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The Global Rare Earths Battle: A Reality Check

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Introduction

The fall of Berlin wall and subsequent disintegration of the Soviet Union brought the Cold war era to a close and gave way to a sort of unipolar world with the sole superpower, US, at the helm. We are now witnessing the next change taking place in the world order. While in the past, changes in the world order were brought about through major wars or revolutionary changes in the political structures, this time around, economic power is the prime mover. This time, not a single bullet has been fired. Nor has there been a single Government or political system toppled. But the war for global supremacy is well under way with battles being fought on multiple fronts. The intense jostling for economic, geopolitical and military supremacy, technological - big data tussles like the Huawei 5G, efforts to depose US $ as the international currency of choice, the crude oil price games and even the raging Wuhan virus calamity, are all battles being fought on different fronts, as part of the larger war for global supremacy and a changed world order. While countries across the globe, from US to Japan and Norway to Argentina are fighting these battles out in the open, there is another battle that is being fought below the radar. It is **The Battle for Rare Earths**, a smaller battle at the moment, but with the potential for immense economic and strategic impact in the future.

Rare Earths & Its Increasing Significance

Rare Earth Elements (REE) are a set of 17 metals. These are Scandium, Yttrium and 15 other elements of the Lanthanide group of metal s which include Neodymium, Dysprosium and Holmium. *Rare Earths* (RE) are divided into two groups. Lanthanium to Europium (atomic Nos 57 to 63) are the *Lighter Rare Earth Elements* (LREE). Gadolinium to Lutetium (atomic Nos 64 to 71) are the *Heavy Rare Earth Elements* (HREE). Scandium (21) and Yttrium (39) are also considered REE. LREE are more abundant on earth's crust than HREE. Although they are called *Rare Earth*, except Promethium which is unstable, the others are relatively abundant in the earth's crust. Even the least abundant of REE, Thulium, is about 100 to 200 times more common than Gold, while Cerium, which is at the other end of the abundance spectrum is about 15,000 times more abundant than gold.

They are called REE due to the fact that they are found highly scattered and sprinkled across the planet in very low concentrates and are generally found mixed together with other deposits including radioactive elements. The difficulty in finding them in concentrations of adequate quantity which lends itself to be mined and separated economically is what makes them *Rare Earths*.

Extraction of RE from mines involves complex separation process. Rare earth extraction is one of the most environmentally destructive and toxic producing of all mining practices. A report by Aylin Woodward, published by Business Insider India on 4 June 2019 states that the Chinese ***Huamei Rare Earth High Tech Company*** located near Baolan, dumps its tailings in a 10 Square Km dam that can hold 230 million cubic meters of their waste[1]. This waste is also believed to contain radioactive tailings. There are no answers to questions about further disposal of this massive toxic lake or to questions regarding options for the safe storage of more waste products that are fast accumulating. It is obvious that, at least for the time being, such *irritating* environmental issues can be overlooked in China. Jamil Anderlini, reported from Shanghai on 11 November 2011, in the Financial Times, that China's ***General Administration of Quality Supervision*** has found excessive levels of toxic rare earths in a batch of the ***Iron Buddha Tea***, a product under Lipton Tea label, produced and sold in China by Unilever. Unilever later clarified that the RE metals had come from the soil where the tea was grown and had nothing to do with their manufacturing process[2].

REE display special luminescence, magnetic, electronics related, catalytic, heat resistant and optical properties. These special properties makes rare earth elements an essential ingredient in hundreds of products across a wide range such as fighter jets, ballistic missiles, guidance systems, electronic displays, lasers, radars, sonar, communications systems, GPS, Satellites, Oil refineries, automobile industry, fuel cells, aviation industry, surgery, jewellery, high end hi-tech consumer products like cell phones, computer hard drives, batteries and motors in electrical and hybrid vehicles, wind turbines, flat screen monitors, fiber optics, CFL, LED, solar panels and also in almost every clean energy and green technology application. The list is endless. A US Congressional Research Service paper dated 30 April 2012 reiterates the super magnetic strength of Rare Earths which enables extraordinary miniaturisation of components such as those in samarium-cobalt permanent motors used in the fins of precision guided bombs[3]. Similarly, Neodymium is a key element in hyper efficient motors, generators and wind turbines. Lanthanum is a major ingredient of hybrid car batteries. Terbium is vital for low energy lights and Cerium is used in Catalytic convertors.

