MODULE 7 - ENERGY AND ENVIRONMENT (PART-1)

OBJECTIVES

By the end of this session the students shall be able to learn about –

1. What is energy and what are energy resources.
2. Energy consumption is the indicator of progress of a country.
3. Conventional energy resources such as coal, petroleum, L.P.G. and radio-active elements.

SUMMARY

Energy is an important requirement for the progress of a nation. Energy resources are of two types – conventional and non conventional. These days most of the countries of the world specially the developing countries are facing the problems of energy crisis in view of the exhaustion of conventional resources like coal, petroleum, LPG, etc. Such countries should depend upon non conventional resources like solar energy, wind energy and hydroelectricity. In India, solar energy is available in plenty and it should be exploited to the maximum limit. It does not create any pollution problem. Non conventional sources can not be used in all seasons e.g. solar energy not available in India during rainy season and cloudy weather. Under such situation we have to resort to the use of traditional resources like coal, petroleum and LPG.

Petro-cropping and petro-plantation are new devices to harness energy from plant and biomass. This can also solve energy requirement to considerable extent. Developing countries like China, India and several other countries of Asia who have the problem of population and poverty have to explore new resources which are non conventional.

India has plenty of sunlight available during most of the months. This energy should be used by using solar cookers and solar cells. Big cities in India should use biomass energy to overcome the problem of pollution.

TRANSCRIPTION

Introduction

Energy means the capacity to work. The resources used to do work are called energy

resources. The demand for energy doubles every 14 years. So the consumption of energy is considered as the parameter of progress.

India with 16 % of the world's population consumes only 1.5 % of the total energy produced in the world in comparison to U.S.A. which has 6.25% population of the world and utilizes 33% of the energy. In 1998, the World Resource Institute found that the average American uses 24 times the energy used by an Indian. Even today about 80% of the Indian population depends upon fuel wood, dung and agricultural waste as energy sources for cooking food.

Energy is an essential input for industrial development. Energy is produced from commercial sources like coal, petroleum hydroelectric schemes as well as from non commercial sources like cow dug, fuel wood and agricultural waste.

India's per capita consumption of commercial energy that is energy from coal, petroleum and hydroelectric energy is very low. It is only one eighth of the world average.

In India commercial energy accounts for a little over half of the total energy used in the country, the rest coming from non commercial sources. Share of agriculture in commercial energy consumption has risen rapidly over the past 4 decades. Industry consumes about 80% of the coal and 70% of the electrical energy in India. The transport sector accounts for 65% of the total oil consumption. The energy consumption of household sector has also increased due to air conditioners, refrigerators and other electrical appliances. India has to increase not only the indigenous availability but also aim at efficient utilization of energy.

Energy generation and environmental conservation are the twin issues arising from exploitative interaction of man with natural resources. A 1987 report of the International Energy Agency contains a simple but remarkable statement- "Investment in energy conservation at the margin provides a better return than investment in energy supply".

That means conservation of a unit of energy is cheaper and environmentally more desirable than generating an additional unit. Actually generation of every additional Kilowatt hour of energy requires an investment of Rs.7000/- to 12,000/- in the form of new energy generation equipments.

Excessive utilization of coal and oil for generation of electricity leads to multiple problems like Global warming and acid rains. Tension in Gulf countries increases because they are the major petroleum supplying countries.

To reduce dependency on coal for generation of electricity, hydroelectricity power stations and nuclear power plants were advocated. Huge dams can contribute

significantly to electricity generation but they inundate forests, farm lands and wild life habitats. Entire community of indigenous people becomes homeless. In Harsood in M.P. is a very good example. Its population was displaced due to the construction of a dam on the Narmada River. People who have lived there over generations found themselves to be refugees in their own land.

Nuclear power plants come with the risk of radiation leakage which result in diseases like cancer and birth of crippled children.

Between 1950 and 1990 the world's energy requirement has increased four times. By 2020 it is expected that the Asia- Pacific region will consume 40% more energy than North America.

