

Solar Cooker SK12 Experiences and Visions

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Summary

The progress of the recent years in the development and dissemination of SK12-type solar cookers has helped to overcome the well-known solar cooker problems. In combination with insulating containers (e.g. hay-baskets), these cookers meet all essential requirements for family and institutional use (e.g. community kitchens) and can be produced in small workshops equipped with simple tools and materials.

Approximately 4000 SK12-type solar cookers (SK9 to SK14) have been installed in over 60 countries with the assistance of development aid groups and individual workers. Workshops e.g. at missions and schools around the world have been established.

The solar cooker program SK12 has been developed for the last 12 years by the author, his family and many inspired persons all over the world.

There was progress in following areas:

a) Technical and practical characteristics:

Capacity, stability, safety, easy use, large pots, durable reflecting surfaces, combination with locally available insulating containers to multiply the capacity of the cooker and to separate cooking time and meal time.

b) Production:

Steel structure easy to produce and to assemble, structure for screwing or welding, bamboo structure, simple mounting of thin reflector panels.

c) Dissemination:

World-wide co-operation and workshop installation, solar cooker sponsorships, information, assistance and supply of sample cookers by development aid groups. The use of the solar cooker documentation is free of charge.

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Fig. 1: Solar Cooker SK12

Support, documentation, sample cookers, reflector material are available from EG-Solar e.V. (Development Group Solar Cooker of the State Technical College Altötting), Neuöttinger Str. 64c, D-84503 Altötting, Tel.: 08671 96 99 37; Fax: 08671 96 99 38

1. Features of solar cooker SK12

- The cooker is designed for use by families and - in a modular way - for institutions.
- It is well suited for community kitchens, which take care of cooking and baking for the public.
- applicable for cooking, baking, frying, regenerating adsorbers of refrigerators
- high power (nominal 0.6 kW); cooking from one hour after sunrise to one hour before sunset (ECSCR-test: 48 litres of water a day)
- big pot (12 litres, 20 litres); almost all pot designs acceptable
- reflector (diameter 1.4 m) with short focus distance (28 cm) i.e. "deep focus"-type reflector for safety, long tracking intervals and high efficiency
- robust structure and stable support of the pot;
- pot remains automatically in upright position in the focal area of the reflector; easy one-step access to the pot without glare due to the shadow of the big pot; adjustment of the reflector to the sun by use of a shadow indicator
- low material cost due to cheap material for structure (steel, 22 kg) and low aluminium mass (3 kg for 1.5 square meter aperture), thin, hard aluminium sheets with protected, high reflecting surface.
- The cooker is designed for easy production in simple workshops, possibly without electricity. The design is adaptable to local conditions.
- Combination with hay-boxes ("hay baskets") is strongly recommended.

