24
DEVELOPMENT OF ENERGY RESOURCES

24.1 INTRODUCTION

In the preceeding lessons you have studied agriculture and manufacturing industries in India. Indian farmer consumes diesel and electric energy on a very large scale for his daily farm operations. The industry also consumes electric energy to run its machines. The large scale regional specialisation of both agriculture and industry calls for dense and efficient networks of transport and communication so that thousands of products, both from agriculture and industry, can be traded locally, regionally, nationally and even internationally. In view of this energy, transport, communication, banking and trade have become basic services with a new and collective label of "infrastructural resources". In this lesson you will study exclusively on energy as the main infrastructural resource.

24.2 OBJECTIVES

After studying this lesson, you will be able to .

- explain the role of various infrastructural resources for the development of economy;
- highlight the importance of energy for the development of agriculture and industry;
- classify various sources of energy;
- identify merits and demerits of different sources of energy;
- locate on a map the patterns of distribution of different sources of energy.
- explain the advantages of power grid systems at regional and national levels;
- appreciate the role of non-conventional sources of energy as the energy resources of the future.

24.3 ROLE OF INFRASTRUCTURAL RESOURCES

The economic development of a country is judged by the level of its agricultural development and efficiency of its manufacturing processes. Very diverse inputs are needed for the production on farms and in factories. However, the processes of production also need some common and basic services. These services facilitate the processes of production and also of distribution of goods, of every possible description.

Power system, networks of transport and communication and marketing or trading facilities etc. are the important parts of such services. We can not think of any production or distribution activity without these services. They are the important and indispensable components which support the process of production and distribution and help in the economic progress of a country. They provide a basic structure for the development and hence they are called the infrastructural resources. Power is needed for running the machines. Transport is required for the smooth and quick flow of goods and people. And means of instant communication are also very essential for the flow of information and messages at every state of production and marketing. Thus all these infrastructural resources play an important role for the development of the economy of a country.

24.4 SOURCES OF ENERGY AND THEIR CLASSIFICATION

There are several sources of energy. They are classified in different ways. One way is to distinguish between commercial and non-commercial sources of energy. In rural India even today a large number of people use human labour or man power, animal power, animal refuge, farm or crop residue as easily available and relatively inexpensive sources of energy. As against this, the sources of energy used in urban areas are commercial in nature. They may include coal, petroleum, natural gas, cooking gas and electricity.

Another classification of sources of energy is based on their longevity. For instance mineral resources such as coal, petroleum, natural gas and radio-active minerals are all non-renewable or exhaustible resources. On the other hand running water, the sun, wind, tides, hot springs and bio-mass are all inexhaustible or renewable sources of energy. They are also pollution free.

Mineral sources of energy include coal, petroleum and natural gas. These mineral sources of energy represent nothing but the stored energy of the sun. Hence they are also called fossil fuels. Then there are radio-active or atomic minerals. They all cause pollution. Non-mineral sources of energy include running water, sun, wind, tides and hot springs. The power derived from these is pollution free.

Yet another classification of energy is based on conventional and non-conventional sources The former includes coal, petroleum, natural gas and running water. The non-conventional sources of energy include sun, wind, tides, hot springs and bio-mass.

* Fuel wood, animal waste and crop residue are traditional or non-commercial sources of energy. They still meet the energy demand in rural areas to a considerable extent.
* Coal, petroleum, natural gas, water falling from a hieght and uranium and thorium are the conventional sources of energy.
* The Sun, wind, bio-mass, tides and hot springs are the non-conventional sources of energy. They are still in the initial stage of experimentation for want of appropriate and viable technology.
* They are important because they are renewable and pollution free sources of energy.

24.5 GROWING PRODUCTION AND CONSUMPTION OF ELECTRICITY

Electricity is the most convenient and versatile form of energy. When, coal, petroleum and natural gas are used for generating electricity, it is called thermal energy. Power generated from running water, in adequate quantity while falling from a great height is known as water power or hydel power or hydro-electricity. Yet another way of generating electricity is through nuclear fission from atomic minerals. This energy is termed as nuclear power. It is also a thermal energy but from a different source and needs highly developed technology.

