1 Indian Mineral Industry & National Economy

NATIONAL ECONOMY

Minerals and Mining Industry are significant to the National Economy and have their distinct effects on other Sectors/Industries that influence the econony.

India, looking well into the future, has embarked upon a slew of reformation initiatives that are aimed at rationalising and transforming the Mineral Sector in a manner such that all area of development, in terms of contribution to GDP, employment in the Sector, technological upgradation, R & D initiatives, meeting demands of Infrastructure/Manufacturing sectors, local area development ,etc. get bouyed up for sustainable growth prospects.

The past year has been marked by some major reforms. The transformational Goods and Services Tax (GST) was launched in July 2017.

With a policy change of such scale, scope, and complexity, the transition unsurprisingly encountered challenges of policy, law and information technology systems, which especially affected the informal sector. Expeditious responses followed to rationalise and reduce rates, and simplify compliance burdens and the long-festering Twin Balance Sheet (TBS) problem were decisively addressed by sending the major stressed companies for resolution under the new Indian Bankruptcy Code (IBC) and implementing a major recapitalisation package to strengthen the Public Sector banks. As a result of these measures, the dissipating effects of earlier policy actions and the export uplift from the global recovery, the economy began to show signs of picking up in the second half of the year. This should allow real GDP growth to reach 6.75% for the year as a whole and it is further expected to rise to 7-7.50% in 2018-19. Continuity of this trend will enable India reclaim its position as world's fastest growing major economy. Against emerging macroeconomic concerns, policy vigilance will be necessary in the coming year, especially if high international oil prices persist or elevated stock prices correct sharply, provoking a "sudden stall" in capital flows. The agenda for the next year consequently is critical— stablising the GST, completing the TBS actions, privatising Air India, and staving off threats to macro-economic stability. The TBS actions, noteworthy for cracking the long-standing "exit" problem, need complementary reforms to shrink unviable banks and allow greater Private Sector participation. The GST Council offers a model "technology" of cooperative federalism to apply to many other policy reforms. Over the medium term, three areas of policy focus stand out —Employment: finding good jobs for the young and burgeoning workforce, especially for women; Education: creating an educated and healthy labour force; Agriculture: raising farm productivity while strengthening agricultural resilience; and above all, India must continue improving the climate for rapid economic growth on the strength of the only two truly sustainable engines, i.e., private investment and exports.

The outlook for 2017-18: A final, important factor explaining the growth recovery is fiscal, which is providing a boost to aggregate demand. For reasons related to smoothening the transition, GST revenues will only be collected for 11 months, which is akin to a tax cut for consumers. Meanwhile, overall revenue expenditure growth by the central and state governments remains strong at 11.7% (April-2017 to November-2017). Cyclical conditions may also lead to lower tax and non-tax revenues, which act as an automatic stabiliser.

The CSO forecast of real GDP growth for 2017-18 is estimated at 6.5 percent. However, this estimate has not fully factored in the latest developments in the third quarter, especially the greater-than-CSO-forecast exports and government contributions to demand. Accordingly, real GDP growth for 2017-18 as a whole is expected to be close to 6.75%. Given real GDP growth of 6% in the first half, this implies that growth in the second half would rebound to 7.50%, aided by favourable base effects, especially in the fourth quarter.

Consider the components of demand that will influence the growth outlook. The acceleration of global growth should in principle provide a solid boost to export demand.

Private investment seems poised for rebound, as many of the factors that were a drag on growth over the past year finally are showing signs of easing off. Translating this potential into an actual investment rebound will depend on the resolution and recapitalisation process.

Consumption demand, meanwhile, will encounter different tugs. On the positive side, it will be helped by the likely reduction in real interest rates in 2018-19 compared to the 2017-18 average. At the same time, average oil prices forecast by the IMF are expected to be about 12% higher in 2018-19, which will crimp real incomes and spending—assuming the increase is

passed on into higher prices, rather than absorbed by the budget through excise tax reductions or by the oil marketing companies. And if higher oil prices require tighter monetary policy to meet the inflation target, real interest rates could exert a drag on consumption.

Putting all these factors together, a pick-up in growth to about 7-7.50% in 2018-19 can be forecasted and if realised this would re-instate India as the world's fastest growing major economy. This forecast is subject to upside potential and downside risks.

The biggest source of upside potential will be exports. If the relationship between India's exports and world growth returns to that in the boom phase, and if world growth in 2018 is as projected by the IMF, then that could add another 0.5 percentage point to growth.

Another key determinant of growth will be the implementation of the IBC process. Here timeliness in resolution and acceptance of the IBC solutions must be a priority to kick-start private investment.

Persistently high oil prices (at current levels) remain a key risk. They would affect inflation, the current account, the fiscal position & growth and force macroeconomic policies to be tighter than otherwise.

A key policy question will be the fiscal path for the coming year. Given the imperative of establishing credibility after this year, given the improved outlook for growth (and hence narrowing of the output gap), and given the resurgence of price pressures, fiscal policy should ideally have targeted a reasonable fiscal consolidation. However, setting overly ambitious targets for consolidation especially in a pre-election year based on optimistic forecasts that carry a high risk of not being realized will not garner credibility either. Pragmatically steering between these extremes would suggest the following: a modest consolidation that credibly signals a return to the path of gradual but steady fiscal deficit reductions.

Against this overall economic and political background, economic management will be challenging in the coming year. If the obvious pitfalls (such as fiscal expansion) are avoided, then the looming risks also could be averted which itself would be no mean achievement.

India's Merchandise Trade

Exports

India's merchandise exports (on customs basis) had reached the level of US$ 314.4 billion in 2013-14. Following the global trend of decline in export growth, India's exports also declined during 2014-15 and 2015-16, by 1.3% and 15.5% , respectively.

India's export growth continued to be negative in the first half of 2016-17 at (-)1.3%. However, in the second half of 2016-17, it started recovering, resulting in exports reaching US$ 275.9 billion with growth of 5.2% for the year 2016-17. In 2017-18 (April – December) export growth picked up further to 12.1 per cent. India's export growth (non-fuel) which has generally been higher than world export growth (non-fuel) moved to negative territory in 2014 and was lower or in tandem with world export growth (non-fuel) since then. Other BRICS countries also showed similar trends.

India's positive export growth in 2016-17 was on account of positive growth of both POL and non-POL exports at 3.2% and 5.4% , respectively. In 2017-18 (April-December) export growth was 12.1%, with POL and non- POL growth at 18.5% and 11.2%, respectively. India's export volume growth (3MMA), which moved to positive territory since March 2016, showed an upward trend till April 2017, but started decelerating though it was still broadly in positive territory. Since August 2017, it has again picked up and increased sharply in November 2017 in tandem with the sharp increase in export value growth. However, in December the growth rate of export volume and value index decelerated. Non-oil export volume index followed a similar trend.

Imports

Merchandise imports also fell from a high of US$ 490.7 billion in 2012-13 to US$ 381 billion in 2015-16 and registered a mild increase of 0.9% to US$ 384.4 billion in 2016-17. The increase in the value of imports in 2016-17, despite the decline in gold and silver imports by 17.3%, was due to rise in POL imports and a small increase in non-POL and non-gold and silver imports which had fallen in 2015-16. In 2017-18 (April-December), imports grew by 21.8%. Growth of POL import was 24.2 percent mainly due to the rise in crude oil prices. Non-POL imports registered a growth of 21.1% due to the growth of 52% in gold & silver imports, while non-POL and non-gold & silver imports grew by 18.1%. Growth in value of gold imports has fallen since September 2017 due to decline in the growth of volume of gold imports. Gold import value index has been moving in tandem with gold volume index.

Growth of both total import volume index and non-oil non-gold import volume index 3 months moving average (3MMA) which had picked up since January/ February 2017 started to decelerate from May 2017 though it continued to be in positive territory till December 2017.

Trade deficit

India's trade deficit (on custom basis) which had registered continuous decline since 2014-15, widened to US$ 74.5 billion in H1(first half year) of 2017-18 from US$ 43.4 billion in H1 of 2016-17. India's trade deficit was US$ 108.5 billion in 2016-17, with the reduction in both POL deficit and non-POL deficit. In 2017-18 (April-December) trade deficit (on customs basis) shot up by 46.4% to US$ 114.9 billion with POL deficit growing by 27.4% and non-POL deficit by 65 percent.

Among India's trading partners, the top five countries with which India has negative bilateral trade balance are China, Switzerland, Saudi Arabia, Iraq and South Korea while the top five countries with which it has surplus trade balance are USA, UAE, Bangladesh, Nepal and UK. India has the highest trade deficit with China. Its share in India's total trade deficit increased from 20.3% in 2012-13 to 47.1% in 2016-17 and 43.2% in 2017-18 (April-September). India's major items of imports from China are telephone sets including mobiles, automatic data processing machines, diodes & other semi-conductor devices, electronic devices, chemical fertilizers, etc. India's major items of exports to China are cotton yarn, copper refined and copper alloys unwrought, POL items, granite, aluminium ores, other fixed vegetable fats & oils, cyclic hydrocarbons, cotton, polymers and iron ore. In the case of Switzerland, the trade deficit is mainly due to import of gold. This deficit has fallen in the last two years. Moreover, a part of it is used in exports. In the case of Saudi Arabia and Iraq, the deficit is due to crude oil imports, while for South Korea it is due to import of electrical machinery equipment and iron & steel.

MINING INDUSTRY

The index of mineral production (base year 2004-2005=100) for all minerals (excluding atomic minerals) stood at 132.2 points in 2016-17 registering an increase of 2.2% over that of the previous year.

The total value of mineral production (excluding atomic minerals and fuel minerals) was at ₹ 1,01,426 crore during 2016-17.

The value of metallic minerals in 2016-17 at ₹ 40,017 crore increased by about 19% over that of the previous year. Among the principal metallic minerals, iron ore contributed ₹ 25,138 crore or 63%, lead (concentrate) & zinc (concentrate) together ₹ 5,305 crore or 13%, chromite ₹ 3,643 crore or about 9%, manganese ore ₹ 1,602 crore or about 4%, silver ₹ 1,832 crore or 5%, bauxite ₹ 1,417 crore or 4% and the remaining value was from copper (concentrate), gold and tin concentrates (Table-1).

In metallic ores, production increased in respect of chromite (28%), manganese ore (10%) and iron ore (21%). The production of zinc concentrates increased marginally by one percent. The production of copper concentrates decreased by about 11% and bauxite by 12% during 2016-17.

Table – 1 : Indian Mineral Industry : Value of Production*
2014-15 to 2016-17

(In ₹ crore)

Sector	2014-15 (R)	2015-16 (R)	2016-17 (P)
Total : All Minerals	**290587**	**284899**	**101426**
Fuels	193372	189711	NA
(a) Solid fuel	97450	95881	NA
(b) Liquid & gaseous fuels(ev)	95922	93830	NA
Metallic minerals	37909	33622	40017
Non-metallic minerals	7914	7572	7415
Minor Minerals	51390	53994	53994

** Excluding the minerals declared as prescribed substances under the Atomic Energy Act,1962 and minor minerals.*
(ev) : Value estimated.
NA: Not available.
***Note**:- The value of fuel minerals production is not reflected from source agency hence not reflected for the year, 2016-17.*

The value of production of non-metallic minerals at ₹ 7,414 crore during 2016-17 decreased by 2% from that of the previous year. Limestone with a contribution of 90% of the total value of non-metallic minerals, retained its leading position in 2016-17 in the group. The other important non-metallic minerals in value terms, were phosphorite/rock phosphate (5%) and diamond (1%). Indian Mining Industry is characterised by a large number of small operational mines. The total number of reporting mines [excluding atomic minerals, minor minerals, petroleum (crude) and natural gas (utilised)] in the country was 2,020 in 2016-17 as against 2,131 in 2015-16. Among them, 512 mines were of fuel minerals, 644 mines were of metallic minerals and 864 mines were of non-metallic minerals (Table-2). There were 637 mines in the Public Sector and the remaining 1,383 mines were under Private Sector.

Table – 2 : Number of Reporting Mines 2015-16 and 2016-17

Sector		2015-16 (R)	2016-17 (P)
All Minerals*		**2131**	**2020**
I	(i) Public sector	634	637
	(ii) Private sector	1497	1383
II	(i) Fuel minerals(e)	512	512
	(ii) Metallic minerals	715	644
	(iii)Non-metallic minerals	904	864

** Excluding atomic minerals, petroleum (crude), natural gas (utilised) and minor minerals.*
Source: *MSMP, March-2017.*

Role of Public Sector

The entire production of copper ore & concentrates among metallic minerals; and diamond, fluorite, selenite and sulphur in respect of non-metallic minerals was reported from the Public Sector. Public Sector also had a sizeable contribution in production of phosphorite/ rock phosphate (99%), gold (primary) (99%), natural gas (ut.) (78%), petroleum (crude) (76%), tin conc. (83%), graphite (76%), magnesite (54%) and manganese ore (44%).

Gross Value Added from Mining & Quarrying Sector

The Ministry of Statistics & Programme Implementation has released the new series of national accounts, revising the base year from 2004-05 to 2011-12 in the year 2015. The Industry-wise estimates are now presented as Gross Value Added (GVA) at basic prices. Certain changes have been made in this series including for Mining & Quarrying Industry. During 2016-17 Mining & Quarrying Industry accounted for about 2.2% of the GVA at current prices. The GVA at current and constant prices for the period from 2014-15 to 2016-17 is furnished in Tables- 3 & 4.

Employment

The estimated average daily employment of labour engaged in Mining Sector (excluding atomic and minor minerals) was 4,77,399 in 2016-17. Of this, 3,76,819 or 79% were in Public Sector and 1,00,580 or 21% in Private Sector. Fuel minerals accounted for 77%, metallic minerals 17% and non-metallic minerals 6% of the total labour force during the year.

India's ranking in 2016 in world production was 2nd in coal & lignite, 3rd in steel (crude), kyanite, andalusite & sillimanite and; 4th in chromite, iron ore, aluminium and zinc (slab); 5th in bauxite, 6th in manganese ore, copper (refined) and 10th in magnesite. The statistics on indigenous and world production of principal minerals and metals are detailed in Table- 5.

