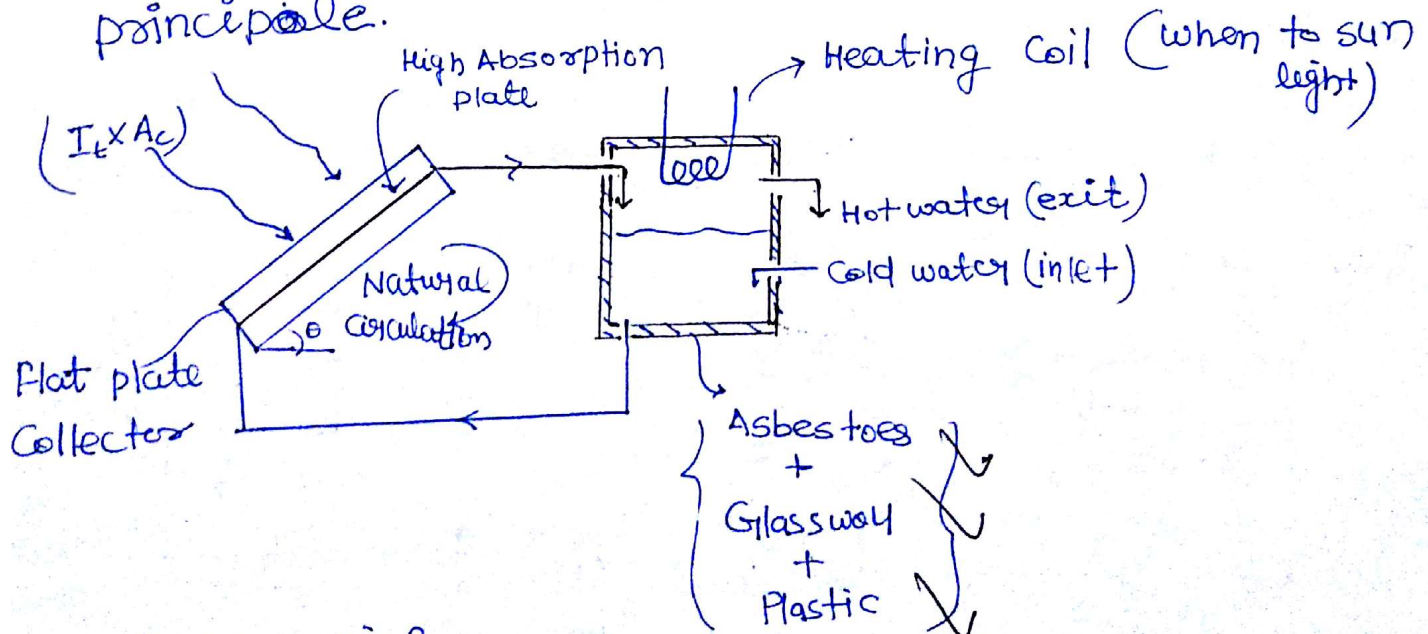


Solar thermal Energy Application

1. Solar water Heating :- solar water heating is classified as

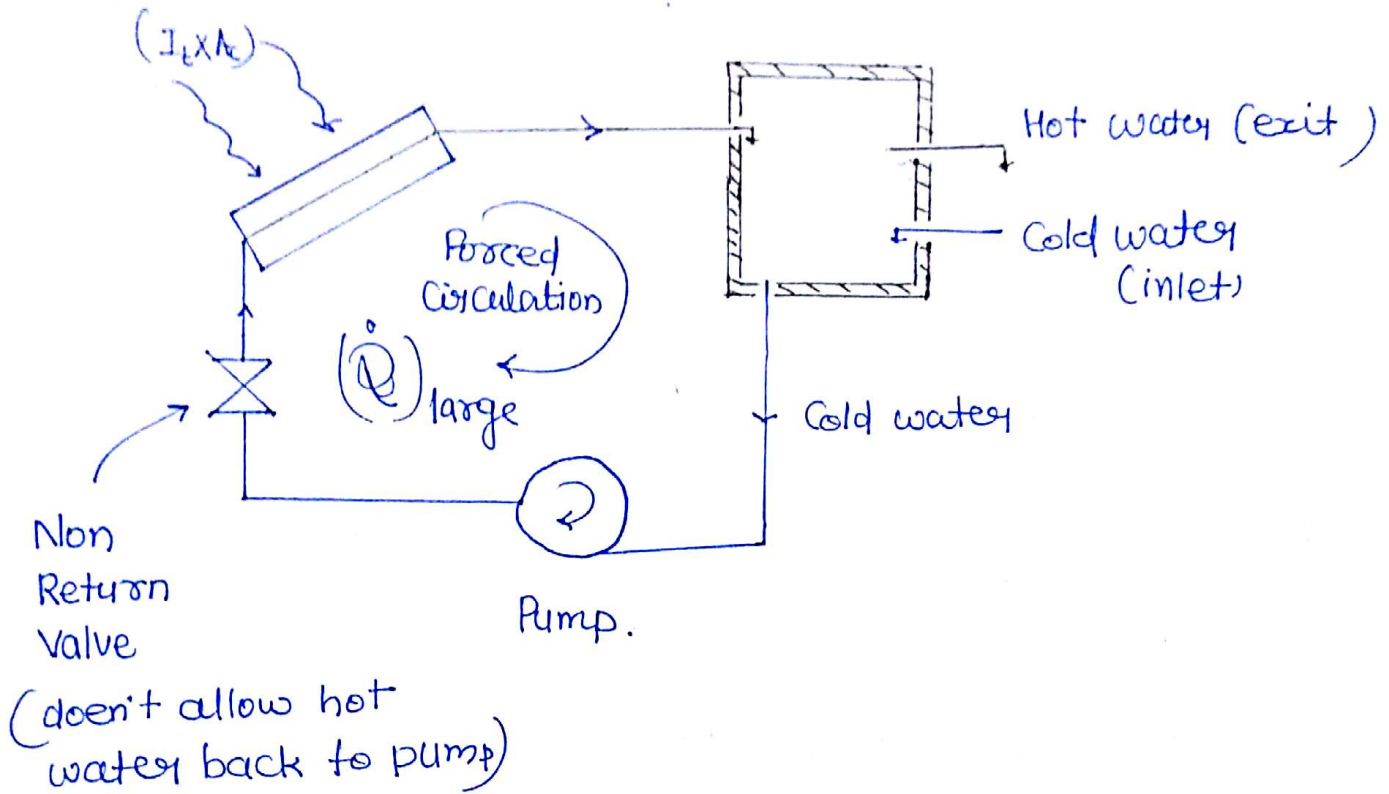
(a) Natural convection :- In natural circulation solar water heater the temp. of fluid at the exit is around $40 - 45^{\circ}\text{C}$ (low temp. application) and it is based on buoyancy principle.



* it is mainly used in domestic cases

(b) Forced Circulation System:-

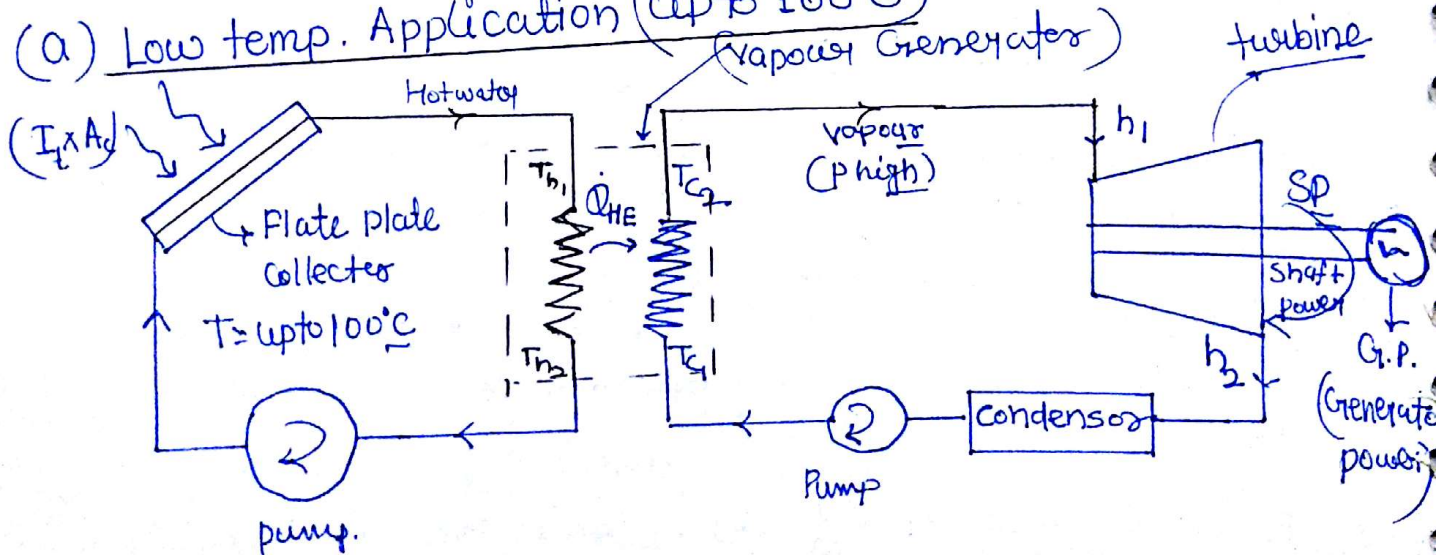
- It has dedicated pump for circulation
- It is mainly used for industrial purpose and high discharge rate application purpose.



