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Asia Emerging Robotics

Electric Revolution: Resilience – A Critical Chokepoint for Humanoid Robots and EVs

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Welcome to the 2026 edition of Bernstein's Electric Revolution series - our annual cross-sector look at the transformation of the EV landscape. This year, we focus on supply chain resilience, a theme rising in importance as EV adoption diverges by region and geopolitical risks intensify. OEMs and suppliers face growing pressure to anticipate, navigate, and recover quickly from disruptions across sourcing, production, and logistics, etc. In this note, we would like to focus on the critical supply chain chokepoint for humanoid robots and EVs.

Decoupling in robotics. The latest U.S. ban (link) on new foreign-made mobile robots (incl. humanoids and quadrupeds) marks a milestone in the decoupling of emerging robotics and could further extend to the broader Physical AI (e.g. intelligent vehicles, fixed robots). As Physical AI emerges as a strategic battleground among leading nations, control of critical chokepoints could ultimately determine who gains the upper hand.

Rare-earth magnets are critical to humanoid robots and EVs. Rare-earth magnets remain indispensable for high-performance motors (Exhibit 1, Exhibit 2), enabling high torque density, compact size, lightweight design, and thermal resistance. A humanoid robot can consume more than twice as much magnetic material as an EV motor (Exhibit 3), highlighting the growing strategic importance of rare-earth magnets. Beyond well-known neodymium (Nd) and samarium (Sm), rare-earth elements such as dysprosium (Dy), terbium (Tb), and praseodymium (Pr) are also critical for magnetic performance (Exhibit 4, Exhibit 5). We therefore see the entire rare-earth magnet value chain as strategically important.

China's dominance. China dominates the rare-earth magnet value chain across mining, refining, and magnet production (Exhibit 6, Exhibit 7). Rebuilding a comparable ecosystem elsewhere faces hurdles in raw-material availability, know-how, equipment, and economies of scale. International Energy Agency (IEA) expects China to maintain its dominance for the foreseeable future (Exhibit 8 to Exhibit 13), with recycling unlikely to materially mitigate supply chain risks (Exhibit 14).

China is sharpening its rare-earth toolkit. China is increasingly using rare-earth controls as a strategic response to geopolitical tensions and unfair trade restrictions, with measures becoming more forceful and targeted (Exhibit 15): 1) China has introduced a form of "long-arm jurisdiction" and 2) dozens of Japanese, U.S., and European firms were added to export-control lists. While China's approach has remained measured and restrained, its dominance across the rare-earth magnet value chain gives it significant leverage over global humanoid robot and EV industries.

Implications. We view China's dominance in rare-earth magnets as a strategic backstop in an increasingly multipolar world. This leads us to three conclusions: 1) Chinese EV (e.g. BYD) and humanoid OEMs could benefit from an improved competitive position overseas. 2) Chinese robotic actuator (e.g. Tuopu, Sanhua) and EV-motor suppliers (e.g. Inovance) could gain share globally, as rival supply chains remain more vulnerable to rare-earth magnet disruptions. 3) Non-Chinese rare-earth magnet players (Exhibit 17) could benefit from growing requests for supply-chain diversification.

