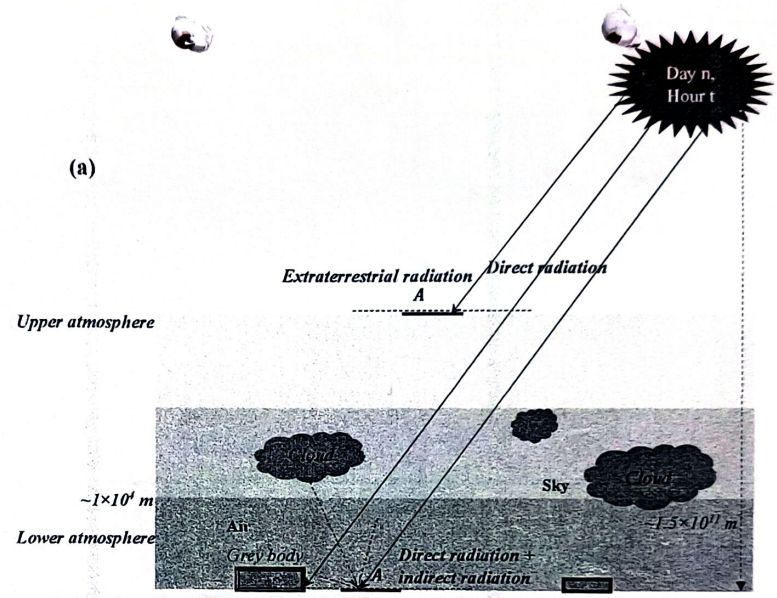
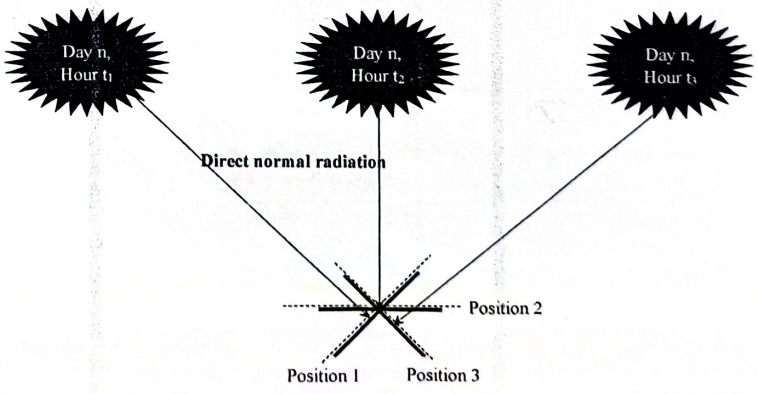
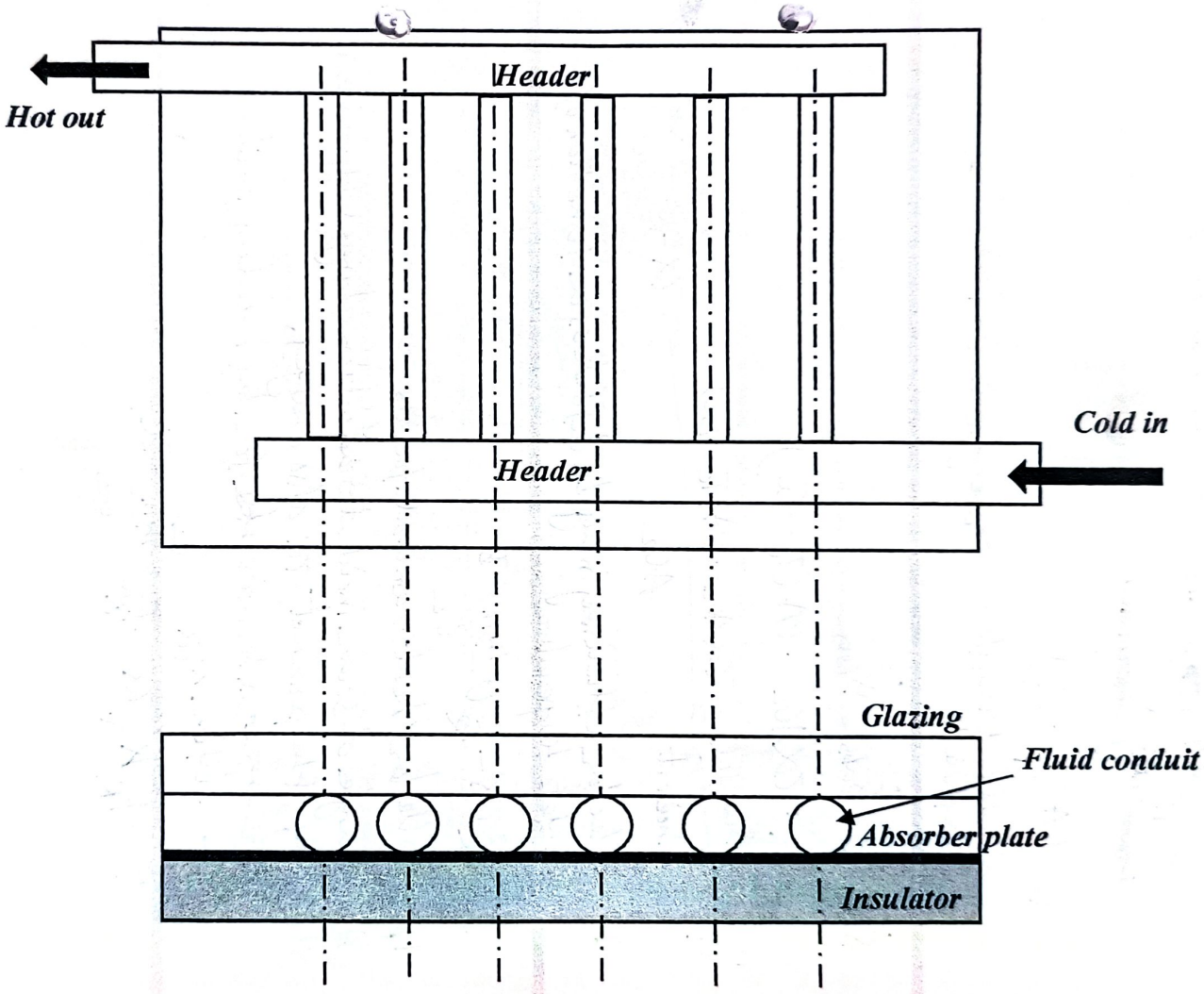

