

PETROLEUM

Oil provides the most important lubricating media and is used as a raw material for various petrochemical products. Petroleum is obtained from sedimentary rocks and is also known as mineral oil. It is an inflammable liquid and can be transported to the consuming areas with the help of pipelines. It gives out very little smoke and leaves no residue.

Distribution of Petroleum in India

The major producers of oil are divided into:

1. Areas in north-east India
2. Oilfields in western India

Oilfields in North-East India

(a) Assam is the oldest oil producing area and the important oilfields are:

- (i) Naharkatiya Oilfield
- (ii) Digboi Oilfield
- (iii) Moran-Hugrijan Oilfield

The oilfields are very far from the areas which consume oil and it is refined in Digboi, Guwahati, Barauni, etc.

- (b) Arunachal Pradesh
- (c) Tripura

Oilfields of Western India

Gujarat

The main oilfield is Ankaleshwar and it is refined at Trombay and Koyali refineries. The other oilfields at Gujarat are Khambhat or Lunej and Ahmedabad oilfields.

Mumbai High

This is situated on the continental shelf 176 km north-west of Mumbai. Oil is taken out with the help of a platform known as Sagar Samrat. The greatest success achieved by the ONGC is the discovery of a large amount of oil here.

Bassein

It is located south of Mumbai High. Huge reserves have been found here and the production is expected to pick up fast.

Aliabet

It is located in the Gulf of Khambat. Oil has also been discovered in the Kaveri Basin and the Krishna-Godavari Basin also.

Oil Refineries

When oil is taken out of oil wells it is in the form of crude oil. Therefore it has to be refined or impurities have to be removed. After it is purified, products such as diesel, petrol, kerosene and lubricants are got. Some of the important refineries in India are:

Some Oil Refineries in India

Refinery	Capacity (ml tonnes)	When established
1. Digboi	0.65	1901
2. Mumbai	6.00	1955
3. Vishakhapatnam	7.50	1957
4. Guwahati	0.85	1962
5. Koyali	9.50	1965
6. Kochi	7.50	1966
7. Chennai	5.60	1969
8. Haldia	3.75	1975
9. Mathura	7.50	1982
10. Mangalore	3.00	1996

Research, development and exploration of oil and natural gas are carried on mainly by:

(a) Oil India Ltd. — Public sector

(b) Oil and Natural Gas Commission

Now most of the work is carried out by ONGC which was converted into a corporation in 1994.

Advantages of Petroleum

1. Convenient fuel for transport
2. Can be transported through pipelines
3. Does not emit smoke and ash.
4. Can be used for the generation of power.
5. By-products used in petrochemical and chemical industries.

Disadvantages of Petroleum

1. Not environment-friendly
2. It is expensive

NATURAL GAS

1. Natural gas is fast becoming an important source of energy in India. It occurs where oil reserves are found. The Gas Authority of India Ltd. (GAIL) is doing well in the exploration of natural gas. It is the largest company in India for marketing of natural gas.
2. The gas supplied for cooking is known as LPG (Liquified Petroleum Gas) and is a by-product after oil is refined.
3. The gas used for running vehicles is known as CNG (Compressed Natural Gas).
4. The gas is used for transport, industries, agriculture, cooking and for lighting purposes.
5. Natural gas reserves are found in Khambhat Basin, Jaisalmer (Rajasthan), Tamil Nadu, Gujarat, Assam and Mumbai.
6. The Reliance Group of Industries have discovered gas near Krishna-Godavari basin in Andhra Pradesh.
7. The largest gas reserves have been found at Mumbai High, Gujarat, Assam.

Advantages of Natural Gas

1. Cheaper
2. Eco-friendly, Non-polluting
3. Can be used directly for burning
4. Has a high calorific value.

Disadvantages of Natural Gas

1. Reserves are limited
2. It is easily combustible so care has to be taken in transportation.

Electricity

Electricity or power plays a major role in the development of a country. There are three types of electricity depending on the raw material used and the mode of production.

1. Thermal
2. Hydel power
3. Nuclear

HYDEL POWER

1. It is energy obtained from river water.
2. It is cheap, clean, environmental-friendly and renewable.
3. In India, there are number of rivers so hydro-electric power is easily obtained, though expensive.

