The Use of Solar Cookers in Refugee Camps

Patricia McArdle
Member, Solar Cookers International Global Advisory Board

solarwind1@mac.com
www.patriciamcardle.com

Abstract: With shortages of both wood and food reaching crisis proportions in many refugee camps, deploying an integrated cooking system (ICS)[1], with solar cookers as the primary cooking device (*and wood stoves/ retained heat cookers used when there's no sun)* has now become an issue of survival. Over the past few decades, United Nations donor countries have spent tens of millions of dollars providing refugees with firewood and combustion stoves, but the crisis continues. Negative observations by United Nations officials involved with solar cooking projects over the past twenty years, have resulted in the UN's reluctance to sponsor additional projects at this time. In order to convince the UN and the global development community at large that integrated cooking systems can produce significant fuel savings, the solar cooking sector should provide a proof of concept via a third party study comparing wood consumption by families using only a combustion stove with families receiving the same quantity of wood but using ICS. Demonstrating the willingness of refugees to adopt this mix of technologies over the long term will be an additional challenge.

Key words: solar cooking, solar cooker, retained heat cooking, integrated cooking method, United Nations High Commission for Refugees

An Integrated Cooking System

In his forward to a 2015 Chatham House[2] report titled, "Heat, Light and Power for Refugees", Kofi Annan noted that "amazing advances in technology are not being used systematically to respond to the needs of uprooted people or the communities that host them." This same report states that solar cookers were 'excluded' from Chatham House's recommendation scenarios for resolving the fuel crisis in refugee camps because of "the lack of studies proving the effectiveness of these technologies at scale." Practical Action's "Review of Cooking Solutions for Humanitarian Settings"[3] includes the following caveat: "Solar…stoves, which fall under the 'renewable fuel' category, have been excluded as they are supplementary options rather than replacements."

"In a perfect world perhaps with a great, non-polluting wood stove would come a retained heat cooker, a solar oven for baking and a parabolic reflector for boiling water... Whole package might cost $100, which is dinner and a movie for some folks." – Dean Still, Director, Aprovecho Research Center, 2001

---

[1] http://solarcooking.wikia.com/wiki/Integrated_Cooking_Method

[2] https://www.chathamhouse.org/sites/files/chathamhouse/publications/research/20151117HeatLightPowerRefugeesMEILahnGrafhamEmbargoed.pdf?dm_i=1TY5,3SZT6,BHZKA9,DPL2F,1

[3] ibid.

Despite Dean Still's 2001 call for the funding of an integrated cooking system, this concept has been met with resistance from many quarters over the past two decades. Some solar cooker NGO's have been reluctant to promote the combined use of solar cookers, retained heat cookers and biomass stoves because they lack the funding for such an expanded project. Others believe women might be confused by having to juggle three new technologies. Development experts refuse to accept the ICS concept because they tend to conflate stove stacking[4], a practice that wastes fuel with ICS, which saves fuel.

Most biomass and other combustion stove manufacturers view solar cookers as competition rather than as a complementary technology. This wasn't always the case. Before Dean Still became a leader of the biomass stove industry, he was living in Baja California and building Telkes solar box cookers for his Mexican neighbors. Peter Scott, another rock star in today's well-funded biomass stove sector, showed up at Aprovecho in 1997 after reading an article about solar cooking in *Mother Jones*[5]. A Moroccan engineer who was designing hybrid solar box cookers for fishermen in his country, shifted a decade ago to biomass stove design and manufacture because, "that's where the money is."

In 1996, an instructional manual titled "Capturing Heat, Five Earth Friendly Cooking Technologies"[6] written by Dean Still was released by the Aprovecho Research Center in Oregon. This manual provided detailed DIY construction plans along with an explanation of how solar, biomass and retained heat cooking technologies could be combined into an integrated cooking system for maximum fuel efficiency. Jewish World Watch's 20011 Solar Cooker Project Best Practices Manual[7] provides step-by-step guidance for teaching the integrated cooking method in refugee camps.

Barriers to Adoption

Over the past three decades, the United Nations High Commission for Refugees (UNHCR) has partnered with NGOs including Solar Cookers International to introduce a variety of solar thermal cookstoves into refugee and IDP camps. Studies of these projects have highlighted the following issues that contributed to the lack of long-term adoption of this technology:

1. The absence of durable, affordable, easy-to-use solar cooking devices designed for harsh desert conditions.
2. An insufficient understanding of local cooking habits on the part of NGOs prior to the introduction of solar cookers.

