

# 1 Indian Mineral Industry & National Economy

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## 1. NATIONAL ECONOMY

Economic growth decelerated in 2008-09 to 6.7% which represented a decline of 2.1% from the average growth rate of 8.8% in the previous five years. The global financial meltdown and consequent economic recession in developed economies were the major factors in India's economic slowdown.

Gross Domestic Product (GDP) is an important key indicator by which a nation's economic performance is gauged. Economic policies bring about pronounced changes in the industrial policy, foreign trade, domestic and international taxation policies, monetary exchange rates, etc., and in turn, affect the overall growth in economy. The overall growth of GDP was 6.7% in 2008-09 at factor cost (at constant 1999-2000 prices) as against 9.5%, 9.7% and 9.0% in 2005-06, 2006-07 and 2007-08, respectively.

Economic parameters as published in Economic Survey 2008-09 reveal that the GDP in 2008-09 at current market prices and at constant market prices was Rs. 5321,753 crore (revised estimate) and Rs. 3609,425 crore, respectively. The deceleration of growth in 2008-09 was observed in all the sectors except mining & quarrying and community, social & personal services. The growth rate of GDP at factor cost (1999-2000 prices) of mining sector was 4.9% in 2005-06, 8.8% in 2006-07, 3.3% in 2007-08 and 3.6% in 2008-09. The manufacturing, electricity (including gas and water supply) and construction sector decelerated to 2.4%, 3.4% and 7.2%, respectively, during 2008-09 from 8.2%, 5.3% and 10.1%, respectively, in 2007-08.

The external sector of the Indian economy exhibited resilience despite sharp deceleration in net capital inflows during 2008-09 (April-December 2009). Exports rose from 11.1% of GDP in 2003-04 to 14.1% in 2007-08 and 15.2% during 2008-09 (April-December). Imports grew even faster from 13.3% of GDP in 2003-04 to 21.9% in

2007-08 and 27.1% in 2008-09 (April-December). Thus, the trade deficit widened to 7.8% of GDP in 2007-08 and 12% of GDP in 2008-09 (April-December). The higher trade deficit could be attributed to a rise in imports of petroleum, oil and lubricants (POL) as well as non-POL imports.

Export to Import ratio vis-a-vis Balance of Payment (BOP) was 67.0% in 2005-06, 67.6% in 2006-07, 64.5% in 2007-08 and 55.9% in 2008-09 (April-December). The current account balance in external trade as a proportion of GDP was (-)1.2% in 2005-06, (-)1.1% in 2006-07, (-)1.5% in 2007-08 and (-) 4.1% in 2008-09 (April-December).

The Index of Industrial Production (IIP) (base 1993-94 =100) showed 8.2% and 11.6% increase in 2005-06 and 2006-07, respectively, over the previous years. Though growth of industrial sector slowed down in 2007-08 (first half), the overall growth remained as high as 8.5%. The Index of Industrial production (IIP) in 2008-09 points towards a sharp slowdown with growth at 2.4%. Growth of manufacturing sector was at 2.3% in 2008-09 as compared to 9% in 2007-08, while mining grew at 2.3% in 2008-09 as against 5.1% in 2007-08.

The performance of six core industries comprising crude oil, petroleum refinery products, coal, electricity, cement and finished steel (carbon) grew at 2.7% as compared to 5.9% in 2007-08. The growth in index for crude oil turned negative 1.8% as compared to positive 0.4% in 2007-08. There was a deceleration in the growth of cement and finished steel reflecting the negative sentiments in construction and manufacturing sectors.

FDI is considered to be the most attractive kind of capital flow for emerging economies as it is expected to bring in latest technology and enhance production capabilities of the economy. With reforms in policies, better infrastructure and vibrant financial sector, FDI inflows in to India have accelerated since 2006-07 from US \$ 22.8 billion. FDI equity inflows of

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US \$ 27.5 billion were received during 2008-09 (April-December) as against US \$ 34.4 billion in 2007-08. As per UNCTAD's report, India achieved a growth rate of 85.1% in FDI inflows in 2008 which was largest globally. In 2008, India ranked 9th in global FDI inflows.

The contribution of the domestic mineral industry to the national economy is discussed in the following paragraphs:

### 2. MINING INDUSTRY

Mineral production in the country maintained an upward swing. The index of mineral production (base 1993-94=100) for all minerals (excluding atomic minerals) stood at 172.42 points in 2007-08 as against 166.90 points in 2006-07 registering an increase of 3.3%.

In the mineral fuel sector, coal mining including lignite increased by 10.75 points or 6.2%, petroleum & natural gas increased by 1.16 points or 0.8%, metallic minerals increased by about 20.94 points or 7.38% over that observed in 2006-07 whereas that of non-metallic minerals decreased by 6.79 points or 3.27%.

In metallic ore mining sector, production increased in respect of bauxite (47%), iron ore (10%), copper concentrate (6%), lead concentrate (17%), zinc concentrate (9%), gold ore (35%) and manganese ore (21%). However, the production of chromite at 4.8 million tonnes in 2007-08 registered a decrease of about 9% as compared to that in the previous year.

Among the important non-metallic minerals, rise in production in 2007-08 was observed in phosphorite (17%), magnesite (4%) and talc/steatite (12%). However, substantial fall was noticed in the production of mineral gypsum (13%), limestone (4%) and kaolin (12%). The production of dolomite showed a marginal decrease as compared to that in the previous year.

The total value of mineral production (including minor minerals) showed increase of about 10% in 2007-08 over that recorded in 2006-07. This was due to overall rise in the production of coal, lignite, natural gas (utilised), bauxite, gold, lead concentrates, iron ore, manganese ore, copper ore, zinc concentrate, phosphorite rock phosphate, etc. (Table-1).

**Table – 1 : Indian Mineral Industry : Value of Production\***  
**2005-06 to 2007-08**

Sector	2005-06 (R)	2006-07 (R)	2007-08 (p)	% change between		Sectoral contribution to the total value in %	
						2006-07	2007-08
				2005-06 and 2006-07	2006-07 and 2007-08		
<b>Total : All Sectors</b>	<b>907448</b>	<b>1044905</b>	<b>1145150</b>	<b>+15.15</b>	<b>+9.60</b>	<b>100.0</b>	<b>100.0</b>
Fuels	630665	661583	703363	+4.90	+6.31	63.31	61.42
(a) Solid fuel	358284	374628	414102	+4.56	+10.53	35.85	36.16
(b) Liquid & gaseous fuels	272381	286955	289261	+5.35	+0.80	27.46	25.26
Metallic minerals	139034	182858	240381	+31.52	+31.45	17.50	20.99
Non-metallic minerals	28946	33515	34456	+15.78	+2.80	3.21	3.01
Minor minerals**	108802	166949	166949	+53.44	0.00	15.98	14.58

Figures rounded off.

\* Excluding the minerals declared as prescribed substances under Atomic Energy Act, 1962.

\*\* Earlier year's figure has been taken as estimate for 2007-08 because of non-receipt of data.

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The value distribution of mineral production in 2007-08 showed that fuels accounted for about 61%, metallic minerals about 21%, non-metallic minerals about 3% and minor minerals the remaining 15 percent. Minerals prescribed under Atomic Energy Act, 1962 were excluded. In the value of metallic mineral production, iron ore accounted for about 77%, chromite 8%, manganese ore 5%, lead (conc.) and zinc (conc.) together 4%, copper (conc.) and bauxite 2% each and silver, tin concentrates, etc. accounted for the remaining meagre production values.

Amongst the non-metallic minerals, about 96% value was shared by 10 minerals namely, limestone (70%), phosphorite/rock phosphate (9%), kaolin & dolomite (4% each), barytes, mineral gypsum, talc/soapstone/steatite (2% each), magnesite, garnet (abrasive) and silica sand (1% each). The remaining 4% value was contributed by other non-metallic minerals. The production in respect of emerald, corundum (ruby), garnet (gem) and pyrites was not reported.

India produced as many as 84 minerals which included 4 fuel minerals, 10 metallic minerals and 44 non-metallic (industrial minerals), 3 atomic minerals and 23 minor minerals (building and other materials) in 2007-08.

