

Solar Cooking

Energy from the sun

The sun can be described as the earth's powerhouse. Solar radiation provides the energy for all the processes that sustain life - photosynthesis, the water cycle, plants and even fossil fuels that are nothing else than energy caught in ancient plant matter. The sun's energy can be harnessed through using the sun's heat (solar thermal techniques) or using the sun's light (photovoltaics). The two processes require different technologies and materials. Solar thermal technologies include solar thermal power generation, solar water heating for domestic use and solar cooking. Solar cooking is one of the oldest applications of solar thermal energy.

Solar Cooking

Fuel for cooking and baking may be scarce (as for fuel wood) and expensive (as for electricity, gas and paraffin), negatively affecting the family budget and women and children's workloads. Environmental problems such as deforestation, wood fuel scarcity and emission of green house gasses caused in part by burning fuels can be traced to the ever-present need for energy for cooking purposes. These are some of the reasons why savings in cooking fuel consumption would be welcome - a challenge for fuel-saving stoves such as solar cookers.

Solar cookers use reflection, concentration, glazing, absorption and the greenhouse effect to produce heat to cook food and bake bread and cakes. No other fuels such as wood, paraffin or electricity is required, only sunshine! There are four different types of solar cookers, namely solar box cookers or solar ovens, parabolic reflector cookers, indirect solar cookers and heat retention devices. There are probably more than 200 different stove designs in existence but most of them are design prototypes - there are only a few designs available on a commercial basis. Due to the relative scarceness of solar cookers in the market, low awareness about the products and affordability issues, solar cooking is not yet one of the common solar thermal applications available.

Technology description

The basic types of Solar Stoves

► **Box cookers** are usually insulated containers with a multiple glass or other transparent material cover. These kinds of cookers depend on the "greenhouse effect" in which the transparent glazing permits passage of shorter wavelength solar radiation, but is opaque to most of the longer wavelength radiation. External reflectors such as mirrors may be used to reflect additional solar radiation into the cooking chamber. A double-walled insulated box can also serve to hold the heat inside the cooker. Box cookers are easy to move, they don't require tracking to follow the sun, they keep food warm for a long time, are stable and produce no glare. Box cookers are suitable for baking as well as cooking dishes that require a long cooking time.

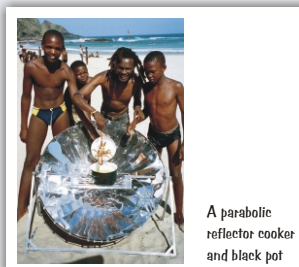


A solar box cooker with external reflectors

► **Concentrator cookers** concentrate direct solar radiation, often enhanced by additional reflectors on a cooking pot. The pot is supported at the focus point where the solar radiation is concentrated. They are quite efficient but require the user's attention to keep them aligned with the sun, maintaining good performance. Higher temperatures can be reached than with normal box cookers but baking is limited.

► **Collector cookers** are made up of two parts that often share a single casing: a collector for gathering heat and a cooking range for exploiting the heat. Pots and collectors are often separated and a heat transfer medium such as oil or steam is required to convey the heat into the pot. These cookers make use of diffuse and direct solar radiation. They are, however, rather complicated to build and more expensive than other cookers.

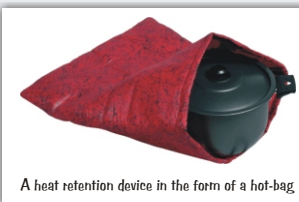
► **Solar heat retention devices** cannot cook food but use residual heat to complete cooking or to keep food warm between cooking and eating it. The cooking process is started on any conventional stove or solar cooker and after some cooking time, the pot is removed and placed in a heat retention device. The cooking process is finished without using any more energy. Heat retention devices include hay-boxes, hot boxes or hot-bags. The principle is that the pot is placed in an insulated container. Retained-heat cookers consist of boxes or baskets padded with cushions of polystyrene balls, while hot-bags use thin foil paper and insulating padding material in a bag. Using a retained-heat cooker can save between 50% and 75% on fuel use. Heat retention cookers can be used with any type of stove but is especially recommended for use with solar cookers if you want to keep your meal warm for eating in the evening when the sun no longer shines.