Although the amount of REE used by weight or volume in a device may be very small, it is not possible as of now, to do without them. As a case in point, a Wyoming State Geological Survey report titled ***Wyoming's Rare Earth Elements*** quotes the example of the spindle motors and voice coils of desk tops and laptops[4]. This fact is further established in a study by Goodenough, and Meriman, wherein they concluded that

> *Though REE may only be used in very small volumes; they can provide performance or longevity benefits that some products rely upon, often making them difficult to substitute*[5].

It is for this reason that rare earth elements are referred by some as the 'vitamins of chemistry'. They produce powerful effects with small doses. In terms of cost, the cost of rare earths are measured in $ per Kg and per Kg cost of Rare Earths is about 20 to 40 times the cost of a ton of steel.

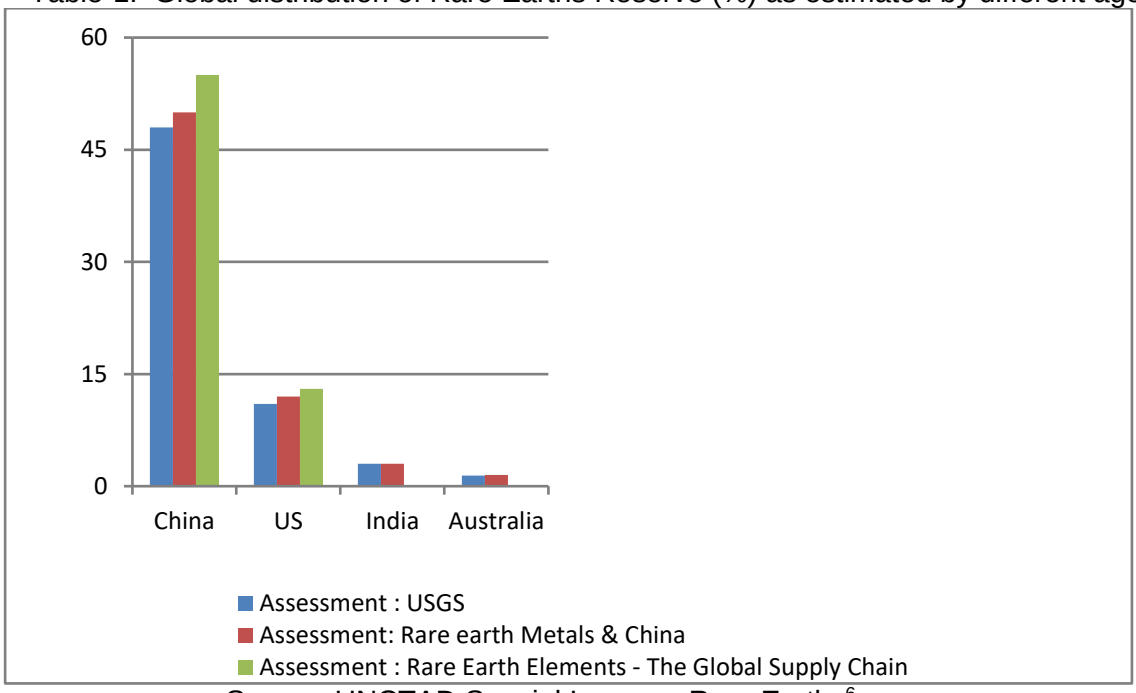
Global Rare Earths Reserves & China's Predatory March Towards Monopoly

Assessment of global rare earth reserves is a difficult exercise and the estimates vary from agency to agency. This aspect was highlighted in the UNCTAD's publication titled ***Commodities at a Glance: Special Issue on Rare Earths*** of May 2014. The report states

The large gap existing between various estimates of world Rare Earth reserves given by various sources of information shows not only the difficulty existing in estimating mineral reserves world-wide, but also the degree of political and economic sensitivity of the RE topic in the international scene.

The largest deposits of Rare Earth Elements are found in China followed by the US. Table 1 gives assessment of global rare earth reserves by three different agencies:-

Table-1: Global distribution of Rare Earths Reserve (%) as estimated by different agencies



Source: UNCTAD Special Issue on Rare Earths[6]

Till 1980's, Mountain Pass in California, was the main source of Rare Earths in the world. It produced 19,900 Tons of REE in 1974 which at that stage was 78% of global production which dropped to about 64% in 1984. By 1992, it dipped to about 1/3rd the global production and further nose dived to a mere 5% by 2002. Mountain Pass mine's journey is very instructive about the manner in which China ascended the Rare Earths ladder. A Congressional Research Service' Report recounts that the Mountain Pass mine operating at its full capacity in 1990's produced 850 gallons waste every minute which also contained radioactive Thorium and Uranium. Occasional pipe bursts spilling this hazardous waste into the desert became a serious concern 'MolyCorp', a unit of the US oil company 'UNOCOL' was ordered by the State of California to clean up the waste. In 2002, the already struggling MolyCorp ran out of space to store the waste from its mine and as a result, the mine had to be closed down[7].

