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RESHAPING THE RARE EARTH SUPPLY CHAIN: US INITIATIVE AND INGENUITY IN THE ROW

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The US-China competition has been taking on a new shape in the past three years since the trade war (2018), which is resulting in the rolling back of all their trade and economic engagements. The recent bill, "Compete Act of 2022", passed by the US House of Representatives, is another step towards greater competition and more disengagement in the supply chain. The geopolitical side of the rare-earth industry began long ago. There is less knowledge about that, among other reasons, for the Japanese bombing of Pearl Harbour in 1941. One was Japan's growing concern about its global ambitions being threatened by the United States when the US imposed export restrictions on critical raw materials and oil. To secure its crucial supply chain, Japan chose the path of proactive violence. The tables have turned and critical resources have changed now, as the US is the one facing restrictions and threats to the supply chain of rare-earth elements.[1]

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1. Brendan P. Dziama, Juan Manuel Chomo Perez and Andreas Ganser, "Rare Earths: Fighting for the Fuel of the Future", *The Diplomat*, January 8, 2022, at https://thediplomat.com/2022/01/rare-earths-fighting-for-the-fuel-of-the-future/#:~:text=Rare%20earths%20are%20as%20critical,quietly%20secured%20a%20near%2Dmonopoly.&text=While%20most%20Americans%20are%20familiar,attack%20are%20much%20less%20understood. Accessed on April 2, 2022.

US-CHINA REE SUPPLY CHAIN CONNECTION

It is noteworthy that the US was the dominant source of REE in the world till 2000. US geologists and mining firms discovered the Mountain Pass rare-earth mine (California) in 1949, which enabled them to dominate the global RE production and supply chain.[2] The US even attempted to get China's geological exploration by negotiating with China's soon-to-be exiled KMT government. But that negotiation never reached fruition due to the People's Liberation Army (PLA) defeating the KMT.[3]

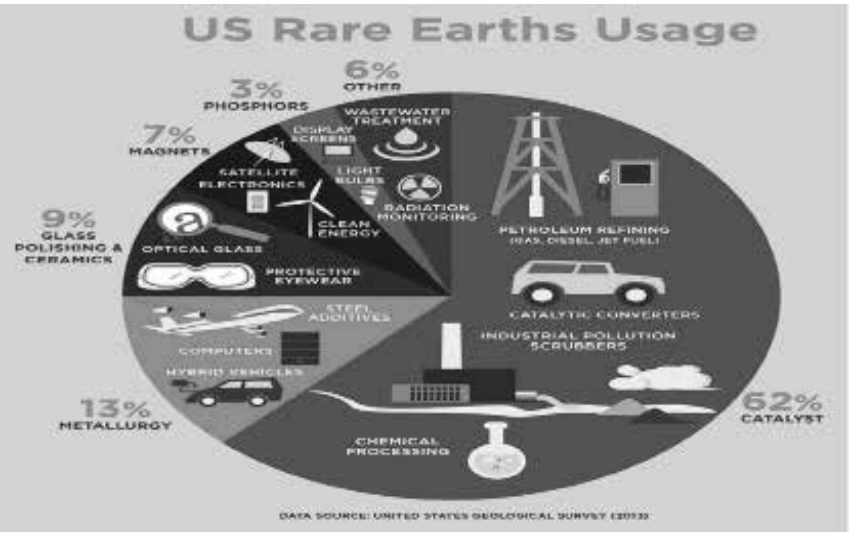
In the 1980s, a regulation was imposed by the Nuclear Regulatory Commission and International Atomic Energy Agency that eliminated the extraction of those rare-earth minerals bearing uranium and thorium. This forced the US to either stop making thorium-uranium or find new ways of extraction. Failing to do both made the Mountain Pass power plant shut down and end its years of domination. While rare-earth production was increasing in China in those years. The failure resulted in the sale of the last US rare-earth manufacturing facility Magnequench to shut down in 1997, and sold to two Chinese companies.[4]

The US dependence on Chinese rare-earth elements continued for the production of electrical vehicles, wind turbines and drones (see Figure 1). As reported by US Geological Survey, the US imported 80 per cent of its RE materials from China in 2019, and 98 per cent in 2020.[5] The main source of dependence remained the United States' limited domestic manufacturing capacity. The United States military dominance is solely due to its reliance on rare-earth elements, as all precision-guided weapons, stealth technology, drones, and satellites

