Evaluation for Jewish World Watch
Tchad Solaire Solar Cooker Project
Touloum and Iridimi Refugee Camps
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Summary

In 2005, the NGO Tchad Solaire (TS) began distributing locally made CooKit solar panel cookers to Sudanese refugees in Eastern Chad in order to reduce the need for women and girls to leave the camps in search of firewood. Fuel-efficient, wood-burning stoves were provided to refugee families by UNHCR. Several years later TS began teaching refugee women to weave and stuff retained heat baskets (gufas), which were intended to further reduce fuel consumption.

An evaluation of the TS project was undertaken in late 2009 at the request of that organization. A team of five solar cooking experts (including the author of this report) and one statistician interviewed the female heads of more than 200 households in Touloum refugee camp. Interviews were also conducted with UNHCR officials, TS Chadian staffers and refugee women employed by the TS staff in the camp.

It is worthwhile noting that the interpreters for the 2009 assessment were all members of the TS staff, and the residents of Touloum camp knew in advance that the survey would be conducted. The 2015 survey team used non-TS individuals as interpreters and camp residents were not informed in advance that the survey would take place.

The 2009 study found that because the majority of households were using Save 80 fuel-efficient stoves provided by UNHCR and solar cookers provided by TS, the monthly UNHCR fuel ration for refugee families appeared to be sufficient. Few households in that survey reported family members having to leave camp to gather additional firewood. Despite these reports, the 2009 survey team members did observe women returning to camp carrying firewood on their heads.

During the 2015 survey, female heads of household told survey team members that refugee women were now leaving the camps before sunrise and returning after dusk to harvest firewood. These extended collection hours may explain why no women were observed during the day entering the camps with bundles of firewood.

In 2005, UNHCR reported a Sudanese refugee population in Chad of 228,836. Today that population is approaching 370,000. While some of this increase is due to

additional refugees crossing the border from Sudan, much is also due to the high birthrate in the camps. Almost every woman we interviewed for the 2015 survey was either nursing or pregnant, with toddlers and/or school age children. The average family size was 7-9. To further complicate the rapid growth of the refugee population, UNHCR has for budgetary reasons begun to reduce food rations and wood distribution to the refugees. The female heads of household interviewed for this study reported receiving only enough fuel wood from UNHCR to last for a few days. Many also reported that their food rations were not lasting until the next distribution.

Despite this scarcity of firewood, our survey revealed that few women reported using their solar cookers or their Save 80 stoves on a regular basis (at least during the 'winter' months). Most women were cooking over traditional mud hearth fires built into the interior walls of their cooking huts. Some of the cooking fires inside the huts were observed to be burning on warm sunny days even when no food was being cooked or water boiled. Almost all women said family members (mostly females) traveled miles from the camp several times a week to collect wood. A few families were purchasing wood from vendors in the camps.

The 2009 survey included a number of recommendations. In addition to greater management autonomy for the TS local staff, it called for more extensive and accurate accounting by TS of solar cooker distribution, use, wear and tear and replacement. That survey also recommended urgent efforts to develop a more durable solar cooker (one that would last years instead of months) and a more permanent replacement for the heat resistant plastic bags, which must be discarded every few weeks due to wear and tear. The 2009 survey also recommended that the retained heat (gufa) baskets made by the refugee women be better insulated in order to function effectively. Finally, the 2009 survey urged TS to consider introducing more permanent and durable, multi-pot solar box cookers, which could be assembled in the camps.

Although the 2009 report did not recommend other types of solar cookers including parabolic solar cookers, since that survey was conducted, significant progress in the development of a number of solar cooker technologies has taken place. Given the complaints this team heard from many refugee women that their solar cookers were too slow (*especially in 'winter'*), these new technologies (*discussed in the "Options/Recommendations" section*) might also be considered for future distribution to families in refugee camps. At a minimum, much more training will be needed in order for refugee families to maximize their fuel savings when using the devices to which they currently have access.