The National Institute of Advanced Studies, Bangalore, in its 2013 publication ***Dominating the world: China and the Rare Earth Industry*** recounts the Chinese efforts to gobble up the entire spectrum of global Rare Earths manufacturing industry. In 2005 a Chinese consortium made an unsuccessful attempt to acquire the US oil giant UNOCAL as part of enlarging its oil interests. But behind the oil façade was the fact that UNOCAL also owned the Mountain pass mine[8]. The deal therefore, was not about oil, but about achieving monopoly in Rare Earths industry. In 2007, China abruptly cut RE supplies to WR Grace, the large US producer of catalyst for petroleum refining industry.

This was immediately followed by a new Chinese rationing policy for RE, which outrightly favoured Chinese domestic producers. The message was loud and clear. If you want access to RE material, shift your shop to China and get preferential treatment. WR Grace did exactly that to avoid being wiped out and moved base to China.

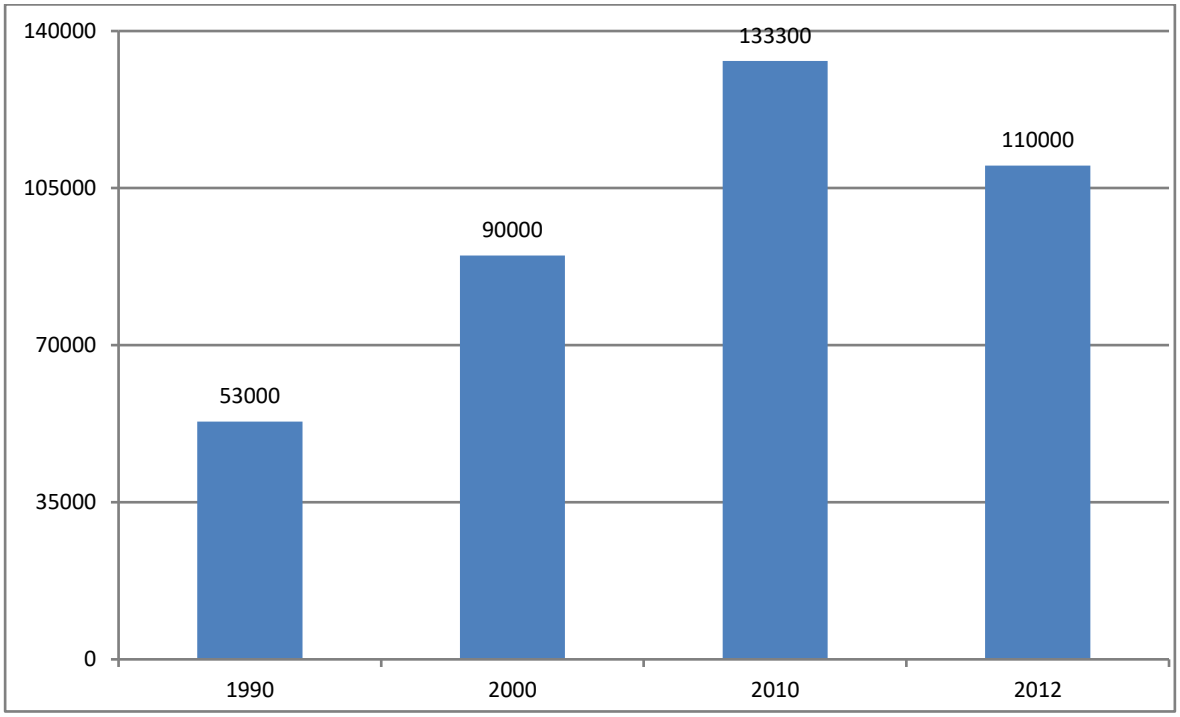
As a part of its efforts to acquire controlling stakes in foreign Rare Earths companies or coerce them to move their manufacturing base to China, an attempt was made to buy stakes in the Australian Lynas& Arafura Resources also. Jeffery A. Green, In his testimony before the ***U.S.- China Economic and Security Review Commission Hearing*** on ***China's Global Quest for Resources and Implications for the United States*** in January, 2012 stated