In 1947 the per capita availability of electrical energy in India was as low as 2.4 KWH. By 1995-96 the per capita consumption of domestic power was 53 KWH. Despite vast improvement, this is very low compared to many other countries of the world. India is a country of about 600,000 villages. In 1947, hardly 300 villages had electricity. Now it has reached to more than 5 lakh villages. This became possible because we have increased production of electricity by 60 times over this period.

The installed plant capacity to produce and supply electricity was as low as 2300 mw in 1950-51. This rose to 94500 mw by 1995-96. Out of this total figure, 11200 mw are produced for non-utilities. The further break up of figures is available only for 82200 meant for utilities. The installed capacity to produce hydel electricity in 1950-51 was 600 mw only. By 1995-96 it rose to as much as 21000 mw. Likewise capacity to produce thermal electricity jumped from 11000 mw to 60100 mw during the same period. Note the fast pace at which capacity to produce thermal electricity has been growing. Installed capacity to generate nuclear energy came into being only in 1970-71 when it was 400 mw. It has now risen to 2200 mw by 1995-96.

Now let us have a look at the actual generation of electricity over these five decades. The total energy produced in 1950-51 was 6.6 billion kwh. By 1995-96 this figure rose to 415 billion kwh. Out of this over-all figure, the break up for 380 billion kwh is available as the remaining amount of 35 billion kwh stands under the head of non-utilities. The production of hydroelectricity in 1950-51 was 2.5 billion kwh. It rose to 72.5 billion kwh in 45 years i.e. by 1995-96. The production of thermal power was not much different from that of hydel power in 1950-51, when it was 2.6 billion kwh. This is more than four times the share of hydroelectricity. The share of nuclear energy is almost insignificant in the overall production of electricity.

The trends in the consumption pattern of electricity in India over the past few decades are highly interesting. Agriculture among all other consumers was almost at the bottom in 1950-51. By 1994-95 it, however, shot up to be the close second, standing next only to Industry. The industry has been at the top all along. The share of industry over this period has, however, shrunk to 34.1% from the dominant share of 62.6%. The share lost by industry has been acquired by agriculture. These two together have been claiming two-thirds of the total consumption.

There is no doubt that there has been a rapid growth of power sector in the country after independence. However India still lags behind in the per capita consumption of energy in the world. There is the need to further increase the power generation for the development our economy. Some measures to increase the power generation in the country are:

(i) Installing new power generation plants.
(ii) Modernising of old and out dated generation plants for increasing the generation capacity.
(iii) Ensuring the supply of required quantity of coal and natural gas to the thermal plants.
(iv) Minimising the wastage of energy and transmission losses.
(v) Improving the management, maintenance and operation systems in the power plants.

The production of thermal power is much higher than hydel power. This is because India has ample poor quality coal which can be best used for generating thermal power. The gestation period for a thermal plant is much shorter than the hydel or nuclear power plant. The use of mineral oil and natural gas has further brought down the gestation period for new plants. The laying of oil and gas pipes has enabled to locate thermal power plants close to the consumption centres.

* Depending upon the source, energy is divided into thermal, hydel and nucelar.
* While hydel power is derived from running water, thermal electricity may be produced from coal, petroleum, natural gas and nuclear or radioactive minerals.
* Thermal electricity in India is obtained largely from coal of poor quality which we possess in an abundant measure.
* There is considerable scope to generate hydroelectricity in India provided we have ample financial resources.

INTEXT QUESTIONS 24.1

Answer the following questions :

1. (a) Name four infrastructural resources

(i) _____ (ii) _____ (iii) _____ (iv) _____

(b) Name the two popular types of power plants in India.

(i) _____ (ii) _____ (iii) _____ (iv) _____

(c) Name a conventional source of energy which is renewable

_____

(d) Name three minerals widely used for producing power in India

(i) _____ (ii) _____ (iii) _____

2.2 Choose the correct option

(1) Which one of the following sectors has shown sharp increase in power consumption in recent years?

(a) Agricultural
(b) Industry
(c) Transport
(d) None of them

(2) Which one of the following forms of energy is non-conventional?