Indian mining industry is characterised by a large number of small operational mines. The total working mines, (excluding atomic minerals, minor minerals, petroleum (crude) and natural gas in the country were 2,854 in 2007-08 as against 3,005 in 2006-07. Among them, 569 mines belonged to coal and lignite, 676 mines to metallic minerals and 1,609 mines to non-metallic minerals (Table-2). There were 755 mines in public sector and the remaining 2,099 mines in private sector.

**Table – 2 : Number of Operating Mines  
2006-07 and 2007-08**

Sector	2006-07	2007-08 (p)
<b>All Minerals*</b>	<b>3005</b>	<b>2854</b>
Coal (including lignite)	570	569
Metallic minerals	639	676
Non-metallic minerals	1796	1609

\* Excluding atomic minerals, petroleum (crude), natural gas (utilised) and minor minerals.

The public sector continued to play a dominant role in mineral production in 2007-08 accounting for 64% or Rs.72,863 crore in the total value. Small mines, which were mostly in the private sector, continued to be operated manually either as proprietary or partnership ventures. The minerals which were wholly mined/recovered by the public/joint sector were copper ore, diamond, dunite, fluorite (con.), fluorite (graded), phosphorite/rock phosphate, rock salt, sand (others), selenite and sulphur. By and large, almost the entire production of lignite, gold (total), barytes and gypsum was from public sector. In 2007-08, the public sector accounted for sizeable 92% production of coal, 85% of petroleum (crude), 76% of natural gas (utilised), 75% of kyanite and 71% of sillimanite.

In 2007-08, the mining and quarrying sector (excluding the minerals declared as prescribed substances under the Atomic Energy Act, 1962) accounted for about 2.72% of the total GDP. The contribution of mining and quarrying sector in GDP in 2007-08 was Rs.92,109 crore (excluding Atomic Minerals), indicating an increase of 9.69% over that in the preceding year. This was mainly due to rise in the value of coal & lignite, natural gas (utilised), bauxite, chromite, copper concentrate, manganese ore, gold, iron ore, lead concentrate and zinc concentrate among metallic minerals and garnet (abrasive), dolomite, gypsum, laterite, magnesite and dunite in non-metallic minerals in 2007-08.

The contribution of fuel minerals in GDP accrued from mining & quarrying sector in 2007-08 was 59%, metallic minerals 22%, non-metallic minerals 3% and minor minerals 16%.

Regarding fuel minerals, the share of coal & lignite to GDP accrued from mining & quarrying sector was 33% and that of petroleum (crude) and natural gas (utilised) 26%. As regard contribution of metallic minerals, iron ore accounted for 17% and chromite about 2%. About 3% was shared by other metallic minerals. Among the non-metallic minerals, the share of limestone was 2%. Other non-metallic minerals accounted for one percent.

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In 2007-08, mining was reported from 32 States/Union Territories and also from the offshore oil wells. The offshore region continued to occupy top position contributing 18% of the GDP accrual from mining & quarrying sector while the remaining was accounted for mainly by Andhra Pradesh (13%), Orissa (12%), Chhattisgarh (9%), Jharkhand and Madhya Pradesh (7% each), Gujarat (5%), Karnataka, Maharashtra and Rajasthan (4% each) and Assam, Uttar Pradesh and West Bengal (3% each). The remaining 8% was shared by other States/Union Territories.

The average daily employment in mining sector in 2007-08 was estimated at 514,009 persons. The public sector accounted for 422,048 persons (82%) and the private sector the remaining 91,961 persons (18%).

India's ranking in 2007-08 in world production was 2nd in barytes, chromite and talc/steatite/pyrophyllite, 3rd in coal & lignite and bauxite, 4th in iron ore and kyanite/sillimanite, 5th in manganese ore and steel (crude), 7th in zinc and 8th in aluminium. The statistics on indigenous and world production of principal minerals and metals are given in Table-3.

**Table – 3 : Contribution and Rank of India in World Production of Principal Minerals & Metals, 2007**

Commodity	Unit of quantity	Production		Contribution %	India's rank in order of quantum of production
		World	India*		
<b>Mineral Fuels</b>					
Coal & lignite	Million tonnes	6357	491	7.7	3rd
Petroleum (crude)	Million tonnes	3885	34	0.9	24th
<b>Metallic Minerals</b>					
Bauxite	'000 tonnes	213000	23084	10.8	3rd
Chromite	'000 tonnes	24000	4798	20.0	2nd
Iron ore	Million tonnes	2043	206	10.0	4th
Manganese ore	'000 tonnes	33800	2550	7.5	5th
<b>Industrial Minerals</b>					
Barytes	'000 tonnes	8100	1072	13.2	2nd
Kyanite, andalusite & sillimanite	'000 tonnes	400 <sup>(e)**</sup>	47	11.7	4th
Magnesite	'000 tonnes	23500	248	1.0	11th
Apatite & rock phosphate	'000 tonnes	159000	1866	1.2	13th
Talc/Steatite/Pyrophyllite	'000 tonnes	8600	1031	12.0	2nd
Mica	tonne	310000	4583	1.5	11th
<b>Metals</b>					
Aluminium	'000 tonnes	38200	1240	3.2	8th
Copper (refined)	'000 tonnes	20900	501	2.4	11th
Steel (crude/liquid)	Million tonnes	1344	54@	4.0	5th
Lead (refined)	'000 tonnes	8100	58	0.7	25th
Zinc (slab)	'000 tonnes	11300	457	4.0	7th

**Source:** World mineral production data compiled from World Mineral Production, 2003-2007, British Geological Survey.

\* Figures relate to 2007-08

\*\* Mineral Commodity Summaries, 2009, US Geological Survey.

@ JPC data (March 2009).

### 3. MINERAL-RELATED POLICIES

The significant developments relating to National Mineral Policy and other mineral related policies that took place in 2007-08 are given below:

#### **The National Mineral Policy**

The Government of India has enunciated National Mineral Policy, 2008 which includes policy measures like assured right to next stage mineral concession, transferability of mineral concessions and transparency in allotment of concessions in order to reduce delays which are seen as impediments to investment and technology flow in mining sector in India. These policy initiatives would provide suitable environment for exploration and utilisation of the mineral potential of the country.

#### **Foreign Trade Policy, 2004-2009**

The Government has notified the Foreign Trade Policy 2004-2009 incorporating the updated Annual supplement. The Policy came in to force with effect from 1st April 2008.

The highlight of the policy are extension of Duty Entitlement Passbook (DEPB) Scheme, Permission of scrap/waste generated in Special Economic Zone (EEZ) to be disposed of in DTA (Domestic Tariff Area) freely subject to payment of applicable custom duty. A number of new measures have also been introduced through Focus Market Scheme (FMS), Focus Product Scheme (FPS) and Export Promotion Capital Goods (EPCG) Scheme. Income Tax benefit to 100% EOU's under section 10F of Income Tax Act are being extended by Government for one more year beyond 31.3.2009.

#### **International Trade Agreements**

The Ministry of Commerce & Industry, Department of Commerce, Government of India, are engaged in trade negotiations and formulating agreements at multilateral, regional and bilateral levels. Some of the major policy initiatives taken by Government of India during 2007-08 towards evolving improved trading relations are: Doha Round, engagement with ASEAN and South-East Asian countries, India-SACU (Southern African Customs Union) PTA, India-Chile PTA, SAARC

Summit, India-EU Trade and Investment Agreement, India-Japan EPA/CEPA Negotiations, India and Korea CEPA Negotiations, India-China Joint Task Force for Regional Trade Agreement, India-Nepal Bilateral Trade Agreement, Negotiations between India and Pakistan, India-US Trade Policy Forum, MoU between India and Mexico, Asia Pacific Trade Agreement (APTA) and Economic and Social Commission for Asia and the Pacific (ESCAP).

#### **New Exploration Licensing Policy (NELP)-VIII for Oil and Gas Exploration.**

New Exploration Licensing Policy (NELP)-VIII was announced by the Government of India on 11.4.2009. NELP-VIII offers 70 oil and gas blocks covering a sedimentary area of about 163,535 sq km comprising 24 deep water, 28 shallow water and 18 on-land blocks. The country is also offering 10 blocks under the 4th round of Coal Bed Methane exploration policy. The blocks offered under CBM-IV cover an area of 5,000 sq km are spread over 7 states.