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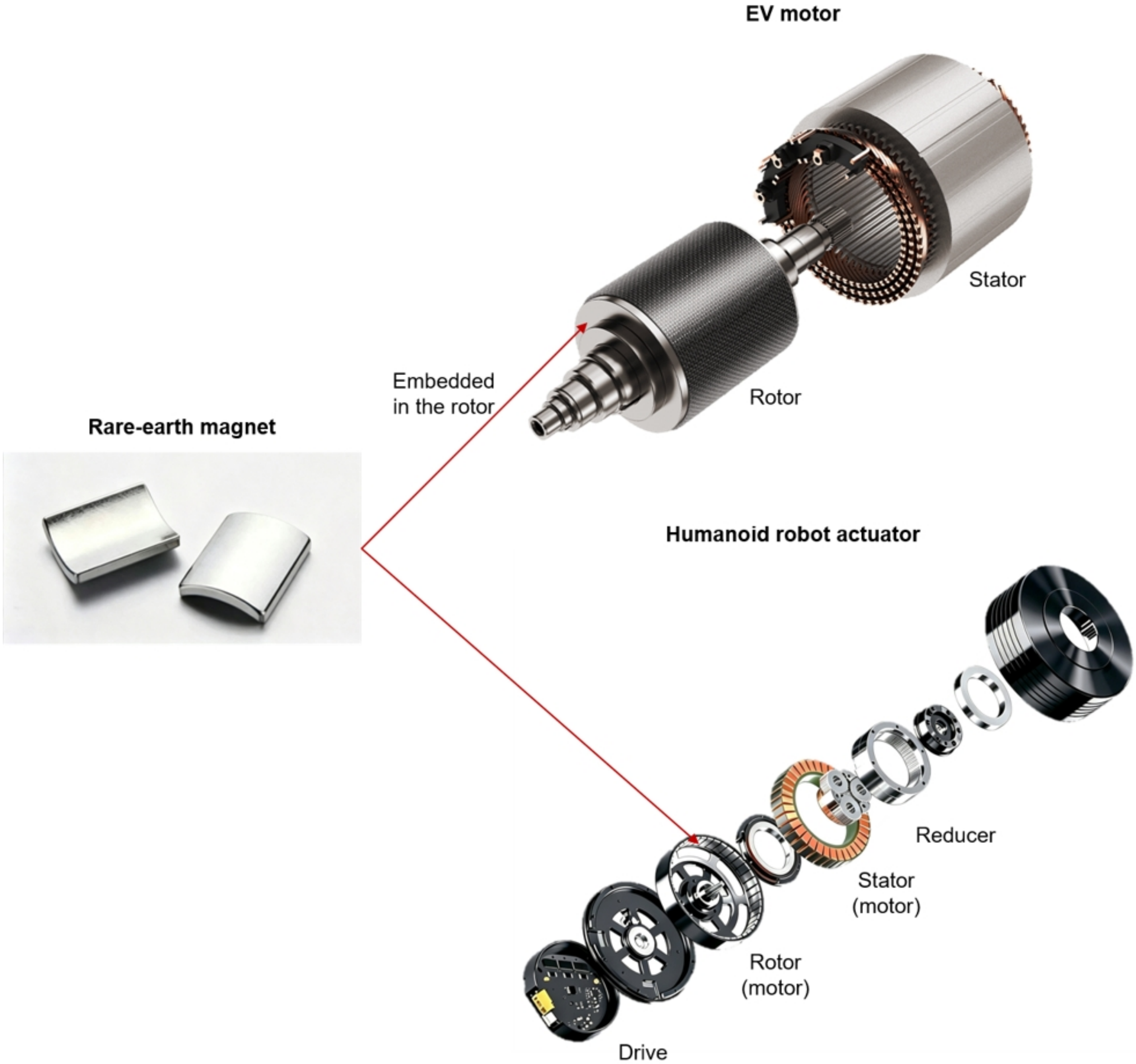
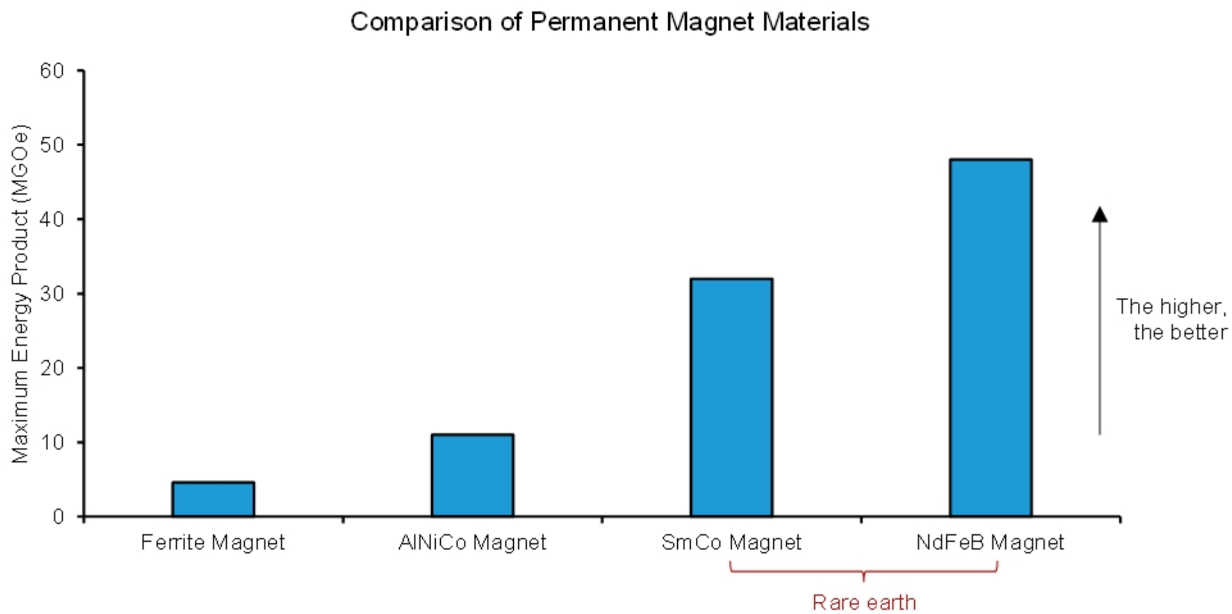
DETAILS

EXHIBIT 1: **Rare-earth magnets: Critical to EV motors and humanoid robot actuators**



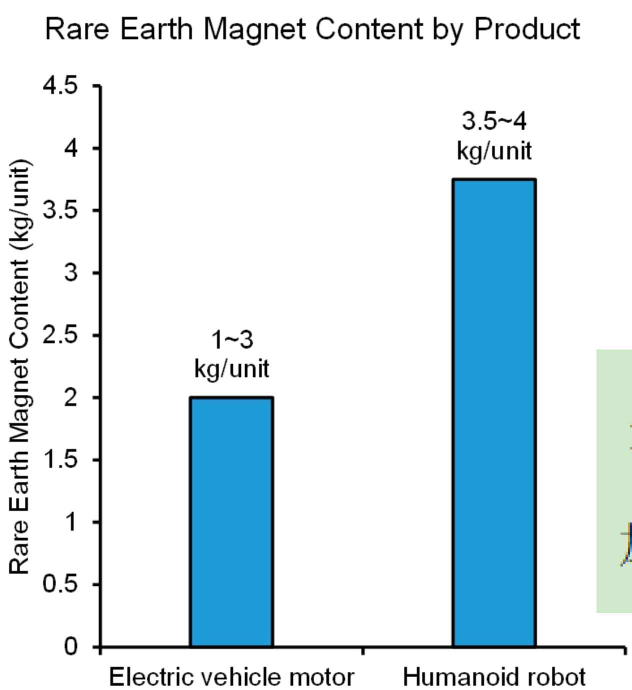
Source: Inovance Automotive, CubeMars, Bernstein analysis

