

CHANCES AND LIMITATIONS OF SOLAR COOKERS

A critical review and new avenues

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Abstract:

Most of the developing countries are in the solar-rich tropics where millions of people who have no access to modern energy forms such as electricity - and even if they have, they cannot afford it for cooking. These are the people who could benefit most from environmentally and socio-economically beneficial solar energy.

Today high quality solar cooking and heating technologies are available, nearly equalling the power output of gas or electricity. If the most important parameters such as suitability to cooking traditions, economic limitations, educational prerequisites, production and promotional requirements, or after sales repair and maintenance services are considered, solar cookers can successfully be spread.

Why is it so difficult, then, to commercialize the product, when the running costs are nil and the multiple benefits are so obvious?

Key words: status of technology, user needs and user choice, commercialization, quality control, after sales service needs, high investment costs, but zero running costs

1. PURPOSE

It is the purpose of this paper to look once more at the failures and successes of past and on-going solar cooker projects and programs, and to scrutinize carefully whether there are any new findings that will lead to a breakthrough in solar technology dissemination.

The central questions at this time are why the demand for solar cookers is so low, when so much subsidy is paid, the investment cost is low, the running costs are zero, no more wood or dung has to be collected, no smoke to be suffered? Why are so few cookers in use when so many people have invested so much time and effort to establish the technology

worldwide? There must be points that have been overlooked, but which? Once these are clear, it will be possible to define new strategies to overcome any hindrances.

2. BACKGROUND

Solar energy, like any other form of energy, is always a means to an end and not an end in itself. What people need is an efficient energy source that reliably and efficiently cooks a meal when it is time to eat. This is not always possible with solar energy, because the sun does not shine in the early morning nor during cloudy and rainy days. Therefore, solar cooking is not a stand-alone technology. However, in many geographical areas only some adjustments are needed for most of the cooking needs. One such area is the Tibetan Autonomous Region of China, and indeed this is where the most impressive successes so far can be found. It is worthwhile to look at this program more closely to see whether there are lessons to be learned for replication elsewhere.

This paper concentrates on solar thermal technologies only, but it is understood that there is a wide range of solar energy uses, such as photovoltaic installations for decentralized electricity production, solar warm water heating, solar drying or cooling, etc. that provide valuable services and should be considered when designing renewable energy strategies.

3. CHANCES AND CHALLENGES OF SOLAR COOKERS

3.1 Chances

In Tibet and other parts of China, an ideal situation for disseminating solar cookers exists, which led to massive dissemination and use of solar cookers. Since this is virtually the only large scale success, it is outlined here in more detail:

- 8-10 months a year of high insolation;
- An efficient and affordable technology through subsidies in the beginning and large-scale industrial production later on;
- Supportive central and regional government policies, including scientific testing and quality standards, as well as special subsidies and grants for low-income groups;
- Cooking traditions that perfectly suit solar cooking (mostly boiling water for tea and soup);
- Thermos bottles for keeping water hot over night;
- Dung often is the only alternative cooking and heating fuel;
- Overuse reduces soil fertility and threatens livelihood;
- Dung or fuel wood saved can be sold, used for winter heating or left on the land as fertilizer;
- Alternative uses of time saved brings many tangible benefits, including better health and more income.

Solar cookers for refugees:

Refugees are usually settled in marginal lands, resulting in over-exploiting of natural resources in a short time, followed by conflicts with the local populations. Free energy provision via solar cookers seemed a good opportunity for introducing solar cookers to provide free cooking energy. Two small pilot projects were started with financial assistance from GTZ. The results were only partly successful for the following reasons:

- A certain percentage of fuel wood and kerosene was provided by UNHCR free of charge, which diminished the interest in solar cookers in Kenya;

- Cookers function best with the right black pots, but these were not always available;
- Family size and cooker size did not always match. The most powerful ones were most appreciated.

On the other hand:

- Working for cookers in refugee camps in Namibia was appreciated, because it gave refugees something useful to do and they acquired valued skills;
- It also gave them the security that the cookers cannot be taken away from them. 80% took them with them when they were repatriated;
- Good training of service personnel was crucial, so that repairs could be taken care of quickly and there was not a long time when the cooker could not be used;
- The poor were more willing to change their cooking traditions (i.e. sending children to school without a warm breakfast, but preparing it solar during the mid-morning break);
- Using the solar cooker made it possible for refugees to sell their kerosene rations. When other options were available, solar cooking was not as attractive, except when the fuel being replaced could be used otherwise.

