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How Vajra Foundation's solar cooker project in the Bhutanese refugee camps in Eastern Nepal became one of the largest in the world – and how this success has been used to kindle environmentalism in Nepal.

Key words

1. strong teamwork
2. participation of beneficiaries
3. monitoring and improvement through feedback
4. networking, fundraising, media
5. importance of the use of a hay box

Abstract

In the early 1990s some 100,000 Lotshampas, living in Southern Bhutan, were expelled from their country. They ended up in seven refugee camps in Eastern Nepal, because many of them had roots going back to this Himalayan country. Vajra Foundation requested and received permission from the UNHCR and the Nepal government to start a pilot project in one of the camps. It took about seven years to find the right type of cooker, to inform and train the refugees, to obtain the required permissions and to find enough donors in order to have almost the entire population of the camp, about 12,000 refugees, prepare their food with solar cookers. Within the next three years the six other camps were supplied and nearly 85,000 refugees made use of solar cookers during the seven dry months of the year. In this article the strategy and the main factors of success are outlined. Finally it discusses how this success was used to promote solar cooking and environmentalism in a broader sense in Nepal.



Solar cooking in the Bhutanese refugee camps in Nepal

Initially some unsuccessful projects

Dutch ecologist Maarten Olthof founded the Vajra Foundation Netherlands (in Dutch: Stichting Vajra) for projects focusing on development and sustainability in Nepal. One of his concerns was the rapid deforestation of the Himalayan region caused by the need of firewood. He thought solar cookers could help to reduce the destruction of forests and launched a few small-scale solar box cooker projects in Nepalese villages in 1996. He expected solar cookers to prove themselves, because of the strong evidence that the devices cook food in the sun, so he guessed demonstrations would be enough to convince people to use solar cookers. Indeed villagers were very interested. They examined the box cookers to see where batteries had to be inserted, because they could not imagine it was possible to cook food without firewood, kerosene or electricity. But after initial enthusiasm, interest faded rapidly. It turned out that nobody was willing to pay for a solar cooker. They would accept one gladly if it was given for free, but by the time of evaluation a few months later the cookers were used as a box to store goods in.



Solar box cooker

Third World Conference on Solar Cooking in Coimbatore

It frustrated Maarten that although solar cookers proved to work, they were not embraced by people. He decided to join the Third World Conference on Solar Cooking in Coimbatore/India in 1997, attended by hundreds of solar cooking enthusiasts. During the conference he did not attend lectures and paper presentations about plans for new projects or about projects that had just been started. Instead, he focused on projects that had proven to be successful over a number of years. He concluded that there are two main areas where solar cooking can be effective:

1. in areas with extreme fuel scarcity, mostly dry or semi-dry areas or remote sub-alpine areas;
2. in refugee situations.

He projected these conclusions on the circumstances in Nepal and found two areas to be suitable. First of all the northern, trans-Himalayan region bordering Tibet with high-altitude deserts. Furthermore the area in south-eastern Nepal, where recently some 110,000 refugees

from Bhutan had settled. The first option in the Himalayas was beyond the capacity of a small foundation like Vajra because of distance, climate and expensive permits for foreigners. Maarten then focused on the seven refugee camps around the eastern village of Damak, where forests surrounding the camps suffered from firewood collection.



He travelled a full day by bus to meet local representatives of Oxfam, the Lutheran World Federation and of course the UNHCR. He succeeded in getting a permission to start with a small pilot project in the camp Beldangi-I with a population of about 12,000 refugees. Finding donations appeared to be a major challenge. At the beginning small amounts were collected from all kinds of funds, from individual donors, from EG-Solar and from organisations for refugee relief.

