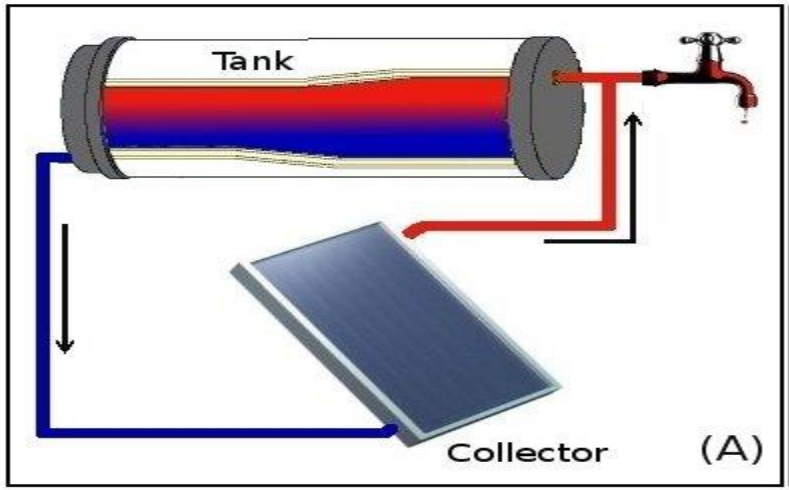
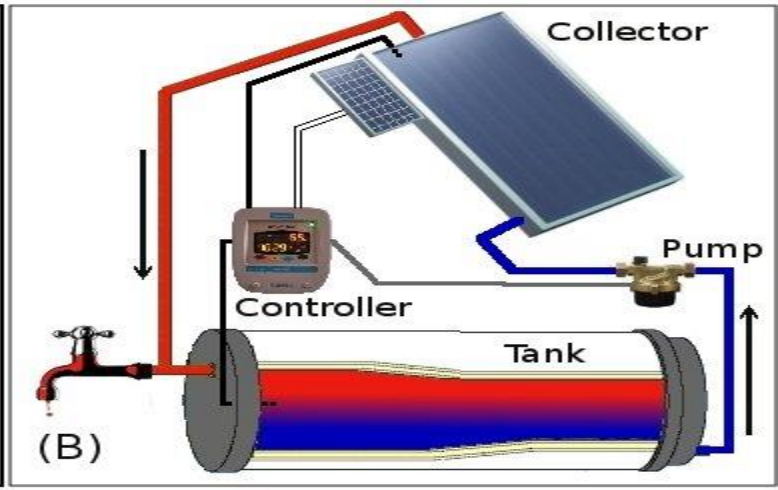
Applications of Solar Energy

Introduction

- **Direct thermal applications**
  - Direct use of heat absorbed of solar radiation
  - For space heating
  - Hot water service
  - Heat for agricultural requirements
  - Industrial applications, which require moderate temperatures



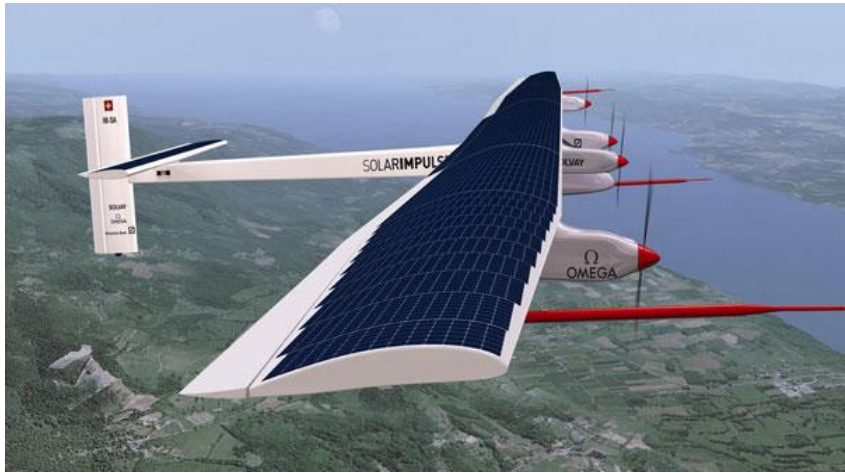


Introduction

- **<u>Solar Electric applications</u>**
  - Solar energy is converted into electric energy directly or indirectly
  - Solar thermal methods
  - Thermo electric effect
  - Photovoltaic methods
  - Other forms of indirect solar energy

