



# TOPICS to be covered

1

Minerals and Energy Resources





## Introduction

Minerals are very necessary for us, as most of the things around us, that we are using in our daily life, are made up of minerals, like machinery, vehicles, even a tiny pin, etc.

### All living things need minerals

Life processes cannot occur without minerals. Although our mineral intake represents only about 0.3 per cent of our total intake of nutrients, they are so potent and so important that without them we would not be able to utilise the other 99.7 per cent of foodstuffs.





## What is a Mineral?

- Geologists define mineral as a “homogenous, naturally occurring substance with a definable internal structure.”
- They are found in varied forms in nature, ranging from the hardest diamond to the softest talc.



More than 2000

How many minerals have been identified?



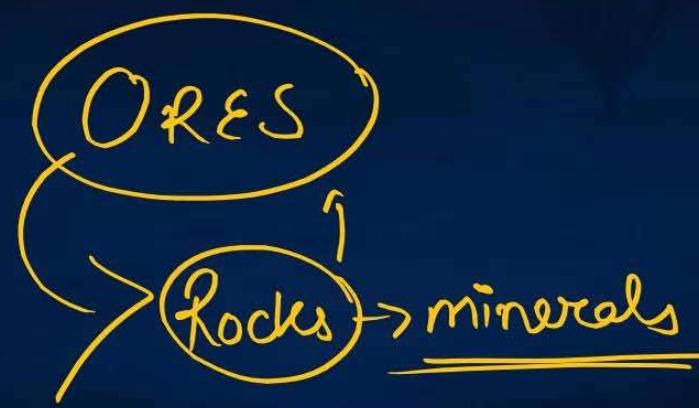
## Study of Minerals by Geographers and Geologists



Geographers - study minerals as part of the earth's crust for a better understanding of landforms, the distribution of mineral resources and associated economic activities.

Geologist - interested in the formation of minerals, their age and physical and chemical composition.

Sirf minerals





## Mode of Occurrence of Minerals



**Veins and lodes:** In igneous and metamorphic rocks minerals may occur in the cracks, faults or joints by getting solidified in them. The smaller occurrences are called veins and the larger lodes, e.g., metallic minerals like tin, copper, zinc and lead etc. are found in lodes and veins.

**In sedimentary rocks:** Minerals occur in beds or layers. They are formed as a result of deposition, accumulation and concentration in horizontal strata. Some sedimentary minerals are formed as a result of evaporation, especially in arid regions eg., gypsum, potash and salt.