(a) Thermal energy
(b) Hydel power
(c) Solar energy
(d) Nuclear power

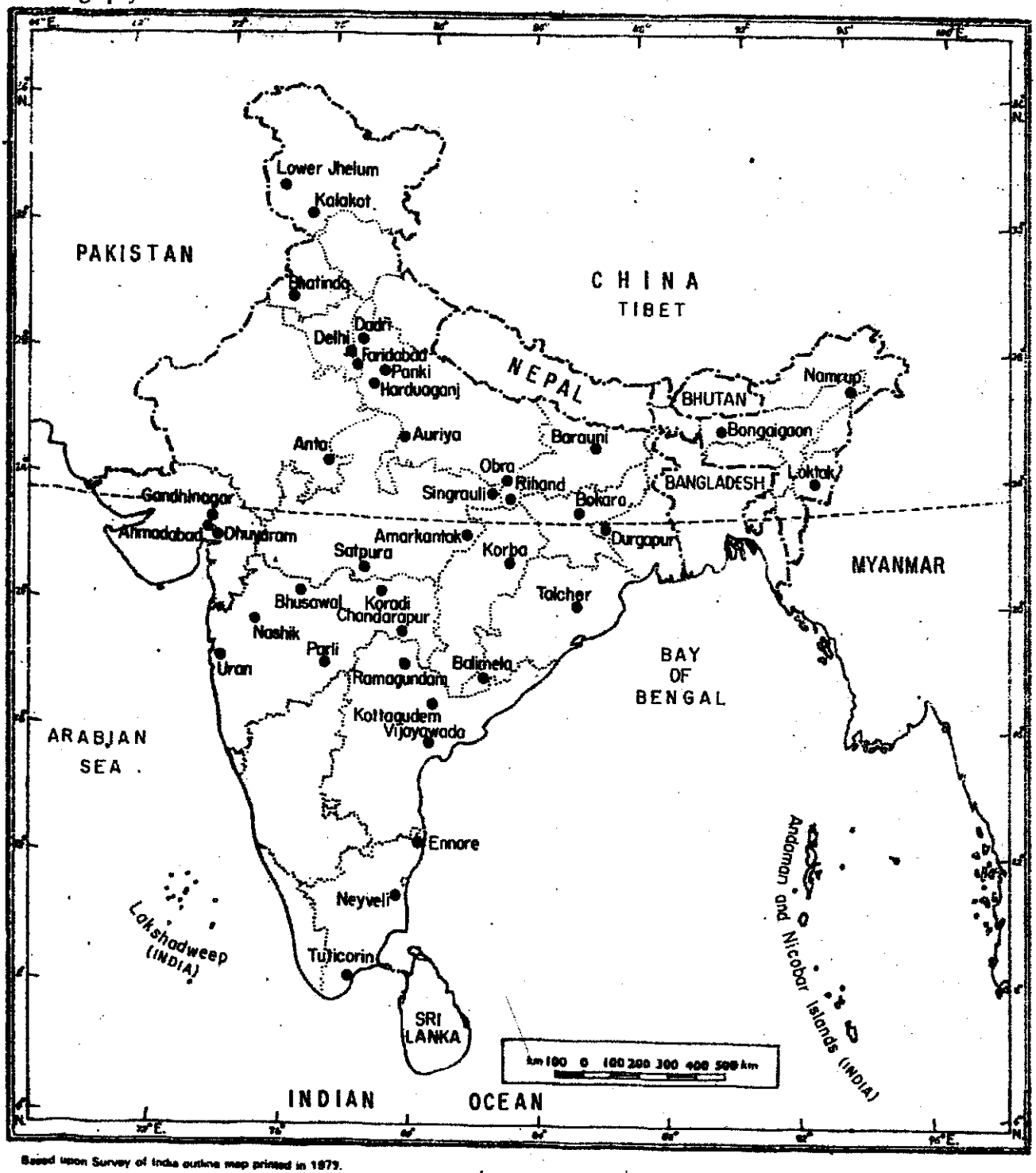
(3) Which one of the following has the highest share in the total energy production?

(a) Hydel power
(b) Thermal power
(c) Nuclear power
(d) Wind energy

24.6 THERMAL POWER RESOURCES

Thermal energy is produced by using mineral fuels. It is the largest source of power supply in the country. The installed capacity of thermal power stations is about three times the installed capacity of the hydel power. While capacity to produce hydel power is 2100 mw. it is as much as 60100 mw in the case of thermal power.

Coal based thermal power units - have been set up near the coal mines to avoid transport costs Transmission of power over long distances is relatively cheaper despite some loss of energy in transit



Based upon Survey of India outline map printed in 1979.

