EVALUATION OF ENERGY - SAVING OPTIONS FOR REFUGEES

SOLAR COOKER - ETHIOPIA

ENVIRONMENT UNIT/UNHCR GENEVA
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Evaluation of Energy-Saving Options for Refugees

Solar Cooker - Ethiopia

Executive Summary

Background and Rationale

This report is the third segment of a cross-country evaluation by UNHCR of energy-saving options for refugees. A variety of non-traditional cooking systems have been assessed in comparison with the open fireplace based around three stones. Though familiar and readily adaptable, this traditional system has the potential to be inefficient, polluting and sometimes unsafe. The result, in some areas, has been excessively high consumption of fuelwood, with consequent environmental damage, a heavy US$ burden on fuel gatherers and the potential for ill effects on refugee health and well-being.

Past reviews of alternative energies were country-specific, technology-specific, not sufficiently detailed or unduly subjective, resulting in lack of clarity over when and where different energy options might be most appropriate. This study was intended to produce a more definitive comparative evaluation of energy-saving alternatives for refugees, and different ways to use those energy sources efficiently, based on a multi-disciplinary approach across several countries.

This particular report focuses mainly on a device promoted in Ethiopia in 1997 and 1998 that uses the heat of the sun for cooking. It is a panel-type solar cooker known as the CooKit, and was being promoted in Aisha refugee camp in Ethiopia (as well as in refugee camps in Kenya) with the technical support of the American NGO, Solar Cookers International (SCI). The first two reports of the larger evaluation looked at a grass burning stove promoted in Uganda and Tanzania.

These evaluations of alternative energies were based on several criteria:

•environmental impact: the net environmental benefit achieved through adoption of the alternative cooking system

•cultural and technical suitability: the appropriateness and acceptability of the cooking system, taking into account factors such as refugee diet, nutritional needs, utensils, customary cooking habits, living arrangements, expectations, etc.

•gender-related impacts: the degree to which the cooking system altered roles and workloads for different refugee groups, especially women

•cost-effectiveness: the balance achieved between financial outlays in promoting the system and economic benefits accrued

•sustainability: the implications for adoption and use of the system after the withdrawal of training or funding.

Report Structure

This report begins with an overview of the solar cooking project in Aisha. It is then divided

into three segments: the first, written by a domestic energy specialist, deals mainly with technical suitability and environmental impact of the device (as well as briefly with sustainability). The second, written by two UNHCR staff members in Ethiopia, covers socio-cultural and gender-related impacts. The third, written by an environmental economist, deals with cost-effectiveness, economic impact and sustainability.

A fourth team member, a representative of SCI, was invited to participate in the field mission for this evaluation, but was unable to join the team.

The primary data for the report was gathered during a field mission to Aisha from 1 - 6 September 1998.

Main Findings

The solar cooker project in Aisha, launched in March 1997 by SCI and UNHCR, suffered from several problems in implementation and design, as summarised below. The fact that due to these problems the project had been running for only a short period at the time of the mission made evaluation somewhat difficult.

The following is a summary of the main findings of each of the three segments of the report and the overall recommendations. It is worth noting the emphasis that the co-authors placed on the need for a more integrated approach to energy and environmental problems in Aisha refugee camp.

•*Sub-report on Technical Suitability, Environmental Impacts and Sustainability*

While enabling a refugee family to substitute some of their fuelwood or charcoal consumption with solar cooking, adoption of the CooKit encountered significant barriers related to slow cooking speed and inability to meet the needs of above-average family sizes. The CooKit ended up being used by the recipient households only to prepare hot drinks and wheat grain for 8 months of the year (when solar conditions were not considered optimal), and more ambitious foods for the other 4 months of the year.

60-80% of cooker recipients appeared to make some use of their cooker in the period immediately after distribution, and it seemed best suited to those smaller families (fewer than 6 people) who could not buy fuelwood. However, only 1,000 households had received solar cookers by the time of the mission because of various delays. For this reason, and due to the short lifespan of the plastic bags (inside which the pot sits), there had been no long-term utilisation. Fuelwood and charcoal savings were therefore too small to be measured. Positive environmental impacts were also thus considered negligible, and disposal of broken plastic bags around the camp created an eyesore.

Problems with project implementation and design included lack of clarity over management and support structures, separation of the project from the rest of the environmental activities under the national programme, extensive delays in clearing imported goods from customs, lack of a local implementing partner, and multiple reporting lines. The project also suffered from a top-down design and lack of delegation of responsibility to refugees. Disillusionment among the refugees when the CooKit supplies failed to materialise was widespread, and hurt the project's credibility.

While local production in Ethiopia was investigated by UNHCR and SCI, this did not prove feasible because of the short duration of the project. SCI also investigated the possibility of using a mylar cuff to replace the breakage-prone plastic bags, but this did not pass field

tests. By the time of the mission, in September 1998, the project was stalled with 1,000 cookers still in storage in Aisha.

It is difficult to determine the likely sustainability of solar cooking in Aisha, given the unfinished nature of the pilot project. However, the potential for cash sale or other refugee contribution, which is considered a key indicator of likely sustainability, appeared very low according to those who had benefited from the project thus far.

•*Sub-report on Socio-Cultural and Gender Impacts*

The refugee community appeared to overcome initial doubts about the concept of "cooking with the sun" and began to use the Cookit for selected tasks after training was provided. There seemed to be no inherent social or cultural barriers present that impeded cooker utilisation, rather technical and operational constraints. After various community-based activities were organised to promote solar cooking, the project became more popular. Nevertheless, the enthusiasm of the refugees diminished when no new cookers or plastic bags were delivered to them between September 1997 and August 1998.

The solar cookers were found relatively easy to use: food could be left unattended and only the pot inside the plastic bag got hot, so children did not burn themselves easily. The impact of the project on the daily life of women was, however, very limited. Cookers had been distributed to fewer than half of the families in Aisha. Due to the plastic bags' lack of durability, refugee women using the cookers were able to use them for only around one month in total.

Solar cooker use was supplementary to normal cooking practices; the cookers were used mainly to prepare tea and small amounts of wheat grain. The poorest families (those without the help of donkeys to collect wood) benefited most. The size of the pot given with the cooker was suitable for cooking one meal for families with 6 or fewer members.

The project's impact on the daily life of refugees and gender roles within the community had been minimal. 49 refugee women had worked for the project as solar cooking trainers in rotation, and this provided them an active role and a small income for a short period of time.

•*Sub-Report on Cost-effectiveness, Economic Impact and Sustainability*

Although in purely economic terms the use of solar cookers was found to lead to benefits at the household level and avoided environmental costs, over the project period these gains failed to outweigh project investment costs and losses in local income and employment. Overall, the promotion of solar cookers by UNHCR/SCI generated economic benefits which were less than project costs, resulting in a net loss of some US$ 62,061 over the project period.

Analysis of a "without project" scenario (i.e. no outside assistance continuing after the pilot phase) where cookers would be provided at their full cost, demonstrates a net economic benefit to households using solar energy of between US$ 71 and US$ 356 a year, and overall of US$ 164,402. For users, fuel savings are greater than the increase in cooking labour time and expenditure on equipment needed for solar cookers. Overall, although leading to losses in local income and employment, the uptake of solar cookers would have a positive economic impact of some US$ 106,794 a year due to environmental benefits and user savings in fuel.

Non-economic factors and practical considerations are likely to be of more relevance than economic factors to the sustainability of solar cookers and incentives for their uptake. However, practical considerations influencing the uptake of solar cookers have a strong economic component, and are mainly to do with the accessibility of solar equipment to refugees. The project had severe difficulties in this area, and under a scenario where external assistance is discontinued, these difficulties would be likely to increase still further.

Even if refugees had access to markets and sufficient cash income, both of which are large assumptions, it is unlikely that solar cookers would be considered a priority for household expenditure. Field evidence suggests that refugee households have inadequate incentives to take up solar cookers permanently and that solar cookers are unsustainable over the long term.

Financial and economic analysis suggests that the UNHCR/SCI project may have little long-term impact on either refugee economic welfare, energy status or environmental conditions in Aisha. Although the potential economic and environmental savings from the use of solar cookers are significant, it is doubtful whether these have been, or will be, achieved. The project in Aisha has provided a large, high-cost subsidy to activities which are unlikely to lead to anything more than a very short-term change in energy consumption and cooking patterns.

Recommendations

The following are drawn from all three sub-reports:

•The solar cooking project should be completed as originally planned. It is important that US$1,500 be made available immediately to enable the stock of supplies in Aisha to be transported to the camp, training workshops to be held, and distribution to be completed. The project could be completed within three months.[1]

•As stated from the start, solar cooking in Aisha should not have been an independent, stand-alone activity. Plans were underway to initiate a larger energy and environment programme. In this vein, it was thought that it would be appropriate to consider:

- •energy conservation (promote energy-saving practices and simple mud stoves instead of focusing on stove technology)
- •establishing a tree nursery within Aisha camp rather than transporting seedlings from elsewhere
- •higher survival rates could be assured if seedlings were offered only to those families expressing an interest, rather than giving to all in equal numbers
- •the species selected should include fruit trees and trees that are fast-growing and provide short-term benefit to refugees, especially in cash if possible

•It was not recommended that solar cooking should proceed in Aisha unless:

- •the cooking equipment is manufactured in Ethiopia

[1] Note: RLO Addis Ababa did subsequently agree to finance this from the 1998 care and maintenance budget for the eastern camps.

- the equipment is significantly more durable
- the parts are not disposable or are at least recyclable
- refugees make a contribution toward the cost of the cookers (in cash, labour, etc.)
- all equipment is guaranteed to be available on-site
- the promoting organisation has a permanent presence in Ethiopia.

- It was further recommended that if solar cooking were to proceed, it be part of a community-based environmental programme with forestry activities, energy saving and other awareness campaigns.

- Woodfuel scarcity and environmental degradation might be better addressed through other means than the promotion of solar cookers. As it seemed likely that refugees would continue to cook primarily using woodfuel sources, project activities targeted at fuelwood and charcoal energy use might be more appropriate in Aisha, and would be a more obvious and direct means of addressing woodfuel-related problems.

- In addition to, or instead of, the promotion of solar cookers, any future energy activities might be better directed at managing the demand for woodfuel and of more sustainable and efficient woodfuel harvesting and production methods, and improving the sustainable supply of woodfuel.

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III. Sub-report on Cost-effectiveness, Economic Impact and Sustainability

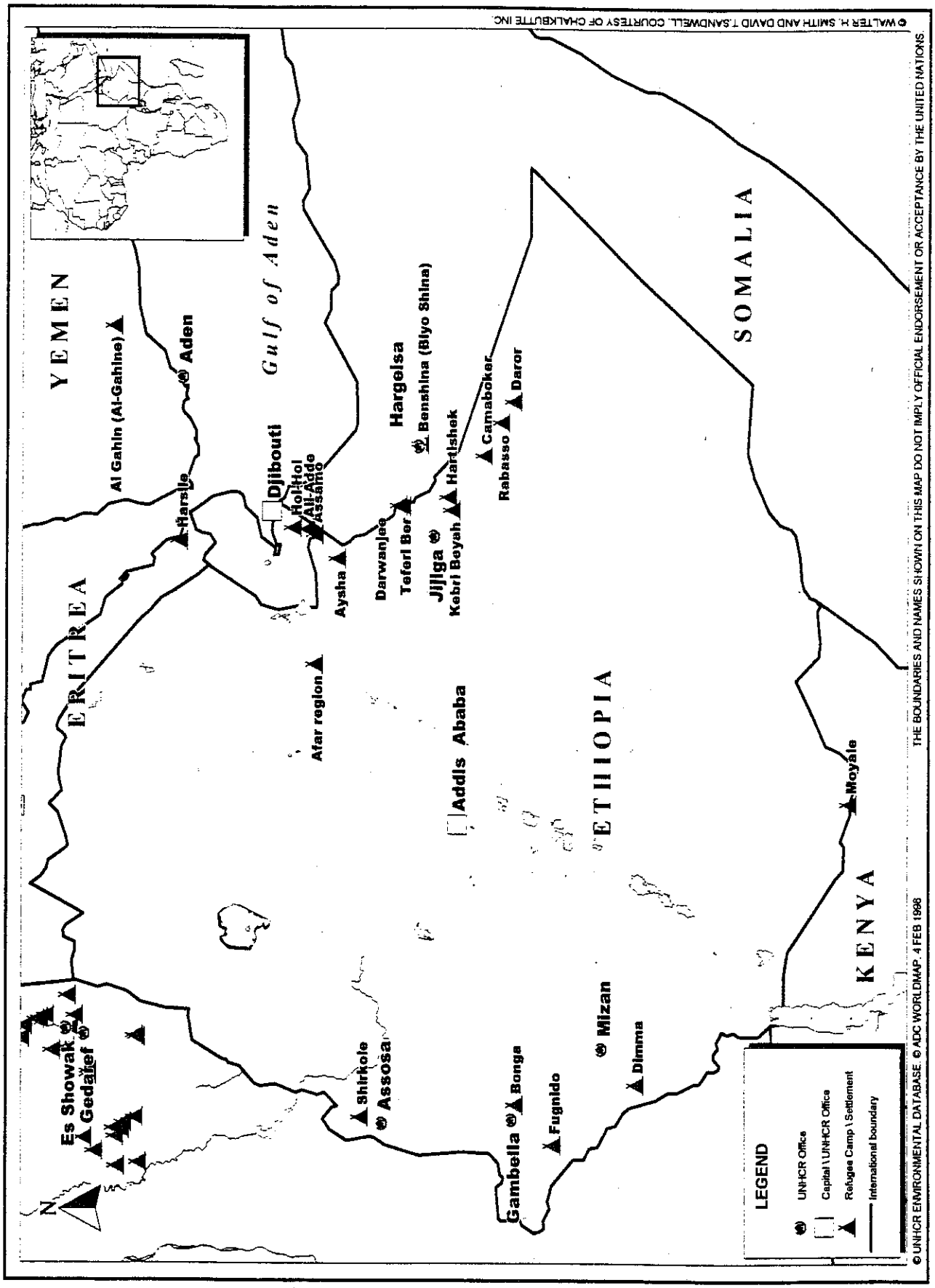
Abbreviations

ARRA Administration for Refugee and Returnee Affairs (Government of Ethiopia)
RLO Regional Liaison Office (of UNHCR, Addis Ababa)
SCI Solar Cookers International
WFP World Food Programme

Exchange Rate

1 US$ = 7.25 Ethiopian Birr (Br.) at the time of the mission.

Ethiopia - Refugee Camp Locations



Introduction

1.1 Camp Background

The pilot solar cooker project was implemented in Aisha refugee camp in the far north-east of Ethiopia. The camp was established in 1989 and is located 16 km west of the Somali border, 80 km south of Djibouti and 30 km south of the actual settlement of Aisha.

