THE EXPERIENCE OF UNHCR AND ITS PARTNERS WITH SOLAR COOKERS IN REFUGEE CAMPS

Prepared by:
Elizabeth Umlas
Associate Programme Officer - Environment

Office of the Senior Coordinator on Environmental Affairs
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I. INTRODUCTION

Solar cooking is just one small element in UNHCR's efforts to create and promote sustainable energy strategies in refugee-affected areas. These strategies are an integral part of UNHCR's reformulated environmental policy, which sets out the following four priorities: integration of the environment into all phases of the organization's activities and decision-making; prevention; participation; and cost-effective planning. UNHCR's overall environmental guidelines, and more specifically its energy sector guidelines (both of which were written in response to the new policy), seek to put these four principles into operation in refugee-affected areas. Both sets of guidelines envision an overall strategy for energy supply, which can encompass, for example, fuel-saving techniques (demand reduction), alternative fuel supply (such as solar energy), and controls over access to energy sources.

The rationale behind introducing solar cookers in refugee camps is simple: cooking food using a free and unlimited source of energy would not only obviate the need for refugees to spend part of their limited resources on fuelwood, it would drastically reduce the problem of massive deforestation associated with refugee camps and settlements. In certain cases, the reduced need for refugees to leave camps would also lower their exposure to violence and landmines. In practice, however, the idea is complex, and runs into cultural, social, technical, and economic problems.

Globally, experiments with solar cooking in refugee situations have not been promising, at least when attempted on a large scale. What works in the laboratory or when tested by small groups of researchers may fail in a refugee setting because of natural human scepticism, vastly differing climatic conditions, or what one experienced field officer has called "culinary conservatism".

This paper addresses both the advantages and disadvantages of solar cooking in the light of a number of specific cases in which UNHCR has been involved. It then discusses various problems with the data from these projects, and makes some general recommendations about the use of solar cookers in refugee camps. It is worth noting that UNHCR has had experience with solar energy use for purposes other than cooking. For example, solar panels were employed for electricity generation, refrigeration, and other purposes in the Waterloo refugee camp in Sierra Leone. Such applications of solar energy are not the focus of this paper, but could have an important function in other camps in the future. UNHCR has also decided against implementing a number of proposed solar cooking projects, apparently because UNHCR staff found the cooker models in those cases to be either too expensive or not suited to the particular circumstances of the camps or settlements where the projects were proposed.

The main conclusion of the paper is that, while in certain very specific and circumscribed refugee camp situations solar cooking may be beneficial to both refugees and the environment, solar cooking still faces many operational problems; it does not *replace*, but only *complements* other forms of cooking (and thus traditional sources of fuel); and it should not be implemented without *extensive investigation* into the specific circumstances of both camp and refugee population. Finally, there is little hard data about the real environmental savings involved in solar cooking projects; this shortage calls for independent and rigorous studies. In this vein, it should be noted that UNHCR plans to conduct in-depth field tests (in 1997) to evaluate solar cookers.

II. PROJECTS IMPLEMENTED

A. Pakistan in the 1980s

Over 5 million Afghans were forced to flee their homes after the outbreak of civil war in 1978, followed by the Soviet invasion a year later. Many of them went east into the North West Frontier Province [NWFP] of neighbouring Pakistan. Although many have repatriated, there are still about 850,000 Afghan refugees registered in the Pakistani camps, and over one million refugees in the camps of Iran, according to that government's official figures.

The central food in the Afghan refugee's diet is the flat bread, *nan*, which is cooked in a large earthen oven called a *tandoor*. The preparation of *nan* is quite energy intensive, and in some areas has exacerbated the deforestation caused by indiscriminate fuelwood cutting. UNHCR's efforts to address the environmental damage associated with the refugee situation date back to the 1980s. In the case of the Pakistani camps, the intention of the agency and some of its field partners has been to lower fuelwood consumption among refugees, not only to prevent deforestation but also to reduce dependency on kerosene.

Solar Cooker Model

UNHCR helped fund a solar cooking project initiated in 1985 by the British organization SERVE (Serving Emergency Relief and Vocational Enterprises). After conducting research in the area, SERVE began a solar oven construction project in Peshawar, producing and distributing the portable ovens to Afghan refugees in the NWFP. The ovens were of the box type, made of wood and glass (see Appendix 1). UNHCR's role in the project was to pay for the direct production costs (labour and material) not covered by the price of the oven, which was heavily subsidized by SERVE because of its high price. While the ovens had the advantage of reducing the amount of fuelwood needed for cooking, they had several weaknesses and eventually the project was dropped for financial and other reasons discussed below.

