CHAPTER 7
MINERAL AND ENERGY RESOURCES

- A mineral is a natural substance of organic or inorganic origin with definite chemical and physical properties
- On the basis of chemical and physical properties, minerals may be grouped under two main categories
  - Metallic Minerals
  - Non-metallic Minerals

Metallic Minerals
- Metallic minerals are the sources of metals
  - Examples: Iron ore, Copper, Gold
- Metallic minerals are further divided into ferrous and non-ferrous metallic minerals

Ferrous Minerals
- Minerals which have iron content
  - Examples: Iron ore, Manganese

Non-Ferrous Minerals
- Do not have iron content
  - Example: Copper, Bauxite, etc

Non-Metallic Minerals
- These minerals do not have contents of metals
- They are further classified into: Fuel minerals and other Non-metallic minerals

Fuel Minerals or Organic Minerals
- These are made up of organic matter of buried animal and plants
  - Examples: Coal, Petroleum
Other non-metallic or Inorganic Minerals
- Examples: Mica, Limestone, Graphite, etc

Characteristics of Mineral Resources
- Distribution over the earth surface is uneven
- Inverse relationship in quantity and quality of minerals i.e. good quality minerals are less in quantity as compared to low quality minerals
- Minerals are exhaustible over time
- Once they used cannot replenished immediately

Agencies involved in the exploration of minerals
- GSI: Geological Survey of India
- ONGC: Oil and Natural Gas Commission
- MECL: Mineral Exploration Corporation Ltd.
- NMDC: National Mineral Development Corporation
- IBM: Indian Bureau of Mines
- BGML: Bharat Gold Mines Ltd.
- HCL: Hindustan Copper Ltd.
- NALCO: National Aluminium Company Ltd
- Departments of Mining and Geology in various states

Distribution of Minerals in India
- Most of the metallic minerals in India occur in the peninsular plateau region in the old crystalline rocks
- Over 97 per cent of coal reserves occur in the valleys of Damodar, Sone, Mahanadi and Godavari
- Petroleum reserves are located in the sedimentary basins of Assam, Gujarat and Mumbai High
- Minerals are generally concentrated in Four broad belts in India

Mineral belts of India
- The North-Eastern Plateau Region
- The South-Western Plateau Region
- The North-Western Region
- The Himalayan belt

The North-Eastern Plateau Region
- This belt includes the regions of Chotanagpur (Jharkhand), Odisha Plateau, West Bengal and parts of Chhattisgarh
Important minerals are iron ore, coal, manganese, bauxite and mica.
Due to availability of these minerals, most of the iron and steel industries are located here.

The South-Western Plateau Region
- This belt extends over Karnataka, Goa, uplands of Tamil Nadu and Kerala.
- Rich in ferrous metals and bauxite.
- This belt packs in coal deposits except Neyveli lignite.
- Kerala has deposits of monazite and thorium, bauxite clay.
- Goa have Iron ore deposit.

The North-Western Regions
- Minerals are associated with Dharwar system of rocks.
- This belt extends along Aravali in Rajasthan and part of Gujarat.
- Major Minerals: Copper, zinc.
- Rajasthan is rich in building stones i.e. sandstone, granite, marble.
- Gujarat and Rajasthan have rich sources of salt.
- Gujarat also known for petroleum deposit.

Himalayan Belt
- Minerals occur on both the eastern and western parts.
- Major Minerals: copper, lead, zinc, cobalt and tungsten.
- Assam valley has mineral oil deposits.

Spatial Pattern of Metallic Minerals

Ferrous Minerals
- India is well placed in respect of ferrous minerals like iron-ore, manganese, chromite, etc.
- These minerals provide a strong base for the development of metallurgical industries.

Iron ore
- India has largest iron ore reserves in Asia.
- The two main types of ore found in our country are Haematite and Magnetite.
- It has great demand in international market due to its superior quality.
- The iron ore mines occur in close proximity to the coal fields in the north-eastern plateau region of the country.
- About 95 per cent of total reserves of iron ore is located in the States of Odisha, Jharkhand, Chhattisgarh, Karnataka, Goa, Telangana, Andhra Pradesh and Tamil Nadu.
  - Odisha
  - Iron ore occurs in a series of hill ranges in Sundergarh, Mayurbhanj and Jhar.
  - The important mines are Gurumahisani, Sulaipep, Badampahar, Kiruburu and Bonai.
  - Jharkhand
  - It has oldest mines and most of the iron and steel plant in India.
Important mines are Noamundi and Gua in Poorbi and Paschimi Singhbhum districts

- Chhattisgarh

- Durg, Dantewada, Bailadiala, Dalli and Rajhara

- Karnataka

- Iron ore deposits occur in Sandur-Hospet area of Ballari district

- Baba Budan hills and Kudremukh in Chikkamagaluru district

- Parts of Shivamogga, Chitradurg and Tumakuru districts

- Maharashtra

- Chandrapur, Bhandara and Ratnagiri districts

- Andhra Pradesh

- Karimnagar Warangal, Kumool, Cuddapah and Anantpur districts

- Tamil Nadu

- Salem and Nilgiri districts

**Manganese**

- Manganese is an important raw material for smelting of iron ore and also used for manufacturing Ferro alloys