EXHIBIT 2: **Rare-earth magnets deliver significantly stronger performance than non-rare-earth magnets**



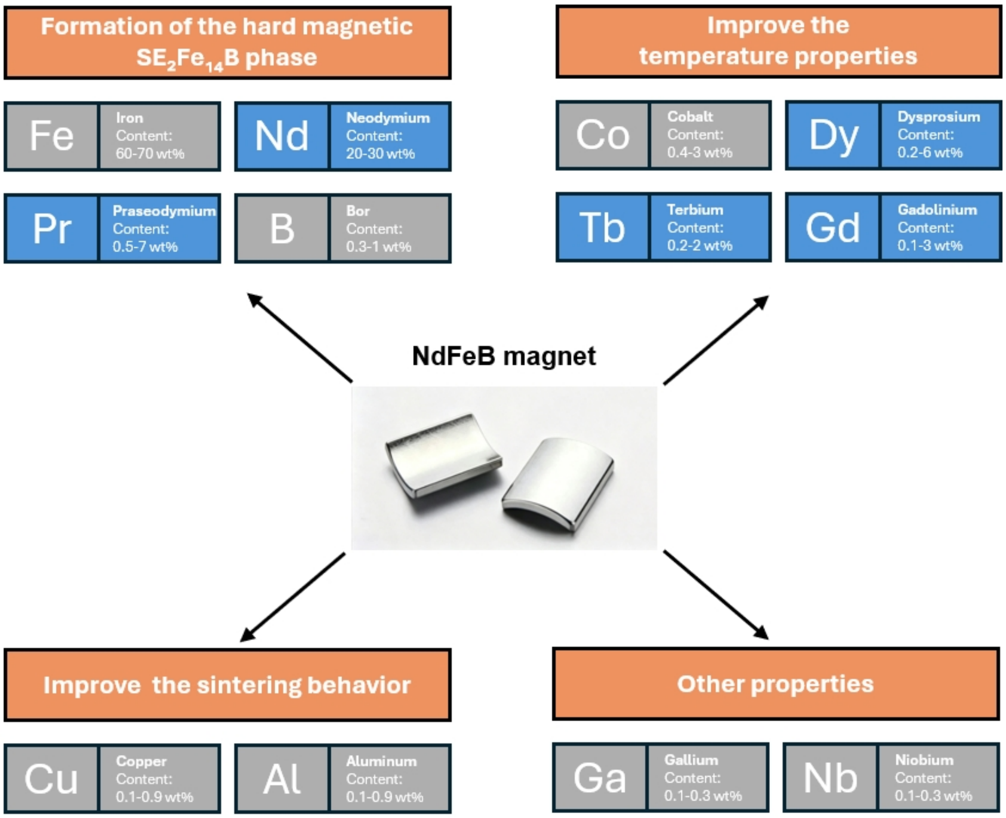
Note: The maximum energy product measures the greatest amount of magnetic energy stored inside a permanent magnet. Higher values mean a stronger and more compact magnet.
Source: Arnold Magnetic Technologies, Senz Magnet, National Taiwan Normal University, Bernstein analysis

EXHIBIT 3: **Rare-earth magnet content per EV motor and humanoid robot**



Source: Rare Earth Exchanges, IEA, China Northern Rare Earth, Bernstein analysis

EXHIBIT 4: **Rare-earth magnets (NdFeB) are composed of multiple raw materials, including various rare earth elements**



