1) What are renewable and non-renewable energy resources

Renewable energy resources: Renewable energy is energy derived from natural sources that are replenished at a higher rate than they are consumed. Generating renewable energy creates lower emissions than burning fossil fuels.

1) Solar energy 2) Wind Energy 3) Hydro energy 4) Ocean energy-Tidal energy-wave energy 5) Geothermal energy 6) Biomass energy

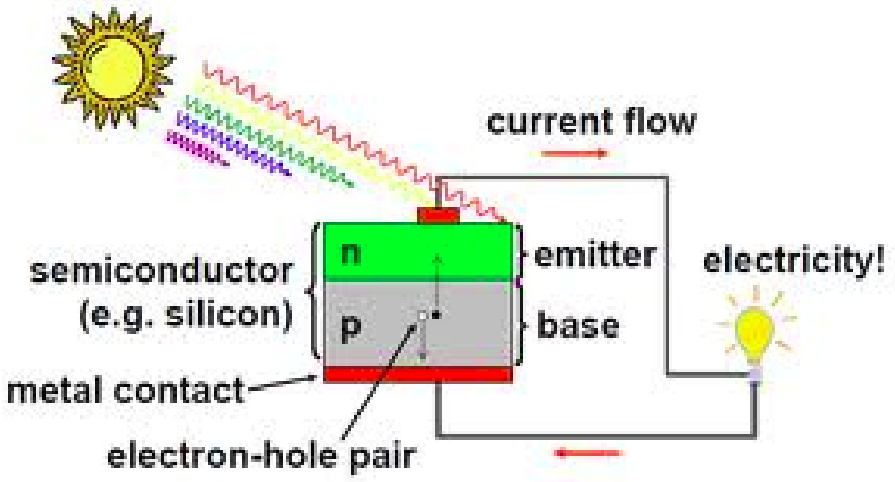
Non renewable energy resources: Nonrenewable resources are limited in supply and cannot be used sustainably.There are four major types of nonrenewable resources: oil, natural gas, coal, and nuclear energy. Oil, natural gas, and coal are collectively called fossil fuels.

Various types of Renewable energy resources

Solar energy: The most commonly used solar technologies for homes and businesses are a) solar photovoltaics for electricity, b) passive solar design for space heating and cooling, and solar water heating. Most heat from the sun arrives as infrared energy.

Solar energy-Solar cell: A solar cell, or photovoltaic cell, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon.The operation of a photovoltaic (PV) cell requires three basic attributes:

- The absorption of light, generating either electron-hole pairs.
- The separation of charge carriers of opposite types.
- The separate extraction of those carriers to an external circuit.



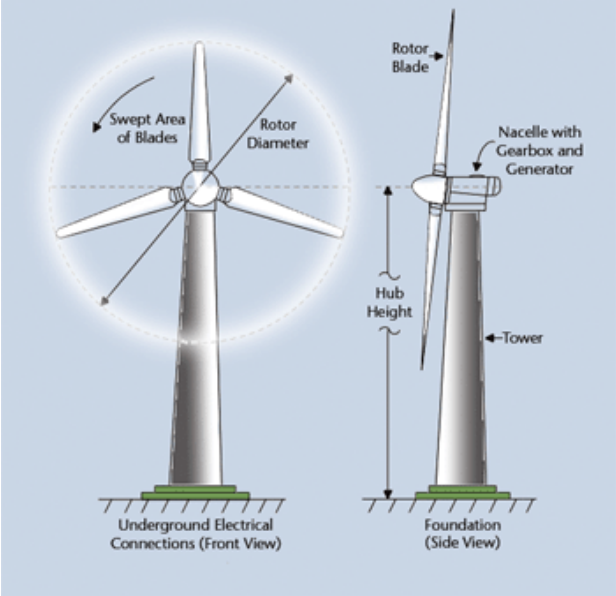
- Photons in sunlight hit the solar panel and are absorbed by semiconducting materials, such as silicon.
- Electrons are excited from their current molecular/atomic orbital. Once excited an electron can either dissipate the energy as heat and return to its orbital or travel through the cell until it reaches an electrode. Usually silicon is used in two layers, one layer being doped with boron, the other phosphorus. These layers have different

chemical electric charges and subsequently both drive and direct the current of electrons.

- An array of solar cells converts solar energy into a usable amount of direct current (DC) electricity.
- An inverter can convert the power to alternating current (AC).

