POLICY BRIEF
December 2010
The Energy and Resources Institute teri

Critical non-fuel minerals security: Why India urgently needs to have a policy in place

CONTENTS

Prepared by
Arpita Asha Khanna and Swati Ganeshan

The Energy and Resources Institute
Darbari Seth Block, IHC Complex,
Lodhi Road, New Delhi- 110 003

Tel. 2468 2100 or 4150 4900
Fax. 2468 2144 or 2468 2145
India +91   Delhi (0) 11

www.teriin.org

Introduction

Mineral resources security is an issue of significance at both the strategic as well as economic levels. Securing access to sufficient, reliable, affordable, and sustainable supplies of minerals is increasingly becoming an important factor for sustainable functioning of economies.

Mineral resources are broadly classified into two categories: fuel and non-fuel. Fuel minerals include fossil fuels such as oil, natural gas, and coal, while non-fuel minerals are commonly understood to include a variety of materials such as metals, metal alloys, and non metals. While fuel minerals, particularly oil and coal, have been studied, discussed, and debated upon extensively, and their security remains a dominant theme in policy and media, non-fuel minerals, despite being indispensable constituents of society, have been relatively understudied, particularly in India. This policy brief focuses on selected non-fuel minerals.

We argue that India needs to be alert to developments in the non-fuel minerals sector, and initiate policies and strategies to ensure materials security.

Context and importance of the problem

Why should there be an increased alertness to non-fuel minerals security?

Global non-fuel minerals markets are characterized by the following factors (see Figure-1 [next page]).

Figure 1 Global trends in non-fuel minerals sector

Rising demand in established sectors

Production and consumption of non-fuel minerals have been consistently high in developed economies. However, since the 1990s, growth in China and India has led to a new spurt in the demand for steel. The demand for non-fuel minerals is, thus, expected to increase manifold from the current low levels in the coming years. Iron ore, manganese, chromium, and molybdenum are some of the non-fuel minerals key to steel production, which have shown a steep increase in demand.

New demand from emerging sectors

Advances in renewable energy technologies, telecommunications, automotive, and defense industries have all been made possible by incorporating new applications of non-fuel minerals such as silicon, indium, tungsten, titanium, tantalum, gallium, cadmium, selenium, tellurium, and rare earths.

Strong growth in emerging economies

Strong growth in emerging economies, particularly China, has led to a significant increase in the demand for non-fuel minerals. Between 2002 and 2008, China's consumption of key metals grew at an average of 16.1% per annum, as compared to less than 1% demand outside China (World Bank 2010). Strong growth in Chinese demand has led to a drastic increase in prices, which tripled during the period under consideration.

Consolidation and rise of oligopolies

Merger and Acquisition (M&A) activities in the non-fuel minerals industry have accelerated in recent years. In 2007, for instance, the number of M&A deals was estimated at 411, with a total value of $144.7 billion, as compared to 385 deals in 2006, with the value of $86.4 billion (CRS 2008). The decreasing number of competitors, coupled with the growing size of the remaining firms in the industry, may allow a powerful firm or group of firms to corner markets and control prices opportunistically.

Growing centrality of sustainability issues

With the growing centrality of sustainable development issues among governments, industrial organizations, non-governmental organizations (NGOs), and so on, more attention is needed on resource governance and benefit sharing.

Application of trade distorting measures

Increasingly, many emerging economies are pursuing strategies to promote their downstream industries and preserve domestic reserves for future use. These include quantitative export restrictions (quotas), export taxes, reduction/cancellation of value added tax (VAT) rebates, mandatory minimum export prices, stringent export licensing requirements, and so on[1]. Ukraine, Argentina, Tanzania, and emerging resource-rich economies such as China and Russia are among the key countries involved in applying such measures.

Regionally concentrated production and reserves

Over 70% of world production of 17 non-fuel minerals is concentrated in only two or three nations (see Table-1). Almost the entire world production

[1] As per the notification made to the WTO (by seven countries), out of the total export restriction measures adopted for mining products, 94 were automatic licensing, 1001 were non-automatic licensing, 746 were quotas, and 60 were prohibitions. Export restrictions on natural resource products represented a large share of all notified restrictions, and all the restrictions did fall fairly under General Agreement on Tariffs and Trade (World Trade Report 2010).

