

# 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 1985, and encouraging its 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.

Evaluation of the solar cooker, how to collect data, what data to collect, cooking the same amounts of food using other fuels, evaluating this data. Saving up to 25 kilos of wood per day, more than 8 gas cylinders in a month. The Author meets Wolfgang Scheffler and Deepak Gadhia and a strong bond is established.

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

We build 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 can they get those sorts of solar cookers in their villages. We start manufacturing Sk14 concentrating cookers and establish 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, interesting data 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 trains Barli's workers how to build large Scheffler solar cookers.

Dieter Siefert and Imma Seifert come to Barli, trains village women how to build k14 solar cookers.

Barli Development Institute for Rural Women has becomes a source of

1. Awareness regarding solar cooking, people from all walks of life constantly visit the institute to see this live demonstration.
2. Training, students from India, UK and other countries come to Institute to volunteer and work on the manufacture of these solar cookers. Barli Develops 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, large solar kitchen established for another NGO, in a school for 500 tribal children, others on systems on track.
4. Research and empowerment, Authors give regular presentations to government officials, police, army and others, on the use of solar cookers

**Keywords:** keyword, keyword, keyword (up to 7).

## 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 name among tribal women in the districts where many trainees come from. Barli denotes the central pillar, which supports the tribal house

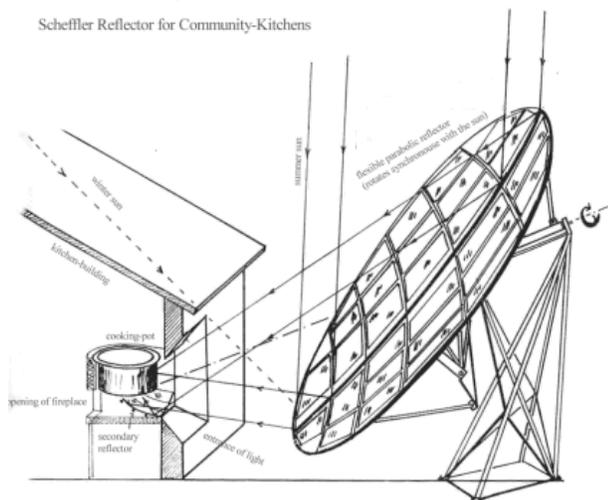
typical of these areas, highlighting the belief of the Institute that women are the central pillars of society. Based in Indore, the Institute has completed 100 residential training programmes for more than 2500 young women from 320 villages of Madhya Pradesh and other parts of India. Priority is given 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.

Though [Barli Development Institute for Rural Women](#) had been using solar box cookers 1985, and encouraging its use in the rural areas with limited success.

In 1998 when the Ministry of Non Conventional 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 and collect data for its evaluation.

## 2. BACKGROUND

The solar cooker invented by Wolfgang Scheffler is designed so that cooking can be done inside the kitchen, where as most other designs of solar cooker the cook has to stand in the sun. Because of this there are certain restraints about the alignment and design of the kitchen building.



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 basically quite simple in practice: it concentrates the solar radiation to one point through absorption onto the black coloured surface a cooking vessel, this concentrated energy is converted into heat and used to cook food inside the cooking vessel.

The basic construction consists of a primary reflector of approximately 8 square metres, made from mirrored acrylic sheets, the sun rays from this reflector are concentrated through an opening in the kitchen wall, then reflected again by a secondary reflector made from aluminum strips covered with household aluminum 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 the cooker arrived from Gardia Solar Enterprises Valsad Gujarat, a foundation had already been made for the stand of the dish. The engineers from Gardia assembled the dish, mounted the stand on the foundation, then erected the dish on the stand. When this was completed, the location of the actual location-cooking place was found. This cooking place then made, then we erected a shed for cooking in, this was a basic structure, but served the purpose very well, it was quite simple structure using mostly building materials that left over from other works. Only major expense being 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, a place for washing vegetables and utensils.

The area where this shed was located was the best area close to the main building where there we could get maximum sunshine throughout the day.

The students use to enjoy being there and it was the main focal point for gathering and relaxing after classes. It resembled the open and airy environment similar to their own villages.

Now that the basic structure was erected, we began the work of actually using the solar cooker, though the Institute had been cooking with solar box cookers for more that 13 years, the success of using these for larger

scale cooking was limited, as they were mostly used for cooking dals, etc. using this type of concentrated cooker was a new experience for everyone.



