

Solar Thermal Systems

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The objective of the project is to design a low cost solar thermal system for the purpose of cooking, baking and heating water for domestic use.

This system needs to be suitable for rural areas of underdeveloped countries. During the design process, students will be limited to use the inexpensive materials available locally.

Problem

-Using wood as a source of energy leads very often to the depletion of forests.

- The ecological balance can be affected.

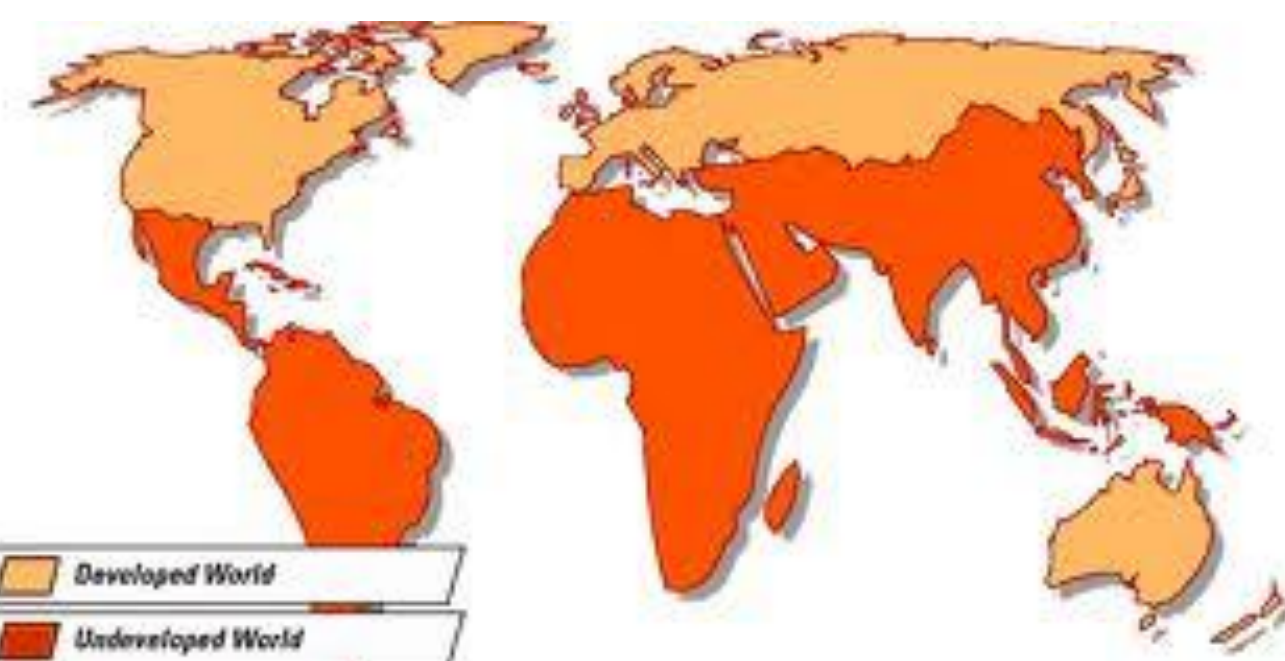
- This can lead to mudslides during the rainy season and can be catastrophic to the area.

-Most of the underdeveloped countries are located in tropical climates where solar energy can be harvested and used.

-Not affordable commercially available solar thermal systems(high cost factor).

-Build-it-yourself systems using available and affordable local materials could improve sustainability of many rural areas in underdeveloped countries.

Aim



The aim is to track the energy from the sun to its useful purpose. To do that we will be investigating:

- Radiation produced by the sun,
- Energy that encounters the earth and atmosphere,
- Energy captured by the collector that converts to heat.

