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TRAINER MrPHILIP

ELECTRICAL AND ELECTRONICS

POWER SYSTEMS 1

Topic 2; renewable energy

Learning outcomes

by the end of the lesson the student should be able to know the

**(a)importance of electrical energy**

**(b)sources of energy**

### **Introduction**

Energy is the basic necessity for the economic development of a country.

Many functions necessary to present-day living grind to halt when the supply of energy stops. It is practically impossible to estimate the actual magnitude of the part that energy has played in the building up of present-day civilisation. The availability of huge amount of energy in the modern times has resulted in a shorter working day, higher agricultural and industrial production, a healthier and more balanced

diet and better transportation facilities. As a matter of fact, there is a close relationship between the energy used per person and his standard of living. The greater the per capita consumption of energy in a country, the higher is the standard of living of its people.

Energy exists in different forms in nature but the most important form is the electrical energy. The modern society is so much dependent upon the use of electrical energy that it has become a part and parcel of our life

### Electrical energy is superior to all other forms of energy due to the following reasons:

**(i) Convenient form.**

Electrical energy is a very convenient form of energy. It can be easily converted into other forms of energy. For example, if we want to convert electrical energy into heat, the only thing to be done is to pass electrical current through a wire of high resistance e.g., a heater.

Similarly, electrical energy can be converted into light (e.g. electric bulb), mechanical energy (e.g. electric motors) etc.

**(ii) Easy control.** The electrically operated machines have simple and convenient starting, control and operation. For instance, an electric motor can be started or stopped by turning on or off a switch.

Similarly, with simple arrangements, the speed of electric motors can be easily varied over the desired range.

**(iii) Greater flexibility.**

One important reason for preferring electrical energy is the flexibility that it offers. It can be easily transported from one place to another with the help of conductors.

**(iv) Cheapness.**

Electrical energy is much cheaper than other forms of energy. Thus it is overall economical to use this form of energy for domestic, commercial and industrial purposes.

**(v) Cleanliness.**

Electrical energy is not associated with smoke, fumes or poisonous gases.

Therefore, its use ensures cleanliness and healthy conditions.

**(vi) High transmission efficiency.**

The consumers of electrical energy are generally situated quite away from the centres of its production. The electrical energy can be transmitted conveniently

and efficiently from the centres of generation to the consumers with the help of overhead conductors known as transmission lines.

Since electrical energy is produced from energy available in various forms in nature, it is desirable to look into the various sources of energy. These sources of energy are :

- I. The Sun**
- II. (ii) The Wind**
- III. (iii) Water**
- IV. (iv) Fuels**
- V. (v) Nuclear energy.**

Out of these sources, the energy due to Sun and wind has not been utilised on large scale due to a number of limitations. At present, the other three sources viz., water, fuels and nuclear energy are primarily used for the generation of electrical energy.

#### **(i) The Sun.**

The Sun is the primary source of energy. The heat energy radiated by the Sun can be focussed over a small area by means of reflectors. This heat can be used to raise steam and electrical energy can be produced with the help of turbine-alternator combination. However, this method has limited application because :

- (a) it requires a large area for the generation of even a small amount of electric power
- (b) it cannot be used in cloudy days or at night

(c) it is an uneconomical method.

Nevertheless, there are some locations in the world where strong solar radiation is received very regularly and the sources of mineral fuel are scanty or lacking. Such locations offer more interest to the solar plant builders.

### **(ii) The Wind.**

This method can be used where wind flows for a considerable length of time.

The wind energy is used to run the wind mill which drives a small generator. In order to obtain the electrical energy from a wind mill continuously, the generator is arranged to charge the batteries.

These batteries supply the energy when the wind stops. This method has the advantages that maintenance and generation costs are negligible. However, the drawbacks of this method are

(a) variable output,

(b) unreliable because of uncertainty about wind pressure and (c) power generated is quite small.

### **(iii) Water.**

When water is stored at a suitable place, it possesses potential energy because of the head created. This water energy can be converted into mechanical energy with the help of water turbines. The water turbine drives the alternator which converts mechanical energy into electrical

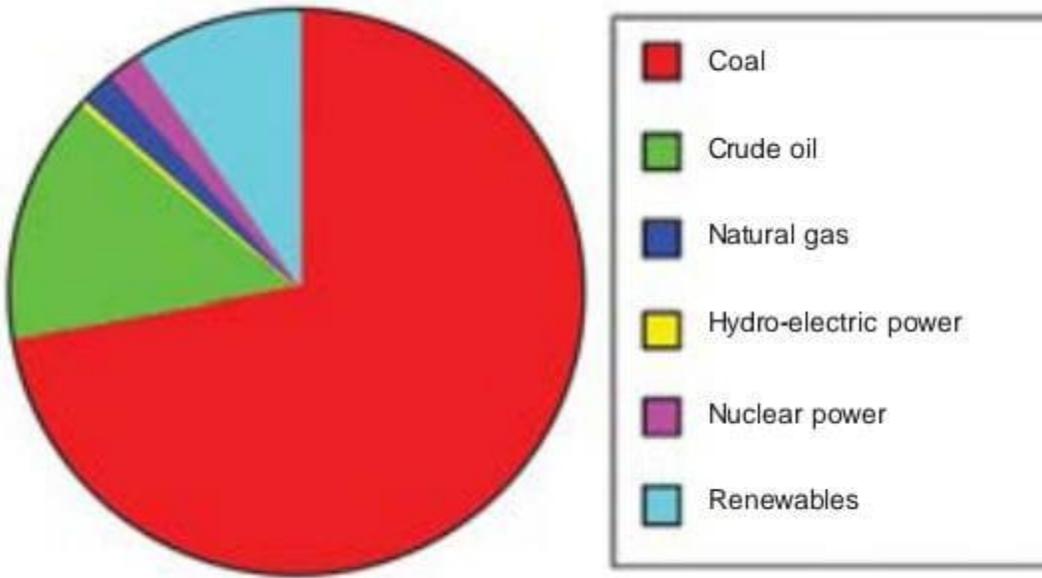
energy. This method of generation of electrical energy has become very popular because it has low production and maintenance costs.

#### **(iv) Fuels.**

The main sources of energy are fuels viz., solid fuel as coal, liquid fuel as oil and gas fuel as natural gas. The heat energy of these fuels is converted into mechanical energy by suitable prime movers such as steam engines, steam turbines, internal combustion engines etc. The prime mover drives the alternator which converts mechanical energy into electrical energy. Although fuels continue to enjoy the place of chief source for the generation of electrical energy, yet their reserves are diminishing day by day. Therefore, the present trend is to harness water power which is more or less a permanent source of power.

#### **(v) Nuclear energy.**

Towards the end of Second World War, it was discovered that large amount of heat energy is liberated by the fission of uranium and other fissionable materials. It is estimated that heat produced by 1 kg of nuclear fuel is equal to that produced by 4500 tonnes of coal. The heat produced due to nuclear fission can be utilised to raise steam with suitable arrangements.



Energy Utilization