SOLAR GREEN HOUSE

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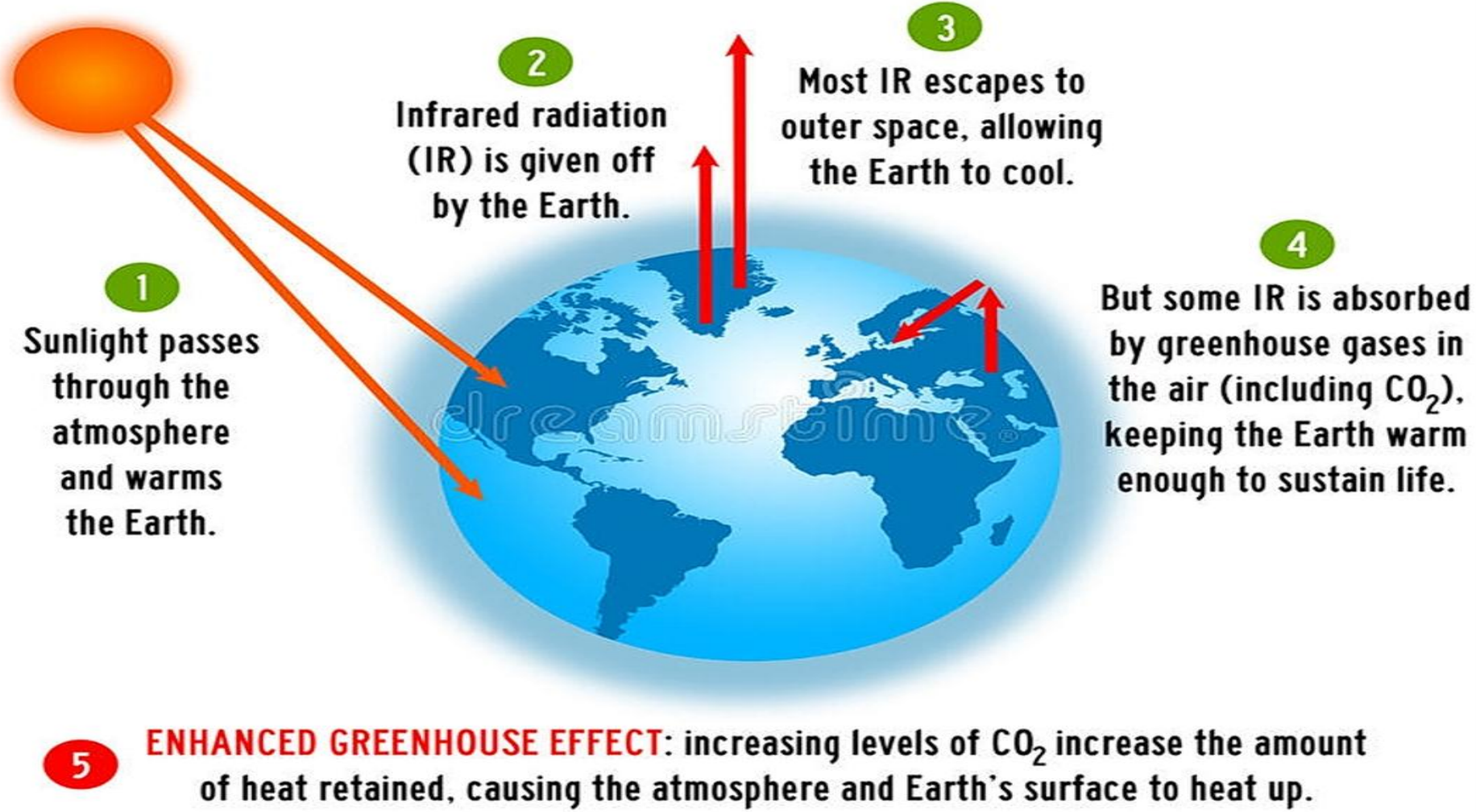
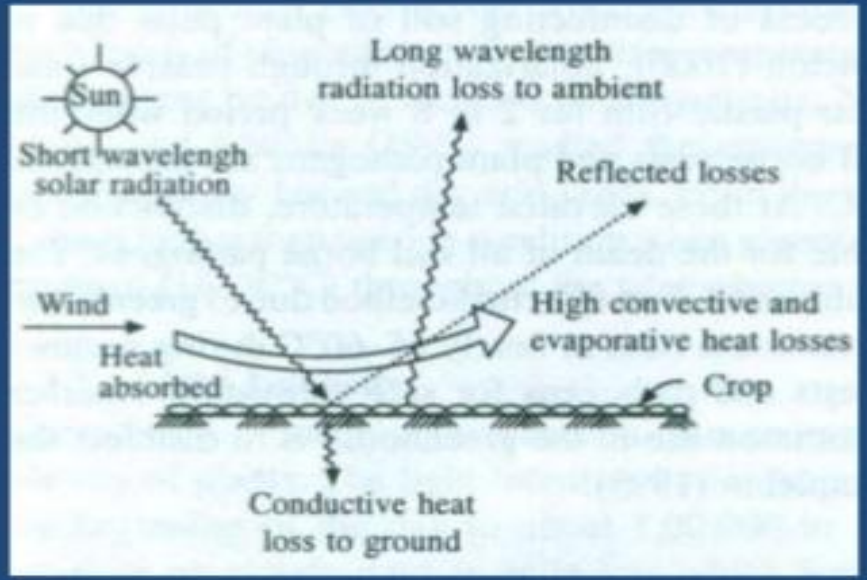
NON-CONVENTIONAL ENERGY
2018-2019