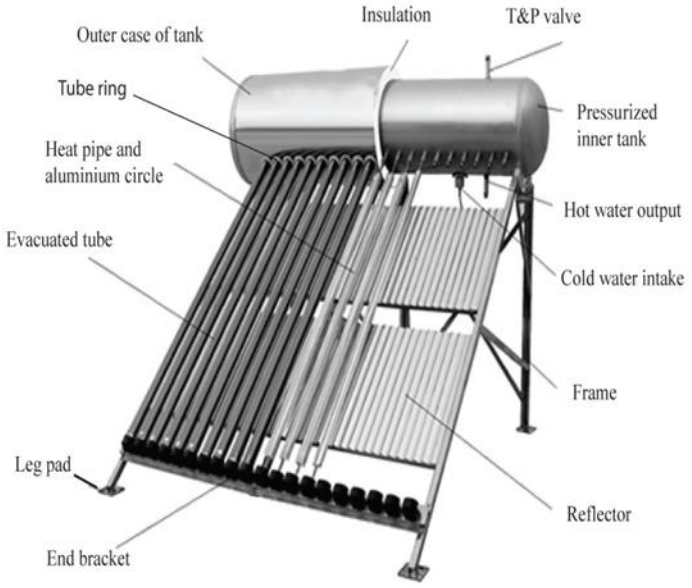
Applications of Solar Energy

1. Solar water heating
2. Space heating
3. Space cooling
4. Thermal power plant
5. Solar distillation
6. Solar pumping
7. Agriculture and industrial process heat
8. Solar furnace
9. Solar cooking
10. Solar production of hydrogen
11. Solar green houses



1.Solar water heating

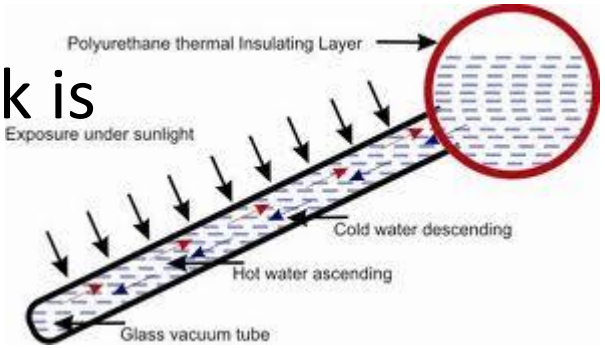
- Main components
  - Flat plate collector
  - Storage tank
  - Circulation system
  - Auxiliary heating system
  - Control system



