# POWER POINT PRESENTATION
# ON
# ELECTRICAL POWER GENERATION SYSTEMS

**IV Semester (IARE-R18)**

**Prepared By**

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# MODULE-I

## CONVENTIONAL POWER GENERATION SYSTEMS

# Introduction

- Electricity is one of the most important infrastructural facilities of modern civilization. The 1st power generation in this planet took place in the United States of America and United Kingdom almost at the same time. In 1882 T.A. Edison inaugurated.
- The first Central Generating Station in New York, the USA. At the same time, The Halborn Viaduct Generating Station was developed in London, the United Kingdom.
- The journey of power generation in (West) Bengal as well as in India started in 1887 by the then British Government with the commissioning of 130 Kilo Watt (K.W.) hydel power generating station at Sidrapong in Darjeeling.

- But thermal power in and around Calcutta in the Gangetic Bengal, flourished because of easy availability of coal from the nearby plateau region, comparatively low cost of production and high industrial demand.

- The generation of thermal power was started in British India by a private company named Calcutta Electricity Supply Corporation, but after the independence, both public and private companies have taken the responsibility of spreading electricity throughout the country.

# Introduction to Thermal Power Plant

- Today we will, in the main, discuss how electrical power is produced from say, heat source and heat source that will take, will be in the context of India is mainly coal.
- Though there are quite a few these days, electrical power plants, they run on gas, natural gas.
- So, the point is that if there is a heat source and you are trying to produce electricity, what is the most convenient and efficient way of producing electricity out of the heat source?
- The most convenient way is to first heat up water, so that becomes steam, run a turbine and after it goes out of the turbine, then you cool it back into liquid form and put it back into the boiler that is the essential thing.
- So, the essential things should be - one, there has to be a boiler.

- There has to be a turbine, then there has to be a condenser and you put it back to the boiler. So, this is the essential thing.
- So, the boiler is at high pressure, high temperature; condenser is at low pressure low temperature.
- So, in order to put the water from the condenser into the boiler, you need to have a pump, because you are putting something from low pressure to high pressure.
- Now, when you do so, it is not difficult to see that there is a high pressure here, there is a low pressure here and turbine is extracting the energy by allowing it to expand from the high pressure to the low pressure and pump is something that is doing the opposite work.

## Line diagram of Thermal power Station

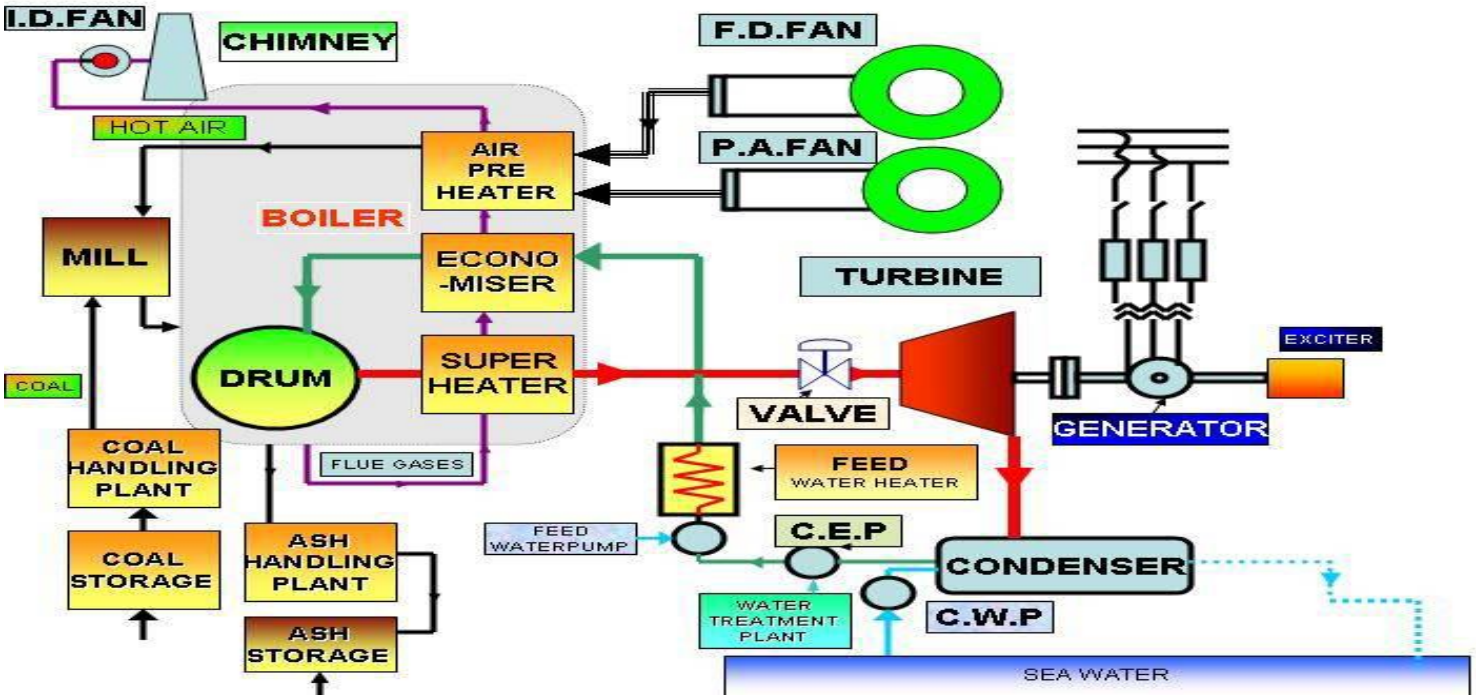



Fig: schematic diagram of Thermal Power Plant

# Major Components of a Thermal Power

- Coal Handling Plant
- Pulverizing Plant
- Draft or Draught fan
- Boiler
- Ash Handling Plant
- Turbine and Generator
- Condenser
- Cooling Tower And Ponds
- Feed Water Heater
- Economiser
- Super heater and Reheater
- Air pre heater
- Alternator with Exciter

# Nuclear Power Plant

**Introduction to Nuclear power station:**

- Many power plants, including nuclear power plants, heat water to produce electricity.