> *Then, during the 1990's, China's rare earths production increased drastically and they flooded the market by more than tripling the previous world supply of the materials. During this time, Chinese rare earth-producing firms were largely unprofitable but were allowed to survive through direct and indirect support by the Chinese government. This backing enabled China's rare earth industry to continue to mine and export these materials at prices far below the actual costs of production. With the additional industrial advantage of a low labor cost, questionable environmental standards, and export taxes, the impact of these efforts were swift and dramatic: within 20 years China went from producing roughly one-third to nearly all of the world's supply of rare earths. Mines in the United States and elsewhere, unable to remain profitable against cheap Chinese exports, went out of business"[9].*

The Red Giant did not stop at merely being the raw material provider to the world and had clearly set its sights well beyond. As part of its efforts to acquire the niche 'Rare Earth permanent magnet' technology by any means, in 1995, China commenced attempts to acquire Magnequench, a General Motors subsidiary which was making permanent magnets in the US. It is evident that the run up to the 'acquisition offer' was very well conceived and executed, because, the acquisition was allowed by US, with certain conditions. What stands out in this acquisition process is that, soon after the contract stipulated curbs expired in 2002, all assets of Magnequench were moved to China by its new owners. By 2012, China had attained the unassailable position as the Global Rare Earths leader[10]. Details of the global and country wise production of REE are given in tables 2 and 3.

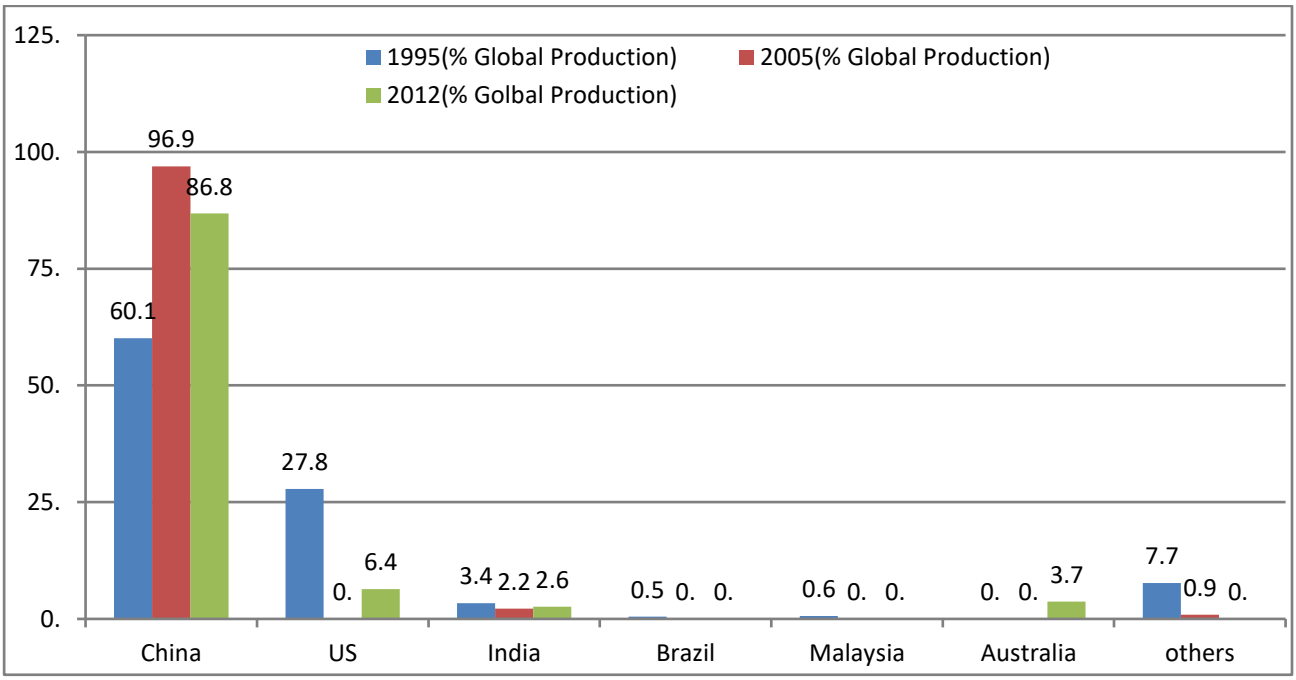
The incredible growth of China from a modest player to the towering Global Rare Earths giant in a matter of just two and a half decades has been brought about through a very carefully thought out plan. Deng Xiaoping, in a speech in January 1992 had said "There is oil in the Middle East, rare earths in China" and "we need to properly manage our rare earth resources and make the most of our country's develop-ment" . It is evident that the Chinese followed this dictate in letter and spirit. China now controls not only the raw materials but also production of the key intermediaries that go into a vast array of hi-tech growth industries. As per the UNCTAD report, the aggregate market capitalization of the top ten US& Western Companies together account for a small fraction, a mere one fifth the size of just one Chinese firm, the Inner Mongolia's Baotou Steel Rare Earth High Tech Company Limited. The present global Rare earth eco system is so designed that, regardless of which corner of the world breakthroughs in Rare earths technology may happen, China is the best placed to exploit such breakthroughs. For countries that depend on China for upstream REE inputs, China's relentless acquisition of advanced technologies used in manufacturing Rare Earths related goods poses a major worry regarding their capacity to com-pete with China for manufacturing such goods.