(a)
Day n,
Hour t
Extraterrestrial radiation
A
Direct radiation
Upper atmosphere
Cloud
Sky
Cloud
~1×10⁴ m
~1.5×10¹¹ m
Air
Lower atmosphere
Grey body
Direct radiation +
indirect radiation
A


(b)
Day n,
Hour t₁
Day n,
Hour t₂
Day n,
Hour t₃
Direct normal radiation
Position 2
Position 1
Position 3


Hot out
Header
Cold in
Header
Glazing
Fluid conduit
Absorber plate
Insulator

The rate of solar heat absorbed by the absorber plate is $\dot{Q}_{abs} = \tau\alpha A G_T$ (G is the solar irradiation)

(τ: transmissivity, α: absorptivity)

$$\dot{Q}_{loss} = UA(T_c - T_a)$$

U: overall heat transfer coefficient; T_c: average collector temperature

$$\dot{Q}_{useful} = \dot{Q}_{abs} - \dot{Q}_{loss}$$

$$= \tau\alpha A G_T - UA(T_c - T_a)$$

$$\eta_c = \frac{\dot{Q}_{useful}}{\dot{Q}_{incident}} = \frac{\tau\alpha A G_T - UA(T_c - T_a)}{A G_T} = \tau\alpha - U\frac{T_c - T_a}{G_T}$$

The collector efficiency may be defined as a function of water inlet temperature

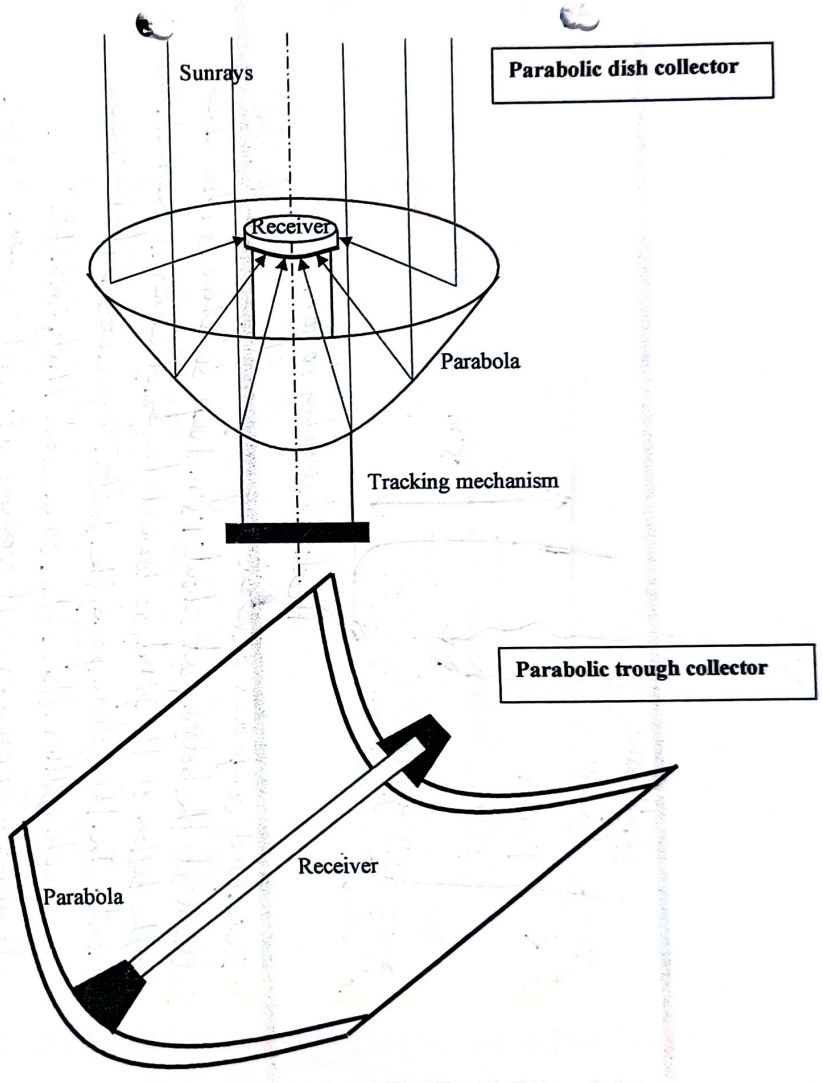
$$\eta_c = F_R\tau\alpha - F_R U\frac{T_{w,in} - T_a}{G_T}$$