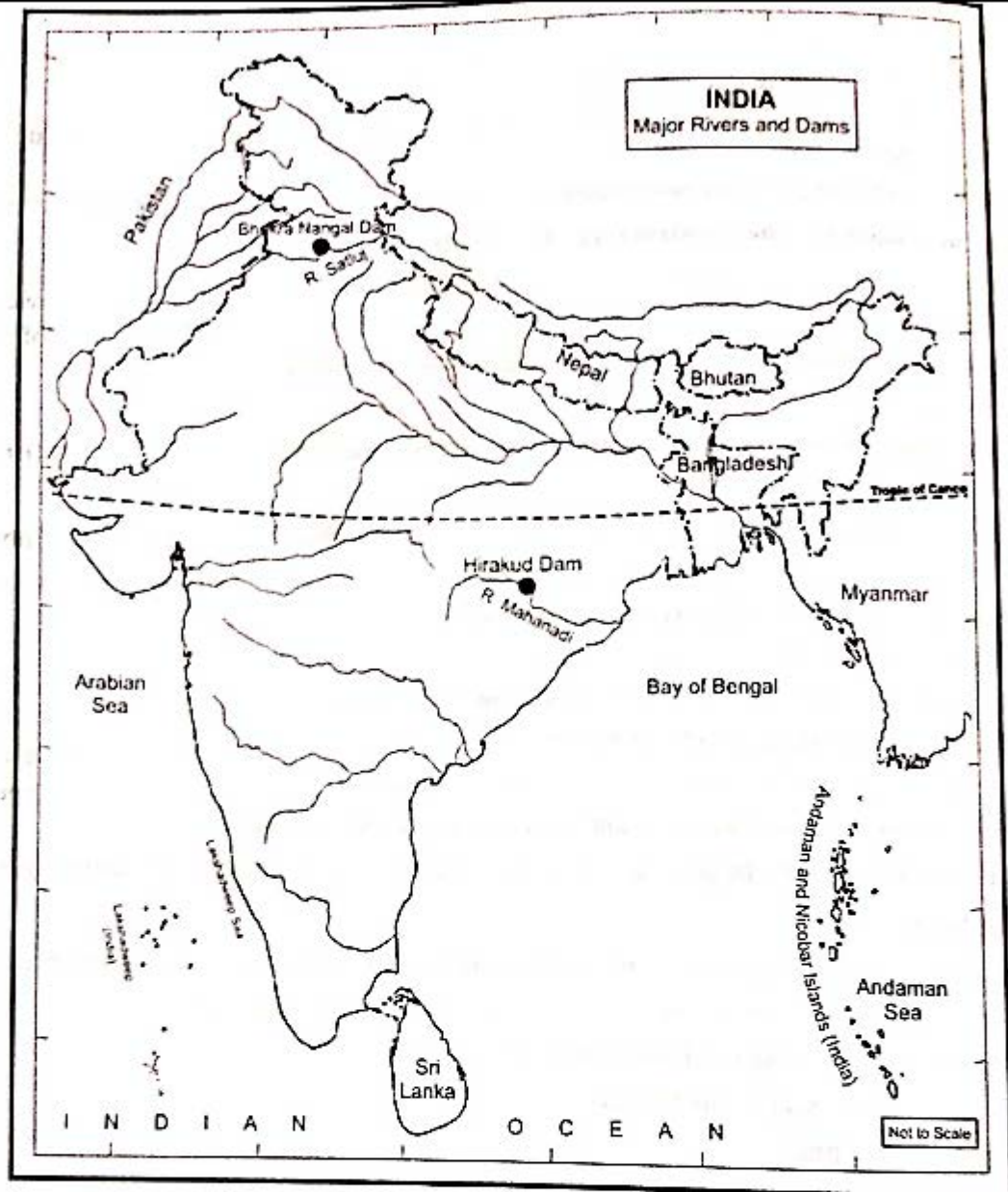
Advantages of Hydel Power

1. Coal and Petroleum are exhaustible therefore we should not depend less on these and develop hydroelectric power instead.
2. Hydroelectricity is renewable, cheap, clean and environment-friendly.
3. The chief resource of Hydel Power is river water. India possesses huge water resources and there are vast possibilities of generating hydroelectricity.

4. **India has not been able to utilise its water resources fully as:**
 - (a) Most rivers especially in south are rain-fed, so they cannot be utilised for hydel power. They have ample water only in the Monsoon season.
 - (b) Consuming centres are far from the areas of production and a lot of energy is wasted in transmission.
 - (c) Most rivers do not have waterfalls and a lot of money has to be spent in making dams.
5. **Factors necessary for the construction of an Hydro-Electric Project:**
 - (a) Perennial rivers to ensure a uniform supply of water.
 - (b) The fall of the river from a height. Therefore a mountainous region is preferred.
 - (c) Rivers should be silt free so water is stored in reservoirs.
 - (d) Rivers should not freeze in winter.
 - (e) An industrial area close by to utilise the energy generated.
 - (f) A gorge is preferred.
6. There is a lot of scope for development of Hydel Power in India because of the presence of perennial rivers, mountainous terrain and a ready market.
7. **Advantages of Hydel Power over Thermal Power:**
 - (a) Hydel Power does not cause pollution.
 - (b) It is easy to build dams than thermal power stations.
 - (c) There is no wastage in Hydel Power.
 - (d) Hydel Power can be transported to long distance.
 - (e) Hydel Power is inexhaustible and renewable source of power.
8. Hydel Projects cover very large area and there is the problem of silting and fluctuating water supply.