2. James C. Kennedy, "Rare Earth Production, Regulatory USA/International Constraints and Chinese Dominance: The Economic Viability Is Bounded by Geochemistry and Value Chain Integration", in *Rare Earth Industry* (Edinburgh: Elsevier Inc., December 2016), 37-55, at http://dx.doi.org/10.1016/B978-0-12-802328-0.00003-6. Accessed on April 5, 2022.
3. Henry Elderfield Greaves and Mervyn J. Greaves, "The Rare Earth Elements in Seawater", *Journal of Nature* 296: 214-19, March 18, 1992, at https://doi.org/10.1038/296214a0. Accessed on April 9, 2022.
4. Ibid.
5. Agence-France-Presse, "Rare Earth Metals at the Heart of China-U.S. Rivalry", *The Hindu*, June 14, 2021, at https://www.thehindu.com/news/international/rare-earth-metals-attheheartofchinausrivalry/article34806588.ece. Accessed on March 30, 2022.

require these elements (see Figure 2). For example, the F-35 fighter jet, which is critical to US defence and future warfare, contains 920 pounds of rare earth.[6] The US consumption of rare earth elements and market size is assumed to increase by 2025 (see Figure 3).

Figure 1: Rare-Earth Usage in the United States



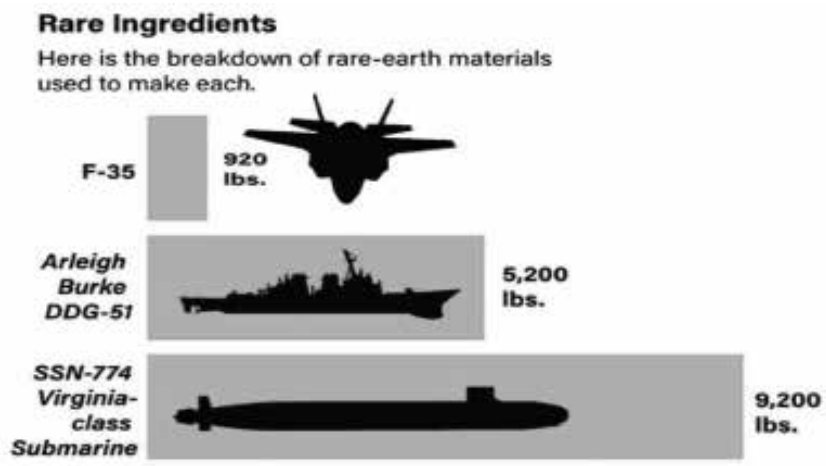
Source: "Rare Earth Elements: Metals, Minerals, Mining and Uses", Geology.com, at https://www.google.com/url?sa=i&url=https%3A%2F%2Fgeology.com%2Farticles%2Frareearthelements%2F&psig=AOvVaw2anrmzpr7qMvhJTYwjW7OP&ust=1649325235680000&source=images&cd=vfe&ved=2ahUKEwjtqM23lf_2AhUr73MBHRXLCQAQjRx6BAgAEAk. Accessed on March 9, 2022.

The CEO of USA Rare Earth, Pini Althaus, said: "The risk has been well-established since President Xi's not so veiled threat last year during his visit to a Chinese rare-earth facility, announcing that potential bans on rare-earth exports to the U.S. as a trade war retaliation." He further said: "From a national security standpoint, having the U.S. military rely on China for rare earth for their fighters

6. Brendan P. Dziama, Juan Manuel Choman Perez, et al., "Rare Earth: Fighting for the Fuel of the Future", *The Diplomat*, January 8, 2022, at https://thediplomat.com/2022/01/rare-earths-fighting-for-the-fuel-of-the-future/. Accessed on April 8, 2022.

and Tomahawk cruise missiles is just not prudent. And there is also the high-tech world and US manufacturing to think about."[7]