---

[4] https://www.youtube.com/watch?v=Fpn04j_0pdQ
[5] http://www.newyorker.com/magazine/2009/12/21/hearth-surgery
[6] http://www.ewb-usa.org/files/2015/05/capturing-heat-one.pdf
[7] http://vignette2.wikia.nocookie.net/solarcooking/images/2/2d/Solar_Cooker_Project_Best_Practices_Manual.pdf/revision/latest?cb=20121205194854

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 independent monitoring and project evaluation to produce the data needed to justify funding for future projects.
6. The decision by some organizations to present 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[8].
7. The lack of long-term coordination and support by reputable on-site organizations plus the challenges of working in a refugee camp setting where in many locales, NGO representatives travel to and from the camps in armed convoys and are able to spend only six hours per day on site.
8. The reduction in economic incentive for refugees to sustainably adopt renewable energy cooking technology when governments and aid organizations start providing free fuel (firewood/paraffin) at the same time solar cookers are being introduced into the camps.

Despite the fact that none of these efforts with the exception of a project in Nepal have resulted in the long-term adoption of zero emission solar cooking technology, refugees when surveyed noted the following advantages from using a solar cooker:

1. Panel and box solar cookers can be left unattended while food cooks or water simmers allowing women to do other work.
2. Panel and box solar cookers present no fire danger around small children.
3. Money can be used to purchase food instead of firewood and dangerous trips to gather fuel outside the camps by women and girls are reduced.
4. Parabolic solar cookers can generate heat as fast and as hot as an open fire and can be used from sunup until sundown 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.

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*"[9]. 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 175C (350F) in the summer/ 140C (285F) in the winter. In 1989-90, UNHCR ended funding for the Pakistan project due to an

[8] http://solarcooking.wikia.com/wiki/Heat-retention_cooking
[9] http://solarcooking.wikia.com/wiki/File:The_Experience_of_UNHCR_and_its_Partners_with_Solar_Cookers_in_Refugee_Camps_1996.pdf

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 Afghanistan's Internally Displaced Persons (IDPs) were still using their solar cookers. Reasons for this decline in usage included: 1. The straw used for insulation around the inner box had 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[10] 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 have been overcome with longer periods of training as well as an ongoing system of local support and training for new 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 commercial development and mass marketing of parabolic solar cookers in India, Germany and China may offer a solution for the need to solar cook with high heat on a flat surface. A 2013 World Bank report titled "Accelerating Household Access to Clean Cooking and Heating"[11] contains a detailed description of solar parabolic cooker manufacture and use in China. If the cost of solar cooker production could be reduced and durability improved through better design and mass production, it might become economically feasible to provide both a box and a parabolic solar cooker to refugee families in order to give them more options for solar cooking traditional foods.

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 some assistance from UNHCR. They have included the distribution of both manufactured and locally constructed cardboard and aluminum foil solar panel cookers and plastic bags. (*Note: Using the Cookit requires the use of a heat resistant plastic bag to maintain and concentrate heat around the cooking pot*.)

---

[10] http://solarcooking.wikia.com/wiki/File:The_Experience_of_UNHCR_and_its_Partners_with_Solar_Cookers_in_Refugee_Camps_1996.pdf

[11] https://www.astae.net/sites/astae/files/publication/Pub 6.pdf

In the SCI/UNHCR-sponsored projects, refugees received free Cookits, plastic bags and in most cases, cooking pots painted black with non-toxic paint. Solar Cookers International began its first pilot project in 1995 in the Kakuma refugee camp in northern Kenya. At that time, UNHCR was only able to provide 20-25% of refugees' fuel wood needs and women were forced to leave camp to find fuel. The 1996 UNHCR report "The Experience of UNHCR and Its Partners with Solar Cookers in Refugee Camps"[12] includes a detailed evaluation of SCI's introduction of solar cookers into Kakuma.

By 1995, three camps near the city of Dadaab in eastern Kenya housed more than 100,000 refugees. In late 1996, UNHCR authorized several more solar cooker projects in collaboration with the German aid organization GTZ in the Dadaab camps. SCI provided 2,000 solar CooKits and training. 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 most 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 (*they were accustomed to cooking over an open fire and the CooKit worked like a crock pot*).
2. 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 since it was vulnerable to moisture and termites.
4. The plastic bag had to be replaced every few weeks.
5. The cooking pots of the refugees' who did not receive pots from the project would not work with the solar cookers (they were too thick and/or lacked the required black paint).
6. The CooKit could not be used to prepare large enough quantities of food and could only hold one pot at a time.