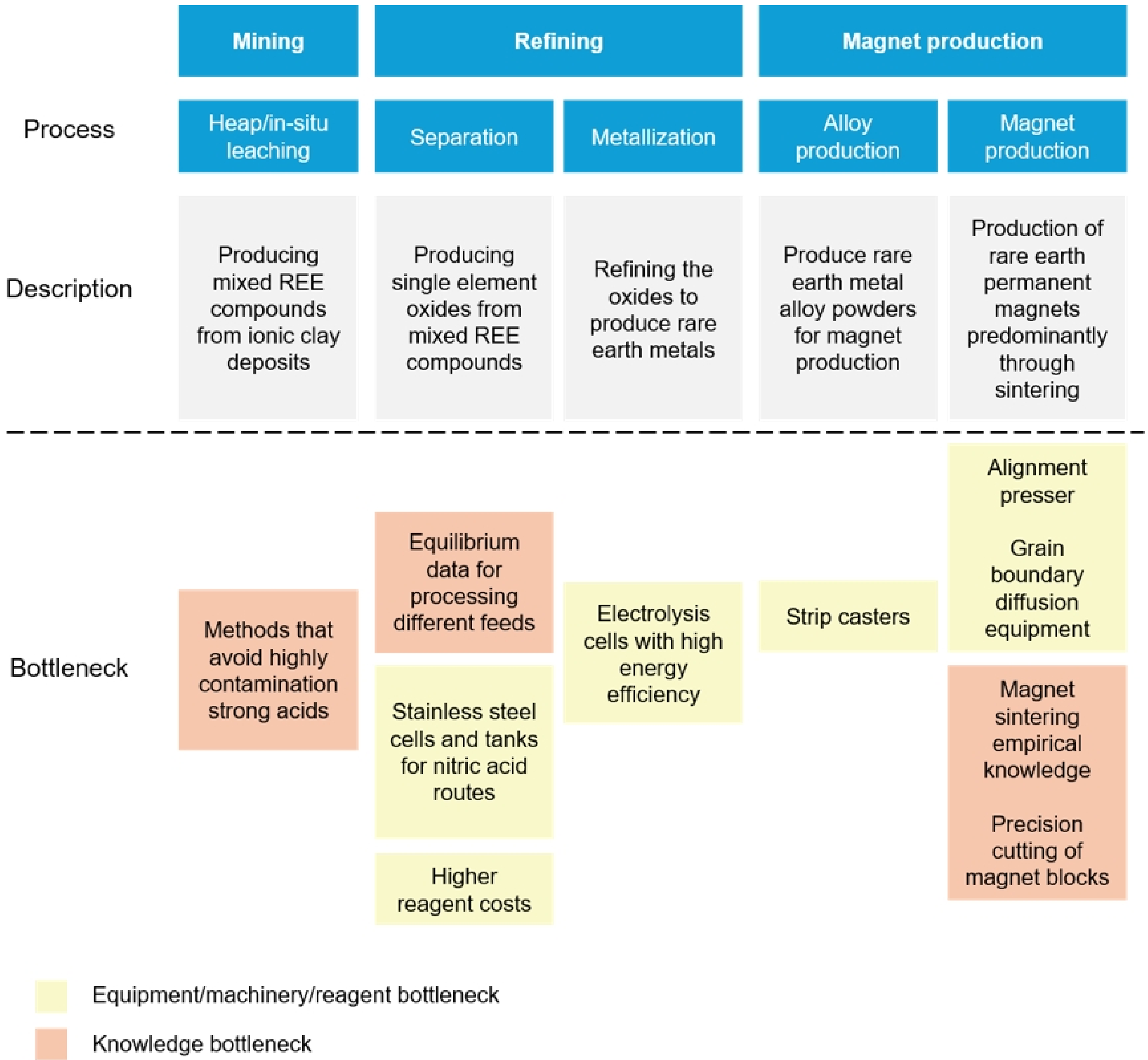
Note: Blue boxes indicate rare earth elements (REEs).
Source: Deutsche Rohstoffagentur, Bernstein analysis

EXHIBIT 5: **Rare-earth elements are critical to magnet performance, e.g. maximum operating temperature**

Max operating temp. (°C)	Approx. Dy content (wt. %)	Approx. Nd+Pr content (wt. %)	Example applications
80	<0.5%	29.5%	Toys, games, advertising, etc.
100	1.4%	28.6%	Hard disk drives, CD/DVD, MRI machines, sensors, refrigeration, etc.
120	2.8%	27.2%	Gauges, hysteresis clutch, magnetic separation, etc.
150	4.2%	25.8%	Wind power generators, industrial motors, electric bicycles, magnetic braking, general automotive applications, etc.
180	6.5%	24.5%	Commercial and industrial generators, wave guides, undulators, etc.
200/220	8.5% - 11%	19% - 21.5%	EV motors, hybrid vehicle motors, high temp. motors and generators, etc.

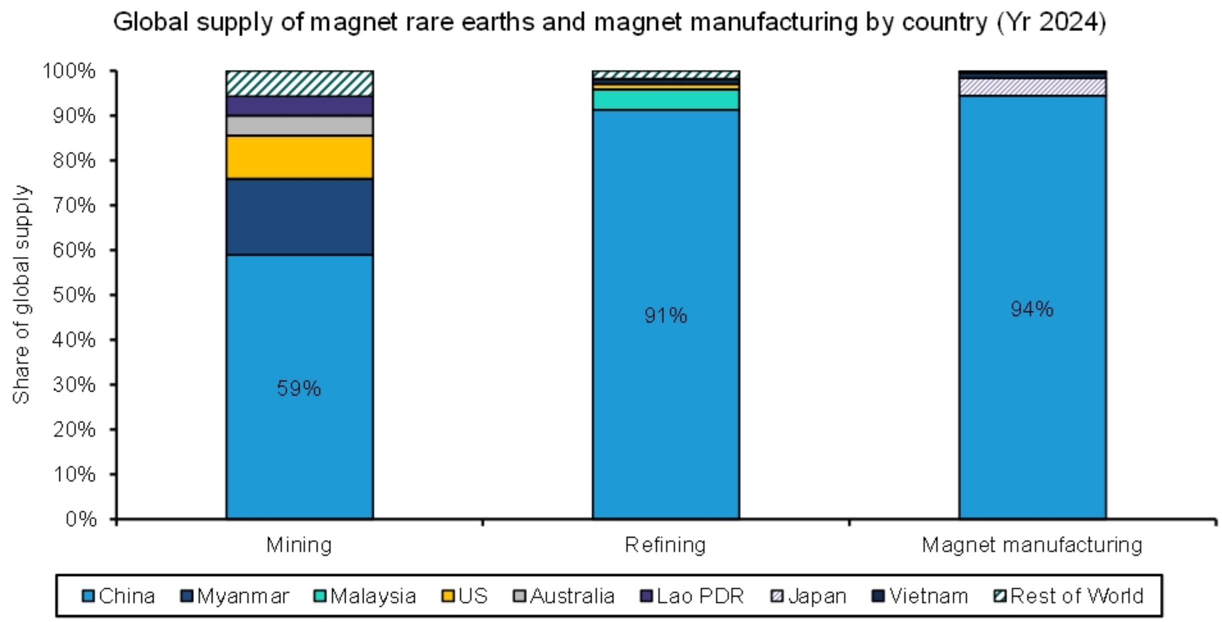
Source: U.S. Department of Energy, Bernstein analysis