Placer Deposits



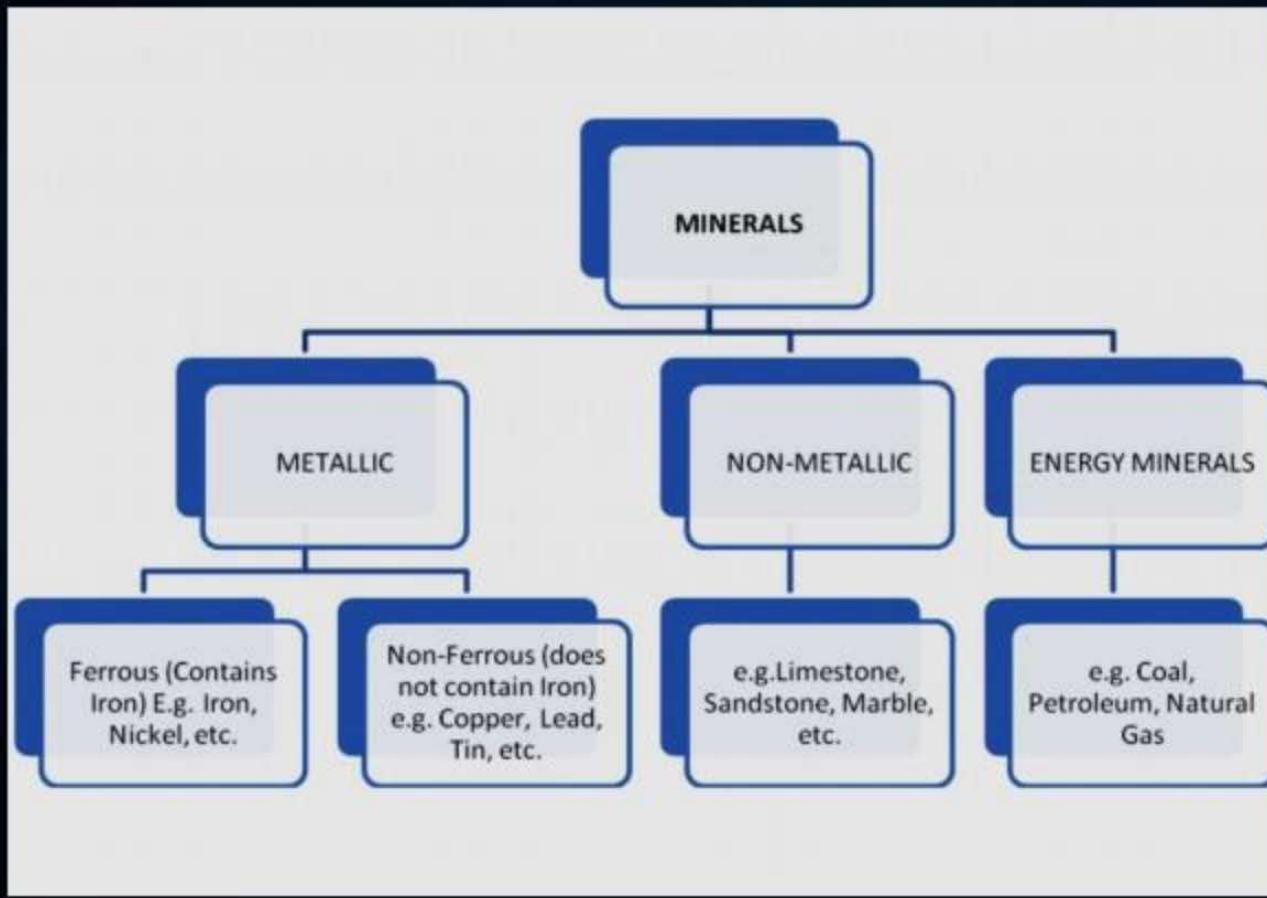
## Mode of Occurrence of Minerals



- **Decomposition:** of surface rocks leaving a residual mass of weathered material containing ores. **Bauxite** is formed this way.
- **Placer deposits:** Certain minerals occur as alluvial deposits in sands of valley floors and the base of hills, eg., gold, silver, tin and platinum. These are called placer deposits and contain minerals which are not corroded by water.
- **Ocean waters:** common salt, magnesium and bromide are largely derived from the ocean waters. The ocean beds are rich in manganese nodules.



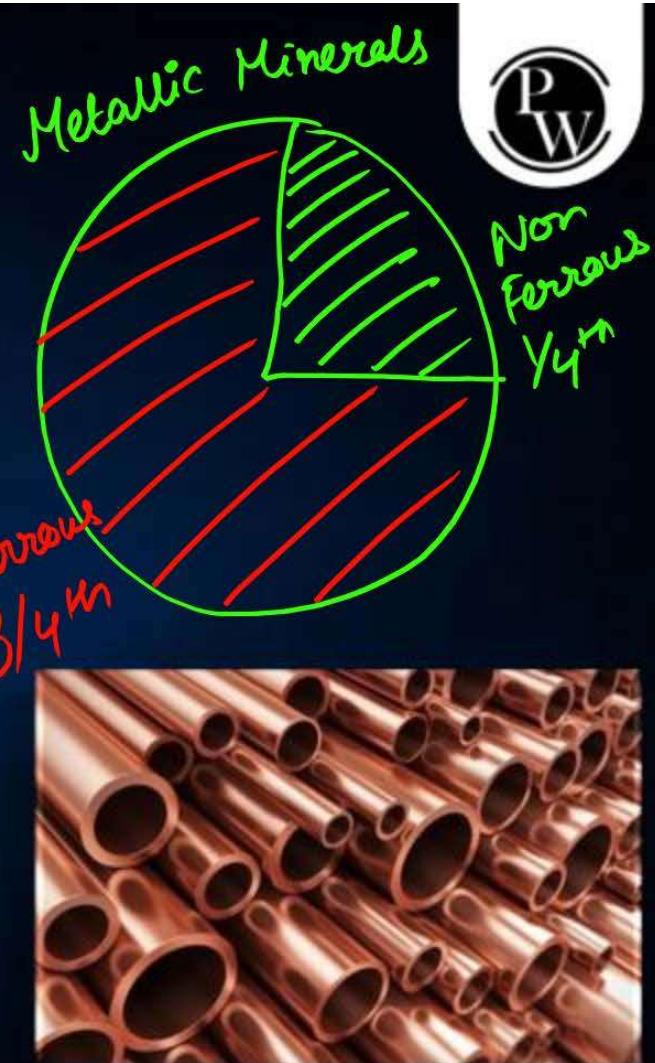
## Classification of Minerals





## Ferrous Minerals

- Account for about three fourths of the total value of the production of metallic minerals.
- Provides a strong base for the development of metallurgical industries.
- Exports substantial quantities after meeting her internal demands.





## Ferrous Minerals



### **Iron Ore :**

- Basic mineral and the backbone of industrial development.

### **Magnetite :**

- Finest iron ore with iron content upto 70 %
- Excellent magnetic qualities
- Valuable in the electrical industry

### **Hematite :**

- Most important industrial iron ore in terms of the quantity used Iron content upto 50-60 %

- In 2018-19 almost entire production of iron ore (97%) accrued from Odisha, Chhattisgarh, Karnataka and Jharkhand. The remaining production (3%) was from other states.



## Major iron ore belts in India



### **Odisha-Jharkhand belt:**

- In Odisha high grade hematite ore is found in Badampahar mines in the Mayurbhanj and Kendujhar districts. In the adjoining Singbhum district of Jharkhand haematite iron ore is mined in Gua and Noamundi.