The camp is one of 8 under the control of the UNHCR Sub-Office in Jijiga, managed by the government's Administration for Refugee/Returnee Affairs (ARRA). It hosts 16,210 Somali refugees (7,496 women and 8,714 men)[2]. 94% are from the Issa clan, who are from an area fairly close to the camp on the Somali side of the border. The remainder represent the Issak, Hawiye, Gedabursi and other groups. The camp has 2,421 households of average size 6.7[3]. Data is currently being collected on the vulnerable groups in the camp including single-headed households, but this data collection has not yet been completed.

The area around the camp is arid, remote and sparsely populated by semi-nomadic pastoralists with camels, goats and donkeys. Annual rainfall averages only 200-300 mm and falls mostly between July and September, and occasionally in April. These seasons are also preceded and accompanied by strong winds[4].

Meteorological records do not exist, but stations in nearby Djibouti record mean monthly temperatures from 21°C in January to 31°C between June and August. Unofficial measurements from Aisha suggest that in June, temperatures in the sun commonly reach 48-49°C with relative humidity below 10%[5].

The arid conditions and strong winds mean that vegetation is sparse and limited to thorny dryland tree species and drought-resistant shrubs. Large areas are also completely bare. As the refugees rely entirely upon woodfuels for cooking, they face considerable energy shortage and must travel up to 30 km from the camp to harvest fuel and construction materials. There is evidence that they have caused some environmental damage in doing so, particularly along the seasonal watercourse of the Qobobe west of the camp, where the vegetation was previously thickest.

Besides a modest tree seedling distribution exercise by ARRA in 1993 there had been no environmental programmes in Aisha prior to the establishment of the solar cooking project.

1.2 Background to Solar Cooking

Solar cooking is intended to address two key problems simultaneously, both environmental and social. It aims to reduce the environmental damage and related conflicts that can arise from the harvesting of fuelwood for domestic use, while also addressing issues of drudgery related to fuelwood collection, health and safety problems related to use of open fires (that include burns and smoke-related complaints) and wastage of food burned to pots (SCI, 1998).

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[2] ARRA camp statistics.

[3] Data from ARRA office in Aisha. The last registration exercise in Aisha was in 1994, at which a population of 15,282 was recorded and is still used for distribution purposes. The current estimated total is based on recorded births and deaths since then.

[4] The Somali name for the camp ("*Deghagho*") means "to slice off the ear", on account of the strength of the winds for which the area is known.

[5] Personal measurements by ARRA staff member for 1996.

Solar cooking has been promoted on a pilot basis in refugee camps in Kenya since 1995 as a supplement to traditional fuels, mainly firewood and charcoal. In 1996 it was proposed that similar activities be expanded to Ethiopia on a trial basis. Although Aisha is a small camp it was selected because of the suitable combination of high solar insolation and extreme scarcity of fuelwood. Refugees, especially women, were known to be travelling long distances under difficult conditions to secure adequate supplies of fuelwood.

The promotion of solar cookers began in March 1997 and was expected to proceed for 8 months[6]. The project was to be implemented jointly by UNHCR and Solar Cookers International (SCI), an American non-profit organisation already running the solar projects with refugees in Kenya, and funded jointly by SCI and the UNHCR Environment Unit.

It was hoped that the Aisha experience would provide the basis upon which to assess the appropriateness of promoting solar cooking in other refugee situations, considering its environmental and social impacts as well as its cultural and technical suitability, cost-effectiveness and sustainability.

[6] SCI intended that this should be a 5 year project (Blum, 1997b), while UNHCR envisaged it as a pilot testing programme that would be completed by the end of 1997 and reviewed in March 1998.

I. Sub-report on Technical Suitability, Environmental Impacts and Sustainability

Matthew Owen, Consultant, domestic energy

Summary of Findings

While enabling a refugee family to substitute some of their fuelwood or charcoal consumption with solar cooking, adoption of the CooKit encountered barriers related to cooking speed, size of family, and tendency to under-fill pots. The CooKit ended up being used mainly to prepare hot drinks and wheat grain for 8 months of the year, when solar conditions are not viewed as optimal, and more ambitious foods for the other 4 months of the year.

60-80% of cooker recipients appear to make some use of their cooker, and it appears best suited to smaller families (fewer than 6 people) who cannot buy fuelwood. However, only 1,000 households had received solar cookers by the time of the mission because of various delays. For this reason, and due to the short lifespan of the plastic bags (inside which the pots sits), there has been no utilisation for more than a few weeks at a time. Fuelwood and charcoal savings are therefore too small to be measured. Positive environmental impacts are also thus considered negligible, and disposal of broken plastic bags around the camp has been an eyesore.

Problems with project implementation and design included lack of clarity over management and support structures, separation of the project from the rest of the environmental activities under the national programme, extensive delays in clearing imported goods from customs, lack of a local implementing partner, and multiple reporting lines. The project also suffered from a top-down design and lack of delegation of responsibility to refugees. Disillusionment among the refugees when the CooKit supplies failed to materialise was widespread, and hurt the project's credibility.

It is difficult to determine the likely sustainability of solar cooking in Aisha, given the unfinished nature of the pilot project. However, the potential for cash sale, which is a key indicator of likely sustainability, appeared very low according to those who had benefited from the project thus far.

1. Project History

1.1 The CooKit Solar Cooker

Early experiments with solar cooking for refugees in Pakistan and Kenya were not outstandingly successful, due partly to the cumbersome nature, expense and unfamiliarity of the models used and lack of adequate adaptation and instruction for beneficiaries. A new type of cooker was developed in Kenya by SCI, however. The "CooKit" is a simple, foldable reflector that was thought capable of overcoming some of the difficulties associated with solar cooking in the past.

The CooKit is a panel-type solar cooker, which is a hybrid between 'concentrator-types' and 'oven-types'. Such models incorporate a curved reflector (which concentrates heat) and a container in which the food is placed (which acts like an oven). In the case of the CooKit, the reflector is made from a cardboard panel with shiny aluminium foil on one side, and the container inside which the pot sits is a plastic bag. The cardboard panel is 91 x 121 cm when laid flat. Most of the units used in the Aisha project used a panel with laminated

backing, which was an improvement developed in Kenya for water-resistance and overall durability. The cooking pot that best suits the CooKit is approximately 6 litres in volume, has a tight-fitting lid and is painted black to absorb heat.

SCI estimates the lifetime of a laminated CooKit panel at 5-7 years, while each plastic bag should last 2-3 months[7]. The bag is made of polypropylene or polyester to withstand high temperatures without melting. It becomes brittle with repeated use, however, and begins to crack. As the Aisha project description (below) outlines, the bags proved less durable than expected. The unusually high temperatures and strong winds were probably responsible.

The CooKit is operated simply by putting the pot of food inside the plastic bag, placing it on the reflector panel (which should be folded inwards and secured) and leaving it facing the sun. The pot is raised slightly off the panel using stones or pieces of wood. The panel should be turned in the middle of the day to optimise the angle of incidence of the sun's rays. In Aisha, solar cooking can start as early as 8.30 a.m. and continue until late afternoon.

Although cooking in the CooKit takes longer than it does using conventional methods, the food in the pot does not burn and in many cases it does not need tending. The system is smoke-free and reduces the risk of children (in particular) being burned or scalded.

1.2 Project Establishment

The Aisha project resulted from an expression of interest by the UNHCR Environment Unit in early 1996. SCI was asked if it would consider expanding its existing solar cooker initiatives from Kenya to Ethiopia. In collaboration with UNHCR RLO Addis Ababa, SCI fielded a mission to Ethiopia in March and April 1996 to determine what such a project would entail.

Aisha camp had been proposed by the Women and Children Officer at RLO Addis prior to the mission as the most suitable location. The SCI team ran solar cooking tests in Aisha and confirmed that conditions were appropriate, and also determined that the camp's small size, homogeneity and lack of fuelwood made it likely that solar cooking would be readily adopted (Meyer, 1996).

UNHCR's Environment Unit fielded its own mission to eastern Ethiopia in December 1996. It was then proposed that the solar cooking pilot project should (administratively) become part of a larger project funded by the Environment Unit entitled "Environment Protection and Education in Ethiopia", which had a total budget of US$ 200,000 and was to run from 1 April - 31 December 1998. Besides solar cooking in Aisha, this project was also to cover environmental education (in all camps), soil erosion control and reforestation (in 2 camps), and the establishment of a computerised environmental database (in Addis Ababa).

The solar cooking component was supported with US$ 45,324 from UNHCR and a further US$ 58,300 in the form of cost-sharing contributions from SCI[8]. At project completion, UNHCR had in fact overspent by about US$ 3,000[9].

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[7] Solar Cooker Review Vol. 2 No. 3, Dec 1996.

[8] The UNHCR contribution comprised US$31,499 from headquarters, mainly for cooker purchase, US$8,000 through RLO Addis, for baseline survey expenses, and US$5,825 (Br. 39,900) in local costs, mainly the salary of the Project Co-ordinator.

[9] The Project Monitoring Report of 30 June 1998 recorded an overspend of Br. 20,393. e.g. UNHCR covered field allowances for visiting SCI staff, although this had been specified as an SCI obligation in the Letter of Agreement; UNHCR covered rental of transport for SCI in March 1997, responsibility for which had not been

As per the project outline, a Baseline Energy Survey was conducted in Aisha in March 1997 by a consultant to the UNHCR Environment Unit. This was intended to provide the basis from which comparisons would later be made, in order to evaluate project's impacts on supply and demand patterns of fuelwood and charcoal[10].

1.3 Project Financing and Management

The solar cooker pilot project was to be implemented jointly by UNHCR and SCI. A Letter of Agreement (valid 25 February 1997 to 31 March 1998) outlined SCI's responsibilities:

- to train refugees to use solar cookers;
- to train and employ local assistants to continue training;
- to assist in activities to promote solar cookers.

SCI's financial contribution was initially expected to cover its own costs, primarily the costs of staff travel and related expenses, and also the costs of refugee trainers and other expenses related to the training programme. In August 1997, however, the Letter of Agreement was altered so that SCI would no longer be responsible for the salaries of the trainers and assistants. This had apparently been a misunderstanding when the original agreement was drafted.

UNHCR's financial contribution was expected to cover purchase and transport of cookers, pots and plastic bags, costs of the baseline energy survey and the salary of a consultant Project Co-ordinator. As mentioned, the salaries of the trainers and assistants in Aisha were also added to the UNHCR budget.

UNHCR recruited the Project Co-ordinator in April 1997, by which time the baseline survey was complete and an SCI team had already been to Aisha and begun a programme of training. Her tasks were to:

- distribute solar cookers, pots and plastic bags in Aisha, through refugee assistants and trainers;
- recruit and train new solar cooker trainers every 3 months;
- using the assistants and trainers, carry out promotional activities such as cooking demonstrations, workshops, theatre production, song-making, etc.
- hold regular follow-up meetings with assistants and trainers, and arrange home visits for further monitoring;
- assist with periodic review missions from SCI and RLO Addis.

The Project Co-ordinator was employed up to September, with an extension later agreed to the end of January 1998. After that she was recruited as UNHCR Field Assistant for Aisha, but continued to monitor and support solar activities as appropriate within her wider range of duties.

While financial obligations within the project were reasonably clear from the outset, there was an apparent lack of clarity over management and support structures. The UNHCR funding component and the initial project idea came from the Environment Unit in Geneva,

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clearly assigned to either agency; the salary of the Aisha Field Assistant was charged to the project for January - March 1998, though the project was inactive from December 1997.

