NUCLEAR POWER PLANT

A nuclear power plant is very similar to a conventional steam power plant except for the furnace. The nuclear reactor becomes the furnace in this case.

It has been estimated that complete fission of 1 kg of uranium produces heat energy equivalent to 4500 tons of coal or 1700 tons of oil.

Some of the important commercial reactors commonly used for power generation are given below:

1. Boiling water reactor (BWR)

2. Pressurized water reactor (PWR)

3. Gas cooled reactor (GCR)

Boiling Water Reactor

A simple boiling water reactor is shown in Fig. 17.2.

Due to nuclear fission of the fuel uranium, large amount of heat is produced.

The nuclear reaction and thereby the temperature is controlled by moderators.

The coolant used here is water which absorbs the heat produced in the reactor. Water evaporates and steam is generated in the reactor itself.

In this type of power plant. there is no need for a separate boiler.

The steam produced in the reactor is used to run the turbine coupled with a generator from which we get the electrical power.

The steam after expansion i the turbine is condensed in the condenser. The condensate after getting heated in several feed water heaters is pumped again into the reactor by means of feed pump.

In the reactor, the thermal shielding reduces the heat loss and th thick concrete shielding prevents external radiation.

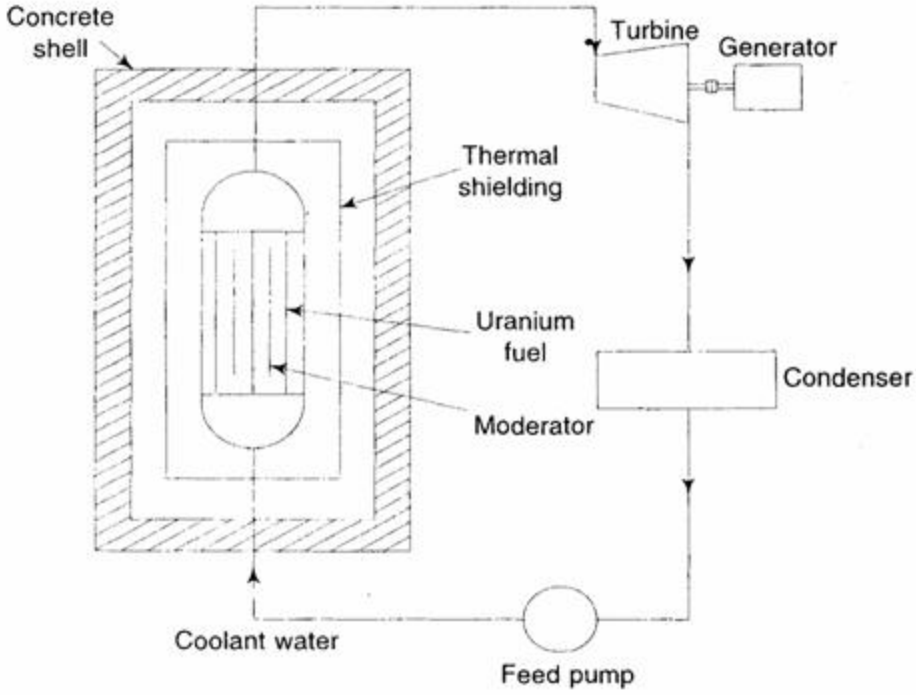

Fig. 17.2 *Boiling water reactor*

17.4.2 Pressurised Water Reactor (PWR)

The schematic diagram of a pressurised water reactor is shown in Fig. 17.2(a). It is also a water cooled reactor. The system has primary and secondary loops.

