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E-mail: (first name)@dsalert.org
info: info@dsalert.org
articles: articles@dsalert.org
subscription: subscription@dsalert.org
online edition: online@dsalert.org
advertisement: advt@dsalert.org

Editorial and Corporate Office
Prabhat Prakashan Tower
4/19, Asaf Ali Road
New Delhi-110002 (India)
+91-011-23243999, 23287999, 9958382999
info@dsalert.org | www.dsalert.org

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MINERAL EXPLORATION - KEY TO INDIA'S MINERAL SECURITY

Mining policies must be amended to ensure best global practices and provide transparent, fair and efficient single window systems. The mining policy must incentivise exploration, encourage private sector participation and provide reasonable tax regimes and fast-track dispute resolution mechanisms.

Geological evidence indicates that Australia, Africa, South America, the Indian sub-continent and Antarctica were part of the ancient supercontinent 'Gondwana' that broke up and moved away about 180 million years ago. India's geological similarity with the mineral-rich regions of Eastern Africa, Western Australia and South America is traced to this theory. The countries of these regions have discovered and exploited their mineral wealth with great success. In fact, minerals excluding petroleum and natural gas contribute 8.2 per cent and 8.1 per cent to the GDP of South Africa and Australia. However, despite the geological evidence of mineral potential comparable with these countries, minerals contribute only a meagre 1.69 per cent to India's GDP. Even after 75 years of independence, India has not succeeded in uncovering its mineral assets.

Mineral Dependence

Supply chain dependency, especially of strategic and critical minerals, renders a country economically and strategically vulnerable. The temporary stoppage of Rare Earths supply to Japan by China in retaliation to the Senkaku incident in 2010 was a clear demonstration of the raw material vulnerability of a country being used as an effective weapon. Today, the world is witnessing the havoc caused by supply chain disruption on the manufacturing sector and the global economy as a whole.

Infrastructure, modern technologies, green technologies, employment, productivity, environment, etc. will assume great significance as we go forward. With India's focus clearly set on becoming a $5 trillion economy within the next three to four years, import dependency for minerals, especially strategic minerals, is likely to jump to levels that would render our national security, economy and even strategic autonomy vulnerable.

An exacavator loads soil onto a truck at an open coal mine near Mahagama in Jharkhand.

India At Global Level

Every step in the country's developmental journey will witness a corresponding rise in our per capita consumption, emission, etc. As a consequence of India's huge population, even a small rise in our per capita consumption, carbon emission, etc. would result in a sizeable cumulative increase in the country's total tally in these factors. One of the biggest challenges that confront India is the need to temper our steep upward growth and consumption trajectory with an even steeper downward emission trajectory. The table below indicates India's position today as the world's third highest energy consumer and carbon emitter despite our alarmingly low levels of per capita consumption and emission levels.

It is evident that a pivot to green technology is a non-negotiable imperative for the world at large and particularly for countries like India and China. Minerals such as Nickel, Manganese, Rare Earths, Molybdenum, Copper, Silicon, Zinc, Chromium, Vanadium, Platinum, etc. are lifeline minerals for green technology. India needs to adopt green and clean modern technologies faster than any other country. India has laid down very ambitious green targets for itself and is committed to achieve net zero emissions by 2070 with well-defined intermediate targets to be achieved by 2030. India's intermediate targets for 2030 include:-

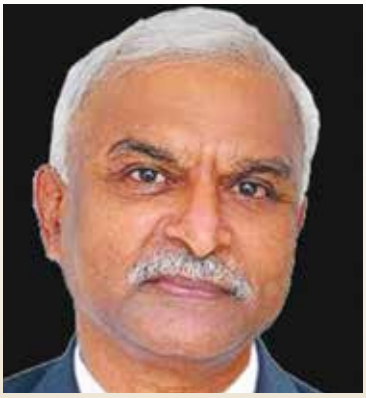
(a) Building up non-fossil energy capacity to 500 GW.

(b) 50 per cent of the country's energy requirements to be met from renewable energy.

(c) Total projected carbon emissions to be reduced by one billion tons.

