

REVIEW OF SOLAR COOKER DESIGNS

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This is a HTML version of the article which appeared in TIDE, Vol 8, No. 1, March 1998 Page 1-37. This paper is now presented here in 16 parts.

This site helps you to find out if your design of solar cooker works or not. (The cartoon is from Prof Bernard's little book on Solar Cookers " La cuisson Solari Facile") Published by Jouyence Silence. France, reproduced here with his and publisher's permission)





Abstract

This review presents about **60 major designs**, 69 variations and 80 drawings of solar cookers. Test data published by other researcher is compiled and a new set of parameters is suggested for testing solar cookers, reflectors, and insulating material. This compilation recommends do – it-yourself box-type solar cookers incorporated in the house for the rural areas (type BDM 2, concept IX). For urban areas, the best suited design would be Prof. Bowman's design with slight modifications (Type MP 3a, Concept IV). Another design for small towns, where smaller houses are more in number, is the roof-top water lens whose focus is suitably deflected to the bottom of the cooking vessel (Type LCA 3a, Concept VI). Of other viable designs Bernard's 'COOKIT' appears to be the best suited, other designs are also discussed. (**Update** 6 more new designs have been added since this site was launched in June 1999, for details see at the end of this part and also in the respective sections)

PLEASE NOTE:

- **The designs designated here as CONCEPTS I to XII were conceived during '80ies, but I do not claim any right over the same, these designs can be tried out without any prior permission from me. However I appreciate if I get a detailed report of the performance.**
- **This is an ACTIVE SITE, a researcher or an Inventor may advertise/contribute his/her design through this pages.**
- **All the new entries made after 6th June 1999 will be entered in parenthesis under the title of UPDATE.**

CONTRIBUTORS TO THIS SITE

- **BRETT WHITE** of Australia, was the first contributor to this SITE. He has updated the folding type Parabolic cookers listed here under PC 8.
- **DERIS JEANNETTE** from USA is the second contributor. She has evolved 'CLEAR DOME SOLAR COOKERS' classified here under LCA 7. She also presents several other interesting variations, some of which are for sale.
- **DAVID DELANEY** of Canada, turns out to be the first critic of the site, and as per his advice, I have renamed the web page as my Homesite. He is concentrating on improving the transparent insulating cover, first suggested by Prof. Bernard and then modified by Prof. Barbara Kerr, more effective. His site should be visited for more detailed information which is a must if the solar cooking has to be effective.
- **QUINSTONE STOWELL** from UK, is the fourth contributor to the site. He had detailed his project work undertaken at Peru and presents several guidelines for easier construction of parabolic solar Cookers.
- **I am delighted to receive very nice words and a beautiful book from Prof. BERNARD, (off France), designer of 'COOKIT'.** The book is in French but fortunately details of his designs are presented by Solar Cooker International.
- **Stoven** has presented an interesting design called FUNNEL COOKERS, I would place it close to 'Cookit', and designate it as LCA 8.
- **Prof. Paul Funk's SEAE Standards on testing Solar Cookers has been added just this month that is, October 2001.**

Active researchers who have tested the solar cookers using this method could please send me the details.

Acknowledgements

The author acknowledges the help and encouragement extended by the late Prof. P.S. Shivram, Head, Department of Printing Technology and Energy Centre, MIT, Manipal , who was solely responsible for the publication of the earlier review in 1995. In fact the work on Solar Cookers was launched here at Udipi way back in 1975 and it was Ms Janet Alarcon of **VITA** and Sri. G K Gopalakrishnan, Chief Documentation officer, TERI , (then located at Mumbai) who not only enthused me further but helped me by sending tons of information. And now, especially to Dr. M C Shukla of TERI, New Delhi, for having recognized this work and encourage compilation of this abridged and updated version, and getting it published in TIDE. I am also grateful to Ms. Bev Blum, Vice President, **Solar Cooker International**, USA. for encouraging me to put this paper on WEB. I am also grateful to Prof. Sureshramana Mayya, Department of Commerce, at our College for taking special interest in converting this paper into HTML format. (for other links see at the end of References)

PROLOGUE

(Read this before you go further)

This site was launched in June 1999, since then over 1400 interested persons have visited the site, and many of them have spoken very high of it and some have also suggested changes which have been incorporated. New designs and works too have been added. But before one continues further I request them to read this prologue.

Many of the Solar Cooker Enthusiasts are still keen on fabricating perfect Parabolic reflectors! But this aspect has been dealt in detail under the section. Many of the Stalwarts like Prof. T. E. Bowman of Florida Institute of Technology, and also Prof. Roger Bernard of France have suggested using Plane mirrors in sted. I guess it would be much easier to do so.

Remember the insulated Box of Box type Gosh Solar Cooker. Prof. Barbera Kerr and several others had suggested using paper balls, straw and a wide variety of materials for making the box and the insulation to go in-between. Inventors like Patel (1981, Ref. 74,) had in fact suggested inverted Glass Jar in sted of a very heavy and combersome insulated Box. Later Prof. Bernard had suggested the use of such a Jar for his 'COOKIT' design. Glass Jars are costly and are prone for breakage so Prof. Barbera Kerr used clear plastic bags to cover the cooking pots very successfully. Prof. Bowman too had realised the importance of the insulation of Cooking vessel and he had suggested FOAM GLASS boxes around cooking pots for the FIT designs. Recently Deris uses two such clear jars (Glass or heat resistant Polycarbonate jars), inverted over the cooking pots where the light is concentrated by a circle of ordinary mirrors! I guess the solar Cooking can not be made simpler than this.