Table 1 Top three the non-fuel mineral-producing nations for select non-fuel minerals

Non-fuel minerals	First	Per cent	Second	Per cent	Third	Per cent	Cumulative per cent share
Gallium	China	83	Japan	17	–	–	100
Germanium	China	79	USA	14	Russia	7	100
Rare earths	China	97	India	2	Brazil	1	100
Vanadium	South Africa	38	China	33	Russia	27	98
Antimony	China	91	Bolivia	2	South Africa	2	95
Platinum	South Africa	77	Russia	13	Canada	4	93
Palladium	Russia	43	South Africa	39	Canada	6	88
Tungsten	China	75	Russia	6	Canada	5	86
Tantalum	Australia	53	Brazil	22	Rwanda	9	85
Lithium	Chile	44	Australia	25	China	13	82
Molybdenum	USA	29	China	28	Chile	21	78
Indium	China	58	Japan	11	Korea	9	77
Chromium	South Africa	45	Kazakhstan	17	India	15	77
Rhenium	Chile	49	Kazakhstan	14	USA	14	76
Silicon	China	58	Russia	11	Brazil	5	74
Cobalt	Congo	45	Canada	12	Zambia	11	67

Source Korinek and Kim (2009)

of rare earths takes place in a single country—China. The distribution of resources[2] for many non-fuel minerals is also concentrated, suggesting that the future production will be similarly geographically restrained. This may increase the potential of supply disruption due to local disturbances in the non-fuel mineral-producing countries, politically inspired embargoes, or cartel actions that raise price by limiting supplies; though attempts of producing countries in creating mineral cartels (for example, Intergovernmental Council of Copper Exporting Countries [CIPEC]) in the past have had little success.

Conflicts in mineral-rich nations

Countries such as Indonesia, Democratic Republic of Congo (DRC), and Peru are increasingly characterized by mining-related conflicts. As countries invite more investments for resource extraction, the already-existing friction could become a global challenge, with the involvement of countries and transnational companies resulting in reduced global supply.

Diffusion of supply/value chain

Certain sub-sectors within the entire value chain from sourcing of non-fuel mineral ores (mining and extraction) and processing them to semi-finished products to the creation of finished products may or may not exist within a country. In certain countries, the ore is only mined, while the processing is conducted in another country. This may make one nation entirely dependent upon another nation for either an ore or the finished product, creating supply risks at various levels.

[2] Resources include all known deposits of the minerals, whether or not they are actually mined, including deposits that are not reserves. Reserves are those deposits that are economically viable, given the present technologies, prices, and production strategies.

What are the strategies that have been followed by importing countries?

There is increased competition between industrialized countries such as the United States of America (USA), Japan, and the members of the European Union (EU), and emerging economies such as China to obtain secured supply of non-fuel mineral resources. These countries have adopted the following policies and programmes to address non-fuel minerals security concerns.

- Defining strategic policies/guidelines for securing non-fuel mineral supplies for the country (Japan, EU, China, and USA).
- Developing and strengthening comprehensive and strategic relations with resource-rich nations (Japan, EU, and China).
- Creating a stockpile of various non-fuel minerals (Japan, China, and USA)
- Providing financial assistance to companies both for mineral exploration and overseas investment (Japan and China).
- Identifying common interests and positions with each other in international fora (EU, Japan, and USA).
- Defining non-fuel minerals essential for its own economy, and launching a cooperative international project to assess the world's undiscovered non-fuel mineral resources (USA).
- Applying export restrictions on a range of non-fuel minerals, seen by other countries as protectionist measure (China).
- Promoting resource efficiency, recycling, reuse, and substitution of essential non-fuel minerals (Japan, US, EU, China).

The Indian context

Rationale for studying non-fuel minerals sector

Studying the Indian non-fuel minerals sector assumes importance on account of the following.

- Rapid economic growth and technological advancements in India in the recent years have created demand for a wide range of non-fuel minerals to perform essential functions. The demand is likely to grow with the development of new products and technologies.
- Industrial sectors such as automobiles, aerospace, telecommunications, and renewable energy, which are important drivers of national economy and are characterized by high growth potential, are significantly dependent upon non-fuel mineral resources.
- India is partially or completely dependent on imports for many of its non-fuel minerals, which include, among others, gallium, platinum group of metals, antimony, molybdenum, nickel, tin, tungsten, cobalt, potash, sulphur, and borax (Planning Commission 2007).
- India is also an important supplier for some strategic non-fuel minerals such as chromite, iron ore, bauxite, magnesite, manganese ore, barytes, kyanite, staealite, and so on (Planning Commission 2007).