#### **FDI Policy**

The FDI policy is reviewed on an on-going basis and appropriate liberalisation measures are undertaken. Major policy changes notified by the Government vide Press Note released in June 2008 are summarised as:

- (1) FDI is prohibited in atomic energy sector.
- (2) FDI up to 100% under the automatic route has been allowed both in setting up and established industrial parks.
- (3) FDI Policy in petroleum & natural gas sector has been rationalised.
- (4) FDI up to 100% (with prior government approval) in mining and mineral separation of titanium-bearing minerals and ores, its value addition and integrated activities has been allowed.

#### **High Level Committee for Aerogeophysical Survey**

The Government constituted a High Level Committee under the Chairmanship of Secretary, Ministry of Mines and 16 other members to frame policy guidelines and develop mechanism for acquisition, processing, utilisation and archiving of data accrued through aerogeophysical survey.

## 4. LEGISLATION

Reconnaissance permits became a mineral right distinct from the prospecting licences after the amendment made in 1999 in MMDR Act, 1957. During 2006-07, no reconnaissance permits were approved by the Central Government or executed by State Governments.

Fifteen prospecting licences covering an area of 1,347 ha in 7 states, all in private sector were executed in 2006-07 as compared to 83 prospecting licences covering 12,072 ha in 2005-06. As on 31.3.2007, there were 7,734 mining leases in force covering an area of 445,847 ha over 23 states in the country, excluding coal, lignite, petroleum & natural gas, atomic minerals and minor minerals.

The significant development, relating to mineral legislation during 2007-08 are given below:

### **Mines and Minerals (Development & Regulation) Act**

The Central Government had enunciated a new National Mineral Policy in March 2008. In order to give effect to the direction envisioned in the new Mineral Policy, the Ministry of Mines circulated a draft Cabinet Note on proposed legislative changes, after due consultations with the important mineral producing State Governments vide Ministry's O.M. number 16/57/2005-MVI dated 14.1.2009. The Ministry received comments in this consultation, which were duly considered.

However, while considering the amendments for legislative vetting, it was suggested in the discussions that the existing law had already been amended several times and in order that the objects and reasons emanating from the Mineral Policy are clearly reflected, repeal of the prevailing Mines and Minerals (Development and Regulation) Act, 1957, and drafting of a new legislation would be preferable. As per this suggestion, the Ministry of Mines has now framed a new draft Mines and Minerals (Development & Regulation) Act, which is available on the website of the Ministry. In this respect, comments on the draft of the new Act are invited from the stakeholders.

### **Revision of Rates of Royalty and Dead Rent on Major Minerals (Other than Coal, Lignite and Sand for Stowing)**

Based on the recommendation of the Study Group, the Central Government revised the rates of Royalty and Dead Rent vide Official Gazette notification number GSR 574 (E) dated 13th August 2009 and GSR 575(E) dated 13th August 2009, respectively, in respect of minerals (other than minor minerals, coal, lignite and sand for stowing). The revised rates of royalty and dead rent would be effective from the date of notification, i.e. 13th August 2009.

As per the new rates applicable, 9 minerals (including iron ore) have been shifted from tonnage basis to ad valorem basis; laterite and bauxite despatched for non-metallurgical purposes would attract ad valorem royalty as per national benchmark price published by IBM.

In case of dead rent, there is a steep hike in the rates from second year of mining lease in order to discourage dormant holdings.

## 5. EXPLORATION & DEVELOPMENT

GSI, AMD, DGMs of various States, public sector companies like NMDC, MECL, MOIL, etc. continued their efforts for surveying, mapping and exploration of new deposits and reassessment of old deposits/mines during 2006-07 and 2007-08. In oil sector, ONGC, OIL and a few joint venture and private companies were engaged in exploration of onshore and offshore areas in 2006-07 and 2007-08. Exploration conducted by various organisations during 2007-08 is highlighted below:

### **Geological Survey of India (GSI)**

The 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 detail geological mapping aided by interpretative analysis of aerogeophysical and remotely sensed data, ground geophysical survey, geochemical prospecting and surface and subsurface exploration through pitting, trenching and drilling. During 2007-08, about 1,316 sq km large-scale mapping,

33.89 sq km detailed mapping and 69,963 m drilling were carried out against 1,394 sq km large-scale mapping, 31.96 sq km detailed mapping and 70,426 m drilling in the previous year. Additional resources were estimated for coal, gold, basemetal, iron ore, manganese, limestone and new bodies of kimberlites- the source rock for diamond, were located. The highlights of the resources assessed are given below in brief:

During 2007-08, GSI estimated about 2,760 million tonnes of coal resources in various coalfields of Andhra Pradesh, Madhya Pradesh and Orissa; about 0.09 million tonnes of gold ore resources (0.93 g/t Au) in Baghmara block, Sonakhan area, Raipur district, Chhattisgarh; about 5.36 million tonnes (2.09 g/t Au) in Delwara West block Bhukia gold belt, Banswara district, Rajasthan; about 7.49 million tonnes iron ore resources (56.8 to 60.6% Fe) in parts of Sandur Schist Belt, Bellary district, Karnataka; about 0.043 million tonnes iron ore resources in Pathuripent-Madhyapur area, Keonjhar district, Orissa; about 6.2 million tonnes (55 to 60.6% Fe) in Ghoraburhani, Sundergarh district, Orissa; about one million tonnes of manganese ore resources in Bolani block, Bonai-Keonjhar belt, Keonjhar district, Orissa and about 1.49 million tonnes limestone (flux grade) resources in Nirwar area, Katni district, Madhya Pradesh. Besides, reassessment of copper ore resources were done in Sikar district, Rajasthan in areas viz. Baniwali-ki-Dhani, 20.18 million tonnes from 18.17 million tonnes, Kundla-ki-Dhani 2.7 million tonnes from 1.93 million tonnes, Dokan block 42.41 million tonnes from 16.85 million tonnes and Dokan north block 19.96 million tonnes from 5.6 million tonnes.

GSI continued its offshore geo-scientific studies both in Exclusive Economic Zone (EEZ) and Territorial Waters (TW) along the East and West Coasts of India. Surveys in the near shore zones were carried out using hired small mechanised boats. During 2007-08, GSI completed a total of about 123,941 sq km sea bed mapping within TW and 1,848,318 sq km in the EEZ.

GSI pursued its airborne geophysical surveys for generating database employing magnetic and gamma ray spectrometric techniques. During 2007-08, aerogeophysical multi-sensor data was acquired surveying over an area of 31,625 sq km involving 15,992 line km in western offshore area between Kanyakumari, Tamil Nadu and South of

Kannur, Kerala and 1,818 sq km involving 3,636 line km in Kanker-Dhamtari area in Bastar Craton, Chhattisgarh were covered using Twin Otter Air-borne Survey System (TOASS) by GSI.

### **MECL**

During 2007-08, MECL established about 3,609 million tonnes coal reserves in Andhra Pradesh, Chhattisgarh, Madhya Pradesh, Sikkim, Meghalaya and Orissa; and about 395 million tonnes lignite reserves in Rajasthan. MECL also assessed about 17.21 million tonnes, copper ore resources (0.32% Cu) in Sanganer area, Bhilwara district and about 1.58 million tonnes (1.15-1.35% Cu) in Devtalai (Phase II), Chittorgarh district, Rajasthan.

### **State Directorates of Geology and Mining**

DGM, Chhattisgarh established about 0.5 million tonnes bauxite resources in Sarguja district; about 93 million tonnes coal reserves in Korba and Mand-Raigarh Coalfields; 23 million tonnes of iron ore resources in Dandewada, Kanker and Rajnandgaon districts; and about 64 million tonnes of limestone resources in Kabirdham and Rajnandgaon districts.

DGM, Jharkhand established about 1 million tonne of graphite resources in Palamau district; about 162 million tonnes of iron ore resources in Singhbhum (West) district; 12 million tonnes of limestone resources in Ramgarh and Singhbhum (West) districts; and about 2 million tonnes of quartz resources in Hazaribagh district.

DMG, Karnataka established about 2 million tonnes of iron ore resources in Tumkur district and about one million tonne of granite and dolerite resources in Chickballapura and Hassan districts.

DGM, Madhya Pradesh established about 109 million tonnes resources of dolomite in Dewas district and about 80 million tonnes resources of laterite in Mandsaur district.