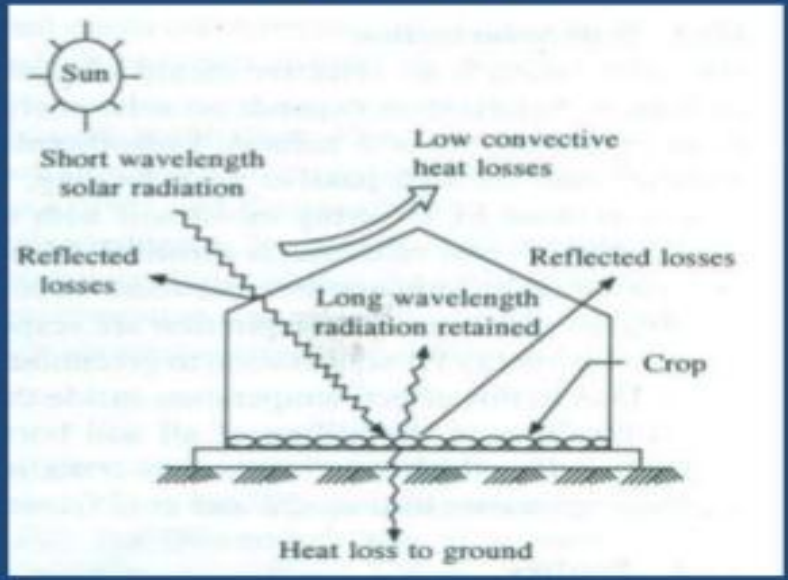

1
Sunlight passes through the atmosphere and warms the Earth.
2
Infrared radiation (IR) is given off by the Earth.
3
Most IR escapes to outer space, allowing the Earth to cool.
4
But some IR is absorbed by greenhouse gases in the air (including CO_2), keeping the Earth warm enough to sustain life.
5
ENHANCED GREENHOUSE EFFECT: increasing levels of CO_2 increase the amount of heat retained, causing the atmosphere and Earth's surface to heat up.

Solar heat conversion

Open air



Greenhouse



What is a Greenhouse?

- A structure that is covered with a translucent material that uses solar radiant energy to grow plants
- The purpose of a greenhouse is to allow the growth of plants all year, especially when conditions are naturally unfavorable

The Greenhouse Effect

The Earth is similar to a greenhouse. The Earth's atmosphere acts like the glass in a greenhouse.

