's largest REE deposit	2- Pre-feasibility	4- EU reserve	Low
Fen field	Norway	Saga Rare Earths	Fen field LREE tenements	1.2mt TREO, 1.28% grade	Early development prep	Fen belt additional pathway; EU diversification	2- Pre-feasibility	3- EU reserve candidate	Low
Tanbreez	Greenland	Tanbreez Mining	Mainly Heavy REEs	45Mt, 0.4%	Exploration licenses approved; environmental review ongoing	Potential strategic source for Europe	2- Feasibility	4- Major non-China HREE option	Low
Wicheeda	Canada	Defense Metals	LREE	700k TREO, 2.02% grade	PFS submitted	Part of North America's resource diversification	3- PFS/permits progressing	3- Canadian NdPr feed candidate; improves North American diversification	Low

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Source: Citi Research, Company Reports, USGS, Bloomberg, Reuters

Figure 21. Rare Earth Strategies Comparison

Region/Country	Resource Control	Processing & Refining	Downstream Industries	Policy Approach	Global Market Role
China	Dominant (~70% of mining, >85% refining)	Mature, cost competitive, full value chain	Global leader in NdFeB magnets, battery alloys, catalysts	Centralized state control, export licensing, quota system	Price-setter, policy gatekeeper
Australia	Large & diversified mining (Lynas)	Growing separation capacity (Lynas Kalgoorlie)	No major downstream, mostly raw material exporter	Export-driven, infrastructure support, foreign investment friendly	Reliable upstream supplier to Japan, EU, U.S.
U.S.	Limited (Mountain Pass, Halleck Creek emerging)	Weak-separation still scaling up	Defense, EV motors, wind (still reliant on imports)	Strategic stockpile, DPA funding, IRA tax credits	Aspiring full-chain participant, defense-driven
EU	Very limited (Sokli, Tanbreez, Silmet)	Early stage (Estonia Silmet, France pilot plants)	Automotive (VW, Stellantis), wind (Siemens Gamesa), defense	Regulatory frameworks (CRMA), industrial subsidies	Consumer of REEs, aiming to reduce China import share to <65%
Japan	No significant mining	Strong: world-class refining & recycling (Hitachi, Daido)	Global leader in high-performance magnets	Market diversification, offtake agreements, recycling tech	Strategic consumer + tech innovator, diversified supplier base

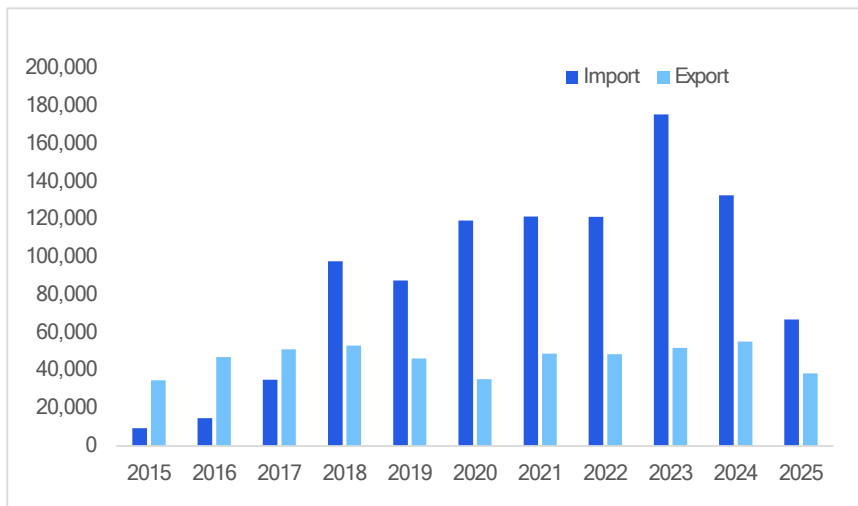
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Source: Citi Research, Company Reports

Global trade flows and supply-chain fragility

Trade patterns

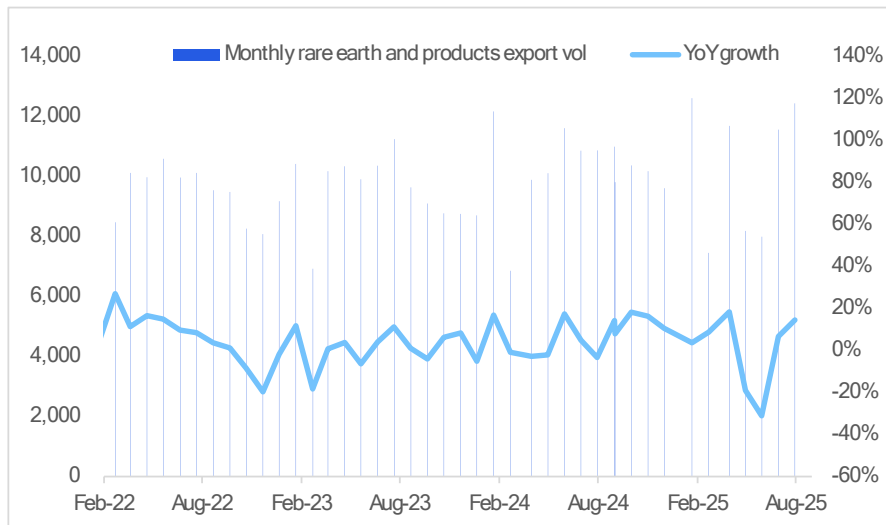
- China plays a central role in the global rare earth trade** – China leads the global rare earth supply chain as both the largest exporter and a key importer. In 2024, it exported over 58,000 tons of rare earth magnets, mainly to Germany, the U.S., and Korea, along with 6,000 tons of oxides and 33,000 tons of compounds, primarily to Japan and the US, per China customs data. At the same time, China imported around 133,000 tons of rare earth raw materials, down 24% from 2023. Imports – mainly oxides and compounds – came largely from Myanmar (34%), Malaysia, and Laos, helping supply HREEs that are less abundant domestically. This illustrates a strategic dual role: China imports low-grade concentrates for domestic processing while exporting high-value finished products. Supply risks remain, particularly from Myanmar due to political instability.

Figure 22. China Rare Earth Import and Export Quantities (2025 YTD as of 7M25)



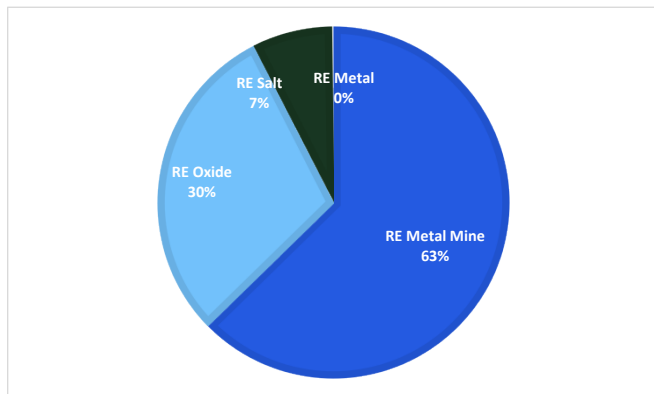
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Source: Citi Research, China Customs, Wind

Figure 23. China Rare Earth and Products Export Volume and YoY Growth



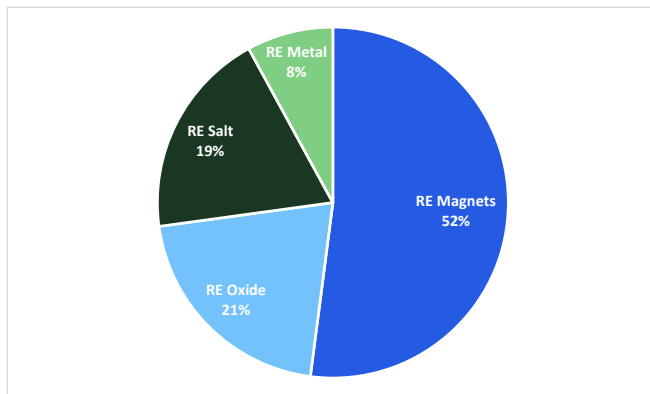
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Source: Citi Research, China Customs, Wind

Figure 24. China Rare Earth Import Structure (2024)



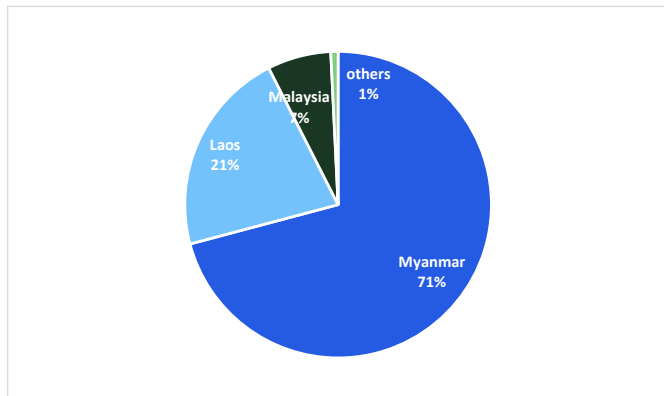
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Source: Citi Research, SMM, China Customs

Figure 25. China Rare Earth Export Structure (2024)



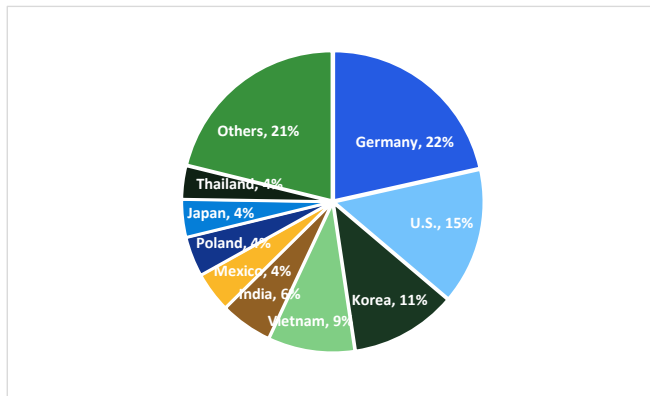
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Source: Citi Research, SMM, China Customs

Figure 26. China RE Oxide Import Country (2024)



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Source: Citi Research, SMM, China Customs

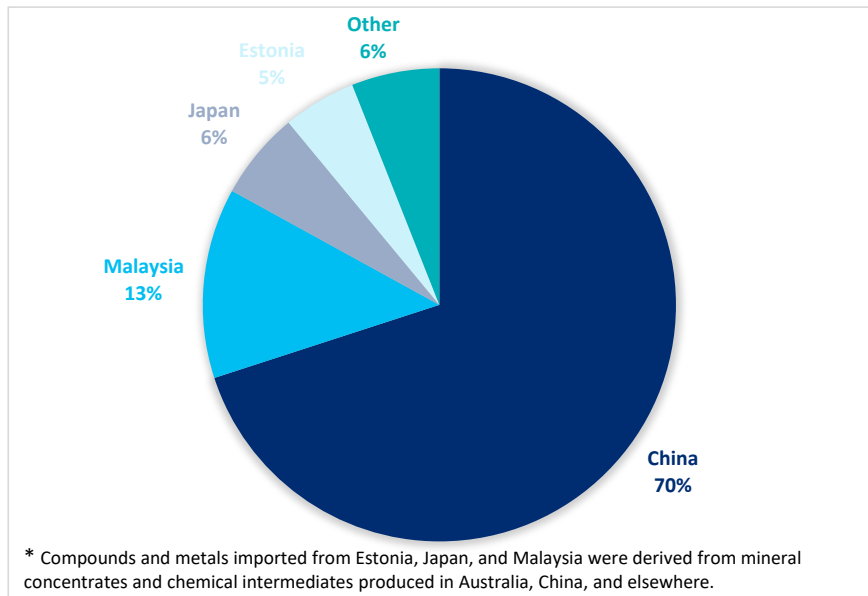
Figure 27. China RE Magnet Export Country (2024)



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Source: Citi Research, SMM, China Customs

- **US, Japan, and EU highly import-dependent, especially for heavy rare earths –** The US relies heavily on rare earth imports, with over 70% sourced from China. While mining occurs domestically at Mountain Pass, most separation and processing still take place abroad. Imports include oxides, metals, and permanent magnets – key to defense and clean energy. Light rare earths dominate in volume, but heavy rare earths are scarcer and more dependent on China. Recent Chinese export controls have raised US supply-chain concerns, prompting efforts to rebuild domestic refining and magnet production, though challenges remain.

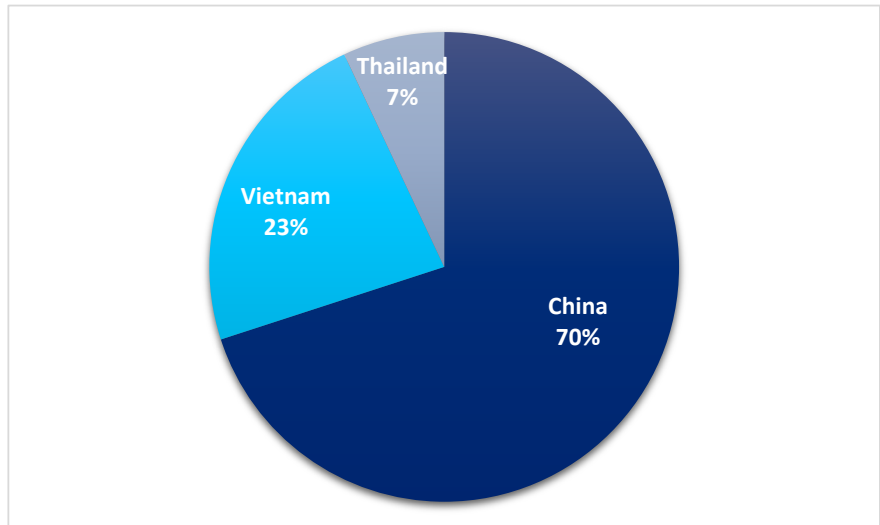
Figure 28. US RE Compounds and Metals Import Sources (2020–2023)



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Source: Citi Research, USGS

Japan’s rare-earth market remains dominated by three key supplier countries shown below. While China remains the dominant supplier, Japan has strategically increased imports from Vietnam and Thailand in response to rising costs and supply risks associated with China’s export controls.

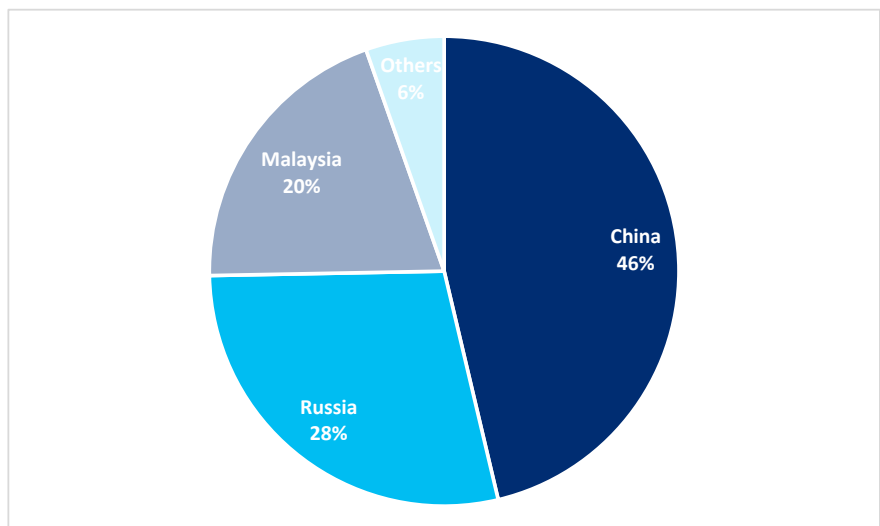
Figure 29. Japan RE Import Landscape (2024)



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Source: Citi Research, GTAIC

Almost half of the European Union's imports of rare earths came from China last year, according to the European Union's statistical office (Eurostat). In 2024, China maintained its position as the EU's largest REE supplier, accounting for 46.3% of all imports (6,000t), followed by Russia (3,700t), and Malaysia (2,600t). These three countries supplied over 94% of total REE imports, reinforcing the EU's continued dependence on a concentrated supplier base. To reduce dependence on China and other individual countries, the EU passed the Critical Raw Materials Act 2024. The aim is to extract 10% of rare earths in the EU itself and cover 15% of demand from recycling. In addition, no single third country is to cover more than 65% of demand.

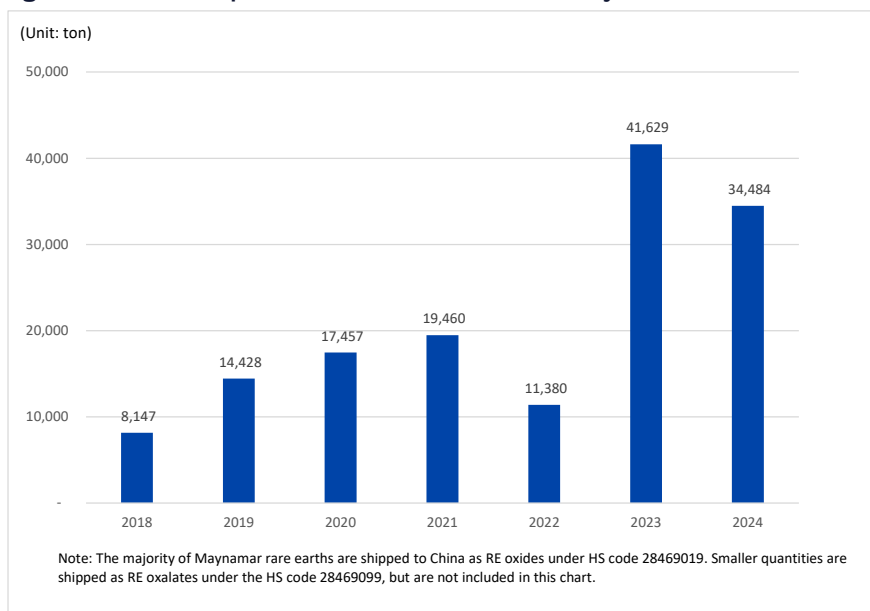
Figure 30. RE Elements Imports to the EU (2024)



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Source: Citi Research, Eurostat

- Geopolitical disturbances: Myanmar** – Myanmar does not possess significant rare earth refining capacity, but it plays a critical role in the global supply chain – particularly for HREEs – through its upstream ore mining and export to China. China, which shares a border with Myanmar, obtains ~50%-80% of its medium to heavy rare earths feedstock from its neighbor, including dysprosium and terbium. China’s reliance on Myanmar ore imports has been a bottleneck in HREE supply chains. Myanmar’s rare earths production, and hence China’s feedstock supplies, experienced further disruptions in 2024 amid internal military conflicts in Myanmar, including in Kachin state, near China’s Yunnan province, which are critical suppliers of rare earth oxides to China. This includes Panwa, a key rare earths mining hub. Policy tightening in Myanmar could also directly affect global HREE pricing. China has been accelerating HREE exploration and recycling to reduce dependency on Myanmar amid geopolitical uncertainty.

Figure 31. China's Imports of Rare Earth Oxides from Myanmar



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Source: Citi Research, China Customs

Figure 32. Myanmar's Role in the Rare Earth Industry

Category	Description
Primary Role	Supplier of HREE raw ore, especially ion-adsorption clays rich in Dy and Tb
Processing	No industrial-scale refining/separation capacity domestically. Nearly all rare earth raw ore is exported to Southern China (e.g. Jiangxi) for refining
Volume Share	According to Chinese customs and industry estimates, Myanmar has supplied ~50-80% of China's HREE import in recent years.
Type of Deposit	Ion-adsorption clays (easily leachable, low-radioactivity HREE-rich ores)
Refining Capability	Local refining is non-existent or very rudimentary- environmental and technological limitations prevent scaling
Policy Risk	Political instability and military-government regulation have led to periodic export bans or disruptions, notably in 2021 and again in early 2024

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Source: Citi Research, USGS, China Customs, CREIA

Supply-chain fragility: global bottlenecks and constraints

Since 2020, the EU, the US, Japan, and Australia have launched coordinated efforts to reduce their dependence on China for rare earths, reflecting both economic security and energy transition priorities.

- The EU's Critical Raw Materials Act (CRMA) sets binding 2030 targets for domestic mining, refining, and recycling of rare earths, while fast-tracking strategic projects like Silmet in Estonia and Sokli in Finland.
- The US, through the Defense Production Act, Inflation Reduction Act, and strategic stockpiling, is rebuilding its rare earth value chain, supporting projects such as MP Materials and Lynas USA.
- Japan, long a leader in rare earth diversification, continues to invest in overseas mining (e.g., Lynas), expand its recycling capacity, and developed advanced permanent magnet technologies, reducing its rare earth imports from China to below 60%.
- Australia has emerged as a critical upstream supplier, with government financing supporting Lynas, Arafura, and Hastings, and is rapidly expanding refining capacity through its Critical Minerals Strategy.

Collectively, these measures from a multi-polar supply-chain response aimed at mitigating geopolitical risks and supporting clean-energy industrialization.

Figure 33. US Policy Measures to Reduce Reliance on Chinese Rare Earths

Measure	Details
Support for domestic production	The U.S. Department of Defense (DoD) signed a US\$120mn contract with Australia's Lynas in Jun 2022 to build a HREE separation facility in Texas; scope under review but cornerstone to reduce Dy/Tb dependence
	MP Materials is building a rare earth facility in California too add HREE processing alongside existing LREE separation. In Apr 2024, it received a US\$58.8mn tax credit under Section 48C of the Advanced Energy Project scheme.
	American Rare Earths Ltd. Is advancing projects in Wyoming and Arizona, with support including \$7.1mn from the Wyoming state govt and a non-binding EXIM Bank letter for up to \$456mn in debt financing.
	In Nov 2024, Congress passed the "Critical Minerals Consistency Act", requiring domestic sourcing for certain minerals and restricting imports of China-linked RE products.
	On Mar 20, 2025, President Trump signed an executive order under the Defense Production Act (DPA) to boost domestic RE capacity by subsidies, tax incentives, and strategic purchases.
	In Jul 2025, U.S. DoD sets a 10-year NdPr price floor at \$110/kg via a multibillion-dollar deal with MP Materials - guaranteeing minimum pricing for NdPr to de-risk U.S. separation/magnet output.
	In Jul 2025, Apple signs a \$500m multi-year agreement with MP Materials to buy U.S.-made NdFeB magnets from the Fort Worth plant - anchoring commercial demand alongside DoD support; production ramp targeted from 2027.
International supply partnerships	U.S.-Japan Critical Minerals Agreement (2023)- shared standards/traceability to secure non-China supply and qualify for clean-energy incentives.
	U.S.- Australia Critical Minerals & Clean Energy Compact (2023)- policy/finance coordination to bring allied REE capacity online.
	Export-credit & development finance signal U.S. backing for allied REE projects that feed non-China supply chains.

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Source: Citi Research

Figure 34. Summary of EU Multi-pronged Approach

Policy Area	Example Measure	China Dependency Impact
Mining & Permitting	CRMA 10% EU mining target	Reduce raw ore imports
Refining & Separation	Estonia Silmet expansion, new Finland plant	Enable local separation
Recycling	Magnet waste recycling push	Lower primary imports
Strategic Stockpiling	National stockpiles considered	Mitigate short-term risks
Trade Alliances	MoUs with Australia, Canada, U.S.	Diversify sourcing
Industrial Incentives	EU Green Deal, Net Zero Industry Act	Secure downstream demand

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Source: Citi Research, Company Reports, European Commission

Despite efforts from the US, the EU, Japan, and Australia to diversify their respective supplies, several structural bottlenecks persist:

■ **Upstream mining expansion limitations**

- Long project lead times: Rare earth mines take 5-10 years from exploration to commercial production.
- Environmental and community opposition: Radioactive waste (thorium, uranium) and acid usage create regulatory delays (e.g. Lynas in Malaysia).
- Capacity intensity and low ROI: Rare earth pricing volatility undermines stable investment in new supply.

