COMPONENTS OF HYDRO POWER PLANT

The main components of the hydro electric power plant are described below

Water reservoir:

It is the area near the dam, where large quantity of water is collected during rainy seasons.

Dam:

Dam is the huge walls erected over water reservoir to store water and maintain the required level of water. The level of water in the dam is known as *Head race.*

When the level of water in the dam is much higher, spillway is used to di we water to other areas. Spillway prevents damage to the dam.

Gate:

It controls and regulates flow of water to the penstock. It is the portion carries water from reservoir to surge tank.

Surge Tank:

It is a pressure compensator, When the load in the turbine is decreased, water rushes backwards in the penstock with turbulence increasing the pressure which is called water hammer. Now, the level of water in the surge tank rises and the water pressure in the penstock becomes normal. Thus the damage to the penstock is avoided by Surge Tank.

Penstock: It is the long pipe carrying water from the dam to the turbine.

Inlet Valve: It controls the quantity of water that flows to the turbine. The valve may be opened widely to permit more water to the turbine during peak load periods. The valve may be closed enough to permit less water to the turbine during reduced load periods.

Turbine: It is a disc mounted on a shaft, with a number of blades fitted on its periphery. Water from penstock strikes the turbine blades and momentum of water is transferred to the turbine shaft.

Generator: The generator is directly connected to the shaft of the turbine to produce electricity.

Draft Tube: It is connected to the exit of the turbine. It helps to place the turbine at any height above the ground.

Tail Race: It is the region of water at the draft tube. The level of water in the tail race is known as the tail race level.

Transformer: It steps up or increases the voltage produced by the generator.

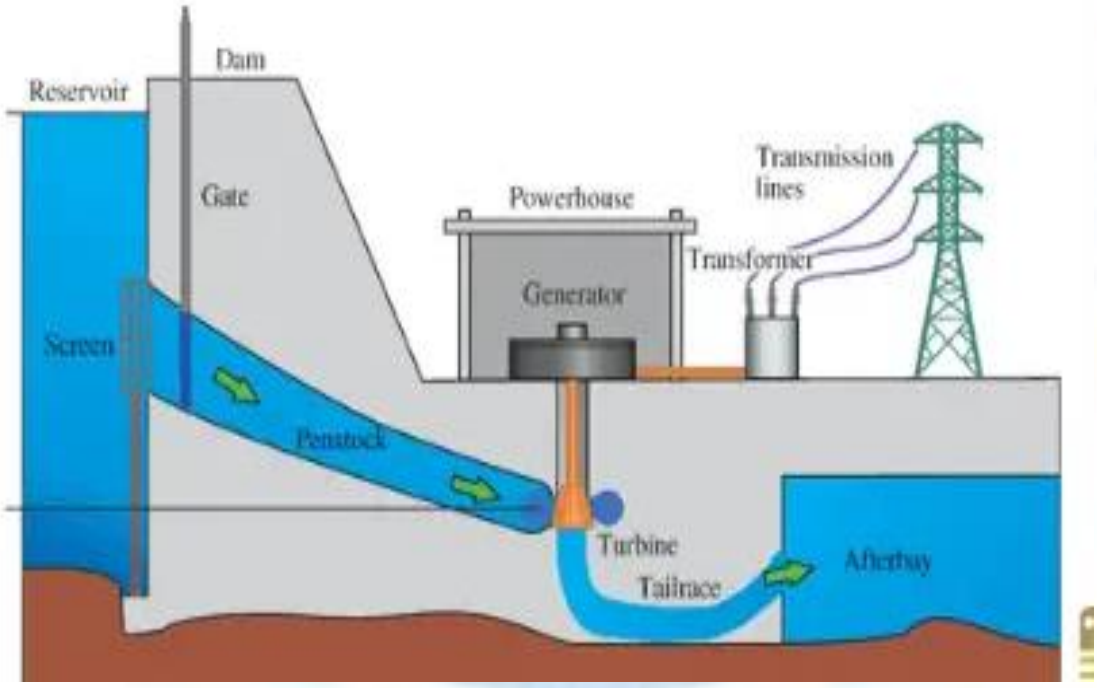

Fig- Hydro power plant (Online sources)