Institutional and regulatory framework

In the non-fuel minerals sector, the regulation of mines and the development of minerals are under the control of the Union, as provided for in the Mines and Minerals (Development and Regulation) Act (MMDRA) 1957[3]. The Act empowers the state government to grant mining and prospecting licenses after the prior approval of the central government. With regard to minor minerals, the states are allowed to formulate their own rules and regulations within the purview of the rules stated in the MMDRA.

The MMDRA has specified minerals in the First Schedule, wherein the states have little power except possession, receiving royalty and some other payments on the specified minerals. While section A pertains to coal and lignite, section B relates to atomic minerals, which includes, among others, minerals of the "rare earths" group, containing uranium and

[3] Currently, the Act is being redrafted. The latest draft version, 3 June 2010, is available on http://mines.nic.in/writereaddata/filelinks/48367262_2.pdf

thorium; lithium-bearing minerals; titanium-bearing minerals and ores such as ilmenite, rutile, and leucoxene, and section C deals with metallic and non-metallic minerals.

In the case of rare earths, monazite is the principal ore that is recovered from beach sand minerals, occurring along with other heavy minerals such as ilmenite and rutile. Monazite is a prescribed substance under the Atomic Energy Act 1962 due to the presence of thorium. The exploitation of beach sand minerals and private sector participation (domestic and foreign) is subject to the Beach and Mineral policy, notified in 1998 (IBM 2008).

The Ministry of Mines (MoM) is the key agency that is responsible for survey and exploration of the minerals and the administration of the MMDRA. The Indian Bureau of Mines (IBM) and Geological Survey of India (GSI) are attached or are subordinate offices to the MoM. In addition, public sector enterprises such as Mineral Exploration Corporation Limited (MECL) and Hindustan Copper Limited (HCL) are under the administrative control of the MoM.

The trade of non-fuel minerals is regulated by the Ministry of Commerce, under the Foreign Trade Policy, underlining the tariffs, duties, and taxes vis-à-vis ores and concentrates and metals. There are certain ores and metals that are canalized through the Minerals and Metals Trading Corporation (MMTC) under the administrative control of the Department of Commerce, while many others are permitted freely. In recent years, the interest and the involvement of private and transnational companies have increased in the non-fuel minerals sector.

Critical non-fuel minerals

To understand the potential constraints on the availability of non-fuel minerals for India, five resources have been taken as case studies—chromium, molybdenum, rare earths[4], tungsten, and cobalt—due to the presence of a number of shared characteristics. First, these are used as inputs for high-technology or strategic sectors (see Table-2). Second, there are no or inadequate substitution opportunities available for these materials. Third, the nation is subject to supply risk due to domestic unavailability and/or geo-political and geo-economic landscape for these materials. These five materials are illustrative of the major issues and challenges impinging upon the non-fuel minerals security in India.

Economic applications and demand

The strategic and industrial applications given in Table-2 are witnessing significant growth, resulting in the increased demand for these non-fuel minerals. India is among the top 10 producers of stainless steel in the world. During the last 15 years, Indian

Table 2 Main applications for select critical non-fuel minerals

Chromium	Stainless steels; manufacture of corrosion and abrasion resistant bricks; foundry; manufacture of chemicals used in a wide variety of end products like clothing, furniture, and so on.
Molybdenum	Missile and aircraft parts; valuable catalyst in petroleum refining; filament material in electrical applications; alloying agent for ultra-high strength steels, vital for development of nuclear power and water desalination plants; emerging uses in new mining technology and nano technology.
Tungsten	Light bulb filaments, television tubes, X-ray tubes (as both the filament and target), super alloys, and hard metals for cutting tools and drills used in metal-working and mining industries.
Rare earths	Automobiles, including hybrid vehicles; air conditioners; wind power generators; fluorescent lights; plasma screens; portable computers; handheld electronic devices.
Cobalt	Metallurgical applications, special alloys/supper alloys industry; aircraft and turbines; magnets; cutting tools; bonded tools for diamond industry; catalysts; dyes; pigments; paint driers/adhesives; glass; and ceramic.

[4] Rare earths encompass 17 elements, namely scandium, yttrium, and lanthanides, with a group of 15 elements—lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, and lutetium—distributed into two categories of light and heavy elements.

stainless steel production has grown at an average of 16% per annum, as against the world average growth of 6% (ISSDA). This has led to a steep rise in the demand for its key raw materials, chromium and molybdenum. The demand will continue to escalate with a projected increase in stainless steel production from 1.7 million tonnes in 2005 to 9.3 million tonnes by 2020.