■ **Refining & separation deficits**

- Technical barriers: REE separation requires high expertise in solvent extraction- a field dominated by China.
- Environmental costs: High pollution footprint has deterred large-scale refining outside China.

■ **Downstream material gaps**

- NdFeB magnet bottleneck: Even if mined and refined elsewhere, most NdFeB magnets are produced in China.
- Limited alternatives: Western countries lack integrated manufacturers to support EV and defense sectors.

China retains structural dominance in the rare earth value chain. While overseas players and governments are making progress to diversify supply, significant bottlenecks and dependencies remain, keeping the global industry vulnerable to Chinese policy shifts. In conclusion, China's near-term monopoly appears secure.

Foreign substitution faces steep hurdles across technology, cost, regulation, and value-chain integration.

III. Policies and Regulation

Policy evolution in China

Supply-side reform initiation and state-led group restructure

Supply-side reforms under the 13th Five-Year Plan: formation of “5+1” rare earth groups and crackdown on illegal production – In 2014, China’s MIIT issued a directive supporting six leading companies – Northern Rare Earth, China Minmetals, Aluminum Corporation of China (Chinalco), Xiamen Tungsten, Southern Rare Earth, and Guangdong Rare Earth – to form large-scale national rare earth groups. By 2016, the restructuring was largely completed, with 66 out of 67 rare earth mining licenses and 77 out of 99 separation companies integrated into the six groups. The crackdown on illegal “black rare earths” was also intensified. According to industry data, about 40,000 tons of illicit rare earth metals were produced in 2014, but illegal operations have now largely disappeared.

Formation of China Rare Earth Group in 2021: establishment of a “North-South Dual-Core” industry structure – To deepen SOE reform and optimize resource allocation, the State Council approved the creation of China Rare Earth Group in December 2021. The group consolidated assets from Chinalco, China Minmetals, and Ganzhou Rare Earth, including equity stakes in key rare earth firms and trading platforms. In 2023, the group further acquired rare earth assets from Xiamen Tungsten and Guangsheng Nonferrous. Today the rare earth industry is structured around two major hubs:

- **Northern Rare Earth:** Focused on light rare earth resources in Inner Mongolia.
- **China Rare Earth Group:** Leads heavy rare earth integration in Jiangxi, Hunan, Yunnan, Guangxi, Jiangsu, Shandong, and Sichuan.

Figure 35. Rare Earth Industry Consolidation in China

Year	Milestone
Jan-11	Nationwide crackdown on illegal rare earth mining launched under MIIT "rectification plan".
Dec-12	Strategic target set to reform and integrate the rare earth sector into six national SOE groups.
Jul-14	Formalization of the consolidation mandate through "Guiding Opinions on Promoting the Merger and Restructuring of Rare Earth Enterprises".
2015	National Rare Earth Product Traceability System launched to combat black-market activities.
Dec-16	Industry integration milestone: 66 of 67 mining licenses and 77 of 99 separation plants consolidated under six national SOE groups
Jul-05	Major anti-smuggling crackdowns in Jiangxi and Guangdong; first national environmental standards for rare earth production issued
2018-2020	Push for "green rare earth" production through stricter environmental compliance and optimized quota management
Dec-21	Formation of China Rare Earth Group (CREG) through merger of Chalco Rare Earth, Minmetals Rare Earth, and Southern Rare Earth entities.
Jan-22	Completion of state-owned equity transfers; CREG gains control of key South China rare earth assets.
Sep-23	Formation of a Fujian-based joint venture between CREG and Xiamen Tungsten to consolidate quota resources
Dec-23	CREG assumes control of Guangdong Rare Earth Group assets; Xiamen Tungsten quotas fully integrated.
Feb-24	New quota allocations designate "North-South" dual-core production model: Northern Rare Earth leading light RE, CREG leading heavy RE.
Jun-24	Updated export control list introduced; licensing expanded to cover seven medium-heavy REEs and magnet products
2025 (YTD)	"North-South" model fully established; CREG emerges as dominant heavy RE and green-tech material leader, Northern RE maintain light RE leadership.

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Source: Citi Research

State-controlled quotas and group-led production

Currently, China's rare earth industry operates under a supply structure characterized by state-regulated production quotas and group-dominated production. Each year, in both the first and second halves, the Ministry of Natural Resources and the Ministry of Industry and Information Technology issue total production control targets – including mining and separation quotas – to major rare earth groups. The two major groups are responsible for reallocating the quotas they receive to specific mines and separation plants under their control, thereby enforcing top-down production regulation.

In addition to China's longstanding quota regime for rare earths, the policy framework was tightened in July 2025 with the Interim Measures for Total-Volume Control of Rare Earth Mining and Smelting- Separation, jointly issued by MIIT, NDRC, and the Ministry of Natural Resources. The Measures operationalize the 2024 "Regulations on the Administration of Rare Earths" by 1) setting annual national quotas approved by the State Council and issuing them directly to approved enterprises; 2) requiring monthly reporting of production and flows into a unified traceability system; 3) linking violations to penalties and next-year quota reductions; and 4) explicitly pulling imported feedstock/recycled streams into the same reporting perimeter. Notably, since mid-2025, the government has stopped publicly announcing quota volumes – the first 2025 mining and smelting quotas were issued quietly without the usual public notice, underscoring a shift to a tighter, 'quota-as-license' operating model with greater data and enforcement, but less public transparency on cadence and size.

Figure 36. China Rare Earths – Production Quotas from 2019–2024 (semi-annual)

Quota (ton)	1H19	2H19	1H20	2H20	1H21	2H21	1H22	2H22	1H23	2H23	2H23-3rd batch	1H24	2H24
RE Mining	60,000	72,000	66,000	74,000	84,000	84,000	100,800	109,200	120,000	120,000	15,000	135,000	135,000
HoH	33%	20%	-8%	12%	14%	0%	20%	8%	10%	0%	-	0%	0%
YoY	-14%	60%	10%	3%	27%	14%	20%	30%	19%	10%	-	13%	0%
RE Smelting and Separation	57,500	69,500	63,500	71,500	81,000	81,000	97,200	104,800	115,000	115,000	13,850	127,000	127,000
HoH	24%	21%	-9%	13%	13%	0%	20%	8%	10%	0%	-	-1%	0%
YoY	-22%	49%	10%	3%	28%	13%	20%	29%	18%	10%	-	10%	-1%

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Source: Citi Research, MIIT

Figure 37. China Rare Earths – Production Quotas from 2019–2024

Quota (ton)	2019	2020	2021	2022	2023	2024
RE Mining	132,000	140,000	168,000	210,000	255,000	270,000
YoY	15%	6%	20%	25%	21%	6%
RE Smelting and Separation	127,000	135,000	162,000	202,000	243,850	254,000
YoY	6%	6%	20%	25%	21%	4%

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Source: Citi Research, MIIT

Figure 38. Production Quotas of Different Rare Earth Type from 2019–2024

Quota (ton)	2019	2020	2021	2022	2023	2024
Rock-type rare earth (LREE)	112,850	120,850	148,850	190,850	235,850	250,850
YoY	-	7%	23%	28%	24%	6%
Ion-absorbed type rare earth (HREE)	19,150	19,150	19,150	19,150	19,150	19,150
YoY	-	0%	0%	0%	0%	0%

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Source: Citi Research, MIIT

Figure 39. LREE Production Quotas of Two RE Groups

Quota (ton)	2019	2020	2021	2022	2023	2024
China Rare Earth Resources	42,100	47,300	48,500	49,200	57,200	62,200
YoY	-	12%	3%	1%	16%	9%
%	37%	39%	33%	26%	24%	25%
China Northern Rare Earth (Group) High-Tech	70,750	73,550	100,350	141,650	178,650	188,650
YoY	-	4%	36%	41%	26%	6%
%	63%	61%	67%	74%	76%	75%

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Source: Citi Research, MIIT

China's export control policy development (2014-2025)

Figure 40. Key Milestones in China Export Control Policy Development (2014-2025)

Year	Policy Phase	Details
2014	WTO-driven reset	WTO ruled China's rare-earth export quotas/duties illegal, forcing a policy overhaul.
2015	Liberalization of exports	China abolished rare-earth export quotas and duties, moving away from headline volume caps.
2020	Framework export-control law	Export Control Law effective Dec 2020-unified lists, licensing, end-use/end-user checks, and extraterritorial reach.
2023	Technology controls	Export ban on key REE processing & magnet-making technologies; leverage shifts from materials to know-how.
2024	Full-chain regulation	Rare Earths Regulations(effective Oct) codify mining-separation-metal-circulation-import/export with a traceability system.
Apr-25	Licensing tightening	Export licensing tightened on selected REEs and rare-earth magnets (license+end-user certification).
Jul-25	Stricter quota mgmt	Authorities maintained a tighter export-control posture; production quotas issued non-publicly, signaling stricter oversight of cross-border flows.

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Source: Citi Research, The Ministry of Commerce

Resource tax: based on sales; heavier tax on heavy rare earths reflects scarcity

In addition to export controls, China imposes a resource tax on rare earth mining to manage supply and environmental externalities. Rare earths are taxed by value rather than by volume and light rare earths 7-12% (set within band by provinces), medium/heavy rare earths 20%, according to the Resource Tax Law of China, effective September 1, 2020. The policy objectives are to: 1) internalize environmental costs from mining and separation processes; 2) regulate excessive extraction and discourage illegal mining; and 3) support value-added processing and technological upgrading within China.

Carbon-neutral goals: rare earths listed as strategic resources for green tech

To align with carbon neutrality targets (e.g., China's 2060 goal, EU's Green Deal, US Inflation Reduction Act), many governments have elevated rare earths to national strategic materials lists. Their roles in enabling low-carbon technologies include: 1) permanent magnets for clean energy: NdFeB magnets are essential components in EV motors and wind turbine generators; 2) energy-efficient lighting and displays: europium and terbium are used in phosphors for LED lighting and screen displays, reducing energy consumption; 3) hydrogen storage and batteries: lanthanum and cerium are used in nickel-metal hydride batteries and hydrogen storage systems; and 4) green tech dependency: according to the International Energy Agency (IEA), demand for rare earths in clean energy technologies could rise 3-7x by 2040E.

Global ex-China rare earth policy landscape

Rare earth elements are critical to modern technology, defense, and the green energy transition. The industry is heavily concentrated in China, which accounts

for most of the global rare earth production and processing. However, geopolitical concerns are driving supply-chain diversification globally.

United States

Policy objective is to achieve rare earth supply chain independence – from mining through to magnets – to reduce dependence on China and support defense and clean energy goals. Key initiatives include:

■ Defense Production Act (DPA)

- Invoked to fund domestic RE separation and magnet production.
- DOE and DOD allocated >\$500mn in grants to U.S. firms (e.g., MP Materials, American Rare Earths, Lynas USA).

■ Inflation Reduction Act (2022)

- Provides incentives for EVs with domestically sourced or allied-sourced rare earth content.
- Certain EV tax credits tied to “non-Chinese” sourcing of critical minerals.

■ Export-Import Bank of the U.S. (EXIM)

- Offering financing for RE processing plants (e.g., MP Materials, American Rare Earths Wyoming project).

■ DoE Critical Materials Institute (CMI)

- R&D on substitution, recycling, and advanced separation tech.

■ US-China tariffs

- Aiming to bolster its domestic supply, in May 2024, the Biden administration announced a 25% tariff on rare earth magnet imports from China that would go into effect in 2026.
- The Trump administration exempted sintered NdFeB magnets from the reciprocal tariff (previously 10% on Chinese-origin), effective September 8. As a result, current duties on Chinese sintered NdFeB imports are ~22.1% total: 2.1% base MFN duty+20% fentanyl tariff.

Yet challenges remain, as no commercial-scale separation plant for heavy REEs are operational yet. The US magnets industry still relies heavily on Chinese imports, for example.

European Union

Policy objective is to secure strategic autonomy in rare earth supply by 2030; reduce Chinese import dependence from ~98% to <50%. Key initiatives include:

■ EU Critical Raw Materials Act (CRMA, 2023)

- Benchmarks by 2030: 10% of the EU’s annual needs for extraction; 40% for processing and 25% for recycling. No more than 65% import reliance from a single third country for any REEs.

■ Strategic projects

- Commission approved 47 EU projects and 13 non-EU projects to fast track permitting, financing and offtakes-several are REE/magnets.
- French, German public funds supporting pilot REE separation plants.

■ **Alliances with partners**

- Green Alliance with Canada, Australia on joint REE supply.
- MOU with the US on critical minerals data and investment co-financing.

Challenges are that EU has limited domestic REE reserves and faces slow permitting processes and high environmental standards.

Figure 41. Summary of Global RE Policy Landscape

Region	Policy Maturity	Domestic Mining	Separation Capacity	Magnet Capacity	Key Risks
China	Mature	Global Leader	Dominant (~90%)	Dominant (>90%)	Global pushback; geopolitical risk
U.S.	High (DPA, IRA)	Scaling (MP, ARE)	Low-medium	Low	Tech lag; dependence on China for HREEs
EU	Emerging (CRMA)	Low-scaling	Low	Very low	Reserve scarcity; slow permitting

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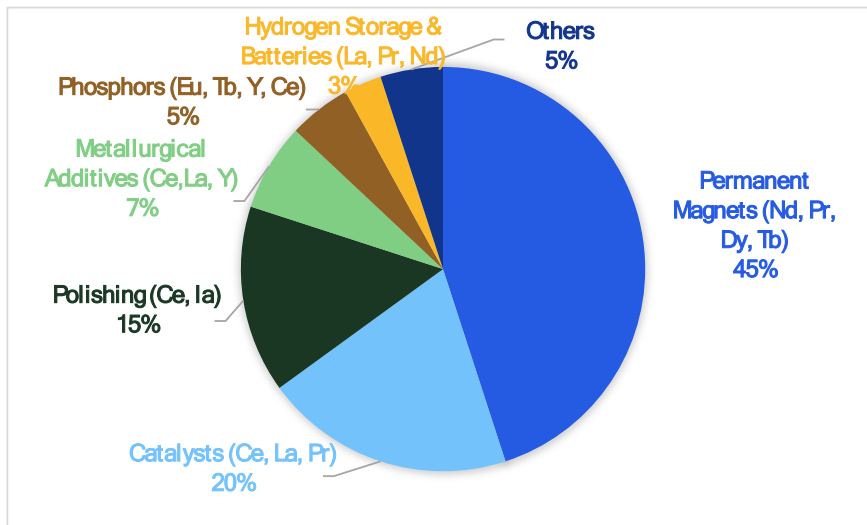
Source: Citi Research

IV. Demand Dynamic and Pricing Drivers

Demand breakdown by end use

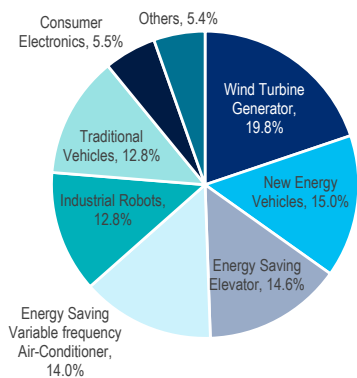
The demand for rare earth elements has grown exponentially in recent years, driven by their critical role in key technological advancements, particularly in clean energy, electronics, and defense sectors. As the global economy transitions towards more sustainable and high-tech industries, the demand for REEs is expected to continue to rise, especially for magnetic materials (mainly NdFeB magnets), which account for ~45% of global REO consumption and are expected to remain the key growth driver over the next decade.

Figure 42. Breakdown of Global Rare Earth Demand by Sector



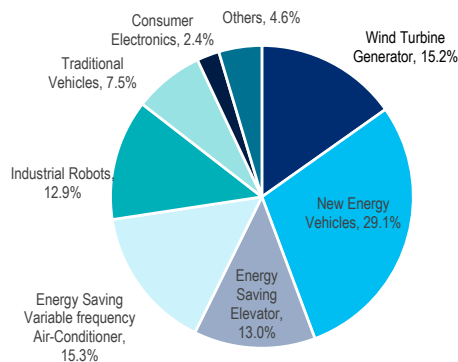
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Source: Citi Research, Natural Resources Canada, Stratview Research

Figure 43. Consumption of High-performance NdFeB PMs by Applications (Global) in 2020



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Source: Citi Research, Frost & Sullivan Analysis

Figure 44. Consumption of High-performance NdFeB PMs by Applications (Global) in 2025E



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Source: Citi Research, Frost & Sullivan Analysis

New Energy Vehicles (NEVs)

Traction motors in BEVs/HEVs are the largest structural growth driver for NdFeB demand. Typical permanent-magnet designs consume 3–5kg of NdFeB per vehicle, with PrNd dominating the oxide pull and Dy/Tb added selectively for high-temperature coercivity in platforms with hot rotors or heavy-duty cycles.

Citi forecasts global EV sales at 22.1/26.9/31.9m vehicles for 2025E/26E/27E, representing YoY growth of 31%/21%/19%, respectively. We expect the global EV penetration rates to continuously climb up, reaching 27%/32%/36% for 2025E/26E/27E. Regionally, Citi forecasts China NEV sales at 16.9/20.6/24.6m vehicles in 2025E/26E/27E, implying a 38%/22%/19% yoy growth, respectively.

We assume the amount of NdFeB PMs used in drive motors of NEVs is 3.0kg/motor, hence we expect the demand for NdFeB PMs required for permanent

magnet synchronous main motors worldwide should reach 94kt, while the China domestic demand should reach 74kt by 2027E.

Figure 45. NdFeB Magnet Demand for NEVs

NEV Demand	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
China NEV sales (thousand vehicles)	1,068	1,174	3,310	6,502	8,873	12,234	16,837	20,623	24,613
YoY		10%	182%	96%	36%	38%	38%	22%	19%
Global NEV sales (thousand vehicles)	2,009	2,987	6,305	10,204	13,454	16,890	22,135	26,852	31,885
YoY		49%	111%	62%	32%	26%	31%	21%	19%
Unit consumption of NdFeB MBs (kg/unit)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Chinese NEV Demand for NdFeB MBs (t)	3,204	3,521	9,930	19,505	26,620	36,702	50,511	61,869	73,839
Global NEV Demand for NdFeB MBs (t)	6,027	8,960	18,915	30,611	40,361	50,670	66,405	80,556	95,655

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Source: Citi Research estimates, ZE Consulting, ICCSINO, Real Lithium

Wind Turbine Generators

Direct-drive and hybrid PM turbines – especially offshore – are highly magnet-intensive, often ~700-800kg NdFeB MW offshore (lower onshore). Project phasing makes annual demand lumpy, but multi-year pipelines, grid-decarbonization mandates, and offshore scale-up anchor a secular rise.

Citi forecasts global wind turbine new installation at 44.6/47/59GW for 2025E/26E/27E, representing YoY growth of 25%/5%/26%, respectively. Regionally, Citi forecasts China wind turbine new installation at 90/95/98.6m vehicles in 2025E/26E/27E, implying a 13%/6%/4% YoY growth, respectively.

Assuming that the penetration rate elevated at 28-32% from 2025E-27E, and the unit consumption of NdFeB per GW is 750 tons, the demand for NdFeB in China's wind power is expected to increase from 15,472 tons in 2024 to 23,659 tons in 2027E at a CAGR of 24% from 2024-27E, while the global wind power demand for NdFeB is expected to rise from 22,403 tons in 2024 to 37,819 tons in 2027E at a 30% CAGR.

Figure 46. Demand for NdFeB from Wind Turbine Generator Sector

Wind Power Demand	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
China Wind Turbine New Installation (GW)	24.9	72.4	47.0	37.0	75.9	79.3	90.0	95.0	98.6
YoY		21%	191%	-35%	-21%	105%	5%	13%	6%
Overseas Wind Turbine New Installation (GW)	34.7	22.4	37.4	38.9	39.5	35.5	44.6	47.0	59.0
YoY		18%	-36%	67%	4%	2%	-10%	25%	5%
Global Wind Turbine New Installation (GW)	59.6	94.8	84.4	75.8	115.4	114.9	134.6	142.0	157.6
YoY		19%	59%	-11%	-9%	52%	0%	17%	5%
Unit consumption of NdFeB (t/GW)	750	750	750	750	750	750	750	750	750
Penetration rate assumption of direct-drive motor	35%	35%	35%	35%	24%	26%	28%	30%	32%
China Wind Turbine Demand for NdFeB (t)	6,531	19,000	12,324	9,702	13,662	15,472	18,900	21,375	23,659
Global Wind Turbine Demand for NdFeB (t)	15,648	24,879	22,152	19,904	20,775	22,403	28,266	31,950	37,819

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Source: Citi Research estimates, Wind

Energy-saving VFACs

Transition from fixed-speed induction to inverter compressors and high-efficiency fan motors underpins rising magnet pull per unit. A typical inverter split system uses roughly 0.08-0.2kg NdFeB across the compressor and two fans.

The consumption volume of high-performance NdFeB PMs in energy-saving VFACs in China increased from approximately 6,941 tons in 2019 to 17,061 tons in 2024, at a CAGR of 20%. Assuming a penetration rate of 73-80%, and the China

VFACs maintain a CAGR of 5% from 2025E-27E, China/global demand for NdFeB in the segment is expected to increase to 24,633/27,211 tons in 2027E.

Figure 47. Demand for NdFeB from Energy-saving VFAC Sector

VFAC Demand	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
China AC Production(mn unit)	219	211	218	222	251	266	279	293	308
YoY	1.0%	-3.7%	3.7%	1.9%	12.8%	6.0%	5%	5%	5%
China VFAC Production(mn unit)	69.4	83.4	107.8	163.0	155.1	170.6	203.9	222.9	246.3
YoY	10.0%	20.1%	29.3%	51.2%	-5%	10%	19%	9%	11%
China VFAC Penetration Ratio	31.7%	39.6%	49.4%	73.3%	70%	70%	73%	76%	80%
Global VFAC Production (mn unit)	82.0	87.8	112.7	180.4	171.3	188.5	225.2	246.2	272.1
Unit consumption of NdFeB (kg/unit)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
China Demand for NdFeB (t)	6,941	8,336	10,780	16,300	15,510	17,061	20,388	22,287	24,633
Global Demand for NdFeB (t)	8,200	8,775	11,272	18,035	17,133	18,847	22,521	24,619	27,211

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Source: Citi Research estimates, IOC, Wind

Energy-saving elevators

Gearless permanent-magnet synchronous hoists dominate new installs in mid-/high-rise and are increasingly specified in modernizations, with ~4kg NdFeB per system. New construction cycles matter, but a large global installed base and safety/efficiency retrofits smooth the profile. According to Frost & Sullivan, China energy-saving elevator productions are estimated to reach 1.8/2.0/2.2mn units whilst global productions to hit 2.5/2.8/3.1mn units from 2025E/26E/27E. China/Global demand for NdFeB in the segment is expected to be 8,796/12,436 tons in 2027E.