Constraints

The problems or failures of the box cooker fell into a few main categories. Perhaps the most important obstacle to the use of the solar box cooker in the Pakistani camps was cultural resistance. As field implementers themselves have pointed out repeatedly, solar cooking requires a radical change not only in thinking (about food preparation and eating) but also in habits; however, expectations of such change may be inappropriate or unreasonable. For example, it was not possible, with this model, to open the oven and test the food before it was done. In some cases, refugees were expected to modify their diet, as the ovens could not accommodate all of their dietary staples. Mistakes or failures involving solar cooking (meals that took too long to prepare, or the inability to cook certain foods) could add to the stress and uncertainty of changing something so fundamental as refugees' preparation of food. Some sources have gone so far as to imply that these "food failures" were more likely to invite abuse of refugee women by others because of the scepticism with which refugees viewed the new-fangled apparatus in the first place.

There were also physical or material limitations: for example, the glass had to be imported (as it was not available locally), it was susceptible to breakage, and it made the model rather heavy. The oven was unable to cook *nan* (although it was used to make other types of bread). This was a major drawback, considering the diet of Afghan refugees.

The main economic constraint (besides the need to import materials to construct the ovens) was the fact that the model had to be heavily subsidized by SERVE (refugees paid less than half of the real price) due to its high cost. Thus there were questions about how sustainable this particular model would be. There were also circumstantial factors that weakened the project. At the time, Afghan refugees (unlike refugees in certain other cases) were largely free to move in and out of the camps, and thus had access to public lands and forests . Therefore, as one former UNHCR field officer has pointed out, they were less limited in their search for labour, firewood and other fuels than are most refugees. The availability of alternatives to solar oven use reduced the incentives for refugees to use the ovens.

Problems of inconvenience were also important in explaining the failure of the oven to gain widespread acceptance. Refugees could make only their midday meal with the box cooker, and they had to use the oven in combination with traditional cooking methods to prepare certain foods that they were accustomed to eating. The latter is an accepted fact among solar cooker implementing agencies--that is, it is unrealistic to think that solar cookers can replace all other forms of cooking in particular refugee situations. However, the use of the solar oven required (and requires) a shift in time management, which may have constituted an unacceptable burden to refugees given what they had already been through.

A number of field experts have noted that the monitoring of solar cooking among refugees is extremely difficult, a point that will be taken up again towards the end of the paper. Although SERVE's reports indicate that refugees accepted the solar cookers as an alternative to fuelwood burning, there is little hard data to show what the acceptance rate was, or more importantly, the rate of *actual usage* of the cookers by refugees. Several field reports on solar cookers in various parts of the world aver that refugees seem commonly to answer in the affirmative when asked if they think saving fuel by using solar energy is a good idea, and whether they themselves are using their solar ovens. This type of response may stem from communication problems between implementers and refugees (or between interpreters and refugees), from questions that are phrased unclearly, from poorly designed surveys, or even from refugee perception that a certain answer is "correct" or "required". The resulting distortions often lead to difficulties in collecting accurate data (for more, see section III).

In the case at hand, in the late 1980s the SERVE project seemed poised to switch to a lightweight, durable cardboard-like material for the solar box, which might have made the product more user-friendly. However, because of a financial crisis in 1989-90, UNHCR had to stop funding the project. SERVE has continued producing box cookers in Peshawar, and as of early 1996 planned to move the programme into Jalalabad. It is worth noting that SERVE is working on improving the design of the portable oven, and reports that most portable ovens sold in 1995 have been sold in Kabul, as a severe fuel shortage and the cutoff of gas and electricity over the past two years have raised demand for alternative fuels in that city.

B. Afghanistan in the 1990s

This section concentrates on a UNHCR-funded project, SERVE's fixed low-cost "hole-in-the-ground" solar ovens in Sar Shahi, a camp just outside Jalalabad, Afghanistan. Sar Shahi was established by UNHCR for internally displaced persons (IDPs) from Kabul, and at its peak housed approximately 150,000 people. It was managed by UNHCR until September 1995, when the camp was signed over to the UN Office for the Coordination of Humanitarian Assistance to Afghanistan (UNOCHA), within the Department of Humanitarian Affairs (DHA). As one Desk Officer points out, the camp is surrounded by desert and therefore lacks nearby fuel sources. Many children leaving the camp to search for fuelwood have been killed or injured by mines: thus the urgent need to distribute solar ovens.

Solar Cooker Model

In 1995, according to a SERVE field report, the fixed low-cost solar oven was "well accepted particularly in areas with scarce fuel resources". The organization is also working on a solar fruit dryer and a solar tea boiler. The hole-in-the-ground model is as it sounds: a hole dug in the ground, with mud walls, a glass reflector (on a stand), and a liner (see Appendix 2). Refugees receive, free of charge, chalk templates, which they use to dig a hole (about one metre by 0.5 metres by 0.35 metres deep). They then surround the hole with a sloping mud wall. Families receive straw for insulation, an oven liner (metal), a frame (wood), a piece of hardened glass (produced locally), four black aluminum pots and a sheet metal reflector. The oven functions like a greenhouse; that is, sunlight can enter the glass panel, but cannot pass back out, thus heating up the contents of the box. Refugee instructors (trained by SERVE's Afghan staff) educate the families in oven use and maintenance. Oven parts are available locally, and in fact are produced by refugees in SERVE's workshop and then distributed to the camp. In addition, Afghans manage the production and a significant part of the project's administration.