Figure 2: Rare Earth Use in US Military Equipment

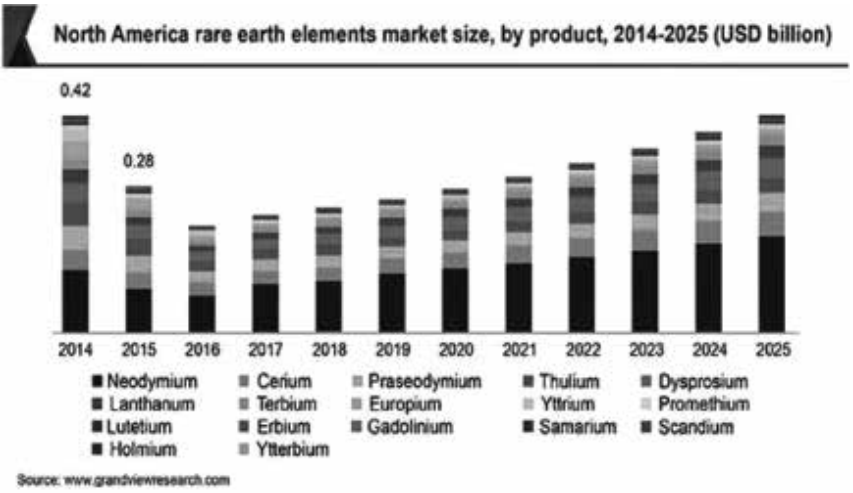


Source: *US Air Force Magazine*. 2018. https://www.airforcemag.com/article/rare-earth-uncertainty/. Accessed on April 10, 2022.

The US-China trade dispute begin to take shape with actions and decisions of US President Donald Trump, such as withdrawal from the Trans-Pacific Partnership; renaming of NAFTA as the US-Mexico-Canada Agreement (USMCA); and allegations against China for disrespecting the intellectual property rights of US companies. The US administration imposed its first tariffs on China in July 2018 and added Huawei technologies to the entity list in May 2019. By June 2019, tariffs had risen to more than US$ 250 million. In retaliation, China also imposed tariffs and restricted market access for American products. However, the most important retaliation was the embargo on the exports of rare-earth metals and their compounds. The official newspaper of the Chinese Communist Party's Central Committee, *Renmin Ribao*, wrote, "We advise the U.S. side not to underestimate

7. Jim Vinoski, "The U.S. Needs China For Rare Earth Minerals? Not For Long, Thanks To This Mountain", *Forbes*, April 7, 2020, at https://www.forbes.com/sites/jimvinoski/2020/04/07/the-us-needs-china-for-rare-earthminerals-not-for-long-thanks-to-this-mountain/. Accessed on April 5, 2022.

Figure 3: Rare Earth Market Consumption in North America



Source: "Rare Earth Elements Market Size, Share & Trends Analysis Report", Grand View Research. https://www.grandviewresearch.com/industry-analysis/rare-earth-elements-market. Accessed on April 12, 2022.

the Chinese side's ability to safeguard the development rights and interests. Don't say we didn't warn you." This reflected the confidence of China in its monopoly over the REE supply chain, which can seriously affect the importer countries, and how China can use the rare-earth metal as potential bait to negotiate their demands.[8] In 2020, China again threatened to cut off the supply of rare earth to the US when Taiwan had a defence deal with the US, particularly with the F-35 producer, Lockheed Martin. The trade war and the follow-up actions by China demonstrated how costly it would be for the US if it didn't reduce its reliance on Chinese rare earth.[9]

WHAT ARE RARE-EARTH ELEMENTS?

According to the IUPAC definition, "Rare Earth Metals are a family of 15 elements in the periodic table, which starts with Lanthanum

8. June Teufel Dreyer, "China's Monopoly on Rare Earth Elements", *Asia Program Analysis*, Foreign Policy Research Institute, October 7, 2020, at https://www.fpri.org/article/2020/10/chinas-monopoly-on-rare-earth elements-and-why-we-should-care/. Accessed on April 10, 2022.
9. Ibid.

and ends with Lutetium, called together as 'Lanthanides Group'."[10] Because of their unique electronic configuration with "4f0 to 4f14" orbital electron cells ([Xe]4f0 to [Xe]4f14), their physical and chemical properties are comparable and occur in nature under similar physico-chemical conditions. Two more elements from Group 3A, Yttrium (Atomic # 39) and Sc (Atomic # 21), are also often included as REEs because of their similarity in physical and chemical properties and geochemical affinity with REEs. Of these seventeen REEs that were discovered in the late 18th and early 19th centuries, Yttrium was the first in 1794, and Promethium was the last to be discovered in 1947. Of these REEs, Pr (Promethium At #61) does not occur in nature.[11]