[10] See Owen (1997). This survey, though finalised in April 1997, did not reach the Aisha Camp Co-ordinator or the solar Project Co-ordinator.

but implementation was to be the responsibility of RLO Addis and Sub-Office Jijiga. The project required assistance at various levels with transport, communications and customs clearance at a scale not envisaged at the outset. Not all staff were well informed about the project, and there was a certain lack of enthusiasm for taking on a labour-intensive project in the most distant of the eastern camps, and one of the smallest.

The project was also treated separately from the rest of the environmental activities under the national programme. It was placed operationally under the Women and Children Officer in Addis Ababa, which distanced it from the more integrated implementation of the larger environmental programme. Furthermore, three separate officers occupied this focal post during the implementation period.

As well as co-ordination and support at various levels within Ethiopia, the co-operation of UNHCR's Branch Office in Nairobi was also needed to source and ship the solar cookers and ancillary equipment from Kenya. There were communications difficulties and lack of technical competence in the shipping process that resulted in extensive delays in clearing imported goods from customs.

Meanwhile SCI operated from the U.S. and had no local implementing partner, making use of staff and cooker production facilities in Kenya as required. Although the Executive Director acted as the focal point most of the time, 6 different SCI staff and volunteers visited Aisha. Prior to its March 1996 scoping mission, SCI had said that it did not see a need for an implementing partner in Ethiopia (Campbell, 1996). After the mission, however, SCI stated that it was of prime importance to identify a local partner agency to offer support and follow-up assistance when SCI trainers were absent (Meyer, 1996). None was identified, however.

Considering the remote and inhospitable location of Aisha, the multiple reporting lines and division of roles and responsibilities between agencies and within agencies was not conducive to smooth project implementation (see Appendix C, Project Timetable).

1.4 Project Implementation

1.4.1 Sourcing of Equipment

Equipment for the project was mostly sourced in Kenya and shipped to Ethiopia by air. SCI placed the orders, while UNHCR was responsible for paying and organising the transportation to Addis Ababa and onwards to Aisha, via its Sub-Office in Jijiga.

The decision to import equipment was based on the short lifespan of the project and likely additional costs and delays that would have been incurred if an Ethiopian supplier was sought. UNHCR had initially anticipated that the CooKit would be mass-produced in Ethiopia, after local adaptations to take into account the types of cooking pots available, family size and durability considerations (Talbot, 1996). SCI, however, had already been working with Kenyan manufacturers for two years and determined that importation from these existing suppliers would be the most practical option.

It was initially expected that the project would purchase 3,000 CooKits in Kenya. This was reduced to a target of 2,000. The equipment was ordered from SCI's Nairobi suppliers[11] and shipped in 2 batches (March 1997: 500 Cookit panels and 2,000 plastic bags, and August 1997 or possibly July, records unclear: 1,500 CooKit panels, 2,000 pots, and

[11] CooKit panels from Pressmaster Ltd., pots from Crystal Industries Ltd. and plastic bags from Cremex Ltd.

15,000 plastic bags).

The equipment was priced by the suppliers as follows:

- CooKit panel (laminated) US$5.40
- Aluminium Pot (6 litres) US$3
- Plastic bag (20 x 30 cm) US$0.08

During the early stages of the project, local production in Ethiopia was also investigated by various UNHCR and SCI staff.

In April 1996, the SCI exploratory mission visited Selam Vocational Training School in Addis Ababa at the suggestion of the Swiss Ambassador. The school's manager provided an estimate of the cost of producing a sheet metal cooker, but this was considered prohibitively high. A sample CooKit was left with the school and they were informed of various potential suppliers of suitable cardboard to determine if they could produce a lower cost alternative, but they were unable to develop a local version at a competitive price.

In July 1996, the UNHCR Agriculturalist from SO Jijiga visited the Rural Technology Promotion Centre in Harar and was given a quotation of Br. 180 for a cardboard-type panel cooker (US$6.35 at that time), or Br. 420 for an aluminium version. Mass production was not considered (see below), although the price for the cardboard model appeared fairly competitive compared with the Kenyan price, especially considering the convenient location of the production facility.

In June 1997, SCI sent a sample cooker to Addis for a local manufacturer (Thermoplastics) to consider mass production, but no response appears to have been forthcoming.

Later in 1997, RLO Addis field tested a solar cooker made by another local manufacturer, Yamare Solar Energy and Biogas R D, at a cost of Br. 35 (equivalent to the Nairobi price at the time). It proved to have serious failings in performance and durability during tests in Aisha. It did not heat food quickly, was not properly laminated and fell apart after only 3 days. The manufacturer was invited to submit a more durable version, but did not do so.

Local production of plastic bags was also considered. At least two companies offered quotations in September 1997. One offered 1,000 x 30 gm bags for Br. 933. Another (Thermoplastics) offered 1,000 x 14 gm bags for Br. 500. These quotations were equivalent to US$ 0.14 and 0.08 per bag, the latter being competitive with the Kenyan price - though it was not clear if the quality of the material was comparable.

As explained, the short duration of the project meant that local production was not considered a viable proposition, but a number of Ethiopian suppliers appeared to show potential for being able to produce CooKits and components at competitive prices, in case the pilot project was extended or expanded.

1.4.2 Transport of Equipment

The purchasing, shipping and clearing process for the cookers, pots and bags proved more cumbersome than first envisaged.

The first batch of 500 cookers, sent in March 1997, spent three months in Addis Ababa airport awaiting customs clearance. In spite of the lessons learned, incorrect paperwork was supplied for the second shipment (of 1,500 panels and other equipment) and this incurred a further delay of 8 months. This second shipment, which comprised the bulk of

the project's supplies, did not reach the field until May 1998, 4 months after the project was due to close. At the end of 1997, only 25% of the cookers had actually reached Aisha. At the time of the review mission in September 1998, although all cookers had reached the field, 50% were still in the ARRA store in Aisha town waiting to be distributed.

Clearly the unavailability of equipment fundamental to the project was bound to have serious implications.

Table 1 summarises the dates on which project equipment from Kenya was procured and delivered. Table 2 outlines the additional supply of items directly to the field by SCI and UNHCR staff.

Table 1: Timetable of Equipment Procurement and Delivery to the Project

Item	Ordered in Nairobi	Delivered in Nairobi	Reached Addis	Cleared from Customs	Sent to Jijiga	Reached Aisha Town	Reached Aisha Camp	Reached Refugees	Notes
500 panels	Jan 97?	Mar 97	Mar 97?	17 Jun 97	200 on 21 Jun 97	25 Jun 97	100 on 28 Jun 97	30 Jun 97	Initial order of panels and bags from Kenya distributed by end of Sep 1997. Pots purchased in Dire Dawa (see Table 2).
							100 on 28 Jul 97	Aug 97	
					200 in Jul 97	200 on 1 Aug 97	100 on 11 Aug 97	19 Aug 97	
							200 on 19 Sep 97	26 Sep 97	
					100 on 4 Sep 97	19 Sep 97			
2,000 bags					500 on 21 Jun 97	25 Jun 97	1,000 on 11 Aug 97	20 Aug 97	
					1,000 in Jul 97?	500 on 1 Aug 97			
						500 in Aug 97?	Aug 97?	Aug 97?	
					500 on 4 Sep 97	19 Sep 97	19 Sep 97	26 Sep 97	
1,500 panels	May 97	July 97	Aug 97?	Apr 98		8 May 98	500 on 29 Jul 98	Aug 98	Balance of 1,000 panels still with ARRA in Aisha
2,000 pots							500 on 1 Aug 98	23 Aug 98	Balance of 1,036 pots still with ARRA in Aisha. 464 pots from Kenya not accounted for. Still in Addis?
15,000 bags					5,000 in Jan 98	?	1,250 on 1 Aug 98	23 Aug 98	Balance of 9,750 bags still with ARRA in Aisha
					10,000 in May 98	?	5,000 on 2 Aug 98		

Sources: UNHCR files, Addis Ababa; Project Co-ordinator's monthly reports; records held by Solar Assistants in Aisha.

Table 2: Equipment Supplied Directly to Field by Project Support Staff

Item	Source	Reached Aisha Camp	Reached Refugees
54 panels	Taken directly to Aisha by SCI mission (Bev Blum)	March 1997	March 1997
108 bags	Taken directly to Aisha by SCI mission (Bev Blum)	March 1997	March 1997
80 pots	Bought in Dire Dawa (Halimo Hussein)	50 in March 1997	April 1997
		30 in April 1997	April 1997
57 pots	Bought in Dire Dawa (Amina Ahmed)	17 June 1997	30 June 1997
100 pots	Bought in Dire Dawa (Amina Ahmed)	64 on 10 July 1997	July 1997
		36 on 10 July 1997	July 1997
96 bags	Taken directly to Aisha by SCI mission (Faustine Odaba)	July 1997	July 1997
60 pots	Bought in Dire Dawa (Amina Ahmed)	11 August 1997	19 August 1997
55 pots	Bought in Dire Dawa (Amina Ahmed)	11 August 1997	19 August 1997
200 pots	Bought in Dire Dawa (Amina Ahmed)	19 Sep 1997	23-26 Sep 1997
750 bags	Taken directly to Aisha by SCI mission (Margaret Owino)	April 1998	April 1998

1.4.3 Solar Cooker Promotion

A three-strong team from SCI launched the project in Aisha in March 1997. They trained a total of 87 families in solar cooking as well as 19 female solar trainers. These trainers were employed up to the end of May, at which point the Project Co-ordinator reduced the training team to 10 newly recruited women and 2 solar assistants (male), and proceeded to rotate them every 3 months. The trainers were paid Br. 270 per month and the assistants Br. 350.

The training programme followed a routine pattern:

1. Trainee identification
2. Training workshops
3. Follow-up home visits

Trainees were mostly identified by their own enthusiasm and interest in participating in the project. Representative proportions were sought from each of the camp's sections, so as not to produce a bias in favour of Section A - the largest and most prosperous.

The workshops involved practical demonstrations of solar cooking using rations donated by WFP. WFP gave an initial 50 kg of wheat grain and 5 litres of cooking oil in March 1997, and a further 1,152 kg of wheat and 90 litres of oil in May. Permission was requested by the Project Co-ordinator to sell a portion of this donation to buy a greater variety of foods for the cooking demonstrations, and this was approved by WFP. 85% of the wheat grain and 70% of the oil was sold, and spaghetti, sugar, rice and tea leaves purchased instead.

Each of the workshops initially involved 5 trainees, later varied to 10 and 8. 10 was ultimately determined to be the most workable size. Participants were able to see the whole solar cooking process and sample the various foods prepared using the Cookit.

The initial period of training was accompanied by various promotional activities in the camp that included group discussions, drama and song-making. On Africa Refugee Day, 20 June 1997, refugees sang songs about solar cookers and their usefulness. A "solar cooking" football team was formed spontaneously by members of the refugee youth committee in June 1997. The Project Co-ordinator had special T-shirts made for the squad and SCI sent the team a trophy in honour of their victory. There was a high level of optimism and interest from the refugees at that time.

By the end of September, all of the CooKits, pots and bags in the first batch from Kenya

had been distributed and the recipient households trained in solar cooking. The remaining 3 months of the year were spent running additional workshops for new families, but the large batch of equipment held up in customs had not been released. By the end of the year, although a total of 1,080 refugee families had been trained in solar cooking through 108 workshops, only 554 had actually received cookers[12]. One source noted that "the Project Co-ordinator lost a lot of credibility among the trainers due to the delay of the project" (Jansen, 1997).

It also became clear that the plastic bags issued with the solar cookers were considerably less durable than expected. Although each beneficiary had been given 2 bags with each CooKit, the bags often lasted less than a week. Thus within 2 weeks of being given a cooker, the recipient families generally required more plastic bags, and these were not available. This not only prevented further use of the cooker, but the waste bags also created an eyesore and a hazard for grazing animals. The Project Co-ordinator commented that "used plastic bags have been carelessly thrown all over the camp. We advised the refugees not to do so" (Ahmed, 1997d).

SCI responded to the problem by experimenting with an alternative system that used a transparent mylar cuff for the pot instead of the plastic bag. Unfortunately this did not work well when field tested in Aisha, mainly because it allowed too much heat to escape.

1.4.4 Project Extension

At the end of 1997, UNHCR considered the project closed as far as budgeting was concerned, in spite of the fact that its goals were far from being met. Some positive news came with the January 1998 release of the 15,000 plastic bags from customs, but with the 1,500 panels and 2,000 pots still detained this did not enable a great deal to be achieved. The Project Co-ordinator was employed only until the end of January, although an extension was agreed until the end of March, during which time she was mostly engaged in other activities in the eastern camps. As explained, she then took up a new post as camp Field Assistant.

The SCI Director went to Addis in February 1998 in an attempt to reach agreement with UNHCR on how the project could be completed as agreed. The Letter of Agreement was about to expire, and the roles of UNHCR and SCI needed to be clarified

SCI felt justifiably frustrated by the closure of the project budget. The causes of the various delays appeared to have been largely out of their hands, yet UNHCR was not providing for a reasonable extension period in which the activities could be completed. SCI decided at that point to offer financial support from its own resources. For example, it provided trainers' incentives of Br. 2,100 in April 1998. These funds were held over for June, July and August by the Project Co-ordinator as the cookers were still detained in customs and training in April would therefore have been premature. SCI also contributed to painting of pots and purchase of paint and brushes in Dire Dawa (about Br. 1,000).

