COLLEGE OF ENGINEERING AND TECHNOLOGIES
ALMUSTAQBAL UNIVERSITY

Power Engineering

EET 305

Lecture 5

- Generating Stations II -

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Dr. Zaidoon AL-Shammari

Lecturer / Researcher

zaidoon.waleed@mustaqbal-college.edu.iq

Diesel Power Station

- A generating station in which diesel engine is used as the prime mover for the generation of electrical energy is known as diesel power station.
- In a diesel power station, diesel engine is used as the prime mover.
- The diesel burns inside the engine and the products of this combustion act as the “working fluid” to produce mechanical energy.

Diesel Power Station

- The diesel engine drives the alternator which converts mechanical energy into electrical energy.

- As the generation cost is considerable due to high price of diesel, therefore, such power stations are only used to produce small power.

Diesel Power Station

- Steam power stations and hydro-electric plants are used to generate bulk power at cheaper cost, yet diesel power stations are finding at places where demand of power is less.

- Diesel power plants are also used as standby sets for continuity of supply to important points such as hospitals, radio stations, houses and telephone exchanges.

Advantages

- It requires less space as compared with other power stations.
- It can be located at any place.
- It can be started quickly and can pick up load in a short time.
- It requires less quantity of water for cooling.
- The thermal efficiency of the plant is higher than that of a steam power station.
- It requires fewer operating staff.

Disadvantages

- The plant has high running charges as the fuel (i.e., diesel) used is costly.
- The plant does not work satisfactorily under overload conditions for a longer period.
- The plant can only generate small power.
- The cost of lubrication is generally high.
- The maintenance charges are generally high.

Nuclear Power Station

- A generating station in which nuclear energy is converted into electrical energy is known as a nuclear power station.

- In nuclear power station, Uranium (U235) is subjected to nuclear fission in a special apparatus known as a reactor.

Nuclear Power Station

- The heat energy thus released is utilized in raising steam at high temperature and pressure.
- The steam runs the steam turbine which converts steam energy into mechanical energy.
- The turbine drives the alternator which converts mechanical energy into electrical energy.

Nuclear Power Station

- The most important feature of a nuclear power station is that huge amount of electrical energy can be produced from a relatively small amount of nuclear fuel as compared to other conventional types of power stations.
- It has been found that complete fission of 1 kg of Uranium (U235) can produce as much energy as can be produced by the burning of 4,500 tons of high-grade coal.

Advantages

- The amount of fuel required is small but it is used for producing bulk electrical energy which is considered economical.
- A nuclear power plant requires less space as compared to any other type of the same size.
- It can be located near the load centers because it does not require large quantities of water and no need to be near coal mines.
- It ensures reliability of operation.

Disadvantages

- The erection and commissioning of the plant requires greater technical know-how.
- The fission by-products are generally radioactive and may cause a dangerous amount of radioactive pollution.
- Maintenance charges are high due to lack of standardization.
- Nuclear power plants are not well suited for varying loads as the reactor does not respond to the load fluctuations efficiently.

Selection of Site for Nuclear Power Station

- Availability of water.
- Disposal of waste.
- Distance from populated areas.
- Transportation facilities.

Gas Turbine Power Plant

- A generating station which employs gas turbine as the prime mover for the generation of electrical energy is known as a gas turbine power plant.
- In a gas turbine power plant, air is used as the working fluid.
- The air is compressed by the compressor and is led to the combustion chamber where heat is added to air, thus raising its temperature.

Gas Turbine Power Plant

- Heat is added to the compressed air either by burning fuel in the chamber or by the use of air heaters.
- The hot and high pressure air from the combustion chamber is then passed to the gas turbine where it expands and does the mechanical work.
- The gas turbine drives the alternator which converts mechanical energy into electrical energy.

- It may be mentioned here that compressor, gas turbine and the alternator are mounted on the same shaft so that a part of mechanical power of the turbine can be utilized for the operation of the compressor.
- Gas turbine power plants are being used as standby plants for hydro-electric stations, as a starting plant for driving auxiliaries in power plants etc.

Advantages

- It is simple in design as compared to steam power station since no boilers and their auxiliaries are required.

- It is much smaller in size as compared to steam power station of the same capacity. This is expected since gas turbine power plant does not require boiler, feed water arrangement etc.

Advantages

- The initial and operating costs are much lower than that of equivalent steam power station.
- It requires comparatively less water as no condenser is used.
- The maintenance charges are quite small.

Advantages

- Gas turbines are much simpler in construction and operation than steam turbines.
- It can be started quickly form cold conditions.
- There are no standby losses. However, in a steam power station, these losses occur because boiler is kept in operation even when the steam turbine is supplying no load.

Disadvantages

- There is a problem for starting the unit.
  - It is because before starting the turbine, the compressor has to be operated for which power is required from some external source.
  - However, once the unit starts, the external power is not needed as the turbine itself supplies the necessary power to the compressor.

Disadvantages

- Since a greater part of power developed by the turbine is used in driving the compressor, the net output is low.
- The overall efficiency of such plants is low (about 20%) because the exhaust gases from the turbine contain sufficient heat.
- The temperature of combustion chamber is quite high (3000oF) so that its life is comparatively reduced.