REFUGEE CAMPS AND SOLAR COOKERS

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Solar cookers, when used as part of an integrated cooking system, have the potential to significantly reduce the amount of wood, charcoal, kerosene and bottled cooking gas used by tens of millions of refugees and internally displaced persons sheltering in camps around the world. *(Note: The term "refugee" refers to those who have left their homes and their country to seek shelter. The term "internally displaced person" (IDP) refers to those who have been forced to leave their homes but have sought shelter inside the borders of their own country.)*

Over the past three decades, the United Nations High Commission for Refugees (UNHCR) has worked with NGOs including Solar Cookers International to introduce a variety of solar thermal cookstoves into refugee and IDP camps. Although none of these efforts have resulted in the long-term or permanent adoption of zero emission solar cooking technology, refugees have reported the following advantages from using a solar cooker:

1. Panel and box solar cookers can be left unattended while food cooks or water simmers.
2. Panel and box solar cookers present no fire danger around small children.
3. Money is saved and dangerous trips outside the camps by women and girls are reduced due to the need for less firewood when solar cookers are used on a regular basis.
4. Parabolic solar cookers can generate heat as hot as an open fire and can be used for frying and fast boiling. They can also be used in very cold weather.
5. No smoke is produced during the cooking process with a solar cooker.

Studies of solar cooker projects in refugee camps have found that the following issues contribute to the lack of long-term adoption of solar cookers:

1. The absence of durable, affordable, easy-to-use solar cooking devices designed for harsh desert conditions: See this YouTube Video for details.
2. An insufficient understanding of local cooking habits on the part of NGOs prior to the introduction of solar cookers.
3. The distribution by some NGOs of their organization's favorite solar cooker rather than the most appropriate solar cooker for a specific refugee population.
4. The lack of funding for long-term training and follow-up.
5. The lack of funding for monitoring and evaluation that can produce the data needed to improve future projects.
6. The decision by some organizations to introduce solar cookers as a replacement for wood stoves rather than as part of an integrated cooking system, including the construction and use of retained heat containers.
7. The lack of long-term coordination and support by an on-site organization.

8. A reduction in economic incentives for refugees to use solar cookers when government aid organizations provide adequate free fuel (firewood/paraffin) at the same time solar cookers are being introduced into the camps.

Although the international development community and the fossil fuel industry have spent tens of millions of dollars over the past decade on R&D and the marketing of wood-burning and other combustion stoves including liquefied petroleum gas (LPG) stoves, there has been almost no funding for similar research to increase and improve the available selection of solar thermal cooking devices. Individual developers and a few universities are currently experimenting with new solar cooker designs and heat retention devices, however without significant R&D funding from governments and the private sector, it will be decades before any of these zero emission solar cooking technologies are mass produced and made available to refugees and IDPs.

Surveys of those who have spent years in refugee camps indicate that a growing number of both men and women are away from home during the day to work and are thus unable to solar cook. Solar cooker designers, David Gordon Wilson of MIT, and Philip Anich are currently (2016) collaborating on the design of a tracking device to be used with Wilson's prototype Fresnel lens solar cooking device which can be left outside unattended during the day to heat a unit containing molten salt. In the evening the heating unit can be carried inside to provide a hot cooking surface for baking, boiling and frying. Like all solar cooker manufacturers and designers Wilson and Anich are seeking grants and investors to help finance their self-funded research.

PAKISTAN/AFGHANISTAN 1985-1995

The first introduction of solar cookers into refugee camps was in 1985 in Peshawar, Pakistan by the British NGO SERVE (*Serving Emergency Relief and Vocational Enterprises)*. For a detailed evaluation of the SERVE project and other early solar cooker projects in refugee camps please see the 1996 report "The Experience of UNHCR and Its Partners with Solar Cookers in Refugee Camps".

With funding from UNHCR, SERVE set up a manufacturing operation and began to distribute solar box cookers to Afghan families, who had sought refuge in Pakistan from the Afghan civil war and from the fighting that intensified after the Russian military invasion. These solar box cookers could hold four small cooking pots and reach 175 °C (350 °F) in the summer/ 140 °C (285 °F) in the winter. In 1989-90, UNHCR ended funding for the Pakistan project due to an internal financial crisis. SERVE continued to fund the project in Peshawar, Pakistan but eventually moved the operation to the city of Jalalabad in Afghanistan.