A parabolic reflector cooker and black pot



A collector cooker with adjustable heat controls



A heat retention device in the form of a hot-bag

How to use a solar cooker

To use a solar cooker, it has to be put in a place that will have full sun for 2-3 hours. The food must be put in black pots with tight lids. Using black pots are very important because black will absorb heat while shiny metal will reflect heat and sunlight away from the pot. Pots are either supplied with the solar cookers or you can use flat-bottom cast iron pots in box cookers and three-legged potjie pots in the reflector cookers. Alternatively you can make your own black pots by spray-painting ordinary aluminium pots black. Except for beans or dry grains, which require the normal amount of water, there is no need to add water especially with vegetables and meat. The cooker must be aimed towards the sun, moving it as required by the type of cooker. Box cookers will only need re-orientation after two hours as the sun moves, while reflector cookers require more frequent tracking. There is no need to stir the food as frequently as usual or watch the food since it rarely burns or boils over.

A few things to note:

- Solar cookers require the sun to cook but a few clouds will not affect them. They can not however, cook at night or in skies that are more than half covered with clouds;
- Any type of food, particularly food that needs a long cooking time (such as beans, samp, rice, meat stews and porridge) can be cooked in a solar cooker. You can bake bread, cake, scones and even meringues in a solar cooker, although the box cookers are more suitable for baking than the reflector cookers;
- Foods that are not suitable for solar cooking are pasta dishes and deep fried dishes such as potato chips;
- Solar cookers will require longer cooking times than with conventional methods. Cooking time depends on the efficiency of your cooker, but generally you can add about an hour to the normal time it takes to cook a specific dish. You will therefore have to plan your cooking and food preparation - don't start half an hour before you want to eat.
- Longer cooking times are not a problem though, because you can leave the cooker to get on with the business of cooking - you don't need to watch it, stir the pot or check that the food does not burn. You can do other things instead of cooking as the cooker does the work for you;
- Most people use a solar cooker to save fuel and therefore, money. If you use your cooker 2-3 times a week, you can expect to save one third of your energy costs. The more you use your cooker, the more money you will save.

Can solar cooking work for me?

Definitely, if you want to broaden your choice of cooking options, if you want to save on your regular cooking energy expenses, if you are in an area where cooking fuel is hard to obtain and if you want to reduce environmental impacts associated with the use of fossil fuels. It is not suggested that solar cookers should replace all other cooking options, but rather that it should be treated as an add-on device. If you view your solar cooker as an additional cooking device similar to your electric stove, microwave oven, braai fire, paraffin stove or gas cooker you can fit it into your cooking habits to best suit your time and the dishes you want to prepare. Campers and outdoor enthusiasts can use solar cookers to cut down on their wood fuel use and to enjoy a fully cooked meal when they return to their campsite after a day of hiking, fishing or other outdoor activities. Solar cookers can also be used for other tasks, such as sterilizing medical equipment in an emergency, purifying water, drying food such as rusks, preserving food and dyeing wool and material.

Benefits of solar cooking

- Saves time which can be spent on other tasks;
- Reduces women's workload by not having to fetch wood or obtain other fuels;
- Saves money that would otherwise be spent on other fuels;
- Is healthier as there is no smoke or fumes;
- Is safe as there are no risks of burns or fire;
- Ensures healthier food as less water and no oil is needed;
- Water can be purified by boiling it in a solar cooker;
- Once you have paid for your cooker, the energy is provided free from the sun; and
- It protects the environment.



Where to find a solar cookers or retained-heat cookers

Contact **SESSA** (012) 804-3435 or info@sessa.org.za for an updated list of suppliers. You can also buy solar cookers on-line at www.solarcookers.co.za.