EXHIBIT 6: **Rare-earth magnet value chain spans a series of technically demanding stages**



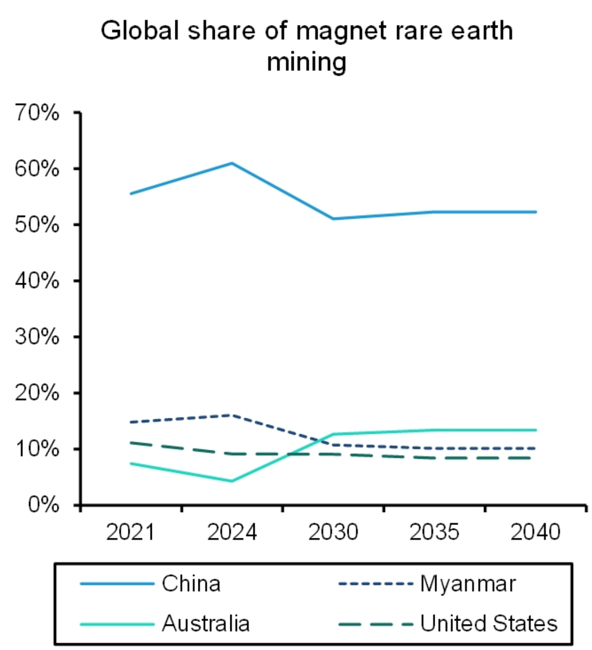
Source: IEA, Bernstein analysis

EXHIBIT 7: **China dominates the value chain of rare-earth magnet**



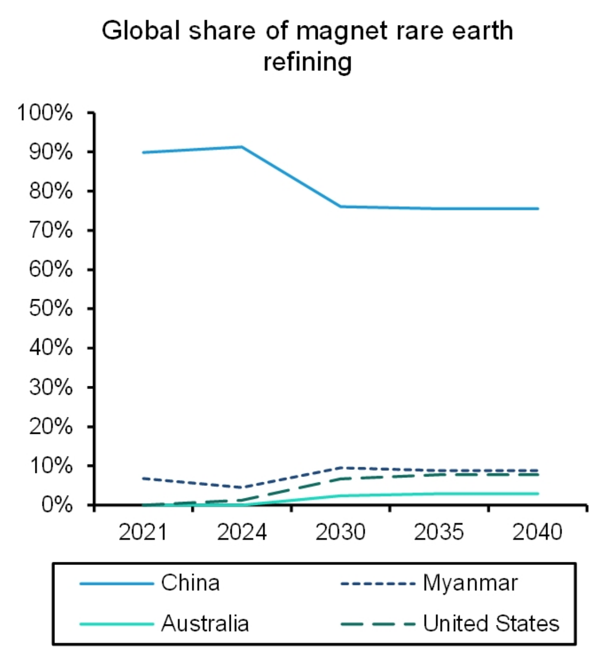
Source: IEA, Bernstein analysis

EXHIBIT 8: **According to IEA estimates, China will maintain a global share of >50% in magnet rare earth mining**



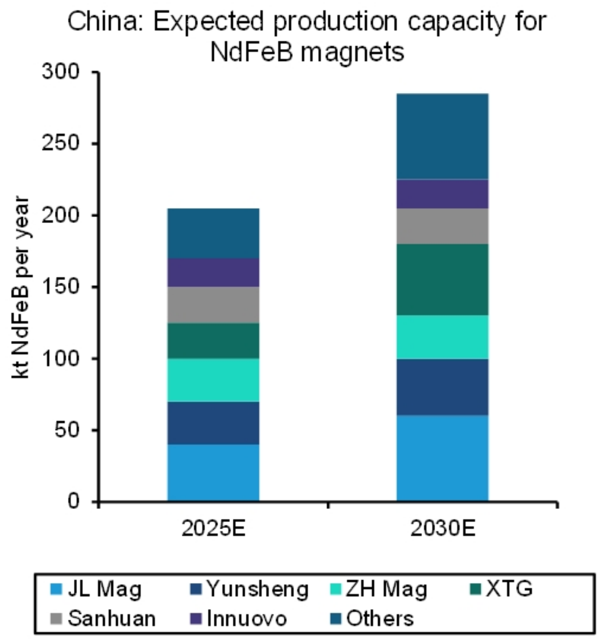
Note: IEA's projections are based on the pipeline of operating and announced mining and refining projects across countries.
Source: IEA, Bernstein analysis