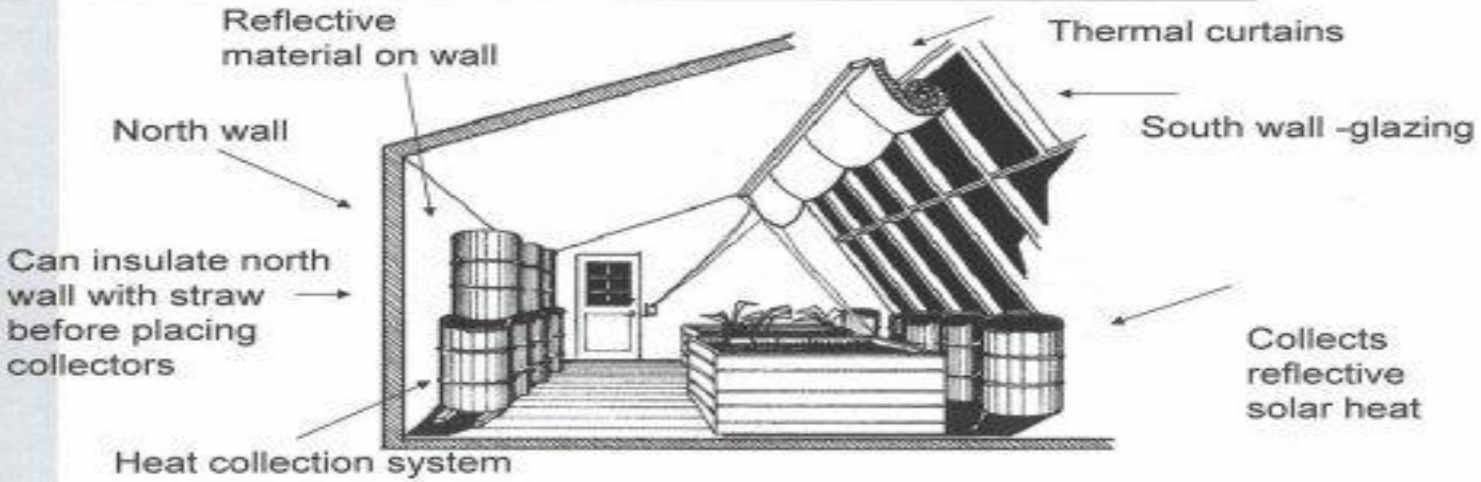
Sunlight streams through the atmosphere and heats the Earth. As this heat radiates up from Earth's surface, some of it escapes into space. The rest of the heat is absorbed by gases in the troposphere and warms the air.

This process of heat absorption is called the greenhouse effect.

Solar greenhouses differ from conventional greenhouses in the following four ways [4]:

- -Have glazing oriented to receive maximum solar heat during the winter;
- -Use heat storing materials to retain solar heat;
- -Have large amounts of insulation where there is little or no direct sunlight;
- -Use glazing material and glazing installation methods that minimize heat loss;
- -Rely primarily on natural ventilation for summer cooling.

