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SUCCESSFUL SOLAR COOKING COOPERATION FINLAND-KENYA - SOLAR OVEN PROJECT IN KAKAMEGA, KENYA

Background

The Lions Club of Helsinki Pohjois-Haaga initiated in 2017 a cooperation project for solar cooking development with two Kenyan partner organisations: the Lions Clubs of Kakamega and Greater Nairobi. Funding for the project was provided by all Nordic Lions Clubs together and the International Lions Foundation. Technical solutions for the solar ovens were based on earlier prototypes developed by Technology for Life Association (TfL) (Tekniikka elämää palvelemaan ry.) in Finland and Ethiopia.

The first phase of the project was completed in 2021, and a second phase is being prepared. About 1 500 solar ovens were constructed in Kakamega town during the first phase and distributed to households in Kakamega and selected villages in Kakamega County. Before distribution of the ovens a two-day solar cooking training programme was arranged for 40 members of local women's associations and environmental teams, and a solar oven user manual was also produced. About ten different local dishes were prepared during the training programme, including the traditional Kenyan dish ugali (maize porridge) and also cakes. The trainers have been responsible for distribution of ovens to families and of user training for the receiving households. A follow-up study of the use of the ovens was caried out in July 2022. The housewives of receiving households (beneficiaries) have been very satisfied with the function of the ovens.

Advantages of cooking with solar ovens:

Various types of solar ovens and other kinds of solar cookers have been developed and used in in the south already since the 1970's, but knowledge of solar cooking technology is still very limited in African countries. Therefore it is important to initiate projects and distribute solar cooking knowledge to local communities all over Africa, particularly in areas where fuelwood and charcoal consumption is high and deforestation a growing problem. The main advantages of solar cooking - particularly using solar ovens, are environmental, economic and health related:

- The need for fuelwood and charcoal for cooking is reduced and thus problems of deforestation and forest depletion can be reduced.
- No need for time-consuming and laborous collection of fuelwood, which is often the task of young girls
- Economic benefit: significant reduction of spending on fuelwood, charcoal, kerosene or electricity bills. Solar radiation is free of charge, and it is abundant in tropical areas.
- Cooking pots do not wear out as fast as when cooking is done with firewood.
- Health benefit for housewives: cooking free of air pollution from smoke and soot. Air pollution is also decreased in the neighbourhood or village.
- No risk for fire hazard or skin burns or burning up the food.
- Cooking with a solar oven is a safe slow-cooking method, which provides housewives possibilities to perform also other tasks while cooking.
- The solar oven has been quite functional for preparing the Kenyan traditional dish ugali porridge.

- A solar oven can hold more than one cooking pot, and thus it is possible to prepare many dishes at the same time.
- A solar oven can keep the food hot for some hours after completed cooking, when the covering lid has been closed. If there is a need to keep the food hot during a long time, it is possible to place a blanket on the covering lid.
- Solar ovens (bigger models) can be successfully used for cooking also in schools and institutions.

Comparisons between different types of solar cookers (solar oven, parabolic solar grill and panel cooker) where made during the project, and the result was, that the solar oven is the best solar cooker for household use in Kenya - since it is safe, effective, functional and easy to use. A parabolic solar grill is more effective than a solar oven, but it is more difficult to use and can cause a fire hazard. A panel cooker is easy to construct and cheap, but it has limited cooking effect. Parabolic and panel cookers do not keep the food hot after sunset, and thus additional heating is required in the evening.

Some experiences from Kakamega solar oven project

The users of the solar ovens in Kakamega have expressed their satisfaction of the functionality of their ovens. Particularly important has been their experience, that cooking of ugali porridge has been easier with the solar oven than using the traditional fuelwood cooking method. Experience has also shown, that many dishes (f.ex. eggs, potatoes, carrots and other vegetables) can be prepared with only small amounts of water. Meat dishes are prepared rather slowly, but without risk of burning. Rice cooking is also easy with a solar oven.

Solar oven construction and function - first phase of the project

The solar ovens constructed in Kakamega during the first stage of the project (2017-21) have a framework of thick (6,5 mm) film-coated plywood, which has been cut into interconnected pieces, which makes assembly rather easy. Part of the plywood was donated by a Finnish forest company (UPM). The bottom and walls of the oven have 30 mm hard rockwool thermal insulation, and the inside of the oven is made from 0,5 mm aluminium sheets. The bottom panel is painted black. The transparent lid of the oven is 4 mm thick polycarbonate sheet. Also tempered window glass can be used, but polycarbonate is more durable (does not crack or brake). A silicon rubber band ensures that the transparent lid rests tightly on the oven wall. It is important to prevent heat from escaping from the oven.

The covering lid is made of plywood, and it's inside has a reflective (glossy) surface (aluminium foil). Both sides of the oven have removable reflective aluminium sheets (side reflectors). The lid (back reflector) and the side reflectors shall during cooking be adjusted so that solar radiation is concentrated inside the oven on the cooking pots, which shall be black painted.