SERVE also introduced a less expensive "hole in the ground" version of the box cooker for use by Afghan IDPs living near Jalalabad. After receiving an additional $100,000 from UNHCR, SERVE supervised the installation of 5,700 "hole in the ground" solar box cookers in Afghanistan. By 1995 only one third of Afghan IDPs were still using their solar cookers. Reasons for this decline in usage included: 1. The straw used for insulation around the inner box rotted or became compressed; 2. The glass cover was not completely airtight; 3. The mud around the cookers cracked and; 4. The reflectors and liners became dirty. Finally, since the Afghan IDP population was mobile, they had to abandon their hole in the ground solar cookers each time they changed locations.

According to the 1996 UNHCR report[1], one of several reasons this introduction of solar cooking was less than successful was due to the fact that it required a 'radical change' in food preparation and cooking habits. This barrier could likely be overcome with longer periods of training as well as an ongoing system of local support for solar cooks. Another issue noted in the UNHCR report regarding the solar box cookers introduced into Pakistan was that although they could cook pots of rice and stew, they could not be used to make the Afghan's staple flat bread known as 'naan', which requires very high heat and a flat cooking surface.

The subsequent commercial development and mass marketing of parabolic solar cookers in India, Germany and China has provided a solution for the need to cook with high heat on a flat surface. A 2013 World Bank report titled Accelerating Household Access to Clean Cooking and Heating contains a detailed description of solar parabolic cooker manufacture and use in China.

KENYA/ETHIOPIA 1995-1998

Over the past two decades, the solar panel cooker known as the CooKit (*an open source design by Frenchman Roger Bernard that was first promoted in the 1990s by Solar Cookers International)* has been introduced into refugee camps in Kenya, Ethiopia and Chad. These projects have been funded by private donations with assistance from UNHCR. They have included the distribution of both manufactured and locally constructed cardboard and aluminum foil CooKits. Using the Cookit also requires the use of a heat resistant plastic bag to maintain and concentrate heat around the cooking pot. In the SCI/UNHCR-sponsored projects, refugees received free Cookits, plastic bags and cooking pots painted black with non-toxic paint.

[1] The Experience of UNHCR and its Partners with Solar Cookers in Refugee Camps *(needs to be added to the refugee wiki page)*

In 1995, Solar Cookers International began its first pilot project in Kakuma refugee camp. A serious energy shortage existed in Kakuma since UNHCR was only able to provide 20-25% of refugees' fuel wood needs. The 1996 UNHCR report includes a detailed evaluation of SCI's introduction of solar cookers into Kakuma Refugee Camp in northern Kenya.

In 1995, three Dadaab camps in eastern Kenya housed 100,000 refugees. In late 1996, UNHCR authorized additional solar cooker programs in collaboration with the German aid organization GTZ in the Dadaab camps. SCI provided 2,000 solar CooKits and training. In Dadaab, recipients were required to perform public service such as planting trees in order to receive a CooKit. One attempt at selling the CooKit to refugees was not successful. **Early evaluations by UNHCR acknowledged that each day of solar cooker use resulted in a measurable amount of firewood not consumed**. Other advantages noted were: lowering the harmful risk of smoky emissions from cooking fires; reducing the instances of burns by women and children; eliminating the need to scrub burned food from cooking pots; a reduction in water usage since solar cooked food requires no water (*meats, eggs, fruits and vegetables*) or less water (*rice, maize meal and beans*) than food cooked over a fire.

Complaints from the refugees included:
1.The slowness of the Cookit (*since they were accustomed to cooking over a fire and the CooKit worked like a crock pot*);
2. The fact that the CooKit couldn't be used on cloudy days (*another strong argument for introducing solar cookers as part of an integrated cooking system*);
3. The cardboard CooKit was not durable if it got wet from rain or spilled water and sauce;
4. The plastic bag had to be replaced every few days or weeks;
5. The erroneous assumption that refugees would provide their own cooking pots; and
6. The fact that the CooKit could not be used to prepare large quantities of food and it could only hold one pot.