Solution

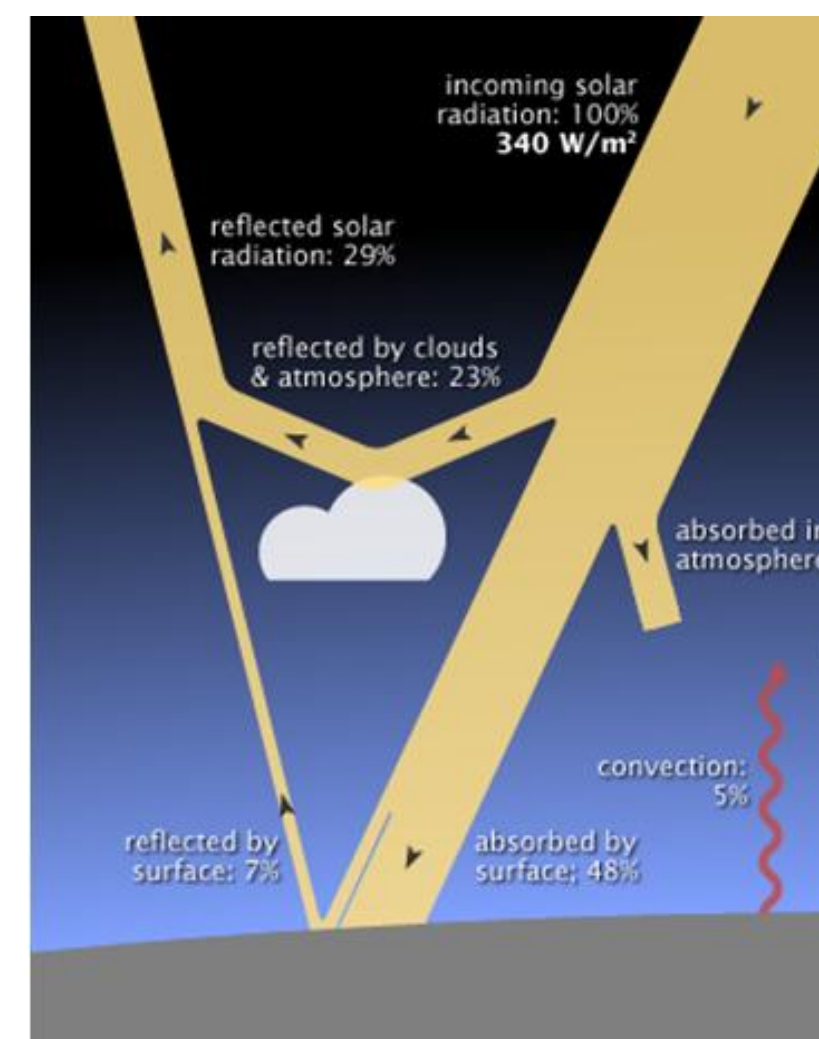
What is Solar Energy generally?

Solar energy systems employ devices that convert the sun's heat or light to another form of energy we use.

Four types of solar energy

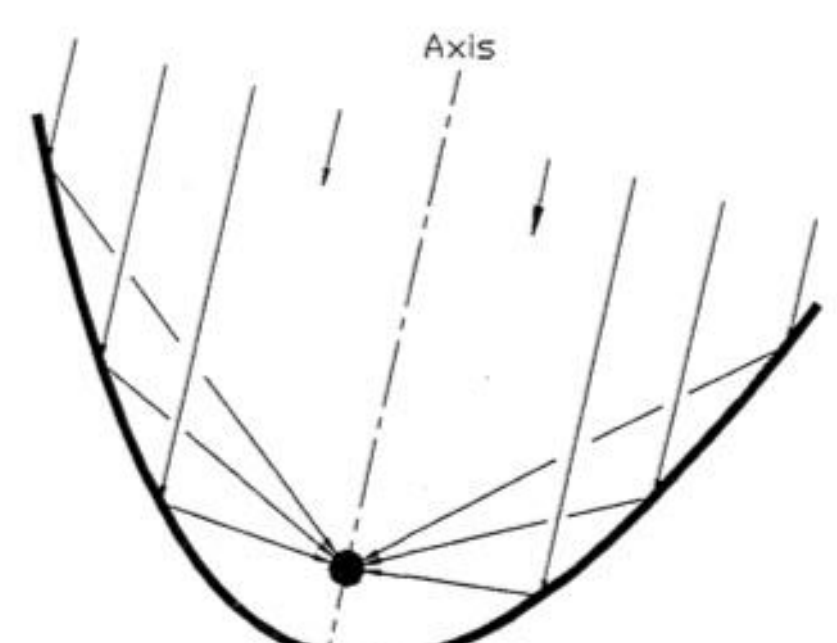
- Photovoltaic (light to electricity)
- Domestic heating, cooling and cooking
- Utility scale heat generation for electricity
- Lighting