With UNHCR funding of $100,000[1], SERVE supervised the installation of about 5,700 of these fixed low-cost solar ovens in March and April 1995 at Sar Shahi. The organization also provided training for camp staff and education of refugee families on solar cooking. SERVE's Public Health teaching programme provides for training in local schools on environmental awareness and solar technology. One of the organization's intentions is for the "appropriate technology" of the oven to be transferable to other areas in Afghanistan (for example, for the displaced to be able to build their own ovens when they return home).

Subsidies are still necessary for the oven, and SERVE is examining ways to reduce this need. One SERVE officer noted that refugees were given the ovens (as opposed to being sold them) by express request of UNHCR: a UNHCR Desk Officer for the region notes that the decision to distribute the ovens free of charge was due partly to the above-mentioned urgency of introducing alternative cooking methods (to prevent refugee deaths in mine explosions); partly to the fact that kerosene was not available; and partly to the fact that those in the camp were unfamiliar with solar ovens and unlikely to use their limited resources to buy them.

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[1] UNOCHA provided funds to UNHCR with the specific condition that UNHCR sign a sub-agreement with SERVE for the solar oven project.

In a proposed budget from late 1995, SERVE indicated that it intended to begin charging refugees 350 Rupees per oven, on the idea that refugees who really want the oven will pay this subsidized price for it, and will be more likely to use it, as they have purchased it. The ultimate aim of the project is for local businesses to start producing the ovens. SERVE reports "excellent cooperation from families in [oven] construction" in Sar Shahi and, in association with solar oven use, a reduction in environmental impact. The organization asserts that the observed increased demand indicates refugee acceptance of solar ovens in general.

Constraints

The low cost of the hole-in-the-ground oven, the local availability of construction materials, and its ability to cook many food items would seem to indicate that the model is an improvement over the heavy box cooker described in the previous section. However, there are several problems with this oven, too. An independent observer hired by SERVE to evaluate Sar Shahi estimated in July 1995 that about one-third of the approximately 5,700 families with the hole-in-the-ground ovens were using them regularly (this estimate was based on extrapolation from a survey of over 570 of these families). SERVE has concluded that this low number was due to the fact that the displaced families were all *given* these ovens, as well as to the fact that food rations were low, and that some refugees had homes nearby and could obtain alternative fuels there, such as poppy stalks.

The outside observer reported several technical problems with the hole-in-the-ground model. Among other things, the straw used for insulation rotted or became compressed; the glass was not air-tight; the mud around the cookers cracked; and the reflectors, glass and liners became dirty. In addition, at least among those surveyed, many claimed that solar bread did not cook well and tasted funny (or even made people sick). A very telling remark was that families "pretended" to be using ovens when the observer team arrived, because they were "afraid that if they were not seen to be using them, something bad would happen." And yet, the observer reports that "there was almost universal agreement that the solar ovens were useful and beneficial in view of the scarcity of fuel".

Other problems included failure rates ranging from 6.5 to 14% for certain foods, including beans, rice and bread; such rates would help explain why the very poor do not seem to use the ovens much, as they can ill afford to lose any percentage of their food. SERVE's own reports acknowledge the fact that the low-cost fixed solar oven cannot *replace* other kinds of cooking. This is due to several factors: there are about 65 cloudy days per year; the oven cannot be used to cook breakfast; and cooking times are slow (3-4 hours to cook a meal for 6-8 people). In addition, demand for solar cookers is low in some areas such as Nangarhar province, for example, because firewood, poppy stalks and other fuels are available. Sar Shahi itself is in Nangarhar province, but as mentioned the camp lacks fuel because it is in a desert area.

One must question the potential for generalized use of solar cookers in Afghanistan, given the ability of many refugees to move in and out of camps, thus mitigating situations of localized fuel scarcity and lowering the incentive to use solar energy.

It seems that the best prospects for solar cookers of any type are in camps that fulfil a *combination* of very specific conditions, for example:

- a high number of days of insolation;
- a high degree of remoteness;
- scarcity of firewood and inability (or great difficulty) of refugees to obtain alternative fuel;
- some likelihood of acceptance of new ideas, at least by part of the refugee population.

In addition, cookers must be somewhat adaptable to or appropriate for specific refugee diets and customs.

