

ESTABLISHING FIRST SOLAR KITCHEN IN MADHYA PRADESH AND CENTRE FOR THE AWARENESS GENERATION AND DISSEMINATION OF SOLAR COOKING TECHNOLOGY AMONG RURAL WOMEN OF CENTRAL INDIA

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ABSTRACT

Barli Development Institute for Rural Women had been using solar box cookers since 1985, and encouraging their use in the rural areas with limited success.

In 1998 when the Ministry of Non Convention Energy Sources New Delhi decided to test Scheffler Solar Cookers in different regions of India, their Regional Testing Centre in Indore selected Barli Development Institute for Rural Women as an ideal place to test this solar cooker, as it had a kitchen cooking simple meals for 40-50 persons daily, and committed staff who could monitor the use of this cooker.

The solar cooker was finally installed in an area near the main building where it could receive maximum sunshine throughout the day and a small shed built for cooking in. Initially there were many problems, e.g. cooks unwilling to cook as they had to be on duty during the day while the sun was shining, drifting focal area because of misalignment, resulting in burning secondary reflector, as well as problems with tracking. Despite these problems it was decided to make this cooker a success.

Work included evaluation of the solar cooker, exploring how to collect data and what data to collect, cooking the same amounts of food using other fuels, and evaluating this data. It was found to save up to 25 kilos of wood per day, more than 8 gas cylinders in a month.

The author met Wolfgang Scheffler and Deepak Gadhia and a strong bond was established.

One year later a second Scheffler dish and a solar storage cooker was installed, another invention of Wolfgang Scheffler and manufactured by Gadhia Solar systems Valsad.

We built a specially designed solar kitchen, first of its kind in central India, and are now cooking for approximately 100 persons daily.

Rural women trainees at Barli started asking how they could get those sorts of solar cookers in their villages. We start manufacturing SK14 concentrating cookers and established a system where the trainees at Barli can get a solar cooker on a subsidised price to take back to their villages. Solar cooking is firmly established in remote villages of Madhya Pradesh and interesting data was collected from users, e.g. women feel safer, because when collecting wood from remote forests they face abuse from forest officials and others.

Solare Brucke of Germany trained Barli's workers how to build large Scheffler solar cookers.

Dieter Seifert and Imma Seifert came to Barli and trained village women how to build SK14 solar cookers.

Barli Development Institute for Rural Women has become a source of

1. Awareness regarding solar cooking, people from all walks of life constantly visit the institute to see this live demonstration.
2. For training, students come from India, UK and other countries to volunteer and work on the manufacture of these solar cookers. Barli Developed a curriculum for trainees to learn how to build and use solar cookers that they take home, and how to use them as an income-generating tool
3. Transfer of this technology to another NGO to establish a large solar kitchen in a school for 500 tribal children, and other systems are on track.
4. Research and empowerment: the authors give regular presentations to government officials,

police, army and others, on the use of solar cookers

Keywords: Scheffler solar cookers rural\ tribal women

1. INTRODUCTION

The Barli Development Institute for Rural Women empowers young rural and tribal women to become agents of social change through the acquisition of a wide range of skills and knowledge needed to improve the lives of their families, their communities and themselves. 'Barli' is a very common female name among tribal women in the districts where many trainees come from. Barli denotes the central pillar which supports the tribal house typical of these areas, highlighting the belief of the Institute that women are the central pillars of society.

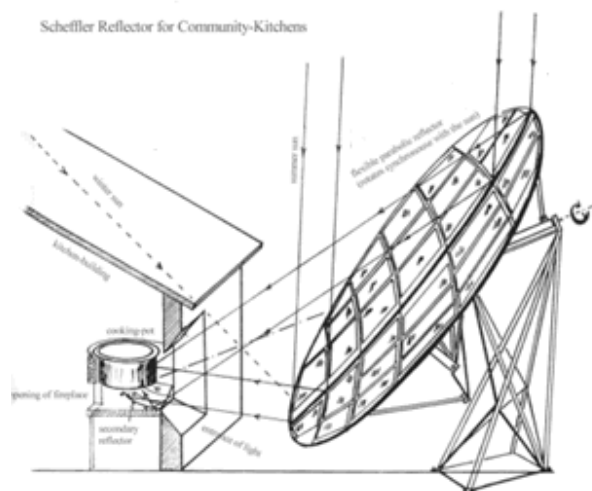
Based in Indore, the Institute has completed 100 residential and other training programmes for more than 2500 young women from 320 villages of Madhya Pradesh and other parts of India. Priority is given to the socially and economically disadvantaged, i.e., 'scheduled castes, scheduled tribes and backward classes', the physically challenged, orphans, widows, divorcees, the abused and the neglected.