DGM, Maharashtra estimated about 2.8 million tonnes of bauxite and 4 million tonnes of laterite resources in Kolhapur district; about 49 million tonnes of coal resources in Chandrapur, Nagpur and Yavatmal districts.

DGM, Nagaland estimated 8 million tonnes of granite resources suitable for dimension stone in Old Avangkhu area.

DMG, Rajasthan estimated one million tonne of copper ore resources containing 1% Cu in Ajmer district; 0.5 million tonne of calcite resources in Sirohi district; 16 million tonnes of laterite resources in Baran district; 1.9 million tonnes of lignite resources in Barmer district; 504 million tonnes of limestone resources in Banswara, Chittorgarh, Jaipur and Rajsamand districts; about 135 million tonnes of silica sand resources in Ajmer, Alwar, Bharatpur and Karauli districts.

### **Oil and Natural Gas Corporation Ltd (ONGC)**

ONGC continued its operations for exploration of oil and gas and acquired a total of 8,157 GLK/LK of 2D and 19,359 sq km of 3D seismic data during 2007-08. A total of 99 exploratory wells with cumulative meterage of 251,580 m and 224 development wells with cumulative meterage of 482,224 m were drilled. ONGC made 14 new oil prospects and 24 new oil pool discoveries in 2007-08 in Assam, Assam Arakan basin, Western offshore and Krishna-Godavari onland and offshore. As a result of these exploratory efforts, ONGC added 182.23 million tonnes of in-place volume of hydrocarbons and 63.82 million tonnes of ultimate reserves in areas under its operation.

### **Oil India Ltd (OIL)**

OIL continued its operations for exploration of crude oil and natural gas in 2007-08 and acquired a total of about 154 GLK of 2D and 1,096 sq km 3D seismic data. In all 13 exploratory wells (6 full and 7 part wells) involving a total meterage of 41,580 m and 28 development wells (19 full and 9 part wells) involving a total meterage of 79,712 m were drilled. Exploration resulted in significant discoveries of oil/gas in Dibrugarh, Sivasagar and Tinsukia districts of Assam.

### **Indian Bureau of Mines (IBM)**

IBM as a facilitator to 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. UNFC system has been adopted by IBM for resource classification and the updated National Mineral Inventory as on 1.4.2005 has been brought out in respect of 65 minerals. Besides, 113 multiminer maps with forest outlays on 1:50,000 scale in respect of Karnataka during 2006-07 and 120 maps covering part of Maharashtra and Tamil Nadu during 2007-08 were prepared in collaboration with Forest Survey of India.

### **Other Agencies**

NMDC estimated about 9.6 million tonnes of kimberlite resources in its lease hold areas in Anantpur district, Andhra Pradesh and 10 million tonnes of hematite resources at Donamalai mine in Bellary district of Karnataka.

GMDC estimated a total of 121 million tonnes of lignite resources in Bhavnagar and Kachchh districts, Gujarat.

OMC established about 84 million tonnes of iron ore reserves in its lease hold areas in Keonjhar district and 1.8 lakh tonnes chromite reserves in Jajpur and Keonjhar districts, Orissa in 2007-08.

Exploration by HGML has established 10.48 million tonnes gold ore reserves in Hutti, Uti and Hira-Buddini in Raichur district of Karnataka.

Singareni Collieries Company Ltd (SCCL) proved 187.20 million tonnes of coal reserves in Godavari Valley Coalfield, Andhra Pradesh during 2007-08.

Reliance Industries Ltd (RIL), a largest acreage holder in private sector had 9 offshore discoveries in 2007-08. Of these, 7 were gas discoveries, one oil discovery and another one contained both oil and gas. These discoveries were across four offshore basins viz. Mahanadi, Krishna, Cauvery and Gujarat-Saurashtra. With these, the inventory of discovered block with Reliance stands at 37 reflecting a success ratio of 63%. In order to assess their commercial values, appraisal process was underway. Other private sector companies, namely, Gujarat State Petroleum Corporation and Videocon Industries Ltd were also engaged in petroleum & natural gas exploration during the year for which information is not available.

## 6. RESEARCH & DEVELOPMENT

The Science and Technology (S&T) programmes of the Ministry of Mines, Government of India, cover the disciplines of Geology, Exploration, Mining and Environment, Bioleaching, Beneficiation, Rock Mechanics, Ground Control and Non-ferrous Metallurgy. So far, a total of fifteen new projects have been received and there were six ongoing projects during 2007-08.

The highlights of work carried out by various research organisations and industries relating to mineral beneficiation and mining & environment during 2006-07 and 2007-08 are given below:

### BENEFICIATION

#### Beach Sand

***Beneficiation Studies on Beach Sand Samples from Srikakulam district, (AP) (NML):*** The modal analysis of the sample contained about 25% heavies. Initial preconcentration of the sample was carried by spiralling to remove major silica. The heavy fraction was subjected to high tension separation of both the conducting and non-conducting materials to separate ilmenite, rutile, garnet, zircon and sillimanite. The sillimanite was further concentrated to + 98% purity by flotation. The project is under progress to prepare bulk sillimanite concentrate.

### CHROMITE

***R & D studies on Chromite Ore sample (IMMT):*** Beneficiation studies were carried out on (1) Chromite ore beneficiation (COB) plant middlings (2) plant tailings containing about 20% Cr<sub>2</sub>O<sub>3</sub> and (3) low grade ferruginous chromite ore containing about 15% Cr<sub>2</sub>O<sub>3</sub>. Flow sheets have been developed to recover most of the chromite values from the sample. It is possible to obtain 20 wt% of chromite concentrate containing 48% Cr<sub>2</sub>O<sub>3</sub> at around 50% recovery involving gravity concentration and flotation from the COB plant tailings. It was also established that about 22wt% of the concentrate can be obtained containing 48% Cr<sub>2</sub>O<sub>3</sub> at around 70% recovery from the sub-grade chromite ore containing 15% Cr<sub>2</sub>O<sub>3</sub>.

## COPPER ORE

***Beneficiation of Copper Ore from Khetri Mines (Jhunjhunu) for M/s HCL (IBM):*** The as received sample assayed 0.83% Cu, 57.95% SiO<sub>2</sub>, 3.71% S(T), 16.68% Fe(T). By adopting flotation route, a concentrate assaying 19.27% Cu, 11.77% SiO<sub>2</sub>, 27.45% S(T), 33.61% Fe(T) with Copper recovery of 89.3% could be obtained at 20% pulp density. When the flotation was conducted at 30% pulp density a copper concentrate assaying 19.54% Cu with 88.5% copper recovery (Weight % yield 3.8) could be obtained.

***Upgradation of a Copper Ore from Banwas Mines, Khetri Copper Complex for M/s HCL (IBM):*** The as received sample assayed 1.59% Cu, 17.23% Fe(T), 3.47% S(T). By adopting flotation route, a copper concentrate assaying 20.87% Cu with 90.6% Copper recovery (Weight % yield 6.6) could be obtained at 20% pulp density. Flotation at higher pulp density - 36% solids, a copper concentrate assaying 20.98% Cu with copper recovery of 90.1% (Weight % yield 6.6) could be obtained.

***Evolution of suitable process flow sheet to obtain Copper concentrate from Banwas mines of M/s HCL (IBM):*** The as received sample contained 1.90% Cu, 19.0% Fe(T) and 7.40% S(T). By flotation process, a copper concentrate assaying 24.98% Cu could be obtained with 93.7% Cu recovery. The grade and recovery achieved was more than the value stipulated by HCL.

## FLUORITE

***Reduction of Silica content in low grade fluorite sample from Dongargaon, Warora of Maharashtra State Mining Corporation (MSMC)(IBM):*** The as received sample assayed 52.96% CaF<sub>2</sub>, 37.41% SiO<sub>2</sub>, 3.25% CaCO<sub>3</sub>, 0.85% Al<sub>2</sub>O<sub>3</sub>, 1.14% Fe<sub>2</sub>O<sub>3</sub>. A fluorite concentrate assaying 88.24% CaF<sub>2</sub>, 6.95% SiO<sub>2</sub> and 0.42% Al<sub>2</sub>O<sub>3</sub> with 49.9% CaF<sub>2</sub> recovery (Wt % yield 30.4) could be obtained. Though the desired 6% SiO<sub>2</sub> limitation of silica could not be achieved, the attained grade of the concentrate in terms of CaF<sub>2</sub> is significant in view of the complex ore nature.