Classification of energy resources

Energy resources are classified as under –

1. Nonrenewable or Conventional resources
2. Renewable or Non conventional resources

1. Non renewable or conventional resources – They are formed once in thousand of years hence they are on the verge of getting exhausted e.g. coal, Petroleum, L.P.G. and Radio active elements. Petroleum is expected to get exhausted within 30 years. LPG within 50 years and coal within 100 years.

2. Renewable or non conventional resources – These resources have a cycle hence they are non-exhaustible e.g. solar energy, wind energy, hydroelectricity Biogas, Petro-cropping, Petro-plantation, thermal energy and Tidal energy.

These sources are discussed one by one.

I. **Non renewable or Conventional resources**

A. Coal – For about 2000 years coal was the primary energy source. It fuelled the industrial revolution in the 19th century. It is used directly in furnaces or converted to electricity in thermal power plants. Coal is a fossil fuel formed when trees got buried inside the earth in absence of oxygen. Carboniferous period of Paleozoic

era, about 80 million years back is considered as the golden age of green plants. At that time carbon-dioxide in atmosphere was 0.04% or 400 ppm as compared to present day which is 0.03% or 300 ppm. The trees attained huge size e.g. Lepido dendron. It is estimated that the earth has deposits of coal to the extent of about 6000 billion tones out of which 2000 billion tones has been used up. Coal deposits of different countries are as under.

S.No	Country	Coal deposits in million metric tones
1	U.S.A.	2,49.995
2	India	2,43,114
3	Russia	1,57,010
4	China	1,14,500
5	Australia	90,400
6	Germany	67,000
7	South Africa	55,333
8	Caja Khastan	34,000
9	Poland	14,309

Coal is mined from the earth. In India coal mines are found in Jharia, Bokaro, Girideeh, Karanpura of Bihar state, Raniganj, Barjora and Darjeeling of Bengal state., Godaveri valley of Andhra Pradesh, Singrouli and Korba of Chhattisgarh state and Suhagpur,Pench valley, Umaria and Lakhanpur of M.P. and Chanda, Kamptee, Umred and Bhanded of Maharashtra.

Even today coal meets 37% of energy demands at world level. It is one of the prime sources of energy.

It is also the source of Phenyl, Ammonia, Naphthalene and coal gas.

Coal has the following adverse environmental effect:-

a. It contributes maximum emission of green house gases leading to global warming.
b. Burning of coal results in the emission of sulphur-dioxide and oxides of nitrogen which cause acid rains. Acid rains kill forest vegetation, damage historical monuments, pollute water and affect human health.

c. Thermal power houses produce fly ash the dumping of which is a problem. These days fly ash is used to prepare cement as well as bricks.

Mineral oil

B. Mineral oil (Petroleum):- Petroleum is popularly called liquid fossil. It was formed when aquatic animals and marine Algae got fossilized that is why oil wells are mostly found in the sea.

Due to heat and high pressure the fat of animals got mixed up with minerals and petroleum was formed. Saudi Arabia, Mexico, USSR, Iraq, Iran, Kuwait, UAE, Qatar and Bahrain have deposits of petroleum. In India, petroleum deposits are found in Bombay high, Gujarat and Assam.

According to Britannica book of the year 2003 the petroleum deposits in various countries are as under:-

S. No.	Country	Petroleum deposition in million barrels
1	Saudi Arabia	261.7
2	Kuwait	96.5
3	Iraq	112.5
4	Iran	89.7
5	U.A.E.	97.8
6	Venezuela (S. America)	76.8
7	U.S.A. (North America)	21.7
8	Canada	4.7
9	Mexico	2.2
10	Norway	22.5
11	Great Britain	5.3
12	U.S.S.R. (Russia)	48.5

13	Libya (Africa)	29.5
14	Nigeria	22.5
15	Algeria	9.2
16	China	24.0
17	Indonesia	4.9
18	India	4.7

At present Gulf countries are the greatest oil exporters. In fact their economy runs on the petro-dollars they earn.

In India O.N.G.C. (Oil and Natural Gas Commission) looks after the Survey of petroleum and gas deposits. Petroleum is considered a clean fuel for automobiles but its drilling, refining transport and utilization have serious environmental consequences. Oil slicks and cleaning of oil tankers and ship wrecks pollute sea water as lot of oil floats on the surface of sea. Sea animals and marine Algae are disturbed. In 1989 a huge oil carrier Exxon Valdez sank due to accident and huge quantities of oil was seen floating on sea surface killing birds, sea otters, seal fishes and other marine life along the coast of Alaska.