Table - 3: Gross Value Added at Basic Price, 2014-15 to 2016-17 (At Current Prices)

(in ₹ crore)

Industry	2014-15 (NS)	2015-16 (NS)	2016-17 (PE)	% Change in 2016-17 over the previous year
GVA (All)	**11481794**	**12458642**	**13669914**	**9.7**
Mining & Quarrying	314177	296253	301921	1.9

***Source** : CSO* *NS : New Series Estimates* *PE : Provisional Estimates*

Table - 4: Gross Value Added at Basic Price, 2014-15 to 2016-17 (At 2011-12 Prices)

(in ₹ crore)

Industry	2014-15 (NS)	2015-16 (NS)	2016-17 (PE)	% Change in 2016-17 over the previous year
GVA (All)	**9719023**	**10490514**	**11185440**	**6.6**
Mining & Quarrying	293821	324740	330485	1.8

***Source** : CSO* *NS : New Series Estimates* *PE : Provisional Estimates*

Table-5: Contribution and Rank of India in World Production of Principal Minerals & Metals, 2016

Sector	Unit of Commodity	Production quantity		Contribution (Percentage)	India's rank in World order
		World	India*		
Metallic Minerals					
Bauxite	'000 tonnes	289000	24664	8.53	5th
Chromite	'000 tonnes	34800	3727	10.71	4th
Iron ore	million tonnes	3305	192	5.81	4th
Manganese ore	'000 tonnes	51200	2393	4.67	6th
Industrial Minerals**					
Magnesite	'000 tonnes	29800	299	1.00	10th
Apatite & Rock phosphate	'000 tonnes	276000	1181	0.43	17th
Metals					
Aluminium	'000 tonnes	58800	2896	4.92	4th
Copper (refined)	'000 tonnes	23400	787	3.36	6th
Steel (crude/liquid)	million tonnes	1623	97.44	6.00	3rd
Lead (metal)	'000 tonnes	11300	142	1.25	14th
Zinc (slab)	'000 tonnes	13800	672	4.87	4th

***Source:** World mineral production data compiled from World Mineral Production, 2012-2016; British Geological Survey.*
** Figures relate to 2016-17.*
***Note:** Data in respect of World Mineral Production is on calendar year basis, however the data on India's production is based on financial year.*
*** As per Government of India Notification S.O. 423(E) dated 10th February, 2015, following minerals have been declared as minor minerals: i) barytes ii) dolomite iii) felspar iv) fireclay v) quartz/silica sand and vi) talc/steatite/ soapstone & pyrophyllite, hence not included in the table due to non-availability of production data with respect to India.*

MINERAL POLICY & LEGISLATION

Important Notifications issued during the period under review are detailed below:

National Mineral Policy 2018

The Hon'ble Supreme Court in its judgement dated 2.08.2017 in the Writ Petition (civil) 114 of 2014 inter-alia directed the Union of India to revisit the National Mineral Policy 2008 (NMP 2008) and announce a fresh and more effective and meaningful policy.

In compliance of the directions given by the Hon'ble Supreme Court, Ministry of Mines (MOM), vide its Order no.15/1/2017-MV dated 14.08.2017, had costituted a Committee.

The Committee had representatives from Central Ministries, State Government, Industry Associates, Professional Bodies and it also consulted the NGOs and many other Stakeholders by co-opting them. The Committee adopted a consultative process and went ahead with an approach towards problem solving and resolving of issues. It held four meetings wherein exhaustive deliberations on the issues raised by the stakeholders were discussed. The Committee also sought written comments/suggestions from stakeholders.

The Committee submitted its report to the Ministry on 31.12.2017.

Foreign Direct Investment Policy (FDI)

(I) As policy, 100% FDI has been permitted via Automatic Route for mining and exploration of metal and non-metal ores including diamond, gold, silver and precious ores and the mining of coal and lignite for captive consumption for power projects, iron, steel and cement units.

(II) Similarly, 100% FDI has been permitted through Government Route for mining of titanium-bearing minerals and its ores, its value addition and integrated activities.

FDI Equity Inflow

As per DIPP "Mining Sector Achievement Report", the FDI equity inflow in the sector increased by 1600 % to US$ 1.2 billion during August 2014-March 2016 as compared to US$ 70.62 million released during the period April 2012-March 2014.

National Mineral Exploration Policy (NMEP)

National Mineral Exploration Policy (NMEP, 2016) encourages Private Sector participation through its revenue sharing model. It also emphasises on generation and dissemination of baseline geo-scientific data by the Government as public good and creation of National Geo-Science Data Repository to promote exploration activities. Implementation of this policy will promote the growth of the sector as currently India lags in base-line geophysical and geochemical Data Creation.

Hydrocarbon Exploration and Licensing Policy (HELP)

The Government recently approved Hydrocarbon Exploration and Licensing Policy (HELP) in March 2016 in order to attract desired level of investment in petroleum exploration. The Government is strategically moving away from cost-sharing model to revenue-sharing model with marketing and pricing freedom for crude oil and natural gas produced by contractors under HELP. The new policy regime is expected to attract more investment to boost exploration and production of oil and gas from conventional and unconventional sources. Further, the HELP is designed to improve bidding for designated areas throughout the year in a very transparent manner.

Foreign Trade Policy

Amendment in Para 4.44 of Chapter 4 of the Foreign Trade Policy (FTP) 2015-20

In the Notification issued by the Ministry of Commerce and Industry (Department of Commerce) (Directorate General of Foreign Trade) and published in the Gazette of India, Extraordinary, Part II, Section 3(ii), dated 22.02.2017 S.O. 596 (E) the following amendments have been effected.

In exercise of powers conferred by Section 5 of FT (D&R) Act, 1992, read with Paragraph 1.02 of the Foreign Trade Policy, 2015-20, as amended from time to time, the Central Government hereby makes following amendments in Para 4.44 of Chapter 4 of Foreign Trade Policy 2015-20.

1. The existing Para 4.44 of FTP 2015-20 reads as under:

4.44. Export of Cut & Polished Diamonds with Re-import Facility at Zero Duty "An exporter (with annual export turnover of ` 5 crore for each of the last three years) may export cut & polished diamonds (each of 0.25 carat or above) to any of the agencies/ laboratories mentioned under paragraph 4.74 of Handbook of Procedures with re-import facility at zero duty within 3 months from the date of export. Such facility of export and subsequent re-import at zero duty will be subject to guidelines issued by Central Board of Customs & Excise, Department of Revenue".

2. ***Effect of Notification***: The facility for export and re-import of cut and polished diamonds at zero duty for the purpose of certification and grading has been extended to the authorised offices/ agencies in India for laboratories mentioned under Paragraph 4.74 of Handbook of Procedures 2015-20.

Amendments in Appendix 4J of Handbook of Procedures 2015-20 and in General Notes for Chemicals and Allied Products of Standard Input Output Norms (SION) relating to Export Obligation Period under Advance Authorisations.

In the Public Notice issued by Ministry of Commerce and Industry (Department of Commerce) and published in the Gazette of India, Extraordinary, Part I, Section 1, dated 24.03.2017, Public Notice, 62 /2015-2020 under F. No. 01/94/ 180/115/AM 17/PC-4, it reads —In exercise of powers conferred under Paragraph 1.03 of the Foreign Trade Policy 2015-2020, as amended from time to time, the Director General of Foreign Trade made amendment in Appendix 4J of Handbook of Procedures 2015-2020:

Amendment in Para 2.54 of the Handbook of Procedures, 2015-2020

Under Ministry of Commerce and Industry (Department of Commerce) Public Notice 62/ 2015-2020 No. 01/89/180/53/AM-01/PC-2 (B), it reads— In exercise of powers conferred under Paragraph 2.04 of the Foreign Trade Policy 2015-2020, the Directorate General of Foreign Trade hereby amends (i) Para 2.54 (d) (iv) of the Handbook of Procedures, 2015-2020 detailing the names of the designated ports for import of un-shredded metallic scrap; and (ii) extends their validity for such imports, in supersession of the provision in Para 2.54(d) (v), notified vide Public Notice No 38(2015-20) dated 06/10/2016 as under:

Existing Paragrapah

Import of scrap would take place only through following designated ports and no exceptions would be allowed even in case of EOUs, SEZs:-
1. Chennai, 2. Cochin, 3. Ennore, 4. JNPT, 5. Kandla, 6. Mormugao, 7. Mumbai, 8. New Mangalore, 9. Paradip, 10. Tuticorin, 11.Visakhapatnam, 12. ICD Loni, Ghaziabad, 13. Pipava, 14. Mundra, 15. Kolkata, 16. ICD Ludhiana, 17. ICD Dadri (Greater Noida), 18. ICD Nagpur, 19. ICD Jodhpur, 20. ICD Jaipur, 21. ICD Udaipur, 22. CFS Mulund, 23. ICD Kanpur, 24. ICD Ahmedabad, 25. ICD Pitampur and 26. ICD Malanpur.

Revised Paragraph

Import of scrap would take place only through following designated ports and no exceptions would be allowed even in case of EOUs, SEZs:-1. Chennai, 2. Cochin, 3. Ennore, 4. JNPT, 5. Kandla, 6. Mormugao, 7. Mumbai, 8. New Mangalore, 9. Paradip, 10. Thoothukudi, 11.Visakhapatnam, 12. Pipava, 13. Mundra and 14. Kolkata.

The existing designated sea ports, namely; Chennai, Cochin, Ennore, JNPT, Kandla, Mormugao, Mumbai, New Mangalore, Paradip, Thoothukudi, Visakhapatnam, Pipava, Mundra and Kolkata will be further allowed to import unshredded scrap till 31st March, 2018 by which time they are required to install and operationalise Radiation Portal Monitors and Container Scanner. Such sea ports which fail to meet the deadline will be derecognised for the purpose of import of un-shredded metallic scrap w.e.f. 1.4.2018.

Effect of the Public Notice: Para 2.54(d)(iv) of the Handbook of Procedures, 2015-2020 has been amended to reflect the list of designated ports for imports of un-shredded metallic scrap and the period for installation and operationalisation of Radiation Portal Monitors and Container Scanner in these ports is extended up to 31.3.2018.

Amendments in Foreign Trade Policy 2015-20

In the Notification S.O 596 (6) of the Ministry of Commerce and Industry (Department of Commerce) (Directorate General of Foreign Trade), it reads — In exercise of powers conferred by Section 5 of FT (D & R) Act, 1992, read with

Paragraph 1.02 of the Foreign Trade Policy, 2015-2020, as amended from time to time, the Central Government hereby makes following amendments in Para 4.44 of Chapter 4 of Foreign Trade Policy 2015-20.

1. The existing Para 4.44 of FTP 2015-20 reads as under:

4.44 Export of Cut & Polished Diamonds with Re-import Facility at Zero Duty-

"An exporter (with annual export turnover of ₹ 5 crore for each of the last three years) may export cut & polished diamonds (each of 0.25 carat or above) to any of the agencies/laboratories mentioned under paragraph 4.74 of Handbook of Procedures with re-import facility at zero duty within 3 months from the date of export. Such facility of re-import at zero duty will be subject to guidelines issued by Central Board of Customs & Excise, Department of Revenue".

2. The amended Para 4.44 of FTP 2015-20 is to be read as under:

4.44 Export of Cut & Polished Diamonds with Re-import Facility at Zero Duty

"An exporter (with annual export turnover of ₹ 5 crore for each of the last three years) or the authorised offices/agencies in India of laboratories mentioned under Paragraph 4.74 of Handbook of Procedures may export cut & polished diamonds (each of 0.25 carat or above) to any of the agencies/laboratories mentioned under Paragraph 4.74 of Handbook of Procedures 2015-20 with re-import facility at zero duty within 3 months from the date of export. Such facility of export and subsequent re-import at zero duty will be subject to guidelines issued by Central Board of Customs & Excise, Department of Revenue".

Sand Mining

Press Information Bureau, Government of India Ministry of Mines published a Guidelines for Sand Mining on 15th December, 2016. The Guidelines for Sand Mining are as follows:

Sand is a minor mineral, as defined under Section 3(e) of the Mines and Minerals (Development and Regulation) Act,1957 (MMDR Act). Section 15 of the MMDR Act empowers State Governments to make rules for regulating the grant of mineral concessions in respect of minor minerals and for purposes connected therewith. The regulation of grant of mineral concessions for minor minerals is, therefore, within the legislative and administrative domain of the State Governments.

Under the power granted to them by Section 15 of the MMDR Act, State Governments have framed their own minor minerals concession rules.

Further, Section 23C of the MMDR Act, 1957 empowers State Governments to frame rules to prevent illegal mining, transportation and storage of mineral sand for purposes connected therewith. Control of illegal mining is, therefore, under the legislative and administrative jurisdiction of State Governments.

The Ministry of Environment, Forest and Climate Change has issued Sustainable Sand Mining Management Guidelines, 2016, which, inter-alia, addresses the issues relating to regulation of Sand Mining. The salient features of the Guidelines in this regard are as follows:

(i) It provides for a detailed programme for ensuring that mining of river sand is done in a sustainable manner;

(ii) Grant of Environment Clearance for minor minerals, including sand and gravel, for mining lease of area up to 5 hectares will be done by the District Environment Impact Assessment Authority headed by the District Collector/ District Magistrate.

(iii) Removal of sand accumulated on the agricultural field after cessation of flooding will not be considered as mining operation and its removal and selling can be allowed without the requirement of environment clearance till it is done only to the extent of reclaiming the agricultural land.

(iv) Exemption of certain cases from being considered as mining for the purpose of requirement of environment clearance like that of extraction of ordinary clay or ordinary sand manually by hereditary Kumhars (Potter) who prepare earthen pots on a Cottage Industry basis;

(v) extraction of ordinary clay or ordinary sand manually by earthen tile makers who prepare earthen tiles on a Cottage Industry basis;

(vi) removal of sand deposited on agricultural field after flood by owner farmers;

(vii) customary extraction of sand and ordinary earth from sources situated in Gram Panchayat for personal use or community work in village;

(viii) community works like desilting of village ponds /tanks, rural roads undertaken in MGNREGS and other Government sponsored schemes;

(ix) dredging and desilting of dam, reservoirs, weirs, barrages, river, and canals for maintenance and upkeep and avert natural disaster. If the dredging activities are undertaken for the purpose of winning mineral and selling it commercially it will be considered mining.

LEGISLATION

Offshore Areas Mineral (Development and Regulation) Act, 2002

In the Notification published vide S.O. 2324(E). dated 30.06.2016 it is stated that — Whereas the Offshore Areas Mineral (Development and Regulation) Act, 2002 (No.17 of 2003) (hereinafter referred to as OAMDR Act) received the assent of the President of India on 30th January, 2003.

Whereas in exercise of the powers conferred by Section 35 of the OAMDR Act, the Ministry of Mines, Government of India notified the Offshore Areas Mineral Concession Rules, 2006 (hereinafter referred to as OAMCR) on 3rd November, 2006.

Whereas the Ministry of Mines by notification in the Official Gazette dated 12th February, 2010 notified 15th January, 2010 as the date on which the OAMDR Act and OAMCR shall come into force.

Whereas in exercise of the powers conferred under Clause (a) of Section 4 of the OAMDR Act, the Central Government vide S.O.339 (E) dated 11th February 2010 notified the Controller General, Indian Bureau of Mines, Nagpur as the Administering Authority for the purposes of the said OAMDR Act.