When we installed this cooker the number of students was around 35, and the total number we had to cook for was for about 45 persons including staff and others. The first experience the cook had was she could cook breakfast without lighting a fire. Though to get the system going was quite difficult, first was to organize the cooking schedule, the Institute had a menu already in place to suit the eating style of the students i.e. they would have poha and tea for breakfast at 9:00 am, rice and dals for lunch at 1:00 p.m. and vegetables and roti for dinner at 7:00 pm.. Normally the scheduled classes of the Institute would end at 6:00 p.m., so the girls would help the cook make chapattis for dinner. We decided to stay with this system, in the morning, the onions, spices etc were fried and then the poha cooked, depending on how fast the poha got cooked, they would put the tea to boil, if there was not enough time then the tea would be made on the wood stove. Next was to cook lunch again 2 items had to be cooked, and to avoid any idle time of the cooker and to maximize it 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. Traditionally she would finish preparing the food, relax and enjoy having food and some rest after the students had eaten, but now everything had to be prepared earlier. It was decided that first we cook the rice then the dal for lunch, this worked fine as the rice normally cooked within 1½ hours, giving time to cook the dal before 1:00 p.m. lunch time, but there was no fast rule about this. After 1:00 p.m. the vegetable for dinner was cooked, we continued with the same system of the trainees helping to cook the chapattis on the wood stove after 6:00 p.m

By now the major difficult that we discovered was that the focal point of the reflected sunlight was drifting downwards, as the dish rotated, original we thought that this was a tracking problem, but when we adjusted the tracking speed, it did not seem to help and 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, we had to reset the seasonal adjustment on a hourly basis resulting in keeping a very narrow focal point, the result of this was to burn the aluminium foil and then melting the aluminium strips of the secondary reflector. We asked Gardia Solar to send us another secondary reflector, so that we always had a spare reflector with the strips and foil replaced, When one reflector got burned we would replace it and there was little or no loss of cooking time. The other problem that we faced was with the clockwork mechanism, when it was working it was ok, but when it stopped it took a lot of time and adjustment to get it going properly again.

We were also convinced that we will make this cooker work whatever, because by now we were satisfied with the cooking ability of this solar cooker, so other problems could get sorted out over time

Main drawback at this time was the attitude of the cook, the main problem being that she has to be on duty for the entire day, and not just cooking for a couple of hours before each meal. In all 2 cooks left the job only because of this reason.

. As this was a project to evaluate the cooking ability of this type of cooker, we started to collect data to be presented to MNES, in the beginning this proved very difficult, and by the time we had got into the system of cooking with the solar cooker the monsoon had set in and we had no reliable data. We had also planned to keep a accurate account of wood and gas used during the monsoon, this also proved difficult and unreliable, and by the time we had a good system in place to get records the monsoon was coming to the end.

Even after we eventually got back to cooking full time after the rains, it still proved very difficult to get data that we could rely on. Basically it was not until January 1999 that we could say that we had data that was reasonably correct. For the next 1 year we collected some interesting data, but size constraints of this paper I cannot show it.

A more detailed of this story written in 1993 can be found at <http://www.geocities.com/bvirw/success> On 2<sup>nd</sup> and 3<sup>rd</sup> November 1999 Ministry of Non Conventional Sources help 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 in partnership with DR. R. L. Sawhney of DAVV Indore. Here I met Wolfgang Scheffler inventor of the system and Deepak

Gardia of Gardia Solar Enterprises manufacturer of the cooker. Attending this was also Dr. A.K. Singhal and others from the MNES. Also it was satisfying to know that our cooker, despite all the trouble we had was performing as well as other cookers installed elsewhere., and I was the only one to present 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 me that the problem of the shifting focus, was an installation problem, and Deepak Gardia and Wolfgang told those present that they had now changed the method of installing the cooker.

It was during the talks with Wolfgang and Deepak they told me 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, because they were quite pleased with the way we had collected the data and tested the community cooker

On 20<sup>th</sup> to 22<sup>nd</sup> December 1999 'National Renewable Convention 99' was held at Indore organised by 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 Gardia also attended this convention, and they decided to stay with us at Barli, this gave me an excellent opportunity to interact with them and consult about different aspects of the solar cooker, during this time we tried to resolve the problem of the drifting focal point, and 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.

As Dr. A.K. Singhal of MNES was also attending this convention, I ask him if MNES could help if I decided to install another dish. They agreed to give the standard subsidy of 25,000 Rs towards the cost of the dish, this agreed we told Deepak to supply us another dish for charging the storage unit. A local Charity Kissan Malhotra Charial Trust gave the other 50% of the cost of the dish to the Institute.

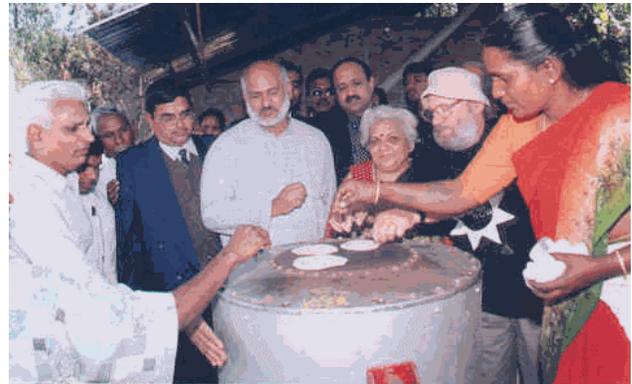
Dr. Sawhney was organising a workshop to show this type of solar cooking to school principals of MP, we

agreed to host this workshop, Deepak agreed that they would get the solar storage system installed and we would inaugurate on the day of the workshop. So we would have to make an extension to our existing shed to house the storage system, and as the dishes need to be about 5 metres apart meant quite a bit of space.