C. Kenya

1. Kakuma

The above conditions seem to prevail in the camps of northern Kenya, which for years have received refugees from strife-torn areas in neighbouring countries. In September 1993, one study concluded that solar energy could be quite important, in particular, in the refugee camp of Kakuma. After conducting feasibility studies and holding discussions with local refugee agencies and a new national solar energy network in Kenya, in January 1995 the California-based NGO, Solar Cookers International (SCI), began a pilot solar cooking programme in Kakuma. The camp, established in 1992, shelters approximately 37,000 refugees. 90% are from southern Sudan, while the remainder are of mixed nationalities (Ethiopian, Somali, Zairean, Ugandan, Rwandan and Burundi). As will be discussed, some of these groups proved more accepting of the new technology than others.

The weather in the area is nearly ideal for the use of solar energy, with high rates of sunshine throughout the year. The camps are isolated, and refugees have substantial disincentives to venture into the surrounding desert, as they have to walk long distances to find scarce fuelwood. In fact, in the case of Dadaab, a camp complex in eastern Kenya (see below), many refugee women have been raped by armed bandits while foraging for wood. Energy supply has been a problem since the establishment of Kakuma, and only 20-25% of fuelwood needs are supplied by a UNHCR-funded programme of controlled wood cutting and distribution.

Solar Cooker Model

The "CooKit" model used by SCI in Kakuma is much simpler than those described in the preceding two sections; it consists of a pliable cardboard panel with a reflector surface, on which is placed a painted black pot inside a clear plastic bag--again, for a greenhouse effect (see Appendix 3). The "oven" is lightweight and relatively inexpensive to produce, as it involves no mirrors, metal, or glass. The unit price could therefore be lower for this type of cooker than for previous models, although it is worth noting that unit prices of the CooKit itself vary according to where it is produced.

At present, the model is still subsidized by SCI in some locations (in others, refugees can "earn" cookers through work programmes or pay cash). And while CooKit may be a relatively cheap model, there are still serious questions about the difficulties of local manufacture, the need in some cases for substitution of materials, and the transport of cookers to camps, all of which can add to the unit price.

Without UNHCR funding, SCI began the first phase of the project with training sessions during January and February 1995. In four weeks the organization trained 69 women, more than half of whom had no formal education. A second phase involved training trainers from the original selected group. During both phases trainers made home visits and conducted group meetings, tactics which seemed to be successful in raising awareness and providing a forum for the discussion of problems that arose with the cookers. SCI received logistical and administrative support from the Lutheran World Federation (LWF), the lead agency in Kakuma Camp. By December 1995, 1,981 families (approximately one-third of the camp's population) had been trained and provided with CooKits. Instead of training refugee leaders, on the assumption that others would follow, SCI chose to train those refugees who seemed most enthusiastic at initial meetings. The other main criterion for choosing trainers was that workshop participants had to live near each other, in order to foster a snowballing adoption of solar cooking. SCI's own reports express satisfaction with this "demonstration effect" method of dissemination of solar technology. In the spring of 1996, SCI reported that the Kakuma project was being run almost entirely by refugees.

A refugee participating in a workshop receives a free cooker and bag, as well as a painted pot and some food. For now, SCI has decided to continue giving the cooker away in Kakuma, although in late 1995 the board discussed proposals to sell second (or replacement) cookers to families, or to start selling them on a trial basis in the small shops in the camp. This issue will be taken up again in the final section.

2. Dadaab

The "cautious optimism" of the project in Kakuma led to UNHCR's decision to allow SCI to start a similar programme, in collaboration with the German organization GTZ, in the Dadaab camps in eastern Kenya. As of late 1995, the three camps of the Dadaab complex housed about 100,000 refugees. SCI agreed to provide 2,000 cookers and training, with GTZ's RESCUE programme as implementing partner.

The "model households" method of choosing training participants was used once again. While in Kakuma, refugees receive cookers in exchange for completing the training programme, refugees in Dadaab may also perform work in the camp, such as planting trees, in exchange for their cookers. Results, in terms of the numbers trained, varied substantially from camp to camp, in part according to the availability of work that refugees could do in exchange for cookers and training. An attempt at *selling* the cookers was unsuccessful.

It is still early to obtain dissemination figures for the project, as it really only began in the autumn of 1995. However, it is not too early to discuss several problems associated with the use of CooKit in both Kakuma and Dadaab, to which the next section turns.

3. Constraints, or Successes and Failures of the Kenya Projects

Once one accepts the fact, acknowledged by solar project implementers and UNHCR alike, that solar cookers are not a *replacement* for other types of cooking but rather a *complement*, several important advantages become evident. In the case of the northern Kenyan camps, one result of solar cooking use has been a savings in fuel, as in the case of Sar Shahi. There has apparently been a consequent decrease in environmental degradation[2]. Further, each day of solar cooker use translates into a measurable amount of fuelwood *not used*. As refugees often have to sell or barter their scarce resources, including food ration cards, to purchase fuelwood, solar cooking can represent a substantial savings to refugee families. Figures from an SCI survey of Kakuma in February 1996 indicate that almost half of the respondents mention a firewood savings as a benefit of solar cookers.