- It is mainly associated with Dharwar

- Odisha

- Leading producer of Manganese : Odisha

- Major mines are located Bonai, Kendujhar, Sundergarh, Gangpur, Koraput, Kalahandi and Bolangir

- Karnataka

- Dharwar, Ballari, Belagavi, North Canara, Chikkmagaluru, Shivamogga, Chitradurg and Tumakuru

- Maharashtra

- Nagpur, Bhandara and Ratnagiri districts

- Madhya Pradesh

- Extends in a belt in Balaghat-Chhindwar-Nimar-Mandla and Jhabua districts

**Leading Iron Ore producing State: Odisha**

**Leading Manganese Producing State: Odisha**
Non-Ferrous Minerals

- India has large deposits of bauxite

**Bauxite**

- Bauxite is the **ore which is used in manufacturing of Aluminium**
- Bauxite is **found mainly in tertiary deposits**
- **Associated with laterite rocks on the plateau or hill ranges of peninsular India and also in the coastal area**
  - Odisha
  - **Largest producer of Bauxite: Odisha**
  - Important producing areas are Kalahandi, Sambalpur, Bolangir and Koraput
  - Jharkhand
  - **Patlands of Jharkhand in Lohardaga**
  - Gujarat
  - Bhavanagar and Jamnagar
  - Chattisgarh
  - Amarkanatak plateau region
  - Madhya Pradesh
  - Katni-Jabalpur area and Balaghat
Copper

- Copper is an **indispensable metal in the electrical industry for making wires, electric motors, transformers and generators**.
- It is **alloyable, malleable and ductile**.
- It is also mixed with gold to provide strength to jewellery.

- **Jharkhand**: Leading Copper Producing States: Singhbhum district
- **Madhya Pradesh**: Balaghat
- **Rajasthan**: Jhunjhunu and Alwar
- **Andhra Pradesh**: Agnigundala in Guntur district
- **Karnataka**: Chitradurg and Hasan
- **Tamil Nadu**: South Arcot district

**INDIA MINERALS - NON-FERROUS**
Non-Metallic Minerals

- **Important Non-Metallic Mineral:** Mica
- **Others:** limestone, dolomite and phosphate

Mica

- Mica is **mainly used in the electrical and electronic industries**
- It can be split into very thin sheets which are tough and flexible
- **Jharkhand:** leading producer of Mica
- Hazaribagh plateau produces a high quality of mica

Andhra Pradesh

- Nellore district

Rajasthan

- A 320 km long belt from Jaipur to Bhilwara near Udaipur

Karnataka

- Mysore and Hasan

Tamil Nadu

- Coimbatore, Tiruchirappalli, Madurai and Kanniyakumari

Kerala

- Alleppey

Energy Resources

- Mineral fuels are **essential for generation of power, required by agriculture, industry, transport and other sectors of the economy**
- Two types - conventional or non-conventional energy resources

Conventional Sources of Energy or Non-renewable Source of Energy

- **Exhaustible resources**
- Examples **fossil fuels** like coal, petroleum and natural gas and Nuclear Energy

Coal

- **Used for generation of thermal power and smelting of iron ore**
- Coal occurs in rocks **mainly of two geological ages,** Gondwana and tertiary deposits
- About **80 per cent of the coal deposits in India is of bituminous type and is of non-coking grade**
- **Gondwana Coal Fields**
- Located in **Damodar Valley**
- They lie in Jharkhand-Bengal coal belt
- important coal fields in this region are Raniganj, Jharia, Bokaro, Giridih, Karanpura
- **Largest coal field- Jharia followed by Raniganj**
- Other river valleys are **Godavari, Mahanadi and Sone**
Tertiary Coal Fields
- Tertiary coals occur in Assam, Arunachal Pradesh, Meghalaya and Nagaland
- Darangiri, Cherrapunji, Mewlong and Langrin
- Assam
- Makum, Jaipur and Nazira

Other Coal Fields
- The brown coal or lignite coal occurs in Neyveli of Tamil Nadu

Petroleum
- Petroleum is known as liquid gold because of its scarcity and diversified uses
- Essential source of energy for all internal combustion engines in automobiles, railways and aircraft
- Crude petroleum consists of hydrocarbons of liquid and gaseous states varying in chemical composition, colour and specific gravity
- It is also used as a raw material in petrochemical industries to produce fertilizer, synthetic rubber, synthetic fibre, medicines, vaseline, lubricants, wax soap and cosmetics, etc.
- Crude petroleum occurs in sedimentary rocks of the tertiary period
- Oil exploration and production was systematically taken up by Oil and Natural Gas Commission (ONGC) set up in 1956
- Assam: Digboi, Naharkatiya and Moran
- Gujarat: Ankaleshwar, Kalol, Mehsana, Nawagam, Kosamba and Lunej
- Mumbai High which lies 160 km off Mumbai was discovered in 1973 and production commenced in 1976
- Krishna-Godavari and Kaveri basin on the east coast

There are two types of oil refineries in India:
- Field Based Refineries: Digboi is an example of field based refinery
- Market Based Refineries: Barauni is an example of market based refinery

There are total 21 refineries as on June 2011.