### **Durg-Bastar-Chandrapur belt:**

- Lies in Chhattisgarh and Maharashtra. Very high grade hematites are found in the famous Bailadila range of hills in the Bastar district of Chhattisgarh. The range of hills comprise of 14 deposits of super high grade hematite iron ore. It has the best physical properties needed for steel making. Iron ore from these mines is exported to Japan and South Korea via Vishakhapatnam port.



## Ballari-Chitradurga-Chikkamagaluru-Tumakuru belt



- In Karnataka has large reserves of iron ore. The Kudremukh mines located in the Western Ghats of Karnataka are a 100 per cent export unit. Kudremukh deposits are known to be one of the largest in the world. The ore is transported as slurry through a pipeline to a port near Mangaluru.

### Maharashtra-Goa belt:

- Includes the state of Goa and Ratnagiri district of Maharashtra. Though, the ores are not of very high quality, yet they are efficiently exploited. Iron ore is exported through Marmagao port.



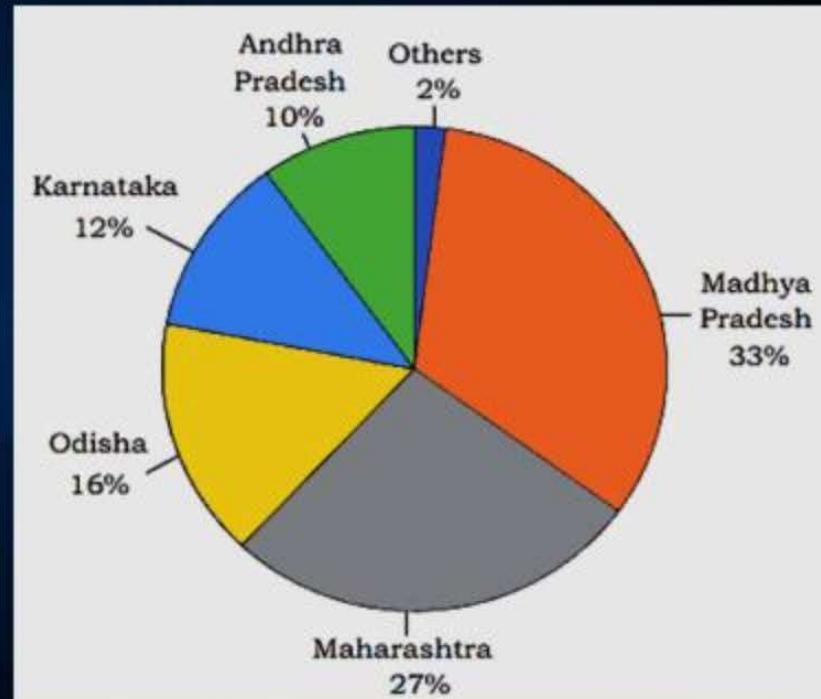
## Ferrous Minerals



### Manganese :

- Mainly used in the manufacturing of steel and ferro-manganese alloy.
- Nearly 10 kg of manganese required to manufacture one tonne of steel.
- Used in manufacturing bleaching powder, insecticides and paints.

10 Kg Manganese → 1 Tonne Steel





## Non-Ferrous Minerals

- India's reserves and production of non- ferrous minerals is not very satisfactory.
- These minerals, which include copper, bauxite, lead, zinc and gold play a vital role in a number of metallurgical, engineering and electrical industries.





## Non-Ferrous Minerals



### ▪ **Copper:**

- India is critically deficient in the reserve and production of copper.
- Being malleable, ductile and a good conductor, copper is mainly used in electrical cables, electronics and chemical industries.
- The Balaghat mines in Madhya Pradesh, Khetri mines in Rajasthan and Singhbhum district of Jharkhand are leading producers of copper.

Properties

Regions





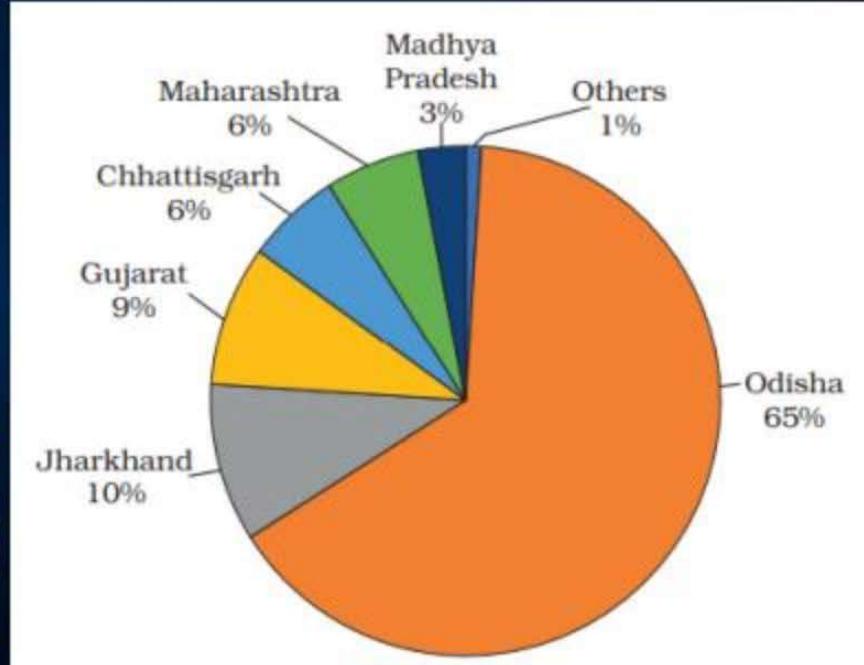
## Non-Ferrous Minerals

(w/o iron)



### ▪ **Bauxite:**

- Bauxite deposits are formed by the decomposition of a wide variety of rocks rich in aluminium silicates.
- Aluminium combines the strength of metals such as iron✓ with extreme lightness and also with good conductivity and great malleability.
- Bauxite deposits are mainly found in the Amarkantak plateau, Maikal hills and the plateau region of Bilaspur-Katni.