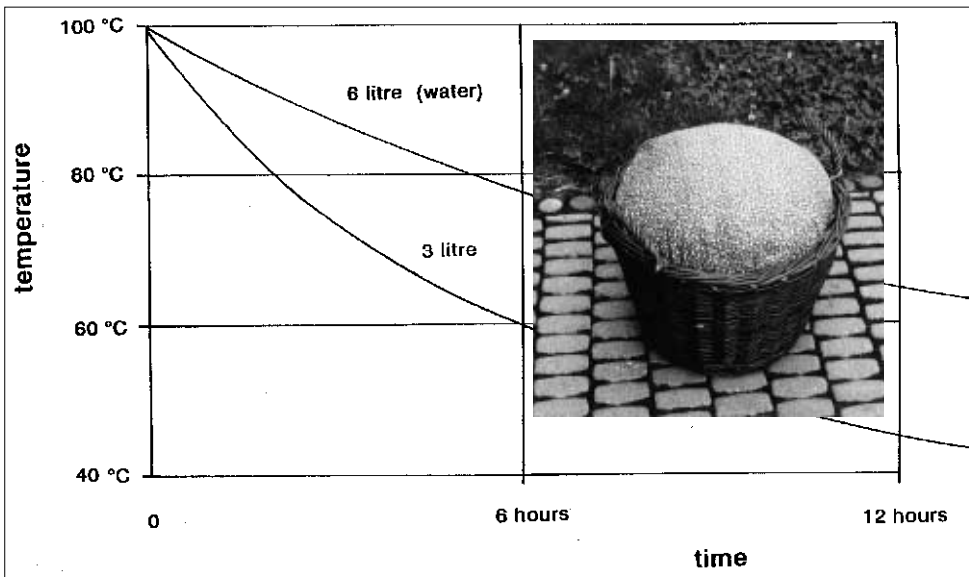


Fig. 2: Temperature in a "hay basket" with a good insulation

2. Overcoming of previous problems

disadvantages of previous cookers:	avoided by SK12-concept:
high cost	<ul style="list-style-type: none"> > reflector made of thin, mass-produced aluminium sheets, mounted on a low-cost basket structure; > cooker easy to produce in simple workshops; > long lifetime of the whole instrument
cooker not usable for all applications	<ul style="list-style-type: none"> > multifunctional cooker: cooking, baking, frying, bottling, sterilising, ... > high pot capacity; > recipient holder adaptable for pot, pan, ...
low power cooker not utilizable in short sunny periods	<p>high power deriving from large reflector 1,5 m² and high efficiency due to</p> <ul style="list-style-type: none"> > use of high reflecting anodised aluminium, > deep focus design, > big, well absorbing pot with lid, automatically remaining in focal area; > unattended simmering in "hay-basket" after short cooking time
high tracking frequency	tracking only every 20 minutes or less, due to deep focus design
lack in stability	firm structure with stable stand
risk of fire and burns	<ul style="list-style-type: none"> > focal area instead of focal point; > stable pot mounting in focal area
dazzling reflector	large pot to absorb all reflected light from well formed, deep-focus reflector
lack of comfort	<ul style="list-style-type: none"> > easy tracking by using an indicator; > no need of looking at the dazzling pot; > high power for quick cooking; > long tracking intervals; > easy access for stirring; > unattended simmering in hay-basket; > design is adaptable to local preferences.
rapid heat loss of the pot without sun	<p>combination with hay-baskets to finish cooking by simmering, to separate mealtime and cooking time, and to liberate the cooker for next pot with other components or for next access in community kitchens</p>
no access for poor people to solar cooking	<ul style="list-style-type: none"> > installation of community kitchens with professional cooks > low cost local production; > reforestation or other work in return for access to solar cooking

3. Experiences with Solar Cooker SK12

3.1 Application

Cooking rice, beans, potatoes, other vegetables, soup, stew, meat, ... (finished in basket with blankets - "hay-box")

Baking bread, cake, ...

Frying fish, meat, chicken, potatoes, ...

Sterilising water and instruments; bottling/preservation of fruits and vegetables

Regeneration of adsorbers

3.2 Production

Small workshops, simple tools and materials

Necessary tools (cost approx. 5000 DM): cutting, punching/drilling device, bending devices (there are designs for welded and for bamboo structure, too)

2 instructed persons can produce several cookers SK12 a day

Material:

- round and strip steel, bolts and nuts,
- anodised high reflecting aluminium sheet, 0,5 mm thick (3 kg)
- thin plastic-coated wire (remainders of telephone installations)

Cost of material for one SK12: approx. 120 DM,

Cost of local production incl. material: approx. 200 DM

The insulating baskets are produced conventionally

The SK12 is a proven design which allows almost any adaptation to the local technical situation and to the ability and capability of the manufacturer.

3.3 Dissemination of Solar Cookers and know-how

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Program of several development aid groups,

EG-Solar and JAGUS, Altötting; Aktion Sonnenbaum, Passau; WOT University Twente, Enschede; Projektgruppe Solartechnik, Freilassing; ... :

Assistance is given free of charge. Expenses are sponsored by donations.