Whereas in exercise of the powers conferred under Sub-section (1) of Section 10 of OAMDR Act, the Administering Authority notified 63 mineral-bearing offshore blocks for grant of exploration licences, vide S.O.1341(E) dated 7th June 2010, which was published in the Official Gazette dated 9th June 2010.

And whereas 377 applications were received from 53 applicants and whereas 16 applicants were shortlisted for grant of 62 exploration blocks (the bounding latitude and longitude of Block Nos. 3 &32 falling in the Arabian Sea were same and therefore these were considered as a single block and granted as Block No.3).

Whereas orders for grant of exploration licences were issued by the Administering Authority on 05.04.2011 to 16 successful applicants for the 62 exploration blocks.

And whereas as per the provisions of Sub-rule (1) of Rule 19 of the OAMCR, where an order has been made for the grant of exploration licence, a deed granting such licence shall be executed within ninety days of the date of the communication of the said order.

Whereas the grant of exploration licences in 62 blocks was challenged in the judicature of various High Courts.

And whereas the Hon'ble High Court of Judicature of Bombay, Nagpur Bench, vide its Order dated 28.03.2011 in Writ Petition No. 1502 of 2011, directed that all subsequent actions be kept in abeyance till the final order of the Hon'ble High Court.

And whereas in keeping with the directions issued by the Hon'ble High Court of Judicature of Bombay, Nagpur Bench, vide its Order dated 28.03.2011, all the 16 applicants were informed that all subsequent actions are being kept in abeyance till the final order of the Hon'ble Court is received. Whereas the Hon'ble High Court of Judicature at Bombay, Nagpur Bench vide interim Order dated 28.11.2011 in Writ Petition No. 1502 of 2011 clarified that the Order dated 28.03.2011 should be confined to 17 blocks for which the petitioner has staked claim and the remaining blocks do not form the subject matter of consideration before the Court.

And whereas the Hon'ble High Court of Judicature at Bombay, Nagpur Bench vide Order dated 17.09.2013 while disposing the Writ Petition No. 1502 of 2011 ordered the continuance of the interim Order dated 28.11.2011 for a period of ten days to enable the petitioner to move an appropriate application for further continuation of the interim Order if so desired.

And whereas the Hon'ble High Court of Judicature at Bombay, Nagpur Bench vide Order dated 27.09.2013 extended the Order dated 28.03.2011 as modified on 28.11.2011 for a further period of six weeks.

Whereas the Hon'ble High Court of Judicature of Andhra Pradesh at Hyderabad vide interim Order dated 22.06.2011 in Writ Petition No. 12835 of 2011 directed that "in the meanwhile, if any steps are taken for grant of exploration licences, the same shall be subject to further orders by this Court". Further, another Order dated 11.07.2011 was issued by the Hon'ble Court in this regard directing that "the interim Order dated 22.06.2011 granted earlier shall continue until further orders".

And whereas the Writ Petition No. 12835 of 2011 filed in the Hon'ble High Court of Judicature of Andhra Pradesh at Hyderabad has not been

disposed as on the date of this order, and the offshore exploration licences granted have not been executed till date.

Whereas it has come to the notice of the Administering Authority that some of the exploration blocks notified for grant of offshore exploration licences vide notification dated 07.06.2010 overlap with areas other than offshore area, to which the OAMDR Act does not apply.

That the jurisdiction of OAMDR Act, applies exclusively to offshore areas which has been defined in the said Act as the territorial waters, continental shelf, exclusive economic zone and other maritime zones of India under the Territorial Waters, Continental Shelf, Exclusive Economic Zone and Other Maritime Zones Act, 1976.

And that the grant of mineral concessions over areas other than offshore areas is regulated by the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957).

Whereas the Central Government vide S.O.19 (E) dated 6th January, 2011, published in the Official Gazette by the Department of Environment, Forests and Wildlife, Ministry of Environment and Forests, has declared the extent of the Coastal Regulation Zone (CRZ) and has also imposed certain restrictions on the setting up and expansion of industries, operations or processes and the like in the CRZ.

And whereas the said statutory Order dated 6.1.2011 states that CRZ shall also apply to the water and the bed area between the Low Tide Line to the territorial water limit (12 Nm) in case of seas and has prohibited in the area so identified as CRZ, inter alia, the mining of sand, rocks and other sub-strata materials except those rare minerals not available outside the CRZ area.

And whereas all the 62 offshore blocks which were notified for grant of exploration licences vide S.O.1341(E) dated 9th June 2010, lie within the area identified as CRZ, i.e. they lie within the territorial water limit of 12 nautical miles which attracts the prohibition of mining (which means any operation undertaken for the purpose of winning any mineral) imposed by the statutory Order dated 6.1.2011 issued by the Central Government.

Whereas production lease is granted under the OAMDR Act for the purpose of winning any mineral from the offshore area.

And whereas grant of production lease is consequential to the grant of exploration license as the OAMDR Act provides that the holder of an exploration licence shall have the exclusive right to a production lease which is the operating right for winning of a mineral.

Whereas in view of the effect of the CRZ Notification dated 6.1.2011 the purpose of executing the 62 offshore exploration licences gets defeated as the applicants cannot undertake operations for winning of minerals subsequent to the grant of production lease after the successful completion of exploration operations.

Taking into consideration all the above stated facts, the Notification issued vide S.O.1341(E) dated 7th June 2010 has been annulled with effect that all subsequent actions undertaken for grant of the 62 exploration licences would stand rescinded.

MMDR Act

Minerals (Transfer of Mining Lease Granted Otherwise than through Auction for Captive Purpose) Rules, 2016.

In the Notification published in the Gazette of India dated 18th May 2016 S.O. 560(E), it reads— In exercise of the powers conferred by Clause (qqja) of Sub-section (2) of Section 13 read with the proviso to Sub-section (6) of Section 12A of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957), the Central Government had made these rules.

Amendment of the Mineral (Auction) Rules, 2015

In the Notification issued by Ministry of Mines and published on 30th November, 2017 under G.S.R.1469 (E), it reads— In exercise of the powers conferred by Section 13 of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957), the Central Government had amended the Mineral (Auction) Rules, 2015.

1. The Bank for the purpose hereof unconditionally and irrevocably undertakes to pay

to the State without any demur, reservation, caveat, protest or recourse, immediately on receipt of first written demand from the State, a sum or sums (by way of one or more claims) not exceeding the Guarantee Amount in the aggregate without the State needing to prove or to show to the Bank grounds or reasons for such demand for the sum specified therein and notwithstanding any dispute or difference between the State and Preferred Bidder or Successful Bidder on any matter whatsoever. The Bank undertakes to pay to the State any money so demanded notwithstanding any dispute or disputes raised by the Preferred Bidder or Successful Bidder in any suit or proceeding pending before any court or tribunal relating thereto the Bank's liability under this present being absolute and unequivocal.

2. The Bank acknowledges that any such demand by the State of the amounts payable by the Bank to the State shall be final, binding and conclusive evidence in respect of the amounts payable by Preferred Bidder or Successful Bidder to the State under the Agreement.

3. The Bank hereby waives the necessity for the State from demanding the aforesaid amount or any part thereof from the Preferred Bidder or Successful Bidder and also waives any right that the Bank may have of first requiring the State to pursue its legal remedies against the Preferred Bidder or Successful Bidder, before presenting any written demand to the Bank for payment under this Guarantee.

4. The Bank further unconditionally agrees with the State that the State shall be at liberty, without the Bank's consent and without affecting in any manner the Bank's obligation under this Guarantee, from time to time to:

i) vary and/or modify and of the terms and conditions of the Agreement;

ii) extend and/or postpone the time for performance of the obligations of the Preferred Bidder or successful Bidder under the Agreement, or

iii) forbear or enforce any of the rights exercisable by the State against the Preferred Bidder or Successful Bidder under the terms and conditions of the Agreement,

and the Bank shall not be relieved from its liability by reason of any such act or omission on the part of the State or any indulgence by the State to the Preferred Bidder or Successful Bidder or other thing whatsoever which under the law relating to sureties would, but for this provision, have the effect of relieving the Bank of its obligations under this Guarantee.

5. Any payment made hereunder shall be made free and clear of and without deduction for, or on account of, any present or future taxes, levies, imposts, duties, charges, fees, commissions, deductions or withholdings of any nature whatsoever.

6. The Bank agrees that the State at its option shall be entitled to enforce this Guarantee against the Bank, as a principal debtor in the first instance without proceeding at the first instance against the Preferred Bidder or Successful Bidder.

7. The Bank further agrees that this bank guarantee and the guarantee obligations herein contained shall remain in full force and effect and shall continue to be enforceable till: (i) all the obligations of the Preferred Bidder or Successful Bidder under or by virtue of the said Agreement with respect to the Performance Security have been fully paid and its claims satisfied or discharged; or (ii) till the State certifies that the terms and conditions of the Agreement with respect to the Performance Security have been fully and properly carried out by the Preferred Bidder or Successful Bidder and accordingly discharges this guarantee; or (iii) on provision of a revised performance security under Sub-rule (2) of Rule 19 of the Mineral (Auction) Rules, 2015 whichever is later. Notwithstanding anything contained herein, unless a demand or claim under this guarantee is made on the Bank in writing on or before the Expiry Date the Bank shall be discharged from all liability under this guarantee thereafter.

8. The payment so made by the Bank under this Guarantee shall be a valid discharge of Bank's liability for payment thereunder and the State shall have no claim against the Bank for making such payment.

9. This Guarantee is subject to the laws of India. Any suit, action, or other proceedings arising out of this Guarantee or the subject matter hereof shall be subject to the exclusive jurisdiction of courts at the State of [respective State].

10. The Bank has the power to issue this Guarantee in favour of the State. This guarantee will not be discharged due to the change in the constitution of the Bank.

11. The Bank undertakes not to revoke this Guarantee during its currency except with the previous consent of the State in writing.

Minerals (Other than Atomic and Hydrocarbons Energy Minerals) Concession (Amendment) Rules, 2016

In the Notification published in the Gazette of India: Extraordinary, Part II, Section 3(i) dt.

08.12.2016, under G.S.R. 1120(E), it reads — In exercise of the powers conferred by Section 13 of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957), the Central Government hereby makes the following rules to amend the Minerals (Other than Atomic and Hydrocarbons Energy Minerals) Concession Rules, 2016, namely—

1. (i) These rules may be called the Minerals (Other than Atomic and Hydrocarbons Energy Minerals) Concession (Amendment) Rules, 2016.

(ii) They shall come into force on the date of their publication in the Official Gazette.

2. In the Minerals (Other than Atomic and Hydrocarbons Energy Minerals) Concession Rules, 2016, in Rule 12, after Sub-rule (5), the following Sub-rule shall be inserted, namely:–

"(5A) Notwithstanding anything contained in Sub-rule (5), the State Government may grant a mining lease for area less than five hectares in respect of a mining lease to be granted in pursuance of the provisions of Clause (b) or Clause (c) of Sub-section (2) of Section 10A of the Act:

Provided that no mining lease shall be granted for area less than one hectare, in respect of small deposits (not fragmented portions of larger ones), shallow in nature, isolated and not exceeding two hundred metres in strike length, which are small by virtue of either origin or mode of emplacement or dislocation due to geological disturbances; and small deposits shall also include float deposits (transported) formed due to mechanical weathering and deposition, alluvial or eluvial placers (buried or otherwise), which generally have peculiar configurations excepting beach sands or placers:

Provided further that no mining lease shall be granted for area less than two hectares, in respect of beach sands or placers, which are mono or multi mineral concentrations, including the dunes occurring on and off the coastal shore line deposited as a product of the ebb and flow of tides, waves and inshore currents, and at places semi-consolidated to consolidated in nature: Provided also that no mining lease shall be granted for area less than four hectares in all other cases other than those specified in the first and second provisos."

Mineral Conservation and Development Rules, 2017

In the Notification issued by the Ministry of Mines and published in the Gazette of India, Extraordinary, Part II, Section 3(i), dated 27.02.2017.G.S.R. 169(E), it reads —In exercise of powers conferred by Section 18 of the Mines and Minerals (Development and Regulation) Act,1957 (67 of 1957), and in supersession of the Mineral Conservation Development Rules, 1988, except as respects things done or omitted to be done before such supersession, the Central Government hereby makes the Mineral Conservation and Development Rules, 2017.

In the said Rules definitions for various terms were defined under Rule 3, further, provisions were made for reconnaissance and prospecting operations, mining operations, plans & sections, sustainable mining, notices & returns, employment of geologists and mining engineers, examination of minerals & issue of directives, revision & penalty, geological reports, mining regulation portal, etc. Further, in the attached schedule Form – A, Form – B, Form – C, Form – D, Form – E, Form – F, Form – F1, Form – F2, Form – F3, Form – G1, Form – G2, Form – G3, Form – H, Form – I, Form – J, Form – K, Form – L, Form – M and Form – N have been enclosed.

Amendment to the Mineral Conservation and Development Rules, 2017

The lease period of merchant miners extended under the Section 8A(6) of the MMDR Act, would expire on 31st March, 2020. There are about 288 mining leases which would expire in 2020, of which 59 are working leases, which give substantial production of key minerals viz. iron ore, manganese ore, chromite ore, etc. The auction process needs to be initiated well in advance to ensure a seamless transition from the existing to the new lessees so that the mineral production is not affected due to expiry of these leases. Exploration of the blocks was required to be done for the auction process of these mineral blocks. The Central Government had earlier issued a directive in 2010 which mentioned that all the existing leases have to be brought to an exploration level of G2 or G1 in 5 years' time. It has been further strengthened by inserting Rule 12 (4A) in the Mineral Conservation and Development Rules, 2017 (MCDR) by way of an amendment notification, published in the Gazette of India vide G.S.R. No.289 dated 27.03.2018. The Rule mandates exploration in G2 level as stipulated under Clause (a) of Rule 5 of the Minerals (Evidence of Mineral Contents) Rules 2015, to be carried out in the mining leases expiring in 2020 by 1st April, 2019. The Rule also lays down the timelines for implementation of the exploration plan prepared with the approval of IBM for satisfying the requirements.

Mines and Minerals (Development and Regulation) Removal of Difficulties Order, 2017.

In the Order published in the Gazette of India: Extraordinary, Part II, Section 3(ii) dt. 04.01.2017 under S.O. 27(E), it reads—Whereas difficulties have arisen in giving effect to the provisions of Clause (c) Sub-section (2) of Section 10A of the Mines and Minerals (Development and Regulation) Amendment Act, 2015 (10 of 2015), in so far as it relates to fulfilment of conditions laid in the letter of intent (by whatever name called) issued by the State Governments within a period of two years from the date of commencement of the said Act.

Now, therefore, in exercise of the powers conferred by Sub-section (1) of Section 24 of the Mines and Minerals (Development and Regulation) Amendment Act, 2015 (10 of 2015), the Central Government issued the order to remove the difficulties relating to fulfilment of conditions laid in the letter of intent.