## IRON ORE

**Beneficiation of a low grade iron ore sample from Sub grade dump of Sankalapuram Iron Ore Mine Bellary District, Karnataka (IBM):** The as received ore contained 54.29% Fe(T), 10.66% SiO<sub>2</sub>, 6.32% Al<sub>2</sub>O<sub>3</sub>, 1.01% FeO, 0.20% MgO and 2.86% LOI. Beneficiation process comprising of grinding, tabling and magnetic separation produced a concentrate assaying 65.02% Fe(T), 1.62% FeO & 0.95% LOI with 78.0% Fe(T) recovery with a wt % yield of 63.10. The concentrate produced meets specifications for pellet grade.

**Iron Ore sample from Sagar Taluk, Shimoga district, Karnataka (IBM):** The as received sample assayed 33.8% Fe(T), 17.7% FeO, 42.6% SiO<sub>2</sub>, 1.13% Al<sub>2</sub>O<sub>3</sub> and 4.03% LOI. The objective was to produce an iron concentrate suitable for pellet manufacture. A concentrate assaying, 66.79% Fe(T), 4.09% SiO<sub>2</sub> and 0.60% Al<sub>2</sub>O<sub>3</sub>, with an over all recovery of 71.0% Fe(T) with wt % yield 37.3 could be obtained. This concentrate is suitable for application in pellet industry.

**Blue dust reject sample from Shree Gulab Mines and Minerals, distt. Jabalpur, M.P. (IBM):** The sample containing 55% Fe (T) was received for development of flow sheet to produce a marketable grade iron concentrate. The beneficiation process evolved comprised crushing of sample to all -30 mesh (0.5mm) followed by hydrocycloning, stub cycloning and wet high intensity magnetic separation which yielded a composite concentrate assaying 63.33% Fe with total iron recovery of 92.8%. Based on the process developed the party has initiated erection of a commercial plant.

## LIMESTONE

**Bench scale beneficiation studies on low grade sample from M/s Madras Cements Ltd (IBM):** The as received sample assayed 42.67% CaO, 72.33% total carbonate, 17.42% SiO<sub>2</sub> and 34.13% LOI. The objective was to produce a limestone concentrate assaying +80% total carbonate with a silica content below 14%. The cleaner concentrate was produced at higher pulp density assayed 87.52% T.C. with a total carbonate recovery of 90.7% (wt % yield 75.2). The SiO<sub>2</sub> content is 6.92%. The rougher concentrate obtained at low pulp density, assayed 85.88% T.C. and 7.80% SiO<sub>2</sub> with total carbonate recovery of 94.6% (wt % yield 79.9). Both

the concentrates produced, meet the specification stipulated by the party and are suitable for cement manufacturing.

**Upgradation of Low Grade Limestone from Karikoil (IBM):** The as received sample assayed 30.52% CaO, 36.30% SiO<sub>2</sub>, 0.47% MgO, and 24.97% LOI. By adopting flotation route, a limestone concentrate assaying 48.16% CaO, 0.34% MgO, 7.80% SiO<sub>2</sub> and 38.96% LOI with 89.8% CaO recovery could be obtained. This high grade concentrate finds application in cement manufacture.

**Beneficiation of siliceous limestone from Jayanthipuram Mine, sponsored by M/s Madras Cements, Chennai (NML):** The flotation data suggest that the beneficiation of limestone both by direct and reverse flotation processes is economically viable. The silica content was brought down to 7% from initial value of 14%. The CaO content was improved to above 50% from its initial value of 42% with a weight recovery of 75%. Further, beneficiation by flotation column was tried and the results were compared to that of conventional flotation. The difference was found to be marginal in terms of grade and recovery.

## LEAD & ZINC

**Recovery improvement in Rajpura Dariba Mine (HZZL):** To enhance the grade and recovery at Rajpura Dariba ore from different Rajpura Dariba mine sections, test work was taken up to produce a suitable bulk concentrate with Rajpura Dariba ore instead of separate Lead and Zinc concentrates. For this, closed cycle flotation test work with the laboratory Mini flotation Unit was carried out during November 2007 and March 2008 in two phases. To minimise the impurities and achieve desired quality for bulk concentrate at lab scale that could be treated through pyro-process for lead, zinc and silver metals was successfully developed.

**Minimising the misplacement of Zn in Pb concentrate and Pb in Zn concentrate (HZZL):** A flotation process for Rampura Agucha ore was developed at laboratory scale using new reagents to reduce the misplacement of Zn in Lead concentrate and Pb in Zinc concentrate. Laboratory test work was taken up during July-

September 2007. Test work was conducted with Sodium bicarbonate, Sodium Phosphate and Sodium Polyphosphate reagents. Considerable reduction in the misplacement of zinc in lead concentrate and some lead in zinc concentrate were achieved using ore sample from Rampura Agucha with sodium phosphate.

**Silver concentrate production from Lead-Silver residue (HZL):** As a means of producing Ag rich concentrate from lead-silver cake, a leach residue from Chanderia lead-zinc smelter was tested. A novel flotation process was developed to produce silver-rich concentrate from residue and there was considerable silver upgradation into concentrate produced.

**Silver recovery from Moore Cake - a leach residue from Zn Smelter (HZL):** The process developed was tested by producing silver concentrate in the two tonnes per day pilot plant by HZL. The silver was upgraded from 300 ppm in the field to 2800-3000 ppm in concentrate with 50% Ag recovery. The test work based on batch flotation tests was later experimented on close cycle test using mini flotation circuit.

**Beneficiation of Lead - Zinc Sample from Latio-ka-Khera Project for MECL (IBM):** The as received sample assayed 0.85% Pb, 4.80% Zn, 15.35% Fe(T) and 21.28% SiO<sub>2</sub>. By adopting flotation route, a lead concentrate assaying 62.78% Pb with 48.7% Pb recovery (wt % yield of 0.6) and a zinc concentrate assaying 51.46% Zn with 87.2% Zn recovery (wt % yield 8.5) could be obtained. Both the concentrates are of suitable grade for use in lead & zinc smelting.

## MANGANESE

**Recovery of manganese from leached sea nodules residue and toxicological studies of the waste, supported by Department of Ocean Development, New Delhi (NML):** During processing of Polymetallic Sea nodules a substantial quantity of residue containing 20% Mn, 10% Fe and 8% Si is generated which constitute 70% of the weight of the nodules treated. In order to improve the overall economics of the process, it is necessary to recover manganese either as metal or Fe-Si-Mn alloy. The leached residue was blended with Mn ore/Fe-Mn slag/Mn metal to have the required Mn/Fe ratio to produce standard grade Fe-Si-Mn by

smelting route. Attempts were also made to recover the manganese as Fe-Si-Mn by two stage semelting of leached sea nodule residue without any blending with the above mentioned Mn containing materials. Several experiments were conducted on 20 kg scale to optimise the various parameters to achieve the standard grade Fe-Si-Mn and good Mn recovery. Based on the above studies, the two stage smelting process was decided to be tried on 350 kg scale in the newly set up Fe-Si-Mn production pilot plant. Campaigns were carried out on pilot scale and standard grade Fe-Si-Mn was produced.

**Processing of polymetallic sea nodules for recovery of valuable metals, supported by Department of Ocean Development, New Delhi (NML):** Manganese nodules obtained from deep ocean floor, contain valuable metals like Cu, Ni, Co besides Mn. Available estimates show that availability of strategic metals like Ni and Co in manganese nodules is about 5 and 40 times higher, respectively, than that in land based resources. NML has developed a process on pilot scale for the metals extraction from sea nodules following the "Reduction roast-Ammonia Leaching - Solvent Extraction - Electrowinning-Leach residue treatment" route. The recoveries of metals on pilot scale processing of sea nodules are Cu-95%, Ni-95% and Co-80%. Manganese recovery in the form of standard grade Fe-Si-Mn from the leached sea nodules residue has been made by smelting route on pilot scale with the Mn recovery of about 75%.