First phase: the box cooker

Maarten Olthof co-founded the Vajra Foundation Nepal in 1998, chaired by Mr. Ramkaji Paudel, for monitoring locally the activities of the pilot project. Several Nepalese engineers were selected to teach refugees how to build solar box cookers. 234 box cookers and 14 SK14 parabolic cookers were the first solar cookers to be distributed in Beldangi-I. To receive a solar cooker, refugees had to pay a symbolic fee and sign an agreement on use and maintenance. From the beginning refugees were involved in the production of the cookers as well as in training and supervising. Vajra organised the refugees in user groups. After the initial training the groups kept on meeting, attended by a supervisor, for evaluation, exchange of knowledge and to stimulate each other to make optimum use of the solar cooker. Families that didn't use their cookers, or didn't maintain them according to signed user agreements, had to return their cookers to Vajra Foundation for redistribution. In 1999 the first evaluation was carried out. It appeared that box cookers did not meet up to the expectations. People thought them too slow. On top of that hinges were rusting and mirrors and glazing were broken, imaginable in a densely populated area with playing children. Other solar cookers were tried, including cardboard Cookits, developed for refugees, and solar cookers made of

earthen materials, the mudbrick cooker, but they were also vulnerable to damage and not as efficient as hoped for.



Second phase: the parabolic cooker

Parabolic cookers proved to be a good combination of durability and efficiency, and a good match for preparing traditional Bhutanese foods because they can reach high temperatures. They were much more expensive than the box cookers, but they cooked much faster. Their efficiency allowed for sharing one cooker among two families, so the costs per refugee was about the same as in the case of a box cooker. The reflectors for the parabolic cookers were imported from EG solar in Germany, the stands were manufactured locally, helping to keep costs low. Continued solar cooker use was encouraged through participation in cooking groups, as well as solar cooking competitions in which refugees could win a pressure cooker. The cookers proved popular, and demand quickly outgrew supplies. Everybody seemed eager to possess this shiny device. While exploring ways to expand the project, Vajra worked on an awareness creation campaign that included regular solar cooker demonstrations and lunches for government officials, UNHCR, NGOs and INGOs like Lutheran World Federation, Oxfam, and the Nepal Red Cross Society.



Maarten and refugees with first SK14 Solar cooking instruction to refugees

Third phase: introduction of the hay box and research

Vajra had proven to the refugees that it was possible to cook food with the sun. But since the refugees would eat their meals at the end of the day, still firewood was used to reheat the food. To solve this problem Vajra introduced the hay box for keeping the food warm after cooking. Even though the introduction of the hay box was much more difficult than the introduction of the solar cooker, it appeared to be one of the key factors for success. During the next period improvements were made in the production and the quality of the cookers and the hay boxes as well as in the training procedures for new solar cooks and refugee supervisors. Brochures published by SCI appeared to be very useful. Between 2001 and 2005 close to 1000 parabolic cookers, twice as many hay boxes with insulating blankets and thousands of black painted pots were distributed. By the end of this period nearly all of the 12,000 refugees of the Beldangi-I camp could prepare meals in solar cookers distributed by Vajra Foundation. Cooperation with Dutch universities was sought and two students from the Utrecht State University surveyed 100 refugees to obtain feedback about the use of their solar cooker. The students made a comparison with kerosene and firewood usage. They concluded that by using a solar cooker an average refugee family could save 2.25 kilograms of firewood per meal. Weather conditions in the area allowed the solar cookers to be used for approximately seven months each year in the camp. The cost of a parabolic cooker equaled thereby the amount that the UNHCR spend on fuel for refugees in just over two years. So the payback period for a cooker was about two years. Furthermore the students calculated that solar cookers could save 3.14 kilograms of CO₂ per meal compared to cooking with firewood, and 0.64 kilograms compared to cooking with kerosene, an enormous contribution to stop climate change.



Refugee taking food from hay box

Factory where stands were produced

Fourth phase: the expansion

Because of the success of the project in Beldangi-I and the outcome of the research, local and UNHCR officials began to take more interest in the project. Vajra Foundation won awards in both Nepal and the Netherlands. The success was shared through media coverage in both countries. Vajra was even invited to give a solar presentation for the late crown prince in the garden of the Royal Palace in Kathmandu. The recognition paved the way for new donations.

At the beginning of 2006 Vajra signed a contract with the UNHCR, the Dutch Refugee Foundation and the Dutch Climate Fund to expand the solar cooker program to the other six Bhutanese refugee camps in the area. There were three conditions: the expansion had to be realised within two years, the project had to cover 80% of the camp population, meaning 85,000 refugees, and the investment per refugee should not exceed \$12 all-in.