ADVANTAGES OF HYDRO-ELECTRIC POWER PLANT

1. Water is a renewable source of energy.
2. Water is the cheapest source of energy, because it exits as a free gift of nature.
3. There is no ash disposal problem as in the case of thermal power plant
4. Hydro-plant does not pose the problem of air pollution as in the case of thermal power plant or radiation hazards as in the case of nuclear plant.
5. Variable loads do not affect the efficiency in the case of a hydro-plant

6. Life of hydro-plant is very long (a few centuries) compared with thermal plant (a few decades). This is because the hydro-plants operate at atmospheric temperature, whereas thermal plants operate at very high temperatures (about 500- to 800°C).
7. Hydro-plant provides additional benefits like irrigation, flood control, fishery and recreation.
8. The water storage of hydro-plant can also be used for domestic water supply
9. Auxiliaries needed for hydro-plant are less compared to thermal plant of equal capacity.
10. It requires less supervising staff.
11. Maintenance cost is low.

DISADVANTAGES OF HYDRO-ELECTRIC POWER PLANT

1. Hydro-plants are situated away from the load centres. Hence, long transmission lines are required for delivery of power. This increases the cost of transmission lines and also transmission losses, But, a thermal plant can be located near the load center, thereby the transmission cost and transmission losses are reduced.
2. The power produced by hydro-plant depends upon the quantity of water which in turn is dependent upon the rainfall. The dry year affects the hydro-power generation considerably.
3. Initial cost of the plant is high.
4. Erection of hydro-plant (construction of dam, etc.) usually takes long period of time.

