

SOME SOLARCOOKING DEVELOPMENTS

Kari Silfverberg, October 2018

Short presentation of solar cooker models and
experience with solar oven developments in
Ethiopia and Kenya

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1 Solarcooking – introduction

- The principle of using direct solar radiation for cooking, baking and drying of food items was known already some 150 years ago.
- Development of cost-effective solar cookers for use in developing countries had an upswing in 1970's during the growth of the appropriate technology (AT) movement.
- Various types of solar cookers and dryers are now widely used in developing countries – maybe more than two million.
- Cooker models vary from simple homemade cookers produced with local and recycled materials to more sophisticated factorymade products. Cost range is from five to 300 euro.
- Cooker design criteria: a) availability and cost of materials, b) cooking effectivity and functionality , c) durability, d) cooking culture and common dishes and foodstuffs.

2 Advantages of solar cooking

- **Solar radiation is a free energy source** – no need to buy costly cooking fuel (fuelwood, charcoal, kerosene, Bhutan gas etc.) or electricity.
- No need to spend time and effort on fuelwood collection.
- Scarce forest and woodland resources can be preserved and natural biodiversity maintained.
- Environmental degradation due to extensive woodfuel consumption can be halted.
- No harmful emissions (smoke) from burning fuelwood, charcoal, cowdung or kerosene.
- The cost of a locally produced simple solar cooker can be recovered by savings from consumption of fuel and electricity in less than one year.
- A solar cooker can be used for cooking many different kinds of dishes, for bread baking, boiling water for tea and coffee, distilling drinking water and drying food items.

Advantages of solar cooking, cont.

- Solar cookers can be used in combination with fuel-saving woodstoves, charcoal stoves, biogas stoves, Bhutan gas stoves or electric stoves.
- When using slowly cooking solar ovens or box-type cookers, there is no risk of burning the food, and no need of constant attending.
- With solar ovens and box-type cookers it is possible to prepare many dishes (2-4) at the same time.
- If the solar oven has sufficient thermal insulation and an insulated cover lid, it can keep food items hot inside the oven for many hours after cooking has been completed. This is a valuable advantage, since family meals are usually taken in the evening after sunset.
- Simple solar cookers can be produced from locally available materials with ordinary hand tools in small workshops or even at home.

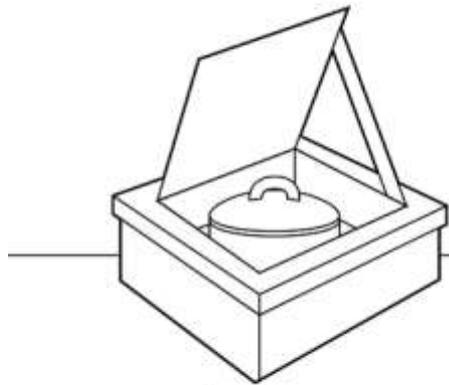
3 Main types of solar cookers

- The cheapest and most easy to construct cooker is the **CooKit panel-type cooker**, which can be built from cardboard, plywood or reflecting metal sheets. Cost of materials can be as low as five euro. The disadvantage of the CooKit is its rather limited effectivity.
- **Panel cookers** reflect solar radiation on a cooking pot placed inside the cooker. They can have many shapes. They are light-weight and rather easy to construct.
- **Parabolic concentrating reflector cookers** (solar grills) are effective, since they concentrate much solar radiation on the cooking pot, which is placed in the focus of reflected radiation. A medium-size parabolic cooker can boil two liters of water in less than 20 minutes during a sunny midday.

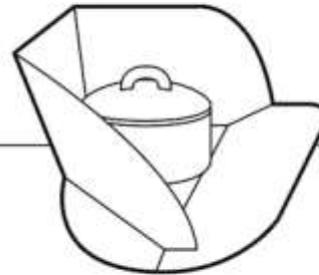
Main types of solar cookers, cont.

- **Solar ovens and box-type solar cookers** are slowly cooking models, which have a box-like container (oven box) with good thermal insulation and black-painted bottom, adjustable reflecting metal sheets on one or more sides, a transparent cover lid (window glass or polycarbonate sheet) and insulated cover lid. The oven box can be designed for two or more cooking pots. Solar ovens have following advantages:
 - They cook rather slowly and do not need constant attention.
 - There is no risk of burning the food.
 - It is possible to prepare many dishes (in 2-4 pots) at the same time.
 - When the insulated cover lid is closed, the food can be kept hot for a long time after cooking has been completed.
 - Temperature inside the oven can reach 180 degrees C or even more if the oven is well designed with sufficient thermal insulation and effective side reflectors.
 - A solar oven can also be used for drying various foodstuffs.