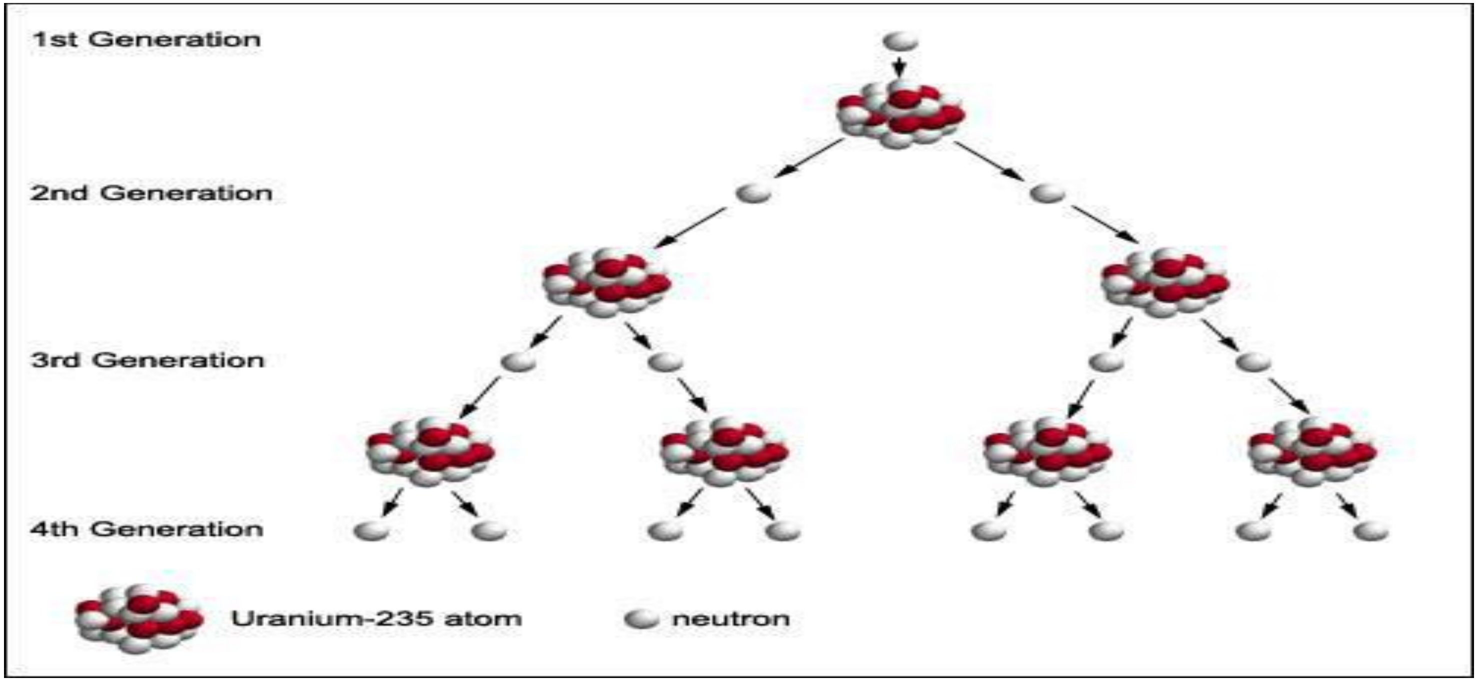
- These power plants use steam from heated water to spin large turbines that generate electricity.
- Nuclear power plants use heat produced during nuclear fission to heat water.
- In nuclear fission, atoms are split apart to form smaller atoms, releasing energy

- Fission takes place inside the reactor of a nuclear power plant.
- At the center of the reactor is the core, which contains uranium fuel.
- The uranium fuel is formed into ceramic pellets. Each ceramic pellet produces roughly the same amount of energy as 150 gallons of oil.
- These energy-rich pellets are stacked end to end in 12-foot metal fuel rods.
- A bundle of fuel rods, sometimes hundreds, is called a fuel assembly

# Nuclear Fission, Nuclear Fusion and Chain reaction

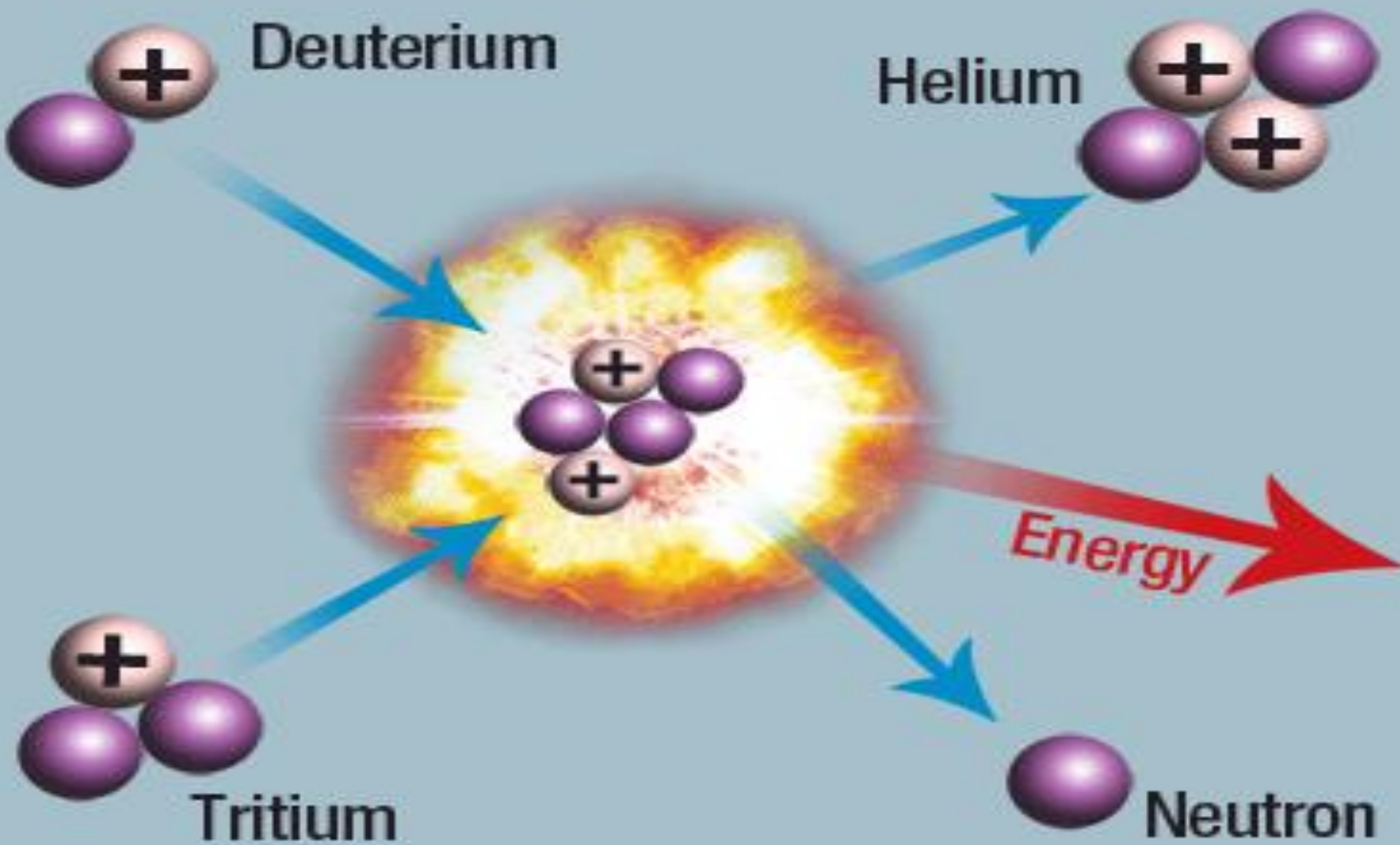
## Nuclear Fission:

Nuclear fission is the reaction by which a heavy nucleus (that is one with a high value of Z) is hit with a small particle, as a result of which it splits into two (occasionally more) smaller nuclei.

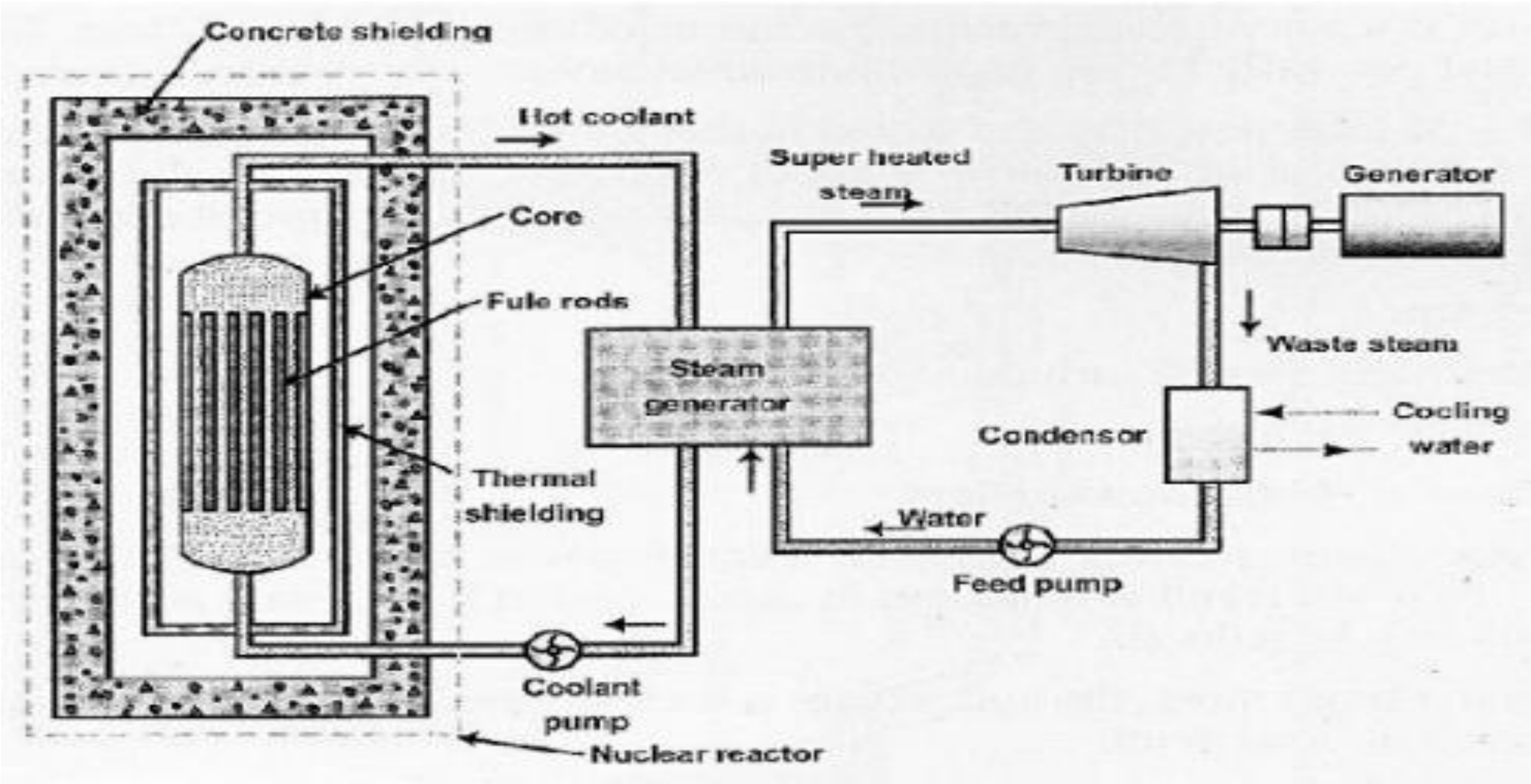


**Nuclear Fusion:**

Fusion is the opposite of fission, it is the joining together of two light nuclei to form a heavier one (plus a small fragment). For example if two 2H nuclei (two deuterons) can be made to come together they can form He and a neutron.


Deuterium
Helium
Energy
Tritium
Neutron

# Layout of Nuclear Power Plant


Concrete shielding
Hot coolant
Super heated
steam
Turbine
Generator
Core
Fule rods
Steam
generator
Waste steam
Cooling
water
Condensor
Thermal
shielding
Water
Feed pump
Coolant
pump
Nuclear reactor

**Main components:**

**The core:**

- of the reactor contains all of the nuclear fuel and generates all of the heat.
- It contains low-enriched uranium (<5% U-235), control systems, and structural materials.
- The core can contain hundreds of thousands of individual fuel pins.