Solar cookers for productive uses

Good opportunities for solar energy technologies also present themselves if businesses can be started and income secured with access to cheap energy – examples karité butter making in West Africa, street restaurants, fruit preservation, etc. There are many examples of such successes, but they will not lead to mass dissemination of solar cookers. Nonetheless, it is an important aspect, as it contributes to making solar energy known more widely.

The recent rise in oil prices means a definite chance for investments in solar energy, because they become relatively cheaper production means.

Solar cookers for housing projects:

With rapid urbanization going on unabated, huge peri-urban communal housing projects are continuing to be constructed. Twenty-five years ago in Kenya such housing projects were equipped with solar water heaters as part of the regular layout. Many such projects were subsidized by government. National solar cooker projects could try to convince national governments to offer subsidies for including built-in solar cookers as part of the housing plan. The challenge there is to reserve sufficient space in the compound or on the rooftop and to provide the necessary security. On the other hand, if every house had a solar cooker, the danger of it getting stolen would be much less.

Even where the total constellation is less than ideal, solar cooking still can make substantive contributions to improve the livelihood of people. It is much more difficult, however, to convince people of future benefits when they are struggling to survive at subsistence level. They may consider the risks too high to spend a large part of their annual income on a new technology. For this group of people government subsidies would be a useful instrument.

3.2 Challenges

New energy options for cooking and heating are developing all the time: gel fuel, ethanol, plant oil fuels. The competition will get tougher with the current and projected investment levels in bio-fuels. To compete with such new energy sources will be a new challenge for solar cookers as these fuels also are renewable and environment friendly.

As cooking is a private activity in most parts of the world, dissemination may to some extent be felt as intrusion into the private sphere. This could be avoided by placing more emphasis on demonstrating solar cooking in public places, such as restaurants, hospitals, and others especially in need of hot water. Knowledge needs to be spread

The strategy of tailoring the cookers for the poor, making the cookers as cheap as possible by using waste materials etc., may result in a low image of the technology. The normal way of introducing a new technology with potential for use by a large part of the population would be to sell high efficiency well functioning units to the middle class at competitive prices, and introduce rock-bottom and subsidised price alternatives for the poor when the technology is widely accepted and established in society.

Therefore, one thought to be considered is that in the past solar cooker projects might have been addressing the wrong target groups, especially as it became more and more obvious that satisfactory results were achieved mainly with high quality products, which were priced beyond the means of the rural poor and environmental considerations are not yet a high priority for most poor people who are struggling for survival. They have no other options.

Technology needs to be sold as modern and highly desirable product to the middle class who can no longer afford the high electricity and gas, kerosene or charcoal prices. They can invest more easily, provided they get something in exchange which has a reasonable payback period. In Tibet this was very short!

There must be real monetary or convenience gains, every time a meal is cooked solar. They can be reached more easily via public media. Population growth rates in cities are growing more rapidly than in rural areas.

For many years private business has neglected to see a potential market in solar cookers. They left the field to the highly motivated and enthusiastic NGO development scene, which usually did not have the means to invest large sums into the development of high quality products. In some cases, the subsidised NGO cookers may have delayed or even prevented local manufacturing investments. Nevertheless, they are widely available today

and appreciated by the users if they are of a reliable quality. The NGO Sector can be credited with making the technology known worldwide, though – given the limited resources - not in depth.

4. CONCLUSIONS

Unfortunately there are not many governments up till now (with the exception of China and India and partly South Africa) who have seen (or have the means) to consider subsidizing solar cooking technologies on a scale and time horizon that would attract industry to invest. The same is true for international donors and development institutions.

Civil society organizations, on the other hand, have invested much financial and personal effort to spread the knowledge, but, because of their too small financial capacity, did not have the impact necessary to establish viable commercial production and marketing systems. These are mainly groups and individuals who are development oriented and want to contribute to poverty alleviation, health improvement or to other social or environmental goals.

Yet even where the total constellation is less than ideal, solar cooking still can make substantive contributions to improve the livelihood of people. It is much more difficult, however, to convince people of future benefits when they are struggling to survive at subsistence level. They may consider the risks too high to spend a substantial part of their annual income on a new technology, which is not yet widely established. For this group of people government subsidies would be a useful instrument to reduce the risk.