2. Power Generation:-

The Generation of electrical energy from solar energy is further classified into three categories.

(a) Low temp. Application (upto 100°C)



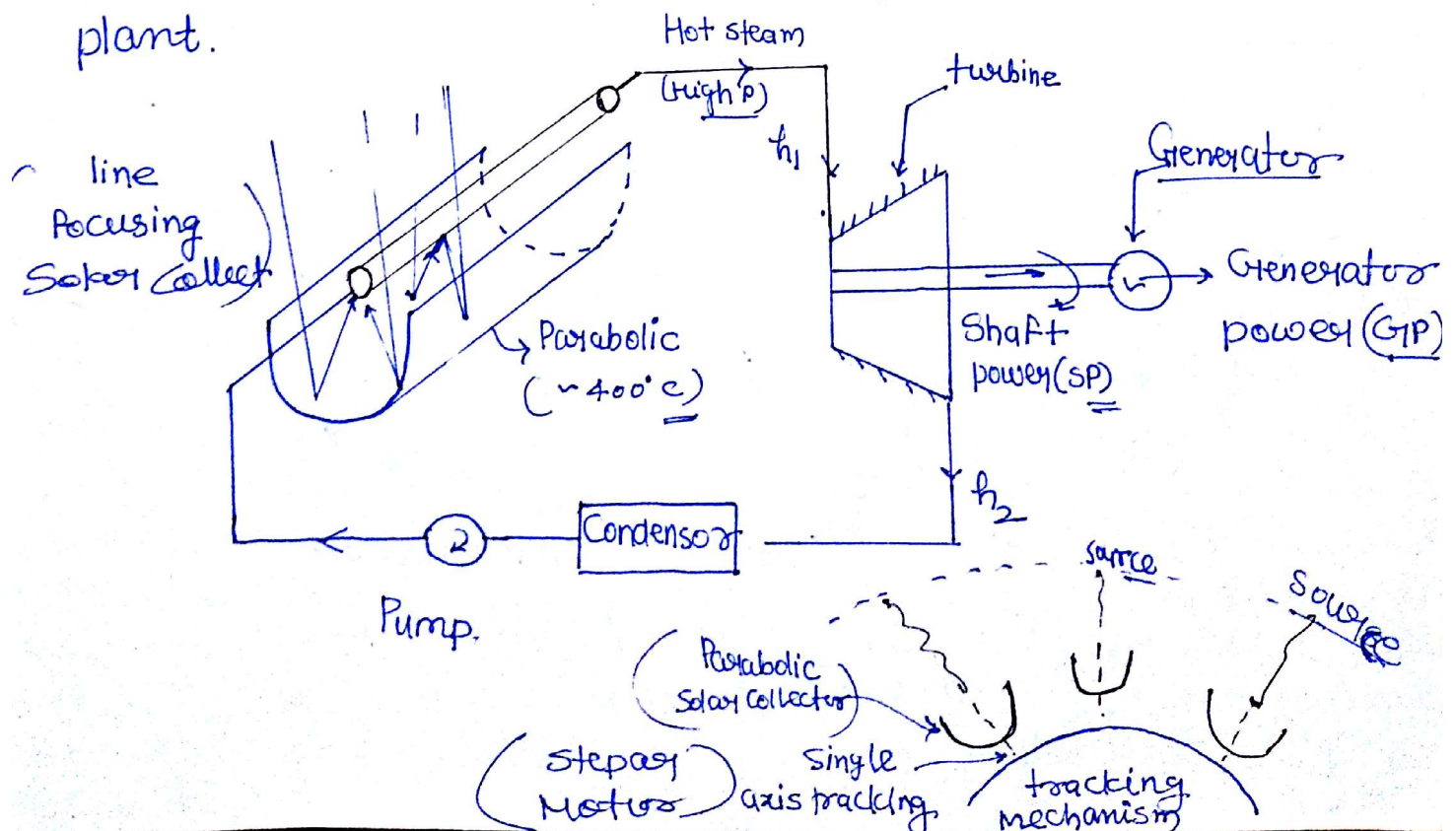
$$\epsilon_{HE} = \frac{(\dot{Q}_{loss})_{Hot} \text{ or } (\dot{Q}_{pin})_{Cold}}{(\dot{m}C_p)_{Small} (T_{hi} - T_{ci})}$$

low temp. system utilizes the flat plate collector to heat fluid upto boiling point and deliver this heat to the working fluid of rankine cycle through vapour generator.