**The coolant**

- Coolant is the material that passes through the core, transferring the heat from the fuel to a turbine.
- It could be water, heavy-water, liquid sodium, helium, or something else.
- In the US fleet of power reactors, water is the standard.

**The turbine:**

- Turbine transfers the heat from the coolant to electricity, just like in a fossil-fuel plant.

**The containment:**

- Containment is the structure that separates the reactor from the environment.
- These are usually dome-shaped, made of high-density, steel-reinforced concrete. Chernobyl did not have a containment to speak of.

Types of Nuclear Power Plant

**Types of nuclear power plants:**

- Pressurized water reactor (PWR)
- Boiling water reactor (BWR)
- Natural uranium reactor, gas-graphite (GCR)
- Advanced Gas Reactor (AGR)
- Gas-cooled reactor at elevated temperature (HTGCR)
- Heavy water reactor (HWR)
- Fast breeder reactor (FBR)

**Pressurized Water Reactor (PWR):**

- The most widely used reactor type in the world is the Pressurized Water Reactor (PWR)
- which uses enriched (about 3.2% U235) uranium dioxide as a fuel in zirconium alloy cans.
- The fuel, which is arranged in arrays of fuel "pins" and interspersed with the movable
- control rods, is held in a steel vessel through which water at high pressure (to suppress boiling) is pumped to act as both a coolant and a moderator.

**Boiling Water Reactors (BWR):**

- The second type of water cooled and moderated reactor does away with the steam generator and, by allowing the water within the reactor circuit to boil, it raises steam directly for electrical power generation.
- Such reactors, known as Boiling Water Reactors (BWRs), throughout the world.
- This, however, leads to some radioactive contamination of the steam circuit and turbine,
- which then requires shielding of these components in addition to that surrounding the reactor.

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# Comparison of PWR and BWR

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# MODULE-II

# HYDROELECTRIC POWER STATIONS

# Introduction to Hydro Power Plant

- The energy prospects are not looking bright with fossil-based sources of energy such as coal, oil and natural gas.
- This gloom prospect in conjunction with the ever expanding global population and the fast industrialization of third world economies leaves humans in grave danger of lack of energy in the future.
- If the current events continue unabated, there won't be sufficient power to cater to humanity's daily needs

- Hydropower is energy generated by harnessing the natural force of water (kinetic energy).
- The energy is harnessed by hydroelectric systems and converted into electricity using a turbine and a generator.
- Hydropower is classified as a renewable source of energy because water supply is constantly replenished by the sun.
- This means that it is a never-ending resource.

**Layout of Hydro Electric Power Plant:**

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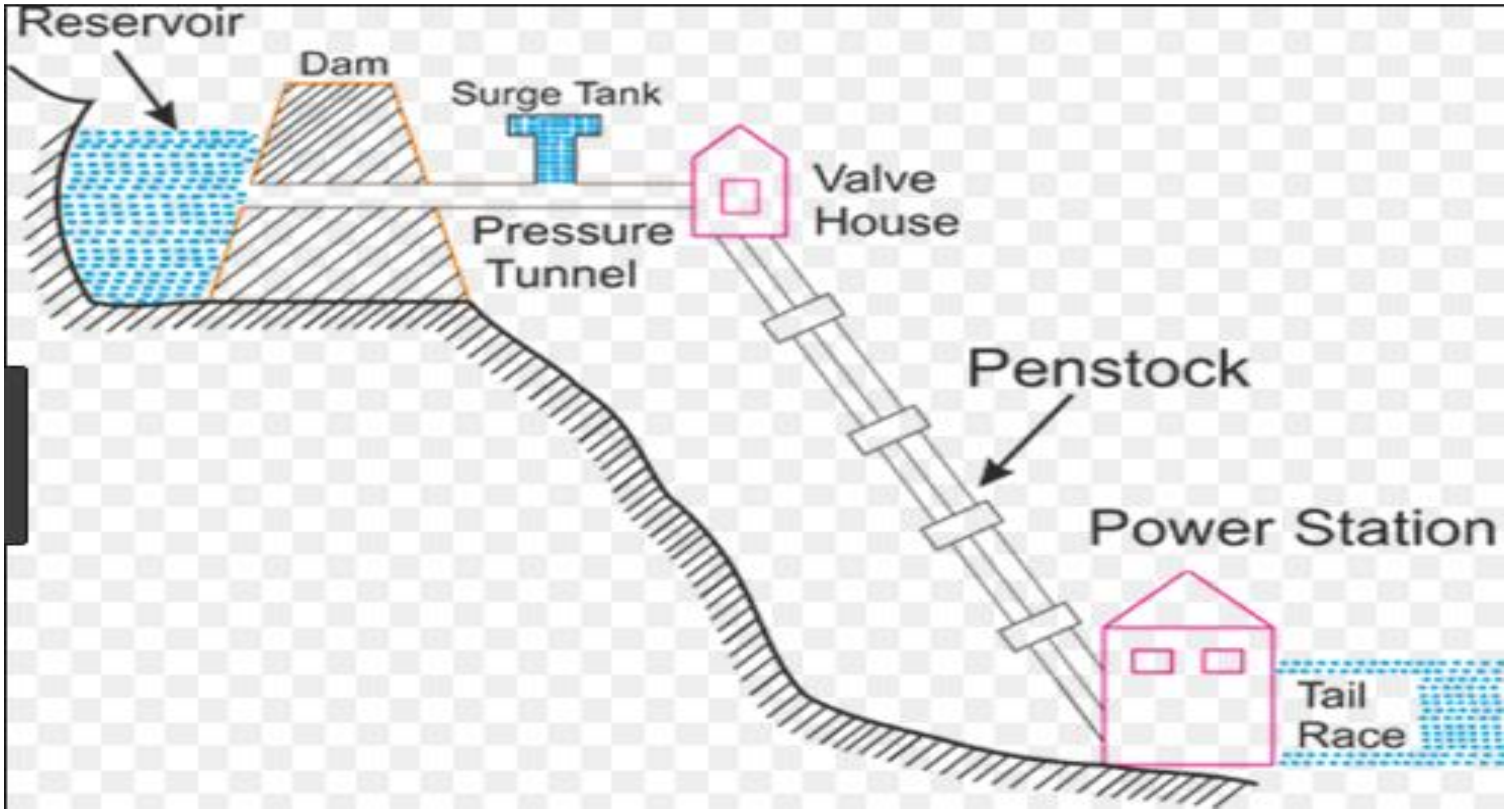
Layout of Hydro Electric Power Plant:



## Dam and Reservoir:

- The dam is constructed on a large river in hilly areas to ensure sufficient water storage at height.
- The dam forms a large reservoir behind it.
- The height of water level (called as water head) in the reservoir determines how much of potential energy is stored in it.