Export Rules

Recognising M/s SGS India Private Limited, for the Inspection of Minerals and Ores– Group-I, under Export (Quality Control and Inspection) Rules, 1964.

In the Notification issued by Ministry of Commerce and Industry and published in the Gazette of India, Extraordinary, Part II, Section 3(ii), dated 12.01.2017, S.O.152(E), it reads–In exercise of the powers conferred by the Sub-section (1) of Section 7 of the Export (Quality Control and Inspection) Act, 1963 (22 of 1963) read with Sub-rule (2) of Rules 12 of the Export (Quality Control and Inspection) Rules, 1964, the Central Government hereby recognises M/s SGS India Private Limited, Door No. 45-56-3/5/1, 1st Lane, Narasimha Nagar, NH 5, Visakhapatnam-530 024, Andhra Pradesh, in the performance of their function under this notification shall be bound by such directions as the Director (Inspection and Quality Control), Export Inspection Council may give in writing from time to time.

Recognising M/s Reliable Analytical Laboratories Pvt. Ltd, Murgao Beach Tower, for the Inspection of Minerals and Ores – Group-I, under Export (Quality Control and Inspection) Rules, 1964.

In the Notification issued by Ministry of Commerce and Industry and published in the Gazette of India, Extraordinary, Part II, Section 3(ii), dated 12.01.2017,S.O. 153(E), it reads— In exercise of the powers conferred by the Sub-section (1) of Section 7 of the Export (Quality Control and Inspection) Act, 1963 (22 of 1963) read with Sub-rule (2) of Rules 12 of the Export (Quality Control and Inspection) Rules, 1964, the Central Government hereby recognises M/s Reliable Analytical Laboratories Pvt. Ltd, Murgao Beach Tower, Ground Floor, Shop No. 07, Opp. Busy Bee School, Desterro, Vasco-Da-Gama, Goa – 403 802, as an agency for a period of three years with effect from the date of publication of this notification, for the inspection of Minerals and Ores Group-I, namely, Iron Ore as specified in the Schedule to the notification of the Government of India in the Ministry of Commerce vide number S.O. 3975 dated the 20th December 1965, prior to export of said Minerals and Ores at Goa Port, subject to the following conditions, namely—

(i) M/s Reliable Analytical Laboratories Pvt. Ltd, Murgao Beach Tower, Ground Floor, Shop No. 07, Opp. Busy Bee School, Desterro, Vasco-Da-Gama, Goa – 403 802, shall give adequate facilities to the officers nominated by the Export Inspection Council in this behalf to carry out the inspection specified under Rule 4 of the Export of Minerals and Ores - Group I (Inspection) Rules, 1965;

(ii) M/s Reliable Analytical Laboratories Pvt. Ltd, Murgao Beach Tower, Ground Floor, Shop No. 07, Opp. Busy Bee School, Desterro, Vasco-Da-Gama, Goa – 403 802, in the performance of their function under this notification shall be bound by such directions as the Director (Inspection and Quality Control), Export Inspection Council may give in writing from time to time.

Apex Court Verdict for Cancellation of Goa Iron Ore Leases

The Apex Court quashed the second renewal of Iron ore leases given to 88 companies in Goa, in 2015. The companies have been directed to stop all mining operations w.e.f. March 2018, until fresh mining leases (not fresh renewal or other renewals) are granted and fresh environmental clearances are granted.

The Supreme Court on 7th February, 2018 has directed the Centre and the Goa Government to grant fresh environment clearances.

Reservation of Area for M/s National Aluminium Company Limited (NALCO)

In the Notification published on G.S.R. 411(E) and [F. No. 4/16/2005-M.VI] dated 27th April, 2017, it reads—In exercise of the powers conferred by Sub-section (1A) of Section 17A of the Mines and Minerals (Development and Regulation) Act, 1957 (67 of 1957), the Central Government, in consultation with the State Government of Odisha, hereby reserves the area of **1738.04 hectares** specified below through M/s National Aluminum Company Limited **(NALCO)**, a Public Sector Undertaking owned and controlled by the Central Government, for undertaking prospecting or mining operations in respect of bauxite deposits in the Taluk of Pottangi of Koraput District in the State of Odisha for a further period of five years with effect from 27th April, 2017, except the areas already held under prospecting licence or mining lease and declares that no other prospecting licence or mining lease shall be granted in the said area, during the said period of five years lying within the boundary of such reserved area and for the mineral specified below, namely—

District: Koraput

Area: 1738.04 hectares, Pottangi Bauxite deposit in the Taluk of Pottangi of Koraput district–

Toposheet No. 65J/14.

Area demarcated by Latitude and Longitude:

Latitude 18° 34' 00" N to 18° 37' 15" N

Longitude 82° 56' 30" E to 83° 000' 00" E

Mineral: Bauxite.

EXPLORATION & DEVELOPMENT

GSI, DGMs of various States, Public Sector companies like NMDC, MECL, MOIL, GMDC, HGML, etc. continued their efforts of surveying, mapping and exploration of new deposits and reassessment of old deposits/ mines during 2016-17. In the Oil and Gas Sector, ONGC, OIL and a few joint venture and private companies were engaged in exploration of onshore and offshore areas in 2016-17. Exploration conducted by various organisations during 2016-17 is highlighted below:

Geological Survey of India (GSI)

GSI is vested with the responsibility of maintaining broad-based and uniform national approach to data generation in respect of mineral resources. With the near exhaustion of resources to the proximity of surface, it has become imperative to have multidisciplinary approach to mineral exploration which comprises large-scale and detailed geological mapping aided by interpretative analysis of aerogeophysical and remotely sensed data, ground geophysical survey, geochemical prospecting and surface & subsurface exploration through pitting, trenching & drilling. GSI's activities in mineral exploration as well as baseline surveys have increased manifold in order to sustain the momentum of national economic development and to meet the increasing demands of various stakeholders. As per recent development towards Policy shift, GSI has been entrusted G2 level of investigations for M-IIA Items that were included in FS 2015-16. GSI also did engage in the task of upgrading the level of investigation in different important exploration items along with identification of resource potential of G3 level, for auctioning as per the recent policies of the Government. Emphasis also has been laid on the need to focus attention on the survey and exploration of those minerals in which the country has high geologic potential but poor resource-cum-reserve base. Similar priority has also been given to minerals that have high internal demand or export potential.

GSI is executing its programmes through Mission-Region hybrid matrix mode.GSI in pursuance of its systematic geological mapping in 2016-17 had completed 8,043 sq km as against the target of 5,500 sq km large-scale mapping, 146 sq km detailed mapping as against the target of 103 sq km and 1,39,072 m drilling as against the target of 1,13,202 m. Out of the total mappable areas of 3.146 million sq km of the country, 3.106 million sq km has been covered (till March, 2017) so far by systematic mapping bringing the total coverage to 98.73%. Since the acquisition and induction of Twin Otter Airbone Survey System (TOASS), a total of 6.50 lakh line km was covered by multi-sensor survey till the field season March, 2016. The highlights of the resources assessed are as below:

Resources augmented by GSI during 2016-17 are furnished below:

i) A total resource of 23.87 million tonnes of high-grade iron ore (cut off 55% Fe) with average Fe content of 61.99% has been estimated and in addition to this, low-grade (45-55% Fe) resources of 5.0 million tonnes with average 50.04% Fe has also been estimated in Rengalaberha North-East block, Kendujhar distrct, Odisha.

ii) A total in situ resource of copper at 1.75 million tonnes with 0.42% Cu by longitudinal vertical section method and 1.72 million tonnes with 0.42% Cu by cross section method with 0.20% Cu cut off and 1.70 million tonnes with 0.42% Cu by cross-section method at 0.3% cut off has been calculated in north of Golwa, Mahendragarh distrct, Haryana.

iii) Exploration for multi-metal deposit was carried out in north of Tosham hill, Bhiwani district, Haryana. The total resources have been estimated to be 8.16 million tonnes tin at 0.21% Sn, 4.08 million tonnes tungsten at 0.29% W and 18.10 million tonnes copper at 0.38% Cu. Cobalt, which was not reported earlier in this mineral belt, has a resource of 0.23 million tonnes with an average grade of 0.16%.

iv) For assessment of cement-grade limestone resource in CAK block, Kurnool district, Andhra Pradesh, a total of 1128.20 m of drilling was completed in 23 boreholes. As per the data available, reserves for Chintalayapalle block have been estimated at 33.14 million tonnes. Reserves for the remaining two blocks are expected to be calculated after receipt of chemical analysis data.

Multibeam Survey concurrently along with sub-bottom (SBP) profiling and gravity surveys were carried out within EEZ, West of Lakshadweep in Arabian Sea. A total of 2020 line km was achieved in an area of 12,500 sq km within water depth from 2788 to 4249 m. Fe-Mn nodules/ encrustations of size varying from a few millimeters to 8 cm were observed on the loose sediment surface.

The planktonic foraminifera is the principle biogenic component and its contribution to the total sediment is around 25%.

MECL

MECL in the current year under review reportedly established a total of 3,184 million tonnes of mineral resources for various minerals. Mineral-wise details of resources estimated by MECL during 2016-17 are as below:

1) A total of 9.26 million tonnes of net reserves of iron ore with average grade of 50.89% Fe, 17.9% SiO_2 4.6% Al_2O_3 at 45% Fe cut off and 4.588 million tonnes net reserves of iron ore with average grade of 59.34% Fe, 8.85% SiO_2, 4.36% Al_2O_3 at 55% Fe cut off were estimated in M.L.No.2563 of M/s Kanhaiyalal Dudheria, Distt. Ballari, Karnataka.

2) A total of 4.542 million tonnes net reserves of iron ore with average grade of 49.52% Fe, 23.97% SiO_2 2.87% Al_2O_3 at 45% Fe cut off and 1.141 million tonnes net reserves of iron ore with average grade of 59.26% Fe, 4.30% SiO_2, 2.44% Al_2O_3 at 55% Fe cut off were estimated in M.L.No.2553 of Smt. Shanthalakshmi Jayaram, Distt. Ballari, Karnataka.

3) A total of 63.331 million tonnes net reserves of iron ore with average grade of 58.84% Fe, 6.54% SiO_2, 4.25% Al_2O_3 and 48.102 million tonnes net reserves of iron ore with average grade of 62.75% Fe, 3.40% SiO_2, 3.25% Al_2O_3 at 55% Fe cut off were estimated at M.L.No.2148 of M/s Rangana Gaud, Distt. Ballari, Karnataka.

4) A total of 7.577 million tonnes net reserves of iron ore with average grade of 52.19% Fe, 9.74% SiO_2, & 6.85% Al_2O_3 and 2.917 million tonnes net reserves of iron ore with average grade of 59.18% Fe, 4.65% SiO_2 and 4.65% Al_2O_3 at 55% Fe cut off were estimated at M.L.No.2245 of M/s Bharat Mines & Minerals Ltd, Distt. Ballari, Karnataka.

5) A total of 9.708 million tonnes net reserves of iron ore with average grade of 55.96% Fe, 13.99% SiO_2, and 3.20% Al_2O_3 at 45% Fe cut off and 8.407 million tonnes net reserves of iron ore with average grade of 60.96% Fe, 6.82% SiO_2 & 3.44% Al_2O_3 at 55% Fe cut off were estimated at M.L.No.995 of M/s Mysore Minerals Ltd, Distt. Ballari, Karnataka.

6) A total of 4.412 million tonnes of copper ore with 0.84% Cu at 0.50% cut off (332 category) was estimated at Thanewasna Block, Distt. Chandrapur, Maharashtra. The resources established during previous exploration by different agencies is included in the present resource estimation.

7) A total of 622.994 million tonnes of limestone with 50.65% CaO, 1.68% MgO, 2.80% SiO_2, 0.27% Al_2O_3, 0.81% Fe_2O_3 & 41.27% LOI (332/333) was estimated at Lumshorton Block, Distt. East Jaintia Hills, Meghalaya. The resources established during previous exploration by different agencies have been included in the present resource estimation.

8) A total of 4.203 million tonnes net reserves of iron ore with average grade of 57.28% Fe, 10.18% SiO_2, 5.42% Al_2O_3 at 45% Fe cut off and 8.680 million tonnes net reserves of iron ore with average grade of 60.36% Fe, 6.82% SiO_2, 4.48% Al_2O_3 at 55% Fe cut off (121) were estimated at ML No-2550 of M/s S. B. Minerals Ltd, Distt. Ballari, Karnataka.

9) A total of 2.153 million tonnes net reserves of iron ore with average grade of 54.37% Fe, 19.02% SiO_2, 8.02% Al_2O_3 at 45% Fe cut off and 1.323 million tonnes net reserves of iron ore with average grade of 59.57% Fe, 11.10% SiO_2, 2.89% Al_2O_3 at 55% Fe cut off (121) were estimated at ML No-2315 of M/s Trident Minerals, Distt. Ballari, Karnataka.

10) A total of 1.061 million tonnes of gold ore with 2.39 gram/tonnes Au at 0.50 gram/tonnes cut off (332) was estimated at Ajjanahalli East Block, Distt. Tumakuru, Karnataka. The resources established during previous exploration by different agencies has been included in the present resources estimation.

11) A total of 0.869 million tonnes net reserves of iron ore with average grade of 46.92% Fe, 11.63% SiO_2, 9.72% Al_2O_3 at 45% Fe cut off (331/332) was estimated at ML No-2187 of Shri B.R. Sunderanath Singh, Distt. Tumakuru, Karnataka.

12) A total of 3.303 million tonnes net reserves with average grade of 46.43% Fe, 30.33% SiO_2, 1.67% Al_2O_3 at 45% Fe cut off (331/332) of iron ore; 5.650 million tonnes net reserves of limestone with average grade of 37.35% CaO, 5.45% MgO, 13.05% SiO_2 at 35% CaO cut off; 8.994 million tonnes net reserves of dolomite with average grade of 15.18% MgO, 28.71% CaO at 15% CaO cut off; and 4.803 million tonnes net resources of manganese ore (Mn + MnO_2) with average grade of 15.43% Mn were estimated at M/s Thangavelu and Others, M.L.No-2585, Distt. Chitradurga, Karnataka.

13) A total of 1.385 million tonnes of gold ore with 2.70 g/tonnes Au at 0.50 g/tonne cut off (331) were estimated at Kempinkote block, Distt. Dharmapuri, Tamil Nadu. The resources established during previous exploration by different agencies have been included in the present resource estimation.

14) A total of 8.645 million tonnes net reserves of iron ore (G1/G2) with average grade of 37.19% Fe, 19.52% SiO_2, 1.91% Al_2O_3 at 35% Fe cut off (331/332) and 0.931 million tonnes resources of manganese ore with average grade of 12.71% Mn & 27.39% Fe at 10% Mn cut off were estimated at Shri Allum Veerabhadrappa, M.L.No-2436, Distt. Chitradurga, Karnataka.