F_R = collector heat removal factor

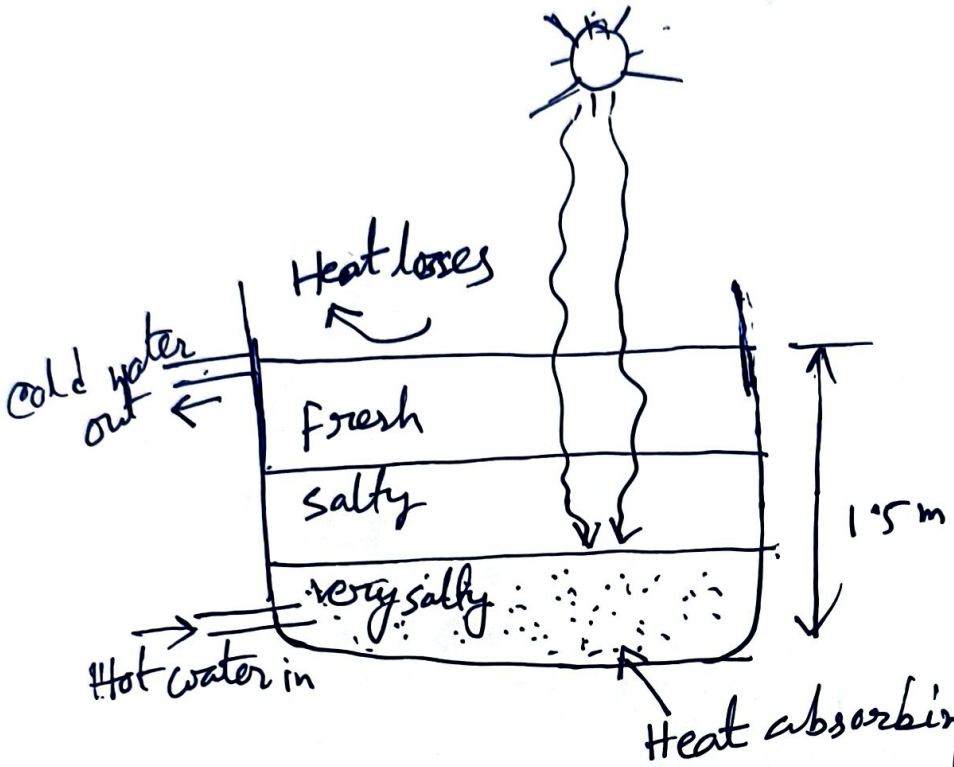
As the angle of solar incident radiation changes throughout the day, the product $\tau\alpha$ also changes.

This change can be accounted for by including incident angle modifier $K_{\tau\alpha}$

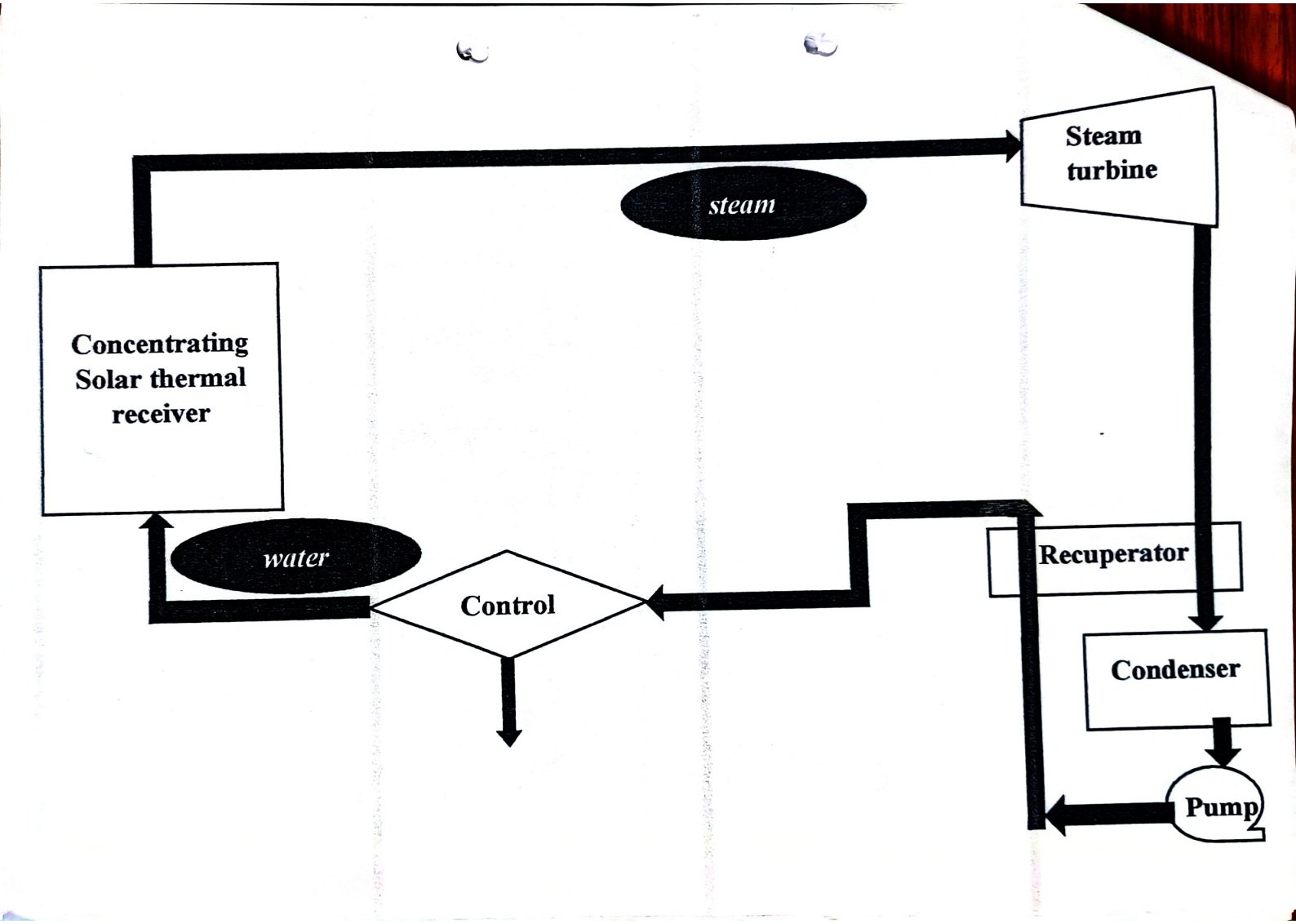
$$\eta_c = F_R K_{\tau\alpha}\tau\alpha - F_R U\frac{T_{w,in} - T_a}{G_T}$$

