COLLEGE OF ENGINEERING AND TECHNOLOGIES
ALMUSTAQBAL UNIVERSITY

Power Engineering

EET 305

Lecture 3

- General Background -

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General Background

- Generation of Electrical Energy.
- Sources of Energy.
- Structure of Electric Power System.

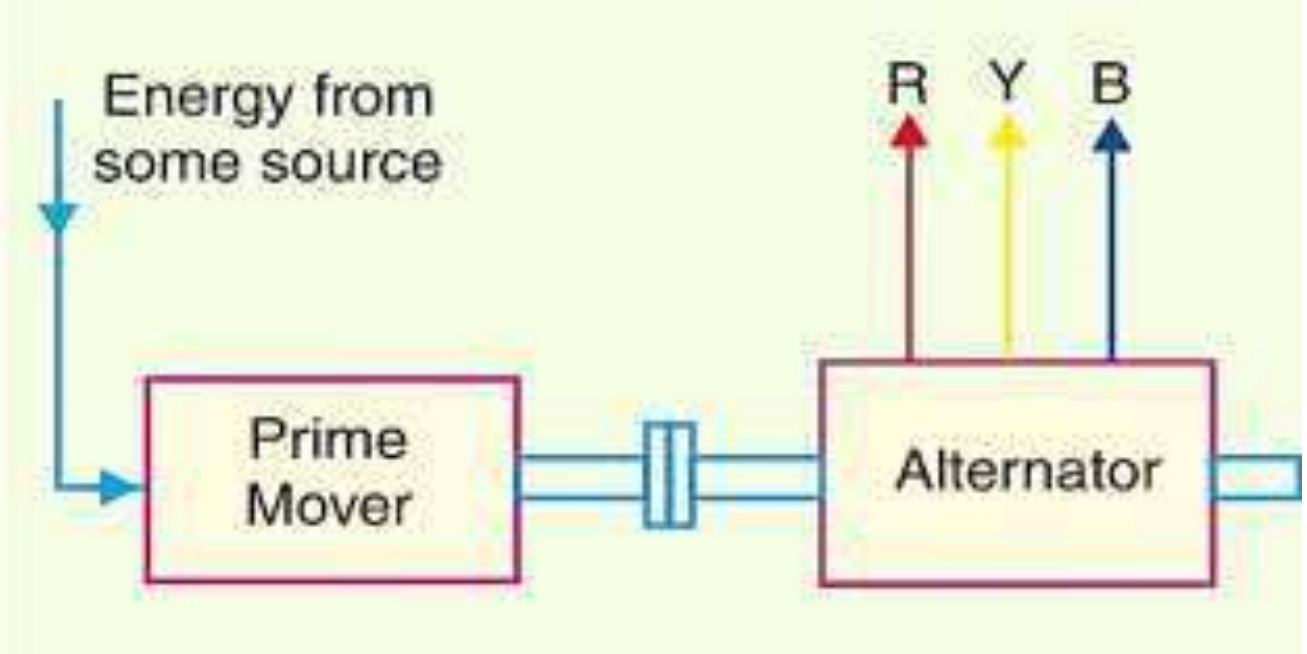
Generation of Electrical Energy:

- The conversion of energy available in different forms in nature into electrical energy is known as generation of electrical energy.

- Energy is available in various forms from different natural sources such as pressure head of water, chemical energy of fuels, and nuclear energy of radioactive substances etc.

- Figure below shows the general way how to produce electrical energy.

Generation of Electrical Energy:



General way to produce electrical energy

Generation of Electrical Energy:

- The prime mover is driven by the energy obtained from various sources such as burning of fuel, pressure of water, force of wind etc.
- For example, chemical energy of a fuel (e.g., coal) can be used to produce steam at high temperature and pressure.
- The steam is fed to a prime mover which may be a steam engine or a steam turbine.
- The turbine converts heat energy of steam into mechanical energy which is further converted into electrical energy by the alternator.

Sources of Energy

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:

- The Sun. (Renewable energy)
- The Wind. (Renewable energy)
- Water. (Renewable energy)
- Fuels. (Classical energy)
- Nuclear energy. (Classical energy)

Sources of Energy

The Sun:

- The Sun is the primary source of energy.
- The heat energy radiated by the Sun can be focused 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.

Sources of Energy

The Sun:

- However, this method has limited application because:

-It requires a large area for the generation of even a small amount of electric power.

-It cannot be used in cloudy days or at night.

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.

The Wind:

- This method has the advantages that maintenance and generation costs are negligible.
- However, the drawbacks of this method are:

-Variable output.

-Unreliable because of uncertainty about wind pressure.

- Power generated is quite small.

Sources of Energy

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.

Sources of Energy

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.

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 tons of coal.
- The heat produced due to nuclear fission can be utilized to raise steam with suitable arrangements.

Nuclear energy:

- The steam can run the steam turbine which in turn can drive the alternator to produce electrical energy.
- However, there are some difficulties in the use of nuclear energy:

a- high cost of nuclear plant.

b- Problem of disposal of radioactive waste.

Structure of Electric Power System

- The function of a power station is to deliver power to a large number of consumers.
- However, the power demands of different consumers vary in accordance with their activities.
- The result of this variation in demand is that load on a power station is never constant, rather it varies from time to time.

- Unfortunately, electrical power cannot be stored and, therefore, the power station must produce power as and when demanded to meet the requirements of the consumers.
- The power demanded by the consumers is supplied by the power station through the transmission and distribution networks.
- As the consumers' load demand changes, the power supply by the power station changes accordingly.