EXHIBIT 9: **According to IEA estimates, China will maintain a global share of >75% in magnet rare earth refining**



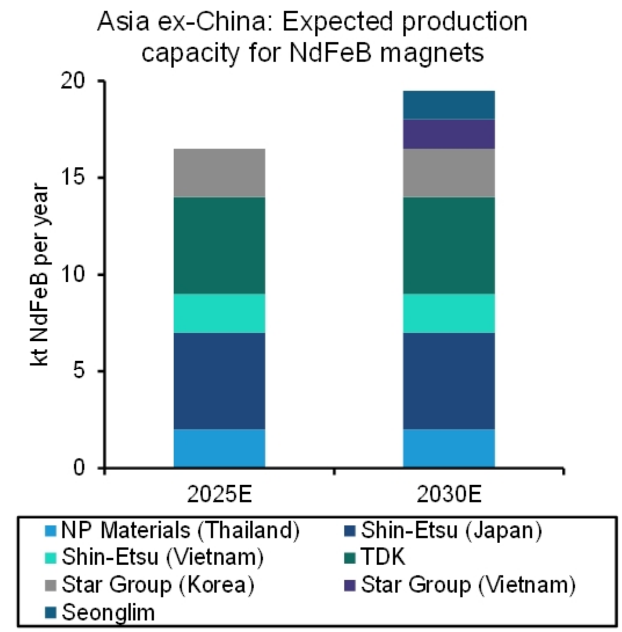
Note: IEA's projections are based on the pipeline of operating and announced mining and refining projects across countries.
Source: IEA, Bernstein analysis

EXHIBIT 10: **China: Production capacity of NdFeB magnets**



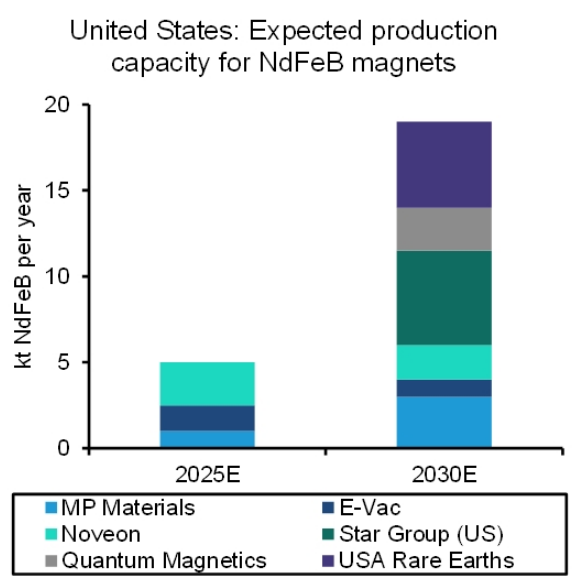
Note: The forecast is made by IEA. The list of projects is indicative of future magnet production capacity based on current announcements, it is not meant to be exhaustive.
Source: IEA, Bernstein analysis

EXHIBIT 11: **Asia ex-China: Production capacity of NdFeB magnets**



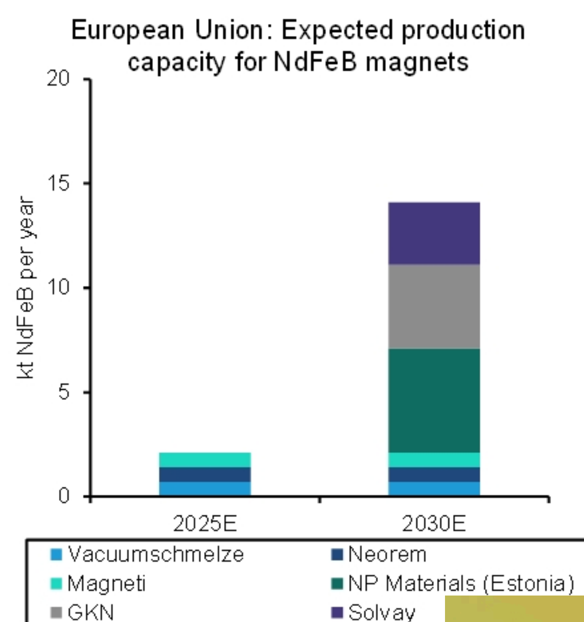
Note: The forecast is made by IEA. The list of projects is indicative of future magnet production capacity based on current announcements, it is not meant to be exhaustive.
Source: IEA, Bernstein analysis