Figure 48. Demand for NdFeB from Energy-saving Elevator Sector

Energy-saving Elevator Demand	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
China energy-saving elevators production(thousand units)	985	1,090	1,321	1,265	1,409	1,601	1,804	2,000	2,199
YoY		10.6%	21.2%	-4.2%	11.4%	13.6%	12.7%	10.9%	9.9%
Global energy-saving elevators production(thousand units)	1,369	1,579	1,871	1,823	1,992	2,195	2,487	2,802	3,109
YoY	1.0%	15.4%	18.5%	-2.6%	9.3%	10.2%	13.3%	12.7%	11.0%
Unit consumption of NdFeB(kg/unit)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
China Demand for NdFeB(t)	3,941	4,359	5,284	5,060	5,636	6,404	7,216	8,000	8,796
Global Demand for NdFeB (t)	5,474	6,317	7,484	7,292	7,968	8,780	9,948	11,208	12,436

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Source: Citi Research estimates, Frost & Sullivan

Consumer electronics & appliances

Phones, wearables, speakers, laptops, and assorted small appliances constitute a broad, high-volume but mature demand pool. We assume a 3%/5% CAGR growth for China/global smartphone sales and 3g unit consumption of NdFeB MB, China/Global demand for NdFeB in the segment is forecast to be 938/4,248 tons in 2027E.

Figure 49. Demand for NdFeB from 3C Sector

3C Demand	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
China Smartphone Sales(mn units)	370	326	329	286	271	286	295	303	313
YoY	-10.8%	-11.9%	0.9%	-13.1%	-5.2%	5.5%	3.0%	3.0%	3.0%
Global Smartphone Sales(mn units)	1,370	1,250	1,350	1,210	1,142	1,223	1,284	1,348	1,416
YoY	-10.8%	-8.8%	8.0%	-10.4%	-5.6%	7.1%	5.0%	5.0%	5.0%
Unit consumption of NdFeB (g/unit)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
China Demand for NdFeB (t)	1,110	978	987	858	813	858	884	910	938
Global Demand for NdFeB (t)	4,110	3,750	4,050	3,630	3,426	3,669	3,853	4,045	4,248

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Source: Citi Research estimates, Canlys

Industrial automation & robots

Factory automation uses NdFeB across servo drives on robot joints/axes, precision spindles, and conveyors. As automation spreads, shipments compound from a relatively small base. We assume 3.5kg NdFeB MB per set for the industrial robots. Humanoid robotics development is still at an early stage, but volumes could step up and contribute a visible boost by 2030E. We assume a typical humanoid uses 4kg of NdFeB in total (a few larger joints plus many small motors).

Figure 50. Demand for NdFeB PMs from Industrial Robot and Humanoid Robot Sector

Industrial Robot Demand	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
China Industrial Robot (thousand units)	187	237	366	443	430	556	723	940	1222
YoY	26.6%	26.9%	54.4%	21.0%	-2.9%	29.3%	30%	30%	30%
Global Industrial Robot (thousand units)	365	417	529	591	641	710	923	1200	1560
YoY	15.8%	14.2%	26.9%	11.7%	8.5%	10.8%	30%	30%	30%
Unit consumption of NdFeB (kg/set)	3.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5	3.5
China Demand for NdFeB (t)	561	711	1,098	1,329	1,505	1,946	2,530	3,289	4,275
Global Demand for NdFeB (t)	1,095	1,251	1,587	1,773	2,244	2,485	3,231	4,200	5,460
Humanoid Robot Demand	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
China Humanoid Robot (units)	304	396	565	865	1,453	4,524	25,714	95,000	184,557
YoY	33.6%	30.3%	42.7%	53.1%	68.0%	211.4%	468%	269%	94%
Global Humanoid Robot (units)	1,297	1,816	2,761	4,362	7,647	22,619	107,142	380,000	683,544
YoY	-2.2%	40.0%	52.0%	10.0%	75%	196%	374%	255%	80%
Unit consumption of NdFeB (kg/set)	3.5	3.5	3.5	4.0	4.0	4.0	4.0	4.0	4.0
China Demand for NdFeB (t)	1.1	1.4	2.0	3.5	5.8	18.1	102.9	380	738
Global Demand for NdFeB (t)	4.5	6.4	9.7	17.4	30.6	90	429	1,520	2,734

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Source: Citi Research estimates, Wind, Frost & Sullivan

Industrial applications and other uses

Polishing, catalysts, phosphors, alloys provide baseline demand but slower growth vs. magnets. These segments have limited bearing on NdPr price cycles yet stabilize overall REO consumption. Cerium and lanthanum are widely used in catalytic converters in the petroleum industry. These are essential for reducing harmful emissions from vehicles and refineries, a key technology in meeting global emissions standards. Lanthanum is also a key component in hydrogen storage technology, which is expected to play a significant role in the future of clean energy and hydrogen fuel cells. As the hydrogen economy grows, driven by the shift towards clean energy, demand for rare earth elements in hydrogen storage and fuel cell technology is projected to rise.

Defense and aerospace

Rare earth elements are indispensable in defense technologies, including laser-guided systems, radar, and missiles, as well as in advanced communications and optical devices. Key elements such as dysprosium, terbium, and yttrium are used in high-temperature-resistant materials and permanent magnets in military applications. The aerospace sector also relies on rare earths for lightweight high-performance alloys in jet engines and aircraft electronics, further adding to the overall demand for neodymium, samarium, and dysprosium. Absolute magnet tonnage is small but strategically important, price-inelastic, and qualification-bound.

Figure 51. Supply and Demand Forecasts for High-performance NdFeB Magnets

	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E	2019-2024 CAGR	24-27E CAGR
NEV Demand											
China NEV sales (thousand vehicles)	1,068	1,174	3,310	6,502	8,873	12,234	16,837	20,623	24,613	63%	42%
YoY		10%	162%	96%	36%	38%	38%	22%	19%		
Global NEV sales (thousand vehicles)	2,009	2,987	6,305	10,204	13,454	16,890	22,135	26,852	31,885	53%	37%
YoY		49%	111%	62%	32%	26%	31%	21%	19%		
Unit consumption of NdFeB MBs (kg/unit)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
Chinese NEV Demand for NdFeB MBs (t)	3,204	3,521	9,930	19,505	26,620	36,702	50,511	61,869	73,839	63%	42%
Global NEV Demand for NdFeB MBs (t)	6,027	8,960	18,915	30,611	40,361	50,670	66,405	80,556	95,655	53%	37%
Wind Power Demand											
China Wind Turbine New Installation (GW)	24.9	72.4	47.0	37.0	75.9	79.3	90.0	95.0	98.6	26%	11%
YoY		21%	191%	-35%	-21%	105%	5%	13%	6%	4%	
Overseas Wind Turbine New Installation (GW)	34.7	22.4	37.4	38.9	39.5	35.5	44.6	47.0	59.0	0%	29%
YoY		18%	-36%	67%	4%	2%	-10%	25%	5%	26%	
Global Wind Turbine New Installation (GW)	59.6	94.8	84.4	75.8	115.4	114.9	134.6	142.0	157.6	14%	17%
YoY		19%	59%	-11%	-9%	52%	0%	17%	5%	11%	
Unit consumption of NdFeB (t/GW)	750	750	750	750	750	750	750	750	750		
Penetration rate assumption of direct-drive motor	35%	35%	35%	35%	24%	26%	28%	30%	32%		
China Wind Turbine Demand for NdFeB (t)	6,531	19,000	12,324	9,702	13,662	15,472	18,900	21,375	23,659	19%	24%
Global Wind Turbine Demand for NdFeB (t)	15,648	24,879	22,152	19,904	20,775	22,403	28,266	31,950	37,819	7%	30%
VFAC Demand											
China AC Production (mn unit)	219	211	218	222	251	266	279	293	308	4%	8%
YoY		1.0%	-3.7%	3.7%	1.9%	12.8%	6.0%	5%	5%		
China VFAC Production (mn unit)	69.4	83.4	107.8	163.0	155.1	170.6	203.9	222.9	246.3	20%	20%
YoY		10.0%	20.1%	29.3%	51.2%	-5%	10%	19%	9%	11%	
China VFAC Penetration Ratio	31.7%	39.6%	49.4%	73.3%	70%	70%	73%	76%	80%		
Global VFAC Production (mn unit)	82.0	87.8	112.7	180.4	171.3	188.5	225.2	246.2	272.1	18%	20%
Unit consumption of NdFeB (kg/unit)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
China Demand for NdFeB (t)	6,941	8,336	10,780	16,300	15,510	17,061	20,388	22,287	24,633	20%	20%
Global Demand for NdFeB (t)	8,200	8,775	11,272	18,035	17,133	18,847	22,521	24,619	27,211	18%	20%
Energy-saving Elevator Demand											
China energy-saving elevators production (thousand units)	985	1,090	1,321	1,265	1,409	1,601	1,804	2,000	2,199	10%	17%
YoY		10.6%	21.2%	-4.2%	11.4%	13.6%	12.7%	10.9%	9.9%		
Global energy-saving elevators production (thousand units)	1,369	1,579	1,871	1,823	1,992	2,195	2,487	2,802	3,109	10%	19%
YoY		1.0%	15.4%	18.5%	-2.6%	9.3%	10.2%	13.3%	12.7%		
Unit consumption of NdFeB (kg/unit)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		
China Demand for NdFeB (t)	3,941	4,359	5,284	5,060	5,636	6,404	7,216	8,000	8,796	10%	17%
Global Demand for NdFeB (t)	5,474	6,317	7,484	7,292	7,968	8,780	9,948	11,208	12,436	10%	19%
3C Demand											
China Smartphone Sales (mn units)	370	326	329	286	271	286	295	303	313	-5%	5%
YoY		-10.8%	-11.9%	0.9%	-13.1%	-5.2%	5.5%	3.0%	3.0%		
Global Smartphone Sales (mn units)	1,370	1,250	1,350	1,210	1,142	1,223	1,284	1,348	1,416	-2%	8%
YoY		-10.8%	-8.8%	8.0%	-10.4%	-5.6%	7.1%	5.0%	5.0%		
Unit consumption of NdFeB (g/unit)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
China Demand for NdFeB (t)	1,110	978	987	858	813	858	884	910	938	-5%	5%
Global Demand for NdFeB (t)	4,110	3,750	4,050	3,630	3,426	3,669	3,853	4,045	4,248	-2%	8%
Industrial Robot Demand											
China Industrial Robot (thousand units)	187	237	366	443	430	556	723	940	1,222	24%	48%
YoY		26.6%	26.9%	54.4%	21.0%	-2.9%	29.3%	30%	30%		
Global Industrial Robot (thousand units)	365	417	529	591	641	710	923	1,200	1,560	14%	48%
YoY		15.8%	14.2%	26.9%	11.7%	8.5%	10.8%	30%	30%		
Unit consumption of NdFeB (kg/set)	3.0	3.0	3.0	3.0	3.5	3.5	3.5	3.5	3.5		
China Demand for NdFeB (t)	561	711	1,098	1,329	1,505	1,946	2,530	3,289	4,275	28%	48%
Global Demand for NdFeB (t)	1,095	1,251	1,587	1,773	2,244	2,485	3,231	4,200	5,460	18%	48%
Humanoid Robot Demand											
China Humanoid Robot (units)	304	396	565	865	1,453	4,524	25,714	95,000	184,557	72%	539%
YoY		33.6%	30.3%	42.7%	53.1%	68.0%	211.4%	468%	269%		
Global Humanoid Robot (units)	1,297	1,816	2,761	4,362	7,647	22,619	107,142	380,000	683,544	77%	450%
YoY		-2.2%	40.0%	52.0%	10.0%	75%	196%	374%	255%		
Unit consumption of NdFeB (kg/set)	3.5	3.5	3.5	4.0	4.0	4.0	4.0	4.0	4.0		
China Demand for NdFeB (t)	1.1	1.4	2.0	3.5	5.8	18.1	102.9	380	738	76%	539%
Global Demand for NdFeB (t)	4.5	6.4	9.7	17.4	30.6	90	429	1,520	2,734	82%	450%
Total China Demand for NdFeB (t)	22,289	36,907	40,406	52,758	63,752	78,461	100,531	118,110	136,878	29%	32%
Total Global Demand for NdFeB (t)	40,558	53,939	65,469	81,263	91,937	106,945	134,652	158,098	185,562	21%	32%
Company Production											
JL MAG	6,632	9,613	10,325	12,786	15,154	21,579	27,274	32,729	39,275	27%	35%
Producer A	3,871	4,670	8,400	10,881	17,512	20,781	24,937	29,925	35,910	40%	31%
Producer B	8,775	8,775	11,050	10,725	11,434	10,637	18,900	21,735	24,995	4%	53%
Producer C	3,981	4,556	8,148	10,138	10,362	11,916	13,704	15,759	18,123	25%	23%
Producer D	-	-	3,373	4,441	4,513	5,836	7,000	8,050	9,258	20%	26%
Producer E	4,363	5,340	5,636	5,229	5,500	7,000	8,000	9,200	10,580	10%	23%
Producer F	1,252	1,522	2,600	2,742	2,475	3,500	4,000	4,600	5,290	23%	23%
Tier 1 players in China	28,874	34,475	49,532	56,941	66,950	81,249	103,815	121,998	143,430	23%	33%
Tier 2 players in China	8,000	10,000	13,000	15,000	17,000	20,000	24,000	27,600	31,740	20%	26%
China total	36,874	44,475	62,532	71,941	83,950	101,249	127,815	149,598	175,170	22%	32%
Overseas players	8,000	10,000	13,000	15,000	17,000	20,000	23,000	26,450	30,418	20%	23%
Global total	44,874	54,475	75,532	86,941	100,950	121,249	150,815	176,048	205,588	22%	30%
Global Supply: Demand Ratio	111%	101%	115%	107%	110%	113%	112%	111%	111%		

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Source: Citi Research estimates, Wind, IOL, CEA, Frost & Sullivan

We estimate total REO demand from NdFeB magnet output using a bottom-up conversion framework. High-performance magnets are assumed to represent 70% of total permanent magnet production, with an average blank-to-finished yield of 65%. Each ton of NdFeB blank contains roughly 28% metallic praseodymium and neodymium (Pr+Nd). This metal content is converted to PrNd Oxide using a 1.166 metal-to-oxide factor, reflecting molecular weight differences, and adjusted for a 5% processing loss. Assuming PrNd Oxide accounts for 25% of total REO usage, we scale accordingly to derive aggregate REO demand. This method links downstream finished magnet volumes directly to upstream oxide requirements, while preserving flexibility for sensitivity testing on each parameter.

This demand analysis excludes rare earth demand from catalysts, polishing powders, and other minor uses. These segments mainly use cerium and lanthanum, which face fewer supply constraints and are more affected by substitution, recycling, and efficiency improvements. Their demand is relatively stable and less tied to the high-growth magnet market driving the major growth; hence we concentrate solely on rare earth usage related to high-performance magnets in strategic sectors like EV motors, wind turbines, robotics, and electronics.

Figure 52. Demand Forecast for Global Rare Earth Oxide

Global Demand (ton)	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
Total Global Demand for NdFeB MBs (40,558	53,939	65,469	81,263	91,937	106,945	134,652	158,098	185,562
High-performance NdFeB MB Blank	62,397	82,983	100,722	125,021	141,442	164,531	207,157	243,228	285,480
NdFeB MB Blank	89,139	118,548	143,889	178,601	202,060	235,044	295,939	347,468	407,829
PrNd	25,850	34,379	41,728	51,794	58,597	68,163	85,822	100,766	118,270
PrNd Oxide	31,728	42,196	51,215	63,571	71,920	83,661	105,335	123,677	145,161
REO	126,911	168,782	204,861	254,283	287,682	334,643	421,342	494,707	580,645
YoY		33%	21%	24%	13%	16%	26%	17%	17%

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Source: Citi Research estimates, SMM

The global rare earth market exhibits a mix of structural tightness and cyclical volatility. On the supply side, China maintains strict control over mining and separation volumes through production quotas. Light rare earths are relatively abundant, sourced mainly from Bayan Obo in Inner Mongolia, while medium-to-heavy rare earths are scarce, concentrated in southern ion-adsorption deposits, and constrained by quotas and environmental regulations, resulting in a structurally tight market. Overseas producers such as MP Materials and Lynas are ramping up output, but their global share remains limited and insufficient to challenge China's dominance. On the demand side, high-performance NdFeB permanent magnets are seeing rapid penetration in EVs, wind power, and energy-efficient motors, driving sustained growth in demand for praseodymium, neodymium, and dysprosium oxides. Traditional uses in polishing, catalysts, and hydrogen storage remain stable. Moreover, emerging applications such as humanoid robots, advanced manufacturing equipment, and aerospace offer significant long-term growth potential for high-performance NdFeB magnets. Overall, light rare earths are broadly balanced but subject to macro-driven price swings, while medium-to-heavy rare earths remain structurally tight, underpinning price resilience and upside potential.

Pricing logic: core pricing drivers

China's REE pricing is guided by published reference prices (e.g. Northern Rare Earth's listing) and market-based trades on platforms like the Rare Earth Exchange. The internal pricing between Baogang and Northern Rare Earth uses a quarterly cost-plus formula tied to ore grade and separation cost. Overseas, long-term contracts often benchmark against public Chinese pricing with discounts or premiums depending on volume and security of supply.

- **Production quotas:** China's quota regime is the single largest lever of global REE supply. First-half and second-half Chinese production quotas drive near-term price expectations in the past years. However, the government has stopped publicly announcing quota volumes – the first 2025 mining and smelting quotas were issued quietly without the usual public notice.
- **Export controls:** Licensing changes (2023-25) sharply influence HREE (Dy/Tb) pricing.
- **Geopolitical events:** Myanmar political risk & US/China and EU/China tensions drive premiums.
- **Demand acceleration:** EV market growth and offshore wind demand lift NdPr-based magnet pricing.
- **Supply delays:** New western mining projects face long timeline (5-10 years), limiting price moderation.

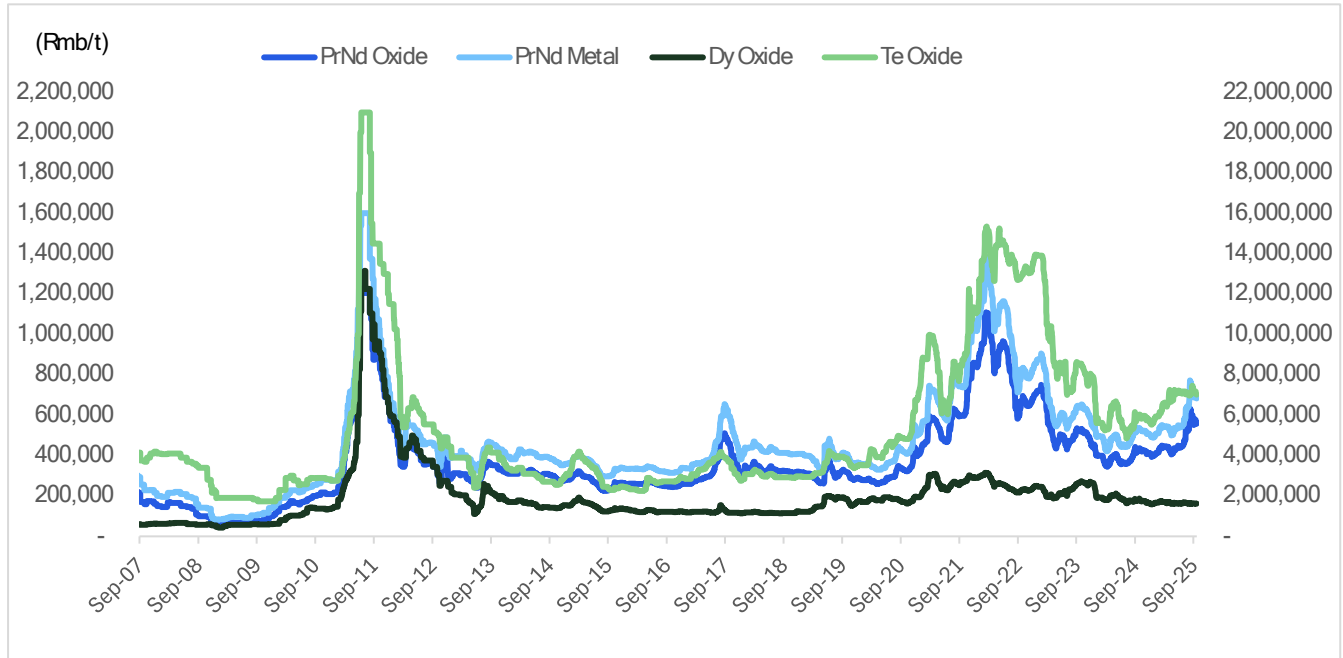
Conclusion: Rare earth prices are strategically influenced, not purely cyclical – heavily exposed to government policy, geopolitical shifts, and emerging green economy demand.

Current pricing outlook

- **Demand recovery gaining steam:** Prices for magnet rare earths are rebounding from 2024 lows. NdPr oxide has risen over 40% from 2024 low point and continued the steady rising momentum at the price range of Rmb600/kg. Global demand is supported by a 38% YoY rise in NEV sales and 25% YoY growth of global wind capacity additions this year.
- **Major rare earth prices movement:** PrNd oxide jumped ~40% from early July to late August peak of Rmb633k/t (~\$88/kg) and then eased to ~Rmb600k/t (~\$84/kg) in early September, leaving higher lows intact. Dy oxide remains resilient around Rmb1.65m/t (\$230/kg). A higher floor is supported by China's tighter quota regime that now covers imported feedstock in smelting/separation, Myanmar feedstock volatility, and new pricing backstops like the US DoD's NdPr price floor of \$110/kg.
- **Supply-side tightness risks:** China has tightened rare earth mining output quota control, and supply from Myanmar remains uncertain, especially for heavy rare earths. These risks could reintroduce upward price pressure later in 2025.
- **Ex-China premiums emerging:** The ex-China rare earth market is witnessing a shift in which buyers are increasingly willing to pay a premium for materials sources from outside China. For instance, Iluka's focus on supplying the ex-China market positions the Eneabba refinery to capitalize on this growing demand for provenance-assured rare earths, aligning with global trends favoring diversification and sustainability in critical mineral sourcing.

- **Policy supports creating price floors:** US strategic programs, including a USD 110/kg NdPr floor price, and new heavy rare earth capacity in Australia are reinforcing non-China market stability and potentially cushioning against further downside.

Figure 53. REO Prices



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Source: Citi Research, SMM

Company Deep Dives

Northern Rare Earth Group High-Tech (600111.SS)

Light Rare Earth Champion with Upstream Stability, Downstream Optionality

Business snapshot

China Northern Rare Earth Group High-Tech Co., under Baotou Iron & Steel Group (Baogang Group), is the world's largest rare-earth supplier by output. It operates the Bayan Obo Mine and controls over 60% of China's light rare earth quota. Known as the "first rare earth stock" in China, it was listed on the Shanghai Stock Exchange in 1997. The company also leads in separation, magnet materials, and research capabilities, supported by the Baotou Research Institute.

Initiate coverage at Buy: premium warranted

The company is China's largest light rare earth producer with a vertically aligned value chain from processing to downstream products, benefiting from captive access to Bayan Obo resources. Its scale, technological capabilities, and diversified product mix underpin relatively stable margins and relatively low earnings cyclicality. As a one of the two key players in China's resource security strategy, NRE benefits from quota allocation, regulatory support, and grants pilot pricing authority.

We value China Northern Rare Earth shares at Rmb72 using 9.5x 2026E P/B multiple set at +2sd above historical average since 2013. See "Valuation analysis" section below for more details.