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In 1998 when the Ministry of Non Convention Energy Sources New Delhi decided to test Scheffler Solar Cookers in different regions of India, their Regional Testing Centre in Indore selected Barli Institute as an ideal place to test this solar cooker, as it had a kitchen cooking simple meals for 40-50 persons daily, and committed staff who could monitor the use of this cooker and collect data for it's evaluation.

2. THE SCHEFFLER COOKER

The solar cooker invented by Wolfgang Scheffler is designed so that cooking is done inside the kitchen, whereas with most other designs of solar cookers the cook has to stand outside in the sun. Because of this there are certain constraints regarding the design and alignment of the kitchen building.



A detailed drawing of the Scheffler solar cooker

The building needs to have a north-facing wall, no large buildings or structures close to the dish, and sloping roof to allow the sun to shine on the dish during the daytime and throughout the year.

The idea of the Scheffler Parabolic Cooker is to concentrate the solar radiation to one point through absorption onto the black coloured surface of a cooking vessel, this concentrated energy is converted into heat and used to cook food inside the cooking vessel.

The construction consists of a primary reflector of approximately 10 square meters, made from glass mirrors, or other reflective material, the sun rays from this reflector are concentrated through an opening in the kitchen wall, onto a secondary reflector made from aluminium strips covered with household aluminium cooking foil, this reflector is strategically placed inside a cooking place (stove) to reflect the concentrated rays to the bottom of the cooking pot.

3. ESTABLISHING THE SOLAR KITCHEN

In April 1998 when the cooker arrived from Gadhia Solar Energy Systems Pvt. Ltd. Valsad Gujarat, a foundation had already been made to place the stand of the dish. The engineers from Gadhia assembled the dish, mounted the stand on the foundation, and then erected the dish on the stand. When this was completed, the location of the actual cooking place was found. When the cooking place was made, a shed for cooking in was erected; this was a simple structure, using mostly building materials left over from other building works. The only major expenses were for the corrugated iron sheets and the angle iron

frame. When it was finally completed, it had a tandoor, and large fuel-efficient wood burning stove, and a place for washing vegetables and utensils.



The solar kitchen at time of being built

The shed was located in an area close to the main building where there was maximum sunshine throughout the day. The students would enjoy being there and it was the main focal point for relaxing after classes. It resembled the open and airy environment, similar to their villages.

Though the Institute had been cooking with solar box cookers in the past, yet cooking on a much larger scale with this type of concentrated cooker was a new experience for everyone. At this time the Institute was cooking 3 meals per day for approximately 50 people using mostly wood and sometimes LPGas.

The Institute had a menu already in place to suit the eating habits of the students. To get the system going was quite difficult, first organizing the cooking schedule without changing the timing of meals. The students would have poha and tea for breakfast at 9:00 am, rice and daals for lunch at 1:00 p.m. and vegetables and chapattis for dinner at 7:00 pm. Scheduled classes of the Institute would end at 6:00 p.m. Between 6:00 and 7:00pm the girls would help the cook make the chapattis for dinner. It was decided to stay with this schedule and not effect the existing class timings.

As soon as the first rays of the sun came on the dish the onions, spices etc were fried and then the poha cooked. Depending on how fast this got done, the tea was put on the solar cooker to boil, or, if there was not enough time, the tea would made on the wood stove. To avoid any idle time of the cooker and to maximize its use, the item to cook next item had to be prepared and be ready to start cooking as soon as the previous item was removed from

the solar cooker This was to prove the most difficult for the cook. Normally she would finish preparing the food, relax and enjoy having food and some rest after the students had eaten but now everything has to be prepared earlier. For lunch 2 items had to be cooked, first rice was cooked in approximately 1.5 hours, and gave time for the dal to be boiled then fried before lunch at 1:00 pm After this time the vegetables for dinner would cook, taking about 3 hours. The same system of the trainees helping to cook the chapattis on the wood stove after 6:00 p.m. was maintained.