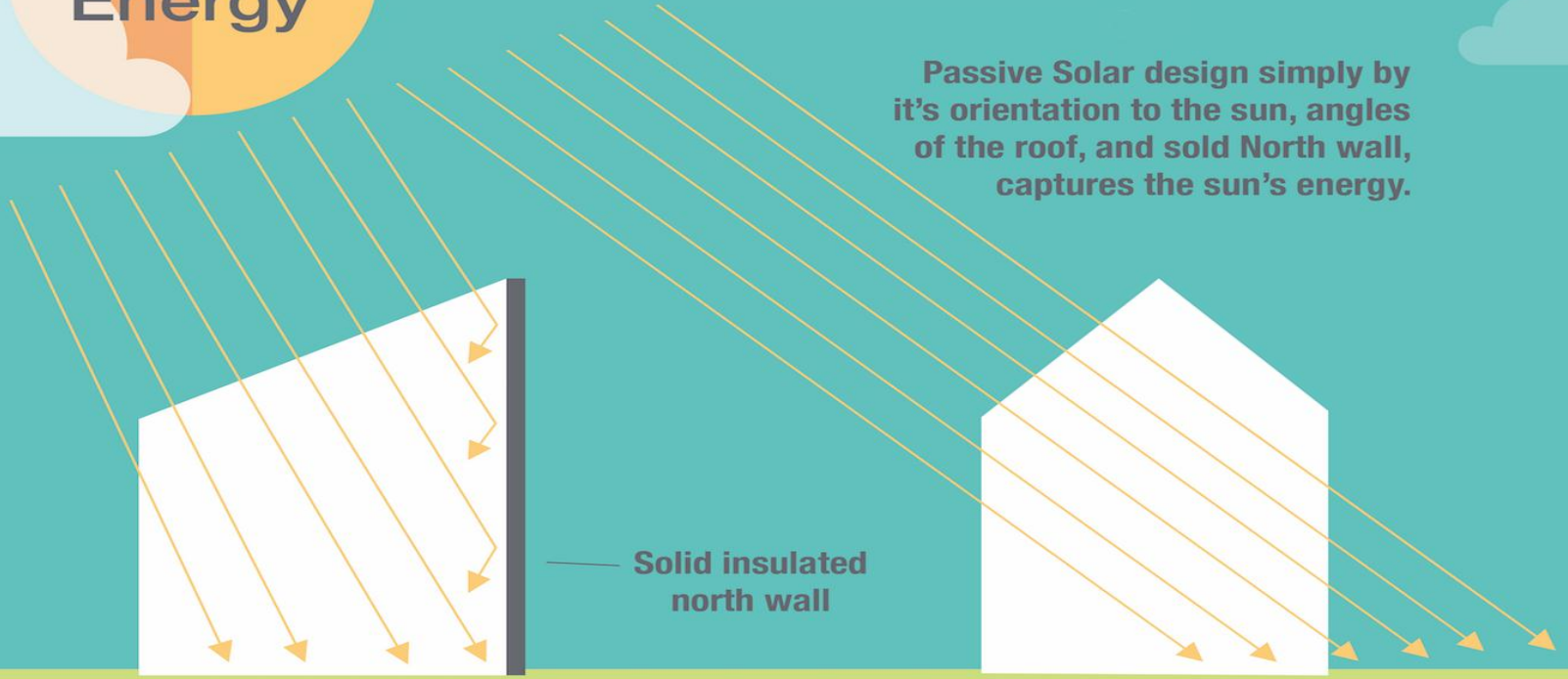
Solar Heated Greenhouse



How It Works

Solar Energy

Passive Solar design simply by it's orientation to the sun, angles of the roof, and sold North wall, captures the sun's energy.

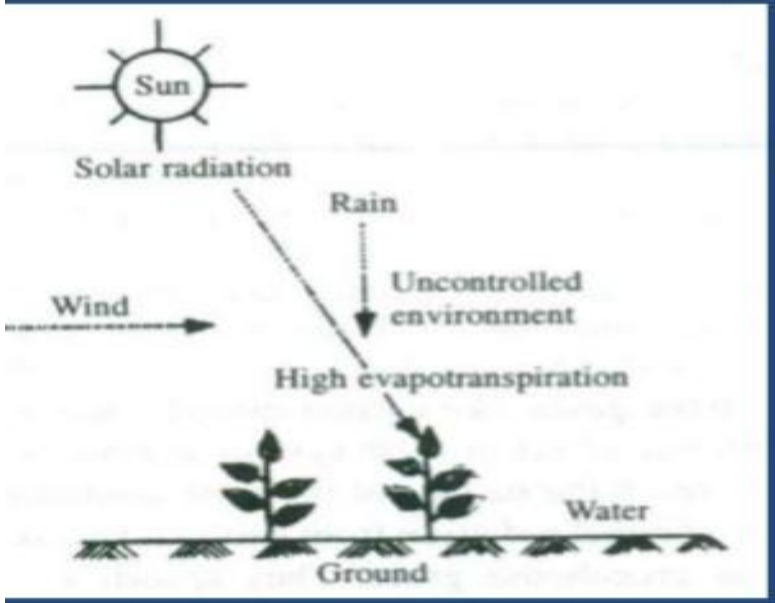


Passive Solar Greenhouse
Nearly 100% of solar energy is absorbed.