Resources and characteristics

Northern Rare Earth primarily sources its feedstock from the Bayan Obo mine in Inner Mongolia, the world's largest rare-earth deposit with an estimated 40mt of proven reserves. The deposit is uniquely rich in light rare earths (notably lanthanum, cerium, praseodymium, and neodymium), accounting for over 80% of China's total light rare earth separation capacity. Mining rights are held by Baotou Steel, which supplies rare earth concentrate exclusively to Northern Rare Earth through a cost-linked transfer pricing mechanism. This vertical integration from concentrate to separation gives Northern Rare Earth a dominant position in the light rare earth market, with strong pricing influence both domestically and internationally.

Figure 54. Bayan Obo Mine in Inner Mongolia



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Source: Citi Research, China News Service

Products

China Northern Rare Earth Group High-Tech Co sources its ore feedstock primarily from Baogang's Bayan Obo mine in Inner Mongolia – the world's largest rare-earth deposit – while it does not directly own mining rights. The company operates an integrated value chain that covers rare-earth separation, high-purity oxide production, rare-earth metals refining, and the manufacturing of NdFeB.

Products range from mixed rare earth carbonate and oxides to high-purity single oxides, metals, and downstream magnetic materials. Applications span permanent magnets, catalysts, phosphors, polishing materials, and advanced electronics, with NdFeB magnets as a strategic growth area.

Figure 55. Northern Rare Earth – Main Products and Application Fields

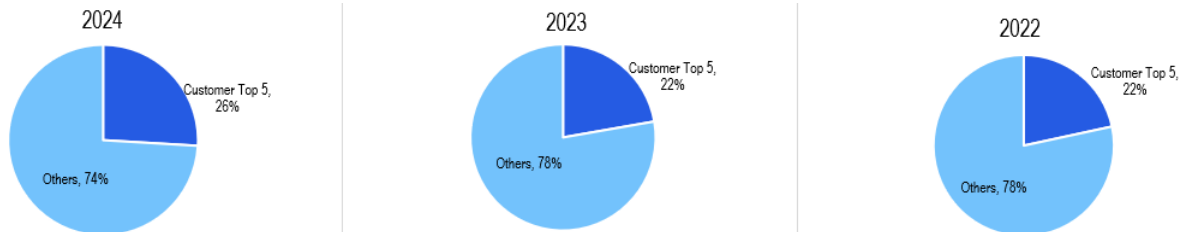
Category & Name		Application fields
Raw Materials	Lanthanum Oxide	Manufacturing special alloys, precision optical glass, high-radiation optical fiber panels, ceramic capacitors
	Cerium Oxide	Manufacturing special alloys, refining catalysts, rare-earth colorants, rare-earth polishing powders, etc
	Lanthanum Cerium Carbonate	Rare-earth polishing materials, agricultural fertilizers, water treatment, etc
	Praseodymium Neodymium Oxide	Rare-earth soil improvers, electronics industry etc
	Pr-Nd Metal	Magnetic materials
	Neodymium Metal	Magnetic materials
	Lanthanum Cerium Metal	Hydrogen storage materials, flints for lighters, etc
	Lanthanum Metal	Hydrogen storage materials, battery electrodes, rare-earth alloys, etc
	Cerium Metal	Hydrogen storage materials, magnetic materials, fuel cell, rare-earth alloys, etc
Materials	Permanent Magnet Materials	Drive motors, servo motor, small & special electrical motor, NEVs, frequency converters, wind power generators, energy-saving elevators, humanoid robots, etc
	Hydrogen Storage Materials	Nickel-metal hydride batteries, hydrogen energy storage, etc
	Polishing Materials	Liquid crystal/panel polishing glass, mobile phone covers, crystal crafts, traditional and precision optical components, polishing in the fields of semiconductor photomasks and integrated circuits, etc
	Catalytic Materials	Automobile emission purification, industrial waste gas purification
	Rare Earth Alloy	Steel, construction, automobile manufacture, etc
Application Products	Permanent Magnet Motor	Wine power, NEVs, industrial motors, E-communication, high-end medical care

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Source: Citi Research, Company Reports

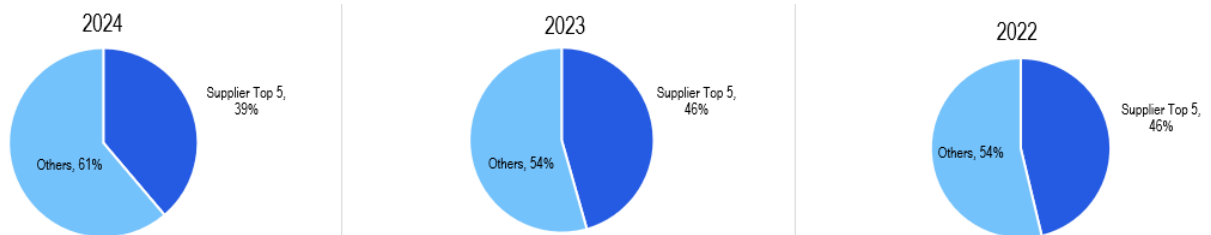
Key customers and suppliers

Figure 56. Northern Rare Earth – Concentration of Top-5 Customers (2022–2024)



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Source: Citi Research, Company Reports

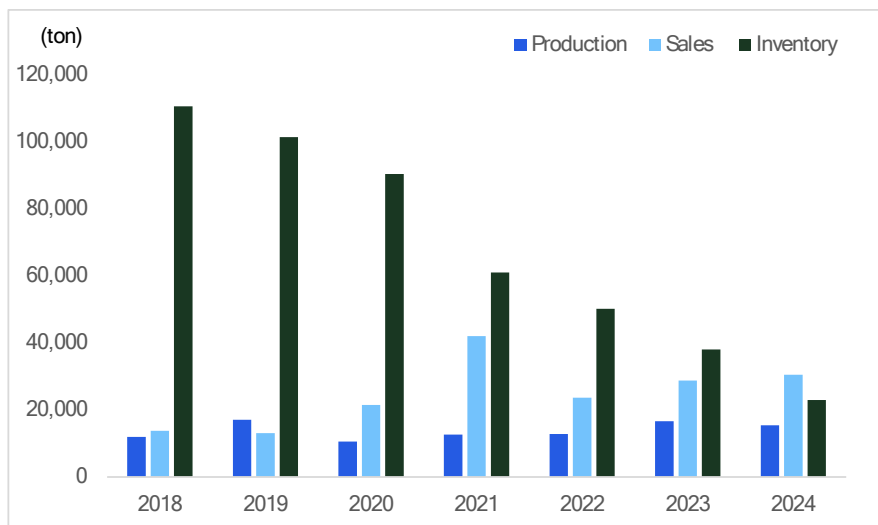
Figure 57. Northern Rare Earth – Concentration of Top-5 Suppliers (2022–2024)



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Source: Citi Research, Company Reports

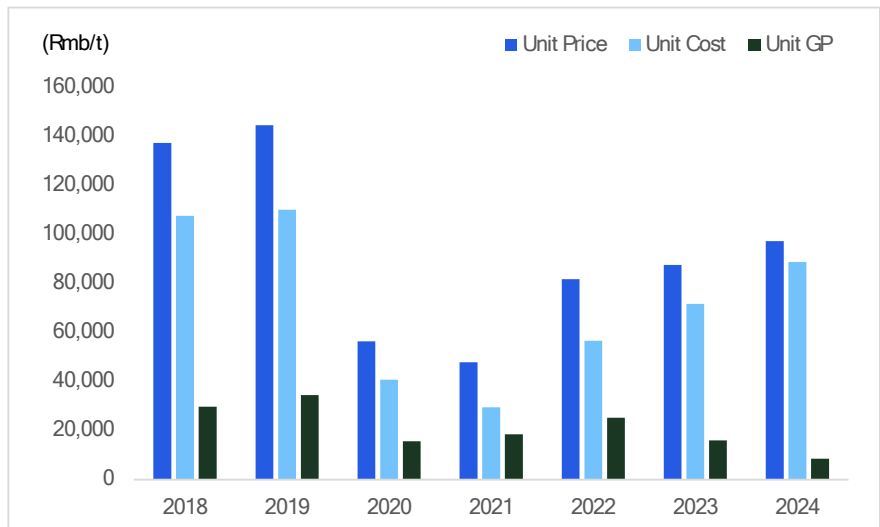
Volume, price, and key operating assumptions

Figure 58. Northern Rare Earth – RE Oxide Production/Sales/Inventory



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Source: Citi Research, Company Reports

Figure 59. Northern Rare Earth – RE Oxide Unit Price/Cost/GP



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Source: Citi Research, Company Reports

NRE–Baogang rare earth concentrate pricing mechanism

NRE sources all its rare earth concentrates from Baogang Steel, its related-party supplier under Baogang Group. The two parties adopt a structured, formula-based pricing mechanism that pegs concentrate prices to the prevailing market prices of REO. The mechanism is reviewed and adjusted quarterly to reflect market dynamics while maintaining fair profit allocation between the mining (Baogang) and the processing (NRE) segments.

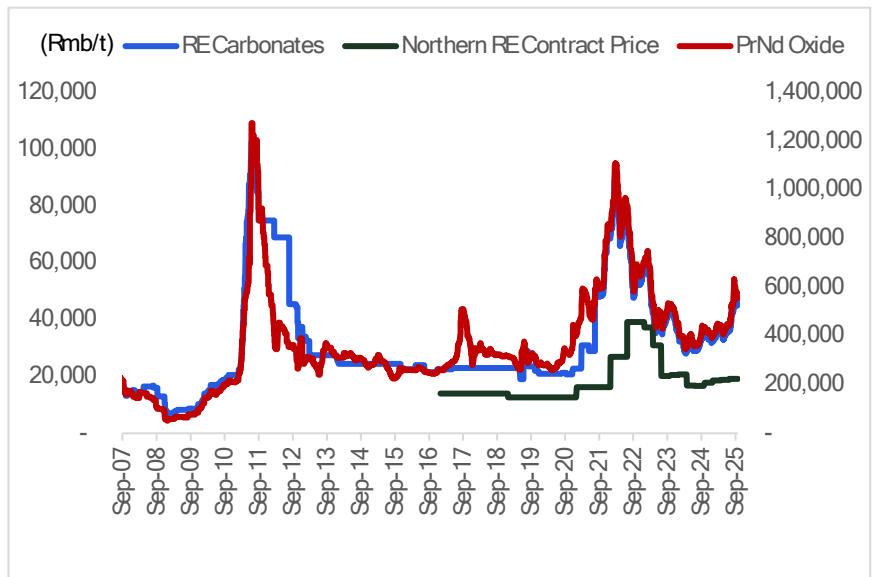
- **Formula 1:** Concentrate Price= (REO price- processing cost- processing margin)/ REO consumption ratio;
- **Formula 2:** Concentrate Price= (REO price- processing cost)/ REO consumption ratio, where REO cost= REO price * cost ratio

Thus, Concentrate Price=50% *Formula 1 result +50% *Formula 2 result

The formula combines two valuation approaches with equal weight. Under the full-value distribution method, the concentrate price equals the oxide price minus processing costs and margins, divided by the conversion ratio—ensuring Baogang shares in the total value of the supply chain. The profit-protection method instead deducts costs from the oxide's cost (defined as price * cost ratio), guaranteeing NRE a minimum gross margin at the oxide level. The final concentrate price is the average of these two methods, using quarterly average REO prices from five benchmark data sources (Baichuan, Ruidao, Asian Metals, Mysteel, Argus).

This dual-formula system creates a balanced value-sharing mechanism: Baogang benefits more in price upcycles as concentrate prices rise almost in line with oxide prices, while NRE's margins are partially shielded during downturns. The structure enhances transparency and stability in related transactions, aligning both parties' interests, but leaving NRE with less profit leverage to rare earth price surges compared with its upstream partner.

Figure 60. Northern Rare Earth – Contract Price vs. Market Price



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Source: Citi Research, Company Reports, SMM

Valuation analysis: P/B approach

We value China Northern Rare Earth shares at Rmb72 using a P/B-based methodology given the sector’s cyclical earnings pattern and policy-regulated nature. We apply a 9.5x target 2026E P/B, set at +2.0sd premium to the stock’s historical P/B average since 2013 to reflect the sector’s early-to-mid upcycle, supported by policy tailwinds, supply discipline, and the growing strategic importance of rare earths in electrification and supply-chain security. While we do not expect this cycle to match the intensity of the previous peak in 2021 – when valuations briefly reached over +4.5SD above the historical mean – we believe structural demand growth, tighter resource control, and stronger policy tailwinds justify a valuation toward the upper end of the historical range. The current multiple represents a mid-cycle premium rather than a peak-cycle assumption, balancing upside potential with demand and geopolitical uncertainties. Our valuation also reflects NRE’s rising ROE profile of 9.3%/13.5%/16.6% for 2025E/26E/27E, well above its historical downcycle averages. Given the rare earth stocks’ high sensitivity to trade barrier measures and rare earths policies in China, the US, and other key markets, we see scope for volatility even as fundamentals improve. Our target price is equivalent to 40.5x 2026E EV/EBITDA and 74.4x 2026E P/E. The shares currently trade at 54.9x 2026E P/E and 7x 2026E P/B.

Valuation history, charts, and correlations

The stock performances of Northern RE and China RE have been highly correlated with China rare earth prices, historically.

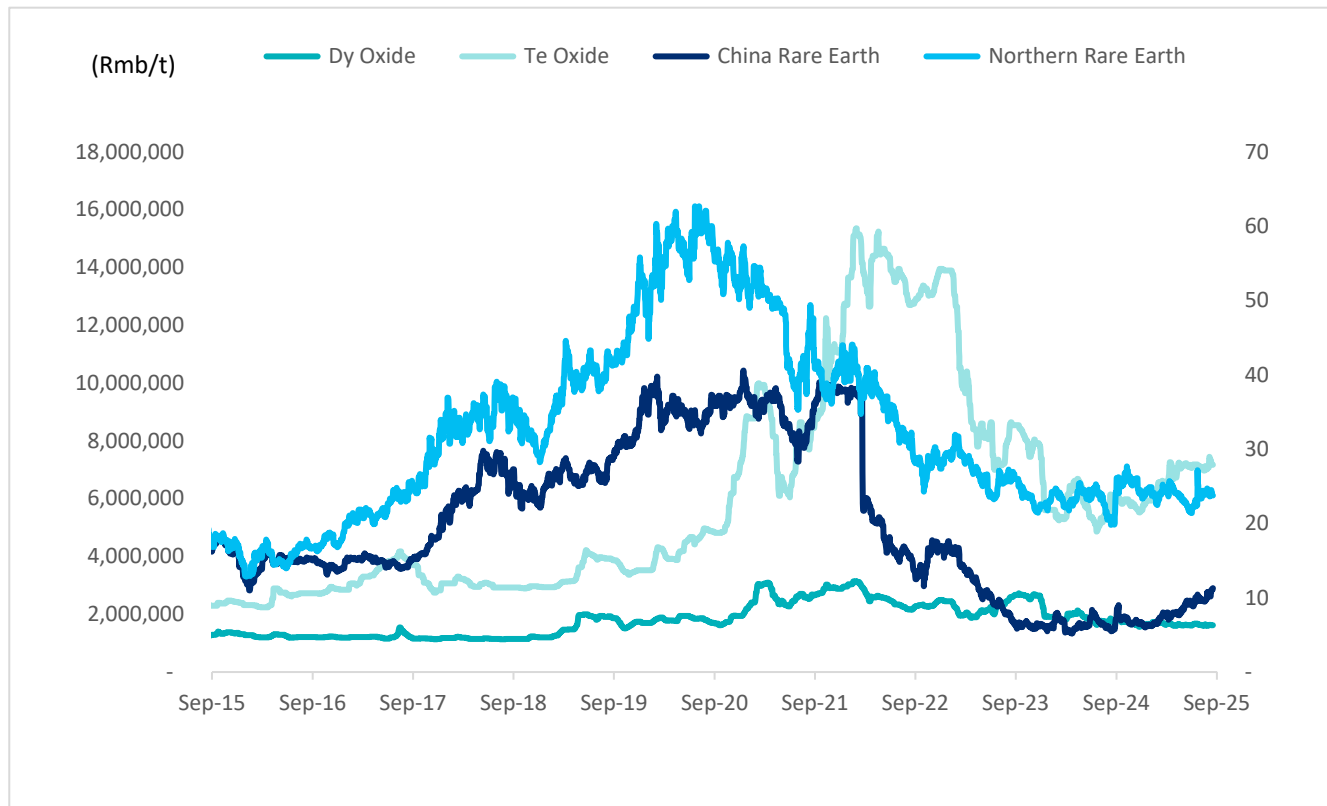
Figure 61. NRE & CRE Stock Performances vs. LRE Oxide Prices



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Source: Citi Research, SMM, Wind

Figure 62. NRE & CRE Stock Performances vs. HRE Oxide Prices



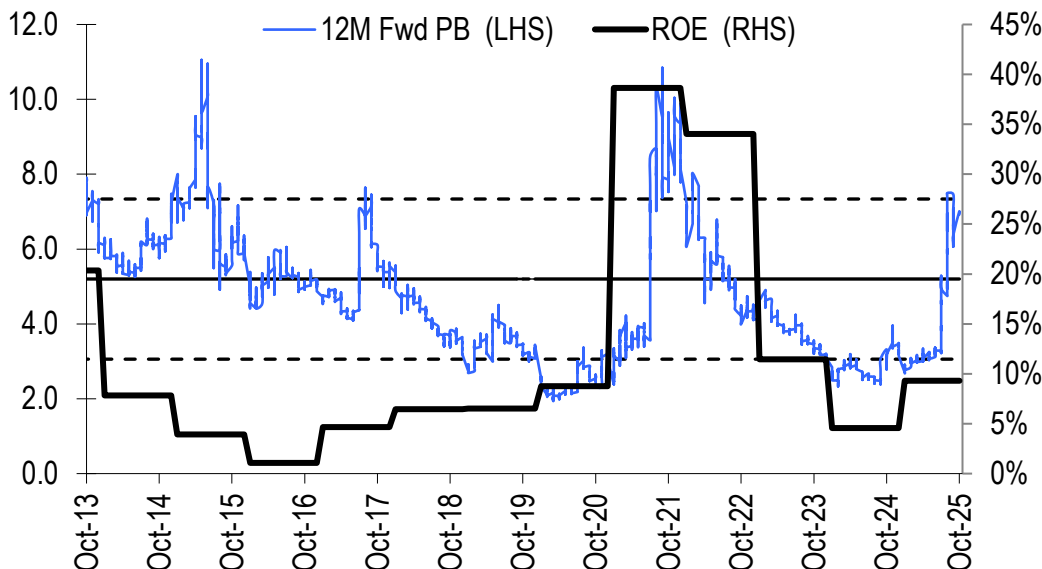
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Source: Citi Research, Wind, SMM

Figure 63. Northern Rare Earth – P/E Valuation Sensitivity to GP Margin and Sales Volume (share price as of 10 Oct 2025)

P/E		RE Oxide Sale Volume(mn sqm)						
		41,026	42,026	43,026	44,026	45,026	46,026	47,026
GP Margin(%)	10.0%	57.3	57.1	56.9	56.7	56.5	56.3	56.2
	11.0%	56.5	56.3	56.1	55.9	55.7	55.5	55.3
	12.0%	55.7	55.5	55.3	55.1	54.8	54.6	54.4
	13.0%	55.0	54.7	54.5	54.3	54.0	53.8	53.6
	14.0%	54.2	54.0	53.7	53.5	53.3	53.0	52.8
	15.0%	53.5	53.3	53.0	52.8	52.5	52.3	52.0
	16.0%	52.8	52.6	52.3	52.0	51.8	51.5	51.3

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Source: Citi Research estimates

Figure 64. Northern Rare Earth – 12M Forward P/B vs. ROE



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Source: Citi Research

Peer comparisons: valuations

Figure 65. Rare Earth Producers Valuation Comp (Share Price as of Oct 10, 2025)

Company Name	Reuters Code	Rating	Mkt Cap USDm	Share					PB (x)		PE (x)		EV/EBITDA (x)		ROE		Dividend Yield	
				Ccy	Price	YTD Chg	TP	Upside	25E	26E	25E	26E	25E	26E	25E	26E	25E	26E
Rare Earth Comparable Valuation Sheet																		
Northern Rare Earth	600111.SH	Buy	26,944	CNY	53.13	147%	72.00	36%	7.9	7.0	88.4	54.9	42.3	29.4	9%	14%	0%	0%
China Rare Earth	000831.SZ	Neutral	8,472	CNY	56.91	95%	61.60	8%	12.3	11.1	179.6	90.5	101.6	60.2	7%	13%	0%	0%
Rising Nonferrous Metals	600259.SH	NR	2,901	CNY	61.47	112%	na	na	5.5	5.0	79.7	48.7	43.6	36.7	9%	9%	44%	37%
Shenghe Resources	600392.SH	NR	6,200	CNY	25.22	133%	na	na	4.7	4.5	58.0	36.9	43.3	30.6	11%	11%	43%	31%
Inner Mongolia Baotou Steel Union	600010.SH	NR	16,388	CNY	2.58	37%	na	na	na	na	127.0	na	na	na	na	na	na	na
Lynas Rare Earth	LYC.AX	Sell	4,307	AUD	20.59	8%	9.50	-54%	8.2	5.8	2,421.4	79.9	82.0	36.6	0%	9%	nm	nm
MP Materials	MP.US	NR	12,802	USD	73.77	363%	na	na	7.2	6.4	na	83.6	na	42.6	8%	8%	na	43%
Average									7.6	6.6	492.4	65.7	62.6	39.3	8%	11%	22%	22%
Rare Earth Magnets																		
JL MAG-A	300748.SZ	Neutral	7,083	CNY	39.49	123%	32.60	-17%	7.5	7.3	75.3	53.2	47.4	34.3	10%	14%	1%	2%
JL MAG-H	6680.HK	Buy	7,083	HKD	26.08	225%	25.30	-3%	4.5	4.4	45.6	32.2	47.4	34.3	10%	14%	2%	3%
Zhenghai Magnetic	300224.CH Equity	NR	2,313	CNY	17.72	45%	na	na	3.7	3.5	48.3	37.5	31.1	25.3	10%	10%	31%	25%
Zhong Ke High-Tech	000970.CH Equity	NR	2,527	CNY	14.82	39%	na	na	2.6	2.5	83.5	60.9	34.9	27.0	4%	4%	35%	27%
Ningbo Yunsheng	600366.CH Equity	NR	2,371	CNY	15.38	108%	na	na	2.8	2.6	65.1	43.7	39.4	28.0	6%	6%	39%	28%
Innuovo Technology	000795.CH Equity	NR	1,770	CNY	11.13	13%	na	na	4.5	4.2	40.7	34.3	27.5	24.0	12%	12%	27%	24%
Earth-Panda	688077.CH Equity	NR	609	CNY	37.94	79%	na	na	na	na	na	na	na	na	na	na	na	na
Advanced Technology	000969.CH Equity	NR	2,199	CNY	14.92	47%	na	na	3.0	2.9	47.3	41.3	27.8	26.5	7%	7%	28%	26%
Hengdian Group DMEGC Magnetics	002056.CH Equity	NR	4,734	CNY	20.75	57%	na	na	2.9	2.5	16.8	14.8	10.2	8.8	17%	17%	10%	9%
Baotou Tianhe Magnetics Technology	603072.CH Equity	NR	1,841	CNY	49.66	-	na	na	na	na	na	na	na	na	na	na	na	na
Baotou INST Magnetics Technology	301622.CH Equity	NR	1,362	CNY	83.76	32%	na	na	na	na	na	na	na	na	na	na	na	na
Jiangsu Huahong Technology	002645.CH Equity	NR	1,452	CNY	16.49	130%	na	na	2.6	2.4	43.3	31.4	25.4	18.2	8%	8%	25%	18%
Shin-Etsu Chemical	4063.JP Equity	Buy	62,863	JPY	5,138.00	-5%	5,000.00	-3%	2.2	2.2	19.1	19.9	8.2	8.2	12%	11%	2%	2%
TDK Corporation	6762.JP Equity	Buy	28,285	JPY	2,281.50	7%	2,200.00	-4%	2.4	2.2	25.9	23.4	7.9	6.8	10%	10%	1%	1%
Average									3.6	3.5	48.5	36.9	29.9	23.4	10%	10%	20%	16%