Objectives:

The primary objectives of this evaluation were: 1. To determine the extent of the use of solar cookers, gufas and fuel efficient wood stoves with a primary emphasis on the first two technologies; and 2. To assess the impact of their usage on the requirement for refugee women and girls to leave the camps in search of additional firewood.

Activities:

The days in the field for conducting this survey were significantly limited by bureaucratic delays encountered while obtaining travel permits from Chadian officials in N'Djamena. Despite the best efforts of our team leader, we were delayed in N'Djamena from Sunday January 11 until Friday January 16, when we finally received our travel and photography permits and were able to leave for eastern Chad. Once we arrived at the UN Compound in Iriba, we were unable to obtain armed escorts for weekend travel to the camps and had to wait for two additional days until the regularly scheduled weekday armed convoy traveled to Touloum camp on Monday January 19. Once in the camp two members of the team with their interpreters began to survey female heads of household, while a third team member stayed at the TS workshop to gather information from the refugee staff and demonstrate a new solar cooker model. The team spent six days in Touloum and one day in Iridimi. One team member (*the author of this report)* missed two days in the camps due to a case of dysentery after accepting a cup of tea at the home of a refugee woman in Touloum camp.

Discussion with UNHCR Chad Deputy Environmental Officer

While in N'Djamena, our team met with Sierge Ndjekouneyom, Deputy Environmental officer, UNHCR Chad, who described the serious fuel shortages facing all refugees in Chad. Wood is currently trucked in from Sudan, but the supply received by the refugees has been cut by 90%. He is aware that women are leaving the camps to collect wood. He is also aware of the devastating impact this is having on the environment and on the livelihood of the indigenous communities who have lived sustainably in the surrounding desert for generations but are now seeing their trees and their water resources plundered by the hundreds of thousands of refugees living in Chad.

Mr. Ndjekouneyom provided us with a copy of UNHCR Chad's Energy strategy, which states that access to sustainable energy for the refugees is now a central element in UNHCR's planning. The plan calls for the use of institutional stoves at transit and refugee in-processing centers. Although UNHCR currently uses institutional wood burning stoves in some refugee camps in Africa, we provided Mr. Ndjekouneyom with information about institutional solar stoves that would also be

appropriate for use in desert camps.

Part of UNHCR Chad's energy plan includes the distribution of the Hot Pot (*a tempered glass and metal solar panel cooker that was developed in the early 2000s by DC-based Solar Household Energy*) to refugees in Chad. (*Please see the "Options/Recommendations" section of this report for more details on the deployment of the Hot Pot in Chad*.) Mr. Ndjekouneyom emphasized that UNHCR Chad's Energy Strategy was "dynamic and can be modified at any time to be adapted to new technologies or opportunities." We recommend that Mr. Mr. Ndjekouneyom receive a copy of this report.

The attachment at the end of this report is a copy of the information sent to Mr. Ndjekouneyom following our team's meeting with him in N'Djamena on January 13, 2015.

Survey Results:

The survey team interviewed _____ female heads of household in Touloum and ____ in Iridimi. One team member remained at the TS workshops to demonstrate the Haines solar cooker and to observe and interview TS refugee staffers in both Touloum and Iridimi about their work, the durability of the CooKits and the plastic bags, and their methods of distribution.

The Use of the TS CooKits and Pots

The average number of solar cookers reported by families was two, although when women were asked to produce their solar cookers, survey teams were often shown only one. Some of these appeared to be unused and some were so damaged they were no longer usable. Most women also had two black pots provided by TS. In some cases the pots appeared to be unused. More than half the women said they also used the pots for cooking over their open fires.