At this juncture I wish to introduce the work being pursued by Prof. David Delaney of Canada. Taking the cue from Prof. Bernard, and Barbera Kerr he is attempting to improve this Glass Jar concept. Covering the Cooking pot with a Glass jar has two problems, handling the cooking pot and its contents become difficult, and condensation of moisture inside the glass container affects the transmission of solar light to the pot. So he suggests use of a upright jar of not more than 2 inches in diameter of the cooking pot. Use of a suitable collar of card board or more stable material for placing the pot into the jar, and also a cooking pot with a clear glass 'insulated' lid. I feel that these suggestions are very apt, but at the sametime find that the Glass jars of that type are rather costly upto Rs. 400 (\$ 10) especially because Gosh type Solar Cookers of 2' x 2' were being sold in our country at Rs. 450 to 650! (\$ 12 to 16 only). I do not suggest that the Box type of Cookers are better, but an attempt is needed to find a suitable material to cover the cooking pot.

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Introduction

Solar energy is the primary source of energy for our planet. Increased utilization of the same would result in an all-round benefit, both in terms of cleaner environment and monetary gain, for the individual users as well as the nation. Use of solar energy would save a lot of time and money for the user and this could be effectively diverted for increased productive activities and monetary gains which means better living standards and overall prosperity. The Gujarat Energy Development Agency (GEDA 1979) calculates that the use of solar cookers by about 2000 families for 10 years would mean a saving of Rs 3.6 million in terms of reduced firewood consumption, or Rs. 100 million worth coal or Rs. 8.55 million worth kerosene (as per 1979 prices).

History

The history of solar cooking goes back to dim recess of antiquity. The use of solar power to ignite altar fires has been mentioned (Meinel, Meinel 1997). References indicate the use of sun rays to melt chemicals and metals. The very first solar furnace was fabricated in France by the famed naturalist George Louis Leclerc Buffon (1707 – 1788). However, the first reference relating to solar cooking was that of Nicholas-de-Saussure (1740 – 1799). There are over 50 major designs of solar cookers, some of which are patented, and more than 100 variations. Of these, this review covers about 59 of the most important variations. The main purpose of this compilation is to present all possible major designs and their variations so as to prevent the solar cooker designer from wasting time on a design which has already been under the Sun. An attempt is made to cover most of the designs, but if there are any omissions then the designers may please send the details (Kundapur 1995). Though the description of the cooker is brief, accompanying diagrams would fill the void. As regards dimensions, adequate guidelines are given in the respective sections, but for concentrating type the area should preferably be more than 1.5 sq. m, and in the case of box type, it should be around 0.6 sq. m.

The solar cookers presented in the review are classified under THREE categories:

- [Concentrator Type](#)
- [Box-type designs](#)
- [Indirect Types](#)

The Concentrator type, concentrate the sun's rays either on to the top or at the bottom of the cooking pot, was the pioneering design. Naturally maximum variations are found under this category and 28 designs are discussed here. The Box type design was one of the first solar cookers to appear under the sun, and is one of the popular designs now. Eleven major designs of this type are described here. The Indirect type solar cookers are those that have collectors outside and the cooking area or plate is inside the house. Some exotic designs are covered here and 11 major designs find place in this review (Chart I).

TABLE I - SOALR COOKERS

<u>Concentrator Type</u>	<u>Box-type designs</u>	<u>Indirect Types</u>
<p>LIGHT FROM ABOVE</p> <p>LIGHT FROM BELOW</p> <ul style="list-style-type: none"> ■ Spherical ■ Fresnel ■ Cylindro parabolic ■ Mirror plane ■ PARABOLIC <ul style="list-style-type: none"> ● Collapsible ● Rigid <ul style="list-style-type: none"> ○ Asymmetrical ○ Shallow ○ Deep 	<ul style="list-style-type: none"> ● Without Mirrors ● With Mirrors <ul style="list-style-type: none"> ○ Single Mirror ○ Double Mirrors ○ Three Mirrors ○ Four Mirrors ○ Four plus Four 	<ul style="list-style-type: none"> ○ IDT 1 Whiller type ○ 1a Stam Cooker ○ 1b Bowman type ○ 1c Venugopal type ○ IDT 2 Chinese type ○ 2a Nijaguna type ○ IDT 3 Stam type ○ IDT 4 Swet type ○ IDT 5 Fraber type ○ IDT 6 Winston CPC tpye ○ IDT 7 Concept XII ○ IDT 8 Chemical types ○ IDT 9 Biogas ○ IDT 10 Solar Hydrogen ○ IDT 11 Solar Water Heater
(for details See Chart Ia)	(for details See Chart Ib)	

(**UPDATE** : Medved et.al., 'SOLAR BALL' under Spherical Concentrators S-2

Amith Kumar's Circular Box with Contored Mirror under BSM 2, Prof Sayiah Type under BSM 3, Prof. El Sebiis type under BSM 4, Fatangares type under BWM 7, Double Parabola under PRS 2,

Prof. Bernard's 'NEPLA' in under MP 3 are 7 new designs considered in this first ed. of the web page)

Source:- TIDE., March 1998, 8-1, pp 1-37, For Comments, suggestions,contributions contact <ashok_kundapur@yahoo.com>

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[click here](#) for comments received

For details regarding testing of solar cookers (International Standards) please [click here](#)

For Comments, suggestions,contributions contact <ashokk12@rediffmail.com>