Problem Statement

To create an innovative solar cooker that could replace the traditional wood based cooking source.

1. Description of the problem to be solved

There is not so much progress in the development in Indian villages. They don't get the facilities that are available to urban areas. We are here trying to focus on the needs of the rural people and of course will surely contribute to for solving environment problems too.

In urban areas we make our meal on time because of availability of LPG at our house whether it will finish we will fix that problem but what about the villages in India? Also the prices of conventional fuels are increasing so they go to cut the trees to burn them and use it as fuel. It results into deforestation which is directly related to the environment and wild life. We are already in problem of Global warming and allowing them to act like this. One is given to understand that presently only 8% of the energy used on earth comes from renewable resources. The rest 92% is from fossil fuel and nuclear sources.

Solar energy is being tapped for variety of uses from generating electricity to cooking foods. India is densely populated and *Thar Desert* has been set aside for solar power projects 700 GW to 1000 GW and has high solar isolation, an ideal combination for using Solar Power in India. In India about 300 clear, sunny days in a year, India's theoretical solar power reception, on only its land area, is about 5 terawatt-hours per year and daily average solar energy incident is from 4-7 kWh/m^2.

2. Description of concepts

A solar cooker box cooker or solar oven is a device which uses the energy of sunlight to heat food or drink to cook it or sterilize it.

The basic principles of solar cooker design are:

- Concentrating sunlight: A reflective mirror of polished glass, metal or metallised film is used to concentrate light and heat from the sun into a small cooking area, making the energy more concentrated and increasing its heating power.

- Converting light to heat: A black or low reflectivity surface on a food container or the inside of a solar cooker will improve the effectiveness of turning light into heat. Light absorption converts the sun's visible light into heat, substantially improving the effectiveness of the cooker.

- Trapping heat: It is important to reduce convection by isolating the air inside the cooker from the air outside the cooker. A plastic bag or tightly sealed glass cover will trap the hot air inside. This makes it possible to reach similar temperatures on cold and windy days as on hot days.

- Greenhouse effect: Glass transmits visible light but blocks infrared thermal radiation from escaping. This amplifies the heat trapping effect.

3. Principle of working

Our proposed model works on two principles

Principle of Heat Retention: Heat retention cooking involves using stored heat to slow cook food in an insulated container. This principle will help us in solving the problems of heat storing for a long time. Here the reflectors are transparent glass or plastic top.

Scheffler cookers: A Scheffler cooker uses a large ideally paraboloidal reflector. The axis passes through the reflector's centre of mass, allowing the reflector to be turned easily. The cooking vessel is located at the focus which is on the axis of rotation, so the mirror concentrates sunlight onto it all day.

4. Technical aspects

Section A:

A Heat Retention Solar Oven will take in enough energy to cook the food, to store some energy for later use, and to compensate for heat lost to the exterior when the oven should also have an effective reflector, so that additional energy in the form of sunlight is reflected into the oven. A Heat Retention Solar Oven will be particularly well-insulated on the sides and bottom; so that it does not lose that energy too quickly (R50 is recommended). And it has a window (solar collector) on the top that is insulated to R3 or better. Heat Retention Materials Bricks, salt or ceramics tiles have a high specific heat capacity (the ability of a material to store heat); they are relatively inexpensive and widely available.