Natural Gas
- The Gas Authority of India Limited was set up in 1984 as a public sector undertaking to transport and market natural gas
- Exclusive reserves have been located along the eastern coast (Tamil Nadu, Odisha and Andhra Pradesh) as well as Tripura, Rajasthan and off-shore wells in Gujarat and Maharashtra
- According to a survey report, there are indications of huge gas reserves in Ramathanpuram in Tamil/Nadu state
Nuclear Energy Sources
- Nuclear energy has emerged as a **viable source** in recent times
- Important minerals used for the generation of nuclear energy are **Uranium and Thorium**

**Uranium Deposits in India**
- It is found in **Dharwar rock system**
  - **Jharkhand** Singhbhum (along with the copper belt)
  - **Rajasthan** Udaipur, Alwar, Jhunjhunu districts
  - **Chhattisgarh** Durg district
  - **Maharashtra** Bhandara district
  - **Himachal Pradesh** Kullu district

**Thorium Deposits in India**
- Thorium is mainly **obtained from monazite and ilmenite in the beach sands of Kerala and Tamil Nadu**
- World’s richest monazite deposits occur in **Palakkad and Kollam** districts of Kerala
  - **Andhra Pradesh**: Vishakhapatnam in Andhra Pradesh
  - **Odisha**: Mahanadi river delta

**History of Nuclear Energy in India**
- **Atomic Energy Commission** was established in 1948
- progress could be made only after the establishment of the **Atomic Energy Institute at Trombay** in 1954
- which was renamed as the **Bhabha Atomic Research Centre** in 1967

**Important Nuclear Projects**
- **Tarapur** (Maharashtra), **Rawatbhata near Kota** (Rajasthan), **Kalpakkam** (Tamil Nadu), **Narora** (Uttar Pradesh), **Kaiga** (Karnataka) and **Kakarapara** (Gujarat)

**Non-Conventional or Renewable Energy Sources**
- **Sustainable energy resources**
- **Renewable in nature**
- Examples: **Solar, wind, tidal and wave energy, hydro, geothermal and biomass**
- These energy sources are more **equitably distributed and environmental friendly**
- **Cheaper energy** after the initial cost is taken care of.

**Solar Energy**
- Sun rays tapped in photovoltaic cells can be converted into energy
- The two effective processes to tap solar energy are **photovoltaics and solar thermal technology**
- It is **cost competitive, environment friendly and easy to construct**
Solar energy is 7 per cent more effective than coal
Used more in appliances like heaters, crop dryers, cookers, etc
The western part of India has greater potential for the development of solar energy in Gujarat and Rajasthan

Wind Energy
- Wind energy is absolutely pollution free, inexhaustible source of energy
- The kinetic energy of wind, through turbines is converted into electrical energy
- The permanent wind systems such the trade winds, westerlies and seasonal wind like monsoon have been used as source of energy
- Land and sea breezes
- The country’s potential of wind power generation exceeds 50,000 megawatts
- Rajasthan, Gujarat, Maharashtra and Karnataka, favourable conditions for wind energy

Tidal and Wave Energy
- Ocean currents are the store-house of infinite energy
- Large Potential: West coast of India
- But these waves have not yet been utilised properly because of lack of technology

Geothermal energy
- When the magma from the interior of earth, comes out on the surface, tremendous heat is released
- This heat energy can successfully be tapped and converted to electrical energy
- Apart from this, the hot water that gushes out through the geyser
- Example: Manikaran in Himachal Pradesh
- The first successful (1890) attempt to tap the underground heat was made in the city of Boise, Idaho (U.S.A.)
- It can be used as an alternative to conventional energy sources

Bio-Energy
- Bio-energy refers to energy derived from biological products which includes agricultural residues, municipal, industrial and other wastes
- It can be converted into electrical energy, heat energy or gas for cooking
- This will improve economic life of rural areas in developing countries
- Reduce environmental pollution
- Enhance self-reliance and reduce pressure on fuel wood
- Example: Okhla in Delhi

Conservation of Mineral Resources
- Adoption of renewable resources like solar power, wind, geothermal energy
- Use of scrap metals
- Use of substitutes for scarce metals
- Export of strategic and scarce minerals must be reduced, so that the existing reserve may be used for a longer period.
- First Atomic power station in India: Tarapur (Maharashtra)
- Minerals which is known as brown diamond: Lignite
INDIA-OIL REFINERIES