By the time the 1,500 cookers and their pots were eventually cleared from customs and arrived in Aisha on 8 May 1998, there was an additional hold-up as the Field Assistant (and solar Project Co-ordinator) was absent for three months due to health problems. A substitute staff member was not offered, thus the cookers were detained several more weeks until the Field Assistant returned. After a one year break, 500 Cookits were eventually given out in July and August 1998. 300 of these went to "vulnerable"

[12] 54 panels came from the first SCI team and 500 were in the later batch from Nairobi that reached Aisha between June and September.

households, as identified by the refugee committee and the Solar Assistants. A further 200 went to additional families who showed interest.

At the time of the review mission in September 1998, 1,000 cookers, 1,036 pots and 9,750 plastic bags still remained in the ARRA store in Aisha. The incentives provided in April by SCI for loaders and trainers, along with the costs of paint, brushes and other materials, had run out at the end of August, and the project was stalled.

2. Analysis

2.1 Technical Suitability of the CooKit

The CooKit responded to a serious problem of fuelwood shortage in Aisha by providing the means to use a free alternative energy source. While not intended to replace fuelwood or charcoal, the device was expected to substitute for a substantial proportion of existing usage. SCI estimates that users of the CooKit can save 30-50% of their annual fuelwood consumption, saving on labour and cash[13].

Whether or not the CooKit could achieve this target would depend very much on the foods being cooked by the refugees, the solar conditions in the field and the general degree of convenience in using the device.

2.1.1 Ability to Prepare Different Foods

Table 3 summarises a typical meal plan for refugees in Aisha.

Table 3: Refugee Meal Plan

Meal	Time	Food	Somali Name	Comments
Breakfast	6 - 9 a.m.	**Black tea with sugar**	Cha	Some families add spices
		Wheat flour pancake	Laxoox	Fermented, like injera
		or wheat porridge	Shuuro	Made with pounded wheat grain
		or ***Famix* porridge**	Fafa	Mainly for children
Lunch	1 p.m.	**Black tea with sugar**		May also be taken later in day
		Wheat flour pancake		Left over from breakfast
		or Wheat porridge		
		or Rice with sauce	Bariis	Tomato-based sauce with vegetables and spices
		or Pasta with sauce	Basta	
		Goat meat	Hilip	Richer families
Dinner	7 - 8 p.m.	**Whole wheat grain, boiled**	Qamadi	Salt and oil added
		Rice with sauce		Less common
		Goat meat		Richer families
		Potatoes, bread (*rooti*), beans (*kiki*), coffee leaves (*qashir*) and *injera* (made with tef).		Less common

Note: (a) The most common meal plan is highlighted in **bold**.
(b) 35-40% of households do not cook lunch, but eat left-over breakfast food, usually cold wheat flour pancake (*laxoox*).

In the solar training workshops, refugees were shown how the CooKit could be used to prepare any of these foods. With this training and through their own trials, they generally found the device most appropriate for the following items:

[13] Solar Cooker Review, Vol. 4 No. 2, July 1998.

- tea/water/milk
- whole wheat grain
- roasted meat
- rice
- pasta

The cooker was found unsuitable for pancakes (*laxoox*), was considered too slow for beans, and was not used for wheat porridge (*shuuro*) or Famix porridge (*fafa*) because the flavour was said to be poor. It was also not used for the tomato-based sauce served with rice or pasta, so a fire would still be lit when these dishes were prepared.

The refugees did not show a tendency to switch to solar cooking for entire meals. It was more common for them to continue using fuelwood or charcoal for the main family dish, and use the solar cooker as a supplementary device for the preparation of drinks for children, the sick or the elderly (for example, hot water, milk or tea).

2.1.2 Solar Conditions and Cooking Speed

Although Aisha appeared to have perfect conditions for solar cooking, it did not prove possible to use the CooKit on a daily basis. During the "cold" period between September and April, for example, when the sun's rays are weaker, it was claimed that boiling point could not be achieved and therefore only tea and wheat grain were generally prepared. (For rice and pasta boiling point must be reached.) Meanwhile during the hotter season from May to August, levels of insolation were said to be sufficient to prepare almost any food. This hotter season is also the period of greatest cloudiness, however, and it was estimated by Solar Trainers that cooking would be possible on only 5 days per week in the hottest season. The prevalence of strong winds in Aisha also reduced the effectiveness of the cooker.

The basic difference in strength of sunshine between different seasons, along with the effect of winds, appeared to dictate what could be cooked with the CooKit at different times of the year and what could not.

Tea was estimated to take 2 hours to prepare using solar, compared with 30 minutes using an open fire. Wheat grain took 4-6 hours, compared with 90 minutes on an open fire. White rice was said to take 3 hours, compared with 30 minutes using a fire, and red rice 4 hours, compared with 1 hour on a fire[14].

2.1.3 Family Size and CooKit Size

The average household size in Aisha is 6.7 according to ARRA records, but actual size of groups who live and cook together is slightly larger, at about 7.3[15]. The CooKit functions optimally using a 6-litre pot which, if full, would be sufficient to prepare rice or other staples for 6-7 people. Given that 50% of refugee families are larger than this, capacity limitations were encountered. As early as June 1997, refugees were requesting larger pots, larger solar cookers or supply of more than one cooker per household (Ahmed, 1997b).

This difficulty was compounded by the habit of only partially filling cooking pots, even when using them on open fires, and by slower cooking speed when using solar for equivalent

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[14] These estimates were given by women in group meetings during the review mission.

[15] Average size of households trained in the solar cooking project.

volumes of food. The result was a tendency among users to put very little food into the CooKit pot. During household visits in the review mission, no cooker was seen with more than 1 litre of liquid inside the 6-litre pot. Thus complete cooking could be assured, but total volume of food prepared was minimal. This habit meant that the cooker was not used to cook for 6 people, even though it had the theoretical capacity to do so.

2.1.4 Usage Rates

It was estimated by the Solar Assistants in Aisha, who were responsible for carrying out follow-up home visits after workshops, that 60-80% of CooKit recipients would use the cooker (on some or all days) when they had a reliable supply of plastic bags.

2.1.5 Summary

While enabling a refugee family to substitute some of their fuelwood or charcoal consumption with solar cooking, the adoption of the technology encountered some barriers related to speed of cooking, size of family, and tendency to under-fill pots.

The result was that for 8 months of the year, when solar conditions are not viewed as optimal, the CooKit was used mainly to prepare tea and other drinks for lunch, and then wheat grain for the evening meal. For about 4 months of the year the CooKit could still be used for lunchtime drinks, but could then cook other more ambitious foods for the evening meal that require boiling point to be reached - such as rice and pasta - as well as the wheat grain as before.

The device appeared best suited to smaller families (of fewer than 6 people) who lacked the funds to buy fuelwood or were unable to collect it due to old age or disability. It is important to note that the quoted family size of 6 is a theoretical maximum, assuming that pots are filled to capacity. They were not, and therefore users were never cooking for more than 1-3 individuals.

2.2 Environmental Impact

Based on the mission findings, a family of 6 using a solar cooker in Aisha for preparing supplementary tea and wheat grain, as seemed to be the dominant practice, could be expected to save 10-20% of their daily consumption of fuelwood and charcoal. Smaller or very poor families might achieve greater savings, whereas larger or wealthier families would be less likely to use the cooker, or would realise smaller savings if they did so.

Only 1,000 households had received solar cookers by the time of the mission, however, and due to the short lifespan of the plastic bags there had been negligible long-term utilisation.

Full take-up by all recipients might have resulted in an overall camp savings in fuelwood and charcoal of 4-8%. Likely adoption rates of 60-80% would have reduced this to 3-6%. Actual take-up rates, however, were so low due to lack of plastic bags that any fuelwood or charcoal savings were too small to be measured.

Due mainly to the constraints the project faced, positive environmental impacts were thus considered negligible. The unexpectedly short lifespan of the plastic bags used in the project, and their subsequent disposal in and around the camp have caused an eyesore.[16]

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[16] See sub-report III for further comments on environmental impact.

2.3 Sustainability

As a pilot project, the solar cooker promotion was not explicitly intended to be sustainable, in the sense that self-supporting manufacture, marketing and sale of the necessary equipment was not envisaged in the one year implementation period. Had the project gone according to plan and been favourably appraised and extended, then longer term independence from external funding support would certainly have been a key goal. As noted, SCI and UNHCR were keen to investigate in-country production of CooKits as the project was being established.

Given the unfinished nature of the pilot project, it would be difficult to determine likely sustainability of solar cooker promotion in the longer term. It was apparent during the review mission that refugees were unwilling to make any payment for the CooKit. At meetings with members of the women's and youth committees, a price of Br. 1 was suggested and rejected by all but one person. "We are refugees, and have no money" it was claimed. Yet the cooking pot alone is worth Br. 35 (unpainted). In comparison with other refugee expenses: a day's supply of fuelwood for a family of 6 costs Br. 4; a metal charcoal stove costs Br. 12 and has been bought by 25% of households; a sack of charcoal costs Br. 15; a donkey costs Br. 400; a mud brick house costs Br. 700 to build in the camp.

It seems that many refugees do indeed have disposable income. This may not match the full price of the CooKit, which is currently about US$9 (Br. 65) ex-factory in Kenya, but could nevertheless represent a substantive contribution. The potential for cash sale is one key indicator of the likelihood of sustainability, but appeared to be very low according to those who had benefited from the project thus far.

2.4 Project Management and Co-ordination

The relationship between SCI and UNHCR was not always smooth during the project. The reasons for this are outlined in section 4.3 above. They included:

- unclear authority for project decision-making;
- division of responsibilities between Aisha, Jijiga, Addis and Geneva;
- top-down project design;
- lack of delegation of responsibility to refugees;
- multiple reporting lines;
- lack of integration with other environmental programmes under the country programme;
- poor communication between Addis and Nairobi over equipment importation.

These constraints led to:

- lack of response to problems identified by the Project Co-ordinator in her monthly reports (e.g. inadequate transport, hold-up of equipment in customs, breakage of plastic bags);
- extensive delays of imported equipment at Addis Ababa airport (3 months and 8 months for the 2 batches) and in forwarding to Aisha;
- periods of project stoppage during absence of the Co-ordinator (especially May-July 1998);
- low level of interest in the project within UNHCR in Ethiopia, and separation under successive Women and Children Officers independent of other environmental activities;
- disillusionment among refugees, who showed early commitment but lost interest when goods failed to materialise;

- deterioration in the relationship between SCI and UNHCR.

SCI apparently had doubts from the outset about the preparedness of UNHCR and whether support as outlined in the Letter of Agreement would be forthcoming. The training team was informed in the week prior to their arrival in March 1997, for example, that transport would not be available from Aisha to the camp, and that they would have to rent a vehicle from Dire Dawa (170 km away). UNHCR agreed to cover this unexpected outlay after some discussion, but it created confusion and doubt in the SCI team. "We are seriously thinking this project isn't ready to start" the SCI Executive Director said in March 1997[17].

The following month, SCI encountered a hitch over salary payments for the trainers and assistants, which it was initially liable to cover under the first Letter of Agreement. UNHCR could not tell SCI where the necessary funds should be sent. SCI made several offers in April and May to transfer the funds immediately upon UNHCR's request, as the trainers in the field had worked for many weeks unpaid, but details were not provided until 12 June.

In response to various misunderstandings and minor hitches such as this, the Director noted that "SCI committed to this Ethiopia project in early 1996...a year before it got underway. We are inclined to feel that it is primarily SCI's persistence and can-do flexibility that prevented it being delayed even another year and perhaps beyond the funding period...Staff turnover and the sheer numbers of decision-makers have contributed confusion" (Blum, 1997a).

In spite of the visit by the Director to Addis in February 1998, during which the key issue of project management and co-ordination was discussed, SCI did not appear to receive guarantees that the working situation in the field would improve.

3. Recommendations

The following recommendations were developed in conjunction with the Associate Programme Officer for Women and Children at RLO Addis Ababa and the Aisha Field Assistant, UNHCR.

3.1 Project Completion

The solar cooking project should be completed as originally planned. Thus far, over US$100,000 has been spent, yet half of the cookers and ancillary equipment remain in the ARRA store in Aisha.

It is considered important that US$1,500 be made available immediately, using 1998 funds already allocated in the RLO Addis budget for plastic bag purchase. This will enable the stock of 1,000 cookers, 1,036 pots and 9,750 bags currently in Aisha to be transported to the camp, training workshops to be held, and distribution to be completed. As SCI has already met its project commitments in full, the costs should be borne by UNHCR, which was the partner most responsible for the delays incurred[18]. The project could be completed within 3 months.

3.2 Other Environmental Programmes

It has been said from the start that solar cooking in Aisha should not have been an

[17] E-mail of 5/3/97 to UNHCR Women and Children Officer at RLO Addis.