Women reported using their solar cookers between zero and four times per week in the winter. (*Note: Winter in eastern Chad means cloudless blue skies on most days with daytime temperatures ranging between 70 and 85 degrees and temperatures between 40 and 55 at night.)* At approximately 13 degrees north latitude, the winter sun at noon is still relatively high in the sky. (*Tests in other regions of the world have shown that CooKits when used properly can reach 250 F. on clear sky days at these temperatures.)*

The TS refugee staff in the workshops also claimed that it was difficult to solar cook food in the winter. When our team arrived at the workshops the women were only heating water for tea. They told us that hot water for tea, macaroni and cous cous cooked well in the winter but not beans and porridge. (We successfully cooked porridge (asida) with a Haines solar cooker in Touloum and in Iridimi in

approximately two hours. We also cooked split yellow peas (ades) but even soaked overnight they took more than five hours to cook.

According to the female heads of household interviewed, the types of food most commonly cooked in the camps for all meals is generally limited to sorghum porridge (*which is ground into flour by mechanical mills inside the camps*) and split yellow peas, both of which are distributed to families by UNHCR in fifty pound USAID bags. Those who have extra cash can buy meat and a limited supply of vegetables in the souk. Due to the reduced food ration approximately one third of the women interviewed said they did not cook a midday meal. Among those who did cook a midday meal, more than 75% used a traditional stove rather than a solar cooker. Everyone reported heating water for their traditional dark sweet tea for each meal, although few were using their solar cookers for this purpose at midday (*at least during the winter period when this survey was conducted*).

When asked why they did not use their CooKits for cooking lunch, the majority of the women said it was winter and thus 'too cold' to solar cook. They also complained that the solar cookers were too slow. Some reported that their solar cookers had been destroyed and they had not obtained a new one. Except at the workshops, we saw no one using two solar cookers at the same time to prepare the midday meal and tea. If the women use only one solar cooker at midday, they also have to start a fire to heat the second pot of food or water, thus negating the advantage of having a solar cooker. Some women appeared to be saving their second solar cooker to be used when their first one was no longer usable.

The majority of women said their husbands did not use the solar cookers even for heating tea water.

When asked what criteria they used to decide when to use a solar cooker, a surprising number of women reported that they only used their solar cooker after they ran out of wood. Most women said they would revert to their traditional fire if they went back to Sudan, where they said, 'there was plenty of wood'

The Durability and Distribution of the CooKits

When asked about problems they have had with the CooKits, women reported that their CooKits got damaged when water or other liquids were spilled on the reflector. Derk Rijks explained that the cardboard backing is now being sprayed with donated Nikwax to protect it from moisture. The vulnerable area however, does not appear to be the cardboard backing of the CooKit reflector, but rather the foil side where food and liquids gets spilled.

In Iridimi camp we observed the women making CooKits with a heavy, reinforced foil that was very difficult to tear. We asked Derk why the women in Touloum were still using cheap cigarette pack foil to cover their CooKits instead of this stronger foil. He explained that he keeps costs down by getting donated rolls of foil with

slight defects from manufacturers in Europe. One company gave him a large roll of the reinforced foil, which is the one being used by the ladies in Iridimi. This foil appears to resist boiling water.

Female heads of household told us that in addition to hot liquids, moving their CooKits around damaged them. This may be a result of their dragging the CooKits through the sand to track the sun without removing the large rocks placed on the outside flaps for stability. Several women asked for a 'stronger' solar cooker. When they were asked how often they replaced their solar cookers, the most frequent response was every month. Others said two months, four months and even one year. The women in the workshop in Touloum told us that if a solar cooker is used every day it will have to be replaced after one month. Derk insists that if they are used properly, they can last for more than a year.

Female heads of household said it took them from one day to two months to get a replacement CooKit. One woman said she was given a solar cooker four years ago but has never received a replacement.

When asked about the new protocol for the distribution of CooKits, Derk explained it was because he was gathering data on solar cooker use in the camps to apply for carbon credits. In order to keep proper records, he said that any women who wanted new solar cookers had to come to the TS workshop, register and pay 250 CFA (*approx 45 cents*). He said that because the TS reps in the zones were illiterate and thus unable to keep accurate records needed for carbon credit certification, all distribution was done from the workshops. The women are also paying for new pots 2000CFA ($3.50). The plastic bags are free.