**Control Gate:**

- Water from the reservoir is allowed to flow through the penstock t the turbine.
- The amount of water which is to be released in the penstock can b controlled by a control gate.
- When the control gate is fully opened, maximum amount of wate is released through the penstock.

## Working Of Hydroelectric Power Plants

- In hydroelectric power station the kinetic energy developed due to gravity in a falling water from higher to lower head is utilised to rotate a turbine to produce electricity.
- The potential energy stored in the water at upper water level will release as kinetic energy when it falls to the lower water level.
- This turbine rotates when the following water strikes the turbine blades.
- To achieve a head difference of water hydroelectric electric power station are generally constructed in hilly areas.

- In the way of the river in hilly areas, an artificial dam is constructed to create required water head.
- From this dam water is allowed to fall toward downstream in a controlled way to turbine blades.
- As a result, the turbine rotates due to the water force applied to its blades and hence the alternator rotates since the turbine shaft is coupled with alternator shaft.

# Types Of Hydroelectric Power Plants

**According to water flow regulation:**

- 1. Runoff river plants without pondage
- 2. Runoff river plants with pondage
- 3. Hydroelectric plants with storage reservoir

**According to Load:**

- 1. Base load plants
- 2. Peak load plants
- 3. Pumped storage plants

**According to head:**

- 1. High head plants (>100m)
- 2. Medium head plants (30-100 m)
- 3. Low head plants (<30 m)

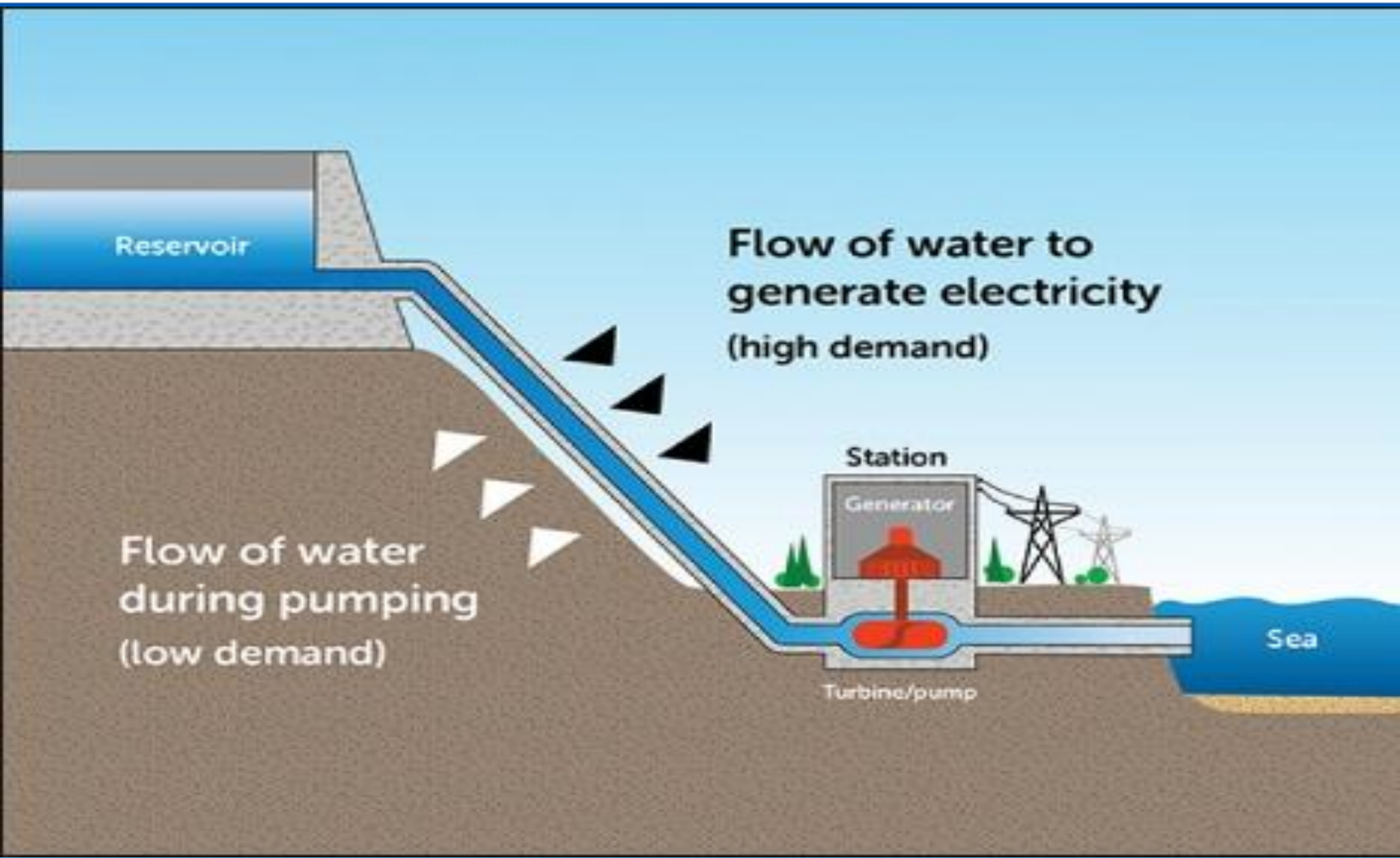
**Conventional Plants:**

- Conventional plants use potential energy from dammed water.
- The energy extracted depends on the volume and head of the water.
- The difference between height of water level in the reservoir and the water outflow level is called as water head.

# Pumped Storage Power Plants

- In pumped storage plant, a second reservoir is constructed near the water outflow from the turbine.
- When the demand of electricity is low, the water from lower reservoir is pumped into the upper (main) reservoir.
- This is to ensure sufficient amount of water available in the main reservoir to fulfill the peak loads.