CHINA'S DOMINANCE IN RARE EARTH SUPPLY CHAIN

For China, resource security is both a national strategic priority and an economic "soft rib", and its potential for geostrategic use of REEs is reflected in its 95-97 per cent critical elements production capacity. China dominates in all aspects of REE supply chains: production, processing, and research and development. It has developed thirteen rare-earth deposits, has 44 million metric tonnes of reserves, and a production capacity of 14 million metric tons. The dominance of China owes much to its revolutionised rare-earth production and processing technology. In order to modernise its high-tech sector, China invested in research and development and started two high-tech innovation programmes called 863 and 973.[12]

China's entry into rare earth politics began through the Sino-Soviet Industrialization Programme in 1956 when Russia began to develop trial alloys in China to develop its own aircraft and ballistic missiles. But the collaboration was tricky, as China continued to supply uranium to assist in the construction of military and

10. Stefania Massari and Marcello Ruberti, "Rare Earth Elements as critical raw materials: Focus on International markets and future strategies", Journal of *Resource Policy*, 38: 36-43, March 2013, at http://dx.doi.org/10.1016/j.resourpol.2012.07.001. Accessed on April 12, 2022.
11. A. Wyttenbach, V. Furrer, P. Schleppi and L. Tobler, "Rare Earth Elements in soil and in-soil grown plants", *Kluwer Academic Publishers*, 199: 267-73, February 1998, at https://doi.org/10.1023/A:1004331826160. Accessed on April 13, 2022.
12. Jost Wübbeke, "Rare earth elements in China: Policies and narratives of reinventing an industry", *Resource Policy*, 38 (3): 384-94, September 1, 2013, at https://doi.org/10.1016/j.resourpol.2013.05.005. Accessed on April 13, 2022.

Table 1: The Seventeen Rare-Earth Elements

Rare Earth Name	Discovery Year	Atomic Name & Number	The Chemist Who Named It	Light/Heavy REE	Critical/ Uncritical	Abundance in the Earth Crust (Parts per million)	Usage
Yttrium	1788	Y-39	Sweden, Johan Gadolin	Heavy	Critical		Metal Alloys and Night Vision Goggles
Cerium	1803	Ce-58	Europe, John Jacob Berzelius	Light	Excessive	60.0	Automobiles
Lanthanum	1839	La-57	Sweden, Carl Gustaf Mosander	Light	Uncritical	30.0	Optical Glasses, Night Vision Goggles
Erbium	1842	Er-68	″	Heavy	Critical	2.1	Fibre and Optic Cables Machine
Terbium	1843	Tb-65	″	Heavy	Critical	0.7	Visual Display and Fuel Cells
Ytterbium	1878	Yb-70	Sweden, Jean-Charles Galissard	Heavy	Excessive	2.0	Stainless Steels

Holmium	1878	Ho-67	Sweden, Per Teodor Cleve	Heavy	Excessive	0.8	High Strength Magnets and Glass Colouring
Scandium	1879	Sc-21	Scandinavia, Lars Fredrik Nilson	Heavy	Critical	16.0	Defence Equipment
Samarium	1879	Sm-62	France, Paul-Émile Lecoq de	Light	Uncritical	5.3	Nuclear Reactors
Thulium	1879	Tm-69	Sweden, Per Teodor Cleve	Heavy	Excessive	0.3	Lasers, Portable, X-ray Machines
Praseodymium	1885	Pr-59	Germany, Carl Auer von Welsbach	Light	Uncritical	6.7	Lasers
Neodymium	1885	Nd-60	″	Light	Critical	27.0	Laser Ranger Finders Communication
Dysprosium	1886	Dy-66	France, Paul-Émile Lecoq de	Heavy	Critical	3.8	Permanent Magnets