## Non-Ferrous Minerals



Non Metallic Mineral

Rock Minerals

### Mica:

- A mineral made up of a series of plates or leaves. It splits easily into thin sheets. Mica can be clear, black, green, red yellow or brown.
- Due to its excellent di-electric strength, low power loss factor, insulating properties and resistance to high voltage, mica is one of the most indispensable minerals used in electric and electronic industries.
- Deposits are found in the northern edge of the Chota Nagpur plateau. Koderma Gaya – Hazaribagh belt of Jharkhand is the leading producer.
- Major mica producing area is around Ajmer Nellore mica belt of Andhra Pradesh.

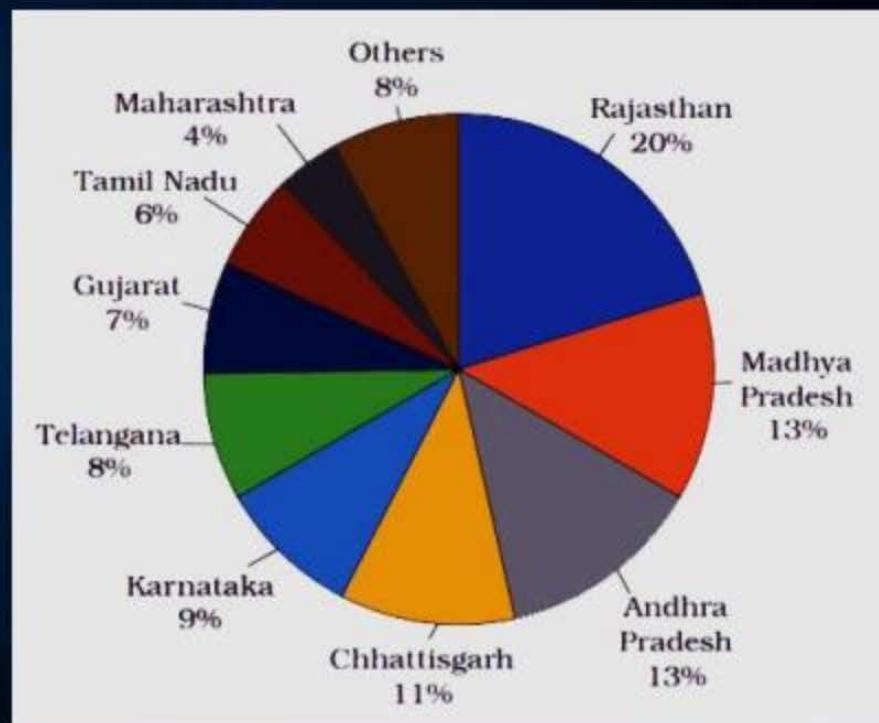




## Non-Ferrous Minerals



- **Limestone:**
- Is found in association with rocks composed of calcium carbonates or calcium and magnesium carbonates.
- It is found in sedimentary rocks of most geological formations.
- Limestone is the basic raw material for the cement industry and essential for smelting iron ore in the blast furnace.





## Hazards of Mining



- Dust and noxious fumes inhaled by miners make them vulnerable to pulmonary diseases.
- Risk of collapsing mine roofs, inundation and fires in coalmines are a constant threat to miners.
- Dumping of waste and slurry leads to degradation of land, soil, and increase in stream and river pollution.