By using CooKit, refugees experience health benefits because the cooking is smoke-free. Women are exposed to less violence because they spend less time outside camps searching for wood, and to some extent their time is freed up for other tasks by not having to spend hours gathering fuel. Food is virtually never burned in the solar cookers, thus removing the burden of scrubbing the pots daily; and solar cooking needs less water, also a savings for refugees and the environment. As mentioned, the camps in northern Kenya seem particularly suited for solar cooking, and have more potential to represent a relative "success" in comparison to earlier solar oven projects. The question of refugee acceptance, however, is somewhat unclear, and there are other problems evident in the programme's first few months.

Frequent complaints of refugees include the cooker's slowness, its uselessness on cloudy days, and the lack of availability of beans or maize flour. The plastic bags given out with the cookers are not very durable, and the assumption that refugees would be able to supply their own pots and lids in good working order was a mistaken one, which caused SCI to have to regroup and provide the necessary parts unexpectedly. The lesson is a good one for future projects.

Further, weather has been a problem in Dadaab, with a substantial amount of cloudiness. A number of the panel cookers have been destroyed by rain. The cardboard material out of which the panels are made does not seem to last very long. SCI asserts that other widely available or inexpensive materials could be substituted, but that there seems to be little interest in these alternatives at present. The longer cooking times have also caused concern and sometimes made cooking the lunchtime meal problematic. SCI has experienced difficulties in Dadaab with both the exchange commodities programme (which seems to favor the unemployed who have time to plant trees or work for the kits), and the price of the oven, which is still too high according to field reports. SCI claims that CooKit's price is similar to that of some fuel-efficient stoves. The organization has addressed the complaint that CooKit cannot prepare large quantities of food (an important concern, as many Sudanese refugee families are quite large) by making larger CooKits.

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[2] SCI's February 1996 draft report on Kakuma found an indication - though not solid evidence - that solar cooker users in the camp saved 17% of firewood over non-users. See the next section for a discussion of the problems with data collection.

Culturally, there are several major challenges. The problem of violence against women due to food failures is still a serious concern. SCI has acknowledged this situation, and stresses the importance of using the introductory instruction process to discuss refugee fears about ruining their valuable food rations with the new technology. However, it is unlikely that this tactic will have much impact on the violence.

Over 90% of the refugees in Kakuma are Sudanese, but SCI's presence among these households is, for the time being, very low. One SCI report notes that, within the camps, cultural differences and differences in education and income level have led some parts of the refugee population to accept the solar cooker more rapidly than others. And while certain groups of refugees speak English, others do not, presenting the implementers with language barriers in addition to cultural resistance.

Finally, a major problem with the project, similar to the programmes in Pakistan, is that of finding out just how widely used the cookers are. As in the cases described above, implementers in Kenya have stated that refugees surveyed are eager to "say the right thing" when asked whether and how often they use their cookers. SCI itself sometimes emphasizes that the very positive results of their household use surveys are therefore quite suspect. For the same reason one must approach with caution the organization's conclusion that refugees have accepted CooKit quite enthusiastically. The problem of data collection and survey responses is taken up in the next section.

III. DATA PROBLEMS

There are several problems with data on solar cooking projects, such that it is often difficult to make concrete conclusions about their successes or failures. There are very few UNHCR reports on projects it has funded; thus one of the few sources of information is field reports from implementing partners. While these usually contain valuable information about the constraints facing NGOs that promote solar cooking, they also sometimes contain suspiciously positive evaluations of refugee acceptance of solar cookers. This optimism or enthusiasm would seem to contradict the serious problems seen in the field, and the real results are quite difficult to verify. For example, SCI has made the valid point that it needs outside researchers to evaluate its projects, a modification that would add a certain amount of objectivity.

In their reports, both SERVE and SCI have commented on what they perceive as interviewees' tendency to answer survey questions with responses they think interviewers want to hear. This may be cultural; it may be situational--refugees are already in a difficult position, and may feel they will bring more trouble on themselves by answering "incorrectly"; and it may be pragmatic--as one SCI report notes, refugee women are "survivors", and "would be very likely to want to please individuals who have demonstrated a desire and ability to be of assistance to them". Finally, as noted earlier, it may be the result of communication problems between implementer and refugee.