One of our team members observed a few women and young girls coming to the Touloum workshop for new solar cookers during the days she was present. Some had their refugee ID cards and were duly registered in the logbook. Others did not. Some paid and others did not. The ladies in the workshop told us that the TS zone representatives can still gather requests for solar cookers from their neighbors and come to the workshop to pick them up, but in that case no ID numbers are recorded. It was not clear if the zone reps collected money from their neighbors and turned it in at the workshop when they picked up the solar cookers

Durability of the Plastic Bag

Although women in the Touloum TS workshop told us that the plastic bags if used every day, last for only one week, women interviewed in their homes said their bags were lasting an average of one month. This longer life may be due to the fact that the bags are not being used every day. When women get new solar cookers they receive only one bag. Derk explained that this was because if they got more than one plastic bag at a time they would use it for other purposes. Having access to a single plastic bag at a time may be limiting the use of solar cookers in the camps.

The Gufa (retained heat container)

The initial intent of introducing the use of the gufa into the refugee camps was to allow women to solar cook two meals per day (lunch and dinner). The noon meal could be solar cooked from 9 am until noon and eaten immediately. The evening meal would then be solar cooked from one until 4 pm (*with the pot(s) then placed in a properly stuffed gufa, to keep them steaming hot for three more hours*).

Despite the recommendations made six years ago for more tightly stuffed gufas, most of the gufas we observed this January still had large air pockets around the pots and are not capable of keeping pots of food hot for several hours. The women are no longer weaving baskets to make gufas but are instead using strips torn from discarded, shredded CooKits to stuff empty fifty pound feed bags.

We were shown several of the bags, which were not adequately stuffed to be able to keep pots hot. We explain this to Derk, who agreed that more training was needed. Retained heat technology if used properly can reduce fuel consumption by more than 30%. It is clear from this video made in Iridimi in 2007 by GIZ, that the proper method of stuffing insulation in the gufas tightly around the cooking pot has been taught to some of the refugee women.

Another equally important fuel saving use of the gufa is to simmer food that has been brought to a boil over an open fire. For dried beans and pulses that require hours of cooking over low heat, the use of a properly stuffed gufa can save several hours worth of fuel. Once a pot of food is brought to a rolling boil for 5-10 minutes, the fire can be extinguished and the hot pot(s) of food placed into the gufa, where they will complete the cooking process in 3-4 hours using no fuel at all. This video by Wonderbag, a commercial manufacturer of retained heat containers in South Africa, demonstrates the gufa's remarkable energy saving capacity. Here's another video showing a simple retained heat container/cooker that can simmer a large pot of beans using only two ounces of denatured alcohol. Retained heat devices like these are simple enough to be built by the skilled craftsmen we saw in the camp souks making furniture and utensils out of discarded pallet wood and USAID salad oil cans.

TS Refugee Staff

There was a flurry of gluing and hammering the first day our team entered the Touloum TS workshop with cameras rolling. The women said they were assembling forty CooKits per day. Based on the observations of the team member who remained behind in the shop, the women are making far fewer than forty per day. Since they have a reserve supply of 400-500 CooKits stacked against the walls, and since very few people seemed to be stopping by for new solar cookers, they may not need to produce forty per day.

When asked why the women are no longer sewing the cloth carry bags, Derk explained that their sewing machines had not been maintained properly and had eventually broken down. He said the bag making had been farmed out, but we didn't see any solar cooker bags in the Touloum shop. There was a small stack of bagged CooKits in the supply room at the Iridimi workshop. The CooKits in the Touloum workshop were not numbered or stamped with a date stamp. The CooKits in the Iridimi workshop were stamped with the date of manufacture but not with the date of distribution as had been recommended in the survey six years ago.