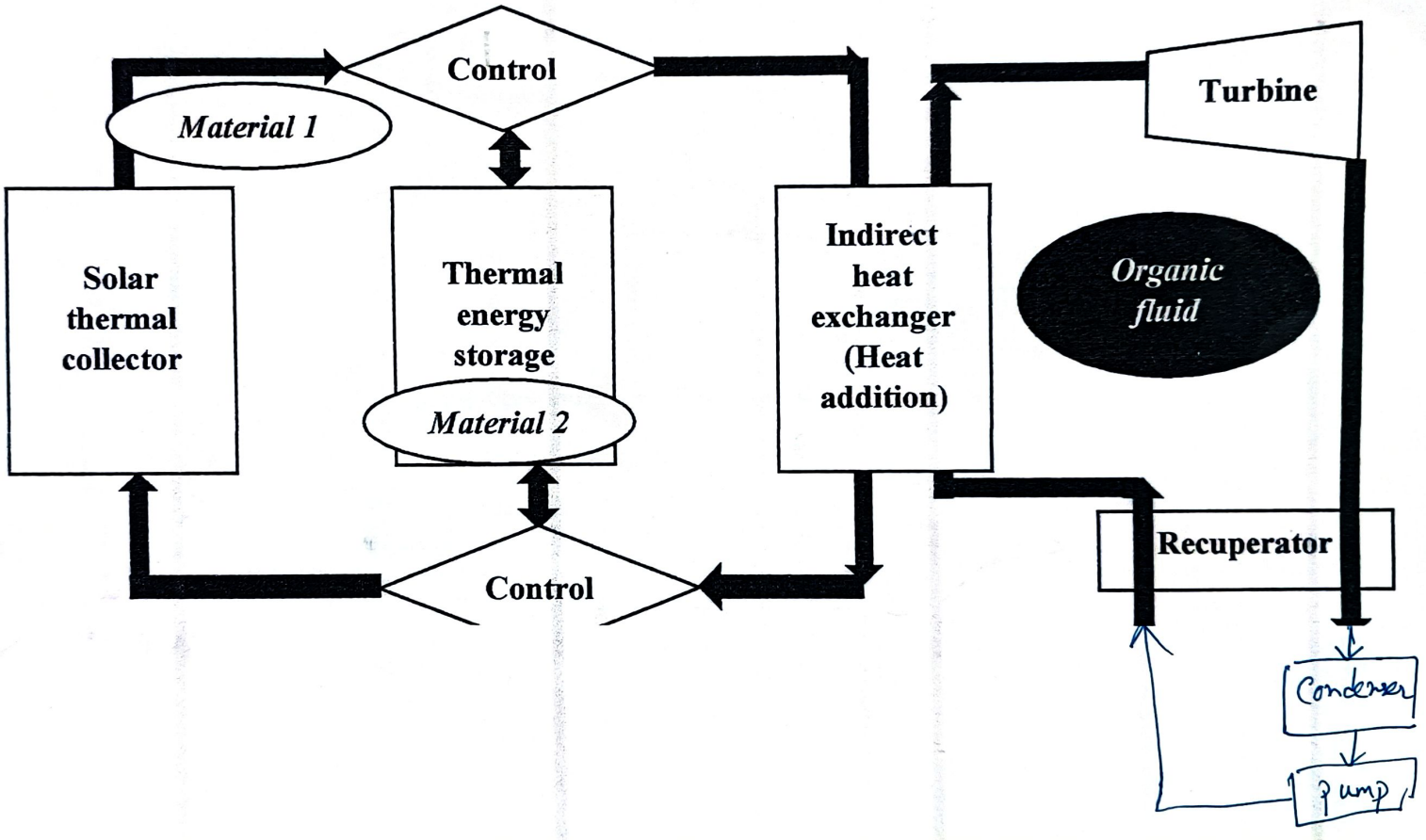

Parabolic dish collector
Sunrays
Receiver
Parabola
Tracking mechanism
Parabolic trough collector
Receiver
Parabola