1.0 kW/m² reaches the world surface



Parabolic Mirror

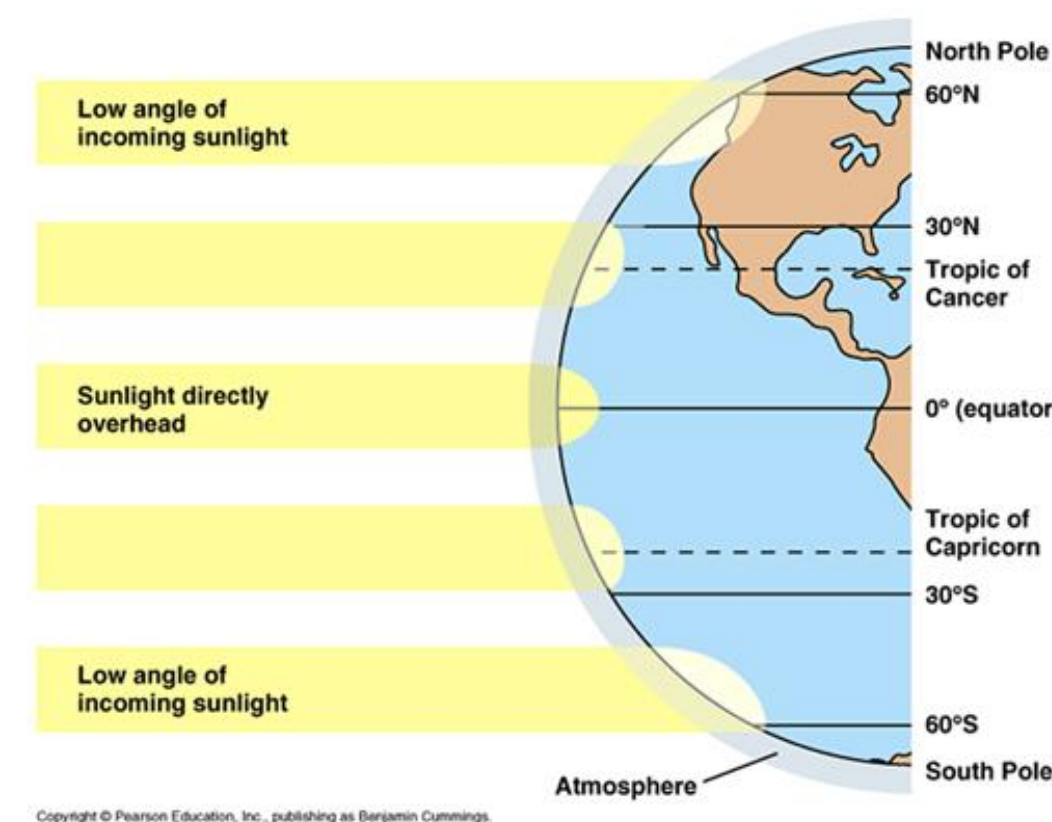
- Focus all parallel rays to a point
- Focus the energy
- Focal location set by incoming angle
- Incoming angle is equal to outgoing angle



Parabolic reflector. All rays entering parallel to the axis reflect to the focus.

Moving Sun

- the sun rises in the east and sets in the west
- move the parabolic mirror with the sun
- different angles at every place in the world



Surface

Surface absorbed, reflected or transmitted the sunlight
Have a wavelength dependence
Determine collection efficiency
Selective materials can improve efficiency

Solar Cookers

1. Panel Cookers

Advantages

- * Easy and inexpensive to make
- * Can be collapsed for storage or transport

Disadvantages

- * Lower temperatures.
- * Can't fry foods.
- * Cooks only 1-2 pots of food.



2.Box-Style Cookers

Advantages

- *Can cook in multiple pots simultaneously
- *Can be built from many different materials
- *Can be built any size to cook large quantities of food
- *Don't have to be turned to follow the sun while cooking

Disadvantages

- *Construction time longer than panel.
- Can't fry foods.