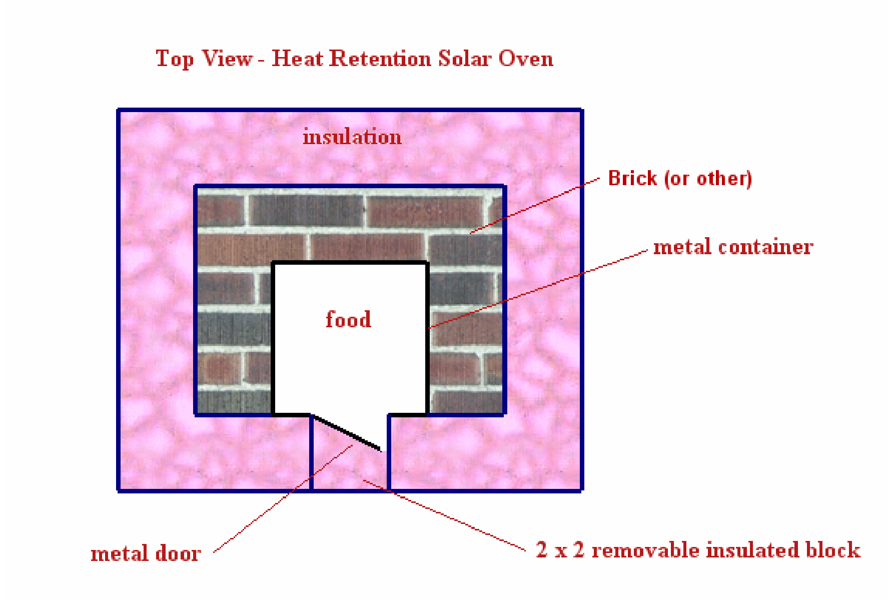


Figure 1

- Inside the solar oven, above the floor, there will be a thick layer of heat retention material, such as bricks, or cinder blocks, or salt (NaCl), or ceramic tiles. Its purpose is to store heat energy from the hottest part of one day, through the cooler portion of the rest of the day and night, and into the next day. The top layer over the bricks (or salt or other material) must be black ceramic or black metal, in order to turn the sunlight into heat.
- The transparent window (solar collector) at the top of the solar oven will be minimum R-value of R3 and allow at least 70% light transmittance. At least three panes of high-temperature glass will be needed to reach R3. The window should be large enough to include both the inner container and the area with the heat retention material.
- The sides of the space between the panes will be black, to absorb light and produce heat. The exterior of the solar oven must be black to raise its temperature, thus improving the effectiveness of the insulation. (Insulation value depends in part on the difference between interior and exterior temperature. Raising the temperature of the exterior wall improves the insulation value.) The interior walls of the solar oven also be black.
- Reflectors should be used around the top of the oven (front, back, and both sides) to increase light energy entering the oven. The angle of the reflectors should be adjustable. The reflectors should be removable or should be able to fold over the window when the cover is placed over the oven.
- The shape of the oven should be a long rectangle, with the lengthwise ends facing east and west. The reflectors and the oven top should be angled towards the angle of declination of the sun. In this way, the largest area of the reflectors will not need to be re-adjusted during the course of the day. The optimum length of the oven is 3x to 4x (or greater) of the width of the oven.

- The optimum angle for reflectors is 20 to 25 degrees on either side of the solar declination. So, if the sun is at 30 degrees, then the reflectors will be at 10 and 50 degrees or 5 and 55 degrees.

- The length of the reflectors should be between 1.2x (for 25 degrees angle) and 2x (for 20 degrees angle), where 'x' is the width of the oven window. The reflectors on the longest side only need to be set in angle once per day. They should reflect light directly into the oven window, or onto the end reflector, but not onto the reflector on the opposite side.