Options/Recommendations

Training

Based on testing and experience in Africa and elsewhere, we know that the CooKit and the gufa can significantly reduce fuel consumption if used consistently and properly in combination with a fuel efficient stove. This survey has revealed that much more training and monitoring of the refugee women is needed if they are to internalize more efficient cooking practices that include the use of a solar cooker, a retained heat containers and a fuel-efficient stove. The prevailing attitude among the female heads of refugee household, appears to be that fuel wood must be gathered, even if other means of cooking are available and even if it meant family members must leave the camp, travel great distances and confront attackers—because that's how it's always been done. If UNHCR truly sees this as a critical humanitarian and environmental issue, it must be willing to sponsor more training as well as rigorous evaluations of current and potentially new energy-saving devices.

The need for a more durable CooKit and a replacement for the plastic bag

The need for a more durable CooKit and a replacement for the plastic bag, which were both emphasized in the 2009 survey, are still critical to the success of this project. Grants from the USG or from private sources will be needed to fund such research. The Department of Energy has, for the past four years, spent millions of dollars on R&D to improve biomass cookstoves but nothing on solar thermal cookstove technology. DOE's National Renewable Energy Lab in Colorado has the resources and the knowledge to make significant contributions to this research.

The Haines Solar Panel Cooker

Three Haines panel solar cookers were demonstrated outside the TS workshops in Touloum and Iridimi. Unfortunately none of the glass pot lids sent by Mr. Haines fit the pots being distributed by TS. When the Haines was assembled for the first time in Touloum, a cover for the pots was jury-rigged with a strip of polycarbonate, paper clips and a plastic bag. Although this cover worked well to raise the temperature of the pots to 250 degrees F., the refugee women at the workshop said that any small pieces of metal, like paper clips or the wing clips that are used to hold the Haines together, would likely be stolen or lost immediately. At their request, grommets were hammered into the Haines so it could be held together with string. The Touloum workshop staff did like the strength of the more durable reflective material used in the Haines, but they felt that the sides were too high and worried that it would block the sun if not turned frequently. They also thought the reflector should be stiff like the CooKit to resist the desert winds. The women in the Iridimi TS workshop expressed concern that a manufactured reflector like the Haines might take away their jobs.

Given the fact that there are only seven women in each camp workshop assembling the CooKits, it might be useful to weigh the maintenance of these positions against the potential to provide thousands of refugees with more durable, manufactured solar cookers. Given the significant need for training that we observed in the camps, some of these assembly jobs might be more productively converted to instructor positions.

We discovered that the transparent polycarbonate (windshield) disks and pot-wrapping strips used with the Haines generated a small static charge in the dry desert air attracting a thin coating of fine red dust. Although the dust can be cleaned off with water, these women don't have access to enough water to wash them on a regular basis. The long-term effect of the thin coat of dust on the efficiency of the Haines solar cooker will require additional testing and evaluation.

Roger Haines reports that he is currently testing his Haines panel cooker with Velcro instead of metal clips to hold the parts together. He reports that the reflective material and clear polycarbonate used in the Haines are rated to last ten years (*although this solar cooker has not yet been subjected to long term testing in a desert environment).* Despite the concerns of the women about the high sides of the Haines, his tests have shown that it does not need to be turned more often than a CooKit to track the sun.

The Hot Pot

UNHCR Chad is considering the distribution of several thousand glass and metal Hot Pot solar cookers, a design developed in the early 2000s by Washington, D.C.-based Solar Household Energy (SHE).

In 2012, SHE sponsored a pilot project with 250 Hot Pots in Gaga refugee camp through AfricaCare. SHE is currently testing Haines reflectors as a possible replacement for the more expensive aluminum reflectors that are currently sold with the Hot Pot.