We hastily made a foundation and when the engineers from Gardia 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

While doing this installation work we looked at the problem of misalignment of the earlier dish, and discovered the problem was with the placement of the cooking area, as this was built into the shed we decided moving the mounting of the dish would be the best way to get the proper alignment.

Over the next few days we got some walls built on the shed



The workshop for the principals of the schools was organised on 22<sup>nd</sup> January 2000, it was a very successful event with about 100 participants coming from MP and other States. Highlight of the workshop being the inauguration of the only working model of a solar storage system worldwide. On that day we demonstrated the system making chapattis.

But on this same area we would build a wing of the new dormitory that had been planned.

In 1999 the building of the new dormitories started, I had planned with the builder that we would not do any work on the area where the solar cookers were located until the onset of the monsoon, in the meantime we would work at getting a new kitchen built on the first floor specially designed for the solar cookers. As the kitchen was not part of the contractors main work, by the time the monsoon started the new kitchen had not reached a stage where we could shift the cookers. The shed was

dismantled along with the Scheffler dishes, and very quickly that place where the shed was, had a proper building.

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

We bought some heavy wheels fitted them to the frame and wheeled 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 with the help of all the students on their day off they were very excited with the task, They heaved, they pulled and they pushed the unit all the way to its destination, the whole operation went very smoothly, and was completed in about 1 hour

The next work was to install the 2 dishes on the first floor, first we made a new mounting frame with the alignment for the earlier first dish. Then to get the dishes installed, unfortunately our building was  $10^\circ$  of the east west plane 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, we had calculated that there would be some shadow of the building on the dish only for about 1 hour in the morning. As we only had 3 metres of space between the north wall of the 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 the following year that we could have the construction of the kitchen to a stage that we could cook in it.

One major difficulty that we faced was with the tracking mechanism especially the pendulum that controlled the speed of tracking, it would work for some time then start to give difficulties and would be very difficult to get back to effective working state.

They had developed a total new tracking system and when he came here, we both agreed that this would be quite difficult to fit the to our existing system, so instead we looked at redesigning the pendulum of the existing tracking system. We looked a different ways of doing this and finally came up with a design we would try. 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 has worked very well up to present thought a time of writing the pendulum is giving



slight problems on both cookers.

Also 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. Which was 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 unit brought into the focal area of the Scheffler dish, so that no sunshine would be wasted

During the last year we also changed the system of covering the aluminium strips in the secondary reflector with aluminium foil. And instead we made these strips from highly polished and hardened aluminium sheet, this material is also used in the construction of SK14 parabolic cooker and other uses such as lighting installations.

Now the cooking Scheffler solar are being maintained by the cooks and any our garden staff is doing technical adjustment or repairs. The cooks clean the reflectors make the seasonal adjustments if the tracking clockwork mechanism stops they get started themselves. They have completely the understood the need to use solar cookers and now even in the monsoon season, when the clouds part and the sun shines for some time I see the dishes are orientated to face the sun, they make sure that no valuable sunshine goes to loss.

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

A the request of our extrainees 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. Seifried. During the training programme at the Institute those trainees who will willing to pay a percentage of the cost and who during the training at the Institute would learn to cook, mostly their own recipes on this small parabolic cooker, take the cooker home with them after the course is complete. 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. Intersol in Austria is funding this project and primary school children are raising the money. At time of writing Institute has supplied more than 280 SK14 and K14 solar cooker to the rural villages.

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

By now we had stopped manufacturing Sk14 and were now using k14 kits imported from Germany. We were very pleased when Dr. Deiter Siefert and his wife imam along with Deepak and Shirin Gadhia visited the Institute and spent four days with us.

Their time was spent very constructively with Dr. Seifert 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. Imam and Shirin were very busy teaching the trainees and others baking cakes, biscuits and other snacks.

#### 4. CONCLUSION

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 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 come to the Institute to learn about the solar cooking and other environmental issues. Development In Action a charity based in UK sends 4-5 student volunteers for up to 5 months to assist in the manufacture of Scheffler and other solar cookers. With the help of volunteers from Canada and America, 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 bean, chick peas, vegetables and others. Also when students set-up their small tailoring shops they use the solar cookers to iron the garments they make.

3. After the training Solare Briuke Barli has started manufacturing Scheffler solar cookers for other NGOs. With the help of Gadhia Solar Systems a large kitchen of 5 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. Author and Director of Barli Development Institute for Rural Women is now regularly called to give presentations to Government Officials and others on Solar Cooking. e.g. on -----gave a presentation to the station commanders of Border Security Force on how they could use solar cookers at remote locations. On----- was the keynote speakers 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 many others including Police training schools, government workshops, workshop, conferences and seminars for NGOs and many others. An Excellent has been established with School of Energy and Environmental Studies DAVV University Indore, with Heike Hoelt and Wolfgang Scheffler of Solare Briuke Deepak and Shirin Gadhia of Gadhia Solar Energy Systems, Deiter and Imma Siefert and many others within India and abroad too numerous to mention here.

As result of this collaboration, different project at time of writing are being planned, like solar vegetable drying, bread making and using solar cookers in the work with fabrics that is an ongoing part of Institute train

programme and at present is the only process that still uses wood as a fuel..