[18] The estimate of US$1,500 was made by the Field Assistant, on the basis of a detailed cost breakdown.

independent, stand-alone activity, but part of a larger, community-based energy and environment programme[19]. Plans are now underway to initiate such activities in Aisha, focusing on improved stove technology and tree planting. It may be appropriate to consider the following approaches:

3.2.1 Energy Conservation

The upcoming programme to reduce energy consumption in Aisha should avoid a focus on stove technology, and in particular stoves built by paid trainers, but could instead promote energy-saving practices and simple mud-stoves built by the refugees themselves. A demonstration of mud-stove construction was organised during the solar review mission, and local anthill soil was found to be ideal for such work (when combined with sand or ash). There appeared to be no need to transport material from distant locations, as was apparently the proposal.

Refugees can therefore build their own mud-stoves of designs that suit their own needs and imagination. Energy-saving practices can be encouraged, that might include the following:

- Cut, split and dry firewood properly;
- Shield or enclose the fire (e.g. with a mud/clay barrier);
- Control the air supply (e.g. with a single opening for firewood);
- Share cooking with other people (e.g. 2 families together);
- Simmer food gently (instead of over-boiling);
- Put out the fire promptly (instead of allowing it to go out slowly);
- Pre-soak wheat grain (use blind taste tests to show that flavour is not altered);
- Cut food into smaller pieces (e.g. meat);
- Use tenderisers (e.g. bicarbonate);
- Use an appropriate pot (clay for slow-cooking, metal for fast-cooking);
- Use a lid;
- Weigh the lid down (e.g. with a stone);
- 'Double Cook' with one pot on top of another to begin warming;
- Add water during cooking rather than all at once;
- Keep pots black (for heat absorption), but not encrusted with soot.

3.2.2 Tree Planting

The proposed programme of tree planting would benefit from establishing a tree nursery within Aisha camp, rather than transporting seedlings over long distances from (for example) Dire Dawa. Refugees would thereby gain knowledge and skills in this new activity, as well as benefiting from any direct or indirect incentives provided.

Rather than distributing tree seedlings on a rationed basis whereby all households receive the same quantity, higher survival rates could be assured if seedlings were offered only to those families expressing an interest and making some visible contribution towards the activity. This contribution might be as basic as signing up on a list and then going to a central area to collect seedlings. Refugees should be included in tree planting demonstrations and information campaigns (ideally using various methods such as

[19]See, for example, Owen (1997), Blum (1997a), Eskonheimo (1998a) and successive reports by the Project Co-ordinator.

pictures, drama and songs).

Payment of cash incentives for participation in household tree planting activities should be avoided.

The species selected should include fruit species, and trees that are fast-growing and provide short-term benefit to refugees. Cash benefits should be prioritised, and hence trees that can offer building poles or fuelwood should be sought.

3.2.3 Education

In addition to environmental education at schools, it is important that non-formal education activities be implemented in order to reach the community properly.

3.3 Continuation of Solar Cooking

The solar cooking project has been expensive, personnel-intensive, encumbered with logistical and co-ordination problems, and has unfortunately had minimal impact so far. The need to import the panels and plastic bags proved a basic hurdle to satisfactory implementation.

It is not recommended that solar cooking proceeds in Aisha unless the following conditions of cost-effectiveness and sustainability can be met:

- The cooking equipment should be manufactured in Ethiopia, preferably in Dire Dawa, using non-imported materials as far as possible, and the refugees should be taught how to maintain and repair the cookers;

- The equipment should be significantly more durable than the CooKit, with a lifetime of at least one year, and should not have any 'disposable' components (such as plastic bags), or these should be recyclable;

- The equipment should have better performance characteristics, such as being able to achieve boiling point at all seasons under refugee conditions of use;

- The refugees should make a contribution towards the cost of the cookers, in cash, labour (tree planting or work on environmental campaigns, for example) or some other acceptable form;

- The project should not proceed until all equipment is guaranteed to be available on-site as needed;

- The promoting organisation should have a permanent presence in Ethiopia, or be working closely with a local implementing partner.

II. Sub-report on Socio-cultural and Gender Impacts

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With contributions from Amina Ahmed, Field Assistant, UNHCR Sub-Office Jijiga (formerly Solar Cooker Programme Co-ordinator in Aisha)

Summary of Findings

Two technical and logistical problems have had major impacts on the implementation of the programme and thus its benefits for the refugee families:

1. Most of the supplies were imported from Kenya.
2. When food is cooked with the CooKit, the pot has to be put in a plastic bag. If the cooker is used regularly, one plastic bag lasts only around one week in Aisha conditions.

The refugee community appeared to overcome initial doubts about the concept of "cooking with the sun" and began to use the CooKit for selected tasks after training was provided. There seemed to be no inherent social or cultural barriers present that impeded cooker utilisation, rather technical and operational constraints. After various community-based activities were organised to promote solar cooking, the project soon became popular. Nevertheless, the enthusiasm of the refugees diminished when no new cookers or plastic bags were delivered to them between September 1997 and August 1998.

The women normally cook with 3-stone fireplaces in cooking shelters which can become hot and full of smoke. The solar cookers, on the other hand, are easy and convenient to use: food can be left unattended and only the pot inside the plastic bag gets hot, so children do not burn themselves easily. The impact of the project on the daily life of women has been, however, very limited. So far cookers have been distributed to fewer than half of the families in Aisha. The families have each received 4 plastic bags with the cookers. Refugee women cooking daily with the CooKits have been able to use them around one month in total because the bags wear out. The solar cookers have been supplementary to normal cooking practices, used mainly for cooking small amounts of wheat grain and making tea. As mentioned in sub-report I, the poorest families (where women and children fetch fuelwood without the help of donkeys) have benefited most. The ideal family size has been 6 persons or under, since the pot is not big enough to cook a meal for larger families.

The project's impact on the daily life of refugees and gender roles within the community has been minimal. In total 49 refugee women have worked for the project as solar cooking trainers in different phases of the project. This has provided them an active role and a small income for a short period of time.

1. Methodology

The organised data collection in the field for the solar cooker project review was done from 1-6 September 1998 in Aisha camp using qualitative research methods such as observation and interviews. The evaluation team walked around the different sections of the camp to see if and how the cookers were used, and interviewed solar cooker recipients. Individual and group discussions were held with the project staff (assistants and trainers), women's and youth committee members, and the camp representative of the government implementing partner, ARRA. The evaluators had also discussed the programme previously with UNHCR representatives in RLO Addis Ababa and in Sub-Office Jijiga as well as with various SCI representatives.

2. Background Information

2.1 Socio-economic Situation[20]

Refugees in Aisha are generally poor and dependent on outside assistance. Due to the isolation of the camp, economic opportunities are limited, although it seems that some people are able to travel to Dire Dawa and Djibouti occasionally. Inside the camp, some locals and refugees are involved in small business activities such as selling items (vegetables, cloth, fuelwood etc.) in the market place. A few of the refugees have been given an opportunity to work for ARRA on a regular basis. They normally work for the health services either as community health agents or traditional birth attendants and earn around Br. 230 (US$ 31.72 in September 1998) per month. The women's committee of 7 members manages the small income women receive for making handicrafts and sewing clothes, sanitary pads, underwear and domestic items in the women's community centre in the camp.

A total of 49 refugees and 2 project assistants received a small income for working on the solar cooker project. At first 19 trainers worked for the project from March to May 1997. The second group of trainers then worked another 3 months, and the third group of trainers a further 3 months. The trainers were paid Br. 270 a month. In addition to the women trainers, 2 young men worked as project assistants from May 1997 onwards receiving Br. 350 a month. Stove recipients were chosen based on their low economic status and their motivation.

2.2 Dietary Habits

The poverty of those living in the camp and the isolation of the camp are illustrated by the dietary habits of the community. The refugees mainly cook the food given to them in the ration, although they sometimes cook other items such as pasta and potatoes. Meat is seldom eaten except by the better-off families. The general food ration consists of 400g of cereals (wheat), 25g of oil, 20g of sugar, 5g of salt and 30g of famix porridge for one person per day in Aisha.[21] Lunch is commonly cooked only for children, while the parents drink tea. The most common dishes are made from wheat (boiled grain, pancakes or porridge) and famix.[22]

The CooKit was known to cook particularly flavourful meat. However, the most common meal made with the cookers is boiled wheat grain for dinner (which in turn is the most common dinner prepared in Aisha).[23] For a family of 6 or under, a whole meal could be cooked, but for a larger family this was not possible with one cooker.[24] The solar cooker was liked by the women who already had one. In fact, every family seemed to want a cooker, as it was easy to use and store inside the home, and the food cooked with it could be left unattended. In addition the cooker was given out free of charge and came with a free aluminium pot.

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[20] See introduction to this evaluation, on population of Aisha refugee camp.
[21] Nutrition Officer, RLO Addis Ababa
[22] See also sub-report I, table 3, "refugee meal plan".
[23] Better- off families can also cook other items, but most of the refugees in Aisha are poor and as mentioned generally cook food that comes from the ration. Any differences in dietary habits are due to economic, as opposed to cultural, factors.
[24] Again, as noted in sub-report I, 6 is a theoretical maximum.

2.3 Gender-Based Division of Labour in Aisha

The women in Aisha are busy with domestic duties for most of the day, resting only in the hottest part of the afternoon, while the men are generally more idle and spend several hours chewing khat. Women and children are responsible for gathering fuelwood and water for domestic use, with the involvement of men for commercial sale. Collecting fuelwood is a time-consuming and arduous task for refugees, although many families have donkeys. Women and children from families without donkeys must leave the camp to collect the fuelwood several times a week. If a family has a donkey, normally only two journeys per month are required to fetch the fuelwood.

Still, the wood has to be collected from far away and women and children must sometimes spend one night in the bush. Drinking water can be obtained from the borehole in the camp, but women and children also collect water from natural sources (such as seasonal rivers) to wash their clothes. Some refugee families are able to buy fuelwood and charcoal, but many cannot. Women and girls are expected to do several other chores such as cooking, washing clothes and keeping the tukuls and the small yards around them clean. The community has not traditionally farmed the land, but some families have recently started small millet plantations in some areas in the camp. Both men and women have carried out the planting, but the women are expected to take care of the plantations.

3. Project Impact on the Lives of Women and Men

As mentioned earlier, there was no supply of cookers or plastic bags from September 1997 to August 1998. The first 554 beneficiaries (in 1997) received 2 plastic bags with the cookers and after one year they were given 2 additional bags. The 500 refugees who got the cookers in August 1998 were given 4 plastic bags. Because the plastic bags wore out easily, the refugees could have used the cookers for a maximum of 4 weeks, assuming regular use. It was also fairly common, especially among the first recipients, that the other plastic bag was saved for a "rainy day" (if they became ill, for instance).

As noted in sub-report I, most of those who received the cooker used it fairly regularly for supplementary cooking during the limited period until the distributed bags wore out[25]. The cookers added a useful supplement to the lives of refugee families for a short period of time, but their impact on the labour burden of women has been minimal.[26]

The implementation of the programme was community-based and refugee women and youth were given key roles. As described in the preceding sub-report, the assistants co-ordinated the programme together with the Solar Cooker Project Co-ordinator, and the trainers organised workshops where food was cooked with the solar cookers. The community became fond of the project, although there was substantial disappointment due to the supply problem. The project not only provided some additional income to the women trainers and the two youth assistants, but also gave them an opportunity to become more active and well known in their community. Unfortunately this participatory implementation of the programme did not enable it to meet its objectives, due to the above-mentioned

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[25] See sub-report I for the implications of weather conditions, family size, and amount of food cooked in pots.

[26] Editor's note: According to the former Solar Cooker Project Co-ordinator, who participated in this evaluation, while using the cookers families of 6 or under were generally able to reduce fuelwood collection by 50%. This is the Project Co-ordinator's own estimate, based on her monitoring of the project and the fuelwood collection practices of people in Aisha. Due to the technical problems outlined above, the cookers were used for only a short period of time, and the authors maintain that under these circumstances the project's impact on women's labour burden and their daily lives has been minimal. (Personal communications from Anu Eskonheimo, 4 - 5 October, 1998).

logistical and technical problems.

4. Concluding Remarks

See sub-report I for recommendations (developed by the domestic energy specialist in conjunction with the Associate Programme Officer for Women and Children and the Aisha Field Assistant).

It should be noted that the pilot project will be finished and the remaining materials will be distributed and promotional activities implemented. RLO Addis Ababa has agreed to finance this from the 1998 care and maintenance budget for eastern camps.

III. Sub-Report on Cost-effectiveness, Economic Impact and Sustainability
Lucy Emerton, Consultant, environmental economics

1. Methodology and Scope of Analysis

This sub-report compares basic financial and economic parameters for woodfuel and solar cookers. The aim of the analysis is to identify the financial and economic impacts of UNHCR/SCI's promotion of solar cookers in Aisha refugee camp, and to investigate whether these activities are likely to have proved cost-effective for UNHCR/SCI and economically sustainable for target populations.