EXHIBIT 12: **United States: Production capacity of NdFeB magnets**



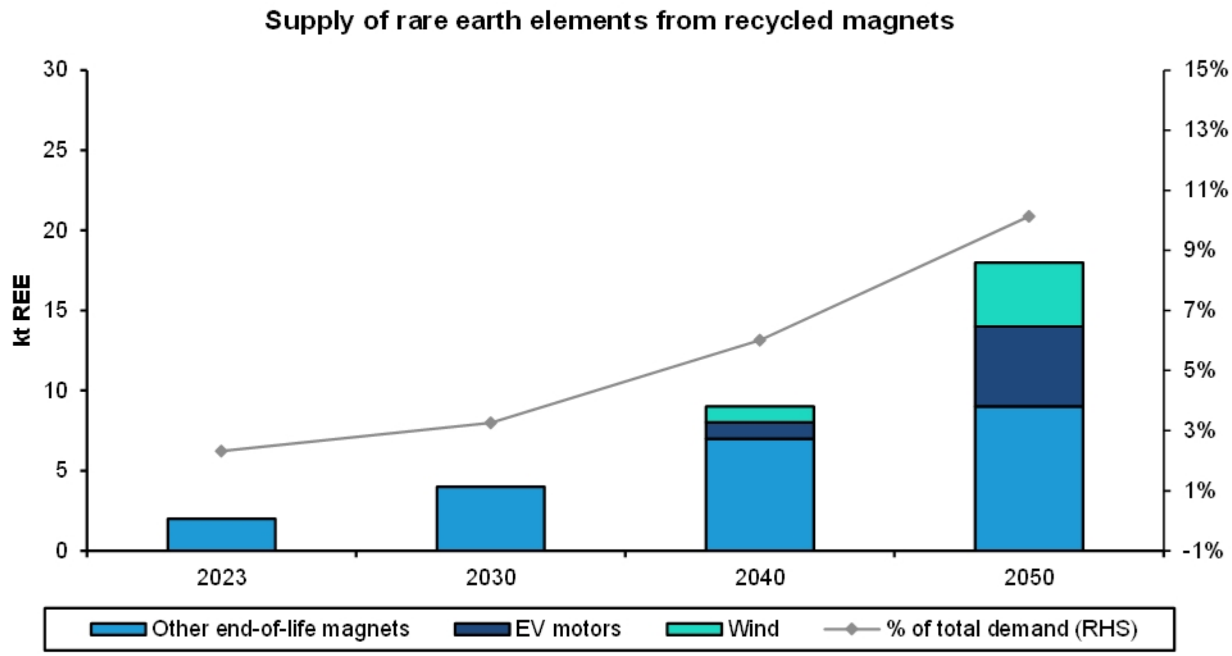
Note: The forecast is made by IEA. The list of projects is indicative of future magnet production capacity based on current announcements, it is not meant to be exhaustive.
Source: IEA, Bernstein analysis

EXHIBIT 13: **European Union: Production capacity of NdFeB magnets**



Note: The forecast is made by IEA. The list of projects is ind
magnet production capacity based on current announceme
be exhaustive.
Source: IEA, Bernstein analysis

EXHIBIT 14: **Magnet recycling is not enough to mitigate supply chain risks**

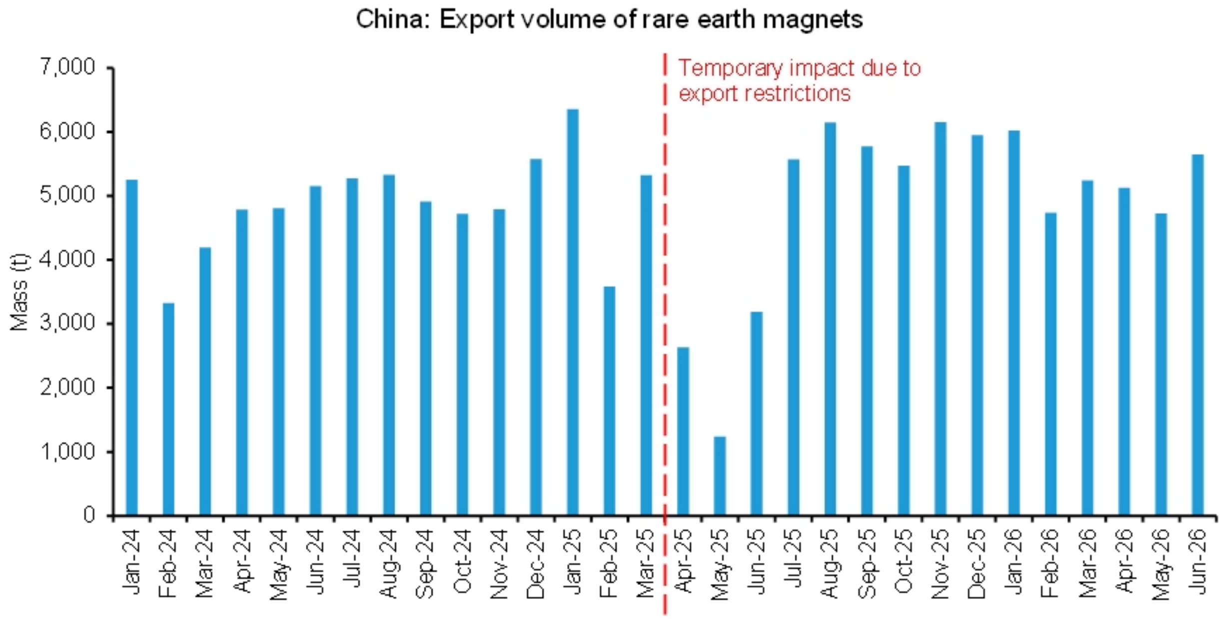


Source: IEA, Bernstein analysis

EXHIBIT 15: **China has been strengthening controls across the rare earth supply chain**