UNHCR officials also expressed concern (*although no documented cases were cited)* about the potential for acts of violence against women by their husbands if the solar cooked food was not prepared properly and served on time. This concern should be measured against documented evidence of acts of violence against refugee women and girls who must travel far from their camps to gather wood. Because the lack of independent data made these projects difficult to evaluate, SCI agreed with UNHCR that

outside researchers were needed to validate these projects. SCI also noted that the cost of independent verification was prohibitive for most small NGOs.

A 1998 UNHCR report titled, "Solar Cooker – Ethiopia - Evaluation of Energy-Saving Options for Refugees" examined SCI's solar cooker project in Aisha, refugee camp, which was launched in March 1997. UNHCR had determined that the camp's small size, its remote location, high solar insolation and lack of firewood would make it a good location for solar cooker adoption. SCI's initial training sessions included demonstrations, group discussions, dramas and singing. The successful completion of this project was ultimately hampered by significant bureaucratic delays, including: a lack of managerial coordination, problems with transport, customs and accounting. These points are detailed in the UNHCR report. The lack of durability of the CooKit and the need to frequently replace the plastic bags was another major issue, which led to the eventual termination of the project. SCI's findings regarding the advantages and disadvantages of using the CooKit in the Ethiopian camps were similar to those found with its two projects in Kenya.

Significant advantages noted by the refugee women in Ethiopia, who had received adequate training in the use of the CooKits, were its ease of use and the fact that the pot could be safely left to cook unattended even around children since there was no fire danger. Another issue, which may have contributed to the project's lack of success, was that the solar cookers were not introduced as part of a community-based energy and environmental program but rather as a stand-alone project.

NEPAL 1998-2013

Between 1998 and 2013, the Varja Foundation Nepal, a Dutch-Nepali NGO introduced solar box cookers and later several thousand German SK-14 solar parabolic cookers into Bhutanese refugee camps in Nepal. By 2013 *(according to Varja officials*) some 85,000 refugees were routinely preparing their meals and heating water with their solar cookers. Precise data is not available on the rate of use or long-term fuel savings by the refugees. By 2015, more than 100,000 Bhutanese refugees had been resettled in other countries. Approximately 13,000 Bhutanese refugees remain in the camps although current data about their use of the solar cookers that were left behind is unavailable. There are unconfirmed reports from Varja that Nepalese families living near the abandoned camps are now using these solar cookers.

KENYA/NAMIBIA 2003-2005

In 2004, UNHCR sponsored the field-testing of German-made parabolic solar cookers in refugee camps in Kenya. A report from the German government's aide organization (GTZ now GIZ) states that, "Trained craftsmen assembled a total of 1,050 solar cookers in the Kakuma and Daadab refugee camps. The type of cooker corresponded to the German parabolic cookers SK10 and SK14. They were distributed to refugee families. Institutions such as schools, churches and hospitals were also given more than 70 cookers. In comparison with the CooKit these cookers could reach considerably higher temperatures and could also be used for frying."

According to the GIZ report, "Another pilot project was launched in 2003 at a refugee camp in Osire in Namibia. The camp was much smaller than the one in Kakuma, with about 12,500 refugees, most of whom came from Angola. Wood was the principal energy source, and for the most part was gathered from the vicinity of the camp. In addition the refugees received paraffin free of charge, not only for lighting but also for cooking purposes. **The paraffin distribution was to prove extremely counterproductive with regard to the use of solar cookers.**

"All in all 111 parabolic cookers of the SK9, SK10 and SK14 type were assembled by trained refugees. Interest in the new technology was great: after just three cookery demonstrations over 460 families had already had their names put down on waiting lists. So as not to raise expectations too highly and because of the limited number of solar cookers available, the demonstrations were then discontinued and the cookers were given out to selected families, who in return worked in communal gardens or other communal facilities."

"The unusual situation in refugee camps makes it easily possible to check the use of solar cookers. **Surveys showed that all of the typical meals that had previously been cooked using firewood could also be prepared on the new equipment.** Nevertheless, the traditional stoves continued to be used, while the solar cookers served as an additional option. Estimates in Kakuma indicated, however, that roughly **35 % of energy consumption could be saved** if the cookers were used as much as possible.