The major difficult now discovered was that the focal point of reflected sunlight was drifting downwards as the dish rotated, original it was thought to be a tracking problem, but when the tracking speed was adjusted, it did not seem to help. We came to the conclusion that this was fault with the cooker; the tracking speed is adjusted by length of the pendulum in the clockwork tracking mechanism. To correct this downward movement of the focal point, the seasonal adjustment was reset on an hourly basis and keeping a very narrow focal area, the result of this was to burn the aluminum foil and then melt the aluminium strips of the secondary reflector. Gadhia Solar sent an extra secondary reflector, so that there always was a spare reflector with the strips and foil replaced. When one got burned we would immediately change it. Another problem was with the clockwork tracking mechanism. When it was working it was OK, but when it stopped it took a lot of time to get it going properly again.

We were also convinced that we will make this cooker work one way or another, because by now we were satisfied with the cooking ability of this solar cooker, and other problems could get sorted out over time A main concern was the attitude of the cook who now had to be on duty for the entire day, and not just cooking for a couple of hours before each meal. Two cooks resigned for this reason only.

Being a project to evaluate the cooking ability of this type of cooker, we started to collect data to be presented to MNES. This proved to be difficult, and by the time we got into cooking with the solar cooker the monsoon had set in with no reliable data collected. During the monsoon we did our best to collect data of the amount of wood and gas used to cook the different items.

FUEL SAVED USING SOLAR COOKING

Food	Ingredients	Wood	LPGas
Poha	5.56 Kgs	3.00 Kgs	250Gms
Tea	7.10 Kgs	2.00Kgs	200Gms
Rice	13.5 Kgs	6.00Kgs	500Gms
Daal	8.25Kgs	5.00Kgs	800Gms
Vegetable	10.50Kgs	8.00Kgs	1200Gms
Total fuel used in one day		24 Kilos	2.95 Kilos

The table above shows the amount of fuel used in a typical day when cooking different items using wood and gas

It was not until January 1999 that we were confident that the data collected was reasonably accurate. For the next year we collected some interesting data, which, due to size constraints of this paper cannot be shown. A more detailed unedited version of this story written in 2003 can be found at:

<http://www.geocities.com/bvirw/solarcooking/success-solar-kitchen.html>

On 2nd and 3rd November 1999 the Ministry of Non Conventional Sources in New Delhi held a workshop on solar concentrating and community cooking systems at the Headquarters of the Brama Kumaris at Mount Abu. I was very privileged to be invited and to share the results of the cooking with the Scheffler system. It was satisfying to know that our cooker, despite all the trouble we had, was performing as well as other cookers installed elsewhere. I was the only one to present findings from the viewpoint of a user; all other papers presented regarding the cooker were from the technical side.

During this meeting we discussed the technical problems with the cooker, and now it seemed clear to all that the problem of the shifting focus was an installation problem, and Deepak Gadhia and Wolfgang told those present that they had now changed the method of installing the cooker so to avoid such misalignment. While talking with Wolfgang and Deepak they informed that they had a new invention that would cook in the night. They said that they would like to send it to Barli for evaluation and testing, as they were pleased with the way we had collected the data and tested the community cooker

On 20th to 22nd December 1999 a 'National Renewable Convention 99' was held at Indore, organised by the National Institute Industry Forum and School of Energy and Environmental Studies DAVV Indore. Again this gave me an opportunity to meet many people involved in solar cooking activities. Wolfgang Scheffler and Deepak

Gadhia also attended this convention, and they decided to stay with us at Barli, giving me an excellent opportunity to interact with them and consult about different aspects of the solar cooker. During this time on the problem of the drifting focal point, it was decided that it needed complete realignment.