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Source: Citi Research estimates, Bloomberg consensus; pricing as at 10-Oct-2025 22:00 HK time

Peer comparisons: financial metrics

Figure 66. Rare Earths Select Peers – Revenue Comparisons

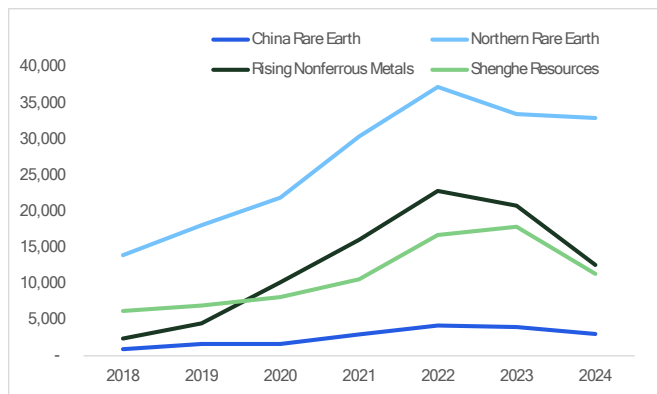


Figure 67. Rare Earths Select Peers – FCF Comparisons

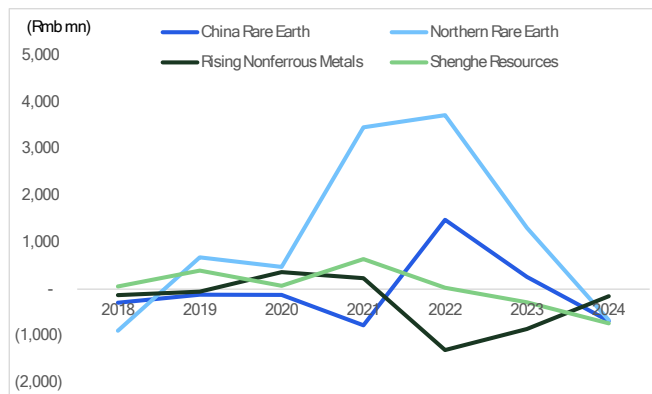


Figure 68. Gross Margin Comparison with Domestic Peers

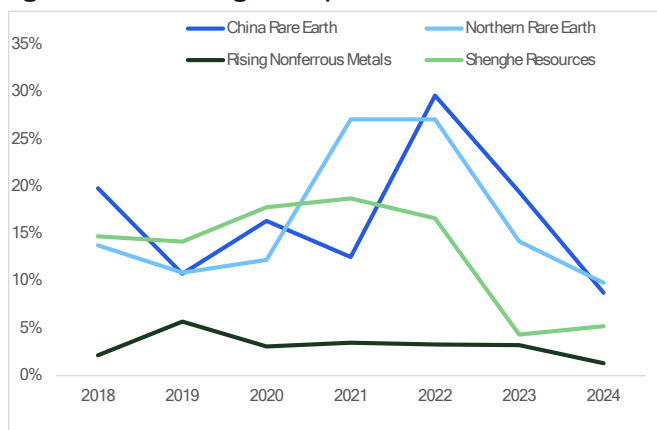
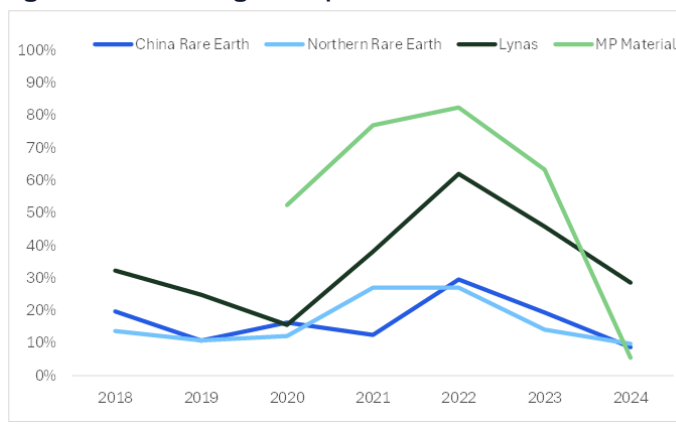


Figure 69. Gross Margin Comparison with Overseas Peers



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Source: Citi Research, Bloomberg

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Source: Citi Research, Bloomberg

Figure 70. Sales Volume Comparison (for RE Oxide)

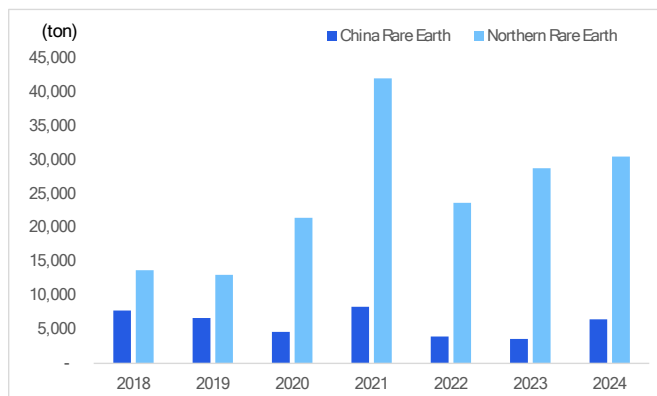
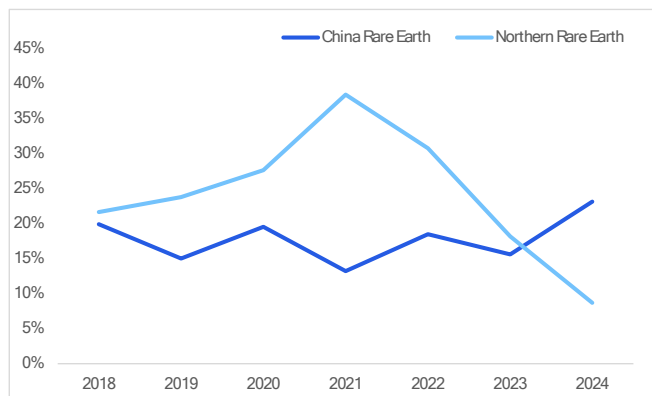


Figure 71. GP Margin Comparison (for RE Oxide)

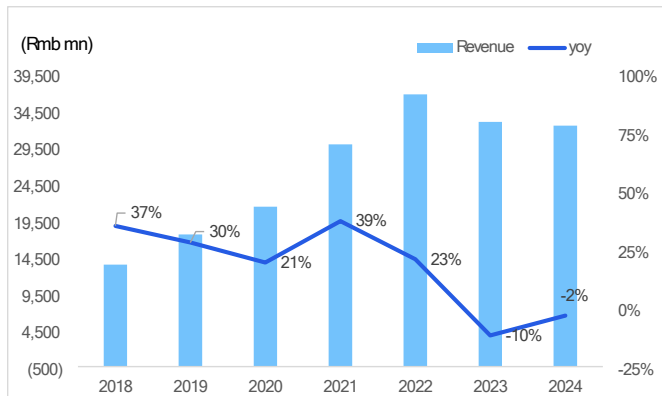


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Financial analysis: revenue and profit trends

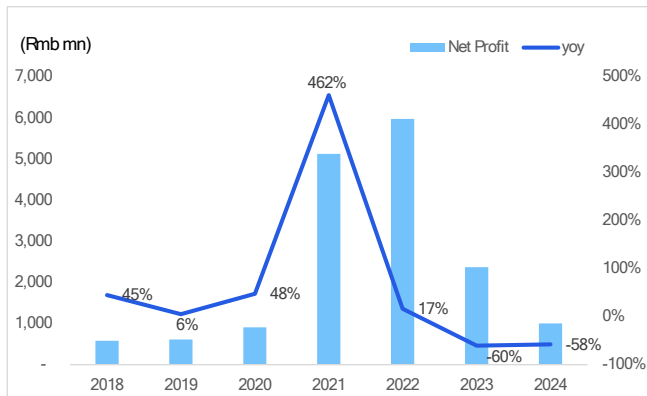
Figure 72. Northern Rare Earth – Revenue and YoY Growth



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Source: Citi Research, Company Reports

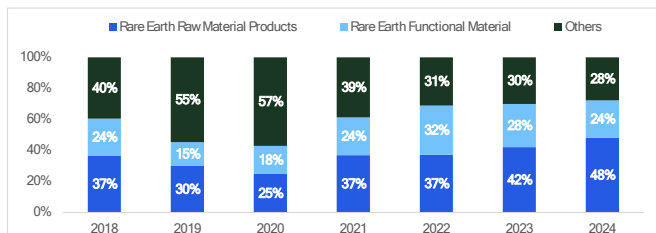
Figure 73. Northern Rare Earth – Net Profit and YoY Growth



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Source: Citi Research, Company Reports

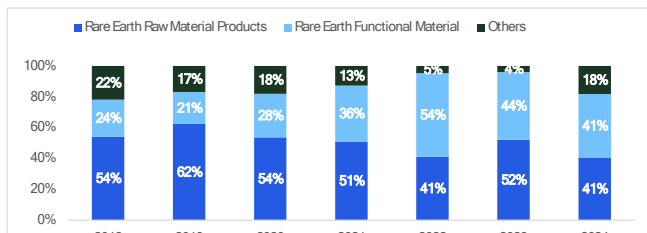
Figure 74. Northern Rare Earth – Revenue Breakdown by Product



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Source: Citi Research, Company Reports

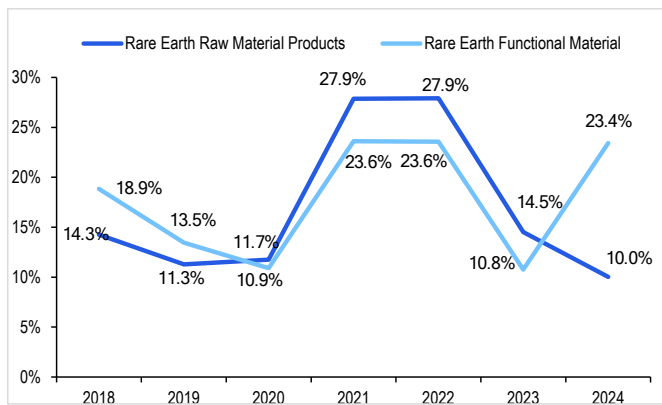
Figure 75. Northern Rare Earth – Gross Profit Breakdown by Product



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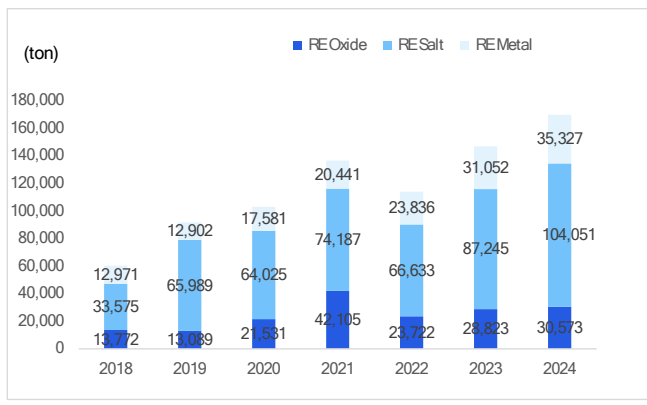
Figure 76. Northern Rare Earth – GPM by Business



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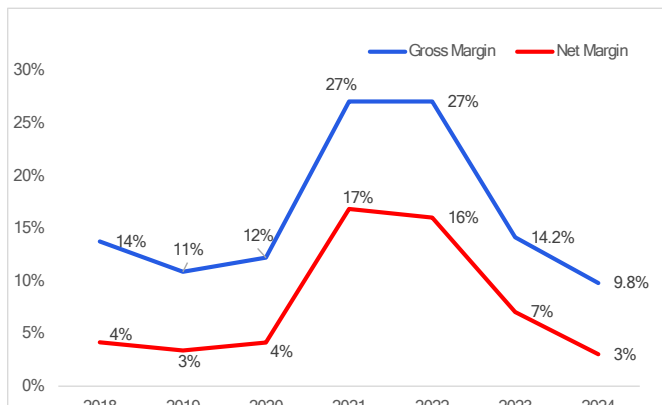
Figure 77. Northern Rare Earth – Sales Volume by Products



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Source: Citi Research, Company Reports

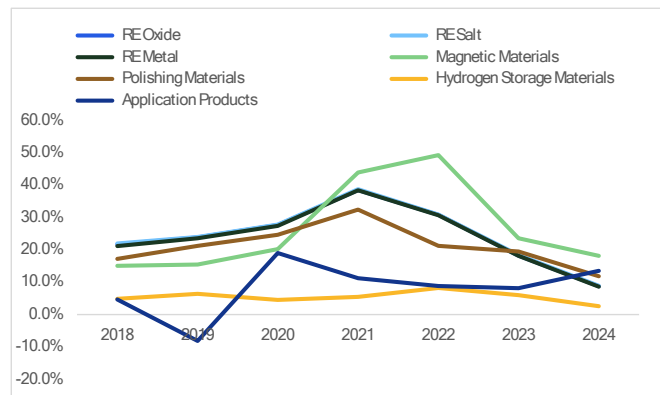
Figure 78. Northern Rare Earth – Gross Margin and Net Margin



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Source: Citi Research, Company Reports

Figure 79. Northern Rare Earth – Gross Margin by Key Products



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Source: Citi Research, Company Reports

Figure 80. Northern Rare Earth – Key Assumptions for Earnings Estimates

Key Output (Rmb mn)	2018	2019	2020	2021	2022	2023	2024	2025e	2026e	2027e
Sales volume (ton)										
Rare Earth Oxide	13,772	13,089	21,531	42,105	23,722	28,823	30,573	36,688	44,026	52,831
Rare Earth Salt	33,575	65,989	64,025	74,187	66,633	87,245	104,051	130,064	156,077	187,292
Rare Earth Metal	12,971	12,902	17,581	20,441	23,836	31,052	35,327	45,925	57,406	71,758
ASP (Rmb/t)										
Rare Earth Oxide	137,366	144,545	56,345	47,832	81,726	87,583	97,247	108,917	114,363	120,081
Rare Earth Salt	15,409	7,046	3,988	5,992	6,222	3,919	4,352	4,874	5,118	5,374
Rare Earth Metal	208,683	237,683	224,710	429,335	482,124	361,628	352,844	395,186	414,945	435,692
Unit cost (Rmb/t)										
Rare Earth Oxide	107,592	110,113	40,751	29,434	56,556	71,629	88,766	95,847	99,496	103,270
Rare Earth Salt	11,110	6,021	2,501	3,485	2,763	2,191	3,291	4,289	4,453	4,621
Rare Earth Metal	229,921	211,593	160,467	259,022	327,909	298,590	308,667	347,763	361,002	374,695
Unit gross profit (Rmb/t)										
Rare Earth Oxide	29,774	34,433	15,594	18,398	25,170	15,954	8,481	13,070	14,867	16,811
Rare Earth Salt	4,299	1,025	1,487	2,506	3,459	1,728	1,060	585	665	752
Rare Earth Metal	(21,237)	26,090	64,244	170,314	154,215	63,038	44,177	47,422	53,943	60,997
Gross margin										
Rare Earth Oxide	22%	24%	28%	38%	31%	18%	9%	12.0%	13.0%	14.0%
Rare Earth Salt	28%	15%	37%	42%	56%	44%	24%	12%	13%	14%
Rare Earth Metal	-10%	11%	29%	40%	32%	17%	13%	12%	13%	14%

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Source: Citi Research estimates, Company Reports

Financial analysis: financial statements

Figure 81. Northern Rare Earth – Income Statement

(Rmb Mn)	2018	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
Gross revenue	13,955	18,092	21,903	30,408	37,260	33,497	32,966	42,314	51,804	64,052
Less: sales tax and surcharges	(100)	(91)	(95)	(225)	(256)	(145)	(139)	(178)	(218)	(270)
Net revenue	13,855	18,000	21,808	30,184	37,004	33,352	32,827	42,135	51,586	63,782
COGS	(11,932)	(16,029)	(19,128)	(21,944)	(26,905)	(28,600)	(29,589)	(36,925)	(44,142)	(53,844)
Gross profit	1,923	1,971	2,680	8,240	10,099	4,752	3,239	5,211	7,444	9,938
SG&A	(732)	(842)	(902)	(1,069)	(1,121)	(1,048)	(1,088)	(1,244)	(1,419)	(1,754)
R&D expenses	(53)	(73)	(109)	(161)	(255)	(244)	(300)	(296)	(363)	(448)
Asset impairment loss	-	-	-	-	-	-	-	-	-	-
Other income/expenses	40	139	(20)	81	(1,016)	(177)	134	(150)	(100)	-
EBIT	1,177	1,194	1,648	7,091	7,708	3,283	1,984	3,521	5,562	7,735
Profit before tax	838	844	1,218	6,696	7,437	3,132	1,837	3,270	5,264	7,388
Income tax expense	(259)	(203)	(232)	(1,086)	(1,080)	(509)	(249)	(556)	(895)	(1,256)
After-tax income	579	640	986	5,610	6,358	2,623	1,588	2,714	4,369	6,132
Minority interests	5	(24)	(74)	(480)	(374)	(252)	(584)	(543)	(874)	(1,226)
Net income	584	616	912	5,130	5,984	2,371	1,004	2,172	3,496	4,906
Reported recurring net profit	606	631	869	5,175	6,563	2,452	1,062	2,172	3,496	4,906

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Source: Citi Research estimates, Company Reports

Figure 82. Northern Rare Earth – Cash Flow Statement

(Rmb Mn)	2018	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
Profit after tax	579	640	986	5,610	6,358	2,623	1,588	2,714	4,369	6,132
Add: asset impairment	-	-	-	-	-	-	-	-	-	-
D&A	344	363	406	467	448	520	713	829	927	1,029
Others	570	490	677	574	1,847	1,032	827	-	-	-
Change in Working capital	(2,192)	(606)	(1,429)	(2,858)	(3,911)	(1,747)	(2,102)	(1,764)	(2,867)	(4,598)
Cash from operating activities	(699)	888	640	3,794	4,741	2,428	1,026	1,780	2,429	2,564
CAPEX	(188)	(207)	(160)	(329)	(1,015)	(1,114)	(1,688)	(1,481)	(1,554)	(1,601)
Other cash flow in investing activities	(1,226)	151	(209)	(1,530)	599	(710)	34	-	-	-
Cash from investing activities	(1,414)	(56)	(370)	(1,859)	(415)	(1,823)	(1,655)	(1,481)	(1,554)	(1,601)
Issuance of share capital	8	33	4	61	423	-	226	-	-	-
Net increase in borrowings	712	(764)	1,763	1,072	(4,812)	814	1,537	3,000	3,000	3,000
dividends or interest payment	(563)	(569)	(373)	(688)	(2,183)	(982)	(830)	(274)	(440)	(618)
Other cash flow to financing activities	(23)	(275)	(6)	(202)	89	330	70	-	-	-
Cash from financing activities	133	(1,575)	1,388	243	(6,483)	161	1,003	2,726	2,560	2,382
Effect of foreign exchange rate changes	13	4	(5)	(6)	44	9	4	-	-	-
BEG cash	4,871	2,903	2,205	3,858	6,029	3,916	4,691	5,644	8,670	12,104
Net change in cash and cash equivalents	(1,968)	(739)	1,653	2,172	(2,114)	775	377	3,025	3,435	3,344
END Cash	2,903	2,164	3,858	6,029	3,916	4,691	5,067	8,670	12,104	15,449
FCF	(887)	681	479	3,465	3,726	1,314	(663)	299	875	962

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Source: Citi Research estimates, Company Reports

Figure 83. Northern Rare Earth – Balance Sheet

(Rmb Mn)	2018	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
Cash and cash equivalent	3,236	2,467	4,107	6,493	4,448	5,302	5,644	8,670	12,104	15,449
Bills receivable	1,699	52	65	326	1,059	2,496	2,899	2,165	2,650	3,277
Accounts receivable	1,293	1,934	3,383	3,841	2,192	3,502	3,418	3,821	4,258	5,265
Prepayment	348	721	232	553	478	497	488	488	488	488
Inventory	9,566	9,335	8,963	10,325	14,505	14,826	15,975	18,007	20,559	24,340
Others	1,146	2,311	2,534	5,196	4,483	2,333	3,238	3,238	3,238	3,238
Current assets	17,287	16,820	19,284	26,733	27,166	28,956	31,664	36,389	43,299	52,057
Long term equity investment	60	62	91	278	282	680	690	690	690	690
PPE	3,503	3,624	4,110	4,170	4,431	5,461	7,004	7,694	8,359	8,969
Intangible assets	742	795	817	789	583	569	622	584	546	507
Goodwill	21	21	21	21	32	32	32	32	32	32
Deferred Cost	240	227	239	306	610	706	617	617	617	617
Other non-current assets	1,879	1,700	2,321	2,410	3,546	4,094	4,752	4,752	4,752	4,752
Non-current assets	6,445	6,430	7,599	7,975	9,484	11,541	13,717	14,369	14,996	15,568
Total assets	23,733	23,250	26,883	34,708	36,650	40,497	45,381	50,758	58,294	67,625
Short term borrowings	4,026	3,507	2,215	1,580	1,417	2,012	2,179	2,179	2,179	2,179
Bills payable	-	806	292	708	513	839	1,123	1,123	1,123	1,123
Account payable	-	643	1,206	1,815	2,232	1,782	3,171	3,107	3,714	4,531
Advance payment	369	258	-	-	-	-	-	-	-	-
Tax payable	129	69	182	750	405	174	128	128	128	128
Other payables	1,611	441	732	5,189	4,754	4,440	4,281	4,281	4,281	4,281
Current portion of other LT loans										
Current liabilities	6,134	5,725	4,628	10,042	9,320	9,248	10,880	10,817	11,424	12,240
Long term borrowings	1,191	463	2,210	2,401	609	3,255	5,157	8,157	11,157	14,157
Deferred income tax liabilities	67	74	69	85	83	86	77	77	77	77
Deferred revenue	271	283	326	349	350	480	484	484	484	484
Other Non-current liabilities	3,606	3,752	5,088	2,608	1,255	526	627	627	627	627
Non-current liabilities	5,136	4,571	7,692	5,443	2,296	4,347	6,345	9,345	12,345	15,345
Total liabilities	11,270	10,296	12,320	15,484	11,617	13,595	17,225	20,162	23,769	27,585
Share capital	3,633	3,633	3,633	3,633	3,615	3,615	3,615	3,615	3,615	3,615
Other reserves	1,569	1,677	2,525	2,143	2,591	2,710	2,853	2,853	2,853	2,853
Retained earnings	3,945	4,356	5,111	9,605	13,499	15,173	15,838	17,736	20,791	25,079
Minority interests	3,237	3,306	3,368	3,875	5,202	5,282	5,724	6,267	7,141	8,367
Total shareholders' equity	12,462	12,953	14,563	19,224	25,033	26,901	28,155	30,596	34,525	40,040

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Source: Citi Research estimates, Company Reports

Key risks

Key risks for Northern Rare Earth include:

- Slower- or faster-than-expected downstream applications demand growth, including demand uncertainty from adoption trends in NEVs, wind power, or other applications.
- Greater- or less-than-expected rare earths mining or processing capacity expansion outside of China, including global supply-chain diversification efforts that could erode the market share of China enterprises, changes in Myanmar export capacity, etc.
- Tariffs and other trade barriers, including those imposed by the US or China, as well as other key global economies.
- Rare earths price volatility from various factors including cyclical swings in rare earth oxide and magnet markets.
- Policy and quota adjustments in China affecting supply, costs, and profitability.