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

The boundary of Meghalaya shown on this map is as interpreted from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be verified.

*Reg. No. 7349 HD'79-2000.

*Printed at the 101 (H.I.O.) Printing Group of Survey of India.

*Price: Twentyfive Paise

*Theme may be deleted when printing a map based on this outline map.

Thermal power stations are scattered all over the country (Fig.24.1)

Super Thermal Power plants have been established mainly very close to big coal mines These are Singrauli (U.P.), Korba (M.P.), Ramagundam (A.P.), Farakka (W.B.), Vindhyachal (M.P.), Rihand (U.P.), Kawas (Gujarat), Gandar (Gujarat) and Talcher (Orissa). Most of these power plants have improved their efficiency and profitability through improved plant load factor (78% against the national average of 63%) with the electrification of trunk routes railways have also set up their own super thermal power stations in the regions lying away from major coal fields. In Tamil Nadu there is a big thermal power plant at Neyveli which is fed by local lignite coal field.

Besides coal based thermal power plants, the latest trend is to encourage diesel and natural gas based thermal power plants. Such plants can be set near the distribution or market centres. The gestation period of oil or gas based plants is generally the shortest. These plants are also found to be more efficient than coal based plants. In 1995-96 the gas fired plants produced 3200 mw of thermal power. The oil and gas pipes have to be laid for continous supply of petroleum and natural gas for such power plants

As India is poor in its mineral oil and proven gas resources, it has to import these raw materials including naptha etc. from Middle East countries. The new Dabhol Thermal Power plant of Maharashtra on the Konkan coast is based on such imported raw material. This plant is an indicator of the new trend.

Petroleum based power units have been set up in the remote areas of North East and Himalaya region.

It is very interesting to note that Karnataka and Kerala states in South have not a single thermal power plant. Can you explain the reason?

24.7 HYDEL POWER RESOURCES

Water power resource differs from thermal power in more than one ways. It is a renewable or inexhaustible resource. It is pollution-free. Its recurring or maintenance cost is minimal. However, this source of energy, has two major drawbacks Firstly, it calls for huge financial lay out, particularly in those regions where water is to be impounded in huge quantity to ensure free flow of water all the year round. Secondly, in most cases its gestation period is too long.

With the water power potential of 41000 mw, India ranks fifth in world after Congo (Zaire), Russia, Canada and the U.S.A. The regional distribution of water power potential of the country is interesting to note. The North-east India covering Arunachal Pradesh, Upper Brahmaputra Valley in Assam and Manipur has about 30% of the country's water power resources. Another 30% of the water power resources lie in the Indian territories of Sutlej and Ganga basins. The remaining 40% of the potential water power resources are located equally in (a) Narmada and Tapti Valleys and (b) the east flowing rivers of peninsular India and along the western slopes of Western ghats.

The Himalayan rivers and the North-eastern region have a natural advantage of a relatively long rainly season followed by the waters of melted snow in late day summer. These rivers can, therefore, be used for producing hydel power without constructing large dams etc. Our

Himalayan neighbours are very rich in water power resources and India is keen to cooperate with them to develop their resources

There is an urgent need to develop our water power resources to their maximum because India's petrolium reserves are limited and coal reserves are unevenly distributed. Development of water power is most essential in those areas where coal or oil deposits are not found.

(a) DEVELOPMENT OF WATER POWER

Our country's water power potentials was hardly developed before independence. There has been a rapid growth in this direction after independence. The following table shows the generation of water power in the country.

Year	Installed Capacity in m.w	Percent of the total Potential of the country
1950-51	575	1 5
1986-87	16,681	40
1994-95	20.830	50