15) A total of 1.765 million tonnes net reserves of iron ore with average grade of 49.02% Fe, 7.95% SiO_2, 2.10% Al_2O_3 and 3.70% Mn at 45% Fe cut off (331/332) was estimated at M.L.No-2229 of M/s Shri G Rajashekhar, Distt. Tumakuru, Karnataka.

16) A total of 116.831 million tonnes of limestone with 45.48% CaO, 2.31% MgO, 10.13% SiO_2, 2.09% Al_2O_3, 1.38% Fe_2O_3 and 37.91% LOI (334) was estimated at Ganchihai block, Distt. Satna, Madhya Pradesh.

17) A total of 0.896 million tonnes net reserves of iron ore with average grade of 52.84% Fe, 19.55% SiO_2 and 3.57% Al_2O_3 at 45% Fe cut off (331/332) was estimated at M.L.No-2515 of M/s S.B. Minerals, Distt. Ballari Karnataka.

18) A total of 0.088 million tonnes net reserves (G-1/G-2) of iron ore with average grade of 36.01% Fe, 38.48% SiO_2, 1.41% Al_2O_3 at 35% Fe cut off was estimated at M.L.No-2190 of M/s Rajapur, district Ballari Karnataka.

19) A total of 297.317 million tonnes of limestone with 64.66% CaO, 1.78% MgO,10.82% SiO_2, 2.19% Al_2O_3, 1.45% Fe_2O_3 at 36.82% LOI was estimated at Jamodi Mahanna block, Distt. Satna, Madhya pradesh.

20) A total of 0.598 million tonnes net reserves (G-1/G-2) of iron ore with average grade of 54.28% Fe, 11.95% SiO_2, 4.76% Al_2O_3 at 45% Fe cut off (331/332) was estimated at M.L.No-2650 of M/s Karnataka Limpo Cement Industry, Distt.Tumakuru, Karnataka.

21) A total of 84.939 million tonnes net reserves of iron ore with average grade of 53.46% Fe, 8.41% SiO_2, 8.68% Al_2O_3 at 45% Fe cut off and 18.168 million tonnes net reserves of iron ore with average grade of 56.66% Fe, 6.15% SiO_2, 7.15% Al_2O_3 at 55% Fe cut-off (121) were estimated at M.L.No-2348 of M/s Deepchand Kishanlal, Distt. Tumakuru, Karnataka.

22) A total of 12.945 million tonnes net reserves of iron ore with average grade of 54.04% Fe, 9.24% SiO_2, 7.96% Al_2O_3 at 45% Fe cut off and 8.782 million tonnes net reserves of iron ore with average grade of 56.47% Fe, 7.15% SiO_2, 6.79% Al_2O_3 at 55% Fe cut-off (121) were estimated at M.L.No-2521 of M/s Mysore Stoneware Pipe & Pottaries Ltd, Distt.Tumakuru, Karnataka.

23) A total of 198.625 million tonnes of limestone with 44.61% CaO, 2.35% MgO, 10.52% SiO_2, 1.64% Al_2O_3, 1.32% Fe_2O_3 & 37.41% LOI (334) were estimated at Naubasta Kolard block, Distt. Satna, Madhya Pradesh.

24) A total of 0.699 million tonnes of molybdenum ore with 0.031% Mo cut-off (333) was estimated at Mannadipatti block, district Dharmapuri, Tamil Nadu. The resources established during previous exploration by different agencies have been included within the present resource estimation.

Oil and Natural Gas Corporation Ltd (ONGC)

Exploration efforts of ONGC during 2016-17 resulted in 23 oil and gas discoveries (13 in onshore and 10 in offshore areas) in domestic fields (operated by ONGC). Out of these, 12 discoveries were made in the new prospects, whereas 11 were new pool discoveries. The ultimate reserve (2P) accretion of oil and oil equivalent gas (O+ OEG) in 2016-17 in domestic assets of ONGC was 64.32 million tonnes.

Oil India Ltd (OIL)

Oil India Ltd has made ten (10) oil & gas discoveries in the upper Assam basin during the year 2016-17. The discovery of oil & gas in a well has opened up new avenue for exploration and exploitation of oil & gas within the respective area of the well and the adjoining areas.

Indian Bureau of Mines (IBM)

IBM as a facilitator to the Mineral Industry (a) provided technical consultancy services in feasibility study, environmental impact assessment, environmental management plan, etc.; (b) carried out mining research on need-based aspects of mining; (c) conducted mineral beneficiation studies, including mineralogical testing and chemical analysis; and (d) prepared mineral maps. Besides, preparation of National Inventory of mineral resources is IBM's designated responsibility. The National Mineral Inventory (NMI) is brought out by IBM on a quinquennial basis. UNFC system has been adopted by IBM for resource classification. Updating of NMI of mineral resources in respect of 71 minerals based on UNFC system, as on 1.4.2015, has been completed.

During 2016-17, up to October, 2016, IBM prepared 79 multi-mineral leasehold maps with forest overlays on 1:50000 scale in respect of the various States.

During 2016-17, IBM conducted 23 ore dressing investigations, chemical analysis in respect of 18,239 samples and 1332 mineralogical examination.

Other Agencies

GMDC estimated lignite reserves under category 111 & 331 and balance reserves as 33.90 million tonnes, 40.00 million tonnes and 20.65 million tonnes, respectively in Surat district.

Exploration by HZL during the year 2016-17 was approximately 74,800 m of surface drilling completed across all mine sites. This drilling added gross Reserves & Resources (R&R) of 26.4 million tonnes, which enhanced the Company's R&R position to 404.4 million tonnes, having grade of 6.7% zinc, 2.2% lead and 79 g/t silver after depletion of 11.9 million tonnes. The total R&R metal content is 27.30 million tonnes of zinc metal, 8.80 million tonnes of lead metal and 32 kt silver metal. The current R&R continues to support a mining life of 25 plus years.

RSMML estimated a total resources of 45.96 million tonnes of rock phosphate with reserves estimated to be about 25.32 million tonnes.

NMDC estimated a total of 43.01 million tonnes of iron ore reserves in Ballari Distt. Karnataka. Out of which 38.91 million tonnes were under 111 category and 4.10 million tonnes under 211 category.

Reliance Industries Ltd (RIL)

During the year 2016-17, RIL commenced production from its Coal-Bed Methane block (CBM), at Sohagpur (West). The production from RIL's Sohagpur CBM fields is expected to gradually ramp-up over the next 15-18 months. Operationally, financial year 2016-17 continued to witness lower upstream production and weak domestic gas price realisations. The domestic oil and gas production (RIL share) was down 23% to 95 billion cubic feet equivalent.

RESEARCH & DEVELOPMENT

The Science and Technology (S&T) programmes of the Ministry of Mines, Government of India, cover the disciplines of Geology, Exploration, Mining, Beneficiation and Mineral Processing, Rock Mechanics, Ground Control and Non-ferrous Metallurgy and Environmental issues related to Mining and Metallurgy. Standing Scientific Advisory Group (SSAG) in its 47th meeting held on 23.08.2016 at Shastri Bhawan, New Delhi considered and recommended Grant-in-Aid under S&T programme of the Ministry of Mines. The 47th SSAG has approved the projects. During 2016-17, Sixteenth meeting of Project Evaluation and Review Committee (PERC) was held on 06.09.2017 at JNARDDC, Nagpur. As per minutes of the said meeting, a total of 116 project proposals were received for the year 2017-18.

As per information of R&D work carried out by various mining & mineral based industries and research organisations relating to mineral/metal, details of some R&D work conducted or completed during 2016-17 are furnished below:

1. Manganese Ore India Ltd

R&D projects carried out by MOIL are serialised below:

(i) Mine Environment

Ventilation reorganisation studies for deeper levels have been conducted at Gumgaon and Chikla Mine by Indian Institute of Technology (IIT), Kharagpur. Recommendations have already been implemented at Gumgaon and the implementation is in progress at Chikla Mine.

(ii) Mines Safety: *Mining Subsidence*—In-house scientific 3-D analysis of subsidence parameter has been carried out for forest cover of Ukwa Mine. The monitoring stations with 5 (five) subsidence monitoring pillars have been properly erected in line with strike and dip directions of the ore body on the surface and quarterly measurement is being done by total station and GPS to monitor the 3-D coordinates.

(iii) Mineral Conservation

R&D studies have also been conducted at Chikla Mine by National Institute of Rock Mechanics (NIRM), KGF.

(iv) Mining Technology

(a) ***Method of Stoping***—R&D project for mechanised stoping operation has been prepared by IIT (Formerly Indian School of Mines), Dhanbad and implemented for mechanised stoping operations and support systems at Ukwa Mine. This helps in improvement in production, safety and productivity by mechanisation of stoping operation.

(b) ***Alternative to Cartage Explosives***—To reduce the ground vibrations, fly rock and noise as also to increase operational efficiency, Site Mix Emulsion (SME) Explosives have been used with shock tubes at Dongri Buzurg opencast mine on experimental basis. The results are encouraging and it is now planned to switch over to the new blasting method.

(v) Collaborative Work with Academic and Research Institutions

(a) MOIL is carrying out joint collaborative R&D project with VNIT, Nagpur for alternative to sand for fill material.

Bench-scale hydraulic stowing plant has been installed at Department of Mining Engineering, VNIT, Nagpur. This project has opened up new avenue for paste fill engineering. Further studies for paste fill are in progress.

(b) MOIL is also into collaborative research for slope stabilisation with NIT, Rourkela for Slope Monitoring Instruments (under S&T Scheme of Ministry of Mines).

(vi) Substitute of Fill Material :- (a) The R&D wing has conducted the study for filling of underground sections at Ukwa Mine by bottom ash on experimental basis. Around 400 cu m (m^3) of bottom ash have been filled in underground by hydraulic stowing. Further trials are to continue for confirmation of the outcome. (b) Mill tailings of Malanjkhand Copper Project of Hindustan Copper Limited have been utilised for hydraulic stowing operation at Ukwa Mine. Mill tailings have been used to replace sand by in-house R&D studies.

Pre-cast RCC Columns & Sections: In-house developed pre-cast RCC columns and sections have been rapidly erected in drift development which improved the safety levels of drift development in underground besides increasing efficiency in concreting operations.

2. Hindustan Zinc Ltd

Some of the R&D projects or innovation in HZL are elucidated below:

(i) Waste Management with 'Paste Fill' Technology:

Paste fill plants commissioned at the underground operations of Rampura Agucha Mine and Sindesar Khurd Mine have ensured fast filling of voids with practically no bleeding. It has offered other advantages like minimum water consumption and drainage with lesser fill and wall dilution in stopes, better recovery of intervening pillars along with better regional stability and surface integrity. The process utilises tailings, a waste of milling operations, which enables freeing up precious land requirements for long term tailing storage.

(ii) Single Shot Stope Blasting

Underground conditions at Rampura Agucha Mine are under high stress environment which poses challenge for safe and economical extraction of shear hosted high-grade reserve of zinc and lead. The drill design was changed for improved ore yield by inducting solo drill rigs and emulsion charging for executing single shot stope blast in place of time consuming conventional slot blasting in long hole open stopes. Single shot stope blasting ensured enhanced production rates in shear hosted mineralisation with a void ratio as low as 11% and resource recovery over 95% in single choked stope blast. This not only eliminated rework and ground squeezing issues that are encountered after blasting but it also reduced the cycle time from 15-17 days to just 1 day.

(iii) Zinc Fumer Process making the smelting process sustainable:

The hazardous wastes usually generated during hydrometallurgical zinc smelting process

are generally neutralised and stored in secured landfills, which are mostly around 4 acres of land per smelter per year. Zinc fuming technology integrated with the existing leaching process helps in converting hazardous wastes into commercially usable slag thereby eliminating the need for land for storage of wastes. The process will ensure improved recovery of zinc and along with it other metals like lead, silver and copper from hydro route which hitherto were relegated as wastes and dumped into secured landfills.

(iv) Enhancing Energy Efficiency in the Jumbo Casting Process:

In an effort to optimise energy consumption, the LPG burners at Pantnagar Plant are being replaced with electric top heaters, which is adding to the energy efficiency of Jumbo Casting process. With four burners modified, the specific consumption has dropped from 10 kg/MT to 6 kg/MT. The conventional electrical LPG vaporisers have been replaced with heater-less vaporisers, thus eliminating the usage of electricity for the purpose. Also, a direct pipeline connection between GAIL depot to Chanderiya plant is being installed to reduce the cost of procurement and also to lessen the environmental footprint.

(v) Research and Development Improving Yield

To improve silver recovery from ore, experiments related to kinetic study were conducted for Kayad ore which necessitated change in dosing pattern of chemicals for improving silver recovery. After successful laboratory and plant-scale trials, silver recovery improved from 44% to 51%, while consumption of hazardous chemicals were reduced by one-third.

(vi) Exploration Techniques for Mining at Depths

Technologies like motorised directional drilling to ensure that deep holes of more than 1 km below surface hit the targeted mineralised zones and down hole electrical geophysical techniques to locate potential off-hole ore zones are now being used. The HZL has implemented new software, such as, Leapfrog to provide high quality 3D visualisation of integrated geological, geochemical and geophysical exploration data and to efficiently manage its drilling geochemical database. All these have resulted in enhanced reserve and resource at lower cost.

3. Hindustan Copper Ltd

Some of the R&D projects undertaken at HCL are seralised below:

(i) Recovery of copper through leaching from ESP dust of flash smelter has been taken up.

(ii) Recovery of nickel metal from nickel waste produced at customer refinery.

(iii) Malanjkhand Concentrator plant that uses pine oil (a natural product extracted from pine trees) as a frother in Concentrator plant process, due to inconsistency in its availability and quality has been looking out for substitutes. The Company has taken R&D initiatives to find a suitable substitute and found one of the chemical product suitable for the application which also is said to be cost-effective. Proposal to replace pine oil in a phased manner is afoot.

(iv) Combination of both sized (80 mm and 90 mm) hi-chrome grinding media was studied and specific consumption of grinding media was brought down to 0.78 kg/MT of milling. Now all the four ball mills are being run with the combined grinding media in 1:1 ratio.

4. National Mineral Development Corporation

Some of the R&D projects undertaken at NMDC are furnished below:

(i) Improve the Screening Efficiency of Iron Ore over Previous Year

The objective of this project is performance evaluation of the secondary screens (fines screening) in the production units and evolving remedial measures to improve the screening efficiency. The results of Plant trials with novel design screen cloth on existing screens at NMDC plants (SP -2, Kirandul) are as under.

(a) The average screening efficiency of the screen fitted with novel design screen cloth are 7.79% to 39.70%, which is higher than the screen fitted with woven wire screen cloth.