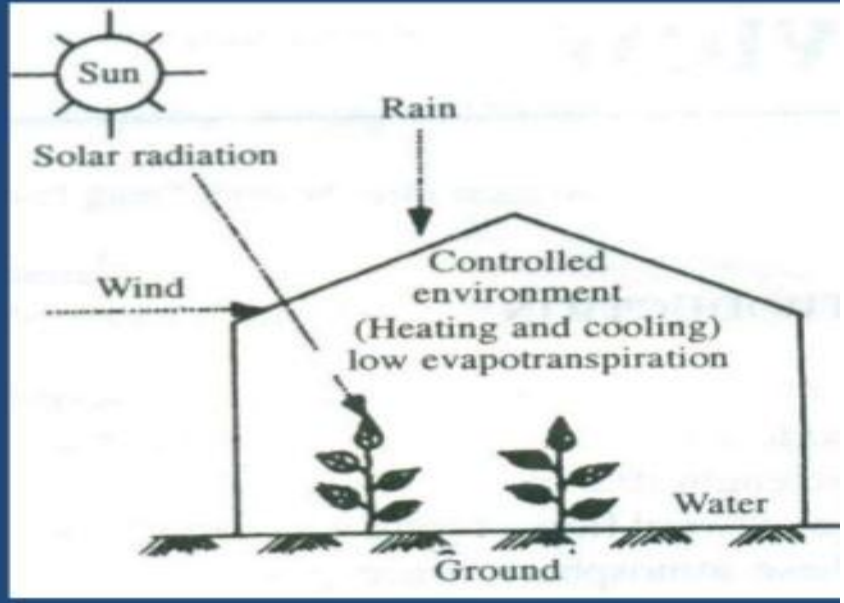
Conventional Greenhouse
50% of solar energy passes through, less than 50% is absorbed.

CERES
GREENHOUSE SOLUTIONS

Crop cultivation under open Sun



Crop cultivation under greenhouse



The two most critical factors affecting the amount of solar heat a greenhouse is able to absorb are:

1. The position or location of the greenhouse in relation to the sun
2. The type of glazing material used

1.The position or location of the greenhouse in relation to the sun

- the sun's energy is strongest on the southern side of a building, glazing for solar greenhouses should ideally face true south.
- However, if trees, mountains, or other buildings block the path of the sun when the greenhouse is in a true south orientation, an orientation within 15° to 20° of true south will provide about 90% of the solar capture of a true south orientation.
- The latitude of your location and the location of potential obstructions may also require that you adjust the orientation of your greenhouse slightly from true south to obtain optimal solar energy gain.
- Some growers recommend orienting the greenhouse somewhat to the southeast to get the best solar gain in the spring, especially if the greenhouse is used primarily to grow transplants.

SLOPE OF GLAZING MATERIAL

❑Slope of Glazing Material In addition to north-south orientation, greenhouse glazing should be properly sloped to absorb the greatest amount of the sun's heat.

❑ A good rule of thumb is to add 10° or 15° to the site latitude to get the proper angle.

❑ For example, if you are in northern California or central Illinois at latitude 40° north, the glazing should be sloped at a 50° to 55° angle (40° + 10° or 15°).

GLAZING

- Glazing materials used in solar greenhouses should allow the greatest amount of solar energy to enter into the greenhouse while minimizing energy loss.
- In addition, good plant growth requires that glazing materials allow a natural spectrum of photo synthetically active radiation (PAR) to enter.
- Rough-surface glass, double-layer rigid plastic, and fiber glass diffuse light, while clear glass transmits direct light.
- Although plants grow well with both direct and diffuse light, direct light through glazing subdivided by structural supports causes more shadows and uneven plant growth.
- Diffuse light passing through glazing evens out the shadows caused by structural supports, resulting in more even plant growth.