Similarly, the demand for tungsten is expected to increase from the current 12 000 tonnes to 26 000 tonnes by 2016 (Planning Commission 2007). In addition to its importance in the industrial sector, tungsten is used in the defence industry, making it a strategic material for India.

The development of new products and technologies in India has boosted the demand for high-technology metals such as rare earths and cobalt. Although these metals are usually required in small quantities, they are becoming more and more essential to the development of technologically sophisticated products. Rare earths, in particular, would witness a significant increase in demand, given India's vision for renewable energy and growing emphasis on green technologies.

Owing to the importance and potential growth in demand for these materials, it is imperative to examine probable constraints on their availability, as any restriction on their supply may affect not only national security but also economic stability and technological competitiveness.

Supply risk

The select critical non-fuel minerals for India (brief profile given in Table-3) are subject to the following constraints, which may undermine the sufficient, reliable, affordable, and sustainable supply of these materials.

Inadequate geological availability

With the exception of chromium, which has estimated ores of 213 million tonnes (IBM, 2008), all other non-fuel minerals—molybdenum, tungsten, and cobalt—have limited geological availability within the country and have been put under "scarce minerals" category by the Planning Commission (2007). The resources of monazite, a principal ore for rare earths, are also estimated at only 10.21 million tonnes (IBM, 2008).

Inadequate availability of economically mineable resources

Reserves constitute only 8% of the total estimated resources for molybdenum, and there are absolutely no economically mineable resources for cobalt and tungsten (IBM, 2008). The extent of economic mineability of the estimated rare earths resources also remains unclear. The economic non-viability has been one of the major factors deterring the production of most of these non-fuel minerals within the country. Even for chromium, which is considered adequately available (Planning Commission 2007), there is a threat to the supply from the economic availability perspective, as reserves constitute only 31% of the total chromium resources within the country.

Dependence on by-products

The dependence on the supply of non-fuel minerals obtained mainly as by-products may be risky, as their availability is largely determined by the availability of the main product and is, thus, relatively insensitive to the changes in its own demand in the short term. There is no production of molybdenum and cobalt ores within the country, and this makes India 100% dependent upon imports. Primary mining constitutes a very small percentage of the total world production of these non-fuel minerals. The mining of rare earths in India may also be insensitive to the changes in demand, as they are obtained as by-products of monazite, recovered from beach and inland placer deposits.

Technical constraints

Mining of chromite is mainly done using open cast method, which is not feasible beyond 100 m of depth. Currently, about 33% of chromite resources are located at depths below 100 m. The exploitation of these resources is contingent upon the adoption of suitable underground technology. But, underground mining

Table 3 A Brief Profile of select critical non-fuel minerals

Metal	Potential or existing ore source	Production of ore in India	Ore deposits	Imports of ore	Exports of ore	Conversion process from ore
Chromium	Chromite	Various producers in public and private sectors, including Orissa Mining Corporation Ltd, Tatas, and Jindals	Orissa (95%)	Minor	World's biggest exporter to China, Japan, and so on	Ferrochrome → Stainless steel
Molybdenum	Associated with copper, lead, and zinc ores	Nil	Tamil Nadu (52%) and Madhya Pradesh (41%)	China, USA, and Chile	Negligible	Ferromolybdenum → Stainless / alloy steels
Tungsten	Wolframite and Scheelite	Nil	Karnataka (42%); Rajasthan (27%); Andhra Pradesh (17%); and Maharashtra (9%)	China till 2005/06; now, Israel and Belgium	Negligible	Tungsten trioxide → various products
Cobalt	By product of copper and nickel extraction and refining	Nil	Orissa (69%); Jharkhand (20%); and Nagaland (11%)	Democratic Republic of Congo (50%) and People Republic of Congo (41%)	Negligible	Metal / oxides → various products
Rare Earths	Monazite	Indian Rare Earths Ltd and Kerala Minerals and Metals Ltd	Andhra Pradesh (37%); Tamil Nadu (18%); Orissa (18%); Kerala (13%); and West Bengal (12%)	–	Negligible	Concentrates → metal/oxides → Separation of individual rare earth elements

is limited to only a few chromite mines, and a cost-effective underground mining technology has not been developed as yet. The appropriate technology for the economical recovery of cobalt and molybdenum as by-products also does not exist in the country. The absence of technical know-how at the mining stage has inhibited the development of indigenous value chain and led to the nation's dependence on imports of semi-finished and finished products.