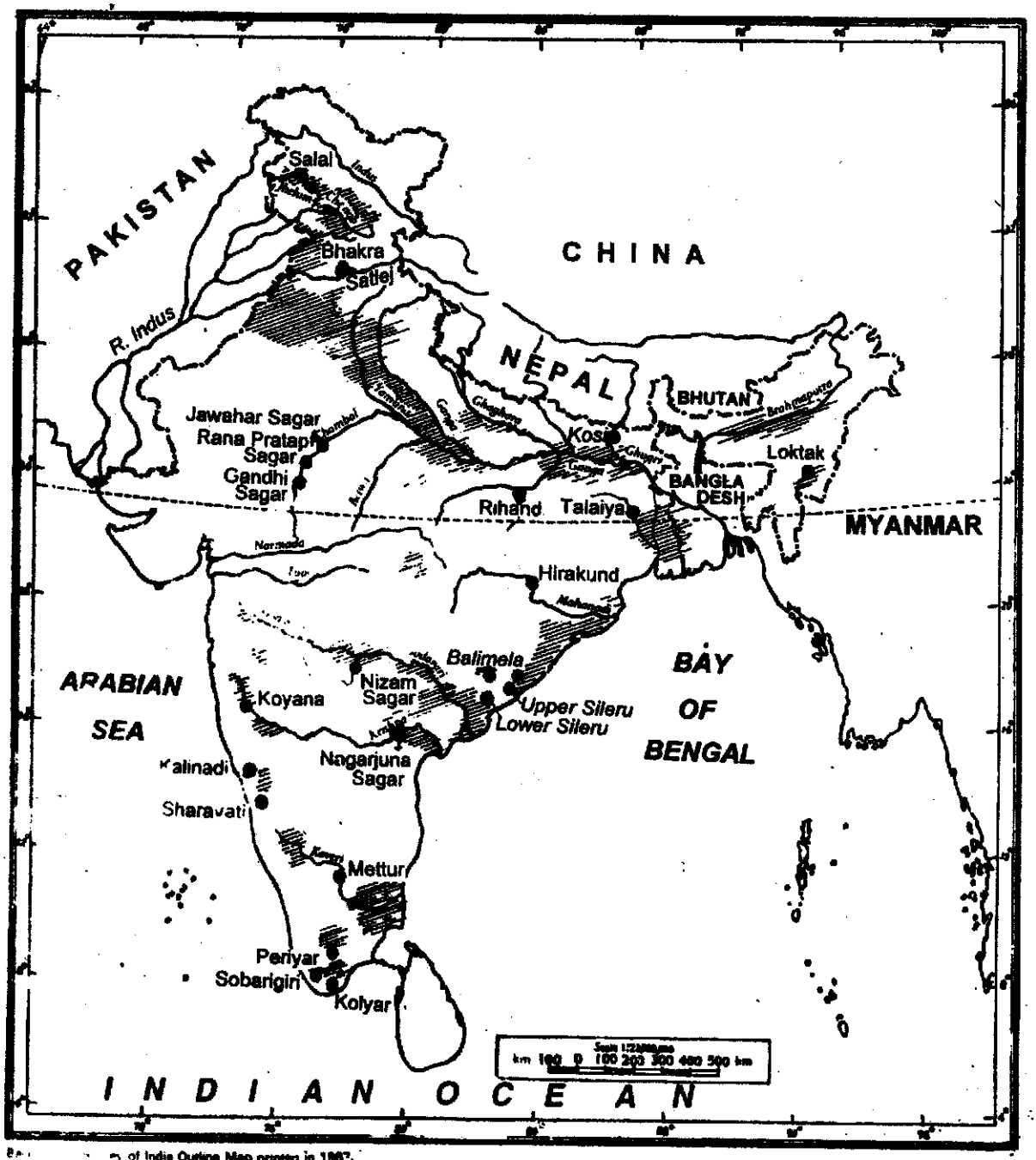
Study the above table, and explain the reasons for the very low development of water power in 1950-51. It gives you an idea that there was not much demand for power in the absence of industries nor was any development of machanised agriculture in the country. Since then there has been rapid development of water power resources. We have developed about 50 percent of the total water power potential of the country. However, the share of developed water power in the total generated electricity in about 26 percent only.

* Hydel power is renewable, and pollution free source of power.
* India was vast potential of water power. Only a half of it has been harnessed by now.
* The share of hydro-electricity in the total installed capacity of electricity is still low.

(b) MAJOR HYDEL POWER PROJECTS

A few hydel power projects developed in India before independence were set up mainly in the peninsular India. Most of earlier hydel power stations are situated in Western Ghat regions. These states are Kerala, Karnataka and Maharashtra.

