INTRODUCTION :>

Energy plays a vital role in our daily life energy is available in different forms like electrical energy, heat energy, neuclear energy etc. day to day the energy consumption is increasing very rapidely. The world fossil fuel supply i.e Coal, petroleum and natural gas will be depleted in few hundreds years the rate of energy consumption is increasing, supply is depleting, resulting in energy shortage this is called energy crisis. So the alternative is reneable energy resources which are very essential to meet the future energy requirement.

Different Forms of energy :>

Different forms of energy are :-

(1) Mechanical energy :-

Mechanical energy is available in two forms

(i) kinetic energy

(ii) potential energy

→ The kinetic energy of the moving body is measured by the amount of work which is done in bringing the body from rest position to its present position. It is given by $\frac{1}{2}mv^2$

→ The energy in a body due to its position is called potential energy it is given by mgh.

(2.) <u>electrical energy</u> :⇒

→ In electrical generator mechanical energy is converted into electrical energy.

→ electrical energy is defined as which is used to generate electrical power.

$$\text{Power} = \frac{\text{energy}}{\text{Time}}$$

$$\text{energy} = P \times T$$

(3) <u>Neuclear energy</u> :⇒

Uranium, plutonium, theorium isotopes are the neuclear fuels which when undergoes neuclear fission released heat as a result the neuclei splits with released of sufficient neuclear energy

When water is fall from a sufficient height then its energy rotates the turbine which is coupled with alternator to deliver electrical energy this means of energy is called hydro energy.

(5) Chemical energy :=>

In fuel ~~shells~~ cells chemical energy is converted into electrical energy during the combustion of fuel (Like coal, wood etc) when it combines with oxygen, it liberate heat energy this heat energy is used to boil water in the boiler which generates stem this steam is passed through steam turbine to generate electricity.

$$\text{fuel} + O_2 \rightarrow \text{Product} + \text{heat energy}$$

Classification of energy sources

Renewable

→ Renewable energy source are those resources which can be used to produce electricity again and again. A Renewable energy source will never Run out

→ eg:- solar, wind, tidal, Geothermal etc

→ operating cost is low and cleaned

→ No harm for the environment.

→ Available in sufficient / Abundant quantity & are free to use.

→ These resources are not very efficient in producing energy in a massive scale.

Non Renewable

→ A Non renewable energy source is that source which cannot be reuse

→ eg:- Coal, petroleum, natural gas etc

→ operating cost is high

→ They are thearthing to the environment

→ Life of this resources are finite & will varnish one day since these are available in limited quantity.

→ A vast amount of energy can be generated by using This sources.

→ Maintainace cost is high

→ Maintainace cost of non renewable powerplant is low.

Classification of Renewable energy sources :-

→ The energy requirement increasing with the population of the world. After the crisis of natural resources. the other energy source is the renewable energy source.

eg:- solar energy, Tidal energy, wind energy, Bio gas, Geothermal energy etc.

(1) SOLAR ENERGY :-

→ Earth recevies energy from sun in the form of electromagnetic radiation. India recevies solar energy equivalent to more than 5000 trillion kwh per year.

→ The main application of solar energy are :- Solar water heater, Solar pumping, Solar street light etc

→ Solar energy is collected by a device called Solar collector. Solar collectors are made up of small units called solar cells. This

Solar cells are made up of a S.C material called silicon

→ A Large no. of cells are connected in series ~~and~~ parallel to get suitable voltage & current. The o/p of Solar cell in the form of DC

(2) TIDAL ENERGY

→ The vast potential energy of sea and ocean which cover about 3/4th of our planet can make a significant contribution to meet our energy requirement.

→ Tidal energy is the energy i.e produce by the tides of the ocean. Tides are made by the pull of gravity of moon, sun and the rotation of the earth there are three ways to use tidal energy

i) Tidal Turbine :→

They are single turbines which are placed in areas where you can find the strong tid

flow. This tidal energy strikes the turbine to rotate it and convert to mechanical energy these turbine is ~~connects~~ coupled to alternato to produce electricity.

(ii) Tidal barrage :→

A tidal barraige is something like a dam when the tide is high the reservoir fills up & then when the tide is low the barrage allow the water to run out the moving water is so strong that it has enough energy to spin the turbine to create electricity.