Bhakra Nangal Dam

1. The Bhakra Nangal project is a joint venture of Punjab, Haryana, and Rajasthan governments.
2. This project consists of two dam — one at Bhakra and the other at Nangal.
3. The Bhakra Nangal consists of the following:
 - (a) Two dams at Bhakra and Nangal
 - (b) Nangal hydel plant
 - (c) Power houses
 - (d) Bhakra canal system.
4. The Bhakra Dam is the second highest (226 metres), 518 metres long and 362 metres wide.
5. The name of the reservoir is Gobind Sagar (166 metres), which has a storage capacity of 9.3 billion cubic metres (3rd largest water reservoir in India).
6. The main aim was to prevent floods in the Satluj-Beas river valley to provide irrigation to nearby states and to generate electricity.
7. The construction of two dams started in 1948 and was completed in 1963.
8. The former Prime Minister of India, Jawaharlal Nehru was the main inspiration behind the construction of the multi-purpose project.
9. Tourism has become very popular due to the artificial Gobind Sagar lake and many water sports, fishing and boating have attracted people from all over the world.



Hirakud Dam

1. This dam is built across the River Mahanadi, about fifteen kilometers from Sambalpur in the state of Odisha.
2. It is one of first major multipurpose river valley projects started after India's independence.
3. The Hirakud Dam is a composite structure of earth, concrete and masonry and is the longest major earthen dam in India.
4. Construction began in 1948 and was inaugurated on 13th January 1957.
5. The Hirakud Dam forms a reservoir/artificial lake having a capacity of 743 km sq.
6. There are two observation towers on the dam, one at each side. They are the 'Gandhi Minar' and the 'Nehru Minar'.
7. The dam also supports two different hydroelectric power houses.

8. The dam helps to control floods in the Mahanadi Delta, irrigate 75000 km² of land and generate electricity.
9. Hirakud Dam has three canals — Bargarh Main canal, Sason canal and the Sambalpur canal.
10. Water from the Hirakud Dam is also used in various industries, mineral processing and thermal power plants.

Non-Conventional Energy Resources

The most common means of generating electricity is by thermal, hydro and nuclear power but due to the fast depleting sources of fossil fuels and problems associated with the production of hydroelectric power, man has been forced to look around for alternative sources of power.

The Sun, wind, biogas, tides, nuclear and geothermal energy have existed much before the conventional sources of energy. These are known as the Alternative or Non-Conventional Sources of Energy.

Advantages of Non-Conventional Sources of Energy

1. They are renewable, i.e., they cannot be exhausted. These are available freely in abundance.
2. They do not cause pollution and are environment-friendly.
3. They are cheaper to produce.
4. They solve the problem of garbage and provide manure.
5. These can be generated in distant areas like hilly regions or dense forests.

A Department of Non-Conventional Energy sources was set up in 1982. It later became a full-fledged ministry and took various steps to exploit the potential of these sources. The sources tapped were:

1. Solar Energy
2. Wind Energy
3. Tidal Energy
4. Geothermal Energy
5. Nuclear Energy
6. Biogas

SOLAR ENERGY

Solar Energy is derived from the Sun which provides inexhaustible source of energy.

To generate electricity photovoltaic cells and high electric collectors are used.

1. **Photovoltaic Cells:** In this, special mirrors are used to produce electricity. It is then used for lightning homes and streets.
2. **Electric Collectors:** It is a device that transforms solar radiation from sun rays into heat which is then transformed to some fluid.

Solar Heater: In this, a number of curved mirrors are installed on roof tops. Water is then passed through pipes in the panels. It gets heated and then collects in insulated tanks from where hot water is supplied to bathrooms or kitchen.

Solar Cooker: The rays are used directly for heating. It consists of a glass-topped box into which the light enters and gets trapped. The heat produced is generally used for cooking or heating up the house.

The Rajasthan Energy Development Agency has started work in the Thar Desert due to the availability of Sun's rays for major part of the year. A large solar power generation unit is being set up with the help of IIT Chennai, BHEL and Germany.

Advantages of Solar energy

1. Solar energy is a clean and renewable energy source.
2. Once a solar panel is installed, it can be produced free of charge.
3. Solar energy is long lasting.
4. Very little maintenance is needed.
5. High return on investment due to the large amount of free energy produced.