Europium	1886	Eu-63	Europe, Eugène-Anatole Demarçay	Heavy	Critical	1.3	Optical Fibres
Gadolinium	1886	Gd-64	Sweden, Johan Gadolin	Heavy	Uncritical	4.0	X-ray and Scanning
Lutetium	1907	Lu-71	Austria, Carl Auer von Welsbach and Georges Urbain	Heavy	Excessive	0.4	Petroleum Refining
Promethium	1947	Pm-61	America, Jacob A. Marinsky, Lawrence E. Glendenin, and Charles D. Coryell	–	–	10^{-18}	Doesn't Exist Like Earth, But Its Isotopes Are Available in the Radioactive Elements

Source: Rose Ragsdale, "Rare earth metals see new medical uses", *Metal Tech News*, June 27, 2020, at https://www.metaltechnews.com/story/2020/04/29/tech-metals/rare-earth-metals-see-new-medicaluses/217.html#:~:text=Holmium%20lasers%20emit%20at%202.1,problems%20with%20a%20thulium%20laser. Accessed on July 16, 2021.

communication bases in the Soviet Union, in the hope of technology transfer for China's nuclear weapons programme. Then, China got to know that the Soviet Union was enhancing its nuclear expertise separately, outside of the Sino-Soviet plan. China began to develop its own rare-earth industry in 1956, and when China conducted its first nuclear weapon test in 1964, the realisation further developed of the need to develop research programmes for rare earths and other non-ferrous metals. The main credit goes to Dr. Xu Guangxian, who is called the "Father of China's Rare Earth Industry" as it was his discovery of the "Cascade theory of countercurrent extraction" that developed ways of isolating uranium while extracting rare earths. This revolutionised rare-earth production and marked the beginning of China's technological superiority in the rare-earth sector. Due to his research, China launched two high-tech innovation programmes, 863 and 973, to modernise its high-tech sector.[13]

China even launched multiple policies and plans such as the "Rare Earth Industry Development Plan (2009-2015)" in 2005 to have a long-lasting transformation of the REE industry. In 2012, the "Rare Earth Industry Accession Requirements" were released to uplift the production and stop illegal mining. An "Implementation Proposal of Clean Production Technologies in the Rare Earth Industry" was released in 2014, which generalised rare earth engineering and reform for cleaner production.[14]

China has two key laboratories working on rare-earth elements: (1) the State Key Laboratory of Rare Earth Materials Chemistry and Applications under Peking University; and (2) the State Key Laboratory of Rare Earth Resource Utilization under Changchun University. Aside from that, China is the only country with journals dedicated to rare earths: the *Journal of Rare Earths*, edited by Professor Xu Guangxian, and the *China Rare Earth Information Journal*, edited by scientists.[15]

However, China went down to the second-highest after Myanmar recently, from the lead rare exporter for over two decades. The

13. Ibid.
14. J. H. L. Voncken, "Economic aspects of the Rare Earths", in *The Rare-Earth Elements: An Introduction*, SpringerBriefs in *Earth Sciences: Switzerland*, pp. 107-14, December 2016, at http://dx.doi.org/10.1007/978-3-319-26809-5_6. Accessed on April 14, 2022.
15. Ibid.

reserves of rare earths are the highest in China but are not the only source. Besides China, the heavy rare earth monazite minerals can be found in Australia, Brazil, India, Malaysia, South Africa, Sri Lanka, Thailand and the US. Furthermore, the light rare-earth minerals are mostly found in China and the United States. It should be noted that even the monopoly of China has been falling sharply in the past decades, with its reserve share reduced from 70 per cent in the 2000s to only 38 per cent in 2020. Its production capacity declined to 58.3 per cent in 2020 from 81.4 per cent in 2016.[16] In order to maintain its monopoly under these falling trends, China has begun investing in the rare earth mines of countries like Myanmar, Madagascar, Greenland, Pacific Ocean, Afghanistan and other possible sites.