The information upon which this report is based is partial and often of doubtful accuracy. There has been no substantive monitoring of the UNHCR/SCI project or of solar cooker use in Aisha on which to base analysis – data are largely speculative, and based on anecdotal evidence. Due to logistical constraints in the field, the environmental economics consultant was not permitted to visit Aisha, so all analysis is based on secondary data collected by other members of the evaluation team. Due to insufficient data all values are based on market prices. Aside from the costing of refugee labour and partial quantification of environmental costs, no shadow pricing has been carried out. All prices are calculated at 1998 dollar rates. At the time of writing 7.25 Ethiopian Birr was equivalent to 1 United States Dollar (US$).

1.1 Camp Population and Cooker Dissemination

There are 16,210 persons, in 2,421 households of average size 6.7, in Aisha refugee camp. By the end of 1998 it is planned that 2,054 solar cookers should have been disseminated, including 54 cookers disseminated as part of field trials in March 1997, 500 disseminated between June and September 1997, 500 in July and August 1998 and 1,000 planned to be disseminated up to the end of December 1998. The staggered phasing of cooker dissemination is described in section 3.1 below, and its implications for the total period of use of solar cookers over the project have been incorporated into financial and economic analysis of project impacts.

1.2 "With" and "Without Project" Situations

The baseline economic situation in this analysis refers to three types of woodfuel users, two of whom are differentiated by their means of fuel procurement. As illustrated in Table 1, three quarters of households, before the project, used fuelwood stoves only, of which 95% collected and 5% purchased all their fuel. A fifth of households used combined fuelwood and charcoal stoves, of which all purchased all their charcoal, 10% purchased and 90% collected their own fuelwood. 5% of households used charcoal stoves only, and all purchased their fuel. Average fuel consumption is 1.2 kg/capita/day for fuelwood stove users, 0.6 kg/capita/day fuelwood and 0.88 kg/capita/day charcoal for combined fuelwood and charcoal users, and 1.77 kg/capita/day for charcoal stove users. No households use improved stoves – the only energy-saving cooking method is the use of lids on pots; all households are assumed to use this method.

Table 1: Energy use and solar cooker dissemination in Aisha Refugee Camp

	Fuelwood	Fuelwood/charcoal	Charcoal	Total
% households using different energy sources	75	20	5	**100**
Of which:				
% collecting fuelwood	95	90	-	-
% purchasing fuelwood	5	10	-	-
% purchasing charcoal	-	100	100	-
Average fuel consumption without solar:				
Fuelwood (kg/capita/day)	1.20	0.60	-	-
Charcoal (kg/capita/day)	-	0.88	1.77	-
No. solar cookers disseminated	1,540	411	103	**2,054**
No. solar cookers used	1,078	288	72	**1,438**

Of the cookers disseminated, it is estimated from field observations that 60-80% are actually used – for cooking particular foods every day for 8 months of the year and for 5 days a week for the remaining 4 months of the year. Economic and financial analysis is carried out for all solar users – the 70%, or 1,438 households, who have continued to make use of the original 2,054 cookers disseminated. Users are assumed to combine solar cooker usage with their original cooking technology. The analysis thus deals with 1,078 fuelwood/solar users, 288 fuelwood/charcoal/solar users and 72 charcoal/solar users. Analysis is carried out at the level of both the project period of March 1997-December 1998 (for assessment of the project cost-effectiveness), and of annual costs and benefits of solar cooker use (for assessment of the economic impacts of solar cookers on refugee households and the local economy). The "without project" scenario refers basically to *after* the project, with no external assistance.

1.3 Financial and Economic Analysis

Three types of analysis are carried out in this report – cost-effectiveness analysis[27], economic impact analysis and identification of economic incentives and sustainability.

1.4 Cost-effectiveness Analysis

Analysis is made of project expenditures made by UNHCR and its implementing partner SCI and of the direct benefits to users from solar cookers. Analysis is based on the comparison of the financial costs of project implementation with direct savings in fuel costs and labour time to users, and is confined to the project period and population. Conclusions are drawn about whether UNHCR/SCI investments in solar cookers have been cost-effective in terms of direct, quantifiable benefits accruing overall, per recipient and per user.

1.5 Economic Impact Analysis

Analysis is made of the costs and benefits of alternative cooking technologies at the household and local economic level. Analysis is based on the comparison of labour and income benefits with financial outlays and opportunity costs of using traditional and alternative cooking technologies, and is applied to a scenario where no external assistance is provided. Conclusions are drawn about whether solar cookers are economically viable for

[27] In the terms of reference for the economist, cost-effectiveness analysis was identified as the comparison of financial outlays and economic benefits of interventions. It is worth noting that this actually extends beyond the scope of a conventional cost-effectiveness analysis, which would usually consider only the financial outlays associated with different means of achieving a given goal in order to determine the least cost option.

users and for local groups. Additional unquantifiable economic costs and benefits associated with use of solar cookers are also identified.

1.6 Identification of Economic Incentives and Sustainability

Based on cost-effectiveness and sustainability analysis, conclusions are drawn as to whether target populations have been provided with sufficient economic incentives to take up and continue to use introduced technologies over the long-term.

2. Summary of Findings: Financial and Economic Impacts of Solar Cookers

As illustrated in Table 2, although in purely economic terms the use of solar cookers leads to benefits at the household level and avoids environmental costs, over the project period these gains fail to outweigh project investment costs and losses in local income and employment. Overall the promotion of solar cookers by UNHCR/SCI has generated economic benefits which are less than project costs, resulting in a net loss of some US$ 62,061 over the project period.

Analysis of a "without project" scenario, where cookers are not provided free, demonstrates a net economic benefit to households using solar energy sources of between US$ 71-356 a year, and overall of US$ 164,402. For users, fuel savings are greater than the increase in cooking labour time and expenditure on equipment implied by solar cookers. Overall, although leading to losses in local income and employment, the uptake of solar cookers would have a positive economic impact of some US$ 106,794 a year due to environmental benefits and user savings in fuel.

Table 2: Summary of solar cooker financial and economic impacts

	WITH PROJECT SUPPORT	WITHOUT PROJECT SUPPORT	
	All users (US$/project)	All users (US$/yr)	Per household (US$/yr)
NET COST OR BENEFIT OF SOLAR COOKERS			
Expenditure on cookers	-106,624	-18,582	-13
User impact of cookers	106,200	182,984	127
Direct impact of cookers	**-424**	**164,402**	**114**
Impact of project on local income and employment	-80,891	-91,789	
Impact of project on environmental costs avoided	19,254	34,181	
Total economic impact of cookers	**-62,061**	**106,794**	
INCREMENTAL IMPACT OF SHIFT FROM FUELWOOD TO SOLAR			
Impact of household change in cooking labour time	-9,379	-16,650	-15
Impact of household change in fuel collection labour for fuelwood collectors	55,782	99,028	97
Impact of household change in fuel expenditure for fuelwood purchasers	4,760	8,451	157
Impact of household change in expenditure on cooking equipment	-7,850	-13,936	-13
Household impact	**43,313**	**76,892**	**71**
INCREMENTAL IMPACT OF SHIFT FROM CHARCOAL TO SOLAR			
Impact of household change in cooking labour time	-625	-1,110	-15
Impact of household change in fuel expenditure	15,574	27,648	385
Impact of household change in expenditure on cooking equipment	-523	-929	-13
Household impact	**14,425**	**25,609**	**356**
INCREMENTAL IMPACT OF SHIFT FROM FUELWOOD/CHARCOAL TO SOLAR			
Impact of household change in cooking labour time	-2,501	-4,440	-15
Impact of household change in fuel collection labour for fuelwood collectors	7,046	12,509	48
Impact of household change in fuel expenditure for fuelwood collectors	28,033	49,766	192
Impact of household change in fuel expenditure for fuelwood purchasers	4,384	7,783	271
Impact of household change in expenditure on cooking equipment	-2,093	-3,716	-13
Household impact	**37,370**	**61,901**	**215**

3. Cost-effectiveness for UNHCR/SCI

This section refers to costs and benefits accruing over the project period, March 1997-December 1998 – a "with project" situation.

3.1 Direct Expenditures by UNHCR/SCI on Solar Cooker Promotion

UNHCR/SCI will have spent a total of US$ 106,624 on the promotion of solar cookers in Aisha refugee camp by December 1998[28]. Over this period 2,054 solar cookers will have been disseminated, of which approximately 70% or 1,438 are likely to be actually used by recipients. As illustrated in Table 3, this translates into an expenditure per solar cooker by UNHCR/SCI of US$ 52 or an expenditure per solar cooker-using household of US$ 74.

[28] The solar cooking component of the project was supported with US$ 45,324, plus an additional overspend of US$ 3,000, from UNHCR. The cost-sharing contribution from SCI was US$ 38,300. The actual project period includes an extension over the time period originally envisaged.

Table 3: Costs of UNHCR/SCI promotion of solar cookers

	FY 1997	FY 1998	Total
UNHCR expenditure (US$)			48,324
SCI expenditure (US$)			58,300
No. solar cookers disseminated	554	1,500	2,054
No. solar cookers used	388	1,050	1,438
Expenditure per recipient household (US$)			**52**
Expenditure per user (US$)			**74**

Solar cooker dissemination has been, and will continue to be, staggered over the project period. A total of 554 cookers were disseminated in two phases during the financial year 1997, and an additional 500 cookers have been, and 1,000 will be, disseminated over two phases to the end of 1998. Taking into account this phasing and considering an actual uptake rate of 70%, this means that solar stoves will by the end of the project have been in use for a cumulative period equivalent to 810 household years, as illustrated in Table 4. In terms of actual uptake over this staggered dissemination period, project expenditures total US$ 132 per household year of solar cooker use.

Table 4: Length of use of solar cookers

	FY 1997			FY 1998			Project
	Mar	Jun-Sep	Total	Jul-Aug	Sep-Dec	Total	Total
Project costs (US$)							**106,624**
Project period (years)			0.5			1.0	**1.5**
No. cookers disseminated	54	500	554	500	1,000	1,500	**2,054**
No. cookers used	38	350	388	350	700	1,050	**1,438**
Average months each cooker in use over year	9.0	5.0		4.5	2.0		
Equivalent cumulative household years of use			174			636	**810**
Expenditure per household year of use (US$)							**132**

3.2 Fuel and Labour Impacts of Stove and Energy Activities on Beneficiaries

The direct impacts of solar cooker promotion on users include changes in household fuel consumption, cash expenditures and labour allocation. Household allocation of cash and labour to energy is described in detail in the next section, which looks at the economic impacts of project activities on refugees; the paragraphs below summarise these data.

As illustrated in Table 5 the potential benefits of solar cookers in terms of fuelwood savings are significant, leading to a decrease in woodfuel energy consumption of up to 25% a year[29]. Given actual solar cooker uptake and annual periods of use, this translates into a maximum saving of 7,107 m^3 of roundwood a year, equivalent to the sustainable yield of approximately 4,738 ha, or the full utilisation of 1,941 ha, of natural woodland.

[29] This reduction corresponds with other estimates of woodfuel savings. SCI itself states that use of solar cookers can save 30-50% of annual fuelwood consumption (probably an upper estimate), and the environmental consultant on this mission estimates charcoal and fuelwood savings of 10-20% with poorer households stated as being more likely to use solar cookers and to achieve greater savings (probably a lower estimate.)

Table 5: Change in fuel demand resulting from solar cooker use

	Fuelwood (per household/yr)			Charcoal (per household/yr)			Fuelwood+charcoal (per household/yr)			Whole project (all recipients/project period)		
Fuel demand	**Before**	**After**	**Impact**	**Before**	**After**	**Impact**	**Before**	**After**	**Impact**	**Before**	**After**	**Impact**
Fuelwood (kg)	2,933	1,039	**-1,894**	-	-	-	1,466	519	**-947**	5,376,145	4,072,361	**-1,303,784**
Charcoal (kg)	-	-	-	4,318	1,529	**-2,788**	2,159	765	**-1,394**	1,396,744	1,058,015	**-338,728**
Roundwood (m3)	7.52	2.66	**-4.86**	47.97	16.99	**-30.98**	27.75	9.83	**-17.92**	29,304	22,198	**-7,107**

Because solar cooker technology implies a shift in energy use away from woodfuel and the use of a different type of cooking technology, solar cookers also lead to changes in the labour and cash costs of procuring fuel and the amount of labour allocated to cooking. As illustrated in Table 6, although annual woodfuel requirements decrease with the use of solar cookers, household cooking labour requirements rise by nearly a third. This rise in labour occurs because the considerably longer time it takes to cook foods on a solar stove means that, although the frequency and period of each individual attendance during cooking is probably less time-consuming than that required for woodfuel stoves, women must make more visits to the solar stove to check food and move panels than is necessary under the shorter period it takes to cook foods on woodfuel stoves. These changes are described in detail in the following section of this sub-report.

Table 6: Labour and cash requirements of different cooking technologies

Per household	**Fuelwood**	**Fuelwood/ charcoal**	**Charcoal**	**Fuelwood +solar**	**Fuelwood /charcoal+solar**	**Charcoal +solar**
Cooking labour (hours/day)	0.9	0.9	0.9	1.1	1.1	1.1
Fuelwood requirement (kg/year)	2,933	1,466	-	1,039	519	-
Charcoal requirement (kg/year)	-	2,159	4,318	-	765	1,529

Taking into account the project length, dissemination phases and uptake rates, the proportion of households using different cooking technologies and frequency of solar cooker use, the project has led to a total positive impact at the household economic level of some US$ 106,200, or between US$ 62-251 per household, as illustrated in Table 7. This economic benefit is comprised of savings in the labour and cash costs of fuel procurement (fuelwood retails for a price of US$ 0.08/kg, charcoal has a market price of US$ 0.14/kg and the labour costs of fuelwood collection are approximately US$ 0.05/kg; these prices are described in detail in the next section of this sub-report). These benefits outweigh the economic loss (of approximately US$ 12,505) implied by increased cooking labour requirements under solar cooking.