First power station in India was set up on the Kaveri river at Sivasamudram in Karanataka in 1902. Later on three hydel power stations were set up in the Western Ghat region in Maharashtra under the Tata Hydro-electricity Scheme betwen 1915 and 1927. Mandi power scheme in the Himachal Pradesh utilises the water of snowfed 'Uhl' river. Upper Ganga Canal Hydro-electric Grid system in UP was also developed during the Pre-Independence period by creating water heads at a number of places along the canal. After Independence, significant development has been made in harnessing the water power. A number of hydel power stations have been set up in different parts of India as a part of multipurpose projects. Damodar Valley, Bhakra-Nangal, Hirakud, Chambal, Nagarjun Sagar and Mettur are some important multipurpose projects (see figure 24 2)



...s of India Outline Map printed in 1987.

...extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

Respo... ... details shown on the map rests with the publisher.

Fig. 24.2 Hydel Power Stations in India

A few exclusive hydel power projects have also been set up in different parts of the country. A brief description of these water power projects is given as under :

The Rihand Project. This hydel power station is located on the Rihand river a tributary of the Son near the border of Uttar Pradesh and Madhya Pradesh. This is the largest hydel power project of Uttar Pradesh. The installed capacity of this project is 300 MW annually.

Ram Ganga Hydel Project. This project has been set up on the river Ram Ganga at Kalagarh in distt. Garhwal (Uttar Pradesh). It annually generates 200 mw electricity.

Other important hydel power projects in this region are. Yamuna Hydel Power Project developed in two stages. Salal Hyalel Project in Jammu and Kashmir, Giribala Hydel project on the border of Haryana and Himachal Pradesh and Kosi Power project on the border of Nepal and Bihar in India.

Although the water power potential in the North-eastern region accounts about 30 percent of the total potential of the country, the development of hydel power is very limited. Its main reason is the very low demand for electricity as this region is sparsely populated and there are only a few manufacturing industries.

In Manipur state, an important hydel power project has been set up by using the water of lake Loktak.

The Peninsular Region of the country is also rich in water power potential. Hydel power has been developed in all southern states especially in Karnataka, Maharashtra and Kerala.

Koyna hydel project in Maharashtra is an example of engineering skill. Water of the east flowing Koyna river has been impounded only to be diverted through a tunnel towards the west so that it falls with great force along the steep slope of the ghats into Konkan region. The installed capacity of this project is 880 mw annually.

The Sharavathy and Kalinadi hydel projects are the important projects of Karnataka state which have the installed capacity of 891 and 270 mw. electricity respectively.

In Tamil Nadu the major hydel power projects are Mettur, Kundah, Papanasanam and Pykara. Mettur hydel power project is on the river Kaveri and has the generating capacity of 240 mw electricity. Salem, Thanjavur, North and South Arcot districts use its electricity. Kundah project has the installed capacity of 535 mw and is situated on the Kundah river.

Sabarigiri, Idukki, Pennar and Periyar are some of the important hydel schemes of Kerala situated on the river flowing along the slopes of the Western Ghats into the Arabian Sea.

Ukai (Gujarat), Balimela (Orissa), Nizamsagar and Sileru (Andhra Pradesh) are other main hydel power projects (see figure 24.2).

With Indian technical and financial assistance, Chukha Hydro electric project in Bhutan, was set up in 1986 with the insallted capacity of 336 MW. India buys surplus power being generated here.

24.8 NUCLEAR POWER

India had developed the technology of generating energy from nuclear minerals such as uranium and thorium. Installation of nuclear reactors for generating power requires huge capital and sophasticated technological skills.

Although, generation of nuclear power in India started in the year 1969, it is still in its initial stage. The share of nuclear power, in the total energy produced in the country is hardly 2%.Nuclear power is a promising source of energy for future it would play a complementary role when the other sources of power like coal and pertorlium would be exhausted.

Among the four nuclear power plants, Tarapur (Maharashtra) is the first which started in 1969 Present power generation capacity of this plants is 400 mw. Rawat Bhata (Rana Pratap Sagar) near Kota in Rajasthan is the second which has 400 mw installed capacity. Kalpakkam near Chennai in Tamil Nadu is the third important power plant based on thorium, a nuclear mineral. Its generating capacity is also 400 mw. Its power is suppled to Tamil Nadu and Karanataka. The fourth nuclear power station has been set up at Narora on the banks of the Ganga in Bulandshahr district in Uttar Pradesh, not very far from Delhi. Its two units have started functioning

Kakrapar nuclear power station is being set up in Gujarat and Kaiga power station is under construction in Karnataka. They are expected to start functioning in near future.