Disadvantages:- Not economical because it require large collector area.

(b) Medium temp. system:- Medium temp. power plant require line focusing parabolic concentrator which can achieve the temp. upto 400°C

It is the most effective category of solar power plant.



Note:- Tracking Mechanism:-

line focusing solar collector requires single axis tracking mechanism so that the incident radiation direction always coincide with the focal point of the parabolic collector

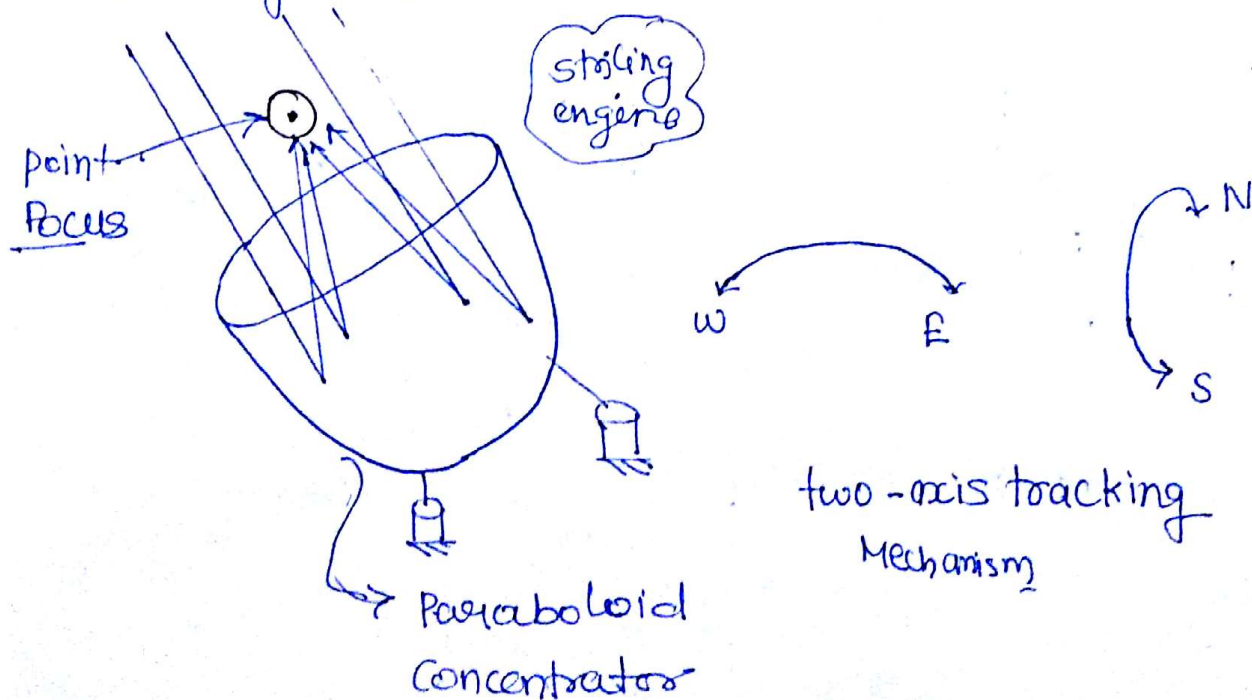
(C) High temperature Application :-

It is further divided into two categories for the temp range upto 1200°C .