- It is required almost throughout the year

1.1 Natural circulation solar water heater

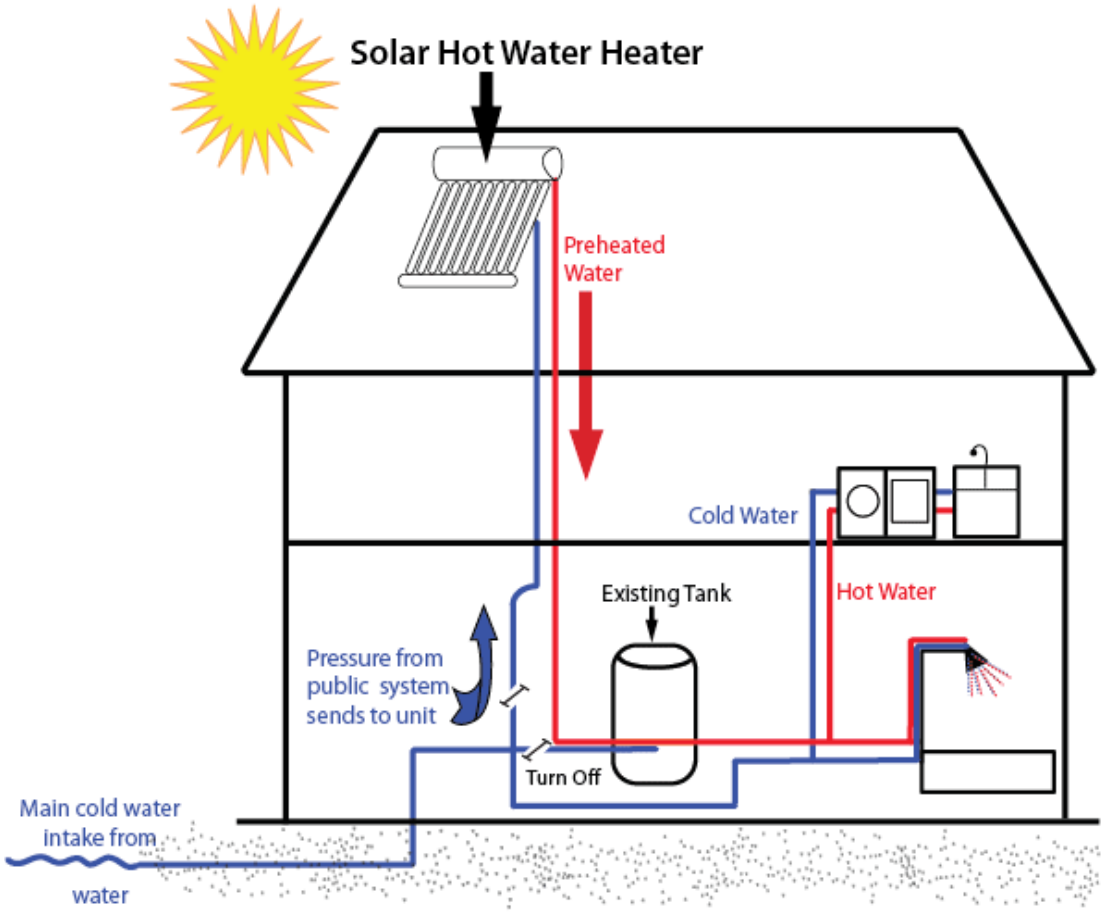
- It consists of
  - A tilted collector(south facing) with transparent cover glasses
  - A separate highly insulated water storage tank
  - Well insulated pipes connecting two
- No external energy required for circulation as bottom of the tank is at least 0.3 m above the top of collector



1.1 Natural circulation solar water heater

- Works on principle of thermo siphoning
- The density difference between cold and hot water provides the driving force for the circulation of water
- This phenomenon can reverse the flow direction at the night time
- Better suited for un-electrified rural areas with no sub-zero temperatures

1.2 Forced circulation solar water heater

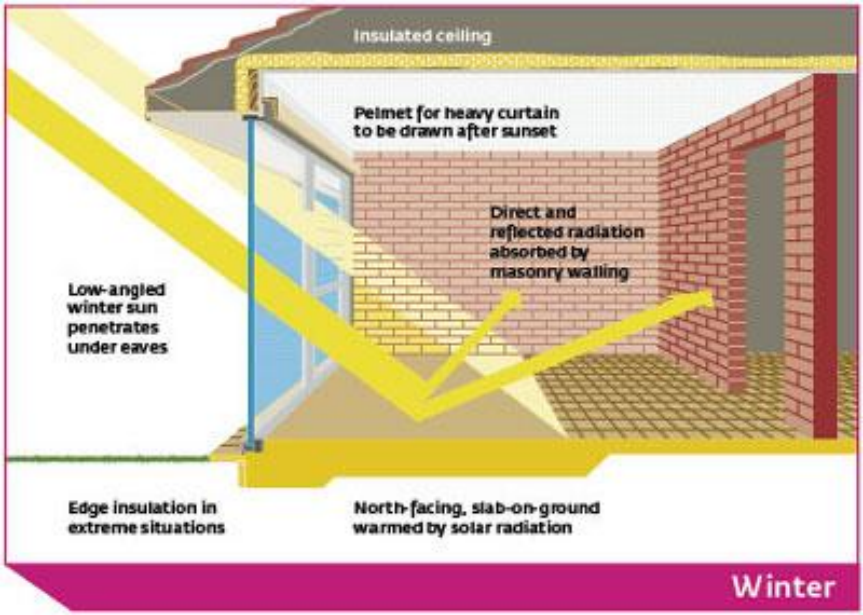


2.Space heating

- Passive systems
  - Solar radiation is collected by some element of structure itself or admitted through large south facing windows
- Active systems
  - It may consist of solar collector, storage device and a back up system