USA'S INITIATIVES AND INGENUITY

The increased monopoly of China on emerging technologies and critical minerals gives it leverage, which has been a growing cause of concern for the US. The Senkaku/Diaoyu Island Dispute (2012) was the first event to mark the interest of the world, most particularly the US and Japan, in securing their supply chain. The first action in this response was in 2013, when the US House of Representatives passed H.R. 761, declaring the availability of rare earths essential for economic growth, national security, technological innovation, and manufacturing and agricultural supply chains.[17] However, the focus within the US political spectrum remained limited to a lower priority. The security of the rare earth supply chain is linked to the US's global technological competition. Historically, the United States has been a leader in developing alternatives, whether during the 1973 oil crisis of oil reserves or during the shift to gas by developing shale gas reserves. In the same way, the US is required to develop its critical minerals and rare-earth capacity when China controls both export and import supply chains.[18]

16. Laura Wood, "China Rare Earth Market Investigation Report 2021-2025", *Business Wire*, June 1, 2021, at https://www.businesswire.com/news/home/20210601005568/en/China-Rare-Earth-Market-Investigation-Report2021-2025---ResearchAndMarkets.com. Accessed on August 22, 2021.
17. US House Committee on Rules, "H.R. 761—National Strategic and Critical Minerals Production Act of 2013", September 17, 2013, at https://rules.house.gov/bill/113/hr-761-0. Accessed on April 2, 2022.
18. Ibid.

The US is heavily dependent on imports of critical minerals for its defence use, clean energy transition, and critical infrastructure. It even imports titanium, palladium, chromium, niobium, germanium, and scandium from Russia. The US supply chain imports are struggling as a result of its trade war with high-exporting China and now with high-critical mineral-source Russia, which is increasing the US vulnerability.[19] The US has been growing its export-import capacity of rare earths, being the fifth largest exporter and fourth-largest importer. The increasing focus of the US adds to its potential to cut down on its dependence on China.[20]

The US administration's initiatives to secure the critical minerals supply chain involve:

(a) Diversification of sources through investment, most particularly in domestic reserves of rare earth, lithium and other critical minerals. It also implies promoting the recycling and refining of critical minerals.
(b) Increasing the role and funding of the Departments of Energy and Defense, as well as the US Agency for International Development, to address environmental, social, and governance issues.[21]

Within one month of coming to office, President Joe Biden conducted the 100-day "Supply Chain Review" that included the rare earth industry as well. While sharing his vision for the future of the US, President Joe Biden said, "We need to level the playing field with China and other competitors, which requires the passing of certain bipartisan bills to increase the investment in emerging technologies and the manufacturing sector." The president of the Information Technology and Innovation Foundation, Rob Atkinson, explained how the US Compete Act was the first major competitiveness act of 1988.[22]

19. Sharon E. Burke, "Russia is a mineral powerhouse—and its war with Ukraine could affect global supplies", *Boston Global Opinion*, March 9, 2022, at https://www.bostonglobe.com/2022/03/09/opinion/russia-is-mineral-powerhouse-its-war-with-ukraine-could-affect-global-supplies/. Accessed on March 5, 2022.
20. Ibid.
21. Ibid.
22. Reuters, "Bill in US Senate to curb US' dependence on China for critical minerals", *Business Standard*, April 1, 2022, at https://www.business-standard.com/article/international/bill-in-us-senate-to-curb-us-dependence-on-china-for-critical-minerals-122040100142_1.html. Accessed on April 2, 2022.

The initiatives of the US administration in the past five years involved the following strategy and rules announcement:

1. ***Strategy to Secure and Reliable Supplies of Critical Minerals***

Former US President Donald Trump announced in 2017, through an executive order 13817, and called critical minerals and rare earth elements vital to the nation's security and economic prosperity. The order implied that the task assigned to the Secretary of Commerce and selective branches to submit a report to the President should include the following in relation to critical minerals: (a) A strategy to reduce reliance on critical minerals; (b) Recycling and processing technologies for critical minerals; (c) Trade and investment to ensure access to critical minerals; (d) Improve US geological and geophysical mapping to assist the private sector in mineral exploration; and (e) Streamline the permitting and review stages to grant leases for domestic discovery and refining of critical elements.[23] The strategy proposes six immediate plans of action:

1. Advance Transformational Research to develop critical mineral supply chains
2. Strengthen the industrial output base for defence equipment
3. Improve International trade and cooperation in terms of critical minerals
4. Improve Domestic Exploration of Critical Mineral Resources
5. Improve Federal lands and reduce the exploration permit time frame
6. Grow the security and availability of the mining workforce.[24]

2. ***Onshoring Rare Earth (ORE) Act***

The COVID-19 heightened awareness of the United States growing supply chain vulnerabilities, prompting Senator Ted Cruz to introduce the ORE Act in 2020. It aims to support domestic manufacturing and rare earth capacity. The Act proposed to amend the Internal Revenue

23. *US Department of Commerce*, "A Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals", June 4, 2019, at https://www.commerce.gov/data-and-reports/reports/2019/06/federal-strategy-ensure-secure-and-reliable-supplies-critical-minerals. Accessed on April 3, 2022.
24. Ibid.