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 undocumented critique offers another good argument for teaching the integrated cooking method so that food can be prepared on time using the least amount of fuel regardless of the weather.)* The UN's concern about the potential for wife beating by hungry husbands 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.

A 1998 UNHCR report titled, "Solar Cooker – Ethiopia - Evaluation of Energy-Saving

---

[12] http://solarcooking.wikia.com/wiki/File:The_Experience_of_UNHCR_and_its_Partners_with_Solar_Cookers_in_Refugee_Camps_1996.pdf

Options for Refugees"[13] 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. According to the UNHCR report, the successful completion of this project was hampered by problems with transport, customs and accounting. The lack of durability of the CooKit and the need to frequently replace the plastic bags was another issue that led to the eventual termination of the project. SCI's findings[14] regarding the advantages and disadvantages of using the CooKit in the Ethiopian camps were similar to those from its two Kenya projects.

Nepal 1998-2013

Between 1998 and 2013, the Varja Foundation Nepal[15], a Dutch-Nepali NGO introduced solar box cookers and several thousand German SK-14 solar parabolic cookers into Bhutanese refugee camps[16] in Nepal. By 1999 Vajra Foundation had determined that the box-type solar cookers they were promoting were not holding up well — hinges were rusting, reflectors and glazing were breaking. Other solar cookers were tried, including cardboard CooKits and solar cookers made of earthen materials, but they were also vulnerable to damage and not as efficient as hoped. In the end, EG-Solar's SK14[17] parabolic-type solar cookers proved to be a good combination of durability and efficiency and a good match for traditional Bhutanese foods. Parabolic cookers are generally more expensive, but their efficiency allowed for sharing among families, which lowered the per-family cost somewhat. Though the reflectors were imported from Germany[18], the stands were manufactured locally, helping to keep costs down. By 2013 *(according to Varja officials*) some 85,000 refugees were routinely preparing their meals and heating water with their solar cookers.

Kenya/Namibia 2003-2005

In 2004, UNHCR sponsored the field-testing[19] of 1,000 parabolic solar cookers in Kakuma and Dadaab refugee camps in Kenya. According to a report[20] from the German government's aide organization (GTZ now GIZ) these cookers could "reach considerably higher temperatures and also be used for frying." The GIZ report noted that, "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 had come from Angola. Wood, their principal source of fuel for cooking was for the most part gathered from forests near the camp.

---

[13] http://vignette2.wikia.nocookie.net/solarcooking/images/7/70/Evaluation_of_Energy-Saving_Options_for_Refugees_-_UNHCR_1998.pdf/revision/latest?cb=20160804180528
[14] http://solarcooking.org/evaluation/Aisha-eval.pdf
[15] http://solarcooking.wikia.com/wiki/Vajra_Foundation_Nepal
[16] http://www.safefuelandenergy.org/where-we-work/project.cfm?p=55
[17] http://solarcooking.wikia.com/wiki/SK14
[18] http://solarcooking.wikia.com/wiki/Germany
[19] http://www.unhcr.org/en-us/news/latest/2004/6/40c08d4b4/solar-cooker-offers-ray-hope-refugee-environment.html
[20] http://solarcooking.wikia.com/wiki/File:Gtz-en-here-comes-the-sun-2007.pdf

"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 oily '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 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. 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 they received from the UNHCR for cooking to wealthier families, while they themselves used their solar cooker.

"A closer investigation of the impacts on fuel consumption revealed, however, that 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."

Although there are no detailed evaluations of this project other than the summary in GTZ's "Here Comes the Sun"[21], the perception among members of the development community has always been that it was a failure. A frequently referenced photo from the aftermath of this project shows piles of damaged solar parabolic cookers tossed into the sand. According to GTZ's report, not only the lack of training of the refugee women but also the donation by USAID of a large quantity of firewood valued at several million dollars to the refugees ultimately ended their interest in solar cooking, allowing them to return to their traditional cooking methods long enough for the project to have been deemed a 'failure'.

Another reason for the refugees' reversion to 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[22] and the Sun Chef[23] have large tripod bases, which allow the parabolic dish to rotate freely. They are also more wind resistant since the tripod can be staked to the ground and spun on its 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[24] in eastern Chad by Derk Rijks of the Dutch

[21] http://solarcooking.wikia.com/wiki/File:Gtz-en-here-comes-the-sun-2007.pdf
[22] https://www.oneearthdesigns.com/solsource-solar-grill/
[23] http://www.solarcooker-at-cantinawest.com/sun_chef_cooker.html
[24] http://solarcooking.wikia.com/wiki/Iridimi_Refugee_Camp

NGO Kozon. 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*[25].