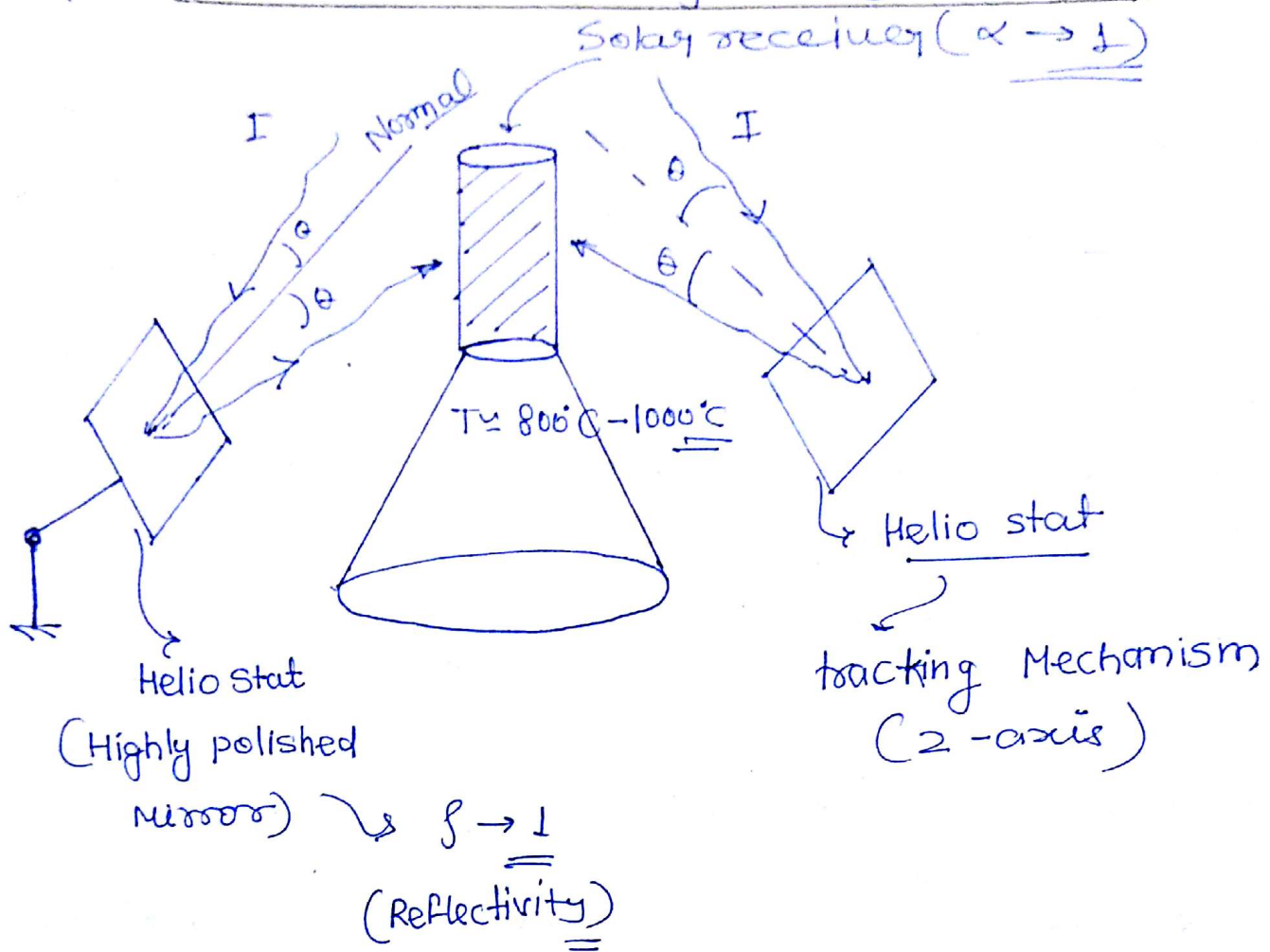
(i) Paraboloid disk Concentrator :-

→ In such concentrator motion or direction of sun rays are track by two axis tracking mechanism to bring them to a point of focus.

→ This system require highly complex and costly tracking mechanism



(ii) Central receiver system (solar tower)



The temp around 800°C and its concentration ratio is 1000.

Note

★

$$\eta_{\text{relative}} = \frac{\eta_{\text{engine}}}{\eta_{\text{carnot}}}$$

Very Imp

- decreasing order
- 1) Paraboloid (point focusing) $\eta_{\text{relative}} \approx 80\%$
 $\Rightarrow$ dual axis tracking $\Rightarrow$ concentration ratio = 10000
 - 2) Solar tower (point focus) $\eta_{\text{rel.}} \approx 70\%$
 $\Rightarrow$ dual axis tracking $\Rightarrow$ C.R. = 1000
 - 3) Parabolic (line focus) $\eta_{\text{rel.}} \approx 60\%$ C.R. = 100
 through one axis
 - 4) Flat-Plate $\Rightarrow$ No tracking $\Rightarrow$ C.R. = 1 $\eta_{\text{rel.}} \approx 25\%$