ENERGY GENERATION

HYDRO, WIND & WAVE







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Introduction to Energy Generation

- It is the process of converting the various energy source such as water, wind, nuclear fusion etc. to electric energy is known as **"Energy generation"**.
- Types of Energy Generation to be discuss are as follow:-
- 1. Hydro Power Generation.
- 2. Wave Power Generation
- 3. Windmill Power Generation.



<u>Bhakra Dam (1963)</u>

1. HYDRO ELECTRIC ENERGY

• A renewable energy source which generate electricity from the kinetic energy of water flowing is called "**Hydro power or Hydroelectric power**".





Turbine

Gravity Dam

Hydro Electric Power Generation in India



Types of Hydro Turbine

A mechanical device that converts the energy of a fluid, like water, steam, or gas, into rotational mechanical energy or electricity is called **"Turbine"**.

Types:- There are two types of turbine:- a.) Impulse Turbine b.) Reaction Turbine



2. <u>Wave Electric Power</u>

- A form of renewable energy that can be utilized from the motion of wave is known as "**Wave Electric Power**".
- Types of Wave Energy Generation System:-
 - Oscillating Water Column(Hundreds of KW)
 - Overtopping Device(Hundreds of KW)
 - Point Absorber(Tens of KW)
 - Attenuator(Hundreds of KW)
 - Submerged Pressure Differential(Hundreds of KW)



Oscillating Water Column & Overtopping Device



Oscillating Water Column

Overtopping Device

Labelled Diagram



Point Absorber & Attenuator



Point Absorber



Labelled Diagram



Point Absorber

Labelled Diagram of Attenuator



Submerged Pressure Differential



Submerged Pressure Differential

3. WINDMILL ELECTRIC ENERGY

• A form of renewable energy that harnesses the power of the wind to generate electricity is known as."Windmill Electric Energy".

• <u>Components of a windmill turbine</u>:-

- a) Rotor Blades
- b) Main Shaft
- c) Gear Box
- d) High Speed Shaft
- e) Generator
- f) Yaw





Labelled Diagram of Windmill



TYPES OF WINDMILL TURBINE

TYPES:- There are 3 type of Windmill Turbine which are as follow:-

- 1. Horizontal Axis Wind Turbine
- 2. Vertical Axis Wind Turbine
 - Darrieus Turbine
 - Savonius Turbine
- 3. Offshore Wind Turbine







Horizontal Axis Wind Turbine

- A Horizontal Axis Wind Turbine has its blades positioned horizontally.
- These turbines need to face into the wind to work properly.
- HAWTs are capable of generating a wide range of power, from a few kilowatts to over **10 megawatts** (**MW**).



Vertical Axis Wind Turbine

- A Vertical Axis Wind Turbine has its blades arranged vertically. This means that instead of spinning around a horizontal pole, it spins around a vertical pole. These turbines can capture wind from any direction, making them suitable for places with changing wind patterns.
- VAWT can generate between **50 kilowatts** (**kW**) to several hundred kilowatts, depending on their size.



Labelled Diagram of Vertical Axis Wind Turbine



Offshore Wind Turbine

- An Offshore Wind Turbine is a type of wind turbine that is installed in bodies of water, usually at sea. These turbines are designed to capture wind energy over the ocean, where wind speeds are often higher and more consistent than on land. Offshore wind farms can have many turbines working together to of generate large amounts electricity.
- Offshore wind turbines can generate a substantial amount of electricity, typically ranging from 3 megawatts (MW) to over 10 megawatts (MW) each.



Offshore Wind Turbine



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THANK YOU