During their visit we discussed the solar storage unit. Deepak had suggested to use the existing dish for a number of hours each day to charge this unit. I did not like to do this as we had by now become dependant on our solar cooker and to use the dish for a number of hours every day was going to spoil our solar cooking routine. I approached about funding for another dish and they agreed to give the standard subsidy of 25,000 Rs towards the cost of the reflector. This agreed, we told Deepak to supply us another dish for charging the storage unit. A local Charity Kissan Malhotra Charitable Trust gave the other 50% of the cost of the dish to the Institute. The School of Energy and Environmental Studies DAVV Indore was organising a workshop to show this type of solar cooking to school principals of MP. We agreed to host this workshop, and it was agreed that they would get the solar storage system installed and we would inaugurate it on the day of the workshop. We had to make an extension to our existing shed to house the storage system, and, as the dishes need to be about 5 meters apart, this meant quite a bit of space. We hastily made a foundation and when the engineers from Gadhia Solar arrived with the new dish and the storage unit we were ready to assist them to get the system up and running as fast as possible. During this work the misalignment of the first dish was corrected.

The workshop for the principals of the schools was organised on 22nd January 2000, it as a very successful event with about 100 participants coming from MP and other States. The highlight of the workshop was the inauguration of the only working model of a solar storage cooking system worldwide.



Demonstration of the storage system making chapattis.

But on this same area we would build a wing of the new dormitory complex that had been planned. It was planned with the builder that no work would take place on the area where the solar cookers were located until the onset of the monsoon. Meanwhile work was going on to get, a new kitchen built on the first floor, this being specially designed for the solar cookers. By the time the monsoon started the new kitchen had not reached a stage where we could shift the large dishes. The shed was dismantled along with the Scheffler dishes.

The solar storage system weighed around 600 kilos, so to get it on the first floor, we considered hiring a crane, but there was the problem of getting the crane into the location to move the system where we needed it. As the main staircase to the first floor was nearing completion it was decided that on the students day off we would get them all together and make some rails and roll the storage unit up the stairs on wheels.

With some heavy wheels fitted to its frame we rolled the unit through what was a building site to the bottom of the stairway leading to the first floor. It was hard work getting the storage cooker onto the first floor, but the students and staff were very excited with this task. They heaved, they pulled and pushed the unit all the way to its destination, the whole operation went very smoothly, and it was completed in about 1 hour.

The next work was to install the 2 dishes on the first floor. Our building was 10° of the east west line needed for exact operation of the Scheffler parabolic dishes. We had already decided to go ahead and build the new solar kitchen on the existing pillars as we had calculated that there would be some shadow of the building cast on the dish only for about 1 hour in the morning. Also, as there was only 3 metres of space between the north wall of the new kitchen and the edge of the building, we had to add a 1 metre cantilever extension to the building to accommodate the supporting frame of the Scheffler dishes. It would take until January 2001 before we could have the construction of the kitchen to a stage that we could cook in it. In this new kitchen we cook for more than 100 persons daily.

Wolfgang Scheffler had informed me that a student Adrian Conrad from Switzerland would come to spend some time with us to study the Scheffler solar cookers. I asked if they could look at the tracking mechanism as it was still giving us problems.

Wolfgang had developed a different tracking system using cycle part as gears, etc., but instead we looked at redesigning the pendulum of the existing tracking system. After a number of days of trial, error and different adjustments we came up with a pendulum

design that seemed to work much better and was also simpler to build than the original. This did improve the tracking mechanism.

At this time we built another secondary reflector and another cooking place. This and the storage system were fitted together on a heavy channel frame, then mounted on rails so that when the temperature of the storage cooker had reached a maximum, the unit could be moved and the direct cooking place brought into the focal area of the Scheffler dish, so that no sunshine would be wasted.



Photo shows the storage cooker and the direct cooker on rails.

Now the Scheffler solar cookers are being maintained by the cooks and our garden staff is doing technical adjustment or repairs. The cooks clean the reflectors and make the seasonal adjustments. If the tracking clockwork mechanism stops they get started themselves.

They completely understand the need to use solar cookers and now even in the monsoon season, when the clouds part and the sun shines for some time the dishes are orientated to face the sun, to make sure that no valuable sunshine is wasted.

4. DISSEMINATION OF SOLAR COOKING TECHNOLOGY

As the trainees saw this use of sun for cooking they kept asking how we could also use the sun for cooking in our homes.