Inadequate beneficiation

Beneficiation is a process whereby the grade of the ore is improved by removing impurities, stones, and other extraneous matter. Through beneficiation, a non-marketable grade can be converted into a grade that is directly useable.

The export policy of the government for chromite, which otherwise is restricted, gives a free hand to beneficiated concentrates with a feed grade of maximum 42% chromium oxide. As a result, many companies have initiated beneficiation activities, in order to take advantage of high chromite price in the international market. This, however, has precluded genuine beneficiation, which requires chromite with less than 38% chromium oxide to be processed into a marketable grade. An expert group constituted by the Ministry of Steel has recommended confining the exports of ore exclusively to concentrates produced by genuine beneficiation. However, so far, no policy stand has been taken.

Socio-environmental carrying capacity consideration in producing regions

Social and environmental issues in current producing regions pose a threat to the long-term availability or sustainability of mining operations for non-fuel minerals, particularly chromium. About 95% of India's chromite resources are located in the Sukinda valley of Orissa, which is included among the top 10 polluted areas of the world. Chromite mines have been identified as a major source of pollution by the generation of hexavalent chromium and large quantities of overburden (Blacksmith Institute 2007). Approximately 70% of the surface water and 60% of the drinking water in Sukinda is contaminated due to the presence of toxic substances (such as hexavalent chromium). Most mines operate without any environmental management plans, and the untreated mine water is discharged into the Brahmani river, which provides sustenance to about 2.6 million people (*ENVIS* newsletter 2006). This has had severe health implications for the people living in the nearby villages.

Geo-political and geo-economic constraints

The world production of non-fuel minerals such as molybdenum, rare earths, and tungsten is highly concentrated. There is an increased tendency of the producing nations to control the prices and quantities made available in the world market. This is particularly true of China, which accounts for a dominant share in the production of these commodities. In the recent years, China has started adopting various policy measures to restrict the export of these ores and the associated products, along with other measures like production quotas, mine closures, restrictions/curb on mining leases, and so on. This has not only immensely affected the mining industry, but has also resulted in considerable shortages of these materials in the world market and, consequently, increased prices. The situation will be aggravated further, considering China's recent announcements of further increase in restrictions. In addition, the country has started using its resource base to attain political objectives, as evident by the reported ban on export of rare earths to Japan in retaliation to the detainment of four Chinese fishermen, whose boat collided with Japanese patrol boats.

Cobalt is also subject to the problem of unavailability, as about 50% of the world production comes from countries like Congo and Zambia, which are witnessing conflicts and political fluctuations. Such situations can have serious consequences for mining activities. For instance, conflicts in the eastern part of Congo have recently led to a complete ban on mining in these areas by the government.

China is a leading producer of refined cobalt, the production of which is mainly dependent upon the import of cobalt ores from Congo. Considering this, in 2006, Congo applied restrictions on the export of cobalt ores and concentrates, in order to restrict the export of unprocessed materials. This resulted in the tightening of the cobalt market and, in turn, in significant increase in prices, which are expected to maintain the upward momentum.

India, with limited or no indigenous production of these materials, is vulnerable to supply disruption at various levels of the value chain.

Policy recommendations

In light of the above observations, it could be inferred that the issues and challenges associated with non-fuel minerals supply have many economic, political, and security implications for India. Addressing these issues necessitates the development of a strategic policy framework, which would reflect the following key aspects.

Augmenting and securing domestic sources of supply

New resources should be identified through increased exploration activities. Beneficiation of non-marketable grade of chromite should be facilitated by bringing necessary changes in policies and regulatory framework. The use of best global sustainable development practices should be promoted, and better framework conditions for extraction should be formulated.

Reducing consumption of primary raw materials

Practices need to be adopted with a view to economize on use of such materials. Resource efficiency, which includes avoidance of use and material conservation; recycling; reuse; and substitution need to be encouraged where possible.

Building technological capabilities

Technologies to convert the existing mineral resources into viable economic resources should be developed within the country. Research and development (R&D) activities to develop technologies for the economic recovery of the by-products should be initiated/accelerated. The state-of-the-art underground mining methods for chromite should be evolved, backed by sound geo-technical studies. In addition, capacity and technological capabilities for the production of ferro-alloys and other processed products should be expanded in the country. Resource diplomacy should also be initiated with technologically advanced economies.

