India must liberate itself by plugging into its rare earth resources through policy and innovation

We Got Rare in Abundance

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Go forth and stumble on it

Homi J Bhabha, father of India's nuclear programme, sought to extract power from the sands along India's vast coastline. Eighty years later, the physicist's foresight might help India — and the world — break free of crippling dependence on China for rare earth (RE) magnets.

During the height of Cold War, Bhabha switched to using thorium, which is in abundant supply in India after US restricted enrichment of uranium for nuclear energy. The hunt for thorium led to the finding and extraction of neodymium as well. Kerala, Odisha and Tamil Nadu are rich in monazite, a key mineral source for both thorium and neodymium. With estimated reserves of 11.93 mn tonnes of monazite, which contains about 1.07 MT of thorium, a fourth of world's known thorium reserves are in India.

Compared to RE magnets like samarium cobalt, neodymium magnets are far more powerful, with the highest energy product. They are far more versatile, and less brittle than samarium cobalt, making them most cost-effective. According to Vivek Vikram Singh, group CEO of Sona Comstar — among the biggest importers of RE magnets into India — even without any heavy RE elements like dysprosium and terbium, which we have no access to, a neodymium-iron-boron (NdFeB) magnet will be only 10-15% weaker, but fully functional and be able to handle 95% of all applications. By adding copper, further improvements are also possible.

India can't shy away from developing indigenous magnets-making capacities. It has neodymium oxide, and IREL's annual production can easily be stepped up

But unlike China, India never really took the next step forward — converting neodymium oxides to metal. Neither did it process that metal to make permanent magnets for modern manufacturing usage. Beijing had the strategic vision to figure out that heavy RE magnets will one day run every motor in the world. By curbing its exports, China has brought the whole world to a skidding halt.

Even back in 2010, following a spat with Japan over the East China Sea, Beijing had weaponised RE exports. But Japan Inc came piggybacking on India's critical minerals and sourced neodymium from Indian Rare Earths Limited (IREL). That seeded Japan's own magnet manufacturing to insulate its domestic industries from future supply shocks. Today, 94% of the world's RE magnet capacity may well be in China. But Japan has managed to eke out a 4% share. The rest is scattered worldwide. If necessity made Japan wiser and innovative, it's time India — which got 53,700 tonnes of RE magnets shipped for multiple industry usage 'liberates' itself too.

Think of anything that needs a high-temperature motor, very-high torque, and is confined in small space — heat-resistant magnets are a must. Wind turbines, space, smartphones, robotics, fighter jets and missile systems, and domestic appliances, much of the world's modern tech relies on these magnets. EVs alone have 33% of total usage of these RE magnets that allow their motors to function at high speed. But they are also used in less exotic, though no less critical, functions performed by windshield wipers, headlights, starters, speedometers, speakers and seat-belt sensors.

It may weigh just 200 g and cost $2, but just one small component can shut down entire production. Being the 3rd-largest automobile market in the world, India is among those hardest-hit, as suppliers of OEMs are staring at the last leg of their inventory that may last till mid-July.

So, how did we land up on the brink of such chronic shortage? Raw materials, or RE mining, hasn't been the bottleneck. Value addition has. Without economies of scale, massive subsidies were essential for sustaining commercial developments. And China hammered prices to such low levels that 'Make in India' would have needed massive cash support for both capex and operating expenditures.

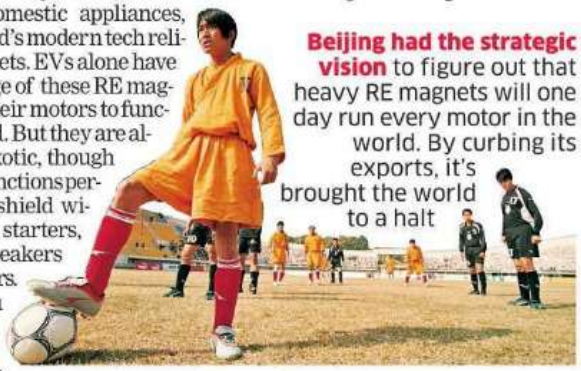
Still, quick-fix workarounds — like temporarily relocating the entire component supply chain and manufacturing to China — will only make us fall further into Beijing's hands. Currently, it's a ₹1,800 cr problem for India. But killing the homegrown components industry will have a multibillion-dollar impact, jeopardising both employment and enterprise.

So, what to do about magnets? A solution could involve three stages:

❶ In the short run, hammer out a diplomatic solution with China to save the domestic auto-component industry. But, fundamentally, India cannot shy away from developing indigenous magnets-making capacities. It has neodymium oxide, and IREL's annual production can easily be stepped up.

❷ Work with domestic miners like Vedanta and Hindalco to help with intermediary steps. If there was ever a strong economic case for PLI, this is it.

❸ Any component manufacturer with knowledge of metallurgy, and familiarity with processes like pressing, sintering, coating and forging, can step in to work with the metal powder and finish making the final product. With domestic capacity, heavy RE like dysprosium and terbium — currently on the ban list — can be imported from countries like Australia and other friendly nations that have massive untapped reserves of RE.



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RE mining, however, is a highly polluting activity. Ruining our coastal ecology for the sake of a magnet in EVs will involve costly trade-offs, and needs to be thought through. If their extraction comes at the planet's expense, the 'clean tech solution' will become part of the problem.

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