3.Parabolic Cookers

Advantages

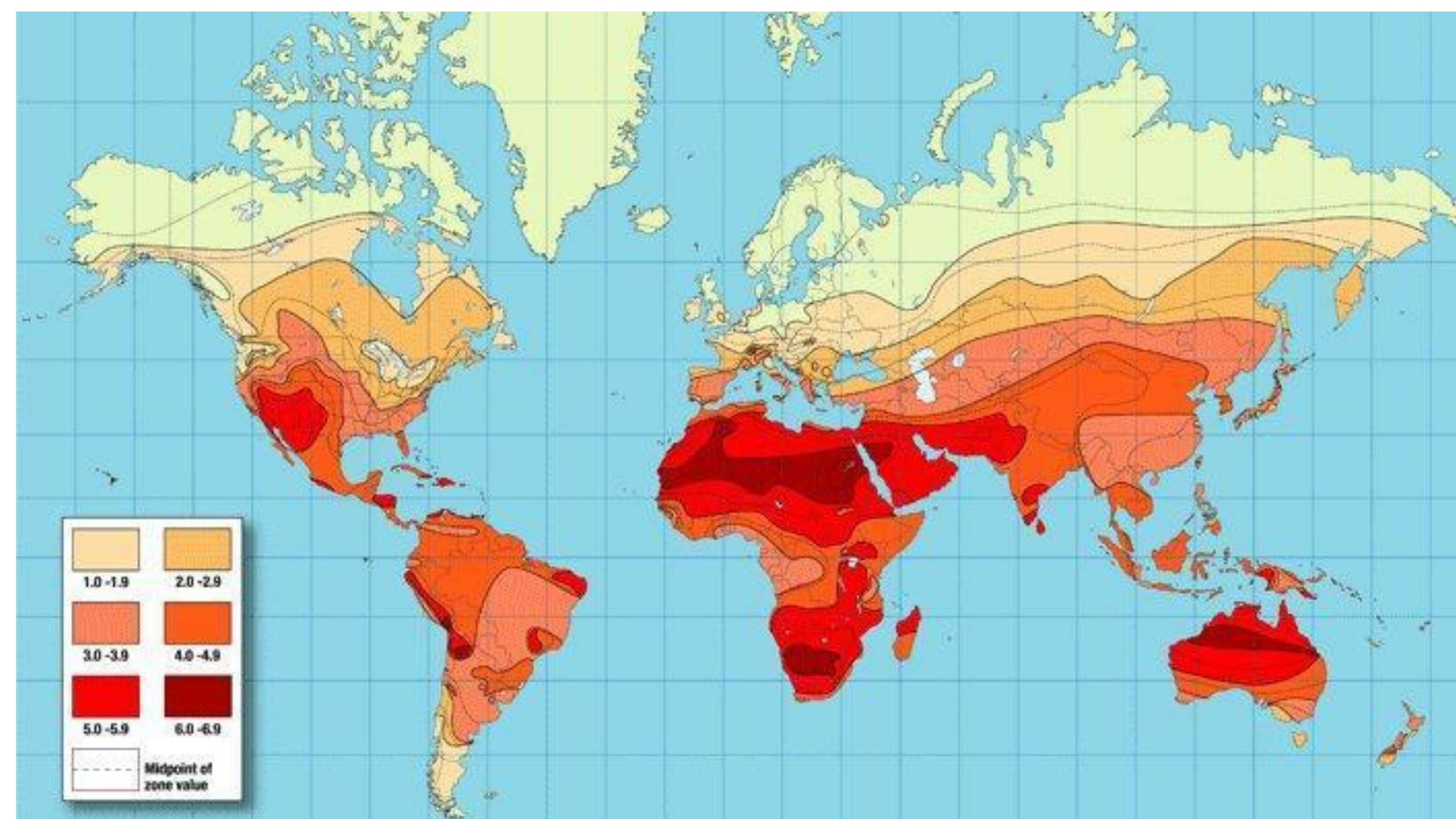
- *Cook as fast as a conventional electric burner.
- *Can fry foods.

Disadvantages

- *More expensive than other models
- *Tricky to make without imported materials.
- *Requires periodic realignment to the sun.
- *Can't bake bread
- *Can damage eyes.



Sun Power - worldwide



Building the parabolic mirror

Several methods are available to build the parabolic mirror.

One easy and ready-made solution is to use a cardboard-water-glue mixture to build the parabola shape.

- Parabola size
- 1 m² → 1 kW of solar power.
- we can get efficiency about 65 %
- If we build a parabola D= 1,5 m we can receive power about 0,84 kW (more, than half of microwave oven power)
- A typical consumer microwave oven consumes power 1,1kW

Materials

There are many materials that can be used to build a parabolic mirror, but many of them are expensive.

Some people have used wood to make the parabola shape.



A parabola shape could be made of ripped cardboard and water.

The simplest glue is that made from a paste of flour and water.

If the parabolic shape is made then it needs to dry and it will be covered with aluminium foil, which is an inexpensive and effective material.



- Wood
- Plastic
- Old Satellites

SOLAR COOKING HUMOR

*Why does a solar cook make breakfast at noon?

...because that is the only time he can cook eggs, sunny side up.



*What is a solar cookers favorite day to cook?

...Sun-day, of course