Miners  
Environment

→ Risk to Miners



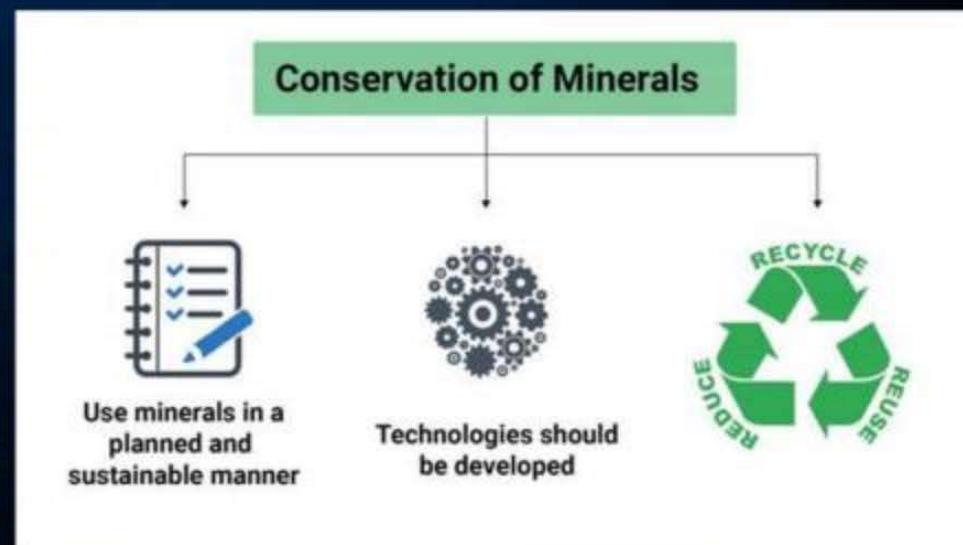


## Conservation of Minerals



- Strong dependence of industry and agriculture upon mineral deposits and the substances manufactured from them.
- Total volume of workable mineral deposits is an insignificant fraction i.e. one per cent of the earth's crust.
- Rates of replenishment are infinitely small in comparison to the present rates of consumption.

Minerals  
→ Non Renewable





- Mineral resources are finite and non-renewable.  
*mixed*
- Continued extraction of ores leads to increasing costs as mineral extraction comes from greater depths along with decrease in quality.

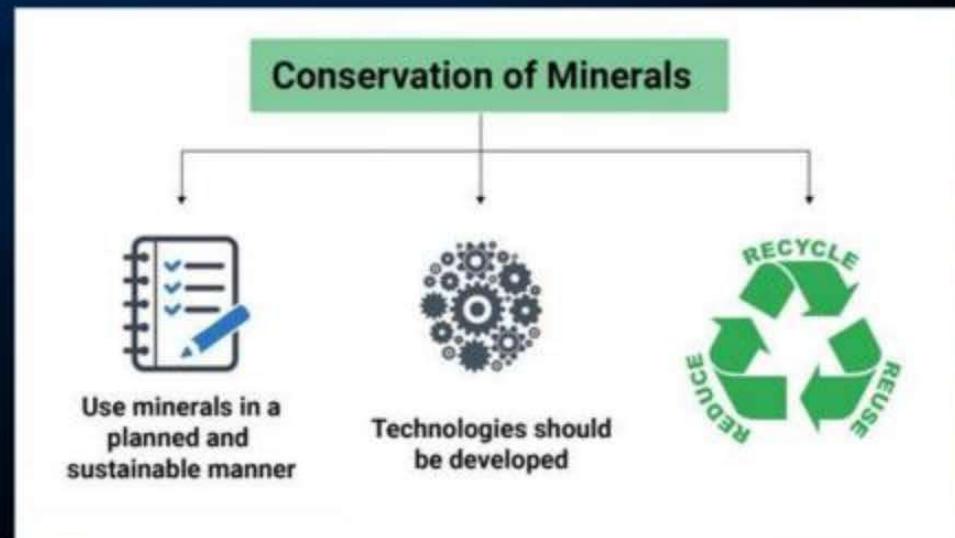


## Conservation of Minerals



### Steps:

- Use mineral resources in a planned and sustainable manner.
- Improved technologies need to be constantly evolved to allow use of low grade ores at low costs.
- Recycling of metals, using scrap metals and other substitutes are steps in conserving our mineral resources for the future.





## Energy Resources



- Conventional: firewood, cattle dung cake, coal, petroleum, natural gas and electricity (both hydel and thermal).
- Non-conventional: include solar, wind, tidal, geothermal, biogas and atomic energy.

(substitutes)





## Conventional Sources of Energy



- **Coal**
- Most abundantly available fossil fuel.
- Uses- power generation, supply energy to industry as well as for domestic needs.
- Formation - due the compression of plant material over millions of years.
- Found in a variety of forms depending on the degrees of compression and the depth and time of burial.



### Peat:

- Decaying plants in swamps produce peat
- Low carbon and high moisture contents and low heating capacity.

Quality

### Lignite:

- Low grade brown coal.
- Which is soft with high moisture content.
- Principal lignite reserves are in Neyveli in Tamil Nadu and are used for generation of electricity.



- **Bituminous:**

- Coal that has been buried deep and subjected to increased temperatures is bituminous coal.
- Most popular coal in commercial use.
- Metallurgical coal is high grade bituminous coal which has a special value for smelting iron in blast furnaces.

- **Anthracite:**

- Highest quality hard coal.





## On the Basis of Age



### **Gondwana Coal:**

- 200 million years in age
- Damodar valley (West Bengal Jharkhand).
- Jharia, Raniganj, Bokaro are important coalfields.
- The Godavari, Mahanadi, Son and Wardha valleys also contain coal deposits.

### **Tertiary coals:**

- 55 million years old
- Occur in the north eastern states of Meghalaya, Assam, Arunachal Pradesh and Nagaland.



