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HYDRO- ELECTRIC POWER PLANT

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INTRODUCTION

- Hydroelectric power (hydropower) systems convert the kinetic energy in flowing water into electric energy.
- Falling or flowing water turns a propeller like piece called a turbine.
- The turbine turns a metal shaft in an electric generator which produces electrictiy.
- The first hydropower was set up in 1897 at Darjeeling of 200KW capacity
- the first major hydro-electric power plant was commissioned in 1902 of 4.5 MW capacity of sivasamudram scheme in mysore.
- The amount of electricity that can be generated by a hydropower plant depends on two factors.
- flow rate - the quantity of water flowing in a given time; and
- head - the height from which the water falls.
- The greater the flow and head, the more electricity produced.

Flow Rate = the quantity of water flowing
Head = the height from which water falls

Advantages

- No fuel required
- The plants are more reliable
- The life expectancy is higher
- High efficiency over wide range of loads
- Less supervising staff
- No air pollution

- Can easily work during high peak daily loads
- Prevents floods

Disadvantages

- Disrupts the aquatic ecosystems
- Disruption of surrounding areas
- Requires large areas
- Large scale human displacement

How a Hydroelectric Power System Works?

Flowing water is directed at a turbine.

The flowing water causes the turbine to rotate, converting the water's kinetic energy into mechanical energy.

The mechanical energy produced by the turbine is converted into electric energy using a turbine generator.

Inside the generator, the shaft of the turbine spins a magnet inside coils of copper wire.
It is a fact of nature that moving a magnet near a conductor causes an electric current.

Selection of site for hydroelectric

- Quantity of water available and method of storage
- Availability of head and storage capacity
- Distance of power station site from power demand center
- Details of soil bearing capacity and rocky foundations conditions
- Access to site for men and material
- Cost of project and the period required for completion
- Free from earthquake damage
- Free from mineral deposits of harmful nature

Hydro Scheme

Reservoir Plants: A reservoir plant is that which has reservoir of such size as to permit carrying over storage from wet season to the next dry season.

Low head plants: In this case small dam is built across the river to provide the necessary head. In such plants Francis type of turbines are used.

Medium head plants: The fore bay provided at the beginning of Penstock serves as water reservoir for such plants. In these plants water is generally carried out in open canals from reservoir to the Fore bay and then to the penstock.

High head Plant: This plants works above 500mtrs and Pelton wheel turbines are commonly used. In this plant water is carried out from the main reservoir by a tunnel up to surge tank and then from the surge tank to the power house in penstock.

Low head plants

In this case a small dam is built across the river to provide the necessary head.
The excess water is allowed to flow over the dam itself.

In such plants Francis, Propeller or Kaplan types of turbines are used.
Also no surge tank is required.

These plants are constructed where the water head available less then 30mtrs.
The production of electricity will be less due to low head.

No surge tanks is used as the plant is located near the dam itself

Medium head plants

Mainly forebay provided before the Penstock, acts as water reservoir for medium head plants. In this plants mainly water is carried through main reservoir to forebay and then to the penstock.

The forebay acts as surge tank for these plants.

The turbines used will be Francis type of the steel encased variety**.**

High head plants

Mainly in these plants pressure tunnel is provided before the surge tank, which inturn connected to penstock.

A pressure tunnel is taken off from the reservoir and water brought to the valve house at the start of the penstocks.

The penstocks are huge steel pipes which take large quantity of water from the valve house to the power house.

Components of hydel scheme

The principal components are

RESERVOIR

Tank

GATE Valve

PENSTOCKS

TURBINES

POWER HOUSE

Reservoir - a reservoir is provided to store water during rainy season and supplies the same in dry season. The water from the resevoir is used to run the hydraulic turbine

Tank – Its function is to provide working head of water for power plant and to increase the storage capacity of reservoir**.**

Penstocks

- open or closed conduits which carry water to the turbines.
- made of reinforced concrete or steel. Concrete penstocks are suitable for low heads less then 30mtrs.
- steel penstocks are designed for any head.
- thickness of penstocks increases with head or water pressure
- penstocks gates are fixed to initial of penstocks, and flow of water is controlled by operating penstock gates**.**
- Since the runner is spinning, the force acts through a distance n this way, energy is transferred from the water flow to the turbine.
- The principal types of turbines are:

1) Impulse turbine
2) Reaction Turbine

Turbines

- turbines are used to convert the energy water of falling water into mechanical energy.
- water turbine is a rotary engine that takes energy from moving water.
- flowing water is directed on to the blades of a turbine runner, creating a force on the blades**.**

Power house

Power house contains the electro mechanical equipment i.e. hydro power turbine, Generator, excitation system, main inlet valves, transformers, Switchyard, DC systems, governor, bus duct, step up transformers, step down transformers, high voltages switch gears, control metering for protection of systems.

Application

- Its use in power supply for home appliances
- Its use in such has samall farm