(b) There has been an increase of 21,958 tonnes in the production from the line with new screen cloth (from 15.03.2017 to 25.03.2017) as compared to the line with conventional screen cloth and the average feed rate for the line with new screen cloth is about 140 TPH which is much more than the line with woven wire screen. Till 8th April, 2017 the tonnage handled has been 1.73 lakh tonnes, which in comparison with the average tonnage handled by conventional screen (with multiple times welding repair work), i.e., 80000 to 85000 tonnes is much higher.

(c)The screen fitted with novel design screen cloth can be run with higher feed rate than the screen fitted with conventional screen cloth and still attain comparatively better screen efficiency.

(d) It is also observed that the new screen cloth apertures are not clogging/blinding even while screening 8% moisture ore at around 400 TPH to secondary screen.

(ii) Development of an Ecofriendly Tailing Disposal System by Filtration of Iron Ore Tailings and Study of issues related to Transportation and Storage (Phase - 4)

The project was undertaken in 2013-14 and envisaged to be completed in 4 phases. The objective of the phases are (a) To evaluate the flow properties and paste rheology of the engineered tailing samples; (b) Address issues related to the storage and transportation of tailing samples; (c)To develop a process which can recover maximum water from the iron ore tailings and enable disposal of tailings in solid or semi-solid form which would minimise the environmental hazard and also make iron ore mining sustainable.

The results of the phases are -

(a) The filtered tailings can be transported by conveyor belt and stacked up to moisture content of 20.2%, 22.6% and 26.7%, respectively for samples 1, 2 & 3.

(b) This moisture is about 3% more than the expected filter cake moisture of all three tailing samples.

(c) The yield stress of the tailing samples 1, 2 and 3 at 68%, 59% and 58% solid concentration by weight are 29 Pa, 70 Pa and 3.7 Pa, respectively.

(d) The yield stress values indicate that the paste tailing can be transported by centrifugal pumps from deep bed thickener to paste disposal location.

(e) The tailing samples are amenable for paste thickening as well as filtration. It is possible to get a paste with 56-72% solids and yield stress in the range of 75-300 Pa. The filtration tests revealed that it is possible to produce a filter cake with moisture content ranging from 14 to 24%.

5. JNARDDC

Some of the R&D projects carried out or completed by JNARDDC are detailed below:

(i) Development of a Real Time Instrument/ System to Measure Bath Ratio, Alumina Concentration, Bath Temperature and Super Heat of the Aluminium Electrolysis Bath

This project has been completed successfully which has resulted in development of a real time instrument which is the combination of thermocouple arrangement, data acquisition system and software for analysing the data to estimate/calculate the bath parameters, such as, bath ratio, alumina concentration, bath temperature and superheat of the aluminium electrolysis bath. Validation trials were conducted at Nalco Angul smelter and the instrument was successfully demonstrated by measuring about 25 readings. Bath parameter values obtained using real time instrument and using conventional existing methods were in confirmity. Real time instrument is bound to replace the conventional existing time consuming laboratory method as it facilitates taking instantaneous corrective measures for controlling the aluminium electrolysis cell.

(ii) **Optimisation of Parameters for Ultrasound Precipitation of Aluminate Liquor with Emphasis on Production of Special Fine Hydrate and Liquor Productivity**

The project aimed at application of ultrasound for production of special fine hydrate and improved yield of product hydrate in precipitation step of Bayer's process has been completed recently. The 22 kHz ultrasound with 80% amplitude is required for 15 minutes duration for fine seed followed by conventional precipitation for 8 hours to obtain a special fine hydrate of d50 of 10.5 microns with liquor productivity of 85.43 gpl (against 84.59 gpl without ultrasound). Encouraging results were obtained when ultrasound is used with conventional coarse seed giving more fines than the conventional precipitation without ultrasound.

(iii) **Synergistic Utilisation of Aluminium Industrial Wastes for Development of Geopolymeric Building Materials**

This project primarily aims at investigating utilisation of synergy among various rejects of aluminium and other industries for development of green building material based on geopolymer

process. The preliminary studies identified 75 mix designs comprising rejects of aluminium, steel and biomass industrial origin. Geopolymer bricks prepared with aluminium industry rejects and biomass of combination confirm IS-3495 (part-I): 1976. Blocks prepared with single and multi components in the mix design reported crushing strength in the range 10–25 N/mm^2 for hard bricks and 5 to 8.5 N/mm^2 for light weight foamed geopolymer (LWFGEOP). Setting up of mini-pilot plant is in progress for estimating the economics.

(iv) Development of Hard and High Temperature Refractory Material/Aggregate from Saprolite

Objective of this project is to develop refractory material/aggregate from saprolite which is waste, unutilised material generated during bauxite mining. De-ironing and leaching trials were carried out for removal of iron oxide from raw saprolite. Sintering test with different additives and parameters, such as, temperature, time and grain size was carried out to obtain high quality refractory product. Characterisation and properties evaluation of sintered granules were also completed. Results of tests conducted to check suitability of sintered aggregates for preparing castables would determine the extensivity of its use in different industries.

(v) Effect of Modified Seed properties in Precipitation of Aluminium Hydroxide from Bayer Liquor

The project aims at exploring the possibility of using seed aluminium hydroxide by altering/ modifying/changing its surface properties to enhance the liquor productivity/yield in precipitation process. This may lead to new process and product development in precipitation. Presently, thermal activation of fine and conventional seed and their characterisation is in progress.

(vi) Studies on Trace Liquor Impurities, its Behaviour and Control in Bayer's Process with respect to Reduction in Product Hydrate

Liquor and solid samples (bauxite, mud, hydrate and alumina) collected from refinery were duly prepared and thoroughly characterised. The spent liquor and green liquor was analysed for trace potassium and zinc concentration. Literature search is on to finalise the suitable plan for impurity control/removal from spent liquor and settler overflow. A trial experiment was conducted using surfactant (reagent) to remove impurities from spent liquor. The results obtained were encouraging.

(vii) Mechanical Activation of Bauxite

Mechanical activation of bauxite can alter the process condition used in various steps in Bayer's process. This project aims to investigate the effect of mechanical activation of bauxite on desilication, digestion and setting process steps. It aims to establish new process parameters to achieve maximum extraction of alumina, minimise alumina and soda losses in red mud and to obtain an acceptable silica level in the liquor. Presently, simultaneous milling and leaching studies (on low and high silica bauxites) in attrition mill are in progress.

IMPORTANT ORE DRESSING INVESTIGATIONS

R & D (Ore Preparation & Process)

1.1 Copper Ore:

Bench-scale Beneficiation Studies on a Copper Ore Sample from West of Nanagwas, Sikar Distt. Rajasthan: A copper ore sample from West of Nanagwas (NW-1&2), District Sikar, Rajasthan was received at Regional Mineral Processing Laboratory, Indian Bureau of Mines, Ajmer for bench-scale beneficiation studies. The aim of the bench-scale beneficiation study was to evolve a process flow sheet that could produce copper concentrate or more than 18% Cu with maximum recovery. The as received sample assayed 0.36% Cu, 4.92% Fe(T), 38.27% SiO_2, 8.77% Al_2O_3, 47.28% Al, 0.11% S(T), 0.40% TiO_2 and 0.06% Sn. The flow sheet evolved comprised grinding to 83% and passing through 200 mesh followed by flotation with three cleanings. The copper concentrate thus produced assayed 40.90% Cu, 13.27% acid insoluble with 84.64% copper recovery (wt.% yield 0.74). On further two cleanings produced a concentrate assaying 30.31% Cu and 20.08% acid insoluble with 88.44% copper recovery (wt% yield 1.04). The copper concentrate did meet all the specifications required for smelter.

***Bench-scale Beneficiation Studies on Gold-bearing Copper Ore Sample from Khera Main Block, Alwar Distt, Rajasthan*:** A gold-bearing copper ore sample from Khera main block, Distt-Alwar, Rajasthan collected as a part of G-2 exploration was received at Regional

Mineral Processing Laboratory, IBM, Ajmer for bench-scale beneficiation study. The objective of the investigation was to evolve a process flow sheet for producing a concentrate assaying more than 18% Cu with maximum possible recovery. The as received sample that assayed 0.59% Cu, 1.43 ppm Au (by fire assay) along with 3.94 ppm Ag, 66.83% SiO_2, 9.63% Al_2O_3, 1.48% S(T), 4.39% Fe(T), 4.62% CaO, 4.35% MgO, 0.37% Na_2O, 3.15% K_2O, 71.62 ppm-Zn, 20.75 ppm-Pb, 308 ppm-As, 100 ppm-Bi, 32.56 ppm-Co with 77.46% Acid insoluble, after adoption of flotation process, produced a composite concentrate that assayed 22.59% Cu with a recovery distribution of 74.8% (wt% yield is 2.03).

1.2 Dolomite

Beneficiation Studies on a Siliceous Dolomite Sample from Kadapa Distt, Andhra Pradesh : A dolomite sample was received for bench-scale beneficiation studies at Regional Ore Dressing Laboratory, Indian Bureau of Mines, Bengaluru. The objective of the investigation was to develop a process flow sheet with silica content less than 5.0% .The as received sample that assayed 32.41% CaO, 12.02% MgO, 11.76% SiO_2, 0.74% Fe_2O_3, 1.19% Al_2O_3, 0.07% P, 39.49% LOI after being subjected to flotation method produced a concentrate that assayed 36.24% CaO, 12.41% MgO, 4.50% SiO_2 44.38% LOI with about 50% recovery of CaO & MgO (wt % yield 42.9). The concentrate obtained is suitable for Steel Industry.

1.3 Glauconite

Bench-scale Beneficiation Studies on a Very Low-grade Glauconite-bearing Drill-Core Sample (G2-stage) in Barwadih and Kurchha Area, Sonbhadra District, Uttar Pradesh: A very low-grade glauconite-bearing drill-core sample from Distt Sonbhadra, Uttar Pradesh was received for bench-scale beneficiation studies at the Modern Mineral Processing Laboratory, Indian Bureau of Mines, Nagpur. The objective of the study was to assess the amenability to produce a glauconite rich concentrate that can be used as a raw material for manufacture of fertilizer. The as received sample assayed 3.82% K_2O (T), 0.29% Na_2O, 10.18% Al_2O_3, 3.55% Fe_2O_3, 50.68% SiO_2(T), 10.60% CaO, 5.58% MgO, 0.32% TiO_2 and 14.33% LOI (Glauconite 5-10%). Beneficiation test works employing attrition scrubbing & screening yielded a product that assayed 5.79% K_2O with 26.1% K_2O recovery (wt% yield: 17.1). Alternately, by adopting roll crushing followed by wet stage grinding of (-)10 mesh sample and wet screening of the ground product, a yield that assayed 4.96% K_2O with 63.1% K_2O recovery (wt%. yield: 48.8) (Glauconite 25-30% approx.) was obtained. The beneficiation test conditions , therefore, successfully produced K_2O enriched product with a reasonably good recovery.

1.4 Iron Ore

***Bench-scale Beneficiation Studies on Bulk Sample of Iron Ore from Nayapalli, Bhubaneshwar District, Odisha*:** A bulk sample of iron ore from Nayapalli, Bhubaneshwar Distt, Odisha was received at the Modern Mineral Processing Laboratory and Pilot Plant, Indian Bureau of Mines Nagpur, for bench-scale beneficiation studies. The objective of the study was to develop a suitable beneficiation process flow sheet to produce an iron ore concentrate suitable for industrial use. The as received iron ore sample assayed 60.26% Fe, 4.23% Al_2O_3, 5.00% SiO_2, 0.141% Mn, 0.099% TiO_2, 0.051 % CaO, 0.025 % MgO, 0.069% Na_2O, 0.048% P and 3.54 % LOI. Two process routes that employed different gravity separation techniques, such as, Classification, Tabling and Multi-gravity Separation were attempted.

i) The as received sample that firstly was subjected to screening, classification, tabling and multi gravity separation yielded a composite Fe concentrate assaying 63.45% Fe, 2.75% Al_2O_3, 3.05% SiO_2 and 2.56 % LOI with 60.2% Fe recovery (wt% yield of 57.2).

ii) In the second process route the as received sample was subjected to stage grinding, classification followed by tabling and multi-gravity separation. The yield of composite concentrate thus produced assayed 64.62 % Fe, 2.26 % Al_2O_3, 2.43 % SiO_2, and 2.33 % LOI with 53.8% Fe recovery (wt% yield of 50.5).

Both the concentrates were found suitable for industrial use.

1.5 Limestone (Core)

Beneficiation Studies on a Siliceous Limestone (Core) Sample from Muddapur mines, Bagalkot Distt, Karnataka: A Limestone (core) sample was received from Muddapur Mines, Bagalkot, Karnataka for beneficiation studies at Regional Ore Dressing Laboratory, Indian Bureau of Mines, Bengaluru. The objective of the investigation was to reduce silica to less than 12 % and to produce a concentrate suitable for cement manufacturing. The as received sample that assayed 33.68 % CaO, 22.75 % SiO_2 (T), 3.06 % MgO, 3.13 % Fe_2O_3, 4.25% Al_2O_3, 0.48 % K_2O, 0.08% Na_2O, 0.005% P, traces of S and 30.20% LOI after being subjected to flotation test with three cleanings produced a concentrate that assayed 49.15 % CaO, 5.32 % SiO_2 (T) with 82.4% CaO recovery (wt % yield 58.20). The flotation with two cleanings assayed 45.64 % CaO, 9.1 % SiO_2 (T) with 91.3 % CaO recovery (wt % yield of 69.4). The concentrate obtained was found suitable for cement manufacturing.

1.6 Phosphate:

Pilot-scale Beneficiation Studies on a Low-grade Phosphate Sample from Hirapur, Sagar Distt, M.P. :

A low-grade phosphate sample was received for pilot-scale beneficiation studies at Regional Mineral Processing Laboratory, IBM, Bengaluru. The objectives of pilot plant studies were: i) to confirm/verify the process scheme developed in the laboratory to produce a phosphate concentrate suitable for phosphoric acid manufacturing on continuous basis simulating commercial plant configuration and conditions and ii) to determine and obtain process technical data required for preparation of techno-economic feasibility report required for commercialisation of the project. The sample assayed 20.26% P_2O_5, 38.13% SiO_2(T), 6.0% reactive silica, 24.55% CaO, 0.55 % MgO, 3.17% Al_2O_3, 5.55% Fe_2O_3, 0.04% Na_2O, 0.36% F.C, 0.70% S(T) , 0.06% S(py), 1.36 % fluorine, 0.09% Cl, 1.73% SO_3 and 1.70 % LOI. The beneficiation scheme adopted comprised Grinding followed by Flotation and a phosphate concentrates assaying 35.55% P_2O_5, 8.73% SiO_2(T), 3.52% reactive silica, 1.11% Al_2O_3, 1.4% Fe_2O_3, 44.46% CaO, 3.27% F, 0.53% SO_3, 0.1% Cl and 0.36% MgO with 76.4% P_2O_5 recovery (wt% yield 43.3) was obtained. The concentrate produced did meet the specifications required for phosphoric acid manufacturing.