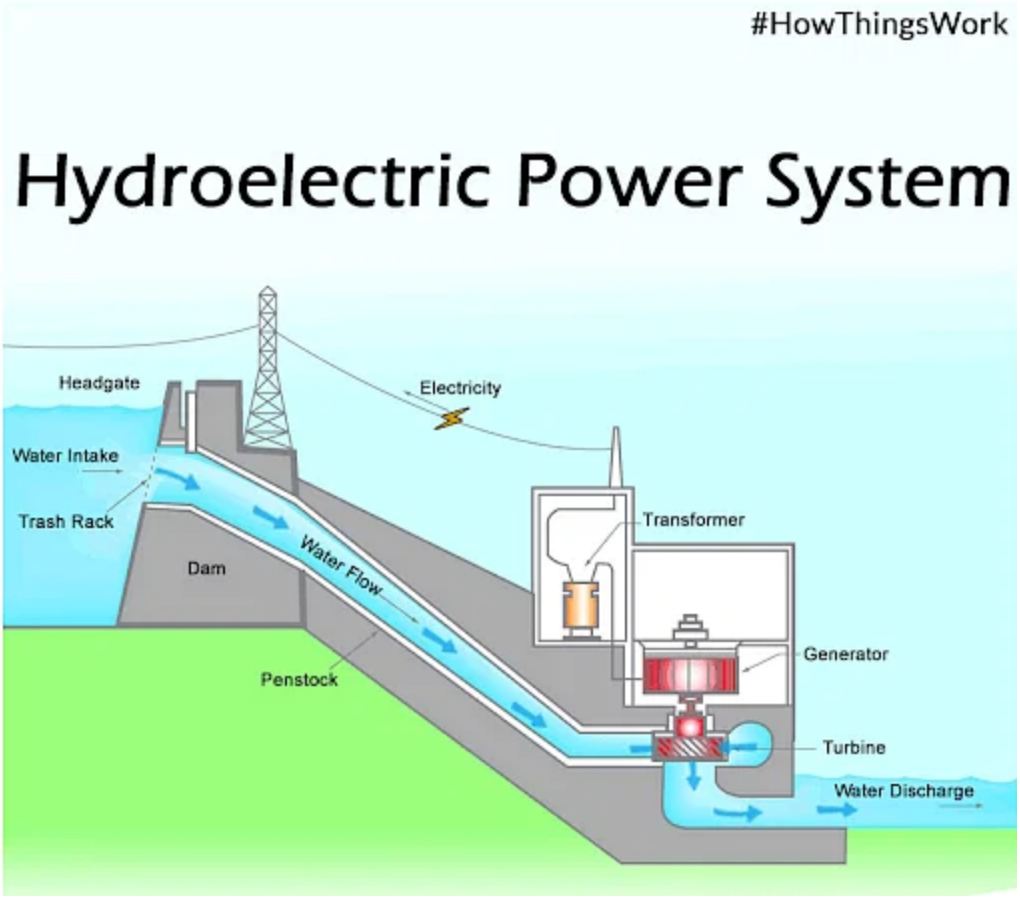
Wind energy: The energy in the wind turns two or three propeller-like blades around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity

Kinetic Energy of particle = ½ mv^2 The amount of air passing in unit time, through an area 'A', with velocity 'V' is (A) V, and its mass 'm' is equal to its volume multiplied by its density 'ρ' of air. $m = \rho AV$, Where, m is the mass of air transversing the area 'A' swept by the rotating blades of a wind mill type generator. KE = ½ mv2 = ½ ρ AV^3



Drawing of the rotor and blades of a wind turbine, courtesy of ESN

Hydro power: Most hydroelectric power plants have a reservoir of water, a gate or valve to control how much water flows out of the reservoir, and an outlet or place where the water ends up after flowing downward. Water gains potential energy just before it spills over the top of a dam or flows down a hill. The potential energy is converted into kinetic energy as water flows downhill. The water can be used to turn the blades of a turbine to generate electricity, which is distributed to the power plant's customers.



Ocean energy

Tidal power: Tidal energy is power produced by the surge of ocean waters during the rise and fall of tides.There are currently three different ways to get tidal energy: tidal streams, barrages, and tidal lagoons. For most tidal energy generators, turbines are placed in tidal streams. A tidal stream is a fast-flowing body of water created by tides. A turbine is a machine that takes energy from a flow of fluid.

Wave power: Wave power converts the periodic up-and-down movement of the oceans waves into electricity by placing equipment on the surface of the oceans that captures the energy produced by the wave movement and converts this mechanical energy into electrical power.

Geothermal energy: Geothermal energy is the heat produced deep in the Earth's core. Earth's temperature rises with depth from the surface to the core. This gradual change in temperature is known as the geothermal gradient. Their heat can be captured and used directly for heat, or their steam can be used to generate electricity.

Biomass energy: Biomass is renewable organic material that comes from plants and animals. Biomass contains stored chemical energy from the sun that is produced by plants through

photosynthesis. Biomass is converted to energy through various processes, including:

- Direct combustion (burning) to produce heat
- Thermochemical conversion to produce solid, gaseous, and liquid fuels
- Chemical conversion to produce liquid fuels
- Biological conversion to produce liquid and gaseous fuels

Direct combustion is the most common method for converting biomass to useful energy. All biomass can be burned directly for heating buildings and water, for providing industrial process heat, and for generating electricity in steam turbines.

Thermochemical conversion of biomass includes *pyrolysis* and *gasification*. Both processes are thermal decomposition processes wherein biomass feedstock materials are heated in closed, pressurized vessels called *gassifiers* at high temperatures. The processes mainly differ in the temperatures and in the amount of oxygen present during conversion.