Consumption & Emissions - Cumulative Vs Per Capita

Indicators (Current)	US	China	Malaysia	Brazil	World	India
Total Annual Energy Consumption (Exajoules)	93	157.65	4.26	12.4	595	35.43
Total Annual Carbon Emission (Gigatons)	4.53	11.68	0.262	0.451	35.9	2 . 41
GDP Per Capita (PPP $)	63416	17192	27032	14916	18400	6461
Electricity Consumption Per Capita (Kwh)	13098	4906	4177	2570	3260	1181
Energy Consumption Per Capita (Kwh)	79897	27452	37054	16325	20993	6924
Carbon Emission Per Capita (Tons)	15.53	6.59	7.67	2.17	4.8	1.58



CA KRISHNAN

The writer is a former Deputy Chief of the Army and a former Member of the Armed Forces Tribunal. Is a post-graduate in Defence studies and M Phil in strategic affairs and Defence Management. Has been on the Board of Directors of Bharat Electronics Ltd and Bharat Dynamics Ltd. A regular speaker on strategic issues and national security and a prolific writer on a wide variety of subjects like Regional Security, Mineral Security, Space mining, Energy security, West Asia, Rare Earths, Afghanistan, Pakistan, Global Population Dynamics, etc. He also provides consultancy to defence industries seeking to expand / streamline their existing defence manufacturing base as well as to potential entrepreneurs contemplating entry into the defence manufacturing arena.

(d) Carbon intensity of economy to be reduced by 45 per cent.

In the backdrop of these ambitious targets, our critical minerals and raw materials vulnerability is set to get more pronounced in the years ahead. We need to discover and exploit every deep-seated mineral deposit that India has. Simultaneously, for the critical minerals that we lack, India must secure raw material resources in friendly countries and also form Joint ventures.

India's Mineral Deposits

In order to grasp the magnitude of India's 'mineral dependency risk', an overview of our mineral scenario is essential. Today, India's domestic mineral production meets just about 25 per cent of the country's needs. Domestic production of minerals excluding coal in 2020-2021 was Rs 1,11,133 crores as against the import of minerals worth Rs 4,24,705 crores. India's thermal coal import is set to touch 243 million tonnes, almost equalling that of China by 2030. Similarly, by 2030, India's per capita steel consumption is estimated to go up from 61 kg to 158 kg. To meet this demand, we will need to double our iron ore mining capacity by 2030. India imports Gold worth Rs 4,20,000 crores, Base metals of copper, lead and zinc worth Rs 55,000 crores, Aluminium worth about Rs 3700 crores and Silver worth Rs 19,000 crores annually.

India has a long list of minerals with 'high import dependency'. In a 2016 study carried out on behalf of the Department of Science and Technology, the Council on Energy, Environment & Water (CEEW), identified a set of minerals that would pose a high supply risk to India by 2030. The risk assessment was based on the economic value, criticality for the manufacturing sector and availability of these minerals. Important minerals projected to pose a high supply risk for India by 2030 along with their current import dependency status are listed in the table below.

India 2030 - High Supply Risk Minerals

Mineral	India's import dependency %	Mineral	India's import dependency %
Aluminium	53	**Beryllium**	100
Antimony	100	**Bismuth**	100
Cadmium	100	**Indium**	100
Rare Earths	100	**Germanium**	100
Cobalt	100	**Vanadium**	100
Copper	68	**Magnesium**	49
Lithium	100	**Molybdenum**	100
Titanium	43	**Zinc**	100
Tungston	100	Iron	48
Lead	81	Potash	100
Gallium	100	Boron	100

(Minerals shown in BOLD are classified as strategic minerals based on their criticality in aerospace and defence industries).

It is evident that India needs to assign far greater importance to uncover and exploit the country's rich mineral deposits and keep our import dependency to the barest minimum.

Why has India not succeeded so far in discovering its deep-seated mineral wealth?

Mining And Exploration Framework

Mining is a sequential process. The process starts with a Preliminary survey or Reconnaissance to identify areas with mineral potential. This is followed by the process of prospecting which narrows down the likely areas of mineral potential. Next comes general exploration for identification and initial delineation of the identified deposit. This is followed by a detailed exploration. The detailed exploration involves three-dimensional delineation of the deposits and establishes all relevant characteristics such as size, shape, structure, etc. of the deposit with a high degree of accuracy. Based on the outcome of detailed exploration, a feasibility study may be carried out to assess the technical soundness and economic viability of mining in the chosen area. The feasibility study also serves as the basis for investment decisions. The actual setting up of a mine requires considerable lead time. Even with the benefit of good quality preliminary survey data, a conducive environment, facilitating policy framework and best practices, the process from exploration to setting up of a mine and commencement of mining could take anything from four to six years and often, much longer.