The fresh water requirement after recovery of water found to be 2.64 m^3per tonne of fresh ore.

- The pressure filtration productivity of phosphate was found to be 0.393 tonnes/sq.meter-hr.
- The unit thickener area required for concentrate was 0.108 sq.m/tonnes of dry solids-24 hr.
- The thickener area required for combined reject was 0.067 sq.m/tonnes of dry solids-24 hr.
- Bond's work index value of the sample was 7.04 kWh/ short tonne.

R&D FOR RECOVERY

BY-PRODUCT RECOVERY

1.1 Graphite

Bench-scale beneficiation studies was conducted on a low-grade Graphite sample from Betul, Madhya Pradesh for the recovery of Rare Earths and Calcite.

In the low-grade graphite bulk (BLK-01) sample received at the Modern Mineral Processing Laboratory & Pilot Plant, Indian Bureau of Mines, Nagpur for recovery of graphite, presence of calcite in the sample was observed. A prospect of upgrading and recovering it as by-product from graphite tails was attempted.

I. The analysis of graphite tails assayed 7.84% FC, 2.53% VM, 0.59% moisture, 56.19% ash and 32.85% acid soluble. The as received sample assayed 17.56% CaO, 1.09% MgO, 5.49% Al_2O_3 , 42.23% SiO_2 and 3.59% Fe_2O_3.

By adopting Froth flotation of graphite flotation tails, a calcite concentrate assaying 43.23% CaO, 3.7% Al_2O_3, 15.02% SiO_2, 0.048% P_2O_5 with 31.4% CaO recovery (wt.%. yield : 12.6) was produced. The calcite concentrate obtained may find application in Cement Industry.

II. The as received graphite sample that assayed rare earth elements at 16.6 ppm La, 15.9 ppm Ce, 9.91 ppm Nd, 4.5 ppm Gd, 2.9 ppm Yb, and 27 ppm Y after Gravity, Magnetic and Electrostatic separation produced a pre-concentrate assaying 0.88% La with 69.1% La recovery, 0.89% Ce with 73% Ce recovery, 0.65% Nd with 85.3% Nd recovery, 0.18% Gd with 52% Gd recovery, 0.15% Yb with 66.2% Yb recovery and 1.35% Y with 64.9% Y recovery (wt% yield: 0.13).

Thus recovery of graphite and recovery of rare earth minerals and calcite as by-products from graphite (BLK-01) surface sample is a step towards achieving zero waste processing.

1.2 Copper Ore

Bench-scale Beneficiation Studies for Calcite By-product Recovery from Copper Tails Obtained in Lab Tests on Copper-bearing Ore from west of Nanagwas, District Sikar, Rajasthan

A copper bearing sample from west of Nanagwas (NW-1&2), District Sikar (Rajasthan), was received at Regional Mineral Processing Laboratory, Indian Bureau of Mines, Ajmer for bench-scale beneficiation studies. The aim of the bench-scale beneficiation study was to evolve a process flow sheet that could produce a copper concentrate of more than 18% Cu with maximum recovery. The as received sample assayed 0.36% Cu, 4.92% Fe(T), 38.27% SiO_2, 8.77% Al_2O_3, 47.28% AI, 19.65% CaO, 4.31% MgO, 0.11% S(T), 0.40% TiO_2, 1.11% Na_2O, 2.37% K_2O, 0.20% Mn, 0.06% Sn,72 ppm Pb, 140 ppm Zn, 34 ppm Co, 50 ppm Ni, 3.15 ppm Ag, 124 ppm Bi and17.34% LOI. It was observed from the chemical analysis of the as received sample that apart from copper as valuable mineral, about 40-45% calcite was also present, which represented CaO content of 19.65% and in terms of $CaCO_3$ about 35.06%. The Froth flotation process was adopted for calcite recovery tests. The sample on chemical analysis assayed 20.29 % CaO, 38.29% SiO_2, 5.10% Fe(T), 8.29% Al_2O_3, 4.14% MgO, 0.43% TiO_2, 1.74% Na_2O, 2.02% K_2O,0.03% Cu, 3.49% Fe_2O_3, 3.72% FeO and 15.81% LOI. After subjecting to flotation test and two stages of cleaning a calcite concentrate assaying 47.79% CaO, 6.69% SiO_2 with 80.07% CaO recovery (wt% yield 34) was produced. This calcite concentrate is suitable for Cement Industry and can also be used as sweetener to blend with the lower grade limestone used in some of the cement plants.

UTILISATION OF WASTES

1.1 Iron Ore Dump

Recovery of Iron Values from Low-Grade Dump Sample of Thimmappanagudi Iron Ore Mine, Sandur Taluk, Ballari District, Karnataka

A low-grade iron ore dump sample of Thimmappanagudi mine was received for beneficiation studies at Regional Ore Dressing Laboratory, Indian Bureau of Mines, Bengaluru. The objectives of the test work were (a) Characterisation studies of the as received sample and (b) to develop a process scheme to produce a concentrate suitable for Steel Industries.

The as received sample that assayed 36.43% Fe(T), 0.12% FeO, 26.0 % SiO_2, 11.78 % Al_2O_3, 0.40 % CaO, 0.1 % MgO, 0.05 % Na_2O, 0.11 % K_2O, 0.24 % Mn, 0.04 % P, 5.78% LOI and trace amounts of sulphur after being subjected to processes that comprised crushing followed by grinding, classification followed by gravity and magnetic separation yielded a gravity concentrate that assayed 65.31% Fe (T), 2.54 % SiO_2, 2.05 % Al_2O with 1.79% LOI weight percent yield of 20.4% and Fe (T) recovery 37.2%.The combined concentrate (Gravity & Magnetic) assayed 60.31 %Fe (T), 6.02 % SiO_2, 4.24 % Al_2O with 3.01% LOI weight percent yield of 31.8% and Fe (T) recovery 53.5%.

Adopting of such simple processes, could enable upgrading of waste dump from Thimmappanagudi Iron Ore mine for use in Steel Industry.

1.2 Iron Ore (Waste Dump)

Beneficiation Studies on an Iron Ore Sample (Waste Dump) from Subbarayanahalli Iron ore Mines, Sandur taluk, Ballari District, Karnataka

A waste dump iron ore sample from Subbrayanahalli iron ore mine was received for beneficiation studies at Regional Mineral Processing Laboratory, Indian Bureau of Mines, Bengaluru. The objective of the test work was to develop a process scheme for upgradation of the iron ore sample to produce a concentrate containing the grade 62% Fe(T). The as received sample assayed 40.50% Fe (T), 0.21% FeO, 16.29% SiO_2, 14.67% Al_2O_3, 1.48% TiO_2, 0.35% CaO, 0.02% MgO, 0.02% Na_2O, 0.01% K_2O, 0.09% Mn, 0.07% P, 8.87% LOI and trace amounts of sulphur. The final process flow sheet adopted comprised grinding followed by gravity separation. The gravity concentrate thus produced assayed 63.50 % Fe (T), 3.56 % SiO_2 , 1.86 % Al_2O_3 with weight percent yield of 26.1% and Fe(T) recovery 40.6 %.

The studies showed that adopting simple processes, iron ores lying as waste dumps could be upgraded and utilised.

FOREIGN TRADE

The year 2016-17 witnessed a turnaround in India's external sector with export growth becoming positive after two years of continuous negative growth, the import growth, however, remained negative, though marginally, for the fourth year in succession. The year also witnessed major policy changes like rationalisation of export promotion schemes, a new push towards building export infrastructure and trade facilitation measures; further opening up of foreign investment; and above all finalising the blue print of the Goods and Services Tax (GST) that got implemented from 1st July 2017.

India's ranking amongst the leading exporters and importers improved from 30 and 23 , respectively, in 2004 to 19 and 13 in 2015 as per the WTO International Trade Statistics 2016.

India's exports turned positive at 5.2% in 2016-17 after an interlude of two years. This along with a marginal decline in imports by 1% resulted in narrowing down of trade deficit to US $ 112.4 billion (5% of GDP) in 2016-17 as compared to US $ 130.1 billion (6.2% GDP) in 2015-16.

After two years of negative growth, merchandise exports (Balance of Payments basis) grew by 5.2% in 2016-17 with positive growth in both Petroleum Oil and Lubricants (POL) and non-POL exports. India's merchandise exports (on customs basis) reached the highest level of US $ 314.4 billion in 2013-14. In tandem with the global trend of decline in export growth, India's export growth also declined during 2014-15 and 2015-16, by 1.3% and 15.5%, ,respectively. However, it registered positive growth of 5.3% during 2016-17, resulting in exports reaching US $ 276.3 billion. It was due to the positive growth of both POL and non-POL exports at 3.7% and 5.6%, respectively. With increase in crude oil prices, POL exports growth at 25.8% was more than double from that of non-POL exports growth of 10% reported in the second half of 2016-17.

India's merchandise imports (on customs basis) also fell from a high level of US $ 490.7 billion in 2012-13 to US $ 381.0 billion in 2015-16 and registered a marginal increase of 0.9% to US $ 384.3 billion in 2016-17 due to rise in POL imports and also marginal increase in non-POL and non-gold and silver imports.

Exports

The total exports (including re-exports) of all merchandise in 2015-16 and 2016-17 were ₹ 17,16,378 crore and ₹ 18,41,314 crore, respectively. During the year 2016-17, the total value of exports (including re-exports)

of ores and minerals was ₹ 2,00,131 crore. The export value of ores & minerals declined from ₹ 1,78,019 crore in 2014-15 to ₹ 1,70,946 crore in 2015-16 and then raised to ₹ 2,00,131 crore in 2016-17. The value of mineral exports showed an increase of about 11% in 2016-17 as compared to that in the previous year.

Diamond (total) continued to be the largest constituent item with a share of 81.3% in the total value of mineral exports in 2016-17. Next in order of share was iron ore with a contribution of 5.1% followed by granite 4.7%, alumina 1.5% and emerald (cut & uncut) 1.02%. The individual share of remaining minerals in the total value of exports of ores and minerals from India during the year under review was less than 1%.

The export of selected mineral-based products during 2015-16 and 2016-17 was valued at ₹ 1,81,834 crore and ₹ 2,00,522 crore, respectively. The exports of petroleum products, e.g., light distillates (naphtha and others), middle distillates and heavy ends, earned foreign exchange of ₹ 1,76,780 crore and ₹ 1,94,893 crore in 2015-16 and 2016-17, respectively, with more than 97% share in both the years in the export of selected mineral-based products.

India also exported metals and alloys valued at ₹ 1,52,912 crore and ₹ 1,82,186 crore during 2015-16 and 2016-17, respectively. Iron & steel, with a share of 47.29%, continued to hold the top position in the total value of metals & alloys. Gold (non-monetary & monetary) accounted for 19.86%, aluminium and alloys including scrap 11.86%, copper & alloys (including brass & bronze) accounted for 9.65% . The contribution of ferro-alloys was 5.56%, zinc & alloys including scrap was 2.25%, precious metals/metals clad with precious metals 1.53%, nickel & alloys including scrap was 0.34% and the individual share of other remaining metals and alloys was less than 1 percent in the total value of metal and alloys.

Imports

The total imports of all merchandise in 2015-16 and 2016-17 were ₹ 24,90,298 crore and ₹ 25,50,926 crore, respectively. The value of imports of ores and minerals in 2016-17 increased by 9.56% to ₹ 8,09,445 crore from ₹ 7,38,788 crore in 2015-16. Petroleum (crude) continued to be the largest constituent item with a share of 58.60% in the total value of mineral imports in 2016-17. Next in order of importance was diamond with a share of 16.02% followed by coal (excluding lignite) with the contribution of 12.39%, natural gas 4.9% and copper ores & concentrates 2.26%. The combined share of these five minerals was 94.24% in 2016-17 as against 95.42% in the previous year.

The import of selected mineral-based products during 2015-16 and 2016-17 was valued at ₹ 94,315 crore and ₹ 91,092 crore,respectively. The imports of petroleum products (total) in 2016-17 increased by 8.20% in value over the preceding year to ₹ 70,727 crore and had a share of 74.99% in the value of import of selected mineral-based products during 2016-17.

The value of imports of metals and alloys at ₹ 3,37,788 crore showed a decrease of 13.47% in 2016-17 from ₹ 3,90,371 crore in 2015-16. Gold, non-monetary & monetary (total) with a share of 54.46% continued to occupy the top position in the total import value of metals & alloys in 2016-17 followed by iron & steel with a share of 21.46%, aluminium & alloys including scrap 6.91%, copper & alloys (including brass & bronze) 6.73%, silver 3.65%, nickel & alloys including scrap 1.10% and ferro-alloys 1.51% percent. The individual share of remaining metals and alloys was less than 1% of the total value of metals & alloys imports.

VALUE-ADDED EXPORT TRADE

India's foreign trade includes exports of minerals, both in the raw form and semi-processed & processed forms like mineral-based primary manufactured products.

Minerals contributed significantly to India's exports trade in 2016-17 with a share of about 11% (i.e., ₹ 2,00,130 crore) in the total value of all merchandise. The contribution of minerals in exports in raw/unprocessed forms was about ₹ 22,370 crore and in semi-processed/processed forms was about ₹1,77,760 crore. The manufactured mineral-based products contributed about ₹ 3,82,073 crore in 2016-17 to the total value of exports of all merchandise. The value-added semi-processed/processed minerals figuring in India's foreign trade included cut & polished diamond/emerald, pulverised barytes, steatite, felspar (cut), garnet, calcined magnesite, magnesia (fused), magnesite (dead-burnt), magnesium oxide, slate (worked), processed mica & manufactured mica products, coke, cut & polished dimension stones, alumina, etc. The manufactured mineral-based commodities included metals & alloys and products thereof, cement, firebricks & other refractory materials, clay-bonded graphite crucibles & silicon carbide crucibles, manganese dioxide, asbestos-cement products, inorganic chemicals like lime & fluorine chemicals, refined borax & borates, elemental phosphorus & phosphoric acid, titanium dioxide, petroleum products, phosphatic & potash fertilizers, etc. Table-6 provides data on contribution of various value-added minerals and mineral-based products to India's exports during 2014-15 to 2016-17.