# Pumped Storage Power Plants



**Purpose of Pumped Storage Hydropower Plants:**

- This type of plants combined with steam power stations reduces the power load fluctuations to narrow limits.
- In some cases, the storage plant consists of pump and motor with no turbines.
- The pump increases the head in the feeder reservoir of a separate hydro-electric plant while motor improves the power factor in the electric supply network.
- Combined with hydro-electric power plants, it can take charge of daily peak load and seasonal variations of water.

**Reversible Turbine Hydro Power Plants:**

- In this type of hydropower plants, Francis turbines which are just a reverse of centrifugal pump functions in one direction as a motor driven pump and in the reverse direction as turbine.
- The efficiencies of pumping and generating processes have been found to exceed 65%.
- As the specific speed of a pump is greater than that of a geometrically similar turbines, two different rotational speeds are necessary for the two machines, if the best efficiency is to be obtained in each direction of rotation.
- The same speed is possibly only with some sacrifice of efficiency

# Pumped Storage Power Plants

**Underground Hydropower Plants:**

- The underground hydropower plants are constructed below the upper level of water. These are low head plants.
- This type of installation consists of a weir across the river to be harnessed and housing the power plants within the weir.
- The head race is connected to the tail race by a straight passage in which the tubular or bulb turbines operate.
- The turbine is connected to the generator by a horizontal or an inclined shaft depending on convenience.

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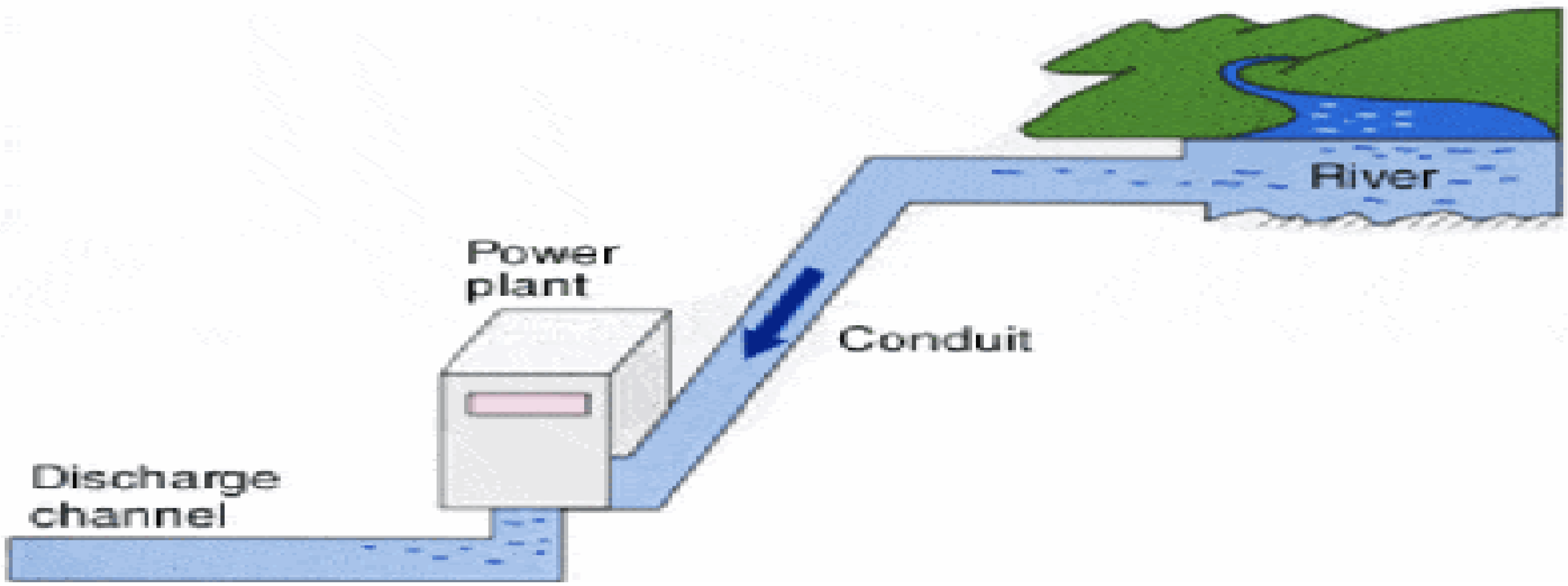
# Underground Hydropower Plants



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## MODULE-III

# SOLAR ENERGY

**Introduction to Solar Energy:**

- Solar energy is an important, clean, cheap and abundantly available renewable energy.
- It is received on Earth in cyclic, intermittent and dilute form with very low power density 0 to 1 kW/m2.Solar energy received on the ground level is affected by atmospheric clarity, degree of latitude, etc.
- For design purpose, the variation of available solar power, the optimum tilt angle of solar flat plate collectors, the location and orientation of the
- heliostats should be calculated.

**Units of solar power and solar energy:**

- In SI units, energy is expressed in Joule. Other units are angley and Calorie where
- 1 angley = 1 Cal/cm2.day
- 1 Cal = 4.186 J
- For solar energy calculations, the energy is measured as an hourly or monthly or yearly average and is expressed in terms of kJ/m2/day or kJ/m2/hour. Solar power is expressed in terms of W/m2 or kW/m2.

## Solar constant and solar radiation on tilted surface

**Solar constant**:

- The total radiation energy received from the Sun per unit of time per unit of area on a theoretical surface perpendicular to the Sun's rays and at Earth's mean distance from the Sun.
- It is most accurately measured from satellites where atmospheric effects are absent.
- The value of the constant is approximately 1.366 kilowatts per square meter.
- The "constant" is fairly constant, increasing by only 0.2 percent at the peak of each 11-year solar cycle .

**solar radiation on tilted surface:**

- The power incident on a PV module depends not only on the power contained in the sunlight, but also on the angle between the module and the sun.
- When the absorbing surface and the sunlight are perpendicular to each other, the power density on the surface is equal to that of the sunlight (in other words, the power density will always be at its maximum when the PV module is perpendicular to the sun).
- However, as the angle between the sun and a fixed surface is continually changing, the power density on a fixed PV module is less than that of the incident sunlight.

**Essential subsystems in a solar energy plant:**

1. **Solar collector or concentrator:** It receives solar rays and collects the energy. It may be of following types:

a) Flat plate type without focusing

b) Parabolic trough type with line focusing

c) Paraboloid dish with central focusing

d) Fresnel lens with centre focusing

e) Heliostats with centre receiver focusing

2. **Energy transport medium:** Substances such as water/ steam, liquid metal or gas are used to

- transport the thermal energy from the collector to the heat exchanger or thermal storage.
- In solar PV systems energy transport occurs in electrical form.