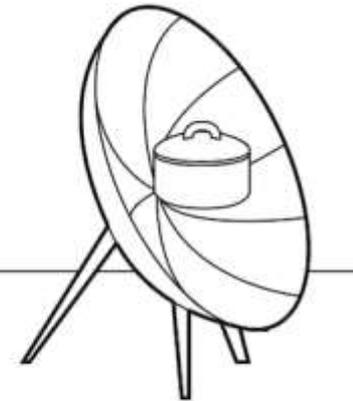
Simple drawings of main types of solar cookers



Solar Oven



Panel Cooker



Parabolic
Solar Cooker

Round parabolic solar grill made from reflecting aluminium sheets (recycled) Burayu Basic Technology Centre, Ethiopia



Round parabolic solar grill made from gypsum with sisal fibre, Burayu BTCentre Ethiopia 1982.



Solar ovens built during training workshop i Helsinki (Harakka Nature Centre) 2016 + factorymade parabolic solar grill





Simple box-type cooker TEP (TfL)-model

Built in Windhoek, Namibia 1996 in cooperation with Penduka Womens Association.



Solar drier, Selam Vocational Training Centre, Addis Ababa, Ethiopia 2012



Parabolic cooker with cooking stand, Metropolia Univ. Of Applied Sciences, Vantaa, Finland 2015



Solar oven (Telkes type), Veikkola school, Finland 2013

This model has good thermal insulation (50 mm glasswool). Can reach 180 degrees C in summertime. Partly recycled materials.



**Turbo-model solar oven built in Metropolia UAC, Vantaa
by Kenneth 2015**

This model can reach up to 240 degrees C during summertime.

4 Cooperation with schools and training institutions / solar cooking development in Finland and Ethiopia etc.

- Simple solar box cookers (TfL-2 model) constructed at **Äetsän kansalaisopisto** in 1994 and distributed to various development organisations in African countries.
- Courses on solar cooking technology organised at **Metropolia University of Applied Sciences**, Vantaa, for students from Finland and various developing countries (Ethiopia, Kenya, Nepal, Tanzania and Zambia etc.) with contributions from TfL (Antti Tohka, Markku Komonen and Kari Silfverberg) since 2012.
- **Veikkola school in Kirkkonummi** started in 2012 to train students in construction of simple solar box cookers with technical assistance from Kari Silfverberg, Jouko Niemi and Arto Vuorela.
- Cooperation was organised with **2 partner schools in Ethiopia** and a study trip arranged in September 2013 – teaching construction and use of solar cookers with teachers and students at the partner schools. Funding provided by Min. of Educ. (Komppi-programme).



Solar oven (Telkes type) and box cooker at Sertse Dengel school in Bahir Dar, Ethiopia, 2013

The exercise was completed in 3 days. Training given by Kari Silfverberg and local carpenter Ato Gash.



Solar oven (Telkes type) completed at Bahir Dar Polytechnic College in Ethiopia, February 2015

Training provided by Aki Kukkonen and Kari Silfverberg. Participants were teachers of the college.

5 Solar cooking cooperation between Finnish and Kenyan Lions Clubs, Kakamega, Kenya 2016-18

- This solar cooking development cooperation was introduced by Pohjois-Haaga Lions Club, Helsinki in 2016, and funding was provided by all Nordic Lions clubs (co-funding). Technical assistance provided by Technology for Life Association (TfL, TEP).
- Kenyan partner organisations are Kakamega Lions Club and Kenyan Lions Federation.
- Project target is to build about 1 400 solar ovens in Kakamega, donate ovens to selected communities and families and provide training for users.
- Already about 1 000 ovens have been completed.
- Long-term target is to facilitate further production of solar ovens by local workshops and small industries as their own business when public interest in solar cooking has been aroused and demand established.

**Solar oven demonstration in Kakamega, Kenya, 2017
two models (Telkes principle), side reflectors still missing**





Finished solar ovens in Kakamega, Kenya, 2017

The framework is made from thick (6,5 mm) plywood sheets with interlocking design.



Solar oven demonstration & donation to Maasai housewives in Lesiolo village, Kenya 2018

The ovens were built by the Finnish-Kenyan Lions clubs cooperation project,



Solar oven constr. Workshop, Kakamega 2017

Plywood sheets (6,5 mm) and hard rockwool insulation sheets (30 mm).

6 Continuation of training programmes for solar cooking

- During February-May 2015 Technology for Life Association (TfL, TEP) prepared a **project plan for an extended solar cooking training programme in Ethiopia** in cooperation with an Ethiopian environmental NGO – the Ethiopian Wildlife and Natural History Society EWNHS.
- **A project funding application** was submitted to the Ministry for Foreign Affairs, but unfortunately the ministry did not provide funding for any new NGO-development projects for 2016, due to the dramatic budget cuts announced by the new government. A new funding application was prepared in May 2016 without success. New possibilities for funding will be investigated.
- **A comprehensive manual** for the construction of solar ovens for Ethiopia was prepared by Kari Silfverberg, Arto Vuorela and Aki Kukkonen.