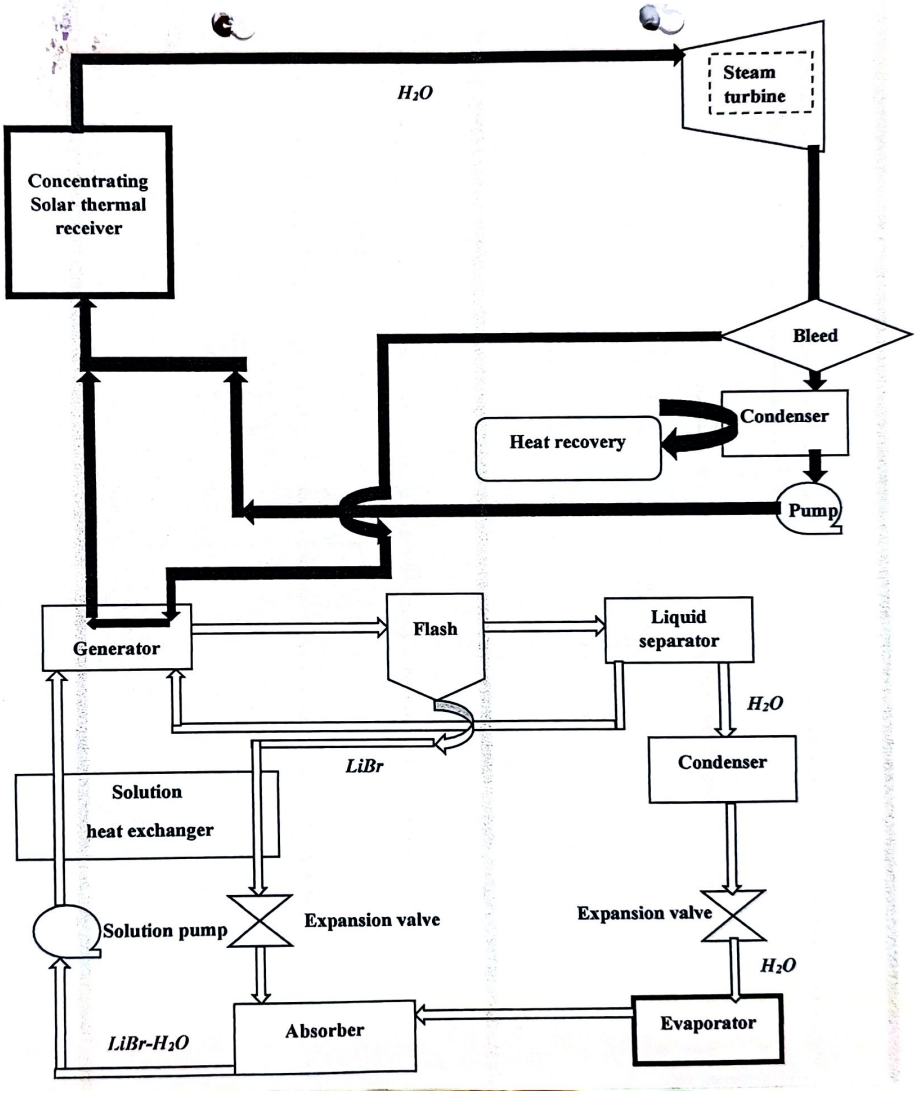
Solar Pond

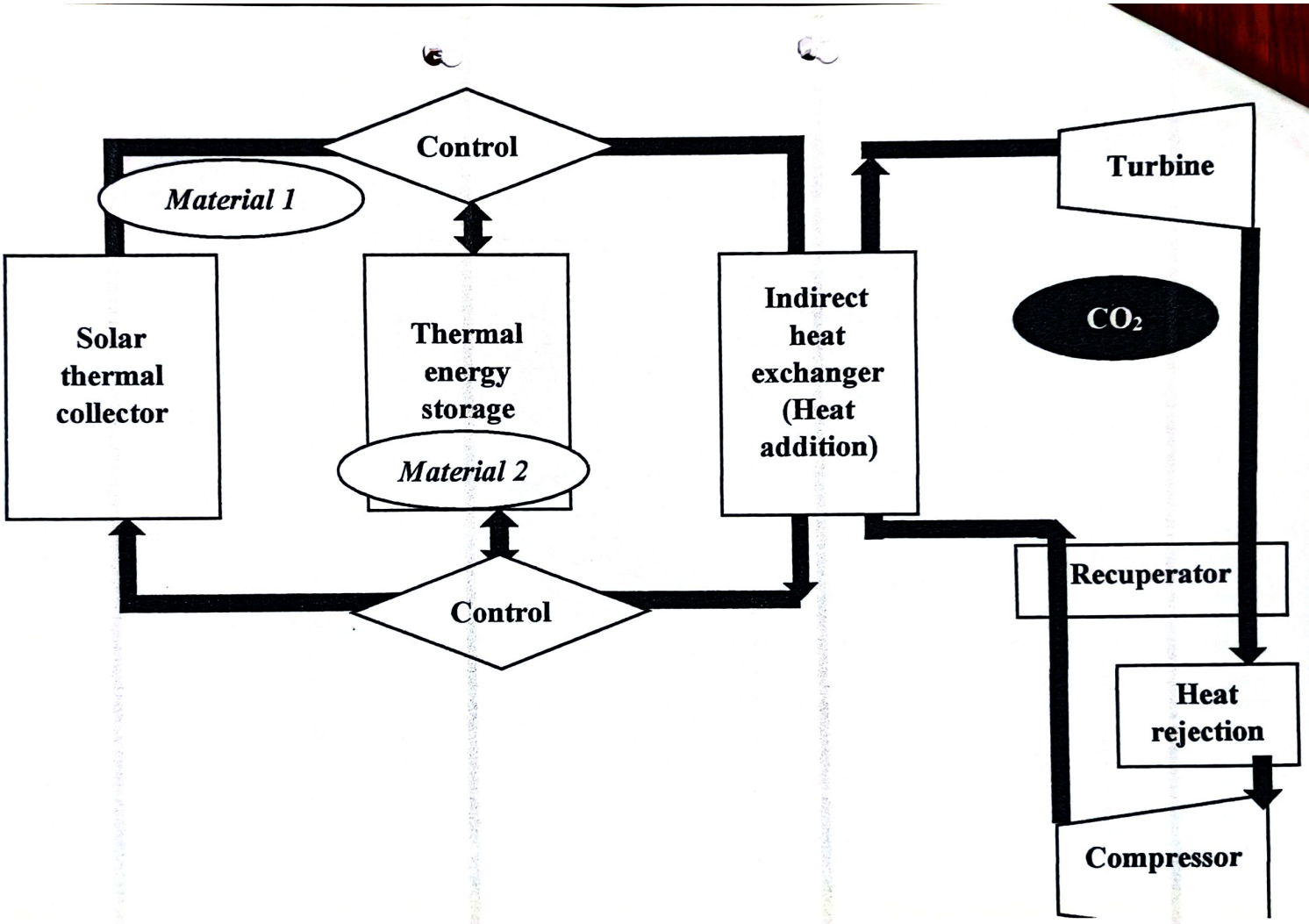


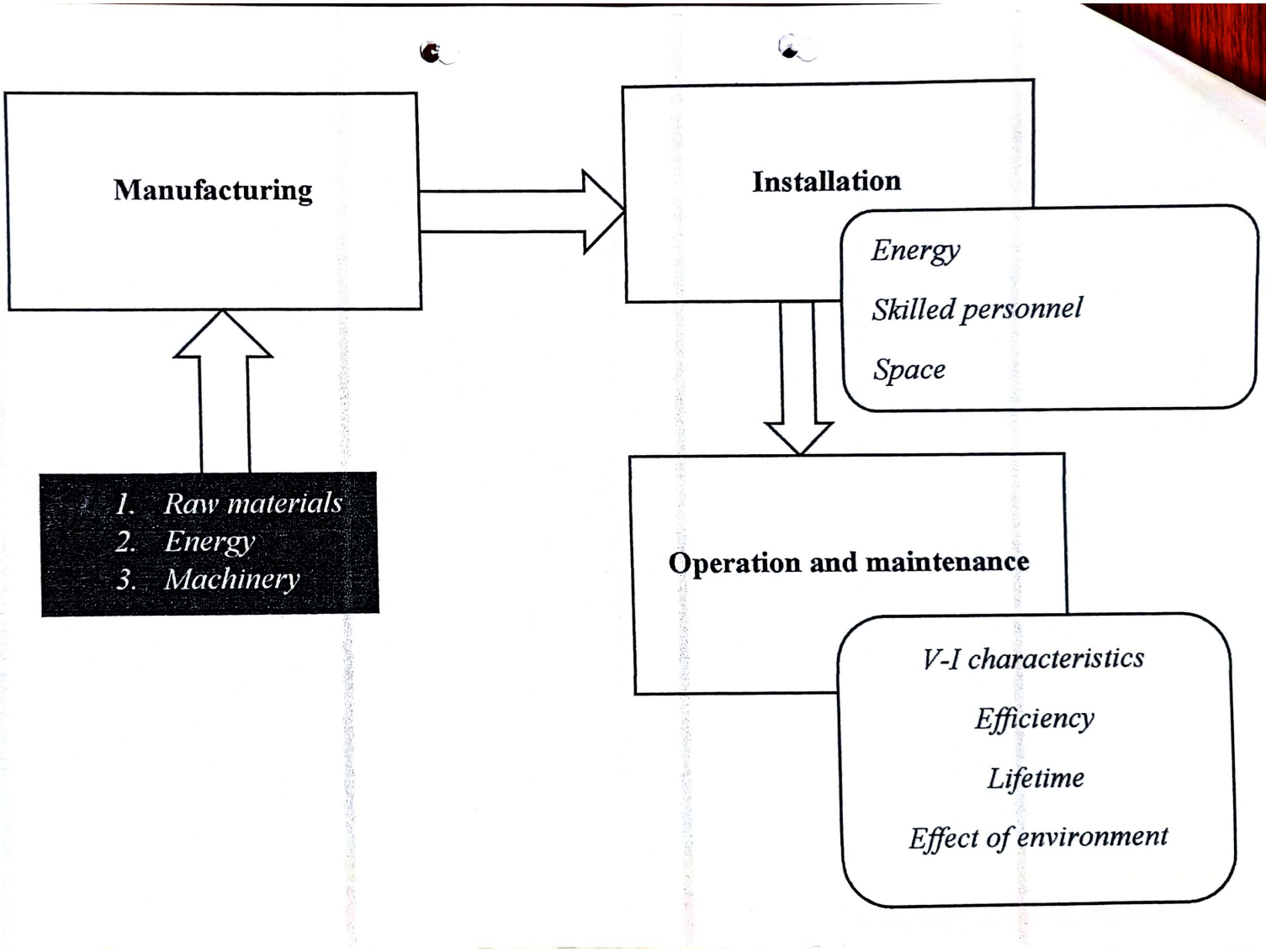
A solar pond comprises several layers of salty water, with the saltiest at the bottom, at about 1.5 m deep. Sunshine is absorbed at the bottom of the pond, so lowest layer of water is heated the most. In the solar pond, the bottom layer was initially made so much saltier than the one above that, even though its density decreases as it warms, it still remains denser than the layer above. Thus convection is suppressed, and the bottom layer remains at the bottom getting hotter and hotter.