During Gulf war (1991) oil wells were bombarded and plenty oil was seen floating on sea surface disturbing marine life. There was black snow fall in Kashmir. When this snow was analysed it was found to be rich in Hydrocarbons proving that it was due to oil pollution, in Gulf countries.

Dependence on oil resources results in political tension, instability and war. At present 65% of world's oil reserves are located in the middle-east. Other countries desire to gain access to the oil wells. This results in war.

Oil powered vehicles emit sulphur-dioxide, carbon dioxide, carbon monoxide, nitrous oxide, hydrocarbon and particulate matter causing the problem of photochemical smog in big cities. Leaded petrol emits lead particle in its white smoke which causes neurological problems whereas unleaded petrol contains Benzene and Butadiene which are carcinogenic.

L.P.G.

C. LPG (Natural gas) - LPG is gas fossil. GAIL (Gas Authority of India Limited) looks after the survey of this gas. LPG is also popularly known as cooking gas. It is neat and clean and convenient source of energy to be used as domestic fuel. From Bombay high and Gujarat a pipe lien runs through Rajasthan and M.P. Hajira Bijaypur Jagdishpura. Gas pipeline is 1730 km long. It transports about 18 million cubic meters LPG per day.

Along with cooking, LPG is also used to produce electricity. It is also used as raw material in fertilizer industry. In 1988-89 the production of LPG in India was 27 million cubic meters. In 1999 the quantity of usable LPG was 692 million cubic meters.

Most of the natural gas in India is linked to oil and because there is no transport system and also there is shortage of storage cylinders therefore it is just burnt off. Thus about 40% of the gas is wasted.

A histogram showing the availability of natural gas is as under:-

Radioactive elements

D. Radioactive elements – In 1938 two German scientists Otto Hahn and Fritz Strassman demonstrated nuclear fission. They bombarded the nucleus of radioactive element uranium atom, with neutrons and succeeded in splitting the nucleus of uranium resulting in the release of tremendous energy. This gave birth to the idea of nuclear power industry. The first nuclear power plant was started in 1957 in Pennsylvania (U.S.A.)

Dr. Homi Jahagir Bhabha is considered as the father of nuclear power development in India. BARC (Bhabha Atomic Research Centre) Mumbai is connected with the research on nuclear technology. 1 Kg of uranium produces electrical energy equal to 3000 tonnes of coal. India has nuclear power plants at Tarapur (Maharashtra) Rawat bhata (Kota - Rajasthan) Kalpakkam (Tamilnadu), Kakrapar (Gujarat) Karvar (Karnataka) and Narora (U.P.). They meet just 5% of the electricity need.

Central Government wants to start 6 more nuclear power plants in different states of India. India gets uranium 235 from Bihar (Singhbhumi) and Rajasthan. Uranium 235 is made into rods. Neutrons are bombarded over these rods. Fission of uranium takes place and energy is released in the form of heat. This heat converts water to steam which drives turbines and electricity is produced. Thus energy produced by fission of U235 is converted to electricity. The drawbacks of nuclear electricity are:-

1. Uranium ash is formed and its disposal is a problem because this ash is radioactive. Previous practice was to seal it in thick crucibles and dump it in the sea. But after a few years the seal are damaged and release the absorbed by sea vegetation and fish can

enter the body of man and harm not only the present generation but also the future because radiation cause mutation in gonads and the children born may be crippled.

New suggestion is that this ash should be dumped in rocks by drilling holes in rocks and sealing the rocks. But in future this will prove to be dangerous whenever this rocks cracks.

In 1979, the nuclear plant in Three Mile Island in USA and in 1986 Chernobyl in Russia had to face the problem of leakage in nuclear reactor resulting in the loss of numerous human lives and causing diseases like thyroid, cancer.

In 2011 Japan was hit by Tsunami and 4 nuclear power plants out of six developed the problem of leakage. These reactors had to be closed.