- Emergence of alternate materials or technologies that could substitute for rare earth elements in key end-user applications.
- Rare earth sector M&A and consolidation activity in China or in other global markets.

Management, shareholders, company background

Key management personnel

Figure 84. Northern Rare Earth – Key Management Personnel

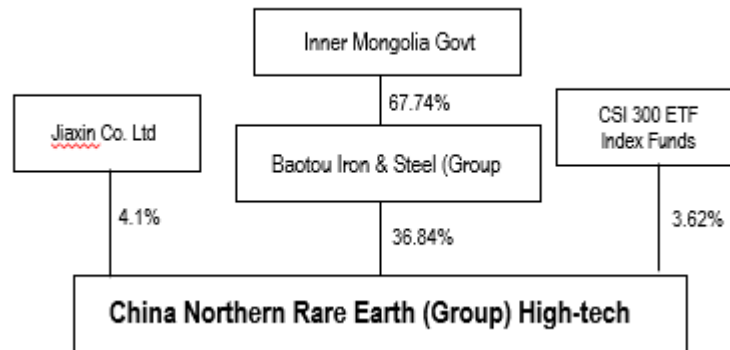
Name	Title	Biography
Mr.Liu Peixun (刘培勋)	Chairman	Born May 1968, MBA, Senior Engineer, CPC member. Held various senior roles at Baogang Rare Earth companies, including Plant Director and General Manager positions; Chairman of Gansu Rare Earth New Materials Co. Ltd. In 2024, appointed Chairman and Party Secretary of Northern Rare Earth.
Mr.Wang Huiwen (汪辉文)	Deputy Chairman	Born Dec 1961, MBA, Senior Economist, CPC member. Former Deputy GM of Nivalis Corp., manager at Hebei International Trust & Investment. Currently Vice Chairman of Northern Rare Earth and Vice GM of Jiaxin Co. Ltd.; also Chairman of several investment companies under Yintai Group.
Mr.Qu Yedong (瞿业栋)	General Manager & Director	Born Jan 1975, MBA, CPC member. Previously CFO and GM of Gansu Rare Earth New Materials; since 2021, serving as Director, GM, and Deputy Party Secretary of Northern Rare Earth; concurrently Chairman of Inner Mongolia Northern Rare Earth Magnetic Materials Co., Ltd.
Mr.Zhang Qingfeng (张庆峰)	Director	Born Apr 1972, Party School graduate, Senior Political Engineer, CPC member. Served in key HR and union leadership positions at Baogang Group and Northern Rare Earth. Currently Director, Deputy Party Secretary, Chairman of the Labor Union of Northern Rare Earth; also holds supervisory roles across affiliated companies.
Mr. Wu Yonggang (吴永钢)	Board Secretary	Born Mar 1971, MBA, Senior Economist, CPC member. Extensive project leadership in construction and permanent magnet motor base. Currently Director, Board Secretary, Chief Compliance Officer of Northern Rare Earth; also Chairman of multiple tech affiliates.
Mr. Wang Zhaoming (王昭明)	Director	Born July 1967, Bachelor's degree, Auditor, CPC member. Longtime leadership in administration, audit, and corporate services at Baogang Group. Since May 2024, serves as Director of Northern Rare Earth; also sits on boards and supervisory boards of several mining and tech firms.
Ms Song Ling (宋冷)	CFO	Born Jan 1977, Bachelor's degree, Senior Accountant, CPC member. Financial leadership experience across Baogang Group and Northern Rare Earth. Currently Director, CFO, and Head of Finance Department at Northern Rare Earth; board member in multiple subsidiaries in rare earth and environmental sectors.

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Source: Citi Research, Company Reports

Shareholding structure

Figure 85. Northern Rare Earth Group – Shareholding Structure (2024)



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Company history

Figure 86. Northern Rare Earth – Corporate Development Timeline

Year	Milestone
1927	Discovery of Bayan Obo Mine
1961	Establishment of North Rare Earth Company
1997	Successfully listed on Shanghai Stock Exchange
2015	Formation of Rare Earth Group and completion of industry integration
2020s	Built the world's largest rare earth raw material and functional materials base

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China Rare Earth Resources & Technology (000831.SZ)

Heavy Rare Earth Price Setter with Scarcity Advantage

Business snapshot

China Rare Earth Resources & Technology Co., Ltd. (“CRE”) is engaged in three major business segments: 1) Rare Earth Materials: Mining, separation, production, and trade of rare-earth oxides, metals, and deep-processed products; 2) Technical Services: R&D, engineering, consulting in rare-earth technologies; new material development; and 3) Geological Survey: Investment in mining assets, exploration, resource processing, integrated utilization, and trade. It is the key listed platform of parent China Rare Earth Group.

CRE is a core platform for China’s heavy rare earth consolidation, integrating various group affiliates and controlling >60% of China’s medium- and heavy-REE quotas. Heavy REEs like Dy/Tb are strategic for EV and wind turbine magnets. A scarcity-driven pricing upcycle in heavy REEs would directly benefit margins. Downstream material investment and potential policy-backed export premium could lift profitability.

As a central SOE controlling medium-to-heavy rare earth resources, China Rare Earth Group holds a strategically vital position in supplying high-tech and defense sectors. Its core business currently centers on mining and primary separation, with limited downstream processing and value-added activities.

Initiate coverage at Neutral due to elevated valuations

We value China Rare Earth Resources and Technology shares at Rmb61.6 using a P/B-based methodology given the sector’s cyclical earnings pattern and policy-regulated nature. We apply a 12x target 2026E P/B, set at +1.5sd premium to the stock’s historical P/B average since 2013 to reflect the sector’s early-to-mid upcycle, supported by policy tailwinds, supply discipline, and the growing strategic importance of rare earths in electrification and supply-chain security. Our target price is equivalent to 72.5x 2026E EV/EBITDA and 97.9x 2026E P/E. Nevertheless, the stock is currently trading at 90.5x 2026E P/E and 11.1x 2026E P/B, with valuations appearing elevated and leaving limited valuation upside despite cycle tailwinds. See “Valuation analysis” section below for more details.

Resources and characteristics

CRE focuses on the refining and separation of medium-to-heavy rare earth products. The company does not directly hold mining rights; instead, it sources feedstock through its parent company’s subsidiary China Southern Rare Earth Group (“Southern RE”), which consolidates several major rare earth mining and processing companies in Jiangxi, Guangdong, and Guangxi. These resources are dominated by medium and heavy rare earths sourced from ionic clay deposits, a globally scarce and strategically important type of rare earth resources.

Southern RE’s mining rights are classified as national strategic resources, and exact reserve figures are not fully disclosed. However, based on annual production quota announcements from MIIT and the Ministry of Natural Resources, China

Rare Earth Group consistently accounts for the largest share of China’s approved mining and smelting separation quotas for medium and heavy rare earths. This dominant position makes it the single most influential supplier of high-value oxides such as terbium, dysprosium, yttrium, and europium.

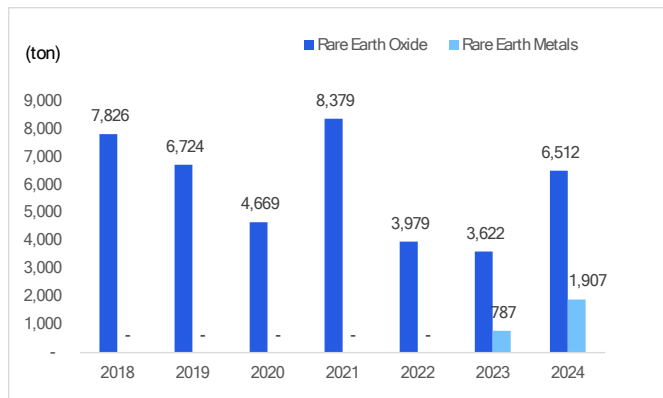
A key characteristic of these ionic clay deposits is their high proportion of medium and heavy rare earth oxides compared to light rare earths, coupled with low radioactivity and relatively easier extraction processes. This gives China Rare Earth Group a structural advantage in supplying high-value-added segments such as NdFeB permanent magnets, catalytic materials, and phosphors, where HREEs significantly enhance product performance.

Products

CRE engages in the production, processing, and trading of rare earth oxides, metals, and deep-processed products, alongside rare earth technology R&D, consulting, and new materials development. Its operation span mining investment, mineral processing, and comprehensive utilization.

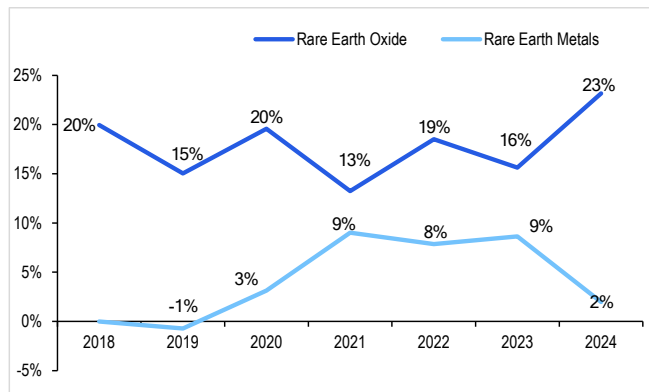
Core activities include rare earth mining, oxide production, and technical services. The company obtains raw materials through in-house extraction and external procurement, followed by separation and refining. Main products include mixed rare earth carbonate, mixed oxide concentrates, high-purity single rare earth oxides, and enriched compounds. Mixed carbonate, an initial output from ore, is calcined into mixed oxides, which are further separated into high-purity single oxides. Products are widely used in magnetic, phosphor, catalytic, and crystal materials, as well as high-end electronics.

Figure 87. China Rare Earth – Sales Volume by Major Products



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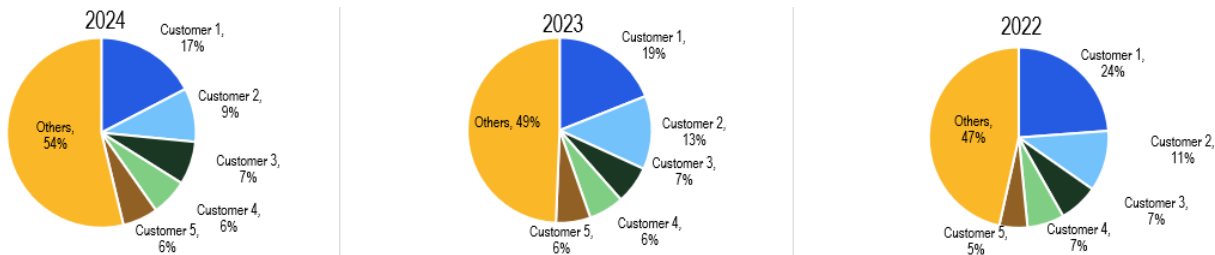
Figure 88. China Rare Earth – Gross Margin by Major Products



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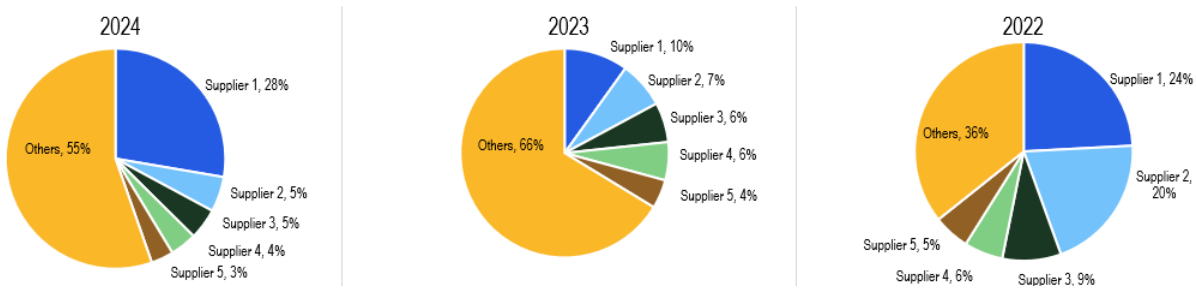
Key customers and suppliers

Figure 89. China Rare Earth – Concentration of Top-5 Customers, 2022-2024



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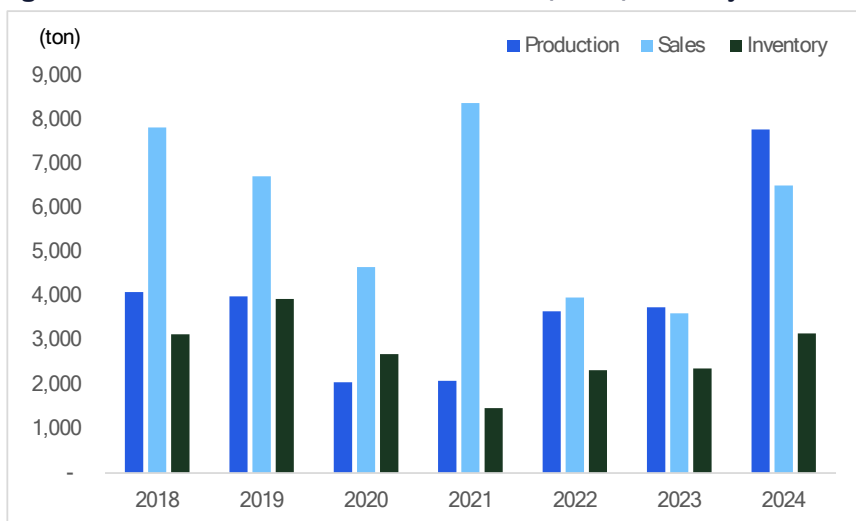
Figure 90. China Rare Earth – Concentration of Top-5 Suppliers, 2022-2024



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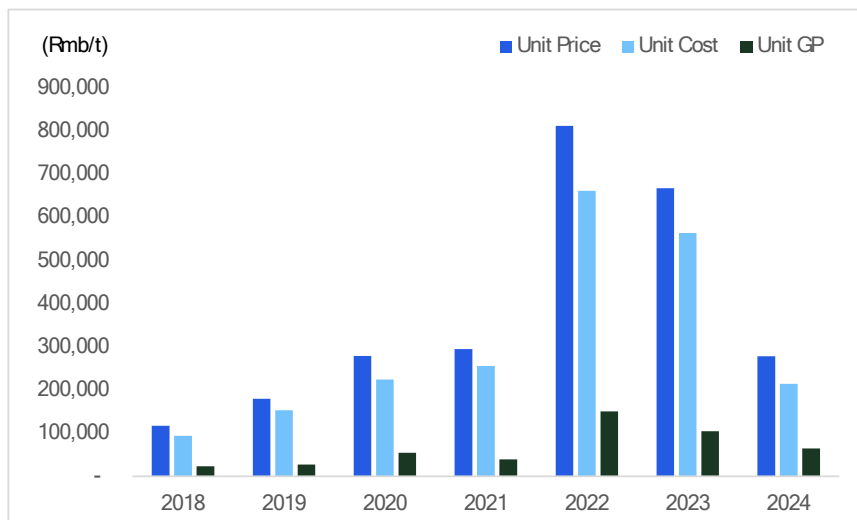
Volume, price, and key operating assumptions

Figure 91. China Rare Earth – RE Oxide Production/Sales/Inventory



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Figure 92. China Rare Earth – RE Oxide Unit Price/Cost/Gross Profit



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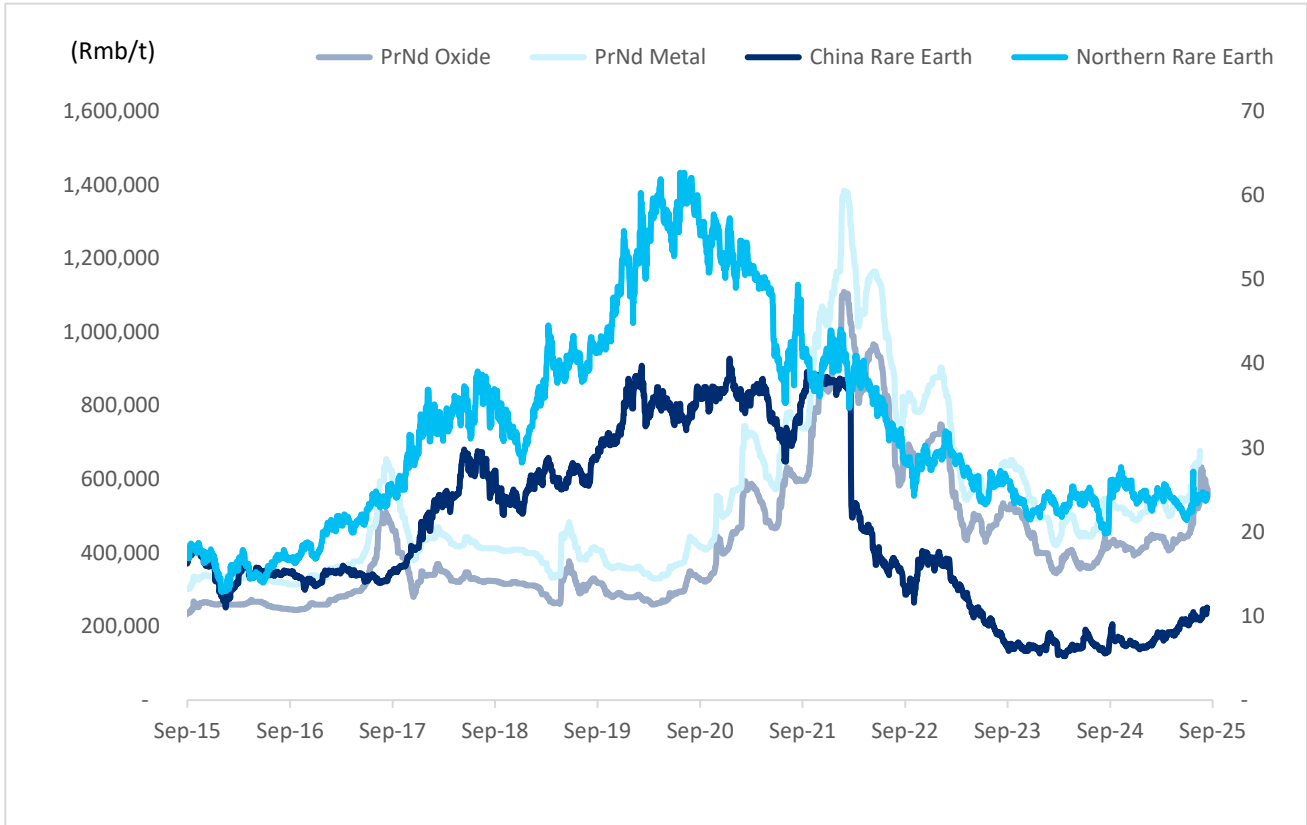
Valuation analysis: P/B approach

We value China Rare Earth Resources and Technology shares at Rmb61.6 using a P/B-based methodology given the sector's cyclical earnings pattern and policy-regulated nature. We apply a 12x target 2026E P/B, set at +1.5sd premium to the stock's historical P/B average since 2013 to reflect the sector's early-to-mid upcycle, supported by policy tailwinds, supply discipline, and the growing strategic importance of rare earths in electrification and supply-chain security. While we do not expect this cycle to match the intensity of the previous peak in 2021 – when valuations briefly reached over +4.5SD above the historical mean – we believe structural demand growth, tighter resource control, and stronger policy tailwinds justify a valuation toward the upper end of the historical range. The current multiple represents a mid-cycle premium rather than a peak-cycle assumption, balancing upside potential with demand and geopolitical uncertainties. Given the rare earth stocks' high sensitivity to trade barrier measures and rare earths policies in China, the US, and other key markets, we see scope for volatility even as fundamentals improve. We forecast 7%/12%/15% ROE for 2025E/26E/27E, implying a sustained normalization toward double-digit returns. Our target price is equivalent to 72.5x 2026E EV/EBITDA and 97.9x 2026E P/E. Nevertheless, the stock is currently trading at 90.5x 2026E P/E and 11.1x 2026E P/B, with valuations appearing elevated and leaving limited valuation upside despite cycle tailwinds.

Valuation history, charts, and correlations

The stock performances of Northern RE and China RE have been highly correlated with China rare earth prices, historically.