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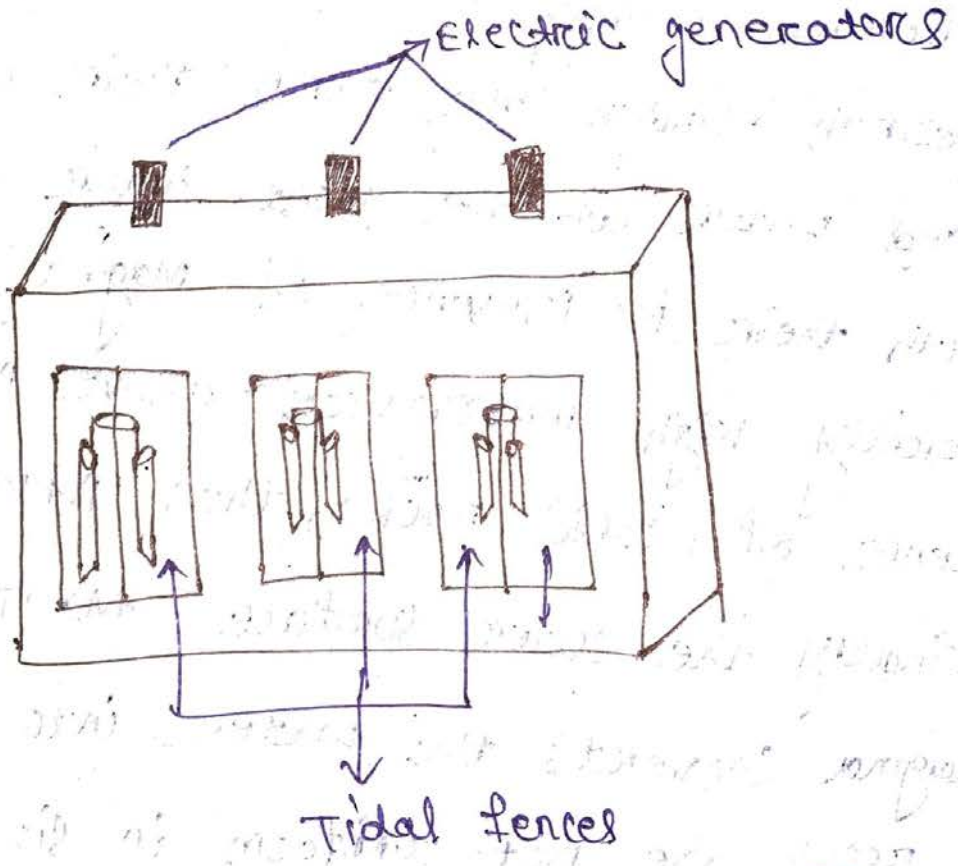
(iii). Tidal fences :→



→ Tidal fences are smaller than barrage they are vertical turbines that form a fence so when the tide is allow to move in and out, the turbine begins to spin and generate electricity.

→ The main advantage of tidal power is that they are pollution free & does not depend upon rain the first commercial 240 MW tidal power plant is in france since 1966. their the average tidal range is 8.5 meter.

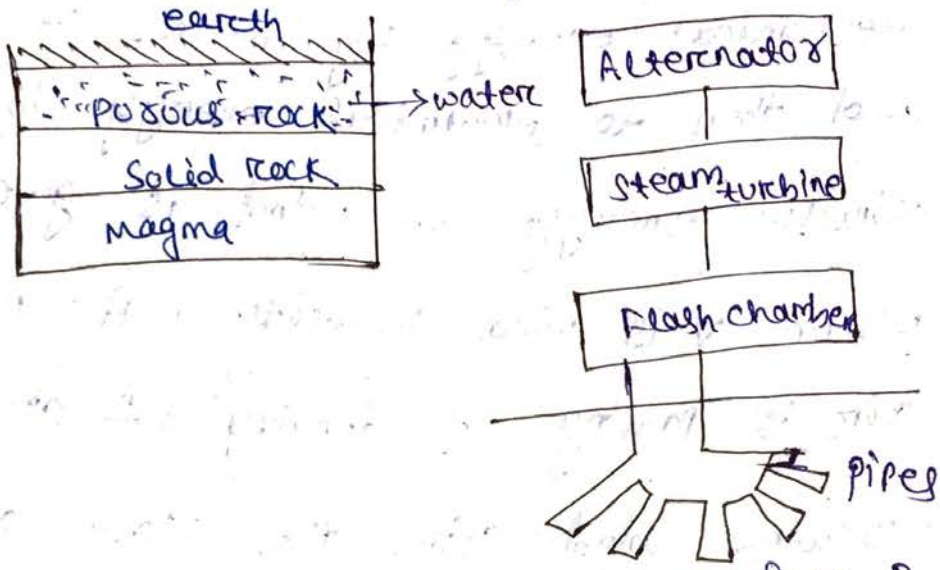
→ Gujarat (cambay), sudarbans region of West bengal

(3) GEO THERMAL ENERGY

Geo thermal energy is the heat energy associate in the earth. under the earth their are many layes and water at the most inear surface of the earth their is presence of magma. which is as extermly high temprature. above magma their is presence of solid rock, then porus rock. and finally the outer surface. ~~AU~~ The temp. of magma converts the water into steam solid rocks are not uniform in size. so the

heat of magma get transferred to the porous rock where water is present now this water is converted into steam and used for power generation.