The UNHCR Chad plan to purchase several thousand HotPots may have been proposed by Lutheran World Foundation (*which replaced Africare in Gaga refugee camp*). Before endorsing this proposal, SHE is waiting for clarification from LWF regarding their evaluation of the adoption and acceptance of the 250 HotPots introduced into Gaga camp by Africare in 2012. SHE is also waiting for details from LWF on their proposed training protocols for this new introduction of Hot Pots. Given the fact that Africare failed to conduct follow-up training or evaluations on the use and acceptance of the initial 250 HotPot project in 2012, more information should be required by UNHCR before this project is implemented.

SOS Sport box solar cooker

The 2009 study recommended the possible introduction of solar box cookers as a more permanent replacement for the CooKits. In 2011, Jewish World Watch working with CORD and with Patrick Fourier of Bolivia Inti Sud Solaire (*a French solar cooker NGO*) conducted a pilot study in Gaga camp which included the construction and use by a small group of refugees of hand-made BISS solar box cookers. The cost was ultimately deemed to high and the project was ended.

The SOS Sport is a rugged, durable, lightweight and relatively inexpensive solar box cooker that comes with two three-liter pots and can reach temperatures at or above 300F. The SOS Sport is manufactured by the Solar Oven Society in Minnesota using recycled soda bottles. Thousands have been distributed to refugees, displaced persons and victims of disaster in Afghanistan, Haiti and elsewhere. The SOS Sport can be shipped in parts and assembled in the camps.

Here are the specs for the SOS Sport, which has been out of production for the past year but is now back in production.
Casing - Rugged Plastic (for weatherability and durability). No BPA's
Insulation - Closed Cell Foam Insulation Does Not Absorb Moisture
Lid - Double Layer with Dead Air Space Enhances Insulating Qualities
Holds two 10-inch Pots (3 quarts each) that come with the cooker.
Uses No fossil Fuel - Only the Free Energy of the Sun
Reaches Temperatures of 300 Degrees Fahrenheit in Equatorial Regions
The floor dimensions of the oven (for cookie sheets, etc,) are 9 1/4 inches x 17 ½ inches.
Optional Detachable Reflectors are available to lengthen the cooking seasons in areas further north.
Here in Minnesota, the cooker works great without reflectors April-September and with reflectors it works well all winter long (when there is sun!).
Quantity Orders For Developing Countries

Call or email Solar Oven Society for pricing and details regarding
1) Unassembled ovens in quantities and
2) Assembled ovens for introducing solar cooking technology in developing countries

Sol Source Parabolic Solar Cooker

Given the concern expressed by the refugee women regarding the speed of cooking, parabolic solar cookers are another potential technology for refugee camps. The Sol Source parabolic solar cooker produced by One Earth Designs in cooperation with nomads in the Tibetan plateau of western China is a durable portable solar cooker that reaches high temperatures even in very cold weather. OED is currently working on less expensive, more durable models that could be used in refugee camps.

The following correspondence between Grace Magney a U.S. citizen, who has resided in Afghanistan for the past four decades and senior UNHCR Environmental coordinator Amare Gebre Egziabher' provides additional details regarding the increased interest in parabolic solar cookers among stressed populations for whom speed of cooking is important. "We used to use wooden box solar ovens in Afghanistan and Pakistan. From our workshop in Peshawar we distributed over 22,000 to the Afghan refugees during the war years. But now some of us are using the parabolic solar dish cookers, which do more than the box oven can do. The parabolic cookers can boil a liter of water in 10 minutes, which an oven does not. It also cooks food and bakes almost as fast as a fire or on our western kitchen cooking stoves. I know Afghans who use their parabolic dish cooker every sunny day summer and winter, and are very grateful for it. We have boiled all our drinking water on it at our home in Kabul for several years."

Heat Storage Units

Many refugee women are now working outside the home during the day and must cook food quickly when they return at lunch or in the evening. They do not want to leave their solar cookers completely unattended when no one is at home. A few researchers including a group of engineering students at UC Irvine are (*thanks to a Gates Foundation grant*) developing small heat storage units for use with solar cookers. A Fresnel lens solar unit with auto tracking could be placed outside in the morning to heat a molten salt container for use as a high temperature-cooking surface when the women come home for lunch or at dinner. Much more research is needed to develop this technology.