Code of 1986 to modify the tax provisions on the property being used or to be used to extract critical minerals and metals.[25] It offers up to a 200 per cent tax reduction to US taxpayers for the acquisition of critical minerals and elements extracted from US mining land. The act implies giving tax incentives for the purchase of mined rare earths and battery minerals or metals, and funding pilot programmes to develop critical minerals in the US. Senator Ted Cruz said, "Much like the Chinese Communist Party has threatened to cut off the U.S. from life-saving medicines made in China, the Chinese Communist Party could also cut off our access to these materials, significantly threatening U.S. national security. The ORE Act will help ensure China never has that opportunity by establishing a rare-earth elements and critical minerals supply chain in the U.S."[26]

3. *US Compete Act 2022*

The act intends to invest more than US$ 300 billion in developing domestic semiconductor manufacturing in order to reduce or eliminate the country's reliance on China. Considering the significance of the bill, Nancy Pelosi, House Speaker, said the bill "will ensure that America is pre-eminent in manufacturing, innovation, and economic strength and can outcompete any nation." Madeleine Dean, Representative of Pennsylvania, described the act as an "opportunity to revitalise communities across our nation that have suffered substantial manufacturing job losses for decades."[27] The "Innovation and Competition Act of 2021" passed by the United States focuses on the sectors of technology and communications, foreign relations and national security, domestic manufacturing, education, trade, and other matters. Along with other goals, this act aims to fund domestic semiconductor manufacturing, ensure supply chain security, and

25. Congress.gov, "S. 3694—Onshoring Rare Earth Act of 2020—116th Congress", May 12, 2020, at https://www.congress.gov/bill/116thcongress/senatebill/3694/text?q=%7B%22search%22%3A%5B%22Onshoring+Rare+Earths+Act+of+2020%22%5D%7D&r=1&s=3. Accessed on April 13, 2022.
26. Shane Lasley, "ORE Act encourages more than rare earths", *Metal Tech News*, June 27, 2020, at https://www.metaltechnews.com/story/2020/05/20/tech-bytes/ore-act-encourages-more-than-rare-earths/236.html. Accessed on March 30, 2022.
27. Ibid.

promote innovation through industry. The main motivation behind the act is to impose sanctions on China for cybercrime.[28]

The US Compete Act proposes to:

(a) allot US$ 52 billion to enhance semiconductor production, which will develop the manufacturing self-sufficiency of the US.
(b) Set aside US$ 1.5 billion for the communication sector by funding the public wireless supply chain innovation fund, which will lead the development of open-architecture software-based wireless technologies for 5G and 6G.
(c) Allocate US$ 9 billion to establish a new technology directorate in the National Science Foundation (NSF) that will focus on technologies like quantum computing, where China leads.[29]

A statement by the two US senators who proposed a law aiming to end China's alleged "chokehold" on rare-earth metal supplies. The law—proposed by Democrat Mark Kelly and Republican Tom Cotton—would aim to ensure the United States can guarantee its supplies of rare-earth minerals. "The Chinese Communist Party has a chokehold on global rare-earth element supplies, which are used in everything from batteries to fighter jets," Cotton said in the statement. Eighty per cent of the United States' rare-earth imports in 2019 were from China, according to the United States Geological Survey (USGS). The bill aims to "protect America from the threat of rare-earth element supply disruptions, encourage domestic production of those elements, and reduce our reliance on China," the statement said. The law would require the departments of the Interior and Defense to create a "strategic reserve" of rare-earth minerals by 2025. That reserve would be tasked with responding to the needs of the army, the tech sector, and other essential infrastructure "for one year in the event of a supply disruption". It also seeks greater transparency about the components' origins, limits the use of rare-earth minerals