The project meant an enormous challenge for the Vajra Foundation. The distribution of solar cookers for 12,000 people had taken Vajra seven years, the remaining 73,000 refugees had to be trained and equipped with cookers within only two years! Six training halls had to be built for instruction to the refugees, trainers had to be trained, supervisors to be appointed and the production had to be sped up tremendously in an environment where solar cookers were completely unknown until that time.

A production line was set up with small factories for the production of 7000 cookers, 14,000 hay boxes as well 28,000 black painted cooking pots. The design of the cooker was changed for mass production and where possible iron parts were replaced by aluminium ones for the iron parts caused problems because of rust. Valuable advice, along with donations, was received from the German NGO Sun and Ice. The LongLife Premium 14 was used as a model. Reflectors were imported from Germany, aluminium parts from China and galvanised parts from India.

By the end of 2008 Vajra had completed what had seemed impossible: the project was finished within the given timeframe, within the budget and about 85,000 refugees were able to cook their meals with the sun. The total reflective surface of the cookers was about 15.000 m², equalling 2.5 soccer fields. The cookers annually saved the exhaust of 20,000 tons of CO₂ and saved the use of 15,000 tons of firewood or equivalently 1.3 litres of kerosene.



Refugees with their cooker in the background



Solar cooking contest

After 2008 Vajra continued follow-up focused on maintenance and repair. At the end of 2010 responsibility was handed over to the UNHCR. By this time, third-country resettlement of the refugees had started and over the next five years the population in the camps dropped to about 10,000 persons. The cookers of leaving families were handed over to Nepali locals surrounding the camps. Unfortunately acceptance was very meagre.

Fifth phase: how the success was used to boost environmentalism in Nepal

During the timeframe of this project many people got inspired by its success. It helped to open the environmental eyes of a new generation. In the meantime Vajra foundation had already built six schools in remote Himalayan Nepal, but since these schools had been handed over to the government, the quality of education remained poor there. To be able to contribute to the quality of education the idea came up to build a school managed by Vajra itself: the Vajra Academy in the Kathmandu valley. Inevitably the success of the solar cooker project had to be incorporated. Through the internet Maarten got in touch with Deepak and Shirin Ghadia and their huge projects with Scheffler dishes. Maarten invited Ramkaji Paudel, chairman of Vajra Foundation Nepal, to visit Deepak and Shirin in India and see with own eyes how solar cooking could be brought to a new level. The three became close friends. It was decided to invite Deepak to build a solar steam kitchen with 10 dishes on top of the Vajra Academy. With the solar kitchen many other environmental ideas came up. A biogas plant was included with a dairy farm that produced milk for the students and dung for the biogas plant. The land around the Academy was shaped into organic vegetable gardens. The school was opened in 2007. The environmental hardware strongly influenced the curriculum set by the government: the Academy developed its own green curriculum. On the Vajra Academy student grow up, familiar with thinking in terms of solutions and not in doom-mongering. They have come up with their own ideas: they are working on encircling the capital of Kathmandu with the largest



Solar steam installation on the roof of the Vajra Academy

rope in the world. But not only that: the rope will be made from garbage plastic! In this way they hope to be able to enter the Guinness World Records book. Within nine years after its opening the school was awarded the status of ‘changemaker school’ by the international Asoka Foundation. These schools are characterised by a large network which makes them influential, with innovative education in which compassion and environment are key factors. The success of the school inspired Ramkaji Paudel to copy the ecological concept of the school into a hotel and a new plan was born: the Vajra Eco Resort near the Tibet border.

Like the Academy it grows its own organic vegetables, it has a dairy farm as well as a biogas plant, yurt tents and of course a solar cooker of the latest generation: a 90 m² MWS dish concentrator. Before the resort could be finalised, it suffered from the 2015 earthquakes; still plans are to have the resort in operation by 2017.