2.1 Passive heating system

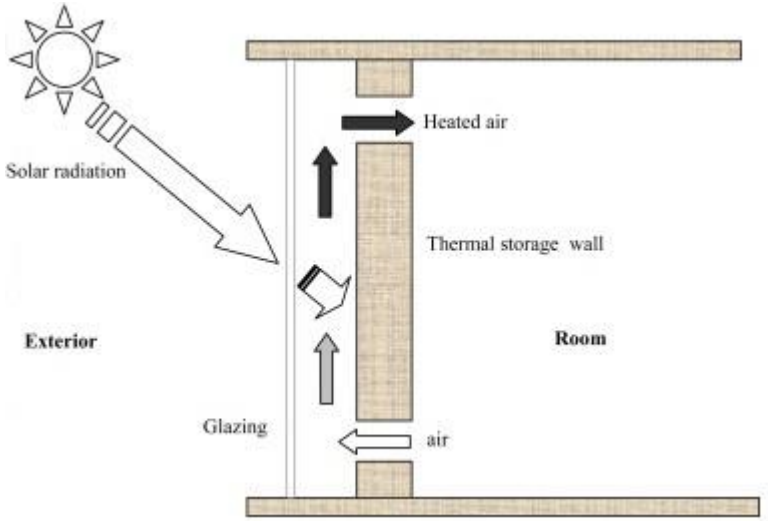
- It operates without pumps, blowers or mechanical devices
- The air is circulated past a solar heated surface and through the building with natural convection
- The building will function as solar store house



2.1 Passive heating system

- Basic principles

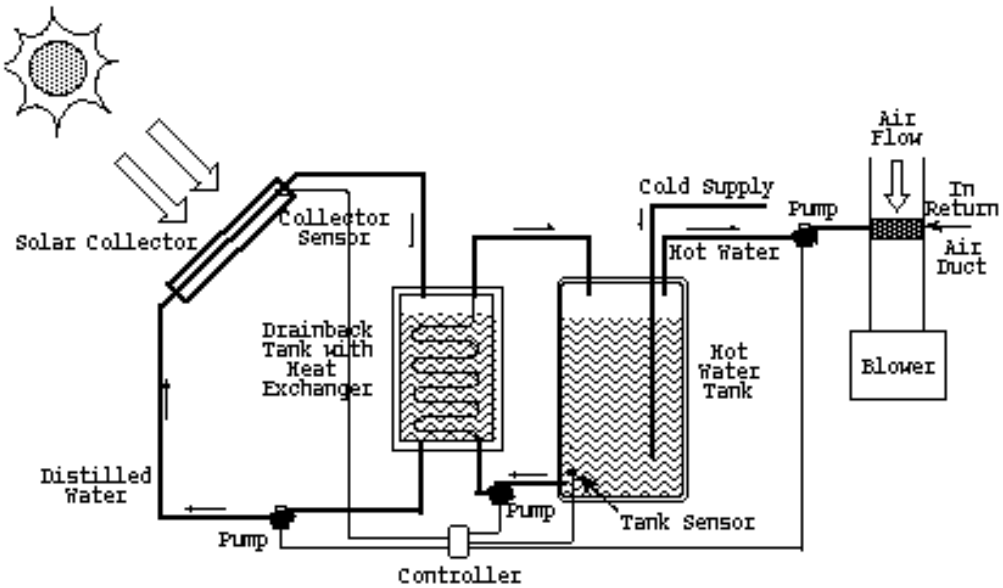
1. Direct gain
2. Thermal storage wall
3. Attached sun space
4. Roof storage
5. Convective loop



2.2 Active space heating systems

- Collectors are used to absorb the solar radiation, transfer it to air or water and store it in tanks of water or rock piles or both