Table 2 – Global REE Production (Metric Tons): 1990 – 2012



Source: UNCTAD. Commodities at a Glance, Special issue on Rare Earths May 2014

Table 3: Country wise global REE Production (%): 1995, 2005 & 2012



Source: UNCTAD Secretariat from Mineral Commodity Summaries (various issues), US Geological Survey

China demonstrated her brute disdain for diplomacy and free trade regulations of raw materials by using the Rare Earths card for political arm twisting when it reacted swiftly and ruthlessly and cut off Rare Earths Supplies to Japan following the 'fishing trawler' collision and arrest of the Captain of the Chinese trawler near the Senkaku island in September 2010. This is what the Chinese Premier Wen Jiabo had to say on 7 October 2010, after the incident,

> *We haven't imposed, and will not, impose an embargo on the industry*[11]*.*

Later in a speech Wen Jiabo said,

> *We are pursuing a sustainable development of the rare earth industry, not only to meet the demand of our own country, but also to cater to the needs of the whole world. We not only need to accommodate the current demand, but also, more significantly, need to take a long-term perspective. It is necessary to exercise management and control over the rare earth industry, but there won't be any embargo. China is not using rare earth as a bargaining chip. We aim for the world's sustainable development*[12]*.*

China has always defended its Rare Earths policies by adopting a convenient stance that its policies are not political, protectionist or discriminatory but are purely guided by environmental concerns and better management and conservation of resources. Compare Wen Jiabo's statement with what Paul Krugman had to say after the incident, in the New York Times editorial on 17 October 2010,

> *… shows a Chinese government that is dangerously trigger-happy, and willing to wage economic warfare on the slightest provocation ... …. Couple the rare earth story with China's behavior on other fronts — the state subsidies that help firms gain key contracts, the pressure on foreign companies to move production to China and, above all, that exchange-rate policy — and what you have is a portrait of a rogue economic superpower, unwilling to play by the rules*[13]*.*

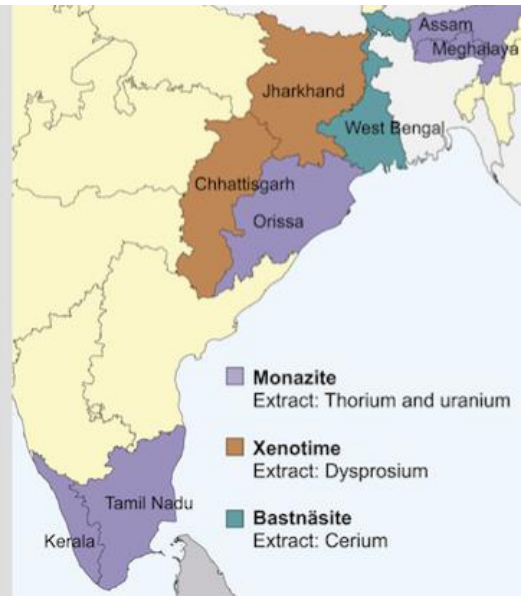
Raghav Bahl, in his book ***Super Economics*** describes the arm twisting and Rare Earths price manipulation that China indulged in to throw the Americans out of Rare Earths race, first by driving down market prices between 1992 and 1996 and after having established monopoly, sending the prices soaring high during 2006 to 2010 by steadily slashing its export from 62,000 tons in 2006 to roughly half that amount by 2010. Bahl further recounts the first time that countries came together to attack China's Rare Earths monopoly when US, backed by the EU, Japan, India, Canada and a host of other countries lodged a complaint with the WTO against China in March 2012 for violating free trade regulations of raw materials through quotas and tariffs on Rare Earth.