## Conventional Sources of Energy



2

### Petroleum :

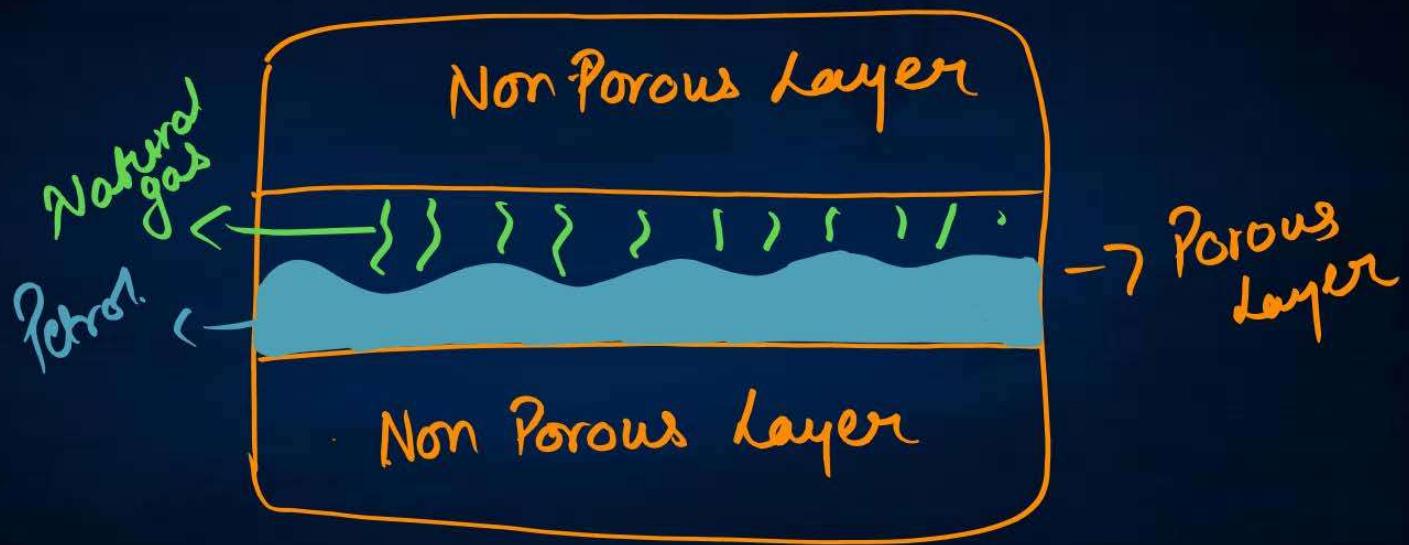
- Provides fuel for heat and lighting, lubricants for machinery and raw materials for a number of manufacturing industries.
- Petroleum refineries act as a “nodal industry” for synthetic textile, fertiliser and numerous chemical industries





### Occurrence :

- Anticlines and fault traps in the rock formations of the tertiary age
- Regions of folding, anticlines or domes, it occurs where oil is trapped in the crest of the upfold.
- Oil bearing layer is a porous limestone or sandstone through which oil may flow. The oil is prevented from rising or sinking by intervening non-porous layers.
- Found in fault traps between porous and non-porous rocks. Gas, being lighter usually occurs above the oil.





## Conventional Sources of Energy



### **Natural Gas :**

- Anticlines and fault traps in the rock formations of the tertiary age
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## Conventional Sources of Energy



### **Natural Gas :**

- Clean energy resource found in association with or without petroleum.

### **Uses:**

- A source of energy
- Industrial raw material in the petrochemical industry.
- Low carbon dioxide emissions





## Conventional Sources of Energy



### **Natural Gas :**

- Krishna- Godavari basin, Mumbai High, Gulf of Cambay, Andaman and Nicobar islands.
- 1700 km long Hazira-Vijaipur - Jagdishpur cross country gas pipeline links Mumbai High and Bassien with the fertilizer, power and industrial complexes in western and northern India.
- Power and fertilizer industries are the key users of natural gas.
- Use of Compressed Natural Gas (CNG ) for vehicles to replace liquid fuels is gaining wide popularity in the country.



## Conventional Sources of Energy



### **Electricity:**

Hydro  
Thermal

- Its per capita consumption is considered as an index of development.
- Hydro electricity is generated by fast flowing water, which is a renewable resource. India has a number of multi-purpose projects like the Bhakra Nangal, Damodar Valley corporation, the Kopili Hydel Project etc. producing hydroelectric power.
- Thermal electricity is generated by using coal, petroleum and natural gas. The thermal power stations use non-renewable fossil fuels for generating electricity. There are over 310 thermal power plants in India.