❑SOLAR HEAT STORAGE

❑For solar greenhouses to remain warm during cool nights or on cloudy days, solar heat that enters on sunny days must be stored within the greenhouse for later use.

❑ The most common method for storing solar energy is to place rocks, concrete, or water in direct line with the sunlight to absorb its heat.

❑Brick or concrete-filled cylinder block walls at the back (north side) of the greenhouse can also provide heat storage. However, only the outer four inches of thickness of this storage material effectively absorbs heat.

❑Medium to dark-colored ceramic tile flooring can also provide some heat storage.

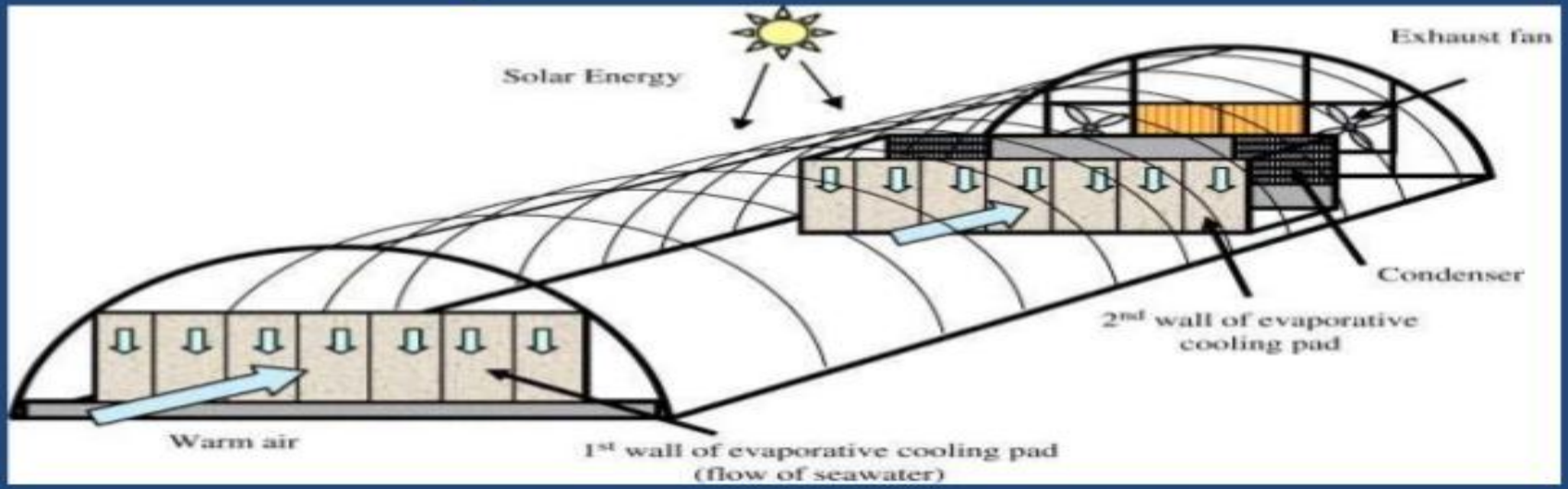
❑ Walls not used for heat absorption should be light colours or reflective to direct heat and light back into the greenhouse and to provide a more even distribution of light for the plants.

VENTILATION

- A building designed to collect heat when temperatures are cold also needs to be able to vent heat when temperatures are warm.
- Air exchange also is critical in providing plants with adequate levels of carbon dioxide and controlling humidity. Because of the concentrated air use by plants, greenhouses require approximately two air exchanges per minute (in contrast to the one-half air exchange per minute recommended for homes).
- To determine the flow requirements for your greenhouse, multiply the volume of the greenhouse by two to get cubic feet of air exchange per minute, which is the rate used in determining the capacity of commercial evaporative coolers.