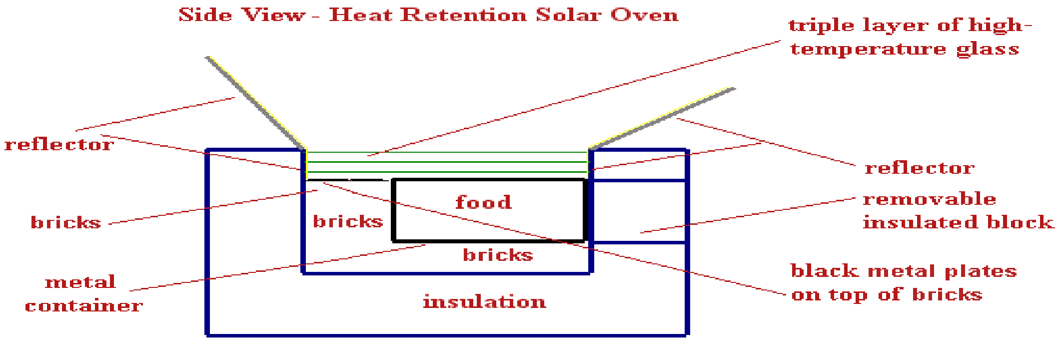
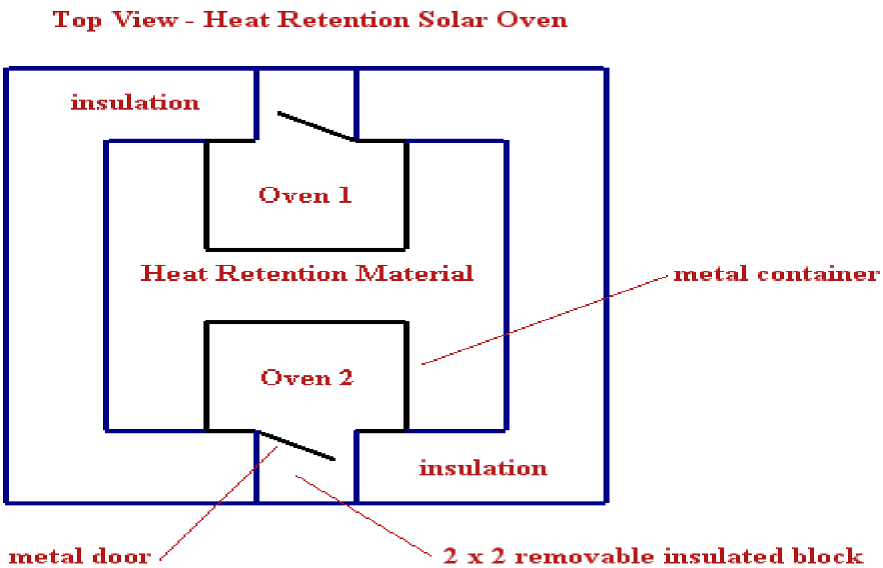


Figure 2

Another proposed model will be like this:



The important matters are as:

- Increasing the size of the Reflector will increase net energy.
- Decreasing the cooking temperature will increase net energy because heat loss depends partly on the temperature difference between the interior and exterior of the oven.
- One of the main obstacles to any solar oven design is minimizing heat loss through the transparent window on top of the oven. This design uses three panes of glass with approximate 2-inch space between each pane and an estimated R-value of 3.23.

Section B

Technical aspect

In our proposed aspect we are using the top paraboloid facing the sun and other three paraboloid plane. The function of paraboloid is that it concentrates the heat at its focus point. Function of other three is to collect the heat. This construction must solve the problem of indoor cooking.