## MARBLE

**Ningha Marble quarry of M/s Jaiprakash Associates Ltd. Dalla Cement, Sonbhadra distt., U.P. for development of suitable beneficiation flow sheet for segregation of marble from quartzite (IBM):** The as received quartzite bearing marble sample assayed 67.71% T.C., 35.21% CaO, 30.58% SiO<sub>2</sub>, 1.03% Fe<sub>2</sub>O<sub>3</sub>, 0.08% Al<sub>2</sub>O<sub>3</sub>, 0.63% MgO and 29.95% LOI. The flotation concentrate obtained assayed 86.8% T.C., 45.91% CaO, 11.85% SiO<sub>2</sub>, 0.07% Al<sub>2</sub>O<sub>3</sub>, 1.39% Fe<sub>2</sub>O<sub>3</sub>, 0.66% MgO with 87.7% recovery and 68.8% wt yield. The concentrate obtained finds application in cement manufacture as sweetener.

## Others

In addition to the above, significant R&D work was carried out by NML on Cobalt, limestone and manganese ore and by HZL on lead zinc and

graphite. Besides, beneficiation studies were also conducted on manganese ore, iron ore and limestone by IMMT and NCBM.

## **MINING & ENVIRONMENT**

### **National Institute of Rock Mechanics (NIRM)**

The Institute took two S&T projects and 25 industry sponsored projects in 2006-07. By the end of 2007-08, investigations were completed for 25 projects and the work with respect to the other 20-odd projects was in progress.

The key areas of research by NIRM included optimum design of mining operations, support systems and stability of excavations in non-coal mines. The work in coal mines comprised strata control investigations, namely, rock reinforcement systems, mine pillar design, caveability of roof strata, extraction of pillars, etc. Besides, rock mechanics studies were undertaken for various hydroelectric projects in the country.

In addition to the field investigations, NIRM has done extensive testing of rock samples as per international standards. The studies carried out on various rock samples included measurement of strain at high temperature under uniaxial and triaxial compressive stress conditions and thermo-mechanical behaviour of rocks.

Fundamental research in the area of engineering and mechanical properties of rock joints under shear, and studies on Kaiser effect were a few unique areas of research undertaken by the Institute in the field of Fracture Mechanics.

### **Indian Bureau of Mines (IBM)**

Mining Research Cell of IBM has rendered charge base consultancy work on environmental Management for the generation of baseline data for the preparation of DIA & EMP Ground vibration studies due to blasting, geotechnical investigation for the design of cut & fill stoping, slope stability investigations, design of tailing dams, waste dump stability analysis, dump management & solid waste management.

The consultancy project on environmental quality monitoring at Copila Gaichem Paul (Shigao) Iron Ore Mine of M/s Fomento Industries, Goa, was carried out for all the four seasons to monitor

environmental parameters, such as, air, water, soil and noise at the mine. Slope Stability Investigations were carried out at Saniem Iron Ore Mine of M/s Taulikekar & Sons (P) Ltd, operated by M/s Fomento Goa, where the footwall benches developed wide tension cracks. The results of investigations and detailed geotechnical analysis indicated that the slopes could be maintained at 28 slope angle with factor of safety of 1.5 by proper support techniques and field instrumentation. Pit slopes were designed up to a depth of another 40 meters to mine the ore body. Geotechnical investigations further revealed that two new tailing stacks/impoundments as designed for Cuddegal Iron Ore Mine of M/s Fomento Goa in the form of input dug dams could increase the holding capacity. Geotechnical investigations were carried out at Deposit No. 5 of Bailadila Iron Ore Project Bachel, M/s NMDC Ltd for assessment of stability of waste Dumps No. 1, 2, 3 and proposed Dump No. 4 & 5 at Bailadila Iron Ore Project of NMDC using numerical modelling techniques for analysing stability of waste dumps with varying slope angles and slope height.

Study was carried out in Amla and Thandiberi limestone mines of M/s Binani Cements Ltd in Sirohi district of Rajasthan to evaluate the effect of blast induced ground vibrations over the nearby surface structure by monitoring with the help of blasting seismograph. As per the directives of Hon'ble High Court of Rajasthan, blast vibrations monitoring was carried out at Chittorgarh Fort and the study report was submitted to the Hon'ble High Court of Rajasthan, Jodhpur. The investigations revealed that vibration levels due to blasting carried out by M/s Birla Cements Works and other nearby stone quarries, are within the limit and are unlikely to cause any damage to the fort area. Ground vibration monitoring carried out at Nangur underground chromite mine of M/s OMC and its responses on the surface were evaluated.

## **7. INFRASTRUCTURE**

The developments of infrastructural sectors, such as, energy, transport, iron & steel and cement hold the key to the success of economic reforms in the country. International competitiveness of our industry and export promotion strategies are dependent critically on efficient performance and

internal demand of these sectors. This calls for greater efficiency and accountability for infrastructure industries most of which are based on minerals. In addition to infrastructure sector, the manufacturing sector also needs minerals as raw materials for consumption to produce quality end-products. Ultimately, minerals are vital for the growth of manufacturing sector too. Thus, the role of mineral sector has been critical to the national economy.

Infrastructure which has direct bearing on sustainability of growth and overall development generates considerable background and forward linkages and hence its development is central to the growth of the other sectors of the economy. The prospects for country's socioeconomic development depend crucially on the performance of infrastructure, such as, power, roads, railways, ports, irrigation and telecommunications. Entailing a radical shift from the old approach of public monopoly to one with encouragement to private enterprise is a significant development which has been made in the fields of power, telecommunication, civil aviation, ports, roads, etc. Since Governmental entities will also continue to remain in most infrastructure, reforms have to be undertaken to increase operational efficiency and accountability of these entities and to infuse commercial principles and financial management in their operations. Government is moving away from its traditional role as a "Provider" of services to one of "Facilitator" and 'Regulator' by ensuring that infrastructure is actually provided in a desirable manner, at the same time, seeking to protect consumer interests and ensuring level playing field by creating and maintaining modern regulatory outlook.

Most infrastructural sectors witnessed subdued growth in production during 2008-09 as the economy slumped in activity consequent to the commodity & oil price shocks and global economic crisis.

The performance of six core industries comprising crude oil, petroleum refinery products, coal, electricity, cement and finished steel (carbon) grew at 2.7% in 2008-09 as compared to 5.9% in 2007-08. The growth of index for crude oil turned negative 1.8% as compared to positive 0.4% in 2007-08. There was deceleration in growth of cement and finished steel reflecting the negative sentiments in construction and manufacturing sector.

## Coal

The power sector is major consumer of coal using about 74% of the country's coal production. Coal-fired thermal units account for around 66% of total power generated in the country. Thus, coal continues to be the mainstay for the power sector. The demand-supply imbalance has been a matter of concern. The dependence on imported coal went up from about 10.2 million tonnes in 2007-08 to about 16 million tonnes in 2008-09. The total consumption of coal by power sector in 2008-09 was 355 million tonnes. Of this, about 16 million tonnes was imported.

Coal production at about 457 million tonnes in 2007-08 was higher by 6.1% than about 431 million tonnes in 2007-08. In 2007-08, out of the total production of coal, 7.5% (34.5 million tonnes) was of coking coal and remaining 92.5% (422.6 million tonnes) was of non-coking coal. Total despatches of coal in 2007-08 at 45.3 million tonnes showed an increase of about 8% over the previous year. About 77% despatches were to electricity sector, 4.6% to sponge iron industry sector, 3.4% to cement industry and 3.6% to steel industry.

## Electricity

The growth in electricity generation by power utilities during 2008-09 at 2.7% fell much short of the targeted 9.1%. The negative growth was observed in power generation in hydro and nuclear sector mainly due to less rainfall and fuel supply constraints, respectively, whereas the growth in total electricity generation was positive due to more than 5% growth in thermal sector.

In keeping with the target set by the National Electricity Policy (NEP), 2005 to raise per capita availability from 704 units in 2007-08 to 1,000 units per annum by the end of 2012, a capacity addition of 78,700 MW has been set for the Eleventh Five Year Plan, of which 19.9% is in the hydel sector, 75.8% in thermal sector and the rest in nuclear sector.

The capacity addition target for 2007-08 was initially fixed at 16,335 MW which was subsequently reduced to 12,039 MW. Against this revised target, a capacity addition of 9,263 MW, comprising 2,423 MW hydro, 6,620 MW thermal and 220 MW nuclear was achieved during the year.