Consequently, there is little hard data on the actual use of solar ovens by refugees. Most accounts are "perceptual", as SCI notes in a report on Kakuma, and are very hard to confirm. In a related vein, a UNHCR officer has noted the enormous difficulty of *monitoring* oven use; unless the observer arrives at the camp while people are cooking, one runs into the problems just described. The recent evaluation of solar cooker use in Kakuma reflects several of the difficulties of research design and data collection, and of measuring the effectiveness of solar cookers in refugee camps, as well as the extent to which they are used. In the case of Kakuma, the data and research problems (including invalid data collected for three out of five zones, the lack of information provided by the evaluation on the specifics of the camp, and language barriers between interviewers and refugees) may make difficult even general conclusions about the solar project there. Sometimes these difficulties can be addressed early on, in the planning stages of the solar project; at other times it is unclear how these obstacles can be overcome, and in several instances they have constituted a fundamental drawback to evaluating solar cooker use.

IV. GENERAL RECOMMENDATIONS

Despite the lack of clarity about many aspects of solar cooking in refugee camps, several points stand out clearly from the reports:

1. Solar cooking and solar energy are appropriate only in certain camps, and then only under quite specific conditions, which were stated earlier in the paper. These include:

   - prevalence of sunny days in the region;
   - high degree of remoteness of camps;
   - fuelwood scarcity and inability of refugees or IDPs to obtain alternative fuel;
   - some degree of openness by refugees to new cooking techniques; cookers themselves must also be somewhat adaptable and appropriate with relation to refugee diet and customs.

   It is also possible, as one energy expert has found for energy use reduction in general, that given their drawbacks solar cooking projects in camps can be successful only in cases of energy shortages. These shortages can be caused both naturally (the absence of traditional fuel sources in and around the camps, for example) and artificially (the restriction of refugee movements and thus access to fuel supplies; and the appropriate pricing of wood and other scarce fuels). This point also finds consensus among implementers. As SCI's Barbara Knudson has put it, refugees do not use solar cookers "for environmental reasons. They're doing this to survive. Solar cookers are most apt to be adopted when people are desperate".

2. There is widespread agreement within UNHCR and among its partners in the field that, if at all possible, ***the cookers should be sold, not given to refugees*** (with special pricing for vulnerable groups). SCI's own experience in Honduras and Belize (not in refugee camps but in villages) has taught them, however, that using a market mechanism also has its drawbacks, because men often control the cash and may place a low priority on solar cooking.

3. Thus the third, and related, point is that women, who in many cultures are the main fuel-gatherers, food preparers and household managers, *must* be integral participants in solar cooking projects for the projects to succeed. This is a challenge particularly in cultures where women are not allowed to take part in community decision-making, but also in camp settings where women's traditional roles in decision-making and income-generation may be ignored or discounted.

4. The same organization has made the crucial observation that the enthusiasm often seen at initial demonstrations of solar cooking, whether in refugee camps or other settings, does not necessarily translate into frequent or sustained use of solar cookers, and could even create unfulfillable expectations.

5. Where possible, implementers should make efforts to use local materials and local labour to produce or install the cookers.

6. Implementers must recognize that solar cooking is a small part of the general strategy to reduce fuel consumption and thus to benefit refugees, local populations, and the environment. As mentioned earlier, UNHCR's new environmental policy and overall environmental guidelines set the foundations for a multi-faceted approach to resource use in general, and energy supply in particular. Solar energy (and by extension, solar cooking) is one component of the larger whole.

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Teeuwen, Joop (1995) *Survey of the 'Hole in the Ground' Ovens in Sar Shahi Camp, Jalalabad (3-14 July 1995)*. Analysis of Database Results. Peshawar.

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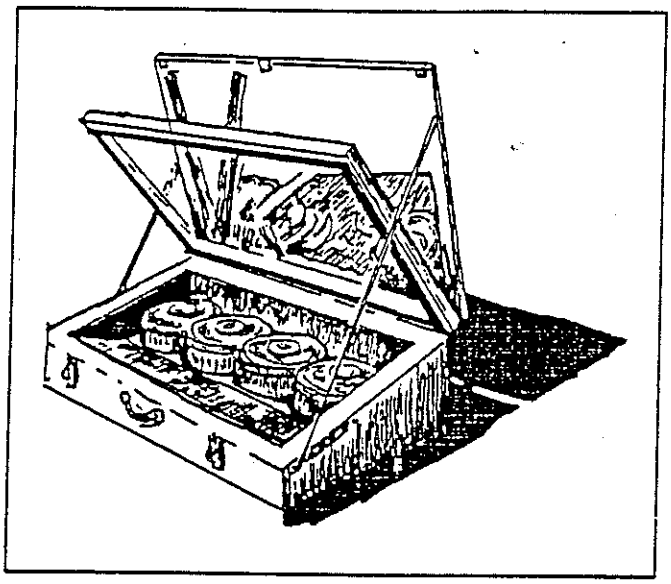
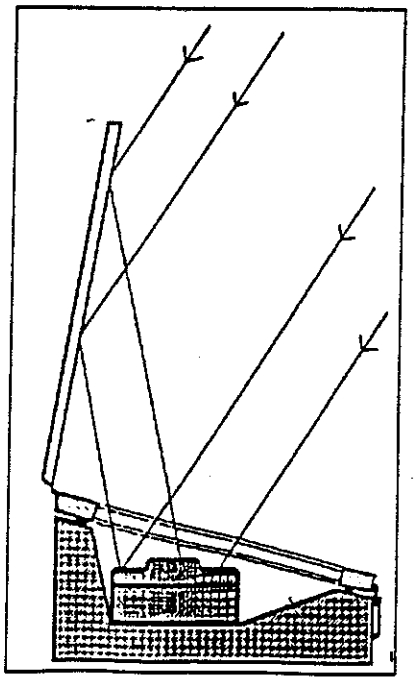
5. The SERVE Solar Project Portable Solar Oven:

The design is a simple hot box cooker. It consists of a well insulated box with a double glazed window in the lid and a single reflector that increases the amount of radiation entering the box. The captured radiation is converted directly to heat which is transferred to cook the food.



The external casing of the ovens is made from sheet steel. The frames for the liner and window are wooden. The inside of the oven is made from used newspaper printing plates (aluminium) which are purchased as scrap. The space between the liner and outer casing is insulated with about 50mm of mineral wool insulation. The box is rectangular in shape with a sloping top which improves the oven's performance in winter when the sun is lower in the sky. The window in the lid is 440mm x 884mm. The glazing is ordinary 3mm window glass and the reflector is made from a thin reflective plastic film on a sheet metal backing.

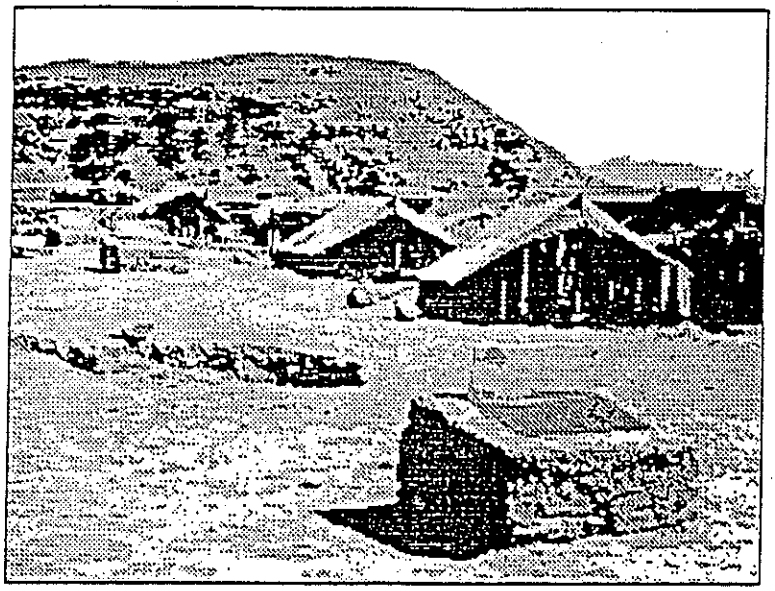
The inside of the oven is painted matt (flat) black to convert the maximum amount of incident radiation into heat. The outsides of the four cooking pots are painted matt black for the same reason. Each pot can hold 1.5 litres of liquid, and is usually used to cook about half a kilogram of meat, rice or vegetables. The oven also cooks bread and cakes very effectively.



The maximum oven temperature in Peshawar is 175°C (350°F) in the summer and 140°C (285 °F) in the winter. If all four pots are used the noon meal is cooked in about 2 hours in the summer. A second meal can be ready 3 hours later. Only a small amount of water is necessary to cook meat and vegetables because of the low cooking temperatures. Also, the cook does not have to give the food constant attention, i.e. stirring the food and feeding the fire, as with a wood or kerosene stove.