"The results of a comprehensive evaluation in Osire were initially encouraging: the families stated that they used the cookers on five or six sunny days each week. They said they liked the taste of the food prepared on a solar cooker, which did not have the 'flavor' of paraffin fumes; meat cooked 'à la solar cooker' was even considered a delicacy among the refugees. The users also praised the fact that solar cookers worked without generating smoke.

"Some families, moreover, proved themselves to be highly inventive. They used their solar cooker for **making soap** and thus generated income for themselves; others used them not only for cooking but also for **heating their clothes irons**, in order to save charcoal. Yet others used the parabolic cookers as **reflectors for lighting in the evening**, by positioning a candle at the place where the pot usually goes. Some poorer families sold the paraffin ration that they received from the UNHCR for cooking to wealthier families, while they themselves used their solar cooker. And not least, **the work of assembling cookers by trained refugees was an activity that they in their own words rated highly** as a meaningful change from the otherwise uneventful daily life in the camp.

"A closer investigation of the impacts on fuel consumption revealed, however, that only fewer than ten of 111 surveyed families used their solar cookers regularly, thereby achieving a saving of 40 %. The great majority cooked only occasionally by solar means, and some families gave up using the cookers in the course of the study or even right at the outset, **since they had access to free paraffin.** This applied in particular to the smaller models of cooker, while **the more powerful SK14 came off better.** Experience was similar in Kenya, where only about 10% of the families used their solar cookers regularly. **When an American aid organization (USAID) donated several million dollars in order to buy firewood for the refugees in Daadab, this brought solar cooking activities to an abrupt end."**

According to Valentine Ndibalema, UNHCR's senior technical officer for the environment, the introduction of the parabolic solar cooker model in Kenya was one of several unsuccessful UNHCR efforts over two decades to introduce solar cookers into refugee camps. Although there are no detailed evaluations of this project except for the summary in GTZ's Here Comes the Sun, the perception among members of the development community is that it was a failure. The frequently referenced photo of the aftermath of this project shows damaged solar parabolic cookers tossed into the sand. **As we now know from GTZ's report, the donation by USAID of a large quantity of firewood valued at several million dollars to the refugees ended their interest in solar cooking and allowed them to return to their traditional cooking methods long enough for the project to have been deemed a failure.**

Another possible reason for the refugees' return to using wood may have been the lack of stability of the various SK-models, which have a small base, cannot withstand strong gusts of wind, and must be dragged through the sand at least every thirty minutes to keep the focal point on the cooking pot. (*Note: Newer solar parabolic cooker models like the Sol Source and the Sun Chef have large tri-pod bases, which allow the parabolic dish to rotate freely. They are also more wind resistant since they can be staked to the ground*

and spun on their axis throughout the day.)

CHAD 2005-2016

The largest solar cooker project to date (also using the cardboard and foil CooKit) was started in 2005 in Iridimi Refugee Camp in eastern Chad by Derk Rijks of the Dutch NGO KoZon. Rijks also established the Chadian NGO, Tchad Solaire, to serve as the in-country sponsor of this solar cooker project. For a detailed account of the origins of this project see Rijks's paper, *The Use and Manufacture of CooKits in a Refugee Camp, Iridimi, Chad*.

In 2006 the Los Angeles, California-based non-profit Jewish World Watch (JWW) became the primary funder of the Chad solar cooker project. Over the next ten years, JWW provided more than a million dollars for the expansion of this project into other refugee camps in eastern Chad. In 2007, JWW officials traveled to Chad to conduct their first on-site visit. JWW's evaluation of the project reported significant fuel savings on the part of the refugees, who were using solar cookers assembled by refugee women at workshops inside the camps. Women were also taught to weave baskets and line them with blankets for use as retained heat containers. Refugee women in each zone in the camps were hired to serve as trainers and provide repair services and replacement plastic bags to the women in their sectors. UNHCR provided families with fuel-efficient Save 80 wood stoves.