In this part of the program we discussed about the nonrenewable or conventional sources of energy. In a second part of this program we shall be taking a look at the non-conventional or renewable sources of energy.

GLOSSARY

1.	Conventional	:	Traditional
2.	Petro-cropping	:	To grow crops of plant sugar cane for obtaining fuel alcohol
3.	Essential	:	Indispensable
4.	Consumption	:	Used up
5.	Refrigerator	:	Cooling machine
6.	Renewable	:	Having cycle to repeat itself
7.	Nonrenewable	:	Which can not repeat itself
8.	Subsidised	:	Concessional
9.	Satellite	:	A planet revolving around another

FAQs

Q.1 What is energy?
Ans. Energy means capacity to do work.

Q.2 In which country per capita consumption of energy is maximum?
Ans. America

Q.3 Do we consider consumption of energy as parameter of progress?
Ans. Yes. More is consumption of energy more advanced is a country.

Q.4 At what rate energy demand is increasing?
Ans. Energy demand becomes double after every 14 years.

Q.5 List 3 conventional sources of energy.
Ans. 1. Coal 2. Petroleum 3. LPG

Q.6 List 3 non conventional sources of energy.
Ans. 1. Cow dung
2. Fuel wood
3 Agricultural waste

Q.7 What percentage of petroleum is consumed by transport sector?
Ans. 65%.

Q.8 Why household consumption of electricity has increased?
Ans. Due to use of electrical appliances such as air conditioner, refrigerator, microwave, cooking range and mixer-grinder.

Q.9 What is another name of conventional resources of energy?
Ans. Non renewable resources.

Q.10 Which is another name of non conventional resources of energy?
Ans. Renewable.

Q.11 List 4 conventional resources of energy.
Ans. 1. Coal
2. Petroleum
3. L.P.G.
4. Radioactive elements such as U 235

Q.12 Which state of India is rich in coal mines?
Ans. Jharkhand

Q.13 What type of air pollution is caused by Coal burning?
Ans. Green house effect resulting in global warming.

Q.14 Which countries are well for earning petrodollars?
Ans. Gulf countries.

Q.15 Why petroleum is called liquid fossil?
Ans. Because petroleum was formed when aquatic animals and plants got pressed and fossilized in absence of oxygen..

Q.16 What is full form of LPG?
Ans. Liquefied Petroleum Gas.

Q.17 What type of pollution is caused by petroleum and diesel smoke?
Ans. Photochemical Smog.

Q.18 What is cause of classical Smog?
Ans. Smoke produced by coal burning.

Q.19 List 2 types of ass pollutions caused by coal burning.
Ans. 1. Green house effect
2. Classical Smog.

CASE STUDY – I

During Gulf war oil wells in Iraq were bombarded and also set on fire. 5 millions barrels of oil was brunt which released tones of Sulphur di oxide a major cause of acid rains. The gas moved to a height of 3 Kms and spread as far as India resulting in black snow fall in Srinagar. The oil spills also polluted the coast line, killing birds and fishes.

CASE STUDY- II

In 1981 a plane called “The Solar Challenger” flew from Paris to England in 5 hours 20 minutes. Its wings and tail were glued with 16000 solar cell. Thus this plane could complete its flight with the help of solar power.

In 1987 in Australia solar operated vehicles covered 3000 Kms.

The world’s first solar powered hospital is in Moli in Africa situated at the edge of Sahara desert. Due to desert area it gets plenty of sunlight. Panels of solar cells supply the power needed to run hospital equipment.

Japanese farmers are using photovoltaic operated insect killer in place of chemical pesticides.

Energy department of DAVV, Indore has building constructed in such a way that it gets maximum light from sun and also has photovoltaic devices to produce electricity to meet out the needs of the department.

There are more than 3000 buildings integrated photovoltaic systems in Germany. Japan has programme to build 70000 buildings with integrated photovoltaic devices.

CASE STUDY – III

Indian industries need most energy than other countries. To produce one ton of steel India spends 9.5 million Kilo calories while Italy spends 4.3 million Kilo calories and Japan spends 4.1 Kilo calories only.

An 18 watt CFL lamp can replace a standard 75 W incandescent bulb.