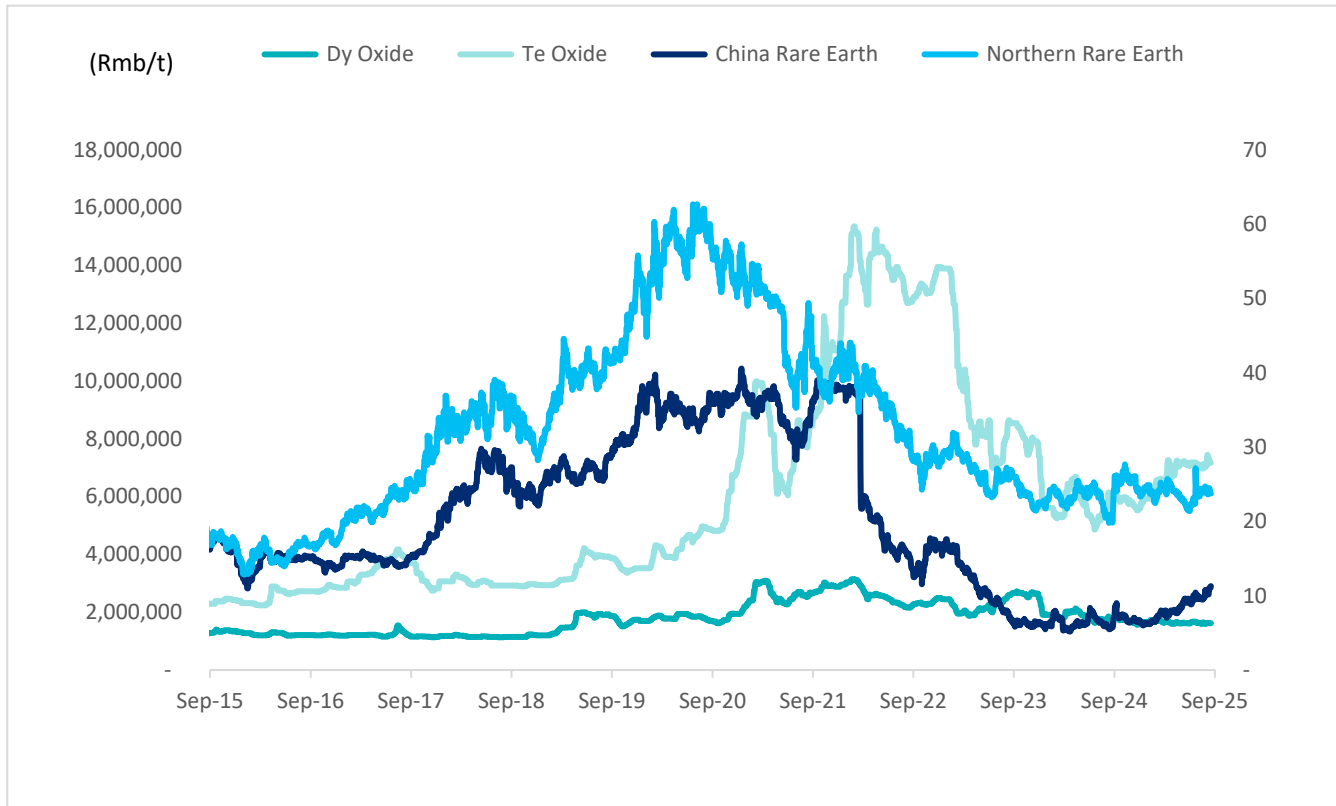
Figure 93. NRE & CRE Stock Performances vs. LRE Oxide Price



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Source: Citi Research, SMM, Wind

Figure 94. NRE & CRE Stock Performances vs. HRE Oxide Price



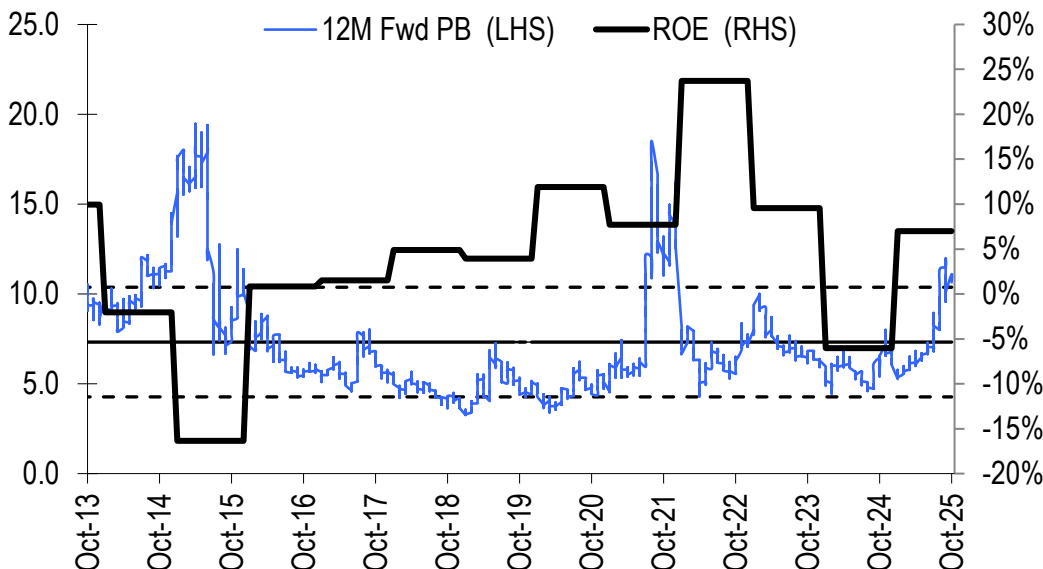
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Source: Citi Research, Wind, SMM

Figure 95. China Rare Earth – P/E Valuation Sensitivity to GP Margin and Sales Volume (share price as of 10 Oct 2025)

2026E P/E		RE Oxide Sale Volume(mn sqm)						
		8,852	9,852	10,852	11,852	12,852	13,852	14,852
GP Margin(%)	20.3%	167	140	120	106	94	85	77
	21.3%	154	130	112	99	88	79	72
	22.3%	143	121	105	92	83	75	68
	23.3%	133	113	98	87	78	71	65
	24.3%	125	106	93	82	74	67	61
	25.3%	117	100	88	78	70	64	58
	26.3%	111	95	83	74	67	60	55

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Source: Citi Research estimates

Figure 96. China RE – 12M Forward PB vs. ROE



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Source: Citi Research

Peer comparisons: valuations

Figure 97. Rare Earth Producers Valuation Comp (Share Price as of Oct 10, 2025)

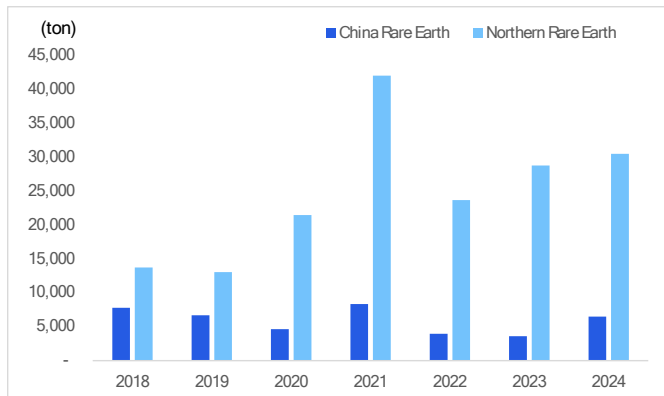
Company Name	Reuters Code	Rating	Mkt Cap USDm	Share					PB (x)		PE (x)		EV/EBITDA (x)		ROE		Dividend Yield	
				Ccy	Price	YTD Chg	TP	Upside	25E	26E	25E	26E	25E	26E	25E	26E	25E	26E
Rare Earth Comparable Valuation Sheet																		
Northern Rare Earth	600111.SH	Buy	26,944	CNY	53.13	147%	72.00	36%	7.9	7.0	88.4	54.9	42.3	29.4	9%	14%	0%	0%
China Rare Earth	000831.SZ	Neutral	8,472	CNY	56.91	95%	61.60	8%	12.3	11.1	179.6	90.5	101.6	60.2	7%	13%	0%	0%
Rising Nonferrous Metals	600259.SH	NR	2,901	CNY	61.47	112%	na	na	5.5	5.0	79.7	48.7	43.6	36.7	9%	9%	44%	37%
Shenghe Resources	600392.SH	NR	6,200	CNY	25.22	133%	na	na	4.7	4.5	58.0	36.9	43.3	30.6	11%	11%	43%	31%
Inner Mongolia Baotou Steel Union	600010.SH	NR	16,388	CNY	2.58	37%	na	na	na	na	127.0	na	na	na	na	na	na	na
Lynas Rare Earth	LYC.AX	Sell	4,307	AUD	20.59	8%	9.50	-54%	8.2	5.8	2,421.4	79.9	82.0	36.6	0%	9%	nm	nm
MP Materials	MP.US	NR	12,802	USD	73.77	363%	na	na	7.2	6.4	na	83.6	na	42.6	8%	8%	na	43%
Average									7.6	6.6	492.4	65.7	62.6	39.3	8%	11%	22%	22%
Rare Earth Magnets																		
JL MAG-A	300748.SZ	Neutral	7,083	CNY	39.49	123%	32.60	-17%	7.5	7.3	75.3	53.2	47.4	34.3	10%	14%	1%	2%
JL MAG-H	6680.HK	Buy	7,083	HKD	26.08	225%	25.30	-3%	4.5	4.4	45.6	32.2	47.4	34.3	10%	14%	2%	3%
Zhenghai Magnetic	300224.CH Equity	NR	2,313	CNY	17.72	45%	na	na	3.7	3.5	48.3	37.5	31.1	25.3	10%	10%	31%	25%
Zhong Ke High-Tech	000970.CH Equity	NR	2,527	CNY	14.82	39%	na	na	2.6	2.5	83.5	60.9	34.9	27.0	4%	4%	35%	27%
Ningbo Yunsheng	600366.CH Equity	NR	2,371	CNY	15.38	108%	na	na	2.8	2.6	65.1	43.7	39.4	28.0	6%	6%	39%	28%
Innuovo Technology	000795.CH Equity	NR	1,770	CNY	11.13	13%	na	na	4.5	4.2	40.7	34.3	27.5	24.0	12%	12%	27%	24%
Earth-Panda	688077.CH Equity	NR	609	CNY	37.94	79%	na	na	na	na	na	na	na	na	na	na	na	na
Advanced Technology	000969.CH Equity	NR	2,199	CNY	14.92	47%	na	na	3.0	2.9	47.3	41.3	27.8	26.5	7%	7%	28%	26%
Hengdian Group DMEGC Magnetics	002056.CH Equity	NR	4,734	CNY	20.75	57%	na	na	2.9	2.5	16.8	14.8	10.2	8.8	17%	17%	10%	9%
Baotou Tianhe Magnetics Technology	603072.CH Equity	NR	1,841	CNY	49.66	-	na	na	na	na	na	na	na	na	na	na	na	na
Baotou INST Magnetics New Materials	301622.CH Equity	NR	1,362	CNY	83.76	32%	na	na	na	na	na	na	na	na	na	na	na	na
Jiangsu Huahong Technology	002645.CH Equity	NR	1,452	CNY	16.49	130%	na	na	2.6	2.4	43.3	31.4	25.4	18.2	8%	8%	25%	18%
Shin-Etsu Chemical	4063.JP Equity	Buy	62,863	JPY	5,138.00	-5%	5,000.00	-3%	2.2	2.2	19.1	19.9	8.2	8.2	12%	11%	2%	2%
TDK Corporation	6762.JP Equity	Buy	28,285	JPY	2,281.50	7%	2,200.00	-4%	2.4	2.2	25.9	23.4	7.9	6.8	10%	10%	1%	1%
Average									3.6	3.5	48.5	36.9	29.9	23.4	10%	10%	20%	16%

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Source: Citi Research estimates, Bloomberg consensus; pricing as at 10-Oct-2025 22:00 HK time

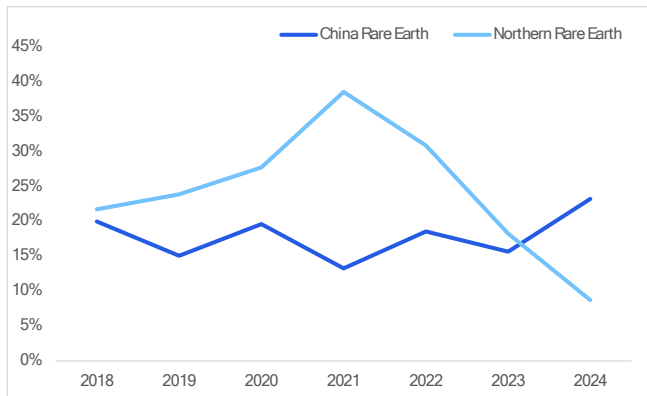
Peer comparisons: financial metrics

Figure 98. Sales Volume Comparison (for RE Oxide)



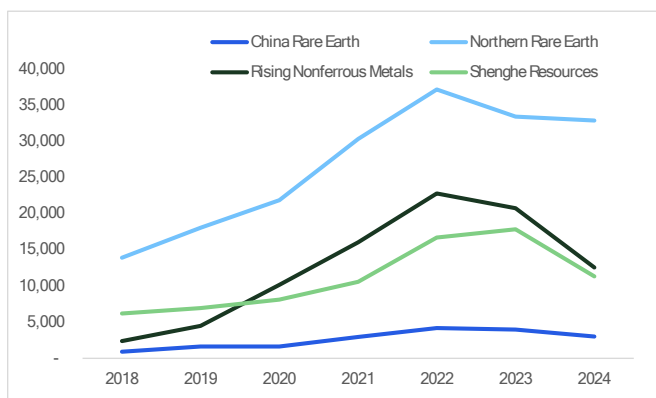
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Figure 99. GP Margin Comparison (for RE Oxide)



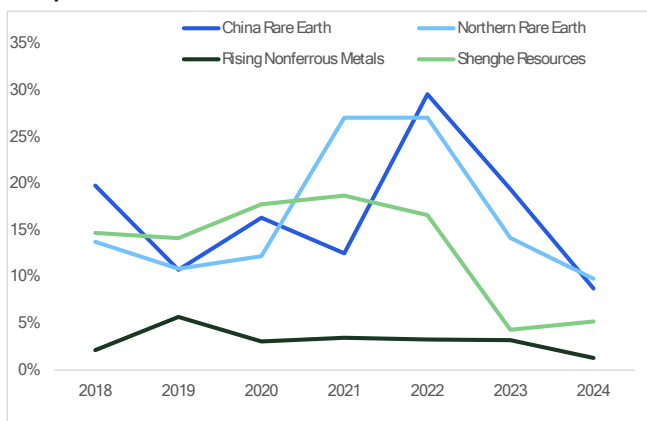
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Figure 100. Rare Earths Select Peers – Revenue Comparison



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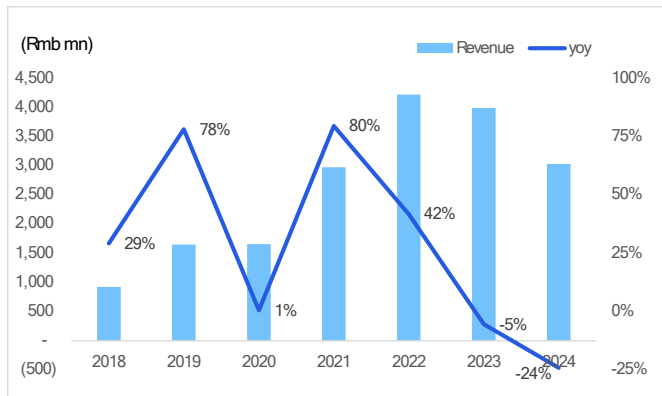
Figure 101. Rare Earths Select Peers – GP Margin Comparison



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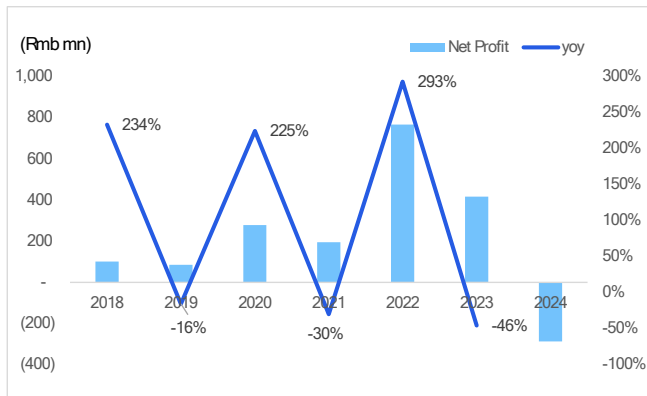
Financial analysis: revenue and profit trends

Figure 102. China Rare Earth – Revenue and YoY Growth



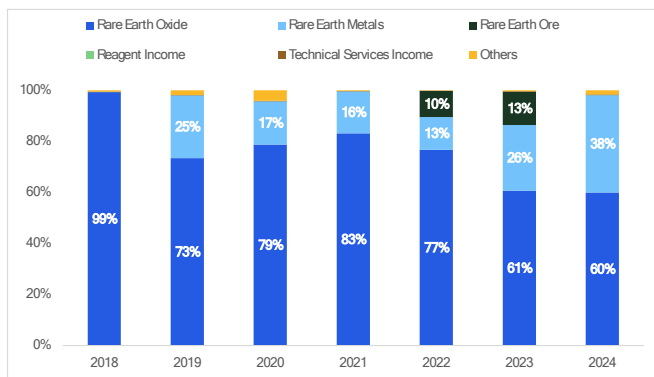
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Figure 103. China Rare Earth – Net Profit and YoY Growth



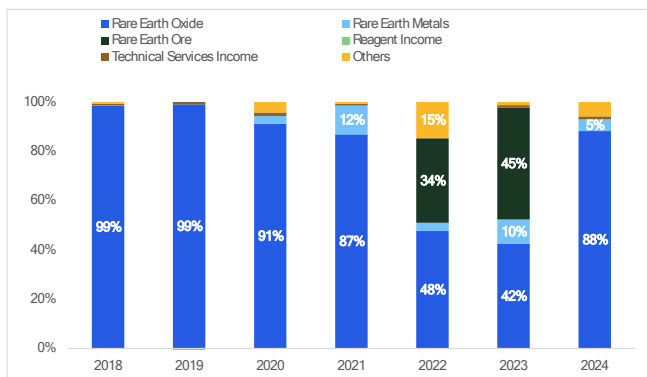
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Figure 104. China Rare Earth – Revenue Breakdown by Product



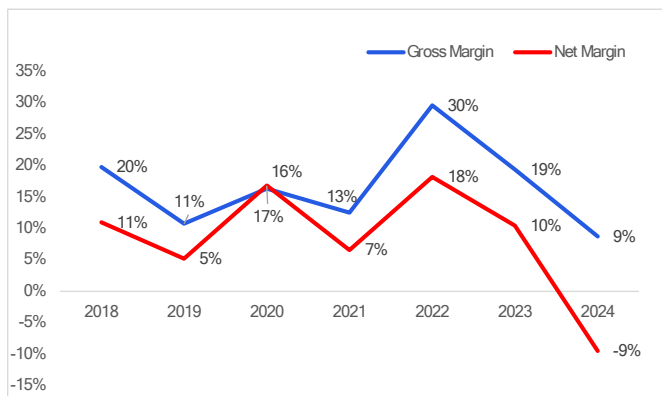
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Figure 105. China Rare Earth – Gross Profit Breakdown by Product



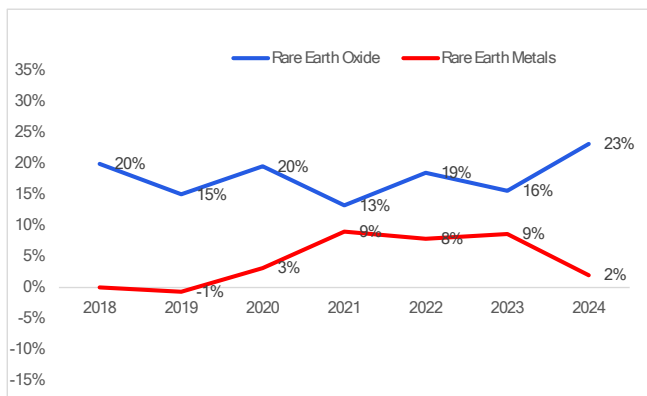
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Figure 106. China Rare Earth – Gross Margin and Net Margin



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Figure 107. China Rare Earth – Gross Margin by Key Products



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Figure 108. China Rare Earth – Key Assumptions for Earnings Estimates

Key Output (Rmb mn)	2018	2019	2020	2021	2022	2023	2024	2025e	2026e	2027e
Sales volume (ton)										
Rare Earth Oxide	7,826	6,724	4,669	8,379	3,979	3,622	6,512	9,117	11,852	15,408
Rare Earth Metals	-	-	-	-	-	787	1,907	2,860	4,004	5,606
ASP (Rmb/t)										
Rare Earth Oxide	117,345	179,903	279,349	295,147	812,970	668,546	278,694	312,137	330,865	340,791
Rare Earth Metals	-	-	-	-	-	1,301,775	606,294	697,238	753,017	775,608
Unit cost (Rmb/t)										
Rare Earth Oxide	(93,946)	(152,830)	(224,693)	(256,049)	(662,466)	(564,122)	(214,116)	(246,233)	(253,620)	(261,228)
Rare Earth Metals	-	-	-	-	-	(1,189,447)	(594,354)	(641,902)	(661,159)	(680,994)
Unit gross profit (Rmb/t)										
Rare Earth Oxide	23,399	27,072	54,656	39,098	150,503	104,425	64,578	65,904	77,246	79,563
Rare Earth Metals	-	-	-	-	-	112,328	11,940	55,336	91,858	94,614
Gross margin										
Rare Earth Oxide	20%	15%	20%	13%	19%	16%	23%	21%	23%	23%
Rare Earth Metals	-	-	-	-	-	-	-	8%	12%	12%

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Source: Citi Research estimates, Company Reports

Financial analysis: financial statements

Figure 109. China Rare Earth – Income Statement

(Rmb Mn)	2018	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
Gross revenue	925	1,647	1,656	2,973	4,216	3,988	3,027	4,903	7,009	9,681
Less: sales tax and surcharges	(3)	(6)	(9)	(4)	(9)	(117)	(212)	(108)	(154)	(213)
Net revenue	922	1,641	1,648	2,969	4,207	3,872	2,816	4,796	6,854	9,468
COGS	(739)	(1,464)	(1,377)	(2,596)	(2,959)	(3,097)	(2,551)	(4,104)	(5,677)	(7,867)
Gross profit	183	178	271	373	1,248	775	265	692	1,177	1,601
SG&A	(50)	(72)	(20)	(59)	(85)	(87)	(82)	(106)	(152)	(210)
R&D expenses	(5)	(11)	(13)	(15)	(25)	(40)	(58)	(71)	(102)	(141)
Asset impairment loss	-	-	-	-	-	-	-	-	-	-
Other income/expenses	6	(2)	56	(13)	(128)	(117)	(394)	(100)	(100)	(100)
EBIT	134	93	293	286	1,010	531	(269)	414	824	1,150
Profit before tax	135	105	312	257	1,003	550	(269)	419	830	1,161
Income tax expense	(33)	(11)	(25)	(50)	(204)	(110)	(13)	(75)	(149)	(209)
After-tax income	101	94	286	206	798	439	(282)	343	681	952
Minority interests	0	(8)	(7)	(11)	(30)	(22)	(5)	(7)	(14)	(19)
Net income	102	86	279	195	769	418	(287)	336	667	933
Reported recurring net profit	102	86	147	192	768	418	(140)	336	667	933

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Source: Citi Research estimates, Company Reports

Figure 110. China Rare Earth – Cash Flow Statement

(Rmb Mn)	2018	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
Profit after tax	101	94	286	206	798	439	(282)	343	681	952
Add: asset impairment	-	-	-	-	-	-	-	-	-	-
D&A	16	16	12	10	53	60	73	74	70	68
Others	(2)	6	(49)	46	48	146	415	-	-	-
Change in Working capital	(397)	(219)	(359)	(1,007)	709	(299)	(801)	(520)	(370)	(692)
Cash from operating activities	(282)	(103)	(109)	(745)	1,609	346	(594)	(103)	380	328
CAPEX	(8)	(14)	(13)	(29)	(121)	(81)	(86)	(74)	(70)	(77)
Other cash flow in investing activities	(8)	(11)	65	5	6	(96)	(326)	-	-	-
Cash from investing activities	(16)	(25)	53	(24)	(116)	(177)	(413)	(74)	(70)	(77)
Issuance of share capital	-	-	-	-	-	2,081	-	-	-	-
Net increase in borrowings	13	160	275	788	(737)	276	110	449	449	449
dividends or interest payment	(0)	(49)	(49)	(91)	(134)	(47)	(95)	(67)	(133)	(187)
Other cash flow to financing activities	-	-	-	(2)	(1)	(1,498)	(1)	-	-	-
Cash from financing activities	13	112	226	695	(872)	811	14	382	316	263
Effect of foreign exchange rate changes	-	-	-	-	-	-	-	-	-	-
BEG cash	418	133	116	285	297	919	1,899	910	1,115	1,741
Net change in cash and cash equivalents	(285)	(17)	169	(73)	621	980	(992)	206	626	513
END Cash	133	116	285	212	919	1,899	906	1,115	1,741	2,254
FCF	(290)	(117)	(122)	(773)	1,487	266	(680)	(176)	310	250

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Source: Citi Research estimates, Company Reports

Figure 111. China Rare Earth – Balance Sheet

(Rmb Mn)	2018	2019	2020	2021	2022	2023	2024	2025E	2026E	2027E
Cash and cash equivalent	215	141	308	212	920	1,900	910	1,115	1,741	2,254
Bills receivable	332	7	2	203	138	265	112	276	346	398
Accounts receivable	269	236	2	17	2	261	329	320	384	477
Prepayment	139	43	387	52	186	4	2	2	2	2
Inventory	914	1,651	1,521	2,381	2,030	1,641	1,876	2,249	2,489	3,017
Others	28	182	442	526	208	514	518	518	518	518
Current assets	1,898	2,260	2,662	3,390	3,486	4,586	3,746	4,480	5,480	6,667
Net Equity Investments In Joint Ventures/Assoc	325	339	341	344	345	346	342	342	342	342
PPE	111	108	82	93	235	467	493	514	528	543
Intangible assets	14	13	7	7	114	82	57	35	22	16
Goodwill	-	-	-	-	-	-	-	-	-	-
Deferred tax assets	26	24	17	10	24	29	104	104	104	104
Other non-current assets	7	22	21	33	221	27	745	745	745	745
Non-current assets	484	506	469	487	939	951	1,739	1,739	1,740	1,749
Total assets	2,382	2,766	3,131	3,877	4,425	5,537	5,486	6,220	7,219	8,416
Short term borrowings	13	225	399	1,071	38	196	223	223	223	223
Bills payable	-	-	55	-	-	-	-	-	-	-
Account payable	87	118	30	17	70	79	222	231	233	216
Advance payment	20	16	18	21	25	31	27	27	27	27
Tax payable	13	15	23	28	34	57	37	37	37	37
Other payables	47	27	47	28	153	74	92	92	92	92
Current portion of other LT loans	-	-	-	-	-	-	-	-	-	-
Current liabilities	180	402	573	1,166	319	437	600	609	612	594
Long term borrowings	-	-	-	-	-	-	-	449	899	1,348
Deferred income tax liabilities	2	6	5	5	5	4	4	4	4	4
Deferred revenue	1	1	0	0	6	7	11	11	11	11
Other Non-current liabilities	-	51	0	5	57	62	56	56	56	56
Non-current liabilities	3	58	6	10	68	73	72	521	970	1,420
Total liabilities	183	459	579	1,175	387	510	672	1,130	1,582	2,013
Share capital	981	981	981	981	981	1,061	1,061	1,061	1,061	1,061
Other reserves	933	945	957	953	1,538	2,065	2,223	2,223	2,223	2,223
Retained earnings	210	297	523	666	1,366	1,730	1,358	1,627	2,161	2,907
Minority interests	75	84	91	101	153	171	171	178	192	211
Total shareholders' equity	2,199	2,306	2,553	2,701	4,038	5,027	4,814	5,090	5,637	6,402

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Source: Citi Research estimates, Company Reports

Key risks

Key risks for China Rare Earth include:

- Slower- or faster-than-expected downstream applications demand growth, including demand uncertainty from adoption trends in NEVs, wind power, or other applications.
- Greater- or less-than-expected rare earths mining or processing capacity expansion outside of China, including global supply-chain diversification efforts that could erode the market share of China enterprises, changes in Myanmar export capacity, etc.
- Tariffs and other trade barriers, including those imposed by the US or China, as well as other key global economies.
- Rare earths price volatility from various factors including cyclical swings in rare earth oxide and magnet markets.
- Policy and quota adjustments in China affecting supply, costs, and profitability.