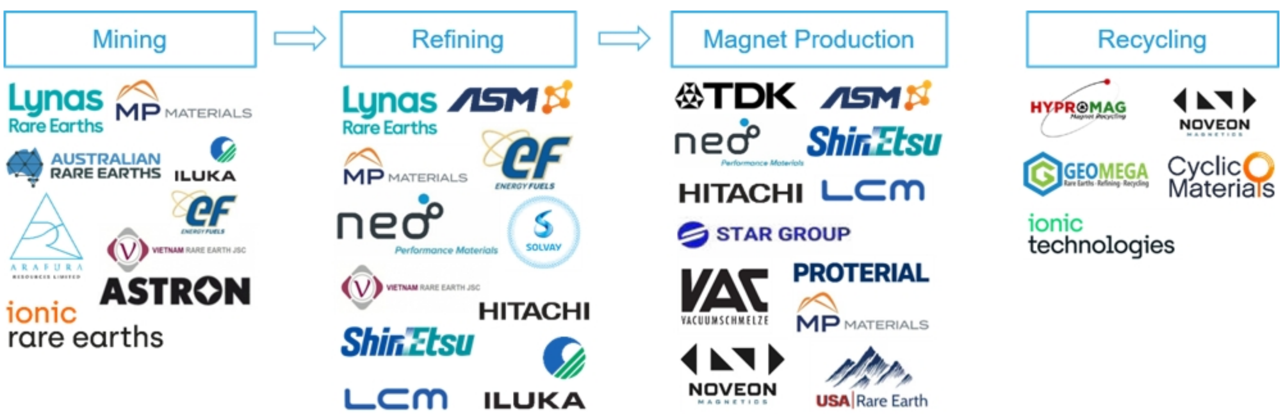
Note: Dy-containing NdFeB magnets, Tb-containing NdFeB magnets, and SmCo magnets are included in the dual-use items.
Source: IEA, MDPI, The Royal United Services Institute, China's Ministry of Commerce, Bernstein analysis

EXHIBIT 16: **China's export controls on 7 rare-earth-related items had an immediate impact on export volumes of rare earth magnets in mid-2025**



Source: China's General Administration of Customs, Bernstein analysis

EXHIBIT 17: **Rare-earth magnet players outside China**



Note: Solvay SA (SOLB.BB) is covered by Bernstein European Chemicals team and others are not listed or covered by Bernsten.
Source: Neo Performance Materials, company websites, IEA, Bernstein analysis

INVESTMENT IMPLICATIONS

We rate Shuanghuan, Tuopu, Inovance, BYD and Xiaomi Outperform, Sanhua and XPeng Market-Perform and Leader Drive Underperform.

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			3 Aug 2026		TTM	Reported EPS				Reported P/E (x)		
			Closing	Price	Rel.							
Ticker	Rating	Cur	Price	Target	Perf.	Cur	2025A	2026E	2027E	2025A	2026E	2027E
688017.CH (Leader Drive)	U	CNY	311.95	115.00	111.8%	CNY	0.69	0.83	0.96	450.5	374.0	324.4
601689.CH (Tuopu)	O	CNY	48.22	75.00	(27.3)%	CNY	1.61	1.81	2.36	30.0	26.7	20.5
2050.HK (Sanhua)	M	HKD	26.56	27.00	(31.3)%	CNY	1.03	0.97	1.11	22.2	23.5	20.7
002050.CH (Sanhua)	M	CNY	38.30	39.00	12.7%	CNY	1.03	0.97	1.11	37.2	39.4	34.6
002472.CH (Shuanghuan)	O	CNY	38.85	60.00	(17.6)%	CNY	1.50	1.70	2.00	25.9	22.8	19.5
1211.HK (BYD)	O	HKD	95.00	136.00	(51.1)%	CNY	3.58	4.90	6.90	22.8	16.7	11.9
1810.HK (Xiaomi)	O	HKD	27.90	43.00	(65.9)%	CNY	1.62	1.02	1.77	14.8	23.5	13.6
XPEV (XPeng)	M	USD	13.00	20.00	(46.1)%	CNY	(1.20)	(2.03)	0.45	(73.3)	(43.2)	194.3
9868.HK (XPeng)	M	HKD	49.00	78.00	(64.1)%	CNY	(0.60)	(1.02)	0.23	(70.5)	(41.5)	186.8
300124.CH (Inovance)	O	CNY	64.11	82.00	(31.8)%	CNY	1.87	2.19	2.65	34.3	29.2	24.2
ASIAX			1,914.70									
SPX			7,489.72									

O - Outperform, M - Market-Perform, U - Underperform, NR - Not Rated, CS - Coverage Suspended

Source: Bloomberg, Bernstein estimates and analysis.

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Underperform	SELL	13.1%	13.6%

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