A capacity addition target of 11,061 MW comprising 9,304 MW thermal, 1,097 MW hydro and 660 MW nuclear was originally planned for 2008-09. On account of revision in definition of commissioning of thermal projects, the capacity addition target for the year 2008-09 has been revised as 7,530 MW comprising 5,773 MW thermal, 1,097 MW hydro and 660 MW nuclear against which a capacity of 3,454 MW has been added up to 31.03.2009.

The main reasons for under achievement of capacity addition targets during 2007-08 and 2008-09 were delayed and non-sequential supply of material by suppliers, shortage of skilled manpower for construction and commissioning of the projects, contractual disputes between project authorities, contractors and their sub-vendors, delay in readiness of balance of plants (BOPs) by executing agencies, shortage of fuel (gas and nuclear), design problems, etc.

The Ministry of Power has launched an initiative for development of coal-based Ultra Mega Power Projects (UMPP), each with a capacity of 4,000 MW. Nine sites were identified; one each in Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa, Andhra Pradesh, Gujarat, Karnataka, Maharashtra and Tamil Nadu. Development work is being undertaken in the Mundra Project awarded to the Tata Power Company and the Sasan and Krishnapatnam UMPPs awarded to the Reliance Power Ltd. The Reliance Power Ltd has emerged as the successful bidder in case of Tilaiya UMPP.

## **Transport**

### ***Railways***

Indian Railways consist of an extensive network spread over 63,221 route km (Rkm) comprising broad guage (46,807 Rkm), metre guage (13,290 Rkm) and narrow guage (3,124 Rkm). During 2008-09, the total revenue earning through freight traffic moved by Indian Railways (except Metro Kolkata) grew at 4.9% to 832.1 million tonnes as compared to 9.0% to 793.9 million tonnes in 2007-08. Major portion of this traffic in 2008-09 (i.e. about 43% in physical terms) was accounted by coal (369.4 million tonnes), raw material for steel plants (excluding iron ore) (10.9 million tonnes), iron ore for export (130.5 million tonnes), cement (86 million tonnes), fertilizers (41.2 million tonnes) and POL (38.8 million tonnes).

Dedicated Freight Corridor (DFC) involves an investment of more than Rs. 28,000 crore, comprising the Eastern Corridor from Ludhiana to Dankuni and Western Corridor from Mumbai to Dadri/Tughlakabad ( a total of 3,287 km). The project is planned to be implemented by an SPV called Dedicated Freight Corridor Corporation of India Limited and will be funded through internal generation, domestic/external borrowing as well as multilateral funding sources.

### ***Ports***

India's coastline of 7,517 km, spread over 13 States/UTs, is studded with 12 major ports and about 200 non-major ports of which about 60 handle traffic. Twelve major ports of the country handle about 75% traffic. Cargo handling capacity at major ports increased from 504.75 million tpy in 2006-07 to 532.07 million tpy in 2007-08. Ports handled a traffic of 530.04 million tonnes in 2008-09 as compared to 519.3 million tonnes in 2007-08 and registered a 2.1% growth. POL, iron ore, coal, fertilizers & raw materials, etc. formed the major traffic.

### ***Roads***

India has more than 3.34 million km road network making it one of the largest in the world, comprising 66,754 km National Highways, 128,000 km State Highways, 470,000 km major district roads and about 2,650,000 km other district and rural roads. National Highways are the prime arterial routes throughout the country and cater to about 40% road transport traffic although they comprise only 2% of the total road length. Under Phase-I and Phase-II of National Highway Development Project (NHDP) about 14,330 km National Highways are to be converted to 4/6 lanes at an estimated cost of Rs. 65,000 crore. These two phases consist of the Golden Quadrilateral (GQ) connecting the four metro cities of Mumbai, Delhi, Kolkata and Chennai; the North-South and East-West Corridors connecting Srinagar to Kanyakumari and Silchar to Porbandar; and port connectivity and other projects.

As of March 31, 2009, 11,037 km of national highways under NHDP has been completed, the bulk of which lies on the GQ. Nearly 98 % works on GQ have been completed by March 2009 and the NS and EW corridors are expected to be completed by December 2009.

Approval of the Government has been given for (a) upgradation of 12,109 km under NHDP Phase-III at an estimated cost of Rs. 80,626 crore, (b) two-laning with paved shoulders for 5,000 km of National Highways under NHDP Phase-IV at an estimated cost of Rs. 6,950 crore, (c) six-laning of 6,500 km of NHs comprising 5,700 km of GQ and balance 800 km of other sections of NHs under NHDP Phase-V at a cost of Rs. 41,210 crore, (d) 1,000 km of expressways with full access control on new alignments at a cost of Rs. 16,680 crore under NHDP Phase-VI and (e) construction of ring roads, grade separated intersections, flyovers, elevated highways, ROBs, underpasses and service roads at a cost of Rs. 16,680 crore under NHDP Phase-VII.

## 8. PERFORMANCE OF SELECTED MINERAL BASED INDUSTRIES

### Steel

Provisional production of finished steel (including C.R. sheets) in 2008-09 at 56.42 million tonnes was marginally higher than 56.08 million tonnes in 2007-08. The total production of saleable pig iron decreased marginally from 5.31 million tonnes in 2007-08 to 5.29 million tonnes in 2008-09. Exports of finished steel at 3.48 million tonnes in 2008-09 were 25% less than the exports of 4.13 million tonnes reported in 2007-08. Also, 2.61 lakh tonnes pig iron was exported in 2008-09 as compared to 5.60 lakh tonnes registered in 2007-08.

### Cement

Production of cement in 2008-09 estimated at 187.42 million tonnes registered a growth of about 7.52% over the previous year. Cement industry was going ahead with modernisation and upgradation of technology in particular to conserve energy. The country is self-sufficient in cement. India exports cement including white cement and clinker. The exports in 2006-07 and 2007-08 including clinker were about 4.8 million tonnes and 3.4 million tonnes, respectively.

### Petroleum Oil and Refineries

Crude oil production in 2008-09 at 33.51 million tonnes was slightly lower than

34.12 million tonnes produced in the previous year. Domestic gross natural gas production was at 32.85 billion cubic metres in 2008-09, marginally higher than 32.42 billion cubic metres in 2007-08. The refinery crude throughput of 160.8 million tonnes in 2008-09 was about 3% more than 156.1 million tonnes processed in 2007-08. The total refining capacity in the country at around 178 million tpy as on 1.4.2009 was 19.5% higher over preceding year and was 4% of the world refining capacity. Production of petroleum products at 152.68 million tonnes (including LPG production from natural gas) was about 3.9% more in 2008-09 than 146.99 million tonnes in 2007-08.

## 9. SELF-RELIANCE IN MINERALS & MINERAL-BASED PRODUCTS

India continued to be wholly or largely self-sufficient in minerals which constitute primary mineral raw materials to industries, such as, thermal power generation, iron & steel, ferro-alloys, aluminium, cement, various types of refractories, china clay-based ceramics, glass, chemicals like caustic soda, soda ash, calcium carbide, titania white pigment, etc. India is, by and large, self-sufficient in coal (with the exception of very low ash coking coal required by the steel plants) and lignite among mineral fuels; bauxite, chromite, iron and manganese ores, ilmenite and rutile among metallic minerals; and almost all the industrial minerals with the exception of chrysotile asbestos, borax, fluorite, kyanite, potash, rock phosphate and elemental sulphur. Despite high degree of self-sufficiency, some quantities of flaky and amorphous graphite of high fixed carbon, kaolin and ballclay for special applications, very low silica limestone, dead-burnt magnesite and sea water magnesia, battery grade manganese dioxide, etc. 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 and semi-precious stones by the domestic cutting and polishing industry, India continued to depend 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/ferro-alloys in 2007-08 is given in Table-4.