In 2006 the Los Angeles, California-based non-profit Jewish World Watch became the primary funder of the Chad solar cooker project. JWW's 2007 evaluation of the project[26] reported significant fuel savings on the part of the refugees, who were using solar cookers assembled by refugee women at workshops inside the camps. Refugee women in each zone of the camps were hired to serve as trainers, provide repair services and replace plastic bags for the women in their sectors. UNHCR provided families with fuel-efficient Save 80 wood stoves.

A November 2009 paper[27] produced after an independent onsite assessment of the solar cooker project in Touloum Refugee Camp in Chad cited the lack of durability of the CooKit as an issue that required swift resolution. The authors recommended the use of more durable panel or box solar cookers. This report[28] 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.

As a result of the recommendations for a more durable solar cooker in the 2009 report[29], JWW initiated a pilot project in Farshana camp, supervised by an official from the French solar cooking NGO Bolivia Inti[30]. 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 provide each refugee family with a solar cooker. A plan to also introduce Cookits into nearby Gaga refugee camp was later cancelled when another U.S. solar cooker NGO, Solar Household Energy[31] (SHE) sponsored a test project in Gaga camp to determine acceptance of the more durable and more expensive glass and aluminum Hot Pot solar panel cookers. Refugee women in Gaga camp who were exposed to the Hot Pots were no longer interested in cardboard and aluminum foil CooKits. In 2015, SHE also tested refugee reaction to the Haines panel solar cooker[32] in Gaga camp as part of its ongoing effort to determine the most appropriate solar cooker for the refugees.

A 2015 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, the lack of training and follow-up for users in the camps and the continuous need to replace the CooKits and the heat resistant plastic bags. This study also confirmed that UNHCR had reduced food rations for refugees. Several months after the 2015 study was completed,

---

[25] http://vignette4.wikia.nocookie.net/solarcooking/images/6/6f/Granada_06_derk_rijks.pdf/revision/latest?cb=20070225011827

[26] http://images3.wikia.nocookie.net/__cb20080205203028/solarcooking/images/7/75/Iridimi_Evaluation_Report_October_2007_compressed.pdf

[27] http://vignette3.wikia.nocookie.net/solarcooking/images/f/ff/Touloum_Refugee_Camp_Evaluation_-_November_2009.pdf/revision/latest?cb=20100217193403

[28] ibid

[29] ibid

[30] http://www.boliviainti-sudsoleil.org/spip.php?rubrique26

[31] http://www.she-inc.org

[32] http://www.hainessolarcookers.com

JWW released the following statement[33]: "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 designer of the Blazing Tube. He has self-funded this project and has reported that in 2015, UNHCR delivered Blazing Tube Solar Appliances[34] to 600 Malian refugee households in Burkina Faso. To operate, a Blazing Tube requires approximately 5 liters of vegetable oil. At peak operation, the oil can reach 200 °C (393F). Olivier Lompo[35], UNHCR's 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."

Overcoming Negative Perceptions with a Proof of Concept

"If you give my neighbor a wood stove and a pile of wood and you give me the same kind of stove, the same quantity of wood…and a solar cooker…guess who's going to run out of wood first?" --Jim La Joie, Solar cooker designer/manufacturer.

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[36] (LPG) stoves, there has been almost no funding for similar research on solar thermal cooking devices. Recent surveys of refugees who have spent years in the camps indicate that a growing number of adult family members spend their days working outside the home and are thus unable to solar cook. Individual designers and several universities are developing prototype solar cookers that include molten salt heat storage and auto tracking devices, which could allow solar thermal cookstoves to be left unattended to heat up during the day and provide a hot cooking surface for use indoors after dark. Without significant R&D funding from governments and the private sector, it will likely be decades before any advanced solar cooking technologies will be made available to refugees.

A controlled study that measures the amount of wood consumed when using only a biomass stove to the reduced amount of wood used with an integrated cooking system, might provide the empirical proof needed to convince the UN and the international development/ humanitarian sector that using solar thermal (*and retained heat*) technology in combination with a biomass stove will significantly reduce fuel consumption, deforestation and air pollution in and around refugee camps.

---

[33] http://www.jww.org/projects/past-projects/solar-cooker-project/
[34] http://solarcooking.wikia.com/wiki/Blazing_Tube_Solar_Appliance
[35] http://cleancookstoves.org/about/news/10-20-2015-blazing-tube-solar-cookers-in-burkina-faso-refugee-camps.html
[36] http://www.cooking-for-life.org