## Non-Conventional Sources of Energy

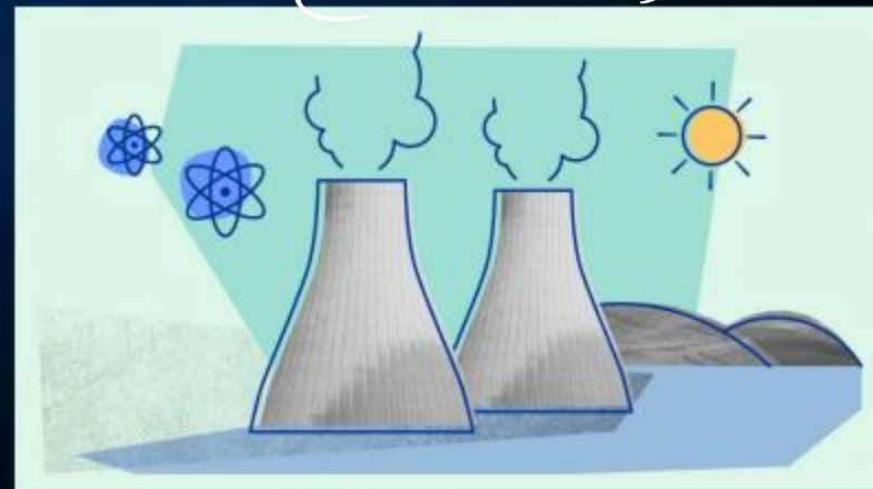


### **Nuclear or Atomic Energy:**

- Obtained by altering the structure of atoms - energy is released in the form of heat and this is used to generate electric power.
- Uranium and Thorium, which are available in Jharkhand and the Aravalli ranges of Rajasthan are used for generating atomic or nuclear power.
- The Monazite sands of Kerala is also rich in Thorium.

> Newer ways

(Substitutes)  
(Renewable)





## Non-Conventional Sources of Energy



### **Solar Energy:**

- Photovoltaic technology converts sunlight directly into electricity.
- Fast becoming popular in rural and remote areas.
- Big solar power plants are being established in different parts of India - will minimize dependence of rural households on firewood and dung cakes - will contribute to environmental conservation and adequate supply of manure in agriculture.





## Non-Conventional Sources of Energy



### Wind Power:

- Largest wind farm cluster is located in Tamil Nadu from Nagarcoil to Madurai.
- Apart from these, Andhra Pradesh, Karnataka, Gujarat, Kerala, Maharashtra and Lakshadweep have important wind farms.
- Nagarcoil and Jaisalmer are well known for effective use of wind energy in the country.





## Non-Conventional Sources of Energy



### **Biogas :**

- Shrubs, farm waste, animal and human waste are used to produce biogas for domestic consumption in rural areas.
- Biogas plants are set up at municipal, cooperative and individual levels.
- The plants using cattle dung are known as 'Gobar gas plants' in rural India.
- Benefits to farmer:
- Form of energy.
- Improved quality of manure.



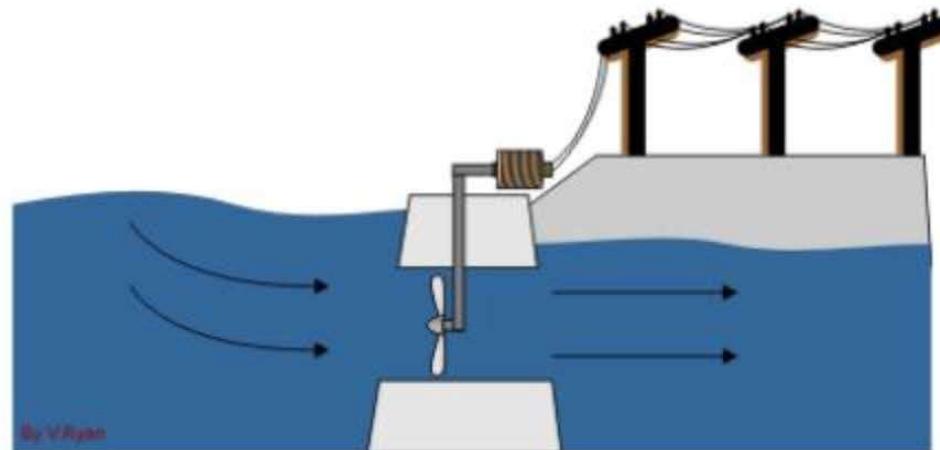


## Non-Conventional Sources of Energy



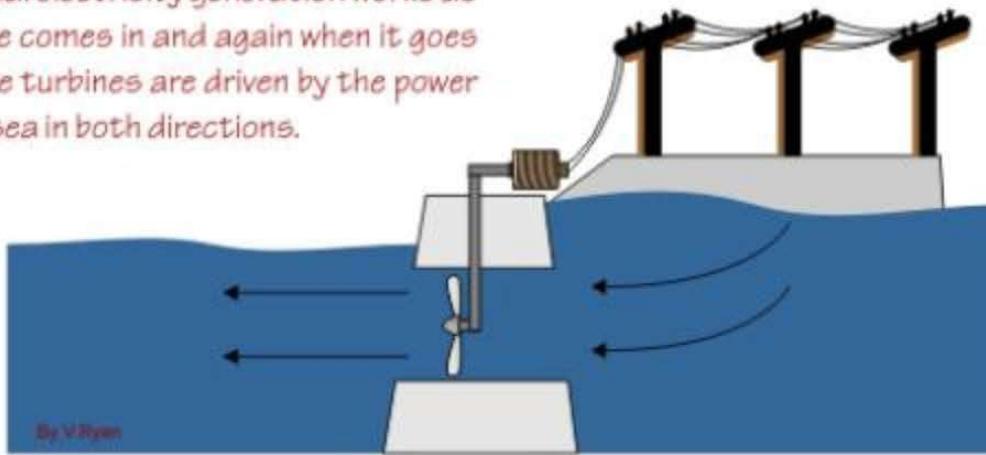
### **Tidal Energy :**

- Oceanic tides can be used to generate electricity.
- Floodgate dams are built across inlets. During ~~high tide~~ water flows into the inlet and gets trapped when the gate is closed.
- After the tide falls outside the flood gate, the water retained by the floodgate flows back to the sea via a pipe that carries it through a power-generating turbine.
- In India the Gulf of Khambhat, the Gulf of Kuchchh in Gujarat on the western coast and Gangetic delta in Sunderban regions of West Bengal provide ideal conditions for utilising tidal energy.