Steam turbine
steam
Concentrating Solar thermal receiver
water
Control
Recuperator
Condenser
Pump

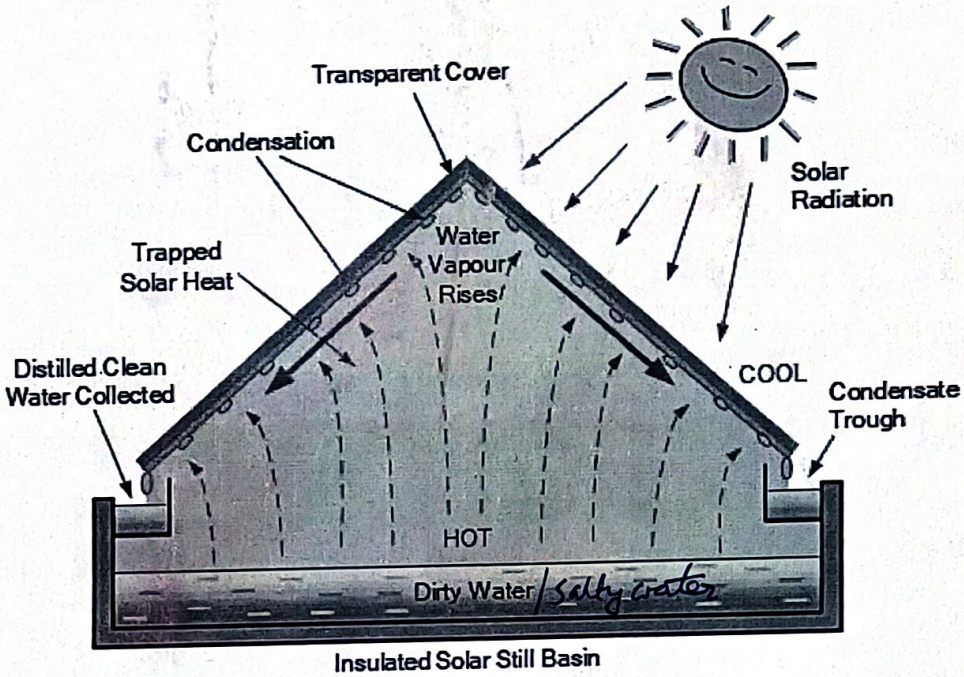

Control
Material 1
Solar thermal collector
Thermal energy storage
Material 2
Control
Indirect heat exchanger (Heat addition)
Turbine
Organic fluid
Recuperator
Condenser
pump


H_2O
Steam turbine
Concentrating Solar thermal receiver
Bleed
Condenser
Heat recovery
Pump
Generator
Flash
Liquid separator
H_2O
Condenser
$LiBr$
Solution heat exchanger
Solution pump
Expansion valve
Expansion valve
H_2O
Absorber
Evaporator
$LiBr$-H_2O

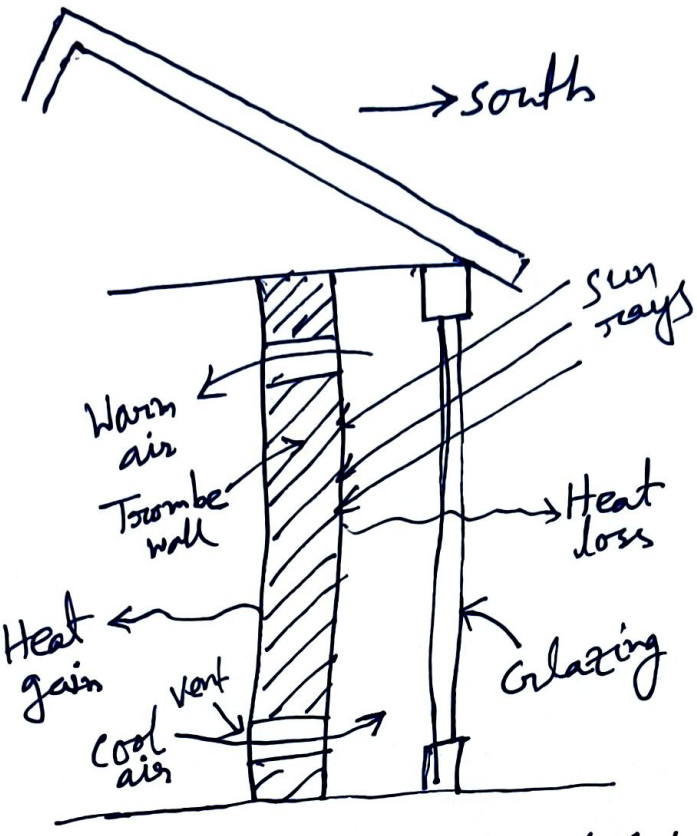

Control
Material 1
Solar thermal collector
Thermal energy storage
Material 2
Control
Indirect heat exchanger (Heat addition)
Turbine
CO_2
Recuperator
Heat rejection
Compressor