3. **Energy storage:** Solar energy is not available continuously. So we need an energy storage medium for maintaining power supply during nights or cloudy periods.

**There are three major types of energy:**

storage: a) Thermal energy storage; b) Battery storage; c) Pumped storage hydro-electric

**Solar thermal energy (STE)**

**Solar thermal energy (STE):**

- Solar thermal energy (STE) is a form of energy and a technology for harnessing solar energy to generate thermal energy or electrical energy for use in industry, and in the residential and commercial sectors.
- The first installation of solar thermal energy equipment occurred in the Sahara Desert approximately in 1910 when a steam engine was run on steam produced by sunlight.
- Because liquid fuel engines were developed and found more convenient, the Sahara project was abandoned, only to be revisited several decades late.

- Solar thermal collectors are classified by the United States Energy Information Administration as low, medium, or high-temperature collectors.
- Low-temperature collectors are flat plates generally used to heat swimming pools.
- Medium-temperature collectors are also usually flat plates but are used for heating water or air for residential and commercial use.

## Flat plate collector

**Flat plate collector:**

- Flat plate collector absorbs both beam and diffuse components of radiant energy.
- The absorber plate is a specially treated blackened metal surface.
- Sun rays striking the absorber plate are absorbed causing rise of temperature of transport fluid.
- Thermal insulation behind the absorber plate and transparent cover sheets (glass or plastic) prevent loss of heat to surroundings.

**Applications of flat plate collector:**

1. Solar water heating systems for residence, hotels, industry.
2. Desalination plant for obtaining drinking water from sea water.
3. Solar cookers for domestic cooking.
4. Drying applications.
5. Residence heating

**Maintenance of flat plate collector:**

1. Daily cleaning
2. Seasonal maintenance (cleaning, touch-up paint)
3. Yearly overhaul (change of seals, cleaning after dismantling

# Photo Voltaic System

**Photo Voltaic System:**

- The Kyoto agreement on global reduction of greenhouse gas emissions has prompted renewed interest in renewable energy systems worldwide.
- Many renewable energy technologies today are well developed, reliable, and cost competitive with the conventional fuel generators.
- The cost of renewable energy technologies is on a falling trend and is expected to fall further as demand and production increases.
- There are many renewable energy sources such as biomass, solar, wind, mini-hydro, and tidal power.

- One of the advantages offered by renewable energy sources is their potential to provide sustainable electricity in areas not served by the conventional power grid
- The growing market for renewable energy technologies has resulted in a rapid growth in the need for power electronics.
- Most of the renewable energy technologies produce DC power, and hence power electronics and control equipment are required to convert the DC into AC power.
- Inverters are used to convert DC to AC.
- There are two types of inverters: standalone and grid-connected.
- The two types have several similarities, but are different in terms of control functions.

# Maximum Power Tracking

**Peak Power Operation:**

- The sun tracker drives the module mechanically to face the sun to collect the maximum solar radiation.
- However, that in itself does not guarantee the maximum power output from the module.
- As was seen in Figure, the module must operate electrically at a certain voltage that corresponds to the peak power point under a given operating condition.

**There are three electrical methods of extracting the peak power from a PV source, as described in the following:**

1. In the first method, a small signal current is periodically injected into the array bus, and the dynamic bus impedance ($Zd = dV/dI$) and the static bus impedance ($Zs = V/I$) are measured.
   - The operating voltage is then increased or decreased until $Zd$ equals $-Zs$. At this point, the maximum power is extracted from the source.
2. In another method, the operating voltage is increased as long as $dP/dV$ is positive. That is, the voltage is increased as long as we get more power. If $dP/dV$ is sensed negative, the operating voltage is decreased. The voltage stays the same if $dP/dV$ is near zero within a preset dead band.

3. The third method makes use of the fact that for most PV cells, the ratio of the voltage at the maximum power point to the open-circuit voltage (i.e., Vmp/Voc) is approximately constant, say K.

- For example, for high quality crystalline silicon cells, K = 0.72. An unloaded cell is installed on the array and kept in the same environment as the power-producing cells, and its open-circuit voltage is continuously measured.
- The operating voltage of the power producing array is then set at K*Voc, which will produce the maximum power.

# Solar GRID Connected Inverter

**Solar GRID Connected Inverter:**

- Introduction for Solar Inverter Material, energy, and information are the three important elements for human survival and development.
- Each new discovery for energy use transformed and greatly promoted the development of modern civilization.
- The invention of the steam engine brought us into the machine age.
- The invention and use of electricity brought us into the electrical age.
- The invention of the semiconductor transistor brought into the information age.

- However, if the light-generated carriers are prevented from leaving the solar cell, then the collection of light-generated carriers causes an increase in the number of electrons on the n-type side of the p-n junction and a similar increase in holes in the p-type material.
- This separation of charge creates an electric field at the junction which is in opposition to that already existing at the junction, thereby reducing the net electric field.

MODULE-IV

# WIND ENERGY

**Introduction:**

- Wind is simple air in motion. It is caused by the uneven heating of the earth's surface by the sun.
- Since the earth's surface is made of very different types of land and water, it absorbs the sun's heat at different rates.
- During the day, the air above the land heats up more quickly than the air over water.
- The warm air over the land expands and rises, and the heavier, cooler air rushes in to take its place, creating winds.

- At night, the winds are reversed because the air cools more rapidly over land than over water.
- In the same way, the large atmospheric winds that circle the earth are created because the land near the earth's equator is heated more by the sun than the land near the North and South Poles
- Today, wind energy is mainly used to generate electricity. Wind is called a renewable energy source because the wind will blow as long as the sun shines.
- The History of Wind Since ancient times, people have harnessed the winds energy.