→ ~~By making~~



→ By making deep holes on the earth surface & ~~inserting~~ inserting pipes inside, the hot water & steam is extracted outside. ~~The~~ Now this hot water and steam is put in flash chamber. Flashchamber separate steam from water and take the steam to the steam turbine which produce mechanical energy the steam turbine coupled with alternator to produce electrical energy. There is a 5KW geo thermal power plant in Pugga valley in Ladakh and Kulu in himachal pradesh

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→ Godavari & Mahanadi

Cow dung is the best source of bio gas as the bacteria present in the dung has more potential than other. Methano bacteria is the bacteria that is found in the stomach of cow this bacteria produceses methane gas which is highly inflamble

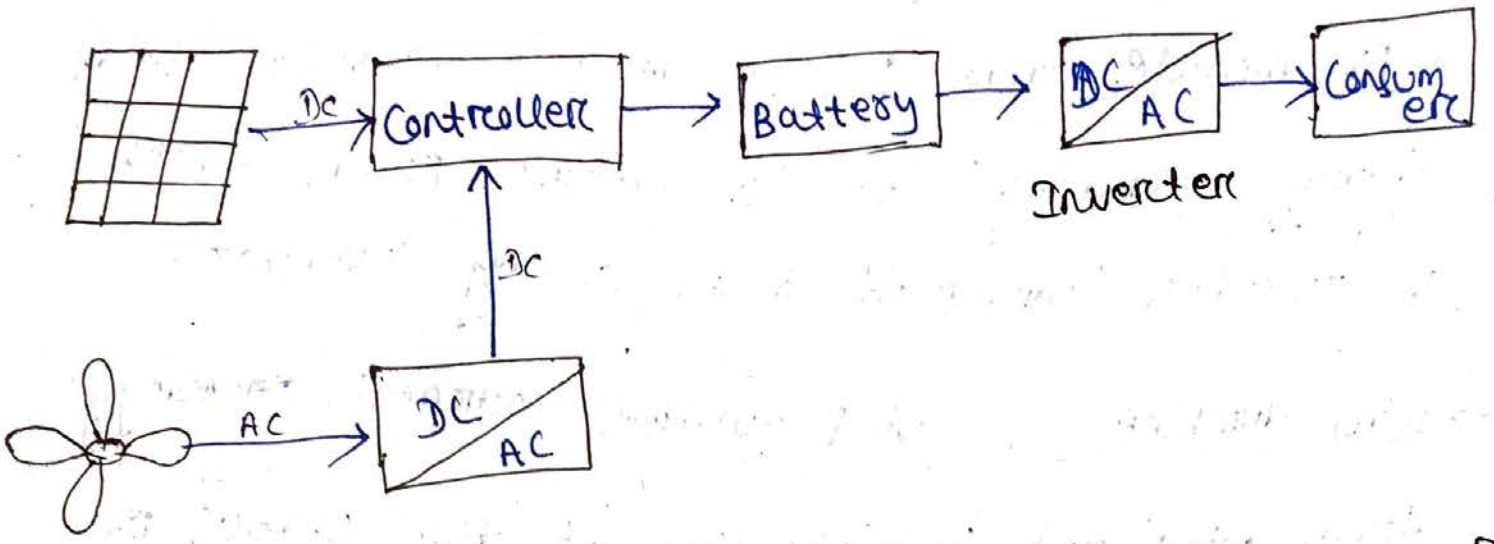
→ Andra pradesh, Maharashtra

HYBRID ENERGY SYSTEM

→ In india there is sevior power shortage & associated power quality problem the quality of grid supply is suffering from large voltage and frequency fluctuations scheduled & unsheduled power cut & load restrictions. So we depend upon renewable energy source in india wind and solar energy sources are available all over at free of cost, tidal energy in costal area and geo thermal energy are available on specific location.

→ The term hybrid power system is used to describe any power system that use two or more energy sources to generate power. All the sources may be renewable, may be non renewable or mixture of renewable &

non renewable.



[Schematic diagram of a solar (PV) wind hybrid system]

→ The ~~figer~~ Figure a hybrid energy system is shown which consist of solar & wind energy sources the hybrid PV wind system is design to supply continous power of 1.5 KW & should has the following capabilities.

(1) stores the energy in lead acid battery.

(2) Control the charge & discharge of battery.

(3) Provides uninterupted electric supply to the load.

(4) When the renewable energy sources ~~fells~~ fails to generate sufficient power then the load should get energy from other sources.

→ The hybrid PV wind energy system include a PV system, wind turbine, MPPT, inverter, ba

bank and charge controller.