### TIDE COMING IN

This tidal electricity generation works as the tide comes in and again when it goes out. The turbines are driven by the power of the sea in both directions.



### TIDE GOING OUT



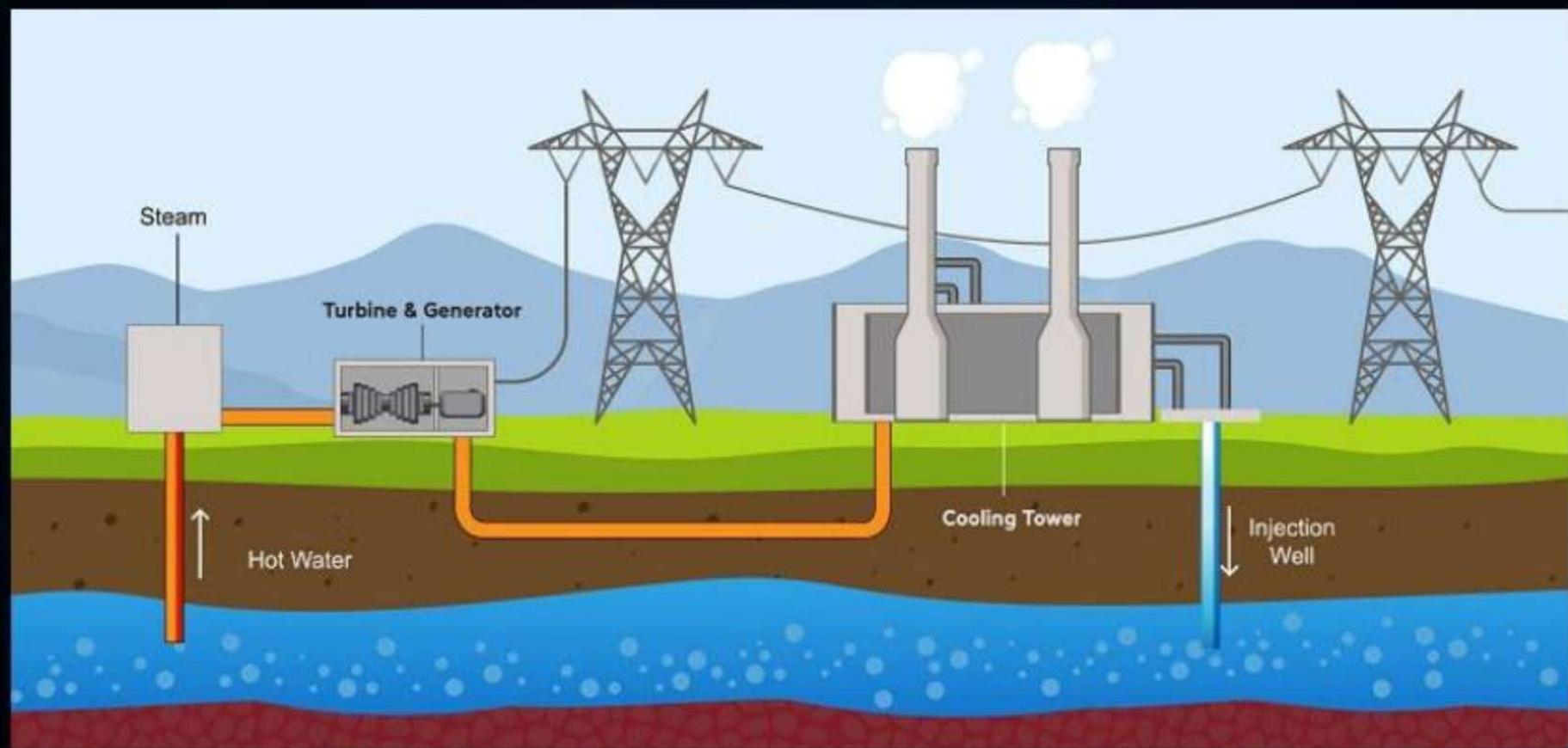
## Non-Conventional Sources of Energy



### Geo Thermal Energy:

- Refers to the heat and electricity produced by using the heat from the interior of the Earth.
- Earth grows progressively hotter with increasing depth.
- Groundwater in such areas absorbs heat from the rocks and becomes hot. It is so hot that when it rises to the earth's surface, it turns into steam. This steam is used to drive turbines and generate electricity.
- Two experimental projects have been set up in India to harness geothermal energy.
- Parvati valley near Manikarni in Himachal Pradesh
- Puga Valley, Ladakh







## Conservation of Energy Resources



- Energy saved is energy produced.