- In case of water heating, a common heat transfer and storage medium is used

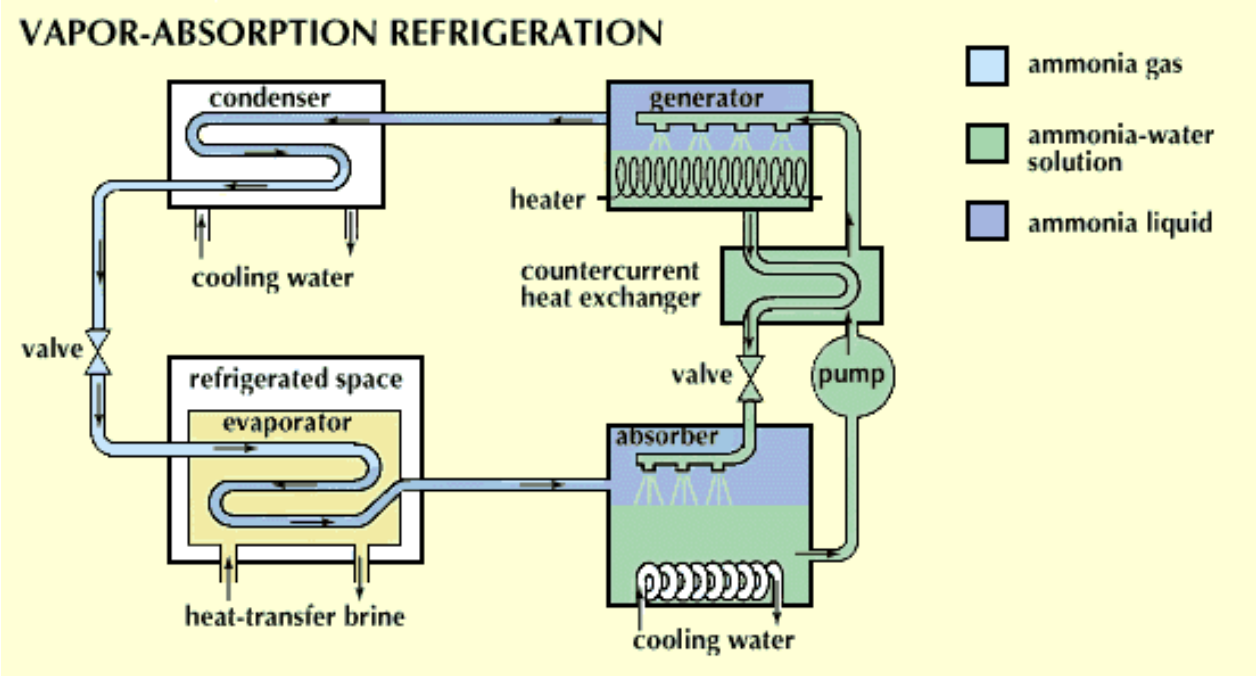


2.2 Active space heating systems

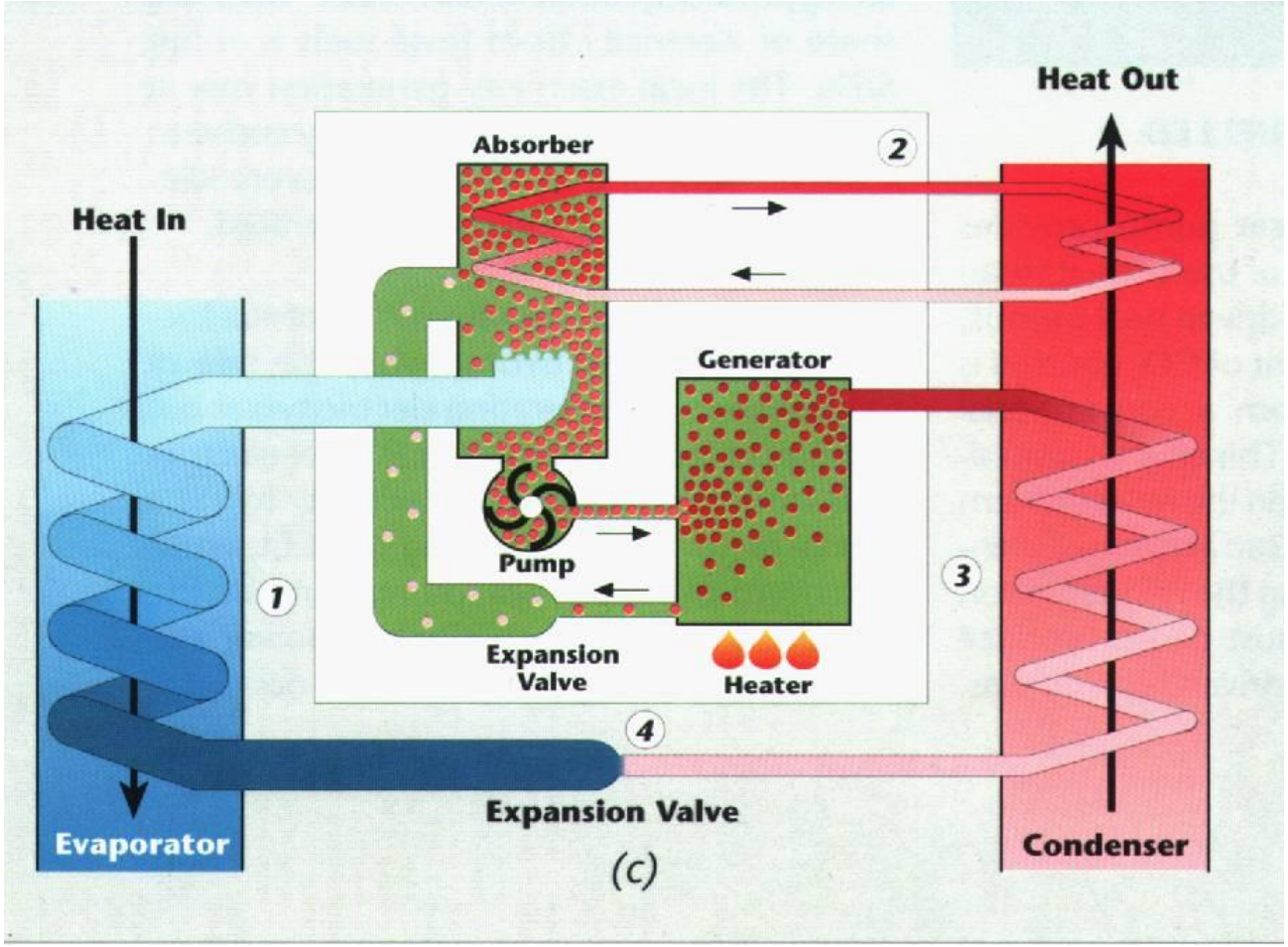
- It requires relatively smaller storage volume
- It can supply energy to absorption air conditioner
- Relatively low requirement of pumping energy
- Temperature control should be good to avoid boiling
- Care has to be taken to avoid corrosion problems