Founding of workshops world-wide:

Ethiopia, Bolivia, Brazil, Cameroon, Ecuador, India, Madagascar, Peru, Philippines, Zimbabwe, Uganda,

at schools, missions, hospitals ...Further workshops are in preparation.

Training of personnel and supply of reflector material and sample cookers.

Till now, 50 solar cooker workers from all over the world have been trained by EG-Solar.

Now there are approx. 4000 cookers of type SK12 in use.

The cooker has participated successfully at the International ECSCR-Solar-Cooker-Test at Almería (Spain).

4. The firewood crisis – loss of a free energy source with global consequences

More than two billion people in developing countries are losing their free or very cheap energy source: firewood.

Most of them can't afford the change to other energy sources.

They destroy their natural resources and sink into misery if they don't get help to self-help.

For a rapidly growing part of mankind solar cooking is no longer a question of acceptance but of survival.

It will be painful for all, not only for the poorest in the world, if we continue to ignore this challenge.

The SK12-program shows a way to overcome the firewood crisis:

5. Calculations to get a survey about a global program for solar cookers SK12 in community kitchens and in households

1 solar cooker and 3 hay-baskets per 10 to 20 persons, i.e. 100 million solar cookers and 300 million hay-baskets are necessary.

If 1000 cookers are produced in one workshop per year, then 10 000 workshops need 10 years for 100 million cookers.

If there are 10 part-time jobs per workshop, then 100 000 part-time jobs are created world-wide.

The cost of a workshop equipment is approx. 5 000 DM, i.e. 50 million DM for 10 000 workshops

Material costs are approx. 120 DM per solar cooker, i.e. 1 200 000 000 DM per year (10 million cookers). Half the amount is for the reflector material.

Local production costs (incl. material) for 1 cooker are approx. 200 DM, i.e. approx. 15 DM per person.

Nominal power of the solar cooker is 600 W i.e. 100 million cookers have a nominal power of 60 000 Megawatt

One cooker can avoid the emission of approx. 10 000 kg CO₂ per year, 100 million cookers avoid approx. 1 billion tons of CO₂ a year. This is more than the CO₂-emission of Germany.

6. Visions

- Millions of community kitchens with 5 to 20 solar cookers (and stoves with high efficiency used in time of sunshine shortage)
- Millions of children who bring their pots (in baskets) to the community kitchens on their way to school and after school they take the cooked meal home instead of gathering firewood
- World-wide use of insulated baskets (hay-baskets) for conserving energy
- Thousands of workshops for manufacture and maintenance of solar cookers and of other appropriate equipment for self reliance
- Reforestation work in return for access to solar cookers
- Network to spread emerging experiences and improvements
- Annually saving the emission of billions of tons of carbon dioxide by solar cooking, by the use of hay baskets and by reforestation
- Support of global solar cooker programs by industrialised countries to meet their commitment for the reduction of CO₂-emission
- World-wide commitment to solar cooking and other perma technologies for escape from firewood crisis and as effective steps to a sustainable development

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7. Indications

Support, documentation, sample cookers and sets of reflector panels are available from EG-Solar e.V. (Development Group Solar Cooker, State Technical College Altötting), Neuöttinger Str. 64c, D-84503 Altötting, Tel.: 08671 96 99 37; Fax: 08671 96 99 38
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8. Literature

- [1] D. Seifert: Neue Konzepte für nachgeführte PV-Generatoren und Solarkocher. 9. Internat. Sonnenforum ISF'94 - Stuttgart, Tagungsbericht, Band 2, p. 1406-13, München: DGS-Sonnenenergie Verlags GmbH 1994
- [2] Bayerisches Staatsministerium für Landesentwicklung und Umweltfragen und Staatsinstitut für Schulpädagogik und Bildungsforschung, München (Hsg.): Modellversuch Umwelterziehung - eine Aufgabe der Berufsschule "Wir kochen mit Sonne ...", München: Verlag Alfred Hintermaier 1992