# Wind Power Generation Working Principle

- Like old fashioned windmills, today's wind machines use blades to collect the wind's kinetic energy.
- Windmills work because they slow down the speed of the wind. The wind flows over the airfoil shaped blades causing lift, like the effect on airplane wings, causing them to turn. The blades are connected to a drive shaft that turns an electric generator to produce electricity.
- With the new wind machines, there is still the problem of what to do when the wind isn't blowing. At those times, other types of power plants must be used to make electricity

Speed and Power Relations

- The wind turbine captures the wind's kinetic energy in a rotor consisting of two or more blades mechanically coupled to an electrical generator.
- The turbine is mounted on a tall tower to enhance the energy capture.
- Numerous wind turbines are installed at one site to build a wind farm of the desired power generation capacity.
- Obviously, sites with steady high wind produce more energy over the year

- Two distinctly different configurations are available for turbine design, the horizontalaxis configuration (Figure) and the vertical-axis configuration.
- The horizontal-axis machine has been the standard in Denmark from the beginning of the wind power industry.
- Therefore, it is often called the Danish wind turbine.\
- The vertical-axis machine has the shape of an egg beater and is often called the Darrieus rotor after its inventor.

# Speed and Power Relations

**Power Extracted From The Wind:**

- The actual power extracted by the rotor blades is the difference between the upstream and
- downstream wind powers. Using Equation 3.2, this is given by the following equation in

nits of watts:

where

Po= mechanical power extracted by the rotor, i.e., the turbine output power,

V= upstream wind velocity at the entrance of the rotor blades, and

Vo= downstream wind velocity at the exit of the rotor blades

- Let us leave the aerodynamics of the blades to the many excellent books available on the
- subject, and take a macroscopic view of the airflow around the blades. Macroscopically,
- the air velocity is discontinuous from V to Vo at the “plane” of the rotor blades, with an “average” of .(V + Vo). Multiplying the air density by the average velocity, therefore,
- gives the mass flow rate of air through the rotating blades, which is as follows

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# Wind Power System Components

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- The wind power system comprises one or more wind turbine units operating electrically in parallel.

**Each turbine is made of the following basic components:**

- Tower structure
- Rotor with two or three blades attached to the hub
- Shaft with mechanical gear
- Electrical generator
- Yaw mechanism, such as the tail vane
- Sensors and control

**High-speed shaft:**

- It drives the generator via a speed step-up gear.

**Brake:**

- A disc brake, which stops the rotor in emergencies. It can be applied mechanically, electrically, or hydraulically.

**Gearbox:**

- Gears connect the low-speed shaft to the high-speed shaft and increase the turbine speed from 30 to 60 rpm to the 1200 to 1800 rpm required by most generators to produce electricity in an efficient manner.
- Because the gearbox is a costly and heavy part, design engineers are exploring slow speed, direct-drive generators that need no gearbox.

# MODULE-V

# ECONOMIC ASPECTS OF POWER GENERATION

The **total annual expenditure** of the plant can be classified into several subheadings namely:

- Fixed Charges
- Semi fixed Charges
- Running Charges

- **Fixed Charges of Power Generation**
- Fixed charges, as the name suggest does not vary either with the capacity of the plant or with plant operation.
- These costs remain fixed under all circumstances.
- These mainly include the salaries of higher officials of the central organization and the rent of the land reserved for future expansion.

## Semi Fixed Charges of Power Generation

These charges mainly depend on the installed capacity of the plant and are independent of the electrical energy output of the plant. These charges include the following :

Interest and depreciation on the capital cost of the generating plant, transmission and distribution network, buildings and other civil engineering works etc.

Capital cost of the plant also includes the interest paid during the construction of the plant, salaries of engineers and other employees, development and construction of the power station

- It also includes all types of taxes, insurance premiums pain on policies to cover the risk of accidental breakdown.

- Rent paid for the land being actually used for the construction purpose.

- The cost due to starting and shutting down of plants are also included in this category, when the power plant operates on one or two shift basis.

## Running Charges of Power Generation

- The running charges or running cost of a power plant, is probably one of the most important parameters while considering the economics of power generation as it depends upon the number of hours the plant is operated or upon the number of units of electrical energy generated.
- It essentially comprises of the following costs incurred mentioned below.

- Cost of the fuel delivered coupled with the fuel handling cost in the plant.

- Coal is the fuel used in a thermal power plant, and diesel oil in case of a diesel station.
- In case of a hydro-electric plant there is no fuel cost as water is the free gift of nature.
- But a hydro-plant requires higher installation cost and their mega Watt output of power generation is also lower compared to the thermal power plants.
- Wastage of the operational and maintenance stuff and salaries of supervisor staffs engaged in running the plant.
- In case of a thermal power plant, power generation economics includes the cost of feed water for the boiler, like the cost of water treatment and conditioning.

## Load Curve

A graphical plot showing the variation in demand for energy of the consumers on a source of supply with respect to time is known as the **load curve**.

If this curve is plotted over a time period of 24 hours, it is known as **daily load curve**.

If its plotted for a week, month, or a year, then its named as the **weekly, monthly or yearly load curve** respectively.

The **load duration curve** reflects the activity of a population quite accurately with respect to electrical power consumption over a given period of time. To understand the concept better its important that we take the real life example of load distribution for an industrial load and a residential load, and have a case study on them, to be able to appreciate its utility from the perspective of an electrical engineer.

## Maximum demand (MD):

MD: Is the greatest of all demands which have occurred during the specified period of time, the maximum demand may be expressed in kW, kvar, etc.

## Demand factor:

DF : Is the ratio of the maximum demand of a system to the total connected load of the system

## Utilization factor (UF):

The utilization factor is the ratio of the maximum demand of a system to the rated capacity of the system, UF indicates the degree to which the system is being loaded during peak load periods with respect to its capacity

## Load factor (LDF) :

LDF: is the ratio of the average load over a designated period of time to the peak load occurring in that period.

## Diversity factor (DF) :

DF: Is the ratio of the sum of the individual maximum demands of the various subdivisions of a system to the maximum demand of the whole system.

## Coincident factor (CF) :

Is the reciprocal of the diversity factor.

## Load diversity :

Is the difference between the sum of the peaks of two or more individual loads and the peak of the combined load.

## Loss factor (LSF) :

Is the ratio of the average power loss to the peak load loss, during a specified period of time. Since power losses are proportional to the square of the load current.

## Load duration :

Is the relationship of demands and the duration of the demands over a specified time period.

## Loss equivalent hours :

Loss equivalent hours are the number of hours of peak loads which will produce the same total losses as is produced by the actual loads over a specified period of time.

## Peak responsibility factor (PRF) :

The peak responsibility factor represents the contribution a component makes to the system demand losses at the time of system peak demand.

EVERY **ENDING**
IS REALLY JUST A
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