2225 mw nuclear power was generated in the year 1994-95 which is a small fraction of the country's total production of electrical energy

Generation of nuclear power is highly hazardous A slight carelessness in the security may cause severe accidents endangering lives of thousands of people in its surrounding areas. Therefore, strict precautions and security measures are highly essential.

INTEXT QUESTIONS 24.2

1 Fill in the blanks:

(i) Electricity generated by using coal is _____ energy
(hydel energy, thermal energy)

(ii) The electricity generated by the force of running water is _____ energy.
(Hydel energy. Tidal energy)

(iii) The two minerals used for generating nuclear power are (1) _____ and (2) _____ (uraminum, Coal, thorium)

(iv) The first atmotic power station developed in India was at _____
(Rawat Bhata , Tarapur)

2 Answer the following Questions briefly :

(i) Give two main advantages of Hydel power
(i) _____ (ii) _____

(ii) What rank does India hold in the world in water power potential?
_____

(iii) Name two gas based thermal power plants in UP.
(i) _____ (ii) _____

(iv) Which region of India has developed the largest proportion of its water power potential?
_____

24.9 NON-CONVENTATIONAL SOURCES OF ENERGY

Conventional sources of power like coal, pertroleum and natural gas are likely to exhaust in near future. The development of hydel power alone can not meet the demand of electricity for the future. Therefore, there is a need to find and develop alternative sources of power Sun, wind, tides, biologoical wastes and hot springs are such sources which can be developed as the alternative sources of power. They are called the non-conventional sources of energy These sources of energy are renewable and pollution free. We shall discuss some important non-conventional sources of energy with refererce to their development in our country.

(a) Solar energy

For the planet earth, the Sun is the primary source of all energy. Sun is the most vital, abundant and direct source of energy. India lies in the tropical zone and has plenty of sun shine, for long hours of a day. There are large possibilities to develop solar energy in the country and that too without much cost.

Solar energy is tapped through the system of Soalr Photo Voltaic (SPV) cells. The thermal heating system can be used for water heating, solar codkers for cooking meals and drying food grains etc. Solar energy can be developed in almost every part of the country,but more so in hot, dry and cloud free areas like Rajasthan.

(b) Wind Energy

Wind can be used as a source of energy in those regions where strong and constant winds blow throughout the year. Wind energy can be used for pumping water for irrigation and also for generating electricity. India has about 20,000 mw wind power potential. Prospective sites for generating electricity wind have been located in Tamil Nadu, Gujarat. Andhra Pradesh

Karnataka and Kerala. At present India's electric generating captailty through wind is around 500 mw.

(c) Biogas

Biogas is obtained by using animal refuge like cow dung. It is widely used in rural areas mainly as domestic fuel. Efforts are being made to popularise the biogas plants in the country. Even farm or agricultural wastes can be used on a large scale to generate gas or energy. This source is called biomass.

Urban and industrial waste is another source of biological energy in big cities and industrial centres. These materials can be used for generating electricity or biogas. The work in this direction is still in its initial stage. Such plants have been installed in Delhi and few cities in India

(d) Tidal Energy

Energy can also be generated from high tidal waves Some of the important sites identified for generating tidal energy are located in the Gulf of Kuchch and Cambay in Gujarat state and the coast of Kerala. A plant of 150 mw capacity has been installed on Kerala coast.

(e) Geothermal energy

The potential of geothermal power is very limited in India. Important sites selected for generating geothermal power are situated in Himachal Pradesh (Mani Karan) and Jammu and Kashmir (Puga valley in Ladakh). The work for installation has not yet been started.

As we have discussed earlier, the non-conventional sources of energy are renewable and pollution free. They can be helpful in the utilization of resources scattered all over the country. But the development of these energy resources is very slow, due to lack of suitable and economically viable technologies. Even so there is no doubt that they would become a reality in not a very distant future.

There are prospects of expanding the manufacturing industries and mechanization of agriculture in the nooks and corners of the country. Naturally, there will be more demand for energy derived from the non-conventional sources.

24.10 POWER GRID

Through a network of transmission lines, all the electricity, generated from different sources of power, is fed into one common distribution system to serve the entire region. This network is known as centralised integrated grid system. Its main advantages are (1) transmitting the surplus electricity of one area to the other deficit area, (ii) in the event of any break down in one area electricity can be rushed immediately to that area and (iii) promoting a balanced distribution of electricity in the entire area for its optimum use.