The temperature inside the oven can reach 150 degrees C during midday in sunny weather. Effective cooking time in Kenya is from about 9 in the morning until 4 in the afternoon. The effectivity of the oven can be improved if thermal insulation is made thicker and the reflectors made from very glossy material. However, in Africa it is necessary to try to minimize the material costs. In Finland I have built my own solar oven with thicker thermal insulation, and with it I can reach even 170 degrees C during sunny days in summertime.

The speed of temperature rise in the oven depends on the amount of water in the cooking pots. Temperature rise is slower If they contain much water. The thermal efficency of the oven can be improved by placing a flat black-painted stone on the oven bottom to be heated before cooking is started.

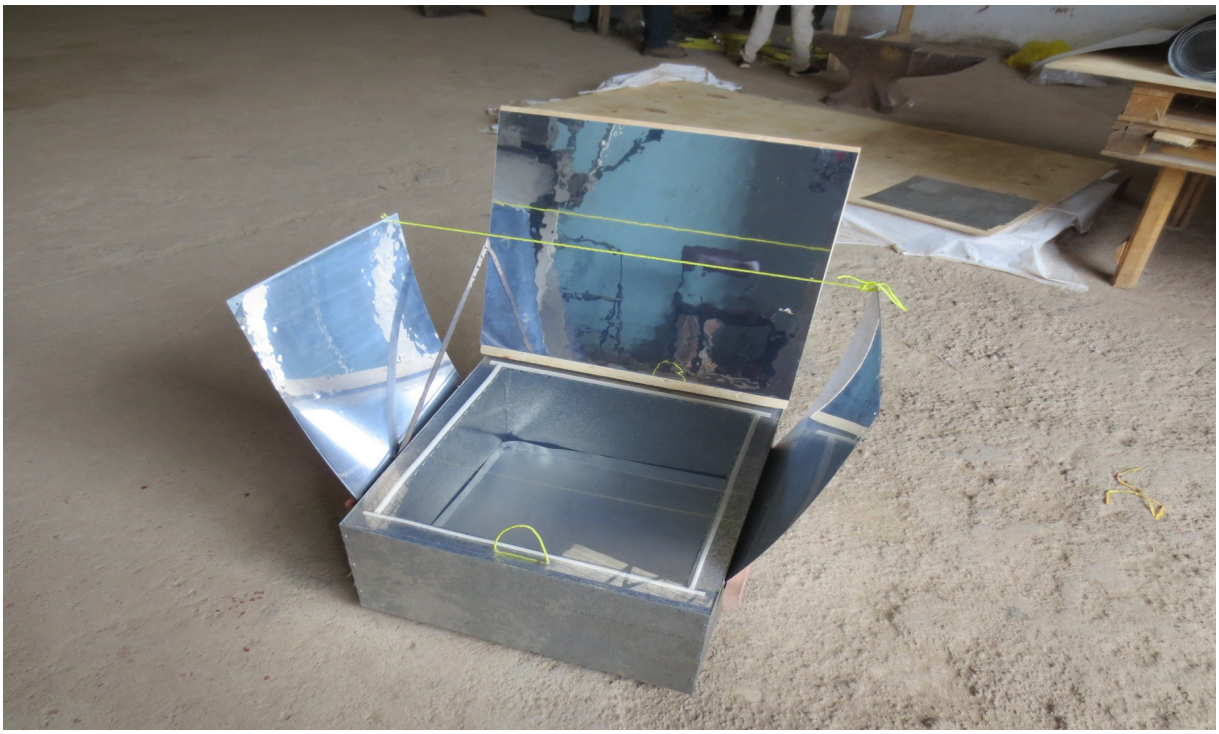
The second stage of Kakamega solar oven project 2023-24

Helsinki Pohjois-Haaga Lions Club received in 2021 a private donation, which provided a possibility to start a new stage of the project. In the second stage there has been some modifications to the solar oven: The framework of the new oven model is galvanized ironsheet, which is a strong material and reasonably cheap in Kenya, since it is a common building material. The outer shell is 0,8 mm thick and the inner shell 0,6 mm. The ironsheets are cut in a metal factory in Nairobi using CAD computer programme. This gives a possibility to assemble the sheets almost without screws, which makes construction fast and easy. The thermal insulation of the bottom and side walls of the oven has been increased to 50 mm thick glasswool.

The targeted upper limit for the construction cost is 80 euros per oven. This is affordable for middle income families in Kenya, but too high for low-income families. For them a subsidy will be needed. It has however been estimated, that the cost of the solar oven can be recovered already in about half a year due to less expenditure on fuelwood, charcoal, biogas, kerosene or electricity.

The long-term target for our Kakamega solar oven project is to make it possible for local small industries to start producing their own solar ovens for sale, and thus create new employment. This can be possible once the use of solar ovens has become common and their advantages has become well known. Our hope is also that other environment and development institutions in Africa will increase solar cooking development and training activities. The Finnish NGO WaterFinns is planning to start solar oven development activities in Ethiopia, based on the experiences from the Lions Clubs cooperation in Kakamega.

Participants of the solar oven training session in Kakamega 2019



The new metal frame solar oven (new Kakamega model)