3. Space cooling

- For region like ours
- **Absorption air conditioning**



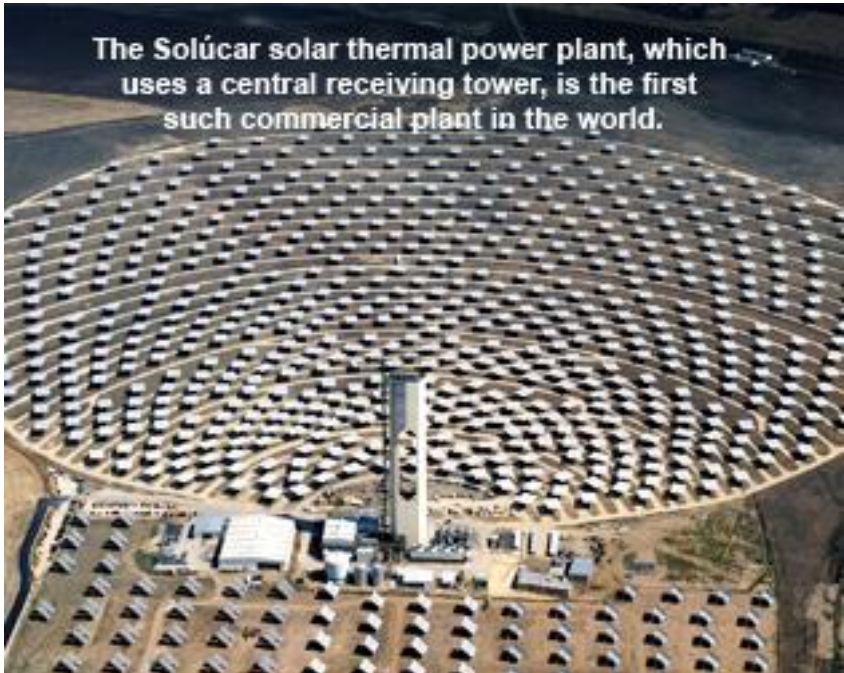
3.1 Vapor absorption cycle



4.Solar thermal power plant

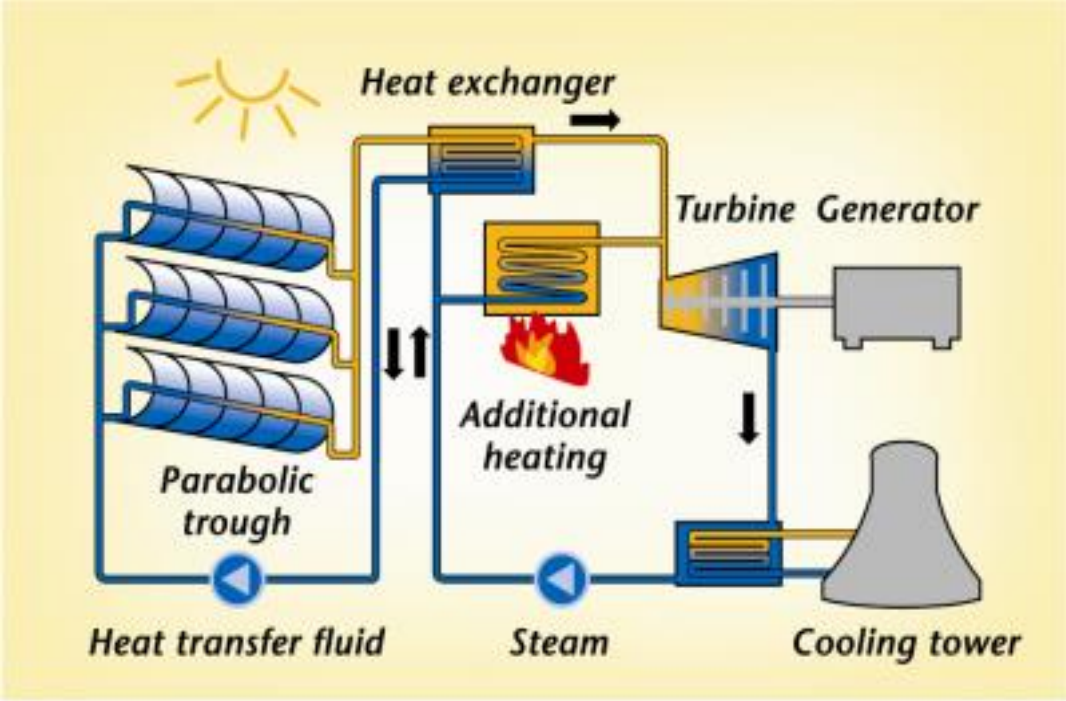
- In the *central receiver system,* commonly known as the power tower design, an array of sun tracking mirrors(heliostats) reflect solar radiation into a receiver mounted on the top of a central tower

- The distributed collector system may consist of number of parabolic trough type or Paraboloid dish type collectors



