Solar ovens – for cooking food and cooling the earth

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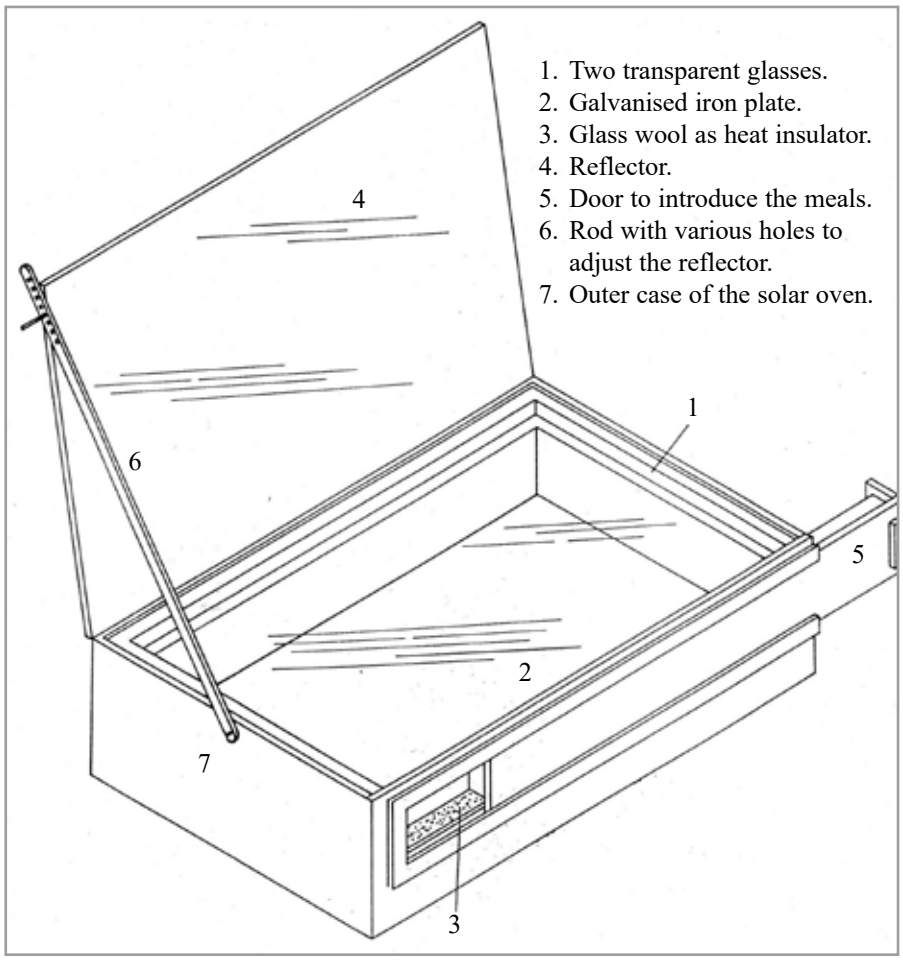

Everyone, from the richest to the poorest, has to eat, creating the obvious need to cook or warm food. That means using some kind of fuel; firewood, coal, oil, kerosene, gas or electricity. Although these fuels have the advantage of representing stored energy, they cost money and contaminate the environment and human health. In principle, the simplest solution is to use solar energy instead, which is free, abundant, and a clean fuel.

The use of solar energy for cooking is not new, of course. I personally made my first solar food warmer for use at my home in Costa Rica in March 1979 and would like to share my practical experience of using solar power for the last 42 years for cooking, heating food, and pasteurising water, etc.

Using solar energy for cooking

Like many people in our country in the 1970s, we used electricity for cooking. Costa Rica's population was 2.5 million at the time, with the country's electricity supplies being generated partly by hydro systems and partly through imported oil. During the dry/sunny season (January to June) water levels declined, which led to a reduction in electricity generation from hydro, leaving the country to import additional oil to meet its electricity requirements.

In February 1979, however, in a move to save on oil imports, the

Dr Nandwani and his range of self-built cookers.

Credit: Dr Shyam S. Nandwani

Government Electric Utility Company (Instituto Costarricense de Electricidad, ICE) imposed electricity rationing for two days a week, between 7 am and 7 pm.

Although, like many others at the time, I had the option of buying a gas cooker, I decided, as a physicist and environmentalist, to make a simple solar food warmer to reheat the food I'd cooked the previous night when electricity use was allowed.

In other words, instead of using expensive and dirty fuel, I preferred to use a free and clean fuel for cooking.

Cooker design

My cooker design involved fitting a thin wooden box inside a thick wooden box. The space between the two boxes was filled with glass wool as a heat insulator. At the bottom of the inner wooden box I fitted a galvanised iron metal plate, the top of which was painted black, to absorb solar radiation. There was also a transparent 3 mm glass panel fixed to the top of outer box. Finally, I fitted a door to the front of the box to enable cold food to be put in and cooked food taken out.

To prepare lunch, I took my previously cooked food out of the freezer about 60 minutes before I would be ready to eat. As the days were sunny, due it being January to June, the solar-powered temperature of the oven reached about 80-90 ºC, sufficient to ensure that my lunch was pleasantly hot.

A local English newspaper, The Tico Times, liked my practical idea and design, and published a report on May 4, 1979, with the headline - SUNNY LUNCH: Dr. Nandwani and his daughter wait for their meal, being heated in the scientist's solar stove.

Based on this first success with solar was as a food warmer, I next started thinking about cooking food from raw ingredients, using only solar energy.

This, of course, needed higher temperatures, compared to just heating food. I therefore had to make some changes to my design to increase the solar radiation and to reduce heat loss from the system.

To do this, I added one more transparent glass panel, located 2 cm above the original panel. I also added a reflector above the box, with the facility to be able to adjust the angle of the reflector manually, as shown in the design illustration.

Dr Nandwani and cooker.

Credit: Dr Shyam S. Nandwani

Still in use

We still use this solar oven, even today, although with a few refinements. The outer box is now made of stainless-steel, for example, to increase its durability. I secured a patent in Costa Rica of my solar oven in 1984.

On a sunny day, the maximum air temperature in the oven reaches 140 °C, before the food goes in, which is more than sufficient to cook it. Once the food is placed in the oven for cooking, the temperature range stays between 90 & 110 ºC.

In our normal climate in Heredia, it's possible to cook with solar power for about 7-8 months in a year.

Although solar ovens have many advantages (economic, environmental, nutritional, and social etc.), there are also some limitations. For example, they obviously need to be located in a good sunny space and are comparatively more expensive, initially, than an electric alternative. The non-availability of 24/7 solar radiation, the world's fluctuating climate, and cultural habits, also impact the use of solar power for cooking.

As a result, solar ovens are still not used on a massive scale, even in rural areas. Nevertheless, the number of solar cookers sold has increased from 1 million in 1994 to more than 3 million today, according to Solar Cookers International, an NGO based in Sacramento, USA.

***Footnote**: During last 40 years, Dr Nandwani has studied, designed, and published programmes for many different models of solar ovens, including a hybrid Solar Electric 110 VAC, 12 VDC, multipurpose and double compartment oven, which is used for research. He has published around 25 technical articles on solar cooking and written a research paper: Solar Cookers and Dryers to conserve Human and Planet Health, Shyam S. Nandwani, which was published in Encyclopedia of Sustainability Science and Technology, Robert A. Meyers (Ed.) Springer Verlag, pp. 9486-9509, 2012, USA. In addition, he has published a book of recipes (in Spanish) for solar oven users.*