Manufacturing
Installation
Energy
Skilled personnel
Space
1. Raw materials
2. Energy
3. Machinery
Operation and maintenance
V-I characteristics
Efficiency
Lifetime
Effect of environment

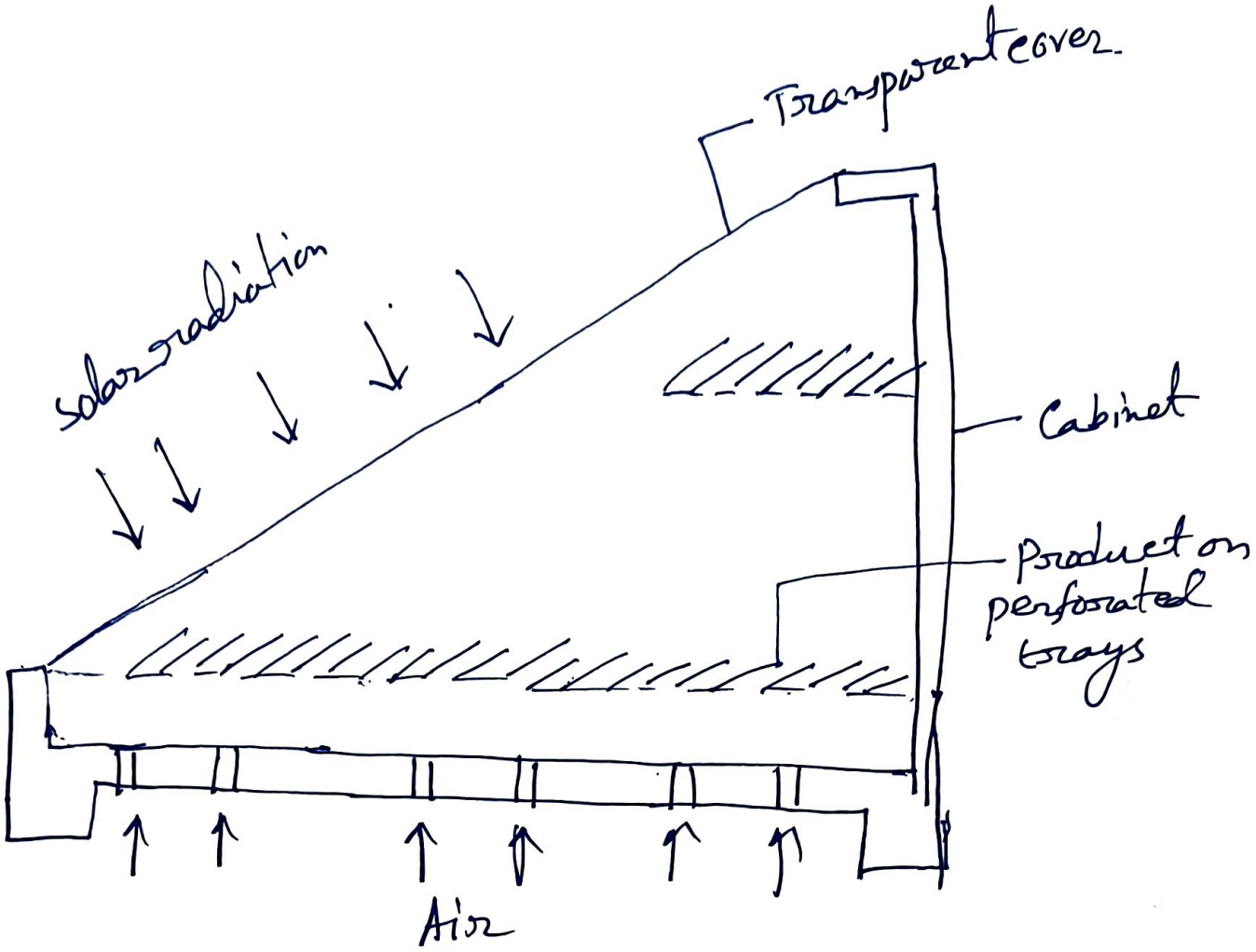
Solar Still



Insulated Solar Still Basin



Dark-painted thick masonary wall called trombe walls as commonly used on south sides of passive solar homes to absorb solar energy, store it during the day, and release it to the house during the night. Usually a single or double layer of glazing is placed outside the wall and transmit most of the solar energy while blocking heat losses from the exposed surface of the wall to the outside. Air vents installed at the bottom and top of the trombe walls so that the house air enters the parallel flow channel between the trombe wall and glazing, rises as it is heated, and enters the room through the top vent.



Temperature ranging from 50 to 80 °C
Drying time ranges from 2 to 4 days
Typical products which can be dried in such devices are dates, apricots, chillies, grapes, etc.