Table 7: Project benefit or cost to households of switching to solar cookers for actual users

	Fuelwood to solar	**Charcoal to solar**	**Fuelwood+charcoal to solar**	**Total project**
Cooking labour (US$ all users)	-9,379	-625	-2,501	**-12,505**
Labour collection costs (US$ all users)	55,782	-	7,046	**62,828**
Market purchase costs (US$ all users)	4,760	15,574	32,417	**52,751**
Impact on fuelwood collectors (US$/household)	**46**	**-**	**127**	**62**
Impact on fuelwood purchasers (US$/household)	**80**	**251**	**144**	**171**
Total impact (US$)	**51,163**	**18,075**	**36,962**	**106,200**

3.3 Cost Effectiveness for UNHCR/SCI

Use of solar cookers gives rise to a direct net economic benefit for users. Taking into account the investment made by UNHCR/SCI and actual levels of uptake and use, project activities to promote solar cookers have resulted in a small negative impact of US$ 424, as

illustrated in Table 8. This loss, combined with the relatively high expenditure of US$ 132 per household year of solar cooker use, casts doubts as to whether the project can be deemed to have been cost-effective. At over 10 times the annual purchase price of solar equipment per user of US$ 12.92, the project has been a very expensive means of promoting solar energy use. The problems encountered during the project, and the apparent unwillingness of refugees to take up the full use of solar cookers,[30] further call into question the cost-effectiveness of UNHCR/SCI activities in Aisha, and are discussed below.

Table 8: Direct costs and benefits of UNHCR/SCI energy programme 1997-98

	Benefit/cost (US$ over project period)
UNHCR/SCI costs	-106,624
Total user impact	106,200
Direct impact of project	**-424**
Expenditure per household year	**132**
Net cost/benefit of project	**-424**
Net cost/benefit of project per household user	**-0.30**

4. Economic Impacts for Refugee and Local Populations

This section refers to the annual costs and benefits of solar cookers for users under a scenario where no external support is provided – a "without project" situation.

4.1 Household Labour and Expenditure Costs Associated with Energy Options

Uptake of solar cookers has an impact on the time and cash allocated by households to fuel procurement and cooking. Although the use of solar cookers substantially reduces fuel requirements, comprising savings in the cash and labour costs of energy procurement, it increases slightly the amount of household labour required for cooking. The economic impacts of these effects are described below.

Because solar cookers reduce woodfuel demand they give rise to savings in the labour and cash costs of procuring fuelwood and charcoal. Fuelwood retails for US$ 0.08/kg and charcoal US$ 0.14/kg in Aisha. Women spend on average 18.5 hours a week collecting sufficient fuelwood (56 kg) to satisfy household needs, translating into a labour cost equivalent to US$ 0.05/kg[31]. As illustrated in Table 9, the lower woodfuel requirements when solar cookers are combined with fuelwood and charcoal stoves lead to significant savings at household level. Solar cooking leads to savings in labour worth between US$ 48-97/year for households who collect their own wood, and reduces cash expenditures by between US$ 271-385/year for those who purchase both wood and charcoal.

[30] Editor's note: as noted in sub-reports I and II, those who have the cooker and bags do use it frequently, but basically for small or supplementary cooking jobs.

[31] Little information is available about income-earning opportunities for women in Aisha. The only available data is for women employed on activities attached to the UNHCR/SCI project, who earn Br 270/month. As these opportunities are limited, the shadow price of women's labour has been assumed to be half this amount, US$ 0.90/day or US$ 0.16/hour.

Table 9: Labour and cash requirements for fuel procurement for energy options

	Fuelwood	Fuelwood/ charcoal	Charcoal	Fuelwood+ solar	Fuelwood/ charcoal+solar	Charcoal +solar
Fuelwood requirement (kg/year/hhold)	2,933	1,466	-	1,039	519	-
Charcoal requirement (kg/year/hhold)	-	2,159	4,318	-	765	1,529
Labour cost of fuelwood (US$/year/hhold)	150	75	-	53	27	-
Market cost of fuelwood (US$/year/hhold)	243	121	-	86	43	-
Market cost of charcoal (US$/year/hhold)	-	298	596	-	105	211

Solar cookers require relatively more time to attend to cooking than do woodfuel stoves, because of the longer time food takes to cook on them. Although they do not require continuous attendance, solar cookers must occasionally be visited and have their panels turned over a longer cooking period than woodfuel stoves. It is assumed that foods cooked on solar cookers require attendance for 2.5% of total cooking time, while labour requirements for food cooked using woodfuel stoves comprise 10% of total cooking time. While solar cookers require less preparation time than woodfuel stoves (an average of 5 minutes per meal compared to 10 minutes per meal for woodfuel), the use of combined energy sources increases preparation time per meal, because two types of stoves must be prepared.

As illustrated in Table 10 the length of time taken for food to cook using combined solar and woodfuel energy sources is far higher, by a factor of four, than cooking times for woodfuel stoves alone. Taking into account the types of foods which can be cooked using solar energy (tea, pasta/rice and wheat grain), and actual periods of use of solar cookers (every day for 8 months of the year, and 5 days a week for 4 months of the year), the use of solar cookers increases average daily cooking labour requirements by almost a third over woodfuel energy sources, from 0.85 to some 1.12 hours a day.

Table 10: Cooking times and labour requirements for energy options[32]

		Woodfuel		Solar+woodfuel	
		Total cooking time (minutes/day)	Labour requirement (average hours/day)	Total cooking time (minutes/day)	Labour requirement (average hours/day)
Morning	Preparation		0.17		0.24
	Tea	15	0.03	120 (solar)	0.05
	Pancake/porridge	15	0.03	15 (woodfuel)	0.03
Noon	Preparation		0.17		0.24
	Tea	15	0.03	120 (solar)	0.05
	Pancake	15	0.03	15 (woodfuel)	0.03
	Pasta/rice	30	0.05	180 (solar)	0.07
Evening	Preparation		0.17		0.24
	Wheat grain	90	0.15	360 (solar)	0.14
	Njera and sauce	30	0.05	30 (woodfuel)	0.05
Total		**210**	**0.85**	**840**	**1.12**

Solar cooking thus has a negative economic impact at the household level in terms of increased cooking labour requirements. As illustrated in Table 11, the cost of these increased labour requirements is some US$ 16/household/year.

[32] Labour requirements for solar/woodfuel energy use are averaged over the year, taking account of periods when solar cookers are not used at all.

Table 11: Cooking labour costs for energy options

	Woodfuel	Woodfuel+solar
Cooking labour (hours/day/hhold)	0.9	1.1
Cooking labour cost (US$/year/hhold)	48	64

Taking into account these labour and cash expenditure impacts, switching to solar cookers gives rise to an economic gain at the household level under all combinations with woodfuel energy. As illustrated in Table 12 the use of solar cookers yields net benefits for households of between US$ 81-369 a year. These benefits are relatively higher for households who cook on charcoal and purchase woodfuel, because of the greater cash savings involved in switching to solar cookers.

Table 12: Household labour and cash impacts of solar cookers

	Fuelwood to solar	Charcoal to solar	Fuelwood+charcoal to solar
Cooking labour (US$/hh/yr)	-15	-15	-15
Labour costs of fuelwood collection (US$/hh/yr)	97	-	48
Market costs of charcoal purchase (US$/hh/yr)	-	385	192
Market costs of fuelwood and charcoal purchase (US$/hh/yr)	157	385	271
Fuel and labour costs fuelwood collectors (US$/hh/yr)	**81**	**-**	**225**
Fuel and labour costs fuelwood purchasers (US$/hh/yr)	**141**	**369**	**255**

4.2 Investment in Solar Cookers Equipment

Without the external assistance provided by UNHCR/SCI, uptake or continued use of solar cookers requires an investment by households in stoves and related equipment. Solar cookers imply several recurrent costs including the purchase of cookers themselves, bags and pots. Fuelwood cooking requires no special equipment. Although charcoal cooking requires the purchase of manufactured stoves, no information is available as to their cost. As the uptake of solar cooking has no incremental impact on investment in charcoal cooking equipment – the same expenditures will be made whether or not solar cookers are also used--these costs have been excluded from calculations.

As illustrated in Table 13, using field estimates of the local purchase price of stoves, bags and pots, the equipment required for solar cooking implies annual costs of some US$ 12.92/household/year.

Table 13: Costs of solar cooker equipment[33]

	Cost/item (US$)	Requirement (no/household)	Replacement interval	Annual cost (US$/hhold)
Cooker	6.35	1	1 year	6.35
Bag	0.08	1	1 week[34]	4.16
Pot	4.83	1	2 years	2.41
Total				**12.92**

[33] Editor's Note: these are Addis prices, assuming purchase in Nairobi plus air freight and clearing.
[34] Although each bag should last 2-3 months, field observations suggest that bags rarely have a lifespan of more than a week.

4.3 Income and Employment Impacts

In addition to the direct economic implications of solar cookers for users, switching from woodfuel to solar energy sources has a number of wider effects on the local economy. While solar cooking, by reducing the demand for purchased energy has a negative impact on existing fuelwood and charcoal sellers, it also provides opportunities for income generation from the production and sale of solar cooking equipment.

No information is available about the number of woodfuel sellers in Aisha, or their estimated income. Based on existing levels of woodfuel purchase and the price of women's labour (described in sections above) to calculate income from woodfuel sales, and assuming a 10% profit margin for male producers and sellers of equipment who have income-earning potential equivalent to that of brick makers (the only male employment opportunity in Aisha for which data is available), the continued use of solar cookers would have a substantial negative impact. As illustrated in Table 14, loss of woodfuel income and employment arising from the uptake of solar cookers gives rise to a net local economic cost associated with solar cookers of some US$ 93,648 or 402 full-time employment opportunities a year while potential income earned from solar equipment sales is equivalent to only US$ 1,858 or one full-time employment opportunity.

Table 14: Local income and employment impacts of solar cookers

	Before		After		Impact	
	Income (US$/yr)	Full time employment (persons)	Income (US$/yr)	Full time employment (persons)	Income (US$/yr)	Full time employment (persons)
Woodfuel	145,012	623	51,364	221	-93,648	-402
Equipment	-	-	1,858	1	1,858	1
Total	**145,012**	**623**	**53,222**	**222**	**-91,789**	**-401**

4.4 Environmental Costs of Fuel Procurement

Field observations suggest that the use of woodfuel biomass energy sources may have negative environmental impacts. There is some evidence that unsustainable fuelwood and charcoal harvesting has led to the depletion of natural woodlands around Aisha refugee camp, in particular in riverine areas. In turn, loss of woodland gives rise to both local and off-site impacts caused by declining ground cover and soil-holding capacity, land degradation and soil erosion. Woodland degradation may also have wider environmental effects linked to the loss of natural habitat and biodiversity. Most of these environmental costs are unquantifiable on the basis of available data.

Work has been carried out on the environmental economic impacts of natural woodland loss under similar ecological and socio-economic conditions in neighbouring Eritrea (Emerton, 1998). These figures can be modified for the case of Aisha. Two methods are used to quantify the economic impacts of environmental degradation arising from deforestation: the costs of replacing lost natural woodlands by replanting trees and carrying out soil and water conservation activities in degraded areas, and the effects on pastoralist livestock production (the predominant land use in the Aisha region) of rangeland degradation through loss of vegetative cover and soil erosion.

Annual rates of soil loss in grazing lands and rangelands similar to those surrounding Aisha refugee camp resulting from the loss of natural woodland have been estimated to be in the region of 15 tonnes/ha/year, leading to a decline in livestock productivity of some 0.05-0.1% per year. It is estimated to cost some Br. 7,602 over a period of 30 years to restore one hectare of degraded natural woodland. As illustrated in Table 15, economic costs

associated with the environmental degradation resulting from loss of natural woodland cover therefore range between a minimum of US$ 0.27/ha/year (their effect on pastoralist production) and a maximum of US$ 35/ha/year (the replacement cost of reforestation, soil and water conservation works).

Table 15: Environmental costs arising from woodland loss

Effect on pastoralist livestock production	
Stocking density (TLU[35]/ha)	0.1
Returns to livestock (Birr/TLU/yr)	260
Returns to land (Birr/ha/yr)	2,600
Erosion-related livestock productivity loss (%)	0.075
Erosion-related productivity loss (Birr/ha/yr)	1.95
Erosion-related livestock productivity loss (US$/ha/yr)	**0.27**
Replacement cost of woodland	
Costs of reforestation, soil and water conservation (Birr/ha over 30 years)	7,602.0
Cost of reforestation, soil and water conservation (US$/ha/yr)	**35.0**

Assuming a standing woody biomass of 6.5 m^3/ha natural woodland, and taking the mid-point of these estimates, the positive environmental impact of decreased woodfuel use implied by the use of solar cookers may represent economic costs avoided of some US$ 34,181 a year, as illustrated in Table 16.