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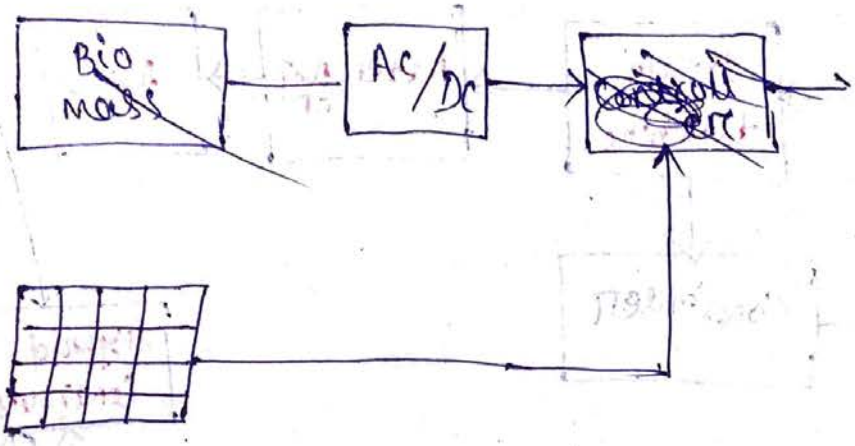
⇒ PV module/pannel :- PV module converts solar energy instantly into DC electric power which is further converted into AC by inverter.

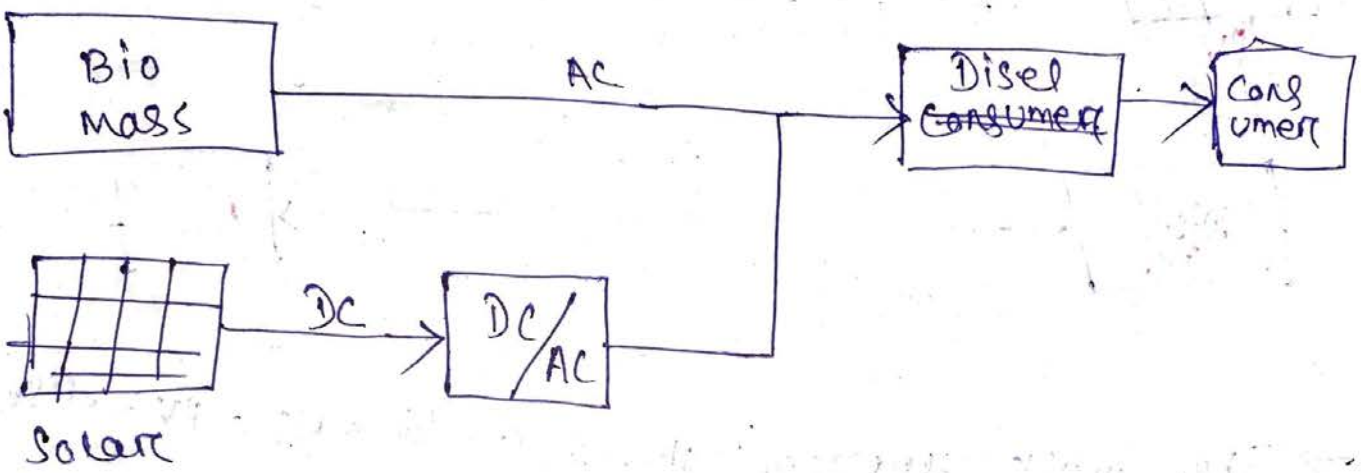
→ Wind turbine :- wind turbine extracts ~~energy~~ energy from wind ~~and~~ by rotation of the blades of the wind turbine power is generated by the wind turbine - alternator set.

→ MPPT :- MPPT device is nothing but a DC-DC converter which ensures delivering of maximum power to the load from the PV ~~Panel~~ Pannel.