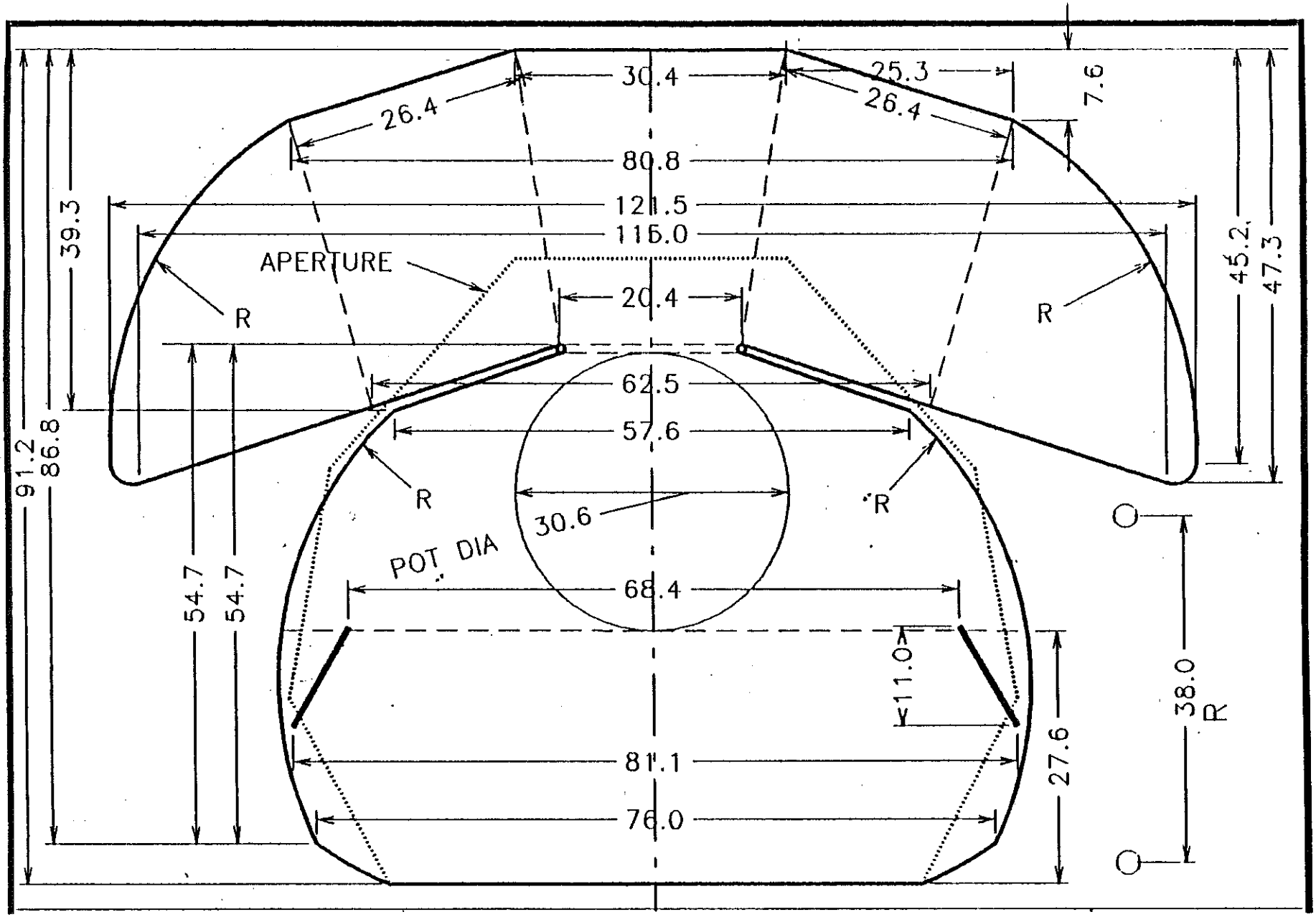
to use it effectively, and followed up to ensure continued usage. A sheet giving written instruction on use, maintenance and repair, with some recipes (all in the two main Afghan languages) is also distributed with each oven.

Like the portable oven, the fixed oven cooks using a basic "greenhouse" theory. Solar radiation passing through the glass lid of the oven hits the black surface of the pots and liner and is transformed into heat energy, which then cannot be re-radiated through the glass. The straw reduces heat loss to the surrounding ground. Cooking times of 3 to 4 hours for most foods in sufficient quantity for a family of 6-8 people are normal, and times will be considerably shorter in the summer. Although not as quick and efficient as our higher quality portable oven, and not usable for the first meal of the day (i.e. breakfast) or on rare overcast days, this oven dramatically reduces the requirement for kerosene and other fuel supplies to the camp residents.



Solar Ovens that can be produced with a capital cost low enough to be within the means of the poor in the developing world are essential if we wish to make any impact on world energy usage and reduce deforestation. The SERVE Low Cost Solar Oven uses production methods that are well within the means of local craftsmen and can be produced at a price within the reach of the majority of the Afghan population. The technology is transferable to many other locations in Afghanistan and other countries where solar cooking is an appropriate solution to fuel needs. If well received the potential for income generation from the production and supply of this type of low cost solar oven is another exciting prospect that we believe could become a reality in the not too distant future.

Source: SERVE 1996 Project Proposal (July 1995)



Title: SCI SEVEN PANEL SOLAR COOKER –
ORIGINAL SIZE (APERTURE = .454 SQ METERS)

NOTED DIMENSIONS IN CENTIMETERS