The Japanese government has expressed interest in investing in the mining sector in India, particularly for non-fuel minerals such as rare earths and titanium, which are under the control of the central government. The government is actively seeking India's partnership and cooperation in this regard. This may be a good opportunity for India, as it requires technological know-how and extensive investments to explore its resources and build its technological capabilities in the value chain. The recent proposition by the Indian and Japanese governments to explore the possibilities of bilateral cooperation in developing, recycling, and reusing rare earths and other metals and in researching and developing their substitutes is a good step in the direction. Similar complementary areas that lead to technological spillover could be identified with EU, as it an important source of technology for India.

Promoting strategic international investments

Indian companies have already initiated acquisition of resources abroad. However, their efforts are slow and are facing sharp competition from countries like China. The Indian government should support such initiatives by increasing economic engagement and strengthening strategic relations with resource-rich nations.

Diversification of sources of supply

In view of the increased concentration of import sources, efforts should be made to diversify the sources of supply from abroad. The higher the geographical diversification of the supply sources, the lower the risk associated with the loss from a particular source.

Promoting international cooperation against protectionist measures

Countries such as Japan, USA, and members of the EU plan to take vigorous actions to challenge the trade-distorting measures adopted by resource-rich economies (particularly, China), which violate the World Trade Organization (WTO) rules. Cooperation with these economies may help in developing collaborative approaches and cooperative mechanisms within the WTO or at a multilateral level to avert some of the measures that pose security concerns for India.

Maintaining strategic stockpiles

Like all government programmes, stockpile is subject to economic, political, and budgetary pressures, and may be misused or result in wastages, if not designed carefully. An effective stockpiling programme requires critical assessments to determine the quality and quantity of material to be stockpiled; legislations for setting appropriate stockpiling goals; coordination between private mining companies, state enterprises, and different government agencies; regularly updated risk assessments; and identification of a suitable government agency for its effective management. To this effect, a committee should be established to evaluate the appropriateness of this policy option to secure the nation against supply disruption from abroad.

Initiating research to understand supply risks and address data and knowledge gaps

Extensive research needs to be initiated to understand the supply risks associated with other key non-fuel minerals and prepare an exhaustive list of critical non-fuel minerals for India. However, this requires appropriate collection, dissemination, and analysis of the data and information. At present, IBM is the only source of information for non-fuel minerals in India, and the data collected and disseminated from the agency is inadequate, diffused, and not conducive to intensive research.

IBM should, thus, enhance the types of data and information it collects and disseminates. Funded support should be extended for scientific, technical, and social scientific research, focusing on the entire non-fuel minerals lifecycle. In particular, attention should be paid to more reliable estimation of consumption of non-fuel minerals by India; international trade and pricing; understanding the stocks and flows of secondary material available for recycling; in-use stocks; material flows; and other related information, as deemed appropriate and necessary. In addition, cooperative programmes involving academic organizations, industry, and government should be promoted to enhance research on the security of non-fuel minerals for India.

References

Blacksmith Institute. 2007. **The World's Worst Polluted Places: The Top Ten (of The Dirty Thirty)**. Details available at www.blacksmithinstitute.org/wwpp2007/finalReport2007.pdf, last accessed on 01 September 2010.

Congressional Research Service Report for Congress. 2008. **Minerals Price Increases and Volatility: cause and consequences**. Details available at www.policyarchive.org/handle/10207/bitstreams/19046.pdf, last accessed on 09 September 2010.

Centre for Environmental Studies. 2006. *ENVIS Newsletter* **5**(1) May–July 2006 [Government of Orissa: Centre for Environmental Studies, Forest and Environmental Department].

Indian Bureau of Mines. 2008. ***Indian Minerals Yearbook***. Government of India: Ministry of Mines.

Korinek J and Kim J. 2010. **Export restrictions on strategic raw materials and their impact on trade**. OECD Trade Policy Working Paper No. 95. OECD Publishing.

Planning Commission. 2007. Working group on Minerals Exploration and Development. [Eleventh Five Year Plan 2007–12, 12 January 2007, Government of India]

World Bank. 2010. ***Global Commodity Markets Review and price forecast***. [A companion to Global Economic Prospects]

World Trade Report. 2010. ***Trade in natural resources***. World Trade Organization, 119 p.

This is the second in a series of policy briefs by TERI based on its research work in specific areas. These briefs are made available to members of parliament, policy-makers, regulators, sectoral experts, civil society, and the media. The briefs are also accessible at http://www.teriin.org/policybrief/. The purpose is to focus on key issues and list our policy recommendations to encourage wider discussion and debate. We would very much value your comments and suggestions.

Previous policy briefs

Title	Date
Strengthening Agricultural Biotechnology Regulation in India	September 2010