WIND ENERGY

Since a long time energy from wind has been used to produce mechanical energy from windmills. This energy is then used to run flour mills, pumping water from wells and for lighting homes and streets. Electricity from wind can be generated only when the wind blows at a high speed. This is possible in the coastal areas where the wind blows at the rate of twenty kilometres per hour. Verawal coast has strong winds in winter. The kinetic energy thus produced can be stored in batteries or tapped and fed into a regional grid.

Advantages of Wind energy

1. It is a renewable source of energy and is replenished regularly being a natural resource.
2. It is a clean or green energy as it does not pollute water resource or emit undesirable gases into the atmosphere. It is eco-friendly.
3. Low operational costs.

TIDAL ENERGY

India has a very vast coastline and the surface water of the sea rise and fall twice in a day. During high tide the water rushes inland with great force but recedes during low tide. At this time the water flows over the turbines which moves the electric generator. This source of energy is inexpensive, inexhaustible and does not cause pollution. At the national level, a research and development organisation has been set up at Chennai. The Gulf of Kutch provides ideal conditions for harnessing tidal energy.

Advantages of Tidal Energy

1. It is an inexhaustible source of energy.
2. It is environment-friendly energy and does not produce greenhouse gases.
3. Efficiency of tidal power is greater as compared to coal, solar or wind energy.
4. 71% the earth's surface is covered with water so there is greater scope to generate it on a large scale.

GEOTHERMAL ENERGY

Geothermal Energy is obtained from the heat in the interior of the Earth. Water seeps into the Earth's crust through cracks and gets heated due to high temperature inside. This turns water into steam, which is passed through turbines to produce electricity. Two experimental projects have been set up—one in the Puga Valley in Ladakh and the other in Parvati Valley in Himachal Pradesh.

Advantages of Geothermal Energy

1. It is eco-friendly
2. Renewable energy resource
3. Widely available all over the world
4. Creates employment opportunities as number of people required are more

National Programme on Improved Chulha (NPIC)

This programme was set up for the welfare of woman in villages under the Eighth Five Year Plan. The main objective was to develop smokeless chulha, conserve fuel and save the health of the woman.

Urja Gram Programme

This programme was started in 1993 in order to supply conventional electricity to distant places in rural area. In the past about 180 villages have benefitted from this programme.

NUCLEAR POWER

India developed its nuclear power in August 1956 and it is among the six countries which have successfully established power stations in the respective countries. The others are Russia, USA, France, UK and Canada.

1. The main raw materials used are:
 - (a) Uranium — Bihar, Himachal Pradesh, Uttar Pradesh Chhattisgarh
 - (b) Beryllium — Rajasthan, Andhra Pradesh
 - (c) Thorium — Tamil Nadu and Kerala
2. The Government of India set up the Nuclear Power Corporation to generate nuclear power. An Atomic Research Centre was set up at Trombay. Research in nuclear science is conducted at the Bhabha Atomic Research Centre.
3. Location of Nuclear Power Stations:
 - (a) Tarapur — Maharashtra
 - (b) Rawatbhata — Rana Pratap Sagar (Rajasthan)
 - (c) Kalpakkam — Tamil Nadu
 - (d) Kakrapar — Gujarat
 - (e) Narora — Uttar Pradesh
 - (f) Kaiga — Karnataka

The power from the Narora plant is used for agriculture.

Advantages of Nuclear Energy

1. Less Uranium is needed to produce the same amount of energy as coal or oil, so expense is less.
2. Nuclear power plant can run continuously for up to 540 days. Since it does not depend on the weather or foreign supplies it is more reliable.
3. The nuclear plant does not give off greenhouse gases.

Disadvantages of Nuclear Energy

- (a) Discharge of radioactivity in the atmosphere is dangerous.
- (b) Risk of leakage of radioactive wastes which are harmful for all human beings.

India conducted its underground nuclear tests at Pokharan which proved its capability in the use of atomic power. India however uses its nuclear power for peaceful purposes.

BIOGAS

In biogas, the organic matter is decomposed to form methane and carbon dioxide gas which can be used in lighting streets, homes and for cooking. Gobar gas plants have been set up in villages. After the gas is removed, the residue is used as valuable manure.

Advantages of Biogas

1. It can be installed on a small scale and saves about 70 lakh tons of fuel every year.
2. It uses the wastes of humans, animals and vegetation and thus keeps the atmosphere clean.
3. Gobar gas produces energy as well as fertilizer.
4. Biogas is available at all times whereas solar energy is dependent on the Sun.

Disadvantages of Biogas

A large area is required for setting up of a Biogas plant.

Under the ministry of Non-Conventional Energy Sources a project was set up in 1981 when many biogas plants were introduced. The gas was used mainly for cooking and lighting. Now the organic plant waste and night soil is being used to generate power. Not only has this effort improved the sanitary conditions in the villages and cities but has also produced organic manure.