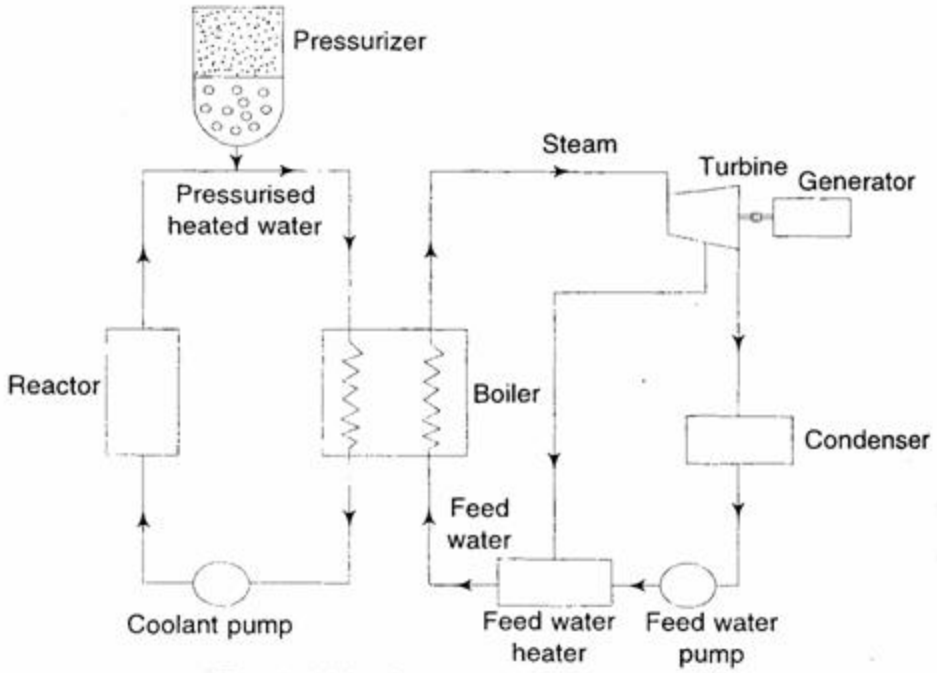

Fig. 17.2(a) *Pressurised water reactor*

In the primary loop, the pressuriser maintains a high pressure in the water in the range of 150 bar. Due to the high pressure of water in the reactor, the water does not boil.

The coolant gets heated in the reactor and the hot water goes to the boiler and transfers the heat to the feed water in the boiler in the secondary loop.

The feed water evaporates and becomes steam and runs a turbo generator from which power is obtained. Functions of various parts of the reactor are the same as those of a boiling water reactor.

Gas Cooled Reactor

The schematic diagram of a gas cooled reactor is shown in Fig. 17.2(b).

In this, gas CO is employed as coolant and the heat carried by the gas from the reactor is either used for steam generation in the secondary circuit like pressurized
water reactor or is directly used as the working fluid in a gas turbine plant. Usually the gas used is CO and graphite is the moderator.

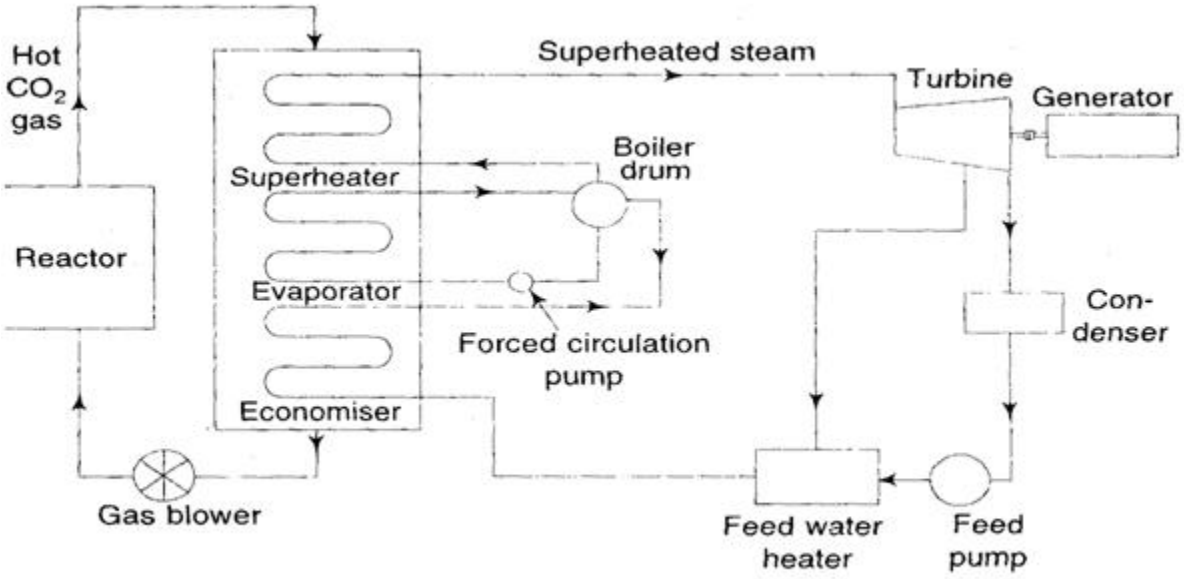

Fig. 17.2(b) *Gas cooled reactor*

C O gas gets heated in the reactor and loses its heat to the superheater, evaporator and economiser tubes in the secondary loop.

The cooled gas is recirculated again in the primary loop by means of a gas blower. The superheat ed steam is expanded in the turbine to run the generator to produce electrical power.

Advantages of a Nuclear Power Plant

1. Very large amount of heat is liberated by a very small quantity of fuel

2. Suitable for large power generation

3. Cost of fuel transportation and storage is less.

Disadvantages

1.Installation cost is very high.

2. Availability of nuclear fuel is scarce and cost is high.

3. Large number of trained and qualified personnel are required to oper ate the plant.

4. Maintenance cost is higher.

5. We have the problems involved in waste disposal and also the risk of radiation hazards.

Source : http://mediatoget.blogspot.in/2011/10/nuclear-power-plant.html