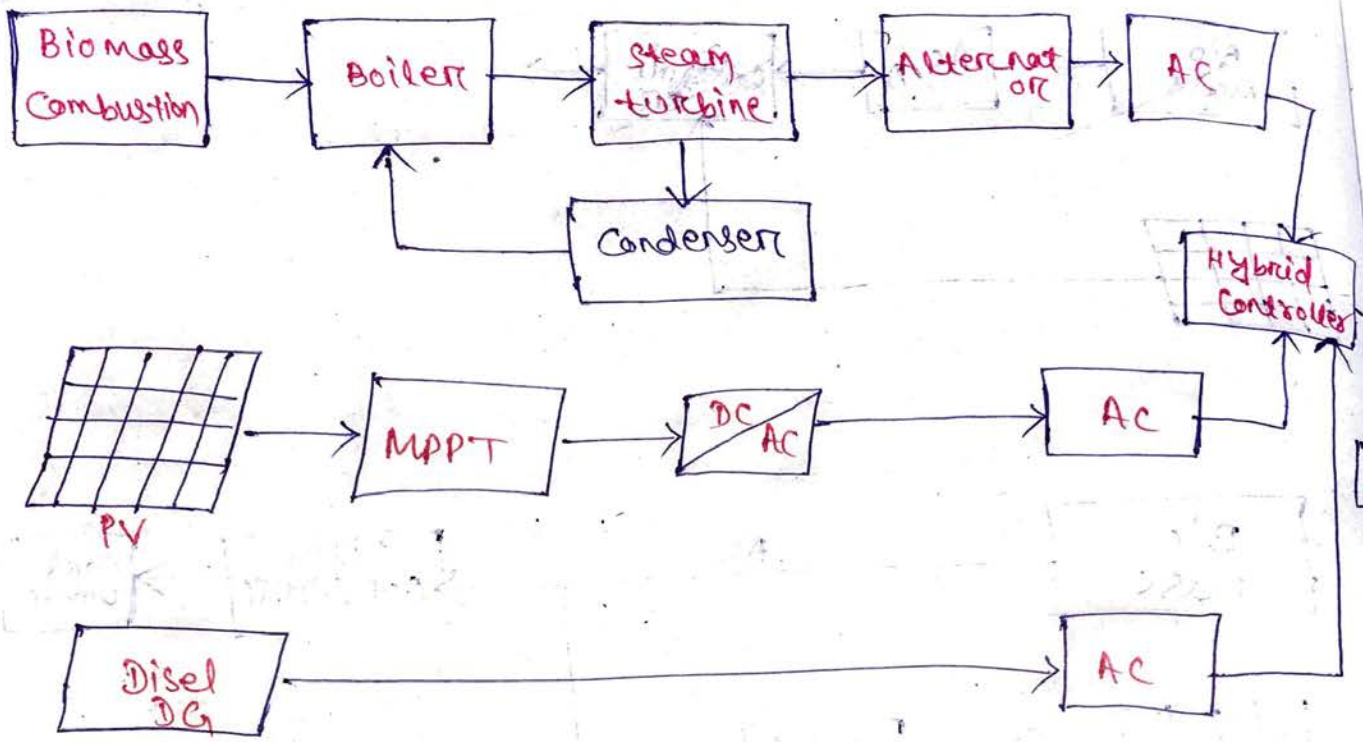
→ Battery bank :- It stores energy in the form of DC, when their is ~~an~~ surplus generation and distribute it when ~~of~~ there is electricity demand.

→ Charge controller :- It protects the battery from over charging & discharging.


Bio mass
AC/DC


Bio mass
AC
Disel
Consumer
DC
DC/AC
Solar

Biomass - PV - disel



→ The block diagram shows a biomass - PV - disel hybrid system. In this system is design to continous ~~supply~~ power. In the biomass combustion the bio gas is relised this bio gas is fed into the boiler to heat the water. the water is heated and converted into ~~steam~~ stem the steam ~~tu~~ is help to rotate the steam turbine the steam is i/p of the steam turbine & the steam generator is rotate. The steam turbine is coupled with the Alternator when the steam turbin e rotate

the i/p of alternator is mechanical energy and it gives the o/p in the form of AC. When the steam is used to ~~the~~ rotate the turbine the steam is fed to the condensor in condensor it keep in high pressure so the steam is convert in to water and gives the boiler for reuse.

→ Then the PV cell is also used in this type of hybrid system the PV cell is convert solar energy into DC the MPPT is placed in between ~~source~~ load and PV cell to maximum power to the load from the PV cell. then a inverter placed in the PV lines is to convert DC to AC.

→ Disel DG is a non-renewable energy source which we can need for continous supply it gives the o/p is AC.

→ Then the o/p of all the sources can be fed in hybrid controller and the hybrid controller control the o/p & supplies to the load.

→ In this hybrid system disel engine is used only as a back up source when the load demand is at its peak value and the renewable sources are insufficient to generate power then the disel engine back up is required.

→ Hybrid controller is a controller which maintain energy balanced during load variation it assignes the priority among the energy sources that means it allow one source which has highest priority. it fed the load if that energy source is capable of meeting the load demand and energy coming from other sources will be stored otherwise allow multiple source to fed the load.

DISTRIBUTED GENERATION & DISPERSED GENERATOR

→ The energy business is changing dramatically from the power suppliers. In day to day life consumers has to suffer for several difficulties like paying electricity bill, ~~ener~~ shortage of electricity during pick demand period etc.. The solution of this is microgrid. So microgrid is a consept where generation & utilization of electricity is done at consumer premisses. Distributed generation & Dispersed generation comes under microgrid.