INDIAN MINERAL INDUSTRY & NATIONAL ECONOMY

**Table – 4 : Degree of Self-Sufficiency in Principal Minerals & Metals, 2007-08 (p)**

Sl. No.	Commodity	Demand/Domestic consumption (‘000 tonnes)	Supply/Domestic supply (‘000 tonnes)	Order of self-sufficiency (%)
<b>Minerals</b>				
1	Asbestos	101	++*	1%
2	Barytes	126	1072	100%
3	Bauxite	10628	23085	100%
4	Chromite	1889	4798	100%
5	Dolomite	4663	5117	100%
6	Felspar	312	411	100%
7	Fireclay	534	460	86%
8	Fluorite	71	7	10%
9	Gypsum	6054	3055 <sup>1</sup>	50%
10	Iron ore	81156	206452	100%
11	Ilmenite	153	172	100%
12	Kyanite	16	5	31%
13	Limestone & other calcareous minerals	175419	188600 <sup>2</sup>	100%
14	Magnesite	254	248	98%
15	Manganese ore	2496	2551	100%
16	Rock phosphate (including apatite)	3885	1866	48%
17	Rutile	19	19	100%
18	Sillimanite	12	43	100%
19	Silica minerals	1732	4280	100%
20	Sulphur	1706	486 <sup>3</sup>	28%
21	Talc/Steatite/Pyrophyllite	303	1031	100%
<b>Metals<sup>4</sup></b>				
22	Aluminium	1315	1239	94%
23	Copper (refined)	313	501	100%
24	Lead (primary)	193	58	30%
25	Zinc	482	457	95%
<b>Ferro-alloys<sup>5</sup></b>				
26	Ferro-chrome	151	933	100%
27	Ferro-manganese	121	337	100%
28	Ferro-silicon	46	83	100%

**Note:** Although 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.

\* Relates to chrysotile asbestos.

1 Includes all the three forms of gypsum, viz., mineral gypsum, by-product marine gypsum and estimated production of by-product phospho-, fluoro- and boro-gypsum.

2 Excludes production of limestone as a minor mineral.

3 Includes recovery of by-product sulphur from petroleum refineries and sulphur equivalent of by-product sulphuric acid recovered from copper & zinc smelters consuming indigenous ores and concentrates.

4 Apparent demand.

5 Excludes production in small-scale sector.

## 10. FOREIGN TRADE

The year 2008-09 was marked by adverse developments in the external sector of the economy, particularly during the second half of the year reflecting the impact of global financial crisis on emerging market economies including India. The external sector of the Indian economy exhibited resilience despite sharp deceleration in net capital flows during 2008-09 (April-December), which turned negative during October-December 2008. The impact of slowdown in export demand was partly offset by lower oil imports bill during October-December 2008 due to decline in the prices of crude in the international markets. The non-oil imports also moderated following decline in commodity prices. The export growth was 3.6% (in US \$ value) in 2008-09 as compared to 28.9% in the previous year. Import also witnessed a growth of 14.4% (in US \$ value) as compared to 35.4% in 2007-08.

Minerals as a group continued to face adverse balance of trade in 2007-08 with the total value of ores & mineral exports at Rs. 95,022 crore as against the total value of imports of ores & minerals at Rs. 349,507 crore in the same year. The total exports value of metals and alloys was about Rs. 66,361 crore in 2007-08 as against imports value of metals and alloys at Rs. 141,947 crore in the same period.

### Exports

According to the data available, the total exports (including re-exports) of all merchandise in 2006-07 and 2007-08 were Rs. 571,779 crore and Rs. 655,864 crore, respectively. The ores and minerals group (including diamond, precious and semi-precious stones) earned foreign exchange worth Rs. 80,931 crore and Rs. 95,022 crore in 2006-07 and 2007-08, an increase of about 17.4% over the previous year. Contribution of cut diamonds in those years was Rs. 47,930 crore and Rs. 57,178 crore while that of iron ore was Rs. 17,656 crore and Rs. 23,400 crore, respectively.

The principal ores and minerals exported from India in order of value contribution are diamond (mostly cut), iron ore, granite, zinc ores concentrates, chromite, bauxite and alumina. Rough diamonds imported into the country are cut and re-exported and these diamonds contributed 60.2% to the total exports of ores and minerals in 2007-08. Iron ore contributed 24.6%, followed by granite 4.5%, zinc ores and concentrates

1.4%, chromite 1.3%, bauxite 1.2% and alumina one percent. The individual share of remaining minerals was less than 1% in the total value of exports of ores and minerals from India in 2007-08.

The exports of petroleum products, e.g., light distillates (naphtha and others), middle distillates and heavy ends, earned foreign exchange of Rs. 81,094 crore and Rs. 107,603 crore in 2006-07 and 2007-08, respectively, with 97.5% and 98% share in the exports of selected mineral-based products.

India also exported metals and alloys, such as, iron and steel with a share of about 62.6% in the total value of exports of metals and alloys of Rs. 66,361 crore in 2007-08, followed by copper & alloys (including brass & bronze) 17.7%, aluminium alloys & scrap and ferro alloys 6.8% each, pig & cast iron (including spiegeleisen) 2.04%, zinc & alloys (including scrap) 1.9% and precious metals/metals clad with precious metals 1.1%.

### Imports

The total imports of all merchandise in 2006-07 and 2007-08 were Rs. 840,506 crore and Rs. 1012,312 crore, respectively. The value of imports of ores and minerals in 2007-08 increased by 15% to Rs. 349,507 crore from Rs. 305,028 crore in 2006-07. Petroleum (crude) continued to be the largest constituent item of imports sharing 73.7% in 2007-08 in the total value of mineral imports. Its imports in 2007-08 at Rs. 257,462 crore were about 21% more than that in 2006-07. Next in order of importance was diamond which had a share of about 9%, followed by coal (excluding lignite) 5.9%, copper ore & concentrates 4.6%, natural gas 2.7% and coke 1.5%.

The imports of petroleum products in 2007-08 rose by 86% in value over the preceding year to Rs. 76,443 crore and had a share of 88% in the value of imports of selected mineral-based products during 2007-08.

The value of imports of metals and alloys at Rs. 141,947 crore showed an increase of 15% in 2007-08 from Rs. 123,461 crore in 2006-07. Share of gold imports was about 47% in terms of value, followed by iron & steel (33.9%), aluminium alloys & scrap and copper & alloys (4.3% each), silver (3.3%), nickel and alloys & scrap (2.1%) and ferro-alloys and lead & alloys (including scrap) (1.1% each).

## 11. 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 2007-08 with a share of 14.5% (i.e., Rs. 95,022 crore) in the total value of all merchandise. The contribution of minerals in exports in raw/unprocessed forms was about Rs. 28,318 crore and in semi-processed/processed forms about Rs. 66,705 crore. The manufactured mineral-based products contributed Rs. 175,683 crore in 2007-08 to the total value of exports of all merchandise. The value-added semi-processed/processed minerals figuring in India's foreign trade included cut and

polished diamonds/emerald, etc., pulverised barytes, steatite, felspar (cut), garnet, calcined magnesite, magnesia (fused), magnesite (dead-burnt), magnesium oxide, slate (worked), processed mica and manufactured mica products, coke, cut and polished dimension stones, alumina, etc. The manufactured mineral-based commodities included metals and alloys and products thereof, cement, firebricks and other refractory materials, clay-bonded graphite crucibles and silicon carbide crucibles, manganese dioxide, asbestos-cement products, inorganic chemicals like lime and fluorine chemicals, refined borax and borates, elemental phosphorus and phosphoric acid, titanium dioxide, petroleum products, phosphatic and potash fertilizers, etc. Table- 5 provides data on contribution of various value-added minerals and mineral-based products to India's exports during 2005-06 to 2007-08.

**Table – 5 : Contribution of Value- added (Processed) Minerals & Mineral-based Products in India's Export Trade, 2005-06 to 2007-08**

Sl. No.	Commodity group	Value of exports (Rs. million)			Contribution (percentage)		
		2005-06	2006-07	2007-08	2005-06	2006-07	2007-08
1.0	All Merchandise*	4564180	5717790	6558640	100.00	100.00	100.00
2.0	Minerals	797900	809307	950225	17.5	14.2	14.5
	2.1 Raw/Unprocessed form	196220	237389	283179	4.3	4.2	4.3
	2.2. Semi-processed/processed forms (preliminary and intermediate stages of processing)	601680	571918	667046	13.2	10.0	10.2
3.0	Manufactured Mineral-based Commodities (final stage of transformation)	880981	1445900	1756834	19.3	25.3	26.8
	3.1 Metals/Alloys	396575	626212	663608	8.7	11.0	10.1
	3.2 Others	484406	828908	1093226	10.6	14.3	16.7

\* Including re-exports