What is needed now is a shift in paradigm. Perhaps the focus for this comparatively expensive technology should not be the poorest of the poor (because they cannot bear the risk inherent in any new technology), but those who are spending an ever greater part of their income on the rising energy costs (and

realise that by making a one-time energy saving investment they can reduce the running cost to zero).

5. SUMMARY

Several possible strategies emerge:

1. Big industrial production took place only in countries where the public sector made substantial initial investments (China, India, to some degree South Africa) and subsidized solar cookers on a large scale.
2. The successful example of China was based on alliances between industry and government, supporting the development of a flourishing cooker industry. China offers the chance to look at strengths and weaknesses of the process.
3. Addressing the more affluent urban and semi-urban population, who are looking for cheaper alternatives for the rising energy costs (electricity, LPG, kerosene, charcoal) and can afford to buy solar cookers can demonstrate the value of the new technology well.
4. Remote from modern energy markets, but financially capable to invest in solar technology if it improves their living conditions.
5. A new strategy could be to find innovative means of financing the up-front costs of high quality solar cookers, such as using the Clean Development Mechanism (CDM) financing as presented by Dr. Seifert et al, or similar mechanisms, which would allow to sell solar cookers at a subsidized and thus affordable price to the lower income groups, who need it more urgently.
6. Women had a much more positive attitude to solar cooking than men, because it is they who benefit from the labour reduction. Women had learned how to cope flexibly, but men insisted on wanting their meals on time.
7. Since solar cookers cannot really be a stand-alone technology, still more technical development efforts should go into developing hybrid solar cookers, where a quick change-over from the solar

cooker to other suitable means (such as flasks and “hay boxes”) or uses (such as heating, baking, etc.) is possible.

8. The cookers should always be sold as a set appropriate to the cultural setting, including pots, flasks etc.
9. National governments should be urged to set quality standards and private business needs to be encouraged to give guarantees.
10. The **quality standards** of the units have to be modified to cater for the needs of a wider distribution. The Standards Institute should take responsibility for controlling the implementation of set standards at factory level, or other localised institutions have to be charged with their control.
11. Each customer has to receive with the cooker a written guarantee, stating guarantee conditions and purchasing date. Also the maintenance requirements have to be supplied in writing.
12. Each cooker should carry a brand name. The quality increases must be ensured by a written guarantee of perhaps two years for each cooker sold, covering materials and proper functioning.
13. As incentives the manufacturers could receive certainty of future orders by government institutions to supply the subsidised poor sector (besides their usual production for the market).
14. The vital role of NGOs

There is no doubt, that the solar cooker programs of NGO's and individuals have a vital role to play in spreading the idea of solar cooking. They must take care, however, not to interfere with private business, but rather to enter into a serious mode of cooperation, because in the long run only a commercialized technology will be sustainable.

However, today (with the exception of the special case of China) we are nowhere near having a situation where the product is so adapted to the local situation that

private business developed an on-going interest to invest on a larger scale in the solar cooker business. But even in China solar cooking might not have been successful, if it did not have strong governmental support.

The task at this time then is to link the informal and formal business sector and try to find the best way of working together in a mutually supportive way to reach the same goal. Right now many businesspeople complain that they cannot make a profit, because well-meaning, development minded groups and individuals disseminate their products at too low prices or low-standard products.

The first step we need to do then is to bring these two different and often antagonistic groups together and try to find the common ground, see how they can best complement each other. I am convinced that for such an approach it would be possible to interest and get funding from national governments and international donors on a larger scale. This is happening at present with the improved cook stove programs, where much of the ‘software’ (awareness raising, technology promotion, monitoring, impact assessments, policy advice, etc.) is provided by developmental groups, while the production of the devices is left to private business. This can only work, however, if there is close cooperation between the two sectors.

One prerequisite for this to function would be to have a common understanding at least on minimum quality standards and methods of measuring them. (see pt. 10)

Since solar cooking depends on so many culture- and region-specific characteristics, that it is recommended, to have strategic **regional meetings** to start with. In such regional meetings each group should define their roles and

responsibilities and agree on the basics and the form of cooperation.

Such meetings might define such vital details as which technology fits which cooking requirements fit best in which type of setting. How important is altitude? Do the Tibetan and Andean people have more in common, for instance, because of related climatic conditions? In other words, which systems function best under which objective conditions (solar insulation, cooking traditions, availability of suitable pots, hours of sunshine, etc)?