Working principle of Nuclear Power plant

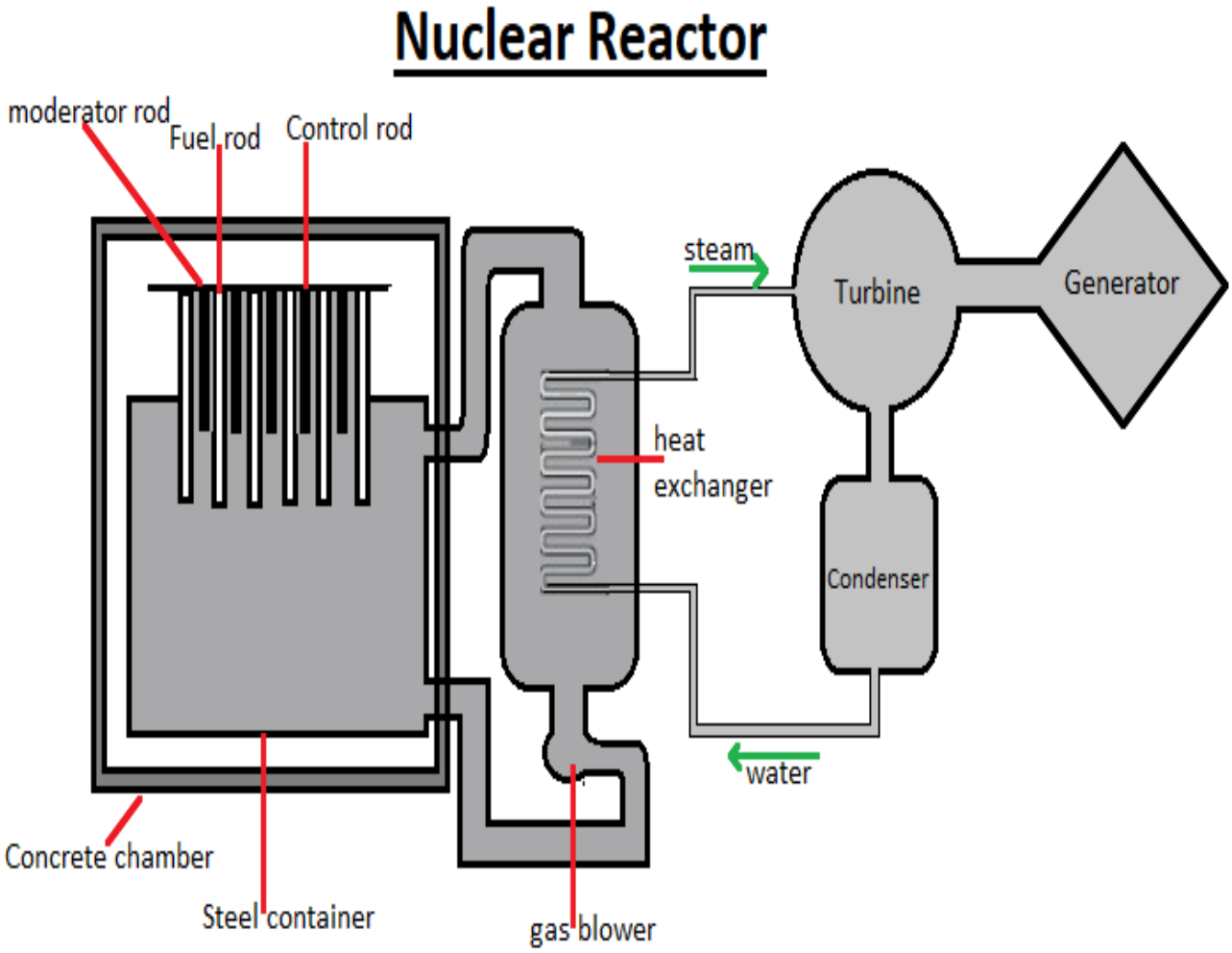

Fig- Nuclear power plant (Online sources)

A nuclear power plant generates electricity by harnessing the heat produced from nuclear fission reactions.

Components of a Nuclear Power Plant:

1. **Nuclear Reactor:**

   The core of the nuclear power plant contains the nuclear reactor where nuclear fission reactions take place.

   Fission of uranium or plutonium nuclei releases a large amount of heat.

2. **Fuel Rods:**

   Fuel rods inside the reactor contain fuel pellets made of enriched uranium or plutonium.

   These rods sustain the nuclear fission reactions.

3. **Control Rods:**

   Control rods made of materials like boron or cadmium are used to control the rate of fission reactions.

   Inserting or withdrawing control rods adjusts the reactor's power output.

4. **Coolant**

   The coolant, often water, circulates through the reactor to absorb heat generated during fission.

   It transfers the heat to a steam generator.

5. **Steam Generator:**

   The steam generator produces steam by transferring heat from the coolant.

   The high-pressure steam is used to drive a turbine.

6. **Turbine**

   The steam from the generator is directed to a turbine.

   The turbine converts the thermal energy of steam into mechanical energy.

7. **Generator:**

   The turbine is connected to an electric generator.

   The generator converts the mechanical energy into electrical energy through electromagnetic induction.

8. **Condenser:**

   After passing through the turbine, the steam is condensed back into water in the condenser.

   Heat is transferred to a cooling medium (usually water), turning the steam back into a liquid.

9. **Cooling System:**

The cooling system releases excess heat from the condenser into the environment, often using cooling towers or natural bodies of water.

Working Steps:

1. **Nuclear Fission:**

   Nuclear fission reactions occur in the reactor core, releasing a significant amount of heat.

2. **Control of Reactions:**

   Control rods are used to regulate the rate of fission reactions and control the power output of the reactor.

3. **Heat Transfer:**

   Heat produced by fission reactions is transferred to the coolant circulating through the reactor.

4. **Steam Generation:**

   The coolant transfers heat to the steam generator, producing high-pressure steam.

5. **Turbine Operation:**

   The high-pressure steam is directed to the turbine, causing it to rotate.

6. **Electricity Generation:**

   The rotating turbine is connected to a generator, producing electrical energy.

7. **Condensation:**

   The steam leaving the turbine enters the condenser, where it is condensed back into water.

8. **Cooling and Reuse:**

   Excess heat is released through the cooling system, and the condensed water is returned to the reactor for reuse.

ADVANTAGES OF NUCLEAR POWER PLANT

1. Nuclear power plant can be easily adopted where water and coal resources are not available.
2. It requires very small quantity of fuel. Hence fuel transportation cost is less
3. Space requirement is less compared to other power plants of equal capacity.
4. It is not affected by adverse weather conditions
5. Fuel storage facilities are not needed as in the case of the thermal power plant
6. Nuclear plants will conserve the fossil fuels (coal, petroleum) for other energy
7. needs.
8. Number of workmen required at nuclear plant is far less than thermal plant

9. It does not require large quantity of water

DISADVANTAGES OF NUCLEAR POWER PLANT

1. Radio-active wastes, if not disposed very carefully, have adverse effect on the health of workmen and the population surrounding the plant.
2. Nuclear plant is not suited for varying load conditions
3. It requires well-trained personnel.
4. It requires high initial cost compared to hydro or thermal power plants