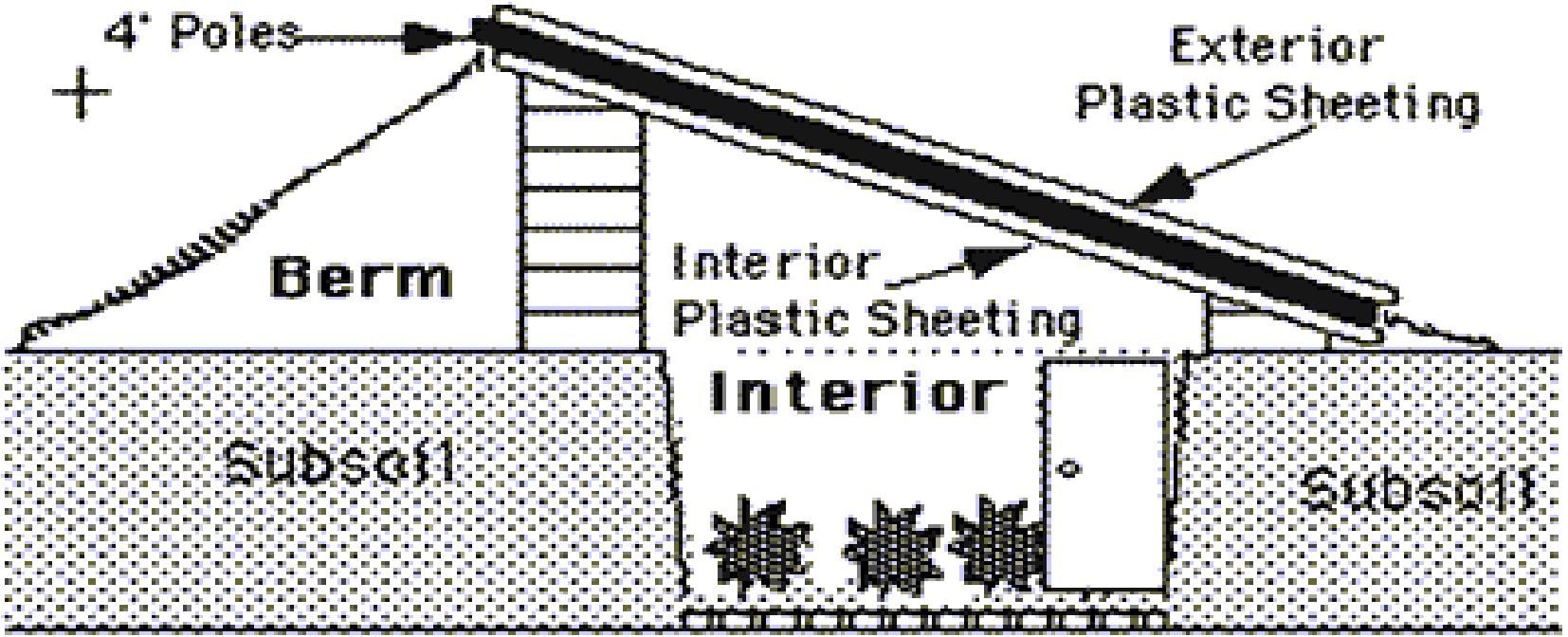
- Roof-ridge and sidewall vents provide natural ventilation. The sidewall vents allow cool air to flow into the sides of the greenhouse, while ridge vents allow the rising hot air to escape.
- Some wind is necessary for this type of ventilation system to function effectively. On still, windless days, fans are necessary to move air through the greenhouse.
- The area of the venting should be equal to between 1/5 to 1/6 of the greenhouse floor area.(1)

Quonset Greenhouses



- Framework consists of curved bars or tubes.
- No span.
- Often covered with white, polyethylene film and used to over-winter nursery stock.

Cutaway View



ADVANTAGE:

- Complete elimination of manpower.
- Reduced energy costs
- Reduced green house gas emission
- Reduced maintenance cost
- Higher community satisfaction