Despite China adopting a stance that its actual rare earth deposits were far below what was being put out by rest of the world and that controls were being imposed by it purely for conservation and environmental protection, the WTO ruled against China[14].

Rare Earths: Where Does India Stand

As far as India is concerned, Saurav Zangeneh, says that India holds about 6% of worlds Rare Earths reserves but remains a low cost 'material provider'. He argues that the country needs to focus on strategic exploitation of its Rare Earths resources by valorising it by creating an eco-system for manufacture of Rare Earths downstream products instead of just selling the oxides. India also needs to adopt the policy of *Technology in exchange for Resources* that was very effectively implemented by China whereby foreign companies with Rare Earths technology were nudged to set up production facilities in China and gradually transfer the technology to their Chinese partners, in exchange for cheaper raw materials[15].

India has adequate potential to exploit upstream resources, especially deposits of Rare Earths contained in the beach sand and carbonate complexes of its west coast[16]. A glimpse of India's Rare Earths potential is shown in the map below.



Wake Up Call & the Way Forward

Consequent to the Fishing Trawl collision incident near Senkaku and the Chinese response to Japan through the 'Rare earth' route, the world has started thinking of alternatives. However, so far, action has been limited to isolated reactions by the affected countries, with no concrete united response from nations around the world. US resumed mining in Mountain Pass in 2018. But the Mountain Pass ore is still shipped to China, where it is separated and processed, before being shipped back to the US. US is now beginning to change this strategy. Blue Line, a US processor of Rare Earths has signed a MoU with Lynas, Australia to build a separation facility in US. Further, in May 2019, the Pentagon initiated a process to fund rare earth magnetic production in the country. There are also reports of Rare earths exploration work in the Round Top mines in US.

A provision has been introduced in ***the US National Defence Authorisation Act***, signed into law in 2018, which prohibits the Department of Defence from buying permanent RE magnets made in China[17]. US recently signed a MoU with Greenland to conduct a hyper-spectral survey to map the country's geology, as part of their initiatives to secure future supplies. It is believed that the Kvanefjeld deposit in southern Greenland has great potential for RE, although the road ahead, for resolution of environmental concerns and policy endorsements to make this a reality, could be long and hurdle ridden. There are also some very encouraging initial reports of large RE deposits underneath Japanese waters.

The Dragon has shown that it will spit fire at will. What is the way forward for rest of the world? Considering the lead time required for possible alternative sources to go into production, there is no escaping from the Dragon's clutches in the short term or even in the medium term. Although turning off the Rare Earths tap will have adverse impact for China as well, China's past track record should sound a loud warning to rest of the world.

Chinese believe that while the US was sorting out the Middle East and Afghanistan, they were wisely focusing on economic development. This draws an eerie comparison in today's scenario where the world is busy fighting the Chinese gifted Wuhan virus, while China itself, after gifting the virus to the world, is back with business as usual, and is busy gobbling up companies and huge stakes in distressed markets around the world.

The global community needs to adopt a collaborative approach. Countries which have the upstream Rare Earth ore resources, those with technology for refining the ores and those with the knowhow for manufacturing the Hi-tech downstream products must come together and evolve a joint win-win model. The successful collaborative models of *International Space Station* and the *Large Hadron Collider* project should provide the incentive and give us plenty of hope. Renewed efforts aimed at exploring new sources of RE and search for alternative material as substitute for Rare Earths must form part of this effort. Research must also focus on mining and refining processes which cause barest minimum environmental damages, more efficient use of RE and efficient recycling methods. There is a need to enter into Long term contracts and commitments for exploration and development of mines as well as manufacturing of downstream products.

Conclusion

China, although an economic giant already, is still only a middle income economy. It still has a long road ahead to become a high income economy. The realistic possibility of China *Growing old before growing rich* also looms large. Therefore, despite having manoeuvred to a totally monopolistic position with the world at its mercy, China is most unlikely to use RE beyond a point and create inadvertent obstacles and turbulence for itself, in its relentless pursuit of its long term objectives. That may just give the world the window of opportunity to get its act together. Till then, the tailings of RE will have to remain in China.

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