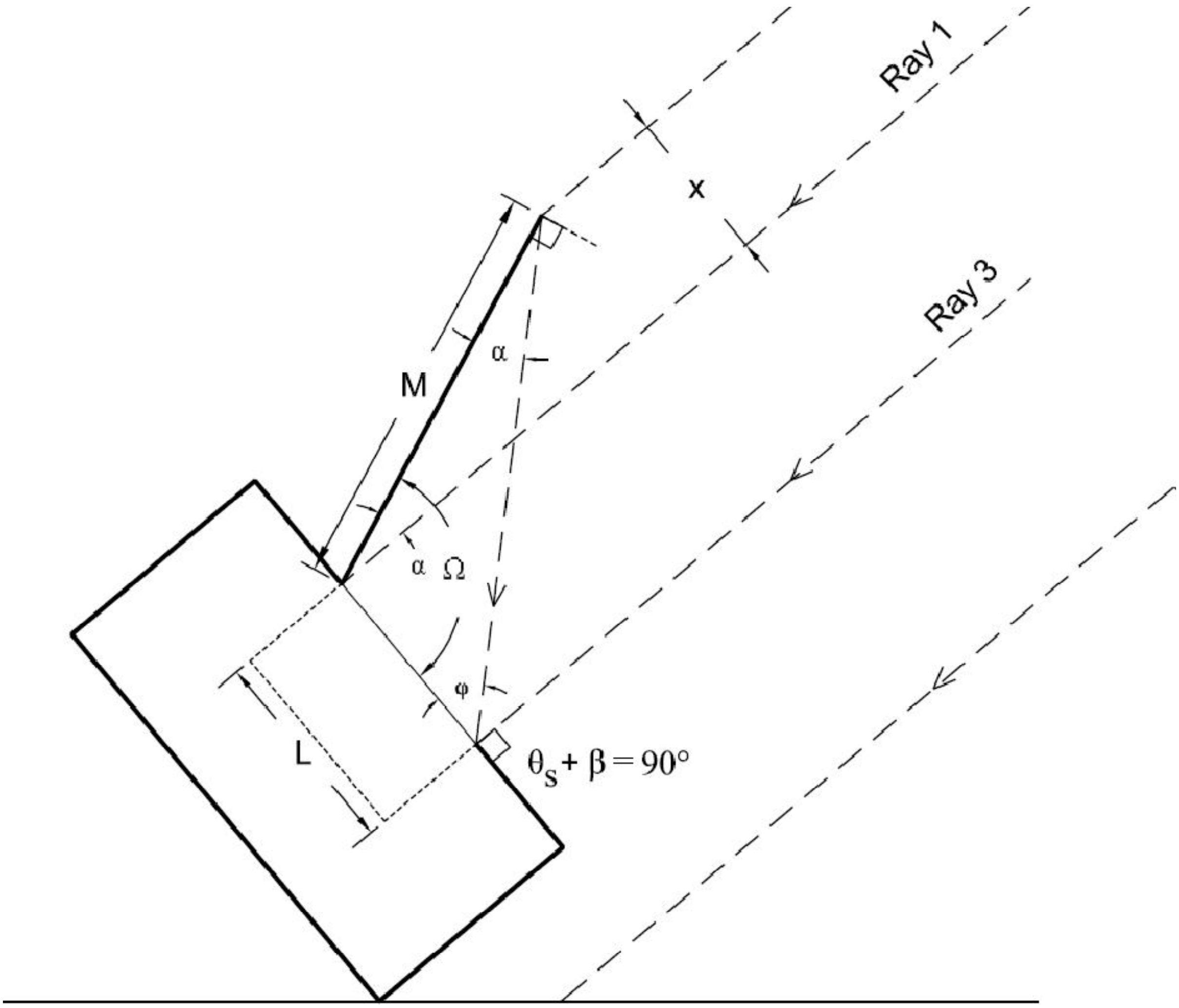


Figure 1

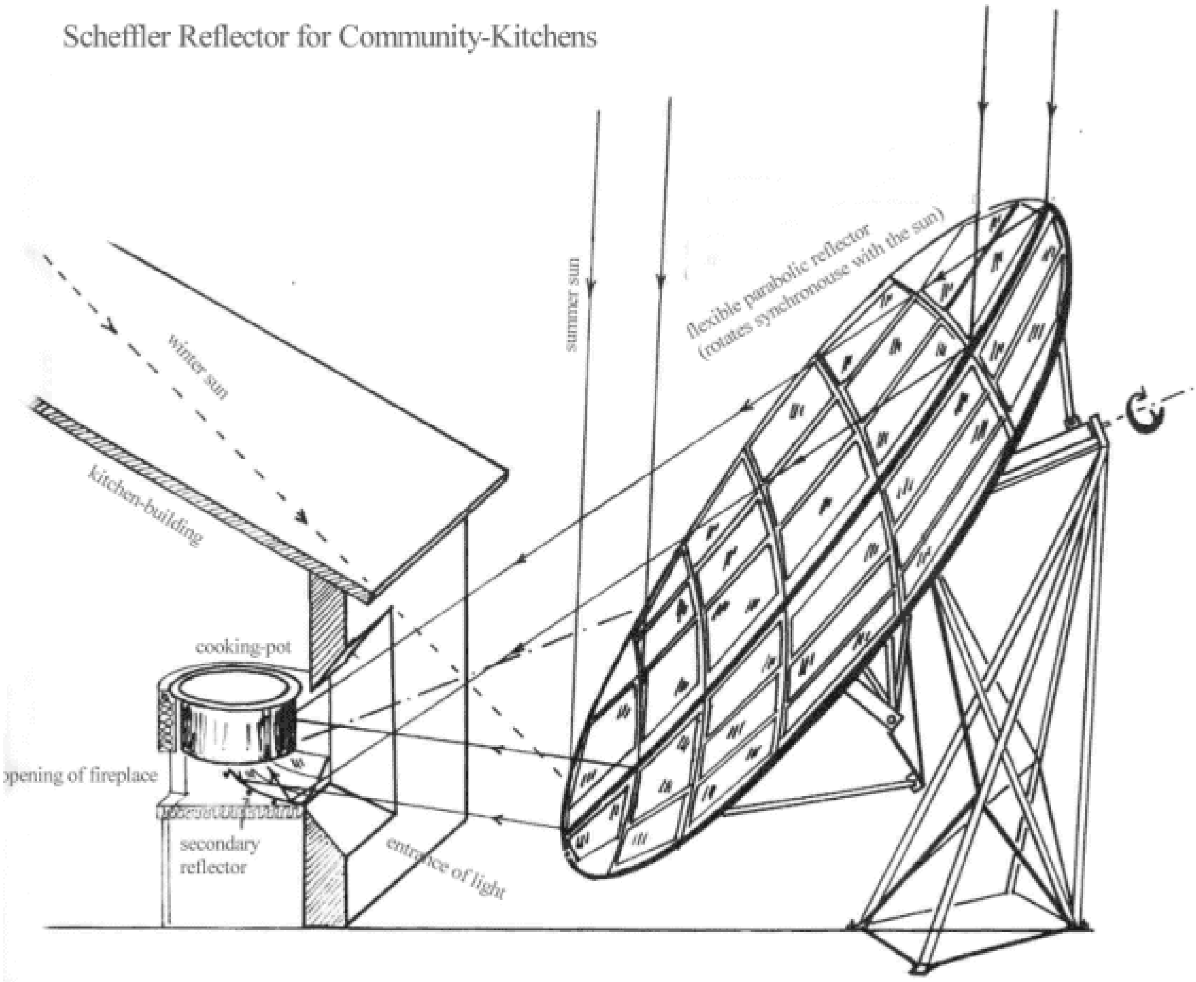

Scheffler Reflector for Community-Kitchens
summer sun
winter sun
kitchen-building
flexible parabolic reflector
(rotates synchronouse with the sun)
cooking-pot
pening of fireplace
secondary
reflector
entrance of light