28. Doug Palmer, "Senators push for expanded China tariff exclusion process", *Politico*, February 7, 2022, at https://www.politico.com/newsletters/weekly-trade/2022/02/07/senators-push-for-expanded-china-tariff-exclusion-process-00006073. Accessed on March 28, 2022.
29. Makenzie Holland, "U.S. awaits bill boosting technology competition with China", *TechTarget*, March 7, 2022, at https://www.techtarget.com/searchcio/news/252514215/US-awaits-bill-boosting-technology-competition-with-China. Accessed on March 22, 2022.

from China in "sophisticated" defence equipment, and calls on the Commerce Department to investigate Beijing's "unfair trade practices" and impose higher customs duties as a result. A bipartisan piece of legislation to be introduced in the US Senate would force defence contractors to stop buying rare earths from China by 2026 and use the Pentagon to create a permanent stockpile of the strategic minerals.[30]

Quad Critical Minerals Partnership Act

With the objective of enhancing the trade partnership among Quad members and reducing their dependence on China, US Senate lawmakers introduced a bill titled "Quad Critical Minerals Partnership Act". According to the Act, the administration should encourage investment in critical resources, finance new projects, develop technologies, and improve coordination among the Quad countries. John Cornyn, US senator, appreciated the "Act as a major step to secure its critical mineral supply from the allied countries, instead of China."[31]

WAY AHEAD AND IMPLICATIONS FOR INDIA-US RELATIONSHIP

Within the increasing initiatives and strategies of the United States to build its critical minerals and elements capacity, India is one such country that fits the partnership and support. India, as a reservoir of 49 major critical and non-fuel minerals, as reported by the Council on Energy, Environment, and Water (CEEW) and the Ministry of Science & Technology, have sustainable sources for the manufacturing sector, thus having high value and economic importance. However, it remains 100 per cent import-dependent for its manufacturing demands, despite having 6 per cent of global rare-earth reserve due to its low production capacity. India's major sources of critical metals and rare-earth elements import are China, Russia and Brazil.[32] The day-to-day global geopolitical events increasingly involve China

30. Ibid.
31. Ibid.
32. Energy.gov, "US-India Strategic Clean Energy Partnership: Responsible Oil and Gas Pillar", September 2021, at https://www.energy.gov/sites/default/files/2021-09/SCEP%20Pillars_Accomplishments.pdf. Accessed on April 11, 2022.

and Russia in one way or the other, for instance, the South China Sea conflict, or the Russia-Ukraine war, which majorly impacts the supply chain of critical elements for India as well. In such a scenario, India also needs to build supply chain resilience by seeking alternative sources and partnerships, which bring the US-India critical supply chain partnership to the rescue.

Critical minerals are a new setting for their collaboration, as seen in the "Quad Critical and Emerging Technology Working Group", developing supply resilience among Quad members—India, the US, Japan, and Australia.[33] Recently, both the US and India have introduced Acts focusing on building the domestic manufacturing capacity of semiconductors, in the form of the US Compete Act and the Indian Semiconductor Mission.[34] Both have adopted concrete actions to achieve their green future goals, which also include the development of necessary infrastructure for a resilient and low-carbon future. India and the US have been designing and implementing policies to create a green and resilient future since their "Strategic Energy Partnership" was announced in 2018, which involves cooperation for green finance, climate and renewable energy resilience and sustainable manufacturing.[35] US initiatives to reduce reliance on Chinese raw materials and critical minerals will potentially pave the way for an India-US Strategic Partnership in the critical energy and minerals sector.

33. Trisha Ray, "A Quad 2.0 Agenda for Critical and Emerging Technologies", Observer Research Foundation, September 24, 2021, at https://www.orfonline.org/expert-speak/a-quad-2-0-agenda-for-critical-and-emerging-technologies/. Accessed on April 13, 2022.
34. Ministry of Electronics and IT, "India Semiconductor Mission", at https://pib.gov.in/PressReleasePage.aspx?PRID=1808676. Accessed on April 2, 2022.
35. Samir Saran and Richard Verma, "US-India Partnership for a Green Future", *The ORF and Asia Group*, June 1, 2020, at https://www.orfonline.org/research/us-india-partnership-for-a-green-future-67181/. Accessed on April 20, 2022.