In a very generic sense, minerals are either surficial or deep-seated. Surficial minerals are generally found on the surface or at shallow depths. Iron ore, bauxite, limestone, dolomite, manganese, chrome, etc. are examples of surficial minerals. There are, of course, jurisdictions where some of these may occur as deep-seated too. Deep-seated minerals on the other hand, as the term suggests, are found deep under the earth's surface. The Mineral Laws (Amendment) Bill 2020 defines deep-seated minerals as "minerals which occur at a depth of more than three hundred meters from the surface of the land with poor surface manifestations". Gold, lead,

zinc, copper, nickel, lithium, diamond, Rare Earths and Platinum Group of Minerals are examples of deep-seated minerals.

Exploration is the foundation of the mineral chain. India's abysmal exploration record is the root problem holding back the country's mineral industry. India has a landmass of close to 3.3 million sq km. Of this, the Geological Survey of India has so far identified 0.57 million sq km as Obvious Geological Potential (OGP) area. Many geologists believe that there is potential for a four-fold increase in India's OGP. As per Ministry of Mines data, while India's mapping coverage for surficial minerals has been 100 per cent of its OGP area, the coverage for deep-seated minerals is as low as 22 per cent. In comparison, Australia's mapping for deep-seated minerals is about 95 per cent of its OGP area. Going beyond, out of India's 0.57 million sq km Obvious Geological Potential area, only about 10 per cent has been explored and only about 1.5 to 2 per cent has been mined. India spends a paltry $17 per sq km for exploration and that too almost exclusively by the government. As against this, Australia spends $246, Canada $192, US $106 and Chile $1202 per sq km for mineral exploration. Most critical minerals are higher up in the mineral value chain and are deep-seated. Deep-seated deposits can only be discovered through detailed exploration. There has been a near total absence of exploration for deep-seated minerals in India, resulting in our huge import bill for these minerals.

Mineral Exploration for deep-seated minerals is a high-risk process with an established success rate as low as 1:100 globally. This makes investment in mineral exploration speculative in nature and unsuitable for governmental investment. Even big mining companies as a rule do not invest in exploration. Globally, mineral exploration is carried out by small companies called junior mining companies. Junior mining companies may spread the risk of exploration over a large group of shareholders or investors. Typically, they work on a model where one successful exploration project makes up for a large number of unsuccessful projects. Their incentives may be in the form of selling their mineral concessions to big mining companies at a considerable profit or alternatively through any appropriately formulated mechanism stipulated in the mining policy.

Workers in mining industry.

Defamed Mining Sector

Over the decades, the mining industry in India has been much maligned and has become synonymous with corruption, illegal mining and environmental destruction. Inappropriate and inconsistent policies, dual jurisdiction, bureaucratic apathy, corruption and the long drawn out and inefficient judicial processes have further made the Indian mining sector ugly, dangerous and subdued. It is in this backdrop that the Indian government, apparently with good intentions and to bring in transparency in the allotment of mining concessions, promulgated a series of policies with auctions as the only means for allotment of mining licences. The policy also effectively prevents private sector participation in exploration. Although, this policy tweaking may have been done with good intention, it has had just the opposite effect as far as exploiting the country's deep-seated high-value minerals are concerned.

Recommended Amendments

It needs no elaboration that an unknown asset cannot be auctioned. Deep-seated minerals are unknown assets and will remain so till they are discovered through detailed exploration. India is in urgent need of extensive mineral exploration and generous private sector participation in exploration. Exploration is an activity which must be treated as distinct and separate from mining and encouraged through facilitating policies. Mining policies must be amended to ensure best global practices and provide transparent, fair and efficient single window systems. The mining policy must incentivise exploration, encourage private sector participation and provide reasonable tax regimes and fast-track dispute resolution mechanisms. India cannot afford to ignore its mineral security anymore. DSA