At a request from our ex-trainees we took 3 different types of solar cookers to the villages and demonstrated how they can use solar cookers in the villages. As a result the Institute started manufacturing small parabolic SK 14 parabolic solar cookers invented by German scientist

Dr. Seifert. During the training programme at the Institute those trainees who are willing to pay a percentage of the cost and learn to cook, take the cooker home with them after training. As result we were able to start a process of use of solar cookers in the rural areas where the need for the use of non-conventional energy is greater and the fuel wood is more difficult to obtain. PLAGE in Austria is funding this project. Solar cooking is firmly established in remote villages of Madhya Pradesh. Data collected from users shows that other than having healthy environment and saving time, money and energy, women feel much safer. When collecting wood from remote forests they face abuse from forest officials and others. In many cases it has proved to be gender-friendly also as the cookers are so ornamental that men like to cook. At the time of writing, the Institute has supplied more than 280 SK14 and K14 solar cookers to the rural villages.

On 28th November 2003 Heike Hoelt from Solare Brücke came to the Institute to train the staff of the Institute and some village fabricators how to build the Scheffler solar cookers. Training lasted for approximately 6 weeks. During this time we learned how to and built all the jigs and fixtures required to manufacture the 10 square metre parabolic reflector, and built and set up one complete reflector. We also learned how to cut and fix the glass mirrors very accurately.

By now we had stopped manufacturing SK14s and were now using K14 kits imported from Germany. We were very pleased when Dr. Dieter Siefert and his wife Imma along with Deepak and Shirin Gadhia visited the Institute and spent four days with us.

Their time was spent very constructively with Dieter and Deepak teaching the trainees and rural women how to build the K14 parabolic cookers and showing us some of the finer points in engineering. Imma and Shirin were very busy teaching the trainees and others baking cakes, biscuits and other snacks.



An SK 14 solar cooker in front of a tribal home.

5. RESULTS OF THE SOLAR KITCHEN

Barli Development Institute for Rural Women has become a place for general awareness about solar cooking and no conventional energy.

1. Since we started keeping records in 2003, 1200 persons from self help groups and micro credit groups have visited on field tours, 250 persons on guided tours by the School of Energy and Environment Studies, 120 Government officials and experts and 700 other visitors interested in the solar cooking

2. Volunteers and others from India and abroad have come to the Institute to learn about the solar cooking and other environmental issues. With the help of volunteers from Canada and America, the Institute has developed a curriculum to help trainees build and use solar cookers (mostly SK and K14) as an income-generating tool, by making and packing snacks for sale in their local market, using materials available in their own homes and region e.g. soya beans, chick peas, vegetables and others. This is a 10-day training programme conducted free of cost to those trainees and self help groups who take the cookers to their homes. Also when students set-up their small tailoring shops they use the solar cookers to iron the garments they make.

3. After the training by Solare Brücke, Barli has started manufacturing Scheffler solar cookers for other NGOs. With the help of Gadhia Solar Systems a large kitchen of five 10-metre parabolic dishes has been installed in a school for 500 tribal children in Jhabua District, Madhya Pradesh. A specially designed solar kitchen has been set up in an orphanage in Indore, and at time of writing a kitchen with 4 dishes designed for cooking for 300 children in a remote area of Dhar district is almost complete and 3 more such projects are in the pipeline.

4. The author and Director of Barli Development Institute for Rural Women are now regularly called to give presentations to Government officials and others on solar cooking. such as a presentation to the station commanders of Border Security Force on how they could use solar cookers at remote locations. I was the keynote speaker at a workshop organised by MP Energy Corporation for Government officials on how to use non-conventional energy for the development of Madhya Pradesh State and at many others including police training schools, government workshops, conferences and seminars for NGOs and many others. An excellent relationship has been established with the School of Energy and Environmental Studies DAVV University Indore, with Heike Hoedt and Wolfgang Scheffler of Solare Brücke, Deepak and Shirin Gadhia of Gadhia Solar Energy Systems, Dieter and Imma Siefert and many

others within India and abroad too numerous to mention here.

As result of this collaboration, different projects at the time of writing are being planned, like solar vegetable drying, bread making and using solar cookers in the work with fabrics, the only ongoing Institute training programme that still uses wood as a fuel.



View of the present solar kitchen. The reflector nearest to the camera was manufactured by Barli Development Institute for Rural Women during training by Solare Brücke