→ Distributed energy system comprise power generatio energy storage & energy managment. It refers to a variety of technologies that generate electricity at or near where it will used. Distributed generation ensures delivery of realiab power & reduce electricity losses along transmi & distribution line. So briefly we can say distributed generation system is an aproach th employes small scale technologies to produce electricity closed to the end user of power.

In a residencial or commercial ~~center~~ sector common distributed generation system includes

1) Solar PV cell

2) Small wind turbine

3) Bio mass combustion

4) Emergency back up generator.

→ Distribution generation have the following benefits

i) It can harness energy that might otherwise be wasted.

ii) By using local energy sources line losses are eliminated. that happens during long transmission.

iii) customers with access to distributed energy system can except to pay less electricity bill as they sell power back to the grid. and are compensated ~~for~~ during peak period.

→ However distributed energy system lead to -ve environmental impacts like

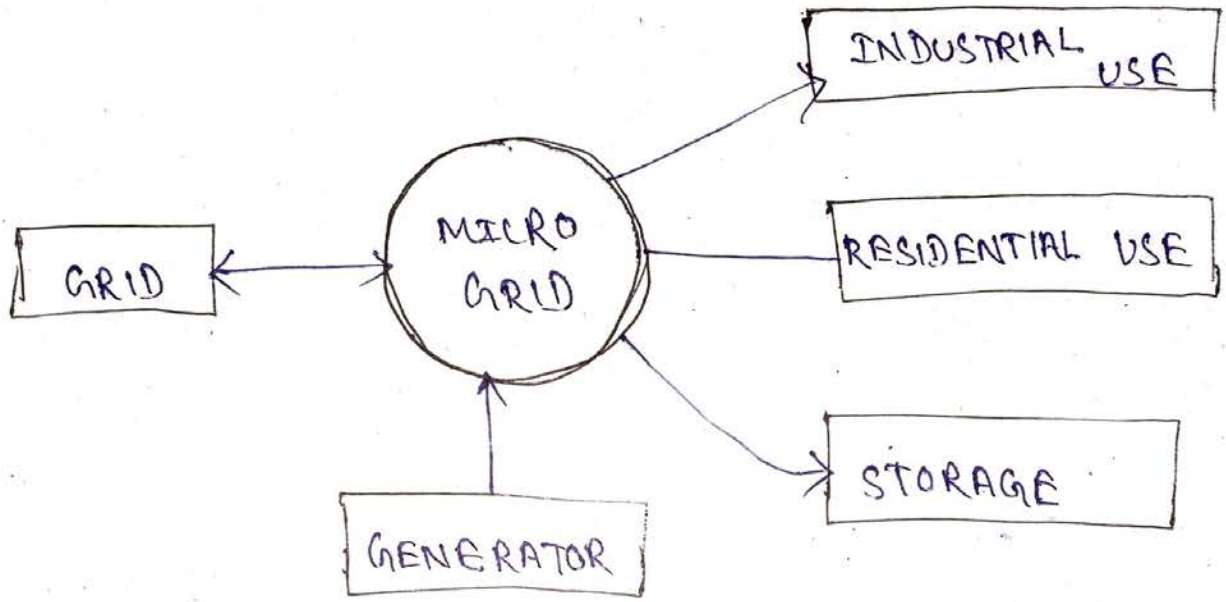
(i) It take of space & cause land use concern at it is located closer to end user.

ii) Burning of fosil fuel cause air pollution.

Dispersed generation is a decentralised power plant, which ~~is~~ generates power to fed individual consumers

NOTE :-

Distributed generation generate power betn 2-50MW where as dispersed generation generate power > 500kW



SOLAR PHOTOVOLTAIC SYSTEM

D:a

Spectral Composition of Solar radiation

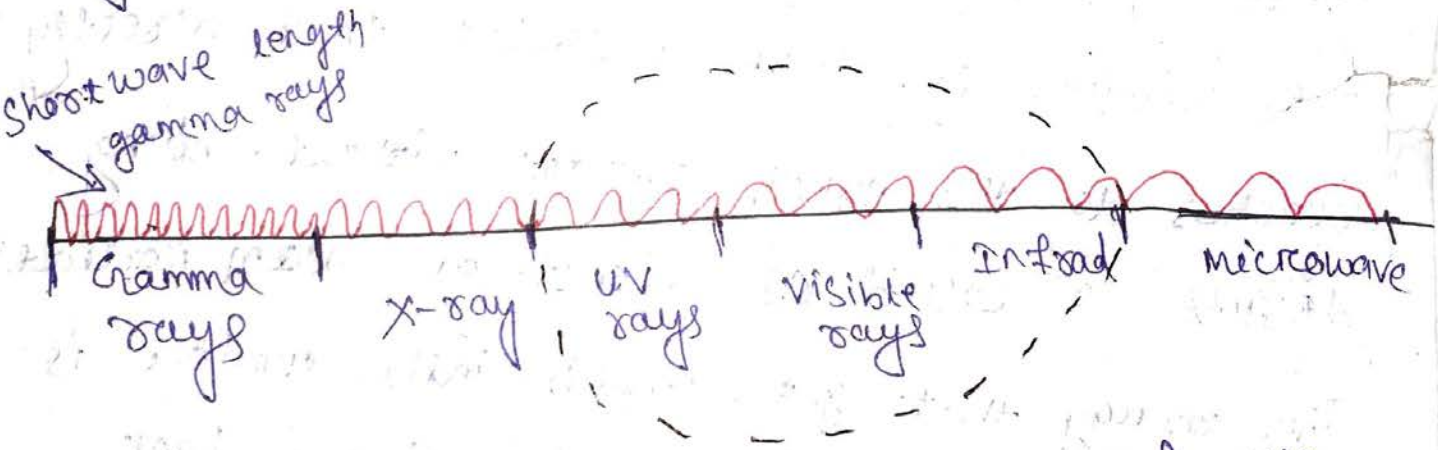
→ Solar radiation is nothing but the electromagnetic radiation emitted by the sun.