Table 16: Economic impacts of unsustainable fuelwood utilisation and introduction of solar cooking technologies

	Woodfuel	Woodfuel+solar	Impact
Fuelwood consumption (kg/yr)	3,584,097	1,269,514	**2,314,583**
Charcoal consumption (kg/yr)	931,162	329,825	**601,338**
Roundwood demand (m^3/yr)[36]	19,536	6,920	**12,616**
Equivalent woodland clearance (ha/yr)	3,006	1,065	**1,941**
Economic cost of woodland clearance (US$/ha/yr)	17.61		
Environmental economic impact (US$/ha/yr)	**52,929.2**	**18,747.9**	**34,181**

4.5 Economic Viability of Stove and Energy Activities for Refugee and Local Populations

Analysis suggests that, on purely economic grounds, solar cookers are economically viable for users over woodfuel energy sources alone. As illustrated in Table 17 the use of solar cookers in combination with existing fuelwood and charcoal stoves gives rise to benefits at the household level of between US$ 68-356 a year, and under a scenario of continued use could lead to economic gains of US$ 164,402 a year for all existing solar users in Aisha refugee camp. Use of solar cookers also avoids environmental costs through decreasing the rate of natural woodland degradation, worth a minimum value of US$ 34,181/year in terms of costs avoided under current levels and combinations of energy use. Although the uptake of solar cookers is clearly not viable for woodfuel sellers, because it may lead to a net loss of some US$ 91,789 or 401 employment opportunities, environmental and household-level benefits outweigh this cost by a factor of more than two.

[35] Tropical livestock units, including camels, cattle, sheep and goats.
[36] One cubic metre of roundwood produces approximately 600 kg dry fuelwood or 90 kg of charcoal; the conversion factor of wet:dry fuelwood is 1:0.65.

Table 17: Economic impacts of solar cookers

Per household impact/year	Fuelwood to solar (US$/yr)	Charcoal to solar (US$/yr)	Fuelwood+charcoal to solar (US$/yr)	Total all users (US$/yr)
Household level:				
Fuel and labour costs fuelwood collectors	81	-	225	141,489
Fuel and labour costs fuelwood purchasers	141	369	255	41,495
Equipment costs	-13	-13	-13	-18,582
Total household costs fuelwood collectors	**68**	**-**	**212**	**124,904**
Total household costs fuelwood purchasers	**128**	**356**	**242**	**39,498**
Total household impact				**164,402**
Local level:				
Local economic costs				-91,789
Environmental costs				34,181
Total local impact				**-57,608**
Total economic impact				**106,794**

5. Economic Incentives and Sustainability

Given the apparently high household economic gains associated with solar cooker use, it is initially surprising that their uptake is partial. However, if field observations accurately represent actual conditions and uptake levels, a relatively high proportion of the recipients of solar cookers – 60-80% – have taken up their use in situations where climate and food types are suitable. This, in combination with the clear savings in woodfuel cash and labour costs, suggests that refugees have some economic incentive to continue to use solar cookers where climatic conditions and food types permit. It is worth noting, however, that economic incentives alone are not sufficient to ensure the uptake of solar cookers – many other social, cultural and practical factors may in fact be more important determinants of energy use and cooking technologies.

The major issue in terms of economic incentives and sustainability is the cash and labour costs associated with solar cookers. The profitability of solar cookers is dependent on the large economic savings they generate for users in terms of decreased woodfuel use relative to their investment cost and increased requirements for cooking labour. Changes in the purchase price of solar cookers, price of women's labour and market price of fuelwood and charcoal all affect the economic viability of solar cookers. These parameters would however have to change drastically to make solar cookers economically unattractive to households. As illustrated in Table 18, where other factors are kept constant, the rise in women's wages required to increase the cost of additional cooking labour sufficiently to make solar cookers unprofitable, the decrease in woodfuel prices required to offset additional cooking labour and investment in equipment and the rise in solar equipment prices required to balance woodfuel savings, are enormous, and unlikely ever to occur without substantial external manipulation.

Table 18: Sensitivity of the profitability of solar cookers to changes in the price of women's labour, woodfuel and solar equipment

	Current price (US$)	Price under which solar cookers would become economically undesirable for users (US$)		
		Fuelwood	Charcoal	Fuelwood/charcoal
Women's labour	0.90/day	5.20	22.50	13.80
Woodfuel	0.05-0.14/kg	0.015	0.011	0.012
Solar equipment	12.92/set	85.27	369.51	228.68

Non-economic factors and practical considerations are likely to be of more relevance to the

sustainability of solar cookers and incentives for their uptake. Social and cultural incentives and disincentives to solar cooker use are discussed in the preceding sub-reports. Practical considerations influencing the uptake of solar cookers, however, have a strong economic component, and are mainly to do with the accessibility of solar equipment to refugees. Two major factors influence the accessibility of solar equipment: the logistics of procurement and local marketing, and whether refugees have sufficient cash to purchase equipment.

The project has faced severe and recurrent difficulties in procuring and transporting solar equipment to Aisha refugee camp. Under a scenario where external assistance is discontinued these difficulties are likely to increase still further, and it is extremely doubtful whether any solar cookers at all can be made available. All the solar equipment used for the project has been imported, and has been subject to long delays clearing Ethiopian customs. There is no reason to suggest that solar equipment will be any easier to import in the future, especially if relying on private traders who may have less influence than UNHCR and SCI. Even if equipment is not imported (solar stoves and their component parts could, potentially, be locally manufactured and procured), it is also unclear whether sufficient interest exists among local traders and producers. There is little demonstrated market for solar cookers in Ethiopia, and no manufacturing facilities or markets are present in or near Aisha. The inaccessibility of Aisha and the relatively small scale of production and trade, even if all refugees were to take up the use of solar cookers, decreases the likelihood of private manufacture, procurement and marketing and casts further doubts as to whether activities can ever be sustainable without external assistance.

A second, linked, issue is the willingness and ability of refugees to pay for solar cookers. It is not clear whether the price of solar equipment would rise under a situation where they were locally manufactured, procured and marketed; although local manufacture prices are in theory competitive with imported costs, the small-scale of production and distance of Aisha from major centres and subsequently high transport costs may increase prices substantially. At current prices, solar equipment may still be unaffordable to refugee households. While field observations suggest that refugees do have disposable income, this does not guarantee that they will be willing to purchase solar cookers. Even if refugees have access to markets and sufficient cash income, both of which are a large assumptions, it is unlikely that solar cookers, in contrast to other investments such as house construction or livestock purchase, would be considered a priority for household expenditure.

Field evidence suggests that these additional non-economic, production and procurement factors will in fact prove sufficient to offset any potential household-level economic gains associated with solar cooking, and has meant both that refugee households have inadequate incentives to take up solar cookers permanently and that solar cookers are unsustainable over the long-term.

6. Conclusions: Economic Evaluation of Solar cookers

Financial and economic analysis suggests that the UNHCR/SCI project to promote solar cookers may have little long-term impact on either refugee economic welfare, energy status or environmental conditions in Aisha. Although the potential economic and environmental savings from the use of solar cookers are significant, it is doubtful whether these have been – or are ever likely to be – achieved. Solar cookers, in theory an economically viable and environmentally sound cooking technology, have not been a successful or acceptable energy source in Aisha camp and are unlikely to be sustainable in the future. The project has provided a large, and high-cost, subsidy to activities which are unlikely to lead to anything more than a very short-term change in energy consumption and cooking patterns.

It is not surprising that solar cookers demonstrate a potential economic gain to households, because they replace woodfuel, an energy source with high recurrent cash/labour costs, with solar, which is free. Potential economic and environmental savings are however not enough to ensure that solar cookers are taken up. Field evidence suggests that the practical constraints regarding equipment manufacture and procurement, and possible cultural and social barriers, are of far more importance to the Aisha project and to the uptake of solar cookers. However great the economic potential of a cooking technology is, it will fail if the necessary logistical support and equipment are not available. The project has been an expensive way of finding out that a number of largely non-economic problems have constrained solar cooker usage – and surely could have been predicted beforehand.

Financial and economic analysis suggests that while woodfuel may be a major constraint for refugees, and that unsustainable fuelwood and charcoal production may be leading to local environmental degradation, the promotion of solar cookers has not been an appropriate means of addressing these problems. The project has been an expensive way of attempting to improve the energy situation in Aisha, and almost definitely will be unsustainable in the future.

7. Recommendations

- Woodfuel scarcity and environmental degradation may be far better addressed through other means than the promotion of solar cookers.
- As it seems likely that refugees will continue to cook primarily using woodfuel sources – even if they also take up the use of solar cookers – project activities targeted at fuelwood and charcoal energy use may be more appropriate in Aisha, and would be a more obvious and direct means of addressing woodfuel-related problems.
- In addition to, or instead of, the promotion of solar cookers, any future energy activities might be better directed at managing the demand for woodfuel (such as through the promotion of energy-conserving cooking practices and technologies), and of more sustainable and efficient woodfuel harvesting and production methods; and improving the sustainable supply of woodfuel (such as through the establishment of nurseries and woodlots at the household or camp level).

Appendix A: Mission Timetable

31 Aug 1998	Arrival in Addis Ababa at 11.00 from Nairobi. Meetings with Women and Children Officer and Environmental Planner at RLO Addis. Review of project files.
1 Sep	Flight to Dire Dawa, rendez-vous with Field Assistant, purchase of supplies and travel to Aisha.
2 Sep	Introductions at ARRA office. Visit to camp. Block tour to observe cooking. Meetings with youth and women's committee.
3 Sep	Review of project files held by solar assistants. Demonstration of mud-stove construction for youth group. Block visits to see solar cooking and interview beneficiaries. Meeting with youth committee.
4 Sep	Further block visits and meetings with solar trainers.
5 Sep	Morning wrap-up meeting with ARRA Acting Co-ordinator. Final visit to camp. Drive to Dire Dawa.
6 Sep	Report writing. Flight to Addis Ababa
7 Sep	Report writing at RLO Addis. Meeting with briquetting expert from Addis Ababa University, at request of Senior Regional Advisor (Refugee Women).
8 Sep	De-briefing with Senior Regional Programme Officer. Departure for Nairobi at 12.00.

Appendix B: Persons Consulted During Mission

UNHCR
Mr Vincent Chordi, Senior Regional Programme Officer, RLO Addis
Dr Amare G-Egziabher, Environmental Planner, RLO Addis
Mr Kefelegn Asrat, Asst. Programme Officer (Agriculture & Forestry), RLO Addis
Ms Anu Eskonheimo, Assoc. Programme Officer for Women and Children, RLO Addis
Mr David Jamieson, Asst. Representative (Programme), RLO Addis
Ms Amina Ahmed, Field Assistant, Aisha Camp

ARRA
Mr Eyob Awoke, Acting Camp Co-ordinator, Aisha

Aisha Camp
Elmy Farah, Solar Assistant
Farah Musse, Solar Assistant
Bashir Haji Ali, Leader of Youth Committee, with members of youth committee
Members of women's committee
Various refugee families, on camp tours

Appendix C: Project Timetable

Key dates in the project's history are summarised as follows:

1996

Feb	Project idea formulated by UNHCR Environment Unit and presented to SCI.
Mar/Apr	SCI scoping mission to Ethiopia, including first field trials in Aisha camp. Confirmation of interest.
Dec	Planning mission to Jijiga by Christopher Talbot, UNHCR Environment Unit. Project outline finalised. Funding proposal developed.

1997

Feb/Mar	Aisha Baseline Energy Survey conducted by Matthew Owen, UNHCR Environment Unit consultant.
Mar/Apr	Project start-up. Field visit by SCI team, including Bev Blum, Faustine Odaba and Louise Meyer. Initial training of trainers. Food donated by WFP
Apr	Consultant Project Co-ordinator recruited (Amina Ahmed).
May	Further donation of food by WFP for training workshops.
Jun	First batch of cookers started to arrive. Full-scale training programme underway.
Jun	Africa Refugee Day celebrations used to promote solar cooking through song and drama.
Jul	Assessment visit by Faustine Odaba of SCI Kenya.
Jul	Solar Cooker football team won camp competition against ARRA side.
Aug/Sep	Completion of cooker distribution.
Oct-Dec	Further training workshops (no more cookers distributed).

1998

Jan	Plastic bags cleared from Customs. Cookers and pots still held.
Feb	Visit to Addis by Bev Blum from SCI to seek continuation agreement.
Apr	SCI follow-up visit (Faustine Odaba, Margaret Owino and Edwin Pejack). Experiments with mylar cuffs instead of plastic bags for *CooKit*. Supply of funds from SCI for project to go ahead.
May 8	Second batch of panels, pots and bags arrived in Aisha. Project Co-ordinator on maternity leave. Distribution delayed 2 months.
Jul	SCI follow-up visit (Faustine Odaba).
Jul/Aug	Second batch of panels and pots distributed, with replacement bags for previous recipients.
Sep	Review mission.

Appendix D: Reference Materials

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