Table – 6 : Contribution of Value-added (Processed) Minerals & Mineral-based Products in India's Export* Trade, 2014-15 to 2016-17

Sl. No.	Commodity group	Value of exports (₹ million)			Contribution (percentage)		
		2014-15	2015-16	2016-17 (P)	2014-15	2015-16	2016-17 (P)
1.	All Merchandise	18963480	17163780	18413144	100.00	100.00	100.00
2.	Minerals	1780194	1709463	2001306	9.39	9.96	10.86
	2.1 Raw/Unprocessed form	193728	182381	223701	1.02	1.06	1.21
	2.2. Semi-processed/ processed forms (preliminary and intermediate stages of processing)	1586466	1527082	1777605	8.37	8.90	9.65
3.	Manufactured Mineral-based Commodities (final stage of transformation)	4604328	3342844	3820738	24.28	19.48	20.75
	3.1 Metals/Alloys	1672957	1529126	1821860	8.82	8.91	9.89
	3.2 Others	2931371	1813718	1998878	15.46	10.57	10.86

Figures rounded off.
** Including re-exports.*

INFRASTRUCTURE

Logistics Sector in India remains unorganised to a large extent. The Sector is facing challenges such as high cost of logistics that which is impacting competitiveness in domestic and global market has been affected with issues relating to under-developed material handling infrastructure, fragmented warehousing, multiple regulatory/policy making bodies, lack of seamless movement of goods across modes, lack of integrated IT infrastructure/modern technology, etc.

The Indian Logistics Industry, worth around US $ 160 billion, has grown at a compound annual growth rate (CAGR) of 7.8% during last five years. Improving that Logistics Sector would have huge implication on exports and it is estimated that 10 percent decrease in indirect logistics cost can increase 5-8 percent of exports. The Global Ranking of the World Bank's 2016 Logistics Performance Index shows that India jumped to 35th rank in 2016 from 54th rank in 2014 in terms of overall logistics performance. Apart from increasing trade, better performance in logistics will augment the programme like "Make in India", and also enable India to become an important part of the global supply chain. Realising the importance of the sector and to address the inefficiencies, the Government has included the Logistics Sector in the Harmonised Master List of Infrastructure Subsector.

Coal

Coal production at around 662.79 million tonnes in 2016-17 was higher by 3.7% from that of 639.23 million tonnes in 2015-16. In 2016-17, out of the total production of coal, 9.3% (61.66 million tonnes) was of coking coal and the remaining 90.7% (601.13 million tonnes) was of non-coking coal. Of the 650.32 million tonnes despatches of raw coal in 2016-17, about 81.1% despatches were to Electricity Sector, 1.9% to the Steel Industry and 1% each to Cement Industry & Sponge Iron Industry.

Electricity

The All-India installed power generation capacity has increased substantially over the years and reached 3,30,860.6 MW as on 30th November, 2017. Programmes have been taken up to address improvement in

performance of distribution companies so that the ambitious plan to provide electricity for all by 2019 can be achieved.

In order to enhance power supply in rural areas, Deen Dayal Upadhyaya Gram Jyoti Yojana was launched in December 2014 to extend financial assistance for capital expenditure by distribution companies (discoms) for strengthening and augmenting distribution infrastructure, including metering, in rural areas. The estimated outlay for the scheme is ₹ 43,033 crore. In addition, the approved outlay of ₹ 39,275 crore of erstwhile Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) has been carried forward to this scheme.

A new scheme, Saubhagya (Pradhan Mantri Sahaj Bijli Har Ghar Yojana), was launched in September 2017 to ensure electrification of all remaining willing households in the country in rural and urban areas with an outlay of ₹ 16,320 crore. Government has also approved establishment of a National Smart Grid Mission in the Power Sector to plan and monitor implementation of programmes related to smart grid activities in India with a budget allocation of ₹ 30 crores for 2017-18.

Energy Conservation includes National LED programme: A programme for promoting use of the most efficient lighting technology at affordable rates was launched in January 2015. In addition, the Bureau of Energy Conservation is simultaneously taking up number of programmes for energy conservation including standardisation and labelling of appliances, buildings, passenger cars and heavy duty vehicles, etc.

Transport

Railways

Facing stiff competition from other modes of transportation, the Government is initiating various transformative measures which are focusing on prioritising investments in important areas, viz. dedicated freight corridors, high speed rail, high capacity rolling stock, last mile rail linkages, port connectivity and attracting private and foreign direct investment. During 2017-18 (up to September 2017) Indian Railways carried 558.10 million tonnes of revenue earning freight traffic as against 531.23 million tonnes during 2016-17 (up to September 2016), showing an increase of 5.06 percent during this period.

To make rail transportation attractive, various initiatives were taken in 2016-17 which includes tariff rationalisation, classification of new commodities, new policy guideline for station to station rates, expansion of freight basket through containerisation, withdrawal of dual freight policy for export of iron ore, rationalisation of coal tariff, policy guidelines of Merry-Go Round System, discount for loading of bagged consignment in open and flat wagons, new delivery models like Roll-on Roll-off services, re-introduction of short lead concession and reduction in minimum distance for charge, digital payment for freight business, Long Term Tariff Contract Policy (which provides tariff stability and attractive rebate in freight to customers), and Liberalised Automatic Freight Rebate scheme for traffic loaded in empty flow directions, etc.

'Station Redevelopment' is the biggest non-fare revenue generating project for redeveloping railway stations in the country and has been included in the Harmonised List of Infrastructure Subsectors. Besides, the redeveloped stations will improve passenger experience by providing amenities like digital signage, escalators/elevators, self-ticketing counters, executive lounges, luggage screening machines, walkways, holding areas for passengers, grand and distinctive roofing and flooring, free and paid Wi-Fi ,etc.

Rapid urbanisation has created increased demand of civic facilities and transport infrastructure. Metro are rapidly being accepted across the country as a solution to the problem of urban transportation.

Aviation

India is the 3rd largest and the fastest growing domestic aviation market in the world in terms of number of domestic tickets sold. Domestic passenger traffic registered a compound annual growth rate (CAGR) of 9.89 percent during 2007-08 to 2016-17. Recent initiatives taken for the growth of the Civil Aviation Sector are (i) Regional Connectivity Scheme- 'Ude Desh ka Aam Naagrik' (RCS-UDAN). To make flying accessible and affordable for the masses in the regionally important cities, the RCS-UDAN scheme was launched in October 2016. (ii) Airport Development: Provision of ₹ 4,500 crore for revival of 50 unserved and underserved airports/air strips has been taken up with budgetary support of the Government and is proposed to be com-

pleted by December 2018. The Government has also granted in-principle approval for setting up 18 Greenfield airports in the country and has granted "site clearance" for 5 Greenfield airports. (iii) Liberalisation of Air Services between Afghanistan and India was taken in September 2016. The Corridor will provide Afghanistan, greater access to Indian market. Another Air Services Agreement between India and Serbia, signed on 31.01.2003, has been liberalised and updated in May 2017 with a view to spur greater trade, investment, tourism and cultural exchanges between the two countries.

Ports and Shipping

Shipping is an important indicator of commodity trade of any country. Around 95 percent of India's trade by volume and 68 percent in terms of value is transported by sea. As on 31st December, 2017, India had a fleet strength of 1,374 ships with dead weight tonnage (DWT) of 18.80 million (12.36 million GT) including Indian controlled tonnage, with Shipping Corporation of India (SCI) having the largest share of around 34 percent. Of this, around 443 ships of 17.19 million DWT (10.88 million GT) cater to India's overseas trade and the rest to coastal trade.

To encourage the growth of Indian tonnage and for higher participation of Indian ships in Indian trade, the Government has implemented several measures which include reduction of GST from 18 percent to 5 percent on bunker fuel used in Indian flag vessels. In India, there are 27 Shipyards comprising 6 under Central Public Sector, 2 under State Governments and 19 under Private Sector Undertakings.

In 2016-17, cargo traffic at Indian Ports has increased by 5.9 percent (Y-o-Y) with 6.9 percent growth in Major Ports and 4.2 percent growth in Non-Major Ports. In 2017-18 (till 31.12.2017), cargo traffic handled at Major Ports has been 499.41 million tonnes as compared to 481.87 million tonnes handled during the corresponding period of 2016-17.

The Sagarmala programme is the flagship programme of the Ministry of Shipping to promote port-led development in the country through harnessing India's 7,500 km long coastline, 14,500 km of potentially navigable waterways and strategic location on key international maritime trade routes. The main vision of the Sagarmala Programme is to reduce logistics cost for international and domestic trade, with minimal infrastructure investment.

The 'Jal Marg Vikas Project' on National Waterways-I (NW-1) in River Ganga, a large integrated IWT project, has been launched between Varanasi and Haldia covering a distance of 1,380 km. On NW-2 (River Brahmaputra), Ro-Ro services have commenced between Dhubri and Hatsingimari in July 2017 on an Inland Waterways Authority of India (IWAI) vessel.

Further, under the National Waterways Act, 2016, 106 additional inland waterways have been declared as National Waterways (NWs). Based on techno economic studies, eight new NWs have been taken up for development in 2017-18. These include, NW-16 (River Barak); three in Goa; NW-86 (River Rupnarayan) ; NW 97 (Sunderbans); NW-9 (Alappuzha-Kottayam-Athirampuzha Canal) and NW-37 (River Gandak). In order to reduce the logistics cost of cargo and facilitate passenger movement between North-East and mainland, MoUs have been signed with Bangladesh.

Roads

India has one of the largest road networks of over 56.17 lakh km comprising National Highways, Expressways, State Highways, Major District Roads, Other District Roads and Village Roads. As on September, 2017, length distribution of road is: National Highways/Express Way- 1,15,530 km, State Highways (As on 2015-16) is 1,76,166 km and Other Roads (As on 2015-16) is 53,26,166 km. In case of inland freight transport, road share is more than railways and other modes of transportation in India. National Highways (NHs) /Express Ways in India accounted for 2.06% of the total road length. So far 3,180 km of State Highways have been converted to NHs. The Government is connecting habitations with rural

roads through the Pradhan Mantri Gram Sadak Yojana (PMGSY), which is a centrally sponsored scheme.

Bharatmala Pariyojana is a new umbrella programme for the Highways Sector that focuses on optimising efficiency of freight and passenger movement across the country by bridging critical infrastructure gaps through effective interventions like development of Economic Corridors, Inter Corridors and Feeder Routes, National Corridor Efficiency Improvement, Border and International connectivity roads, Coastal and Port connectivity roads and Green-field expressways. A total of around 24,800 km are proposed to be constructed in Phase I.

PERFORMANCE OF SELECTED MINERAL-BASED INDUSTRIES

Steel

India from its 8th position in 2003 has climbed up the rank and is currently the world's 3rd largest producer of crude steel and is expected to become the 2nd largest producer of crude steel in the world soon. India is the largest producer of direct reduced iron (DRI) or sponge iron in the world. Production of finished steel (alloys and non-alloys) in 2016-17 at 101.80 million tonnes increased by about 11.89% from 90.98 million tonnes achieved in 2015-16. The total production of pig iron was 9.3 million tonnes and about 9.2 million tonnes in 2016-17 and 2015-16, respectively. Exports of iron and steel (total) were 15.44 million tonnes in 2016-17 as compared to 9.12 million tonnes reported in 2015-16.

Cement

As per DIPP Annual Report, 2017-18, production of cement in 2016-17 at 279.97 million tonnes registered a decrease of about 1.23% over the production of 283.45 million tonnes in 2015-16. Cement Industry has been undergoing a transition with modernisation and upgradation of technology particularly with a view to conserve energy. India exports cement including white cement and clinker. The exports of cement (total) in 2016-17 and 2015-16, were about 6.85 million tonnes and 6.22 million tonnes, respectively.

Petroleum Oil and Refineries

Crude oil production in 2016-17 at 36.01 million tonnes registered a decrease of 2.52 % as compared to that in 2015-16. The production of natural gas (utilised) was at 31,896 million cubic metres in 2016-17, 1.09% lower than 32,249 million cubic metres achieved in 2015-16. The refinery crude throughput of 245.36 million tonnes in 2016-17 was 5.36% higher than 232.86 million tonnes processed in 2015-16. The total refining capacity in the country was about 233.96 MMTPA as on 1.4.2017. Production of petroleum products (including LPG production from natural gas) was 243.55 million tonnes in 2016-17 as compared to 231.92 million tonnes in 2015-16.

SELF-RELIANCE IN MINERALS & MINERAL-BASED PRODUCTS

India continued to be wholly or largely self-sufficient in minerals which constitute primary mineral raw materials that are supplied to industries, such as, iron & steel, aluminium, cement, various types of refractories, china clay-based ceramics, glass. India is self-sufficient in bauxite, chromite. India is about to self-sufficient in iron ore. India is deficient in kyanite, limestone, magnesite, sillimanite, rock phosphate, manganese ore, etc. which were imported to meet the demand for either blending with locally available mineral raw materials and/or for manufacturing special qualities of mineral-based products. To meet the increasing demand of uncut diamonds, emerald and other precious & semi-precious stones by the domestic Cutting and Polishing Industry, India is dependent on imports of raw uncut stones for their value-added re-exports. The degree of self-sufficiency in respect of various principal minerals and metals in 2016-17 is furnished in Table-7.

Table-7: Degree of Self-sufficiency in Principal Minerals & Metals, 2016-17 (P)

Sl. No.	Commodity	Apparent Demand* ('000 tonnes)	Supply/Domestic supply ('000 tonnes) (R)	Order of self-sufficiency (%)
Minerals				
1.	Bauxite	23769	24664	100
2.	Chromite	3651	3727	100
3.	Iron ore	193616	192081	99
4.	Kyanite	3.85	3.25	84
5.	Limestone	327166	313196[1/]	96
6.	Magnesite	433	299	69
7.	Manganese ore	4300	2393	56
8.	Rock phosphate (including apatite)	8686	1181	14
9.	Sillimanite	78	68	87
Metals				
10.	Aluminium(primary)	3100	2896	93
11.	Copper (refined)	840[2/]	787	94
12.	Lead (primary)	272[3/]	142	52
13.	Zinc	686[4/]	672	98

** :Apparent demand (production+ import-export)*

***Source: Production**: MCDR Returns & MSMP, March, 2017 for production data.*

***Note:** As per Government of India Notification S.O. 423(E) dated 10th February, 2015, the following minerals have been declared as minor minerals: i) barytes ii) dolomite iii) felspar iv) fireclay v) quartz/silica sand and vi) talc/ steatite/soapstone & vii) pyrophyllite, these have not been included in the table due to non-availability of production data for the year 2015-16.*

Even in cases where almost entire domestic demand is satisfied by domestic supplies, some quantities of certain special quality/ types of minerals and metals/ferro-alloys are imported to meet the requirement in certain specific end-uses.

1/ Excludes production of limestone as a minor mineral, calcite & chalk and includes limeshell, limekankar and marl.

2/ Based on production of copper cathode and imports & exports of copper & alloys.

3/ Based on production of lead (primary), and imports & exports of lead & alloys.

4/ Based on production of zinc (ingots) and imports & exports of zinc & alloys.