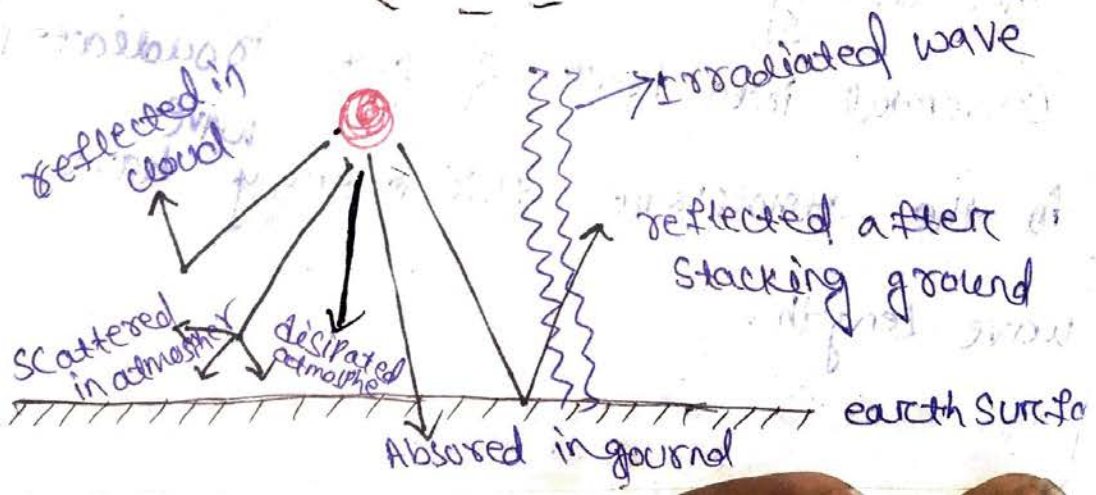
→ It can be divided into two types :-

(i) Ionizing radiation (x-ray, gamma ray)

(ii) Non-Ionizing radiation (i, im, visib.)

→ The highly injurious ionizing radiation does not penitrate the earth atmosphere. ~~In~~ each solar radiati has a shorten wave length. of spectral composition The range of the spectrum that is visible to huma eyes is about 400nm to 700nm





→ The dotted part of the figure are the solar radiation that falls on earth all the waves have various length & frequency that together makes electromagnetic spectrum.

→ Solar radiations is carried by the wave length 0.3 Mt. to 3 Kmeter.

→ When the suns visible light reaches the earth atmosphere some rays are reflected in the cloud, some dissipate in the atmosphere, some hits the ground & get reflected back, some gets scattered and ~~some get absorb by the surface~~, The ~~en~~ some get direct absorb by the surface. The solar radiation that directly reaches to the earth surface without being diffuse is called as direct or beam radiation. The energy that get absorb inthe surface is converted into heat & get irradiated back to the atmosphere this energy wave have longer wave length.

Terestrial & extra terestrial radiation :-

→ The solar radiation that reaches the earth surface after passing through the earth atmosphere are called terestrial radiation. The solar radiation on the outer surface atmosphere of the earth is known as extra terestrial radiation.

Terestrial radiation :→

When the solar radiation passes through the earth atmosphere, the ultra violet rays are absorb by the ozen layer in the atmosphere., infrared rays, are absorbed by carbon dioxide, carbon monoxide & the moisture present in the atmosphere. Some rays are get scratted by the dust & water vapur present in the atmosphere. Finally a portion of these radiations reaches to the earth atmosphere known as defuse radiation. The radiation which reaches directly to the earth atmosphere is called beam or direct radiation. Combinely beam radiation & diffues radiation are known as terestrial radiation

extra terestrial radiation :

The solar radiation on the outer surface

the atmosphere is known as extra terrestrial radiation.