Vajra Eco Resort with MWS dish concentrator and yurts

Since Maarten Olthof organised many trekkings in Himalayan countries, he got inspired to organise the first solar expedition ever. In 2013 he guided a group of 25 trekkers plus 40 Nepali staff members to a holy lake at an altitude of some 14,000 feet near the border between Nepal and Tibet. During the trekking all food was prepared by several huge Prince cookers which were assembled every day and transported by porters. Fresh bread was baked in cardboard cookers. Nepali cooks were trained especially to adapt usual food patterns and meals to fit the possibilities of solar cookers.

Maarten plans to organise another solar trekking in 2018.



Prince cookers with trekker's tents in distance Maarten explaining the cooker to trekkers

The Vajra Academy, the Vajra Eco Resort and the Solar Trekking are open to visitors.



In loving memory of Ms. Shirin Ghadia.

*In June 2013 Ramkaji Paudel and Maarten Olthof
received the Dr. Shirin Ghadia Sustainability Award*

Even though the following points may seem self-evident, the Vajra Foundation considers these ten factors to have been essential for the success of the solar cooking project in the Bhutanese refugee camps in Nepal:

1. *Careful selection of target area and the type of solar cooker*
Solar cookers may technically work in a certain area, but this does not mean that the people of the area will haphazardly adopt solar cookers as a means for cooking their meals. Careful selection of the target area is therefore essential for a successful introduction of solar cookers. Areas with extreme firewood scarcity and refugee camps are places where the best factors for success are met. In other areas it might be more useful to investigate the possibilities for communal solar kitchens with large automated concentrators, for instance in schools, hospitals, ashrams and the like.
2. *Training*
Becoming a solar cook requires intensive training.
3. *Follow up*
But training is not enough. Beneficiaries need follow-up care and instruction for instance on how to use the cooker more efficiently and on how to repair damages.
4. *Monitoring and evaluation / incorporating user feedback / learning from mistakes*
Proper monitoring and evaluation provide valuable information and feedback with which cookers and trainings can be improved, adding largely to the acceptance of the cookers.

5. *Networking / media / fundraising*

In low income situations a lot of time has to be invested in allocating funds to support the project. For this it is imperative to use media in the broadest sense. Not seldom the size of the project or technical practicalities have to be adjusted to meet the budget.

6. *Paying for the device*

However small the amount may be, beneficiaries always have to pay for the cooker.

7. *Involvement of beneficiaries*

For the adoption of the concept of solar cooking it is important to involve users from the beginning in different parts of the project: production, distribution, training, monitoring, repairing etc.

8. *A cooker needs a hay box*

The hay box is a cheap and simple but yet indispensable device, addressing the need to keep solar cooked food warm till evening, thus greatly contributing to the usefulness of the solar cooker. Cooker and hay box are two sides of the same coin: one cannot go without the other.

9. *Strong teamwork between cooperating partners*

In the solar cooker project in the Bhutanese refugee camps the relationship between the Dutch and the Nepalese branch of the Vajra Foundation was crucial. The chairmen of both foundations, Ramkaji Paudel and Maarten Olthof, were the backbone of the project. Jointly, the two visited partner agencies, authorities, UNHCR offices, refugee camps, workshops and solved issues that arose. While Vajra Foundation in the Netherlands had access to funds and specialized knowledge, Vajra Foundation Nepal knew best how to incorporate solar cooking into lives of the Bhutanese refugees. While the Dutch foundation recruited and organized volunteers and students, the Nepalese foundation hosted them with great care and was eager to exchange knowledge. Countless solar demonstrations and lunches were organised for authorities and UNHCR officials which ultimately convinced them that the project was worth supporting (in kind, alas not with financial support; the financial support throughout the project had to be sought elsewhere, although the UNHCR itself benefited greatly from the solar cooking project).

10. *Research*

It is not enough to simply believe that a solar project is cost-effective. Research is needed to find out if an investment is worth the benefits. This depends on how long the device can be used, the percentage of any year the device can be used because of climatic reasons and the number of meals that can be cooked on an average day. Climatic benefits must exceed the negative effects from transportation, production and decomposition of the device.