At present, there are five grid systems functioning in five regions of the country. Four regional grids have already been interconnected As soon as the North-east, region is

connected with the network of the rest of the four regions, the country would fulfill its dream of having a single integrated national grid system.

INTEXT QUESTIONS 24.3

1 Answer the following Questions briefly

(i) Give two main advantages of non-conventional sources o power
(a) _____ (b) _____

(ii) Which areas of the country have largely been benifitted by biogas plants?
_____

(iii) Name two sites identified for developing tidal energy in Gujarat
(a) _____ (b) _____

(iv) Name two ways of tapping the solar energy.
(a) _____ (b) _____

(v) Which are the two main uses of tapping wind energy ?
(a) _____ (b) _____

(vi) Mention one advantage of power grid system.
_____

WHAT YOU HAVE LEARNT

- Energy is a highly important infrastructural resource for the economic development of a country. Main sources of power are coal, petroleum, natural gas, nuclear power and water power. All these sources are known as the conventional sources of energy.

- Power generated by the use of coal, petroleum and natural gas is called thermal energy. These sources of energy are exhaustible and non-renewable They cause pollution. Hydel power is a renewable and pollution free source of energy. Its maintenance costs are very low. Nuclear power is source of power It requires huge capital and sofisticated technology. Careful handling and security measures are necessary for the protection of life all around their sites.

- The share of thermal power is more than 70 per cent out of the total energy produced in India, Next comes is the hydel power whose share is about 26 per cent. The share of nuclear power is only less than 2.5 per cent.

- Coal based thermal power plants are located either near the coal fields or near the consumption centres. These plants are largely located in Madhya Pradesh. Bihar and Orissa. However, thermal plants on the borders of Uttar Pradesh, Maharashtra and Andhra Pradesh are also very important as they serve far off regions in these three states.

- There has been sufficient development of hydel power in the southern states. India has developed about 50 percent of its total water power potential.

- Sun, winds, tides, hot springs, biogas etc. are the alternative sources of power They are known as non-conventional sources of energy. They are renewable, pollution free and inexpensive. There is a slow progress in the utilisation of these sources for want of suitable and economically viable technologies.

- A national power grid helps in transmitting electricity from surplus to the deficit areas and in the event of any break down, the situation can be tided over quickly by rushing energy from other areas.

TERMINAL EXERCISE

1. Answer in briefly :
   (i) Name three important sources of energy which are non-renewable and also pollution free.
   (ii) State two reasons for the low development of hydel power in the North East region of India.
   (iii) Name and rank three major sectors of economy which are consuming the bulk of energy.
   (iv) Differentiate between thermal hydel and nuclear energy. State the share of each in the total production of energy.
   (v) Mention two advantages of non-conventional sources of energy.

2. Distinguish between .
   (i) Regional and National Power Grid System.
   (ii) Conventional and Non-conventional sources of power.
   (iii) Solar energy and Wind energy.

3. Answer the following questions in about 50 words.
   (i) Examine the importance of power as an infrastructural resource for the development of economy.
   (ii) Describe the role of biogas as an energy for the rural areas
   (iii) Explain the significance of power grid system for the smooth distribution of electricity in the country.

CHECK YOUR ANSWERS

INTEXT QUESTIONS

24.1

A (1) (i) Power (ii) Transport (iii) Communication and (iv) Trade (v) Banking (Any four).

(i) Thermal (ii) Hydel power plants

(i) Hydel power

(i) Coal (ii) Petroleum and (iii) Natural Gas

(i) Uranium and (ii) Thorium

B (1) (a). (2) (c). (3) (b)

24.2

(A) (i) thermal energy (2) hydel energy (3) uranium and thorium (iv) Tarapur.

(B) (1) (i) Renewable and (ii) Pollution free
(2) Fifth
(3) (i) Dadri (ii) Auraiya
(4) Peninsular region.

24.3

(i) (a) pollution free (b) enewable

(ii) Rural areas

(iii) (a) Gulf of Kuchch and (b) Gulf of Cambay

(iv) (a) Thermal heating system and (b) generating electricity through photovoltaic routes

(v) (a) For pumping water and (b) for generating electricity

(vi) Transferring surplus energy from one region to the other, which is deficient in energy at a given time.