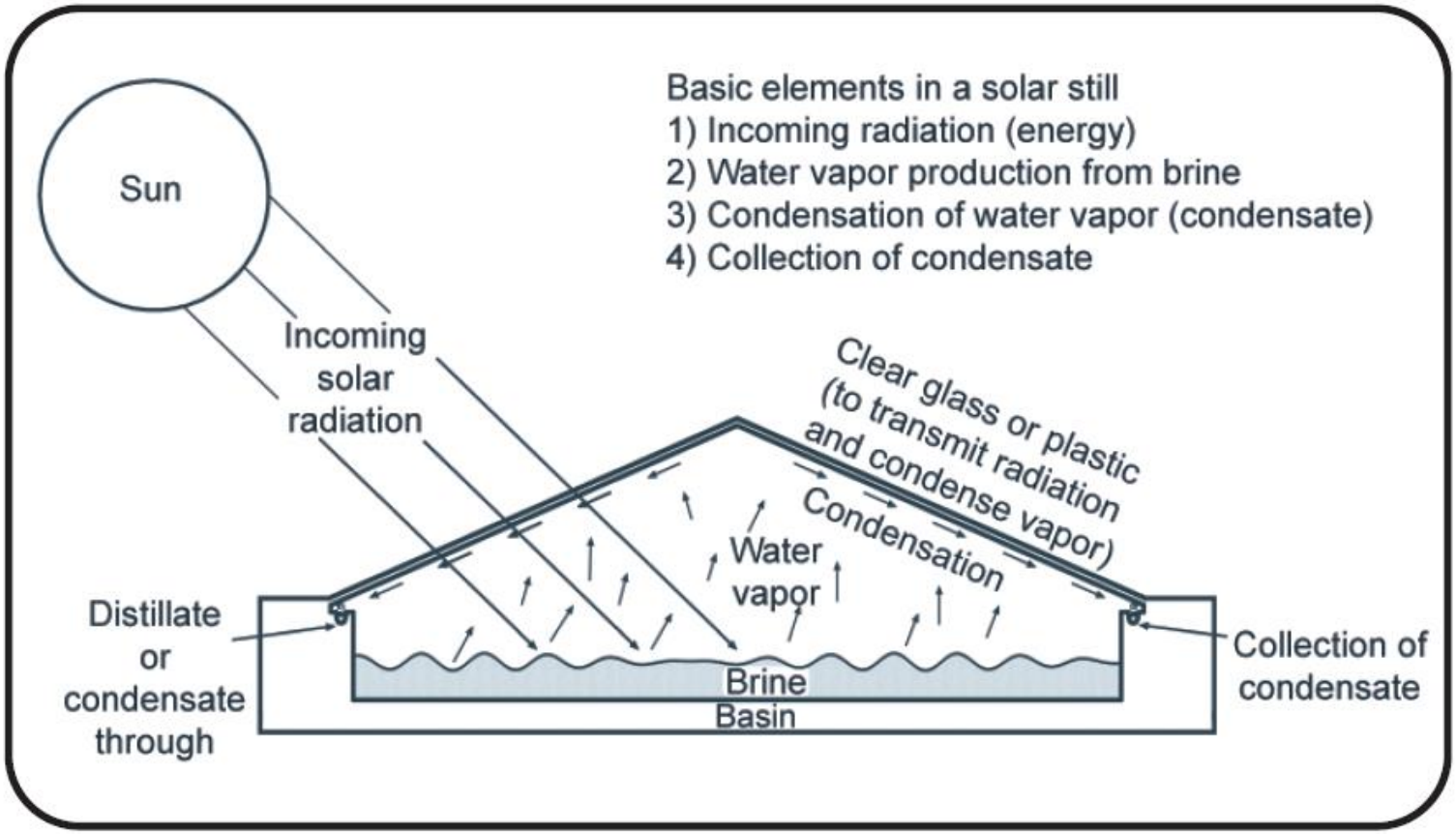
4.Solar thermal power plant

- It is more suitable for large scale power plant
- These types of designs have been implemented at several places including Spain and Australia



5.Solar distillation

- For human being to sustain the fresh water is essential



5.Solar distillation

- Solar still has a blackened basin containing saline water at a shallow depth
- A transparent air tight cover is enclosed over the basin
- The condensed water flows down the sloping roof and is collected in troughs at the bottom
- Operating efficiencies of 35% to 50% for basin type solar still have been achieved

6.Solar Pumping

- Organic Rankine cycle is employed to rotate the turbine by the use of solar energy
- Directly coupled pump with the turbine pumps the water for low head and flow rate requirements
- Another way is to use PV array to generate the electricity and thereby drive the pump using electric DC motor


Thank you!