Cooking needs vary for different refugee groups around the world. If the funds were available, it would be useful to have all of these solar cookers field-tested with control groups in refugee camps.

Attachment 1:

Message sent to Mr. Ndjekouneyom by Patricia McArdle following our team's meeting with him in N'Djamena on January 13, 2015.

1. You should be aware that the Hot Pot solar cookers, which were demonstrated in Gaga refugee camp in 2012, had a capacity of five liters. That size is no longer available. The current Hot Pots have a capacity of three liters. I have used the three and five liter Hot Pots at my home in California and they both work well, but I thought you should be aware of the smaller size of the current Hot Pot. If you do order Hot Pots from the manufacturer in Mexico you should specify that you want them shipped with an aluminum reflector and not with the cardboard and foil CooKit-type reflector, which the manufacturer also sells.

2. A study of Hot Pot usage in Senegal several years ago found that there was little fuel reduction among families that only had one Hot Pot since most families cooked two pots of food for each meal. Because of this, they always lit a fire to cook the second pot of food. As you know, Tchad Solaire provides each family with two solar cookers and two pots to eliminate the need for them to light a fire to cook the second pot of food. Whatever type of solar cooker you decide to distribute, it will be important to provide each family with two of them. *(Note: This message to Mr. Ndjekouneyom was written before we conducted our survey in Touloum and Iridimi and discovered that none of the women were using two solar cookers at the same time.)*

3. The Haines solar cooker, which I showed you yesterday when we met in your office, cooks food at the same temperature as the CooKit. If used with a traditional cooking pot but a glass lid instead of a metal lid, the cooking temperature is higher. Because the Haines solar cooker reflector is made of durable plastic with a bonded, scratch proof metalized coating it should last for up to five years. As I also mentioned, the Haines does not require the use of a plastic bag. If you decide to distribute this model to refugee families, they should also get two. *(Note: Once we got to the camps, and learned that the glass pot lids provided by Mr. Haines did not fit any of the pots being used by the refugee women, we improvised a cover.)*

4. Your energy plan did not mention the importance of increasing the use of guffas (*retained heat baskets*) by the refugees. This simple technology can be assembled by the refugees using materials they already have (*baskets, blankets, pillows*). I use this simple technology when solar cooking at my home in California. If used every day, retained heat baskets can reduce fuel consumption by up to 30%. On sunny days, women can solar cook the noon meal from 9:00 to noon, feed their family lunch, then they can solar cook their family's evening meal from 13:00 until 16:00. When the food is cooked, they can put the hot pot of food inside a retained heat basket to keep the food hot for the evening meal. *(Note: We learned after we got to the camps that the women were not using their gufas properly.)*

The women can also save fuel by using a retained heat basket when cooking with an improved wood stove. For example, normally they must simmer a pot of beans for one to two hours. If they have a retained heat basket they only need to boil the pot of beans for twenty minutes. Then they can put the boiling pot of beans inside a retained heat basket where it will finish cooking in about two hours using no fuel at all. This is a very important energy saving device that all refugees should be taught how to make and use.

5. Your energy plan mentioned the use of institutional stoves at some camps and reception centers. You should be aware that institutional solar cookers are being made and used in India. By using institutional solar cookers during the day, UNHCR would save significant amounts of fuel since your cooks would only have to use wood burning institutional stoves at night or on cloudy days. Why burn wood when you can cook with free sunshine? Institutional-sized retained heat containers are also being used in India for additional fuel savings. I have copied an institutional solar cooker designer/manufacturer in India so that he can provide you with more information. His name is Professor Ajay Chandak. His solar cookers are certified by the Indian government and he is on the board of directors of the International Solar Energy Society. He has also designed and manufactures biogas digesters and institutional gasifier wood stoves.#