- Emergence of alternate materials or technologies that could substitute for rare earth elements in key end-user applications.
- Rare earth sector M&A and consolidation activity in China or in other global markets.

Management, shareholders, company background

Key management personnel

Figure 112. China Rare Earth – Key Management Personnel

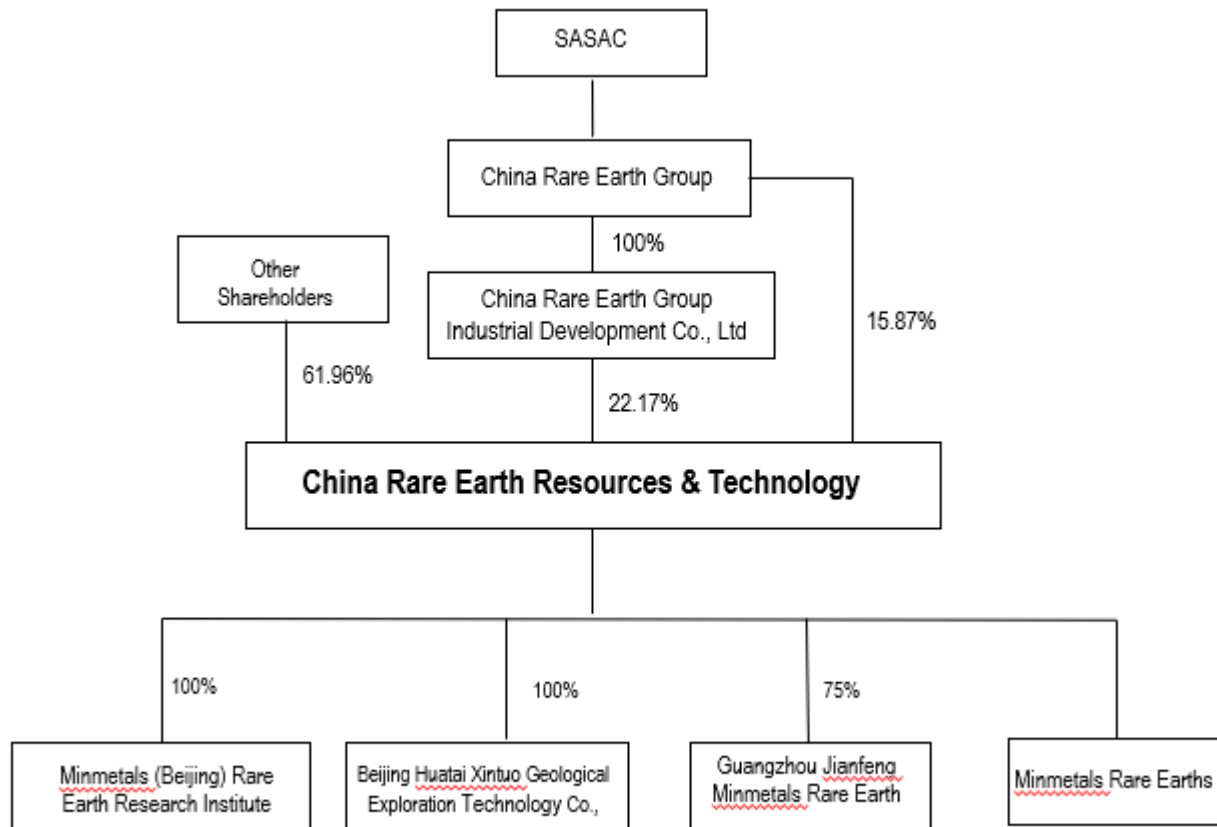
Name	Title	Biography
Mr. Yang Guo'an (杨国安)	Chairman	Mr. Yang previously served as Deputy Director and Researcher of the General Office of the Jiangxi Provincial SASAC, Director of the Polity and Regulations Office, Director of the Enterprise Reform and Restructuring Office, and Member of the Party Committee and Deputy Director of Jiangxi SASAC. He is currently Deputy Party Secretary, Director, and Chairman of the Labor Union of China Rare Earth Group CO., Ltd, and Chairman of the Board of 000831.SZ
Mr. Yan Shengjian (闫绳健)	General Manager and Director	Mr Yan previously served as Director and General Manager of MCC South Asia Investment Development Co., Ltd., and as Deputy General Manager of Minmetals Rare Earth Co., Ltd. He is currently Director and General Manager of China Rare Earth Group Resources Technology Co., Ltd., Chairman of Longchuan Yunlong Rare Earth Development Co., Ltd., Chairman of CRE (Tengchong) Rare Earth Co., Ltd., and Executive Director of CRE (Ganzhou) Rare Earth Co., Ltd..
Mr. Jia Jiangtao (贾江涛)	Deputy General Manager	Mr Jia previously served as Member of the Expert Committee, Consultant, EHS Director, and Chief Engineer of CNNC Weike Zirconium & Hafnium Co., Ltd., as well as Director and General Manager of Dingnan Dahua New Materials Resources Co., Ltd. He is currently Deputy General Manager of China Rare Earth Group Resources Technology Co., Ltd..
Mr. Zhao Xuechao (赵学超)	CFO	Mr Zhao previously served as Chairman of the Supervisory Board of the Supervisory and Audit Department of Guangdong Guangsheng Asset Management Co., Ltd, Party Committee Member and Vice President of Guangsheng Nonferrous Metals Co., Ltd., and Chairman of Longnan Helixin Rare Earth Smelting Co., Ltd. He is currently Chief Financial Officer of China Rare Earth Group Resources Technology Co., Ltd..
Mr. Huang Chengcheng (黄呈橙)	Board Secretary	Mr Huang previously served as Deputy General Manager of Minmetals Rare Earth (Ganzhou) Co., Ltd., Deputy Director of the Board Office of Minmetals Rare Earth Co., Ltd., and concurrently General Manager of Minmetals Rare Earth (Ganzhou) Co., Ltd. Also held positions as Deputy Director of the Office of China Rare Earth Group Co., Ltd., and Deputy Director of the Strategic Planning Department (Investment Management Department, Capital Operations Department) of China Rare Earth Group Co., Ltd. Currently serves as Board Secretary and General Manager of the Securities Department of China Rare Earth Group Resources Technology Co., Ltd., as well as Director of Dingnan Dahua New Materials Resources Co., Ltd., Director of Guangzhou Jianfeng Rare Earth Co., Ltd., and Director of Fujian Sanming Rare Earth Materials Co., Ltd..
Mr. Dong Xianting (董贤庭)	Director	Mr Dong previously served as Manager of the Planning and Development Department of Shanxi Huasheng Aluminum Co., Ltd., Deputy General Manager of Chalco Shandong Innuovo Strong Magnetic Materials Co., Ltd., Deputy General Manager of CRE Innuovo (Shandong) Magnetic Materials Co., Ltd., and Full-time External Director of China Rare Earth Group Co., Ltd. He is currently Director of China Rare Earth Group Resources Technology Co., Ltd..

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Source: Citi Research, Company Reports

Shareholding structure

Figure 113. China Rare Earth – Shareholding Structure (as of 1Q25)



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Source: Citi Research, Company Reports

Company history

China Rare Earth Resources & Technology Co., Ltd (“CRE”), formerly known as Shanxi Guanlv Co. Ltd., was established in 1998 and listed on the Shenzhen Stock Exchange in the same year. In 2009, China Minmetals Corporation acquired a 29.9% stake in Guanlv and became its largest shareholder in 2011. However, the company was delisted in the same year due to three consecutive years of losses. In 2012, the company acquired 100% equity of Minmetals Rare Earth (Ganzhou) and the Rare Earth Research Institute through a non-public share issuance. In 2013, it successfully resumed listing on the Shenzhen Stock Exchange via a backdoor listing and was renamed Minmetals Rare Earth. In 2014, the company acquired a 75% equity stake in Guangzhou Jianfeng. In 2016, it acquired 100% of Huatai Xintuo; In 2022, China Rare Earth Group became the company’s controlling shareholder through a transfer of state-owned equity, and the company was renamed from Minmetals Rare Earth to China Rare Earth.

Figure 114. China Rare Earth – Corporate Development Timeline

Year	Milestone
1998	Established as Shanxi Guanlv Co., Ltd; listed on SZSE
2009	China Minmetals Corp. acquired 29.9% stake
2011	Minmetals became largest shareholder; company delisted due to losses
2012	Acquired 100% of Minmetals Rare Earth (Ganzhou) + Rare Earth Research Institute
2013	Resumed listed on SZSE; renamed to Minmetals Rare Earth
2014	Acquired 75% stake in Guangzhou Jiafeng
2016	Acquired 100% stake in Huatai Xintuo
2022	China Rare Earth Group became controlling shareholder; renamed to China Rare Earth Group Resources Technology Co., Ltd

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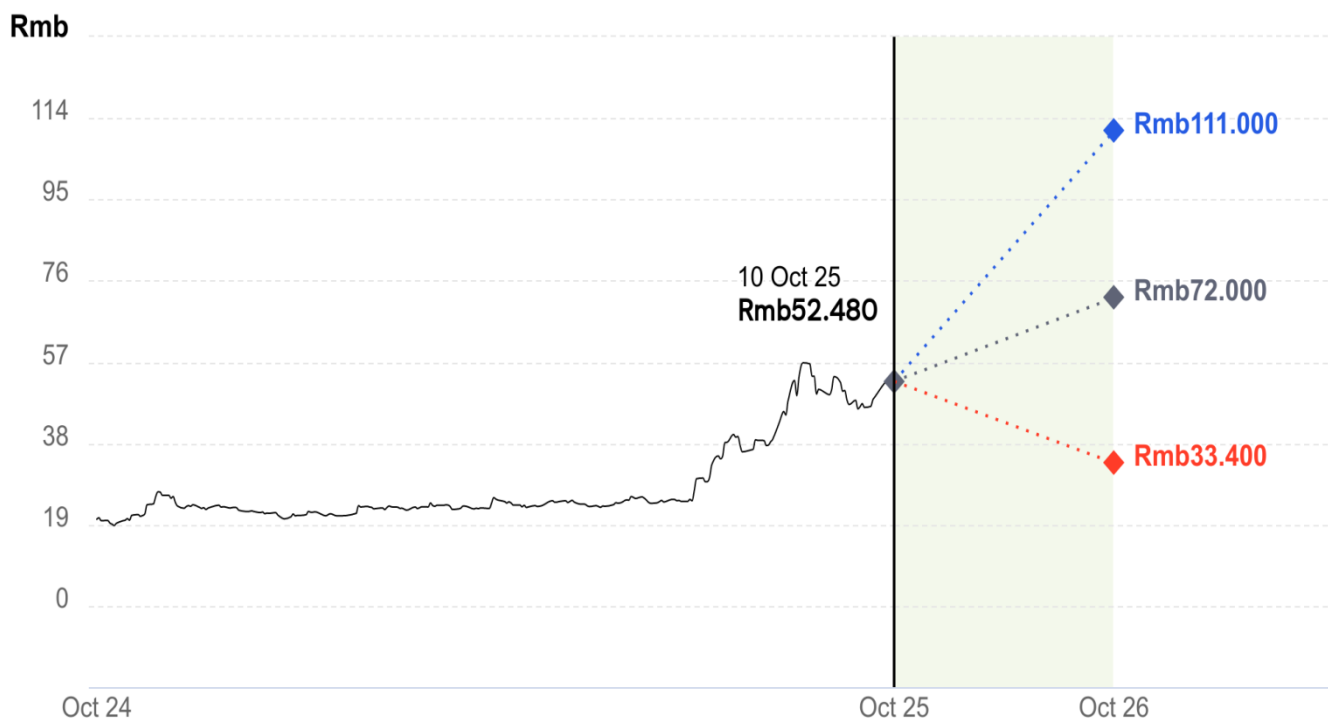
Source: Citi Research, Company Reports

Bull/Bear: China Northern Rare Earth High-Tech (600111.SS)

Rmb **111.000**
▲ 112% Upside

Rmb **72.000**
▲ 37% Upside

Rmb **33.400**
▼ 36% Downside



Spread 148pp
Current Price and expected returns (upside/downside) as of 10 Oct 2025



BULL Assumptions

- P/B multiple at 6sd above historical average



BASE Assumptions

- P/B multiple at 3sd above historical average



BEAR Assumptions

- P/B multiple at historical average

Bull/Bear: China Rare Earth Resources and Technology (000831.SZ)

Rmb **90.800**
▲ 66% Upside

Rmb **61.600**
▲ 13% Upside

Rmb **32.300**
▼ 41% Downside



Spread 107pp
Current Price and expected returns (upside/downside) as of 10 Oct 2025

BULL Assumptions

- P/B multiple at 6sd above historical average since 2018

BASE Assumptions

- P/B multiple at 3sd above historical average since 2018

BEAR Assumptions

- P/B multiple at historical average since 2018

China Northern Rare Earth High-Tech

Company description

China Northern Rare Earth Group High-Tech, under Baotou Iron & Steel Group (Baogang Group), is the world's largest rare-earth supplier by output. It operates the Bayan Obo Mine and controls over 60% of China's light rare earth quota. Known as the "first rare earth stock" in China, it was listed on the Shanghai Stock Exchange in 1997. The company also leads in separation, magnet materials, and research capabilities, supported by the Baotou Research Institute.

Investment strategy

We initiate Northern RE shares as Buy. Benefitting from captive access to Bayan Obo resources, NRE is China's largest LREE producer with a vertically aligned value chain from processing to downstream products. NRE is the largest REO producer globally with integrated mining-separation-downstream capabilities, benefiting from captive access to Bayan Obo resources. Its scale, technological capabilities, and diversified product mix underpin relatively stable margins and relatively low earnings cyclicality, positioning it as the best vehicle to capture sector tailwinds. While margins, are partly capped by cost-plus pricing from Baotou Steel, the company's long-term strategic positioning, policy support, and disciplined supply dynamics justify a premium valuation, in our view.

Valuation

We value Northern Rare Earth shares at Rmb72 using a P/B-based methodology given the sector's cyclical earnings pattern and policy-regulated nature. We apply a 9.5x target 2026E P/B, set at +2.0sd premium to the stock's historical P/B average since 2013 to reflect the sector's early-to-mid upcycle, supported by policy tailwinds, supply discipline, and the growing strategic importance of rare earths in electrification and supply-chain security. While we do not expect this cycle to match the intensity of the previous peak in 2021 – when valuations briefly reached over +4.5SD above the historical mean – we believe structural demand growth, tighter resource control, and stronger policy tailwinds justify a valuation toward the upper end of the historical range. The current multiple represents a mid-cycle premium rather than a peak-cycle assumption, balancing upside potential with demand and geopolitical uncertainties. Our valuation also reflects NRE's rising ROE profile of 9.3%/13.5%/16.6% for 2025E/26E/27E, well above its historical downcycle averages. Given the rare earth stocks' high sensitivity to trade barrier measures and rare earths policies in China, the US, and other key markets, we see scope for volatility even as fundamentals improve. Our target price is equivalent to 40.5x 2026E EV/EBITDA and 74.4x 2026E P/E.

Risks

Key risks for Northern Rare Earth, which could cause the shares to deviate from our target price, include: (a) Slower- or faster-than-expected downstream applications demand growth, including demand uncertainty from adoption trends in NEVs, wind power, or other applications; (b) Greater- or less-than-expected rare earths mining or processing capacity expansion outside of China, including global supply-chain diversification efforts that

could erode the market share of China enterprises, changes in Myanmar export capacity, etc.; (c) Tariffs and other trade barriers, including those imposed by the US or China, as well as other key global economies; (d) Rare earths price volatility from various factors including cyclical swings in rare earth oxide and magnet markets; (e) Policy and quota adjustments in China affecting supply, costs, and profitability; (f) Emergence of alternate materials or technologies that could substitute for rare earth elements in key end-user applications; and (g) Rare earth sector M&A and consolidation activity in China or in other global markets.

China Rare Earth Resources and Technology

Company description

China Rare Earth Resources & Technology Co., Ltd. (“CRE”) is engaged in three major business segments: 1) Rare Earth Materials: Mining, separation, production, and trade of rare-earth oxides, metals, and deep-processed products; 2) Technical Services: R&D, engineering, consulting in rare-earth technologies; new material development; and 3) Geological Survey: Investment in mining assets, exploration, resource processing, integrated utilization, and trade. It is the key listed platform of parent China Rare Earth Group.

Investment strategy

We rate China Rare Earth shares as Neutral. As a central SOE controlling medium-to-heavy rare earth resources, CRE holds a strategically vital position in supplying high-tech and defense sectors. Its core business currently centers on mining and primary separation, with limited downstream processing and value-added activities. Despite strong policy support and resource scarcity, current valuations appear elevated, reflecting strategic importance but leaving limited near-term upside, in our view.

Valuation

We value CRE shares at Rmb61.6 using a P/B-based methodology given the sector’s cyclical earnings pattern and policy-regulated nature. We apply a 12x target 2026E P/B, set at +1.5sd premium to the stock's historical P/B average since 2013 to reflect the sector's early-to-mid upcycle, supported by policy tailwinds, supply discipline, and the growing strategic importance of rare earths in electrification and supply-chain security. While we do not expect this cycle to match the intensity of the previous peak in 2021 – when valuations briefly reached over +4.5SD above the historical mean – we believe structural demand growth, tighter resource control, and stronger policy tailwinds justify a valuation toward the upper end of the historical range. The current multiple represents a mid-cycle premium rather than a peak-cycle assumption, balancing upside potential with demand and geopolitical uncertainties. Given the rare earth stocks' high sensitivity to trade barrier measures and rare earths policies in China, the US, and other key markets, we see scope for volatility even as fundamentals improve. Our target price is equivalent to 72.5x 2026E EV/EBITDA and 97.9x 2026E P/E.

Risks

Key risks for China Rare Earth, which could cause the shares to deviate from our target price, include: (a) Slower- or faster-than-expected downstream applications demand growth, including demand uncertainty from adoption trends in NEVs, wind power, or other applications; (b) Greater- or less-than-expected rare earths mining or processing capacity expansion outside of China, including global supply-chain diversification efforts that could erode the market share of China enterprises, changes in Myanmar export capacity, etc.; (c) Tariffs and other trade barriers, including those imposed by the US or China, as well as other key global economies; (d) Rare earths price volatility from various factors including cyclical swings in rare earth oxide and magnet markets; (e) Policy and quota adjustments in China affecting supply, costs, and profitability; (f) Emergence of alternate materials or technologies that could substitute for rare earth elements in key end-user applications; and (g) Rare earth sector M&A and consolidation activity in China or in other global markets.

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Appendix A-1

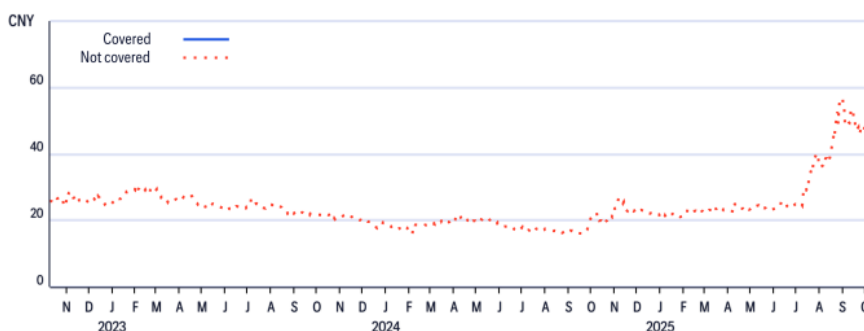
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IMPORTANT DISCLOSURES

China Northern Rare Earth High-Tech (600111.SS)

Ratings and Target Price History
Fundamental Research



*Indicates Change

Rating/target price changes above reflect Eastern Time

China Rare Earth Resources and Technology (000831.SZ)

Ratings and Target Price History
Fundamental Research



*Indicates Change

Rating/target price changes above reflect Eastern Time

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Data current as of 01 Oct 2025	12 Month Rating			Catalyst Watch		
	Buy	Hold	Sell	Buy	Hold	Sell
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Risk rating takes into account both price volatility and fundamental criteria. Stocks will either have no risk rating or a High risk rating assigned.

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