

* Solar power Generation:

I Solar energy refers to energy produced and radiated by sun. Solar energy can be converted directly or indirectly into other form of energy, such as heat and electricity.

In one hour, amount of solar energy from sun falls on earth is more than entire world's consumption in one year. Here energy from sun radiation are converted into the electrical energy using semi-conductor materials like silicon, germanium etc.

Solar energy can be utilized by using direct and indirect method.

Direct method are classified into thermal energy conversion and photovoltaic energy.

Indirect method are tidal, wind, biomass, waves & ocean thermal energy.

II Utilization:

(1) More energy from sun falls on earth in one hour than is used by everyone in world in one year. A variety of technologies convert sunlight to usable energy for buildings.

(2) Most commonly used solar technologies for homes & businesses are solar photovoltaics for electricity, passive solar design for space heating & solar water heating.

(3) Business & industry uses solar technology to diversify their energy source, improve

efficiency & save more money.

(4) Energy developers & utilities use solar photovoltaic & concentrating solar power technologies to produce electricity on massive scale to power cities & small town.

III Diagram : Refer ppt.

IV Components :

(1) PV cell or Solar cell:

(1) They are made from semi conductor, thin films, poly crystalline silicon, mono-crystalline silicon & amorphous cells. Solar cell is a semi conductor device which converts the radiation energy into electrical energy by photovoltaic effect.

(2) If photon of light has energy greater than band gap then electron is emitted & this flow of current creates current. PV system uses one or more solar modules to convert solar energy into electrical energy.

(3) PV cells are used for construction of PV power system. Amount of power given by PV cells is very less, up to few watts, due to surface area limit. For increasing amount of power generated, PV cells are grouped to form PV module.

(4) It is also possible to connect a group of PV modules either in series, parallel or both to form PV array, whose power range

from kW to MW.

(2) PV Module :

(1) Voltage generated by single solar cell is very low, around 0.5V. So large number of cells are connected in both series and parallel connection to get desired output. In case of partial shading, diodes may be needed to avoid reverse current flow in array.

(2) Good ventilation behind solar panel is given to avoid possibility of less efficiency even at high temp.

(3) PV Arrays (Solar Collectors) :

(1) Power requirements cannot be ~~produced~~ ^{fulfilled} by single module. PV array produce DC output voltage, this output can be converted to AC by using inverters & it can be used for running motors, lighting & other loads.

(2) By connecting module in series we get more voltage rating & by connecting in parallel, we get higher current rating.

(3) PV arrays are also called solar collector. Solar collectors are of two types;

→ Flat plate collector

→ Concentrating collector.

Advantages

Disadvantages

Application

} Refer ppt.

* Flat plate collector :

(1) Used in low temp. application upto 100°C .

(2) Generally used in applications like solar water heating, space heating, drying etc.

materials used for flat plate collector should have high tensile strength, high thermal conductivity, high corrosion resistance.

Advantage } PPT
Disadvantage }

* Concentrating Type Solar Collector :

(1) They collect & concentrate solar radiations on absorbing surface.

(2) These collectors have sun tracking device to follow sun for maximum collection of solar radiation.

↳ (1) Parabolic Solar collector :

(1) As they collect solar radiation & focuses on line therefore they called as line focusing type collector. Here highly polished glass or aluminized plastics are used as reflectors.

(2) These are used in thermoelectric power generation. These are used for application where temp. needed ~~more than~~ 300°C in range $50 - 100^{\circ}\text{C}$.

- (2) Cylindrical solar collector:
- (1) These are used in application where temp. ~~above~~ 300°C is required.
 - (2) These collectors are used in vapour engine turbines, process heating industries, cooking etc.

for diagram refer ppt

* Geothermal Energy :

I

Geothermal energy is heat within earth. The word geothermal comes from Greek work "geo" (earth) & "therme" (heat). Geothermal energy is a renewable energy source because heat is continuously produced inside earth. People use geothermal bath for bathing, to heat buildings & generate electricity.

II

Geothermal power plant is also a thermal powerplant, but steam required for power generation is available naturally in some parts of earth surface. According to various theories earth has a molten core.

The fact that volcanic action taken place in many places on surface of earth supports these theories.

III

Diagram: Refer ppt.

IV

Components :

(A) Steam well: Pipes are embedded at places of fresh volcanic action called steam well, where molten internal mass of earth vents to atmospheric with very high temperature. By sending water through embedded pipes steam is raised from underground steam storage well to ground level.

(B) Separator : Steam is then pass through separator where most of dirt & sand carried by steam are removed.

(C) Turbine : The steam from separator is passed through steam drum & is used to run turbine which in turn drives generator. The exhaust steam from turbine is condensed. The condensate is pumped into earth to absorb ground heat again & to get converted into steam.

Location of plants, installation of equipments like control unit etc, within source of heat and cost of drilling deep wells as 15,000 m are some of difficulties commonly encountered.

V Three main types of geothermal systems :

(A) ~~Direct use & district heating system~~ :-

- (1) Dry steam plants
- (2) Flash steam plants
- (3) Binary cycle power plants.

(1) Dry steam plant : Use steam directly from reservoir to turn generator turbines. The first geothermal power plant was build in 1904 in Tuscany, Italy where natural steam erupted from earth.

(2) Flash steam plants: It takes high pressure water from deep inside earth and convert it to steam to drive generator turbines. When steam cools, it condenses to water & is injected back into ground to be used again. Most of geothermal plants are flash steam plant.

(3) Binary cycle power plant:- It transfer heat from geothermal water to another liquid to turn it to steam, which is used to drive a generator turbine.