Figure 2

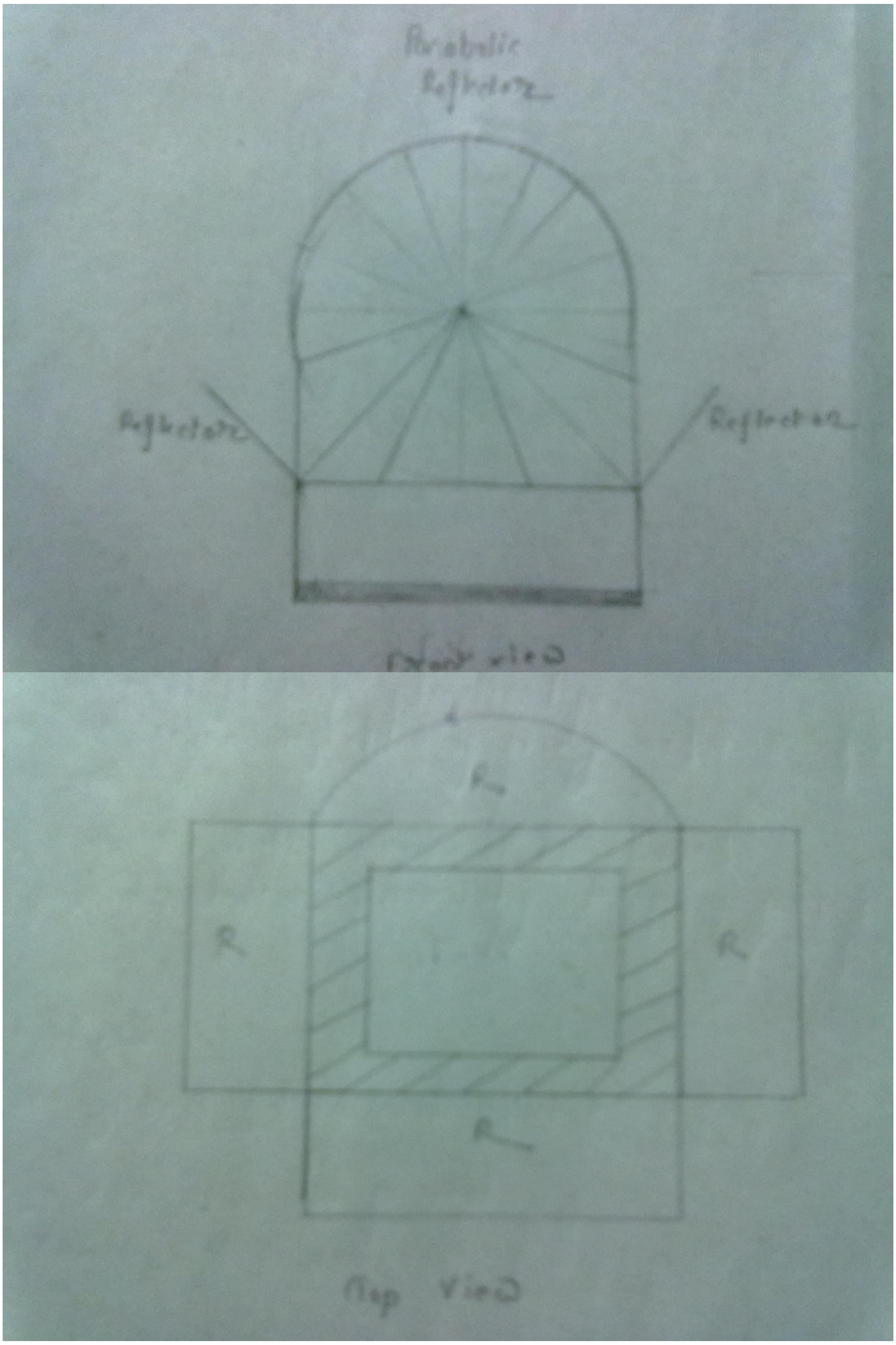


Figure 3

4. Problems may arise are as:

- some fuel-based backup heat source must still be available in mostly rainy and cloudy conditions
- Also, solar cooking provides hot food during or shortly after the hottest part of the day, rather than the evening when most people like to eat. The "integrated solar cooking" concept accepts these limitations, and includes

a fuel-efficient stove and an insulated heat storage container to provide a complete solution which may result in increase in cost.

- Some solar cooker designs are affected by strong winds, which can slow the cooking process, cool the food, and disturb the reflector. In these cases it is necessary to anchor the reflector with string and weights.

  We are trying to overcome all these difficulties.