A November 2009 paper from an independent onsite assessment of the solar cooker project in Touloum Refugee Camp in Chad evaluated the ongoing use of solar cookers by refugee families. That paper cited the lack of durability of the CooKit as an issue that needed swift resolution and recommended the use of more durable panel or box solar cookers. The 2009 report also noted that the woven baskets intended for use as retained-heat containers were not being adequately insulated nor were they being used as intended.

In 2012, Jewish World Watch reported that as a result of a joint security force agreement between Chad and Sudan, violence against women in the camps had declined. JWW then expanded its funding of solar cooker projects with a new partner CORD in the Farchana Refugee Camp. CORD viewed solar cooking as a way to allow refugee girls to attend school instead of spending hours gathering firewood for cooking.

As a result of the recommendations for a more durable solar cooker in the 2009 report, JWW initiated a small pilot project in Farchana Refugee Camp, supervised by an official from the French NGO Bolivia Inti. This test project involved teaching male and female refugees to build and use wooden solar box cookers. JWW determined that despite its popularity, this model would be too expensive to permit it to provide each refugee family with a solar cooker. A plan by CORD to also introduce CooKits into nearby Gaga

Refugee Camp was later cancelled when another U.S. solar cooker NGO, Solar Household Energy (SHE) sponsored a test project in Gaga camp to determine acceptance of their more durable and more expensive glass and aluminum HotPot solar panel cookers. Refugee women in Gaga camp who were exposed to the more attractive glass HotPots were no longer interested in cardboard and aluminum foil CooKits. If SHE's initial pilot test was successful, it had plans to expand its project and distribute several thousand HotPots to the refugees. In 2015, SHE tested refugee reaction to the Haines Solar Cooker in Gaga camp as part of its ongoing effort to determine the most appropriate solar cooker for this refugee group. One issue that has delayed future progress has been the challenge faced by SHE in locating a reliable in-country partner that can provide ongoing supervision and monitoring of the project in Chad.

A 2015 a JWW-funded study of solar cooker use in Touloum and Iridimi camps revealed a significant decline in the use of CooKits due to their lack of durability, a lack of training and follow-up for users in the camps, and the constant need to replace the heat resistant plastic bags. That study also confirmed that UNHCR had reduced food rations for refugees. Several months after the 2015 study was completed, JWW released the following statement (excerpted here): "After careful consideration, we are suspending the work of the Solar Cooker Project, and turning our attention to increasing food rations and supporting programs that allow the Darfuri refugees to become more self-sufficient."

BURKINA FASO 2015-2016

The most recent instance of solar cooker use in refugee camps comes from the maker of the Blazing Tube Solar Appliance, who reports that in 2015, UNHCR has delivered Blazing Tube Solar Appliances to 601 Malian refugee households (1 per household) in Burkina Faso. According to Blazing Tube's manufacturer, feedback from the families indicates that the cooker has reduced their need for firewood. Olivier Lompo, UNHCR Environmental Officer in Burkina Faso stated that, "Before the introduction of the stove, refugee women had to walk several hours a day to collect firewood... Since we have a lot of sunshine, the stove allows them to cook without spending any more time on firewood collection. And, more importantly, it does not produce any smoke - they love it." To operate, a Blazing Tube requires approximately 5 liters of vegetable oil. A solar reflector generates heat, which is transferred to a glass tube containing the oil. The heated vegetable oil becomes

more fluid and a portion of the oil overflows into a special container. In the process, the heat transfers to metal cooking pots that are placed in the container. At peak operation, the vegetable oil can reach 200 °C (393 °F) or higher.

COMMUNITY SOLAR COOKERS

Some refugee- and IDP camps have purchased and are now using institutional (large-scale) wood-burning Rocket Stoves such as those manufactured by Oregon-based In-Stove. Using institutional solar cookers for preparing food and heating water on sunny days could produce significant savings in the consumption of firewood and other fuels since the institutional wood stoves would only be needed for cooking at night and on cloudy days. Institutional solar cookers currently available for purchase or for local construction include: the Sun Oven Villager (which can bake up to 300 loaves of bread per day and which has an LPG back-up), Scheffler Community Kitchens, which allow indoor cooking, and PRINCE Community Solar Cookers, which are shipped flat and can be assembled on site.