→ ~~So~~

Radiant flux or solar radiation calculation

→ Solar flux or solar radiation intensity leaving the surface of sun is given by.

$$\boxed{H_s = L\sigma T^4}$$

where L = Emissivity of the object (let sun is a black body $L = 1$)

T = temp. of the ~~surface~~ sun (5762°K)

σ = ~~stiffness~~ stefan bolt man constant (5.67×10^{-8})

$$H_s = L\sigma T^4$$

$$= 1 \times 5.67 \times 10^{-8} \times 5762^{-4}$$

$$\boxed{H_s = 6.25 \times 10^7 \ W/m^2}$$

tal radiant power emitted from sun, P_0

$$\boxed{P_0 = H_s \times 4\pi R^2}$$

where $4\pi R^2$ surface area of sun

$$P_S = 6.25 \times 10^7 \times 4\pi \times (6.96 \times 10^8)^2$$

$$\boxed{P_S = 3.8 \times 10^{26} \text{ watt}}$$

→ If the sun emits its radiation uniformly in all direction, then this power P_0 is emitted equally in all directions ~~of~~ in space but as the distance from sun increases the power decreases as the intensity of solar radiation decreases. now the solar intensity is given by

$$\boxed{H_{\cancel{ac}} = \frac{R^2 H_S}{r^2}}$$

where R = Radius of sun

r = Radius of earth

$$\boxed{H_0 = 1346 \text{ W/m}^2}$$

$$\boxed{P_0 = H_0 \times 4\pi R^2}$$

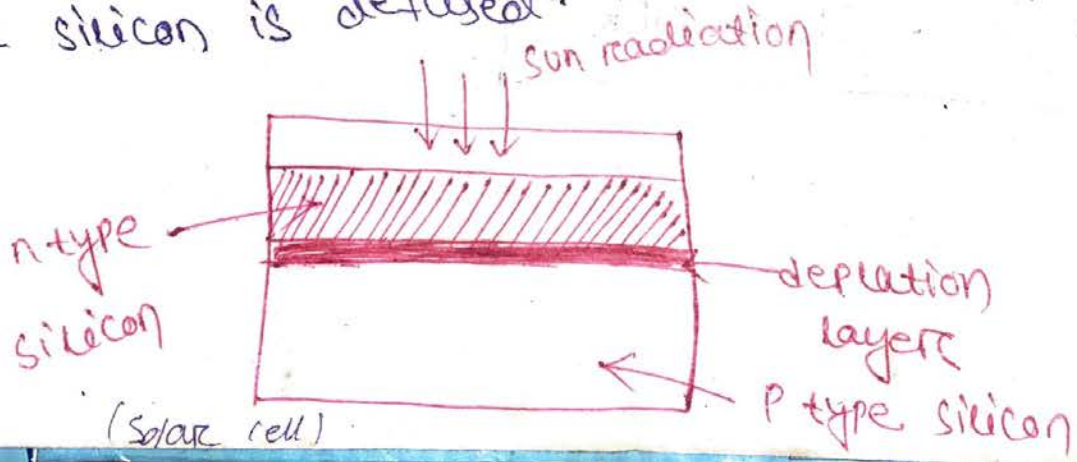
SOLAR CELL :→

→ Solar cells are the basic building blocks of a solar photo voltaic system, which converts solar radiation instantly into electricity. The efficiency of conversion of light into electricity, depends upon many factor like (i) Reflectivity of the surface, absorbitivity of the material, intensity of solar radiation etc.

~~→ The efficiency of~~

→ A solar cell is made up of a semiconductor material like silicon. A semiconductor is a type of material that they normally does not conduct electricity well. but it can be made more conducting under certain conditions.

→ A silicon solar cell consist of a thin slice of 'p' type silicon into which a very thin layer of 'n' type silicon is defused.



(Solar cell)

→ The top layer of the cell contains silicon & a small amount of arsenic, that gives the top layer & excess of electron i.e n-type silicon., The bottom layer contains silicon & a small amount of boron which form 'p' type silicon. when the 2 pices of silicon containing p type & n type impurities are connected together a p-n junction is created.

Advantages of solar cell :-

→ They donot cause any pollution as they use direct sunlight.

→ As their is no moving part so rotational loss is zero.

→ maintainace of solar cell is low.

Disadvantage of solar cell :-

→ The material used in formation of solar cell is ~~very silicon~~ is very costly as the special type sidicon which is used is very costly.

→ The wire used to connect solar cell in series or parallel is silver which is very costly element so manufacturing of solar cell becomes very expensive.

→ The efficiency of electricity production from sunlight is very low as compared non renewable sources.