

A Report on deployment of Parabolic Community Solar Cookers - for Mid-Day-Meal Scheme in Rural Schools

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Introduction

WOTR is a not-for-profit NGO founded in 1993 operating currently in five Indian states - Maharashtra, Andhra Pradesh, Madhya Pradesh, Rajasthan and Jharkhand. WOTR is recognised widely as a premier institution in the field of participatory watershed development. Besides watershed development, WOTR is introducing new elements such as agro-meteorology, renewable and alternate energy, crop planning and management, water budgeting, bio-diversity and market linkages through its Climate Change Adaptation project. WOTR is working on the Climate Change Adaptation programme funded by NABARD, SDC and other donors in 53 villages across three states – Maharashtra, Andhra Pradesh and Madhya Pradesh.

The first phase of the project targeted 29 villages in the Sangamner and Akole taluka of the Ahmednagar district. WOTR undertook a unique solar cooker project targeting Zilla Parishad primary schools in this area. The objective was to provide a clean and efficient substitute for fossil fuel based cooking solutions (like fuel wood and LPG) for the mid-day meals cooked in these schools. In addition, being a zero emission solution, the solar cooker ensures a smoke-free environment for the cook. Currently, 23 solar cookers have been installed in Sangamner and Akole talukas of Ahmednagar district. A few of these cookers were installed at the beginning of 2011 and have given us almost a full year of data of their usage. The other cookers, also installed during the course of the year, have given us plenty of additional data to validate our findings. The report herewith describes the proceedings of the project, feedbacks from the users, our understanding of the user requirements and behavior and way forward.

The Project:

The project was initiated in December

2010 by WOTR, and the following steps were undertaken during the execution of the project.

a) Technology selection : During 2010-11 WOTR worked extensively on selection of appropriate gadget for community solar cooking at schools. Many manufacturers were visited, existing users were interviewed, and interactions were had with many concerned working in solar cooking technologies. Different options under consideration were SK-14 dish cookers, Scheffler concentrators, SK-23 solar community dish cooker and PRINCE-40 solar community cookers. After a careful study of all options, it was decided to deploy PRINCE-40 solar concentrator for the pilot installation.

b) About the cooker : PRINCE-40, an approved technology by MNRE, is a square dish concentrator of 4 sqm aperture area. The unit is manually tracked and is available in a DIY (Do It Yourself) kit form. The cooker packs up in two small boxes and transportability is excellent. The design has won Innovation 2009 award by the Alumni association of IIT Bombay. The cooker is manually tracked every 20-30 minutes and has a special clutch to hold the reflector in any desired position. It has wheels which are used for tracking as well as shifting the cooker if needed.

c) Pilot project : First unit was deployed at 'Shiswad' village in Akole district of Sangamner in January 2011. The solar cooker was assembled by staff of WOTR. The unit was working well and was demonstrated to teachers of other schools. Few minor issues like use of galvanized nut bolts, washers, issues with better painting practice, provision of locking arrangement etc. were reported to the manufacturer and were taken care of in further supplies. Second unit with minor modifications as suggested was

delivered and installed at Veldari hamlet of Pimpaldari village. Along with this process, an installation training camp was organized by WOTR where 7-8 of the field staff of WOTR and villagers were trained in the assembly process. Normal fixing time for one solar cooker is 3 hours for 3 people.

d) Project scale-up : After satisfactory performance of the solar cookers and acceptance of the technology by the end users, the project was scaled up and 21 more solar cookers were installed. Following is the list of locations where the solar cookers are functional.

| Sr. No. | Taluka | Village |
|---------|-----------|-----------------|
| 1 | Sangamner | GUNJALWADI |
| 2 | Sangamner | VARUDI PATHAR |
| 3 | Sangamner | MAHALWADI |
| 4 | Sangamner | SAROLE PATHAR |
| 5 | Sangamner | SAVARGAON GHULE |
| 6 | Sangamner | HANUMAN WADI |
| 7 | Sangamner | KARJULE |
| 8 | Sangamner | PIMPALDARI |
| 9 | Sangamner | BORBAN |
| 10 | Sangamner | BHOJDARI |
| 11 | Sangamner | WANKUTE |
| 12 | Sangamner | KAUTHE BK |
| 13 | Sangamner | KAUTHE KD |
| 14 | Sangamner | KHANDAGEDARA |
| 15 | Akole | PURUSHWADI |
| 16 | Akole | WANJULSHET |
| 17 | Akole | KHDAKI BK |
| 18 | Akole | KHADAKI KD |
| 19 | Akole | SISWAD |
| 20 | Akole | GHOTI |
| 21 | Akole | SISWAD |
| 22/23 | Sangamner | DTC* (2 units) |

*DTC refers to Darewadi Training Centre.

The project generated lot of enthusiasm in the WOTR team as well as the end users. WOTR now has its own team of about 10 field staff and village volunteers who can fix the solar cookers. With every installation few more people get hands on training. All 23 solar cookers under the project were installed by the WOTR team and at no point was there any need to get the fabricators involved in this.

One of our field staff, Mr. Devram Kondhar, has developed a simple but very effective user manual in local language, Marathi. This has been an excellent resource for all users.

Observations

In this section, we have highlighted some of our observations from the field.

- The solar parabolic cookers can be used as a supplement to conventional cooking methods that use gas or fuel-wood for cooking. The cooker works best under direct sunlight. When the sunlight is being partially hindered by clouds, its effectiveness is reduced. Nevertheless, under direct sunlight, the performance of the cooker is remarkable. In most of our project areas, it has been estimated that such clear sky days are available for about 8 months in a year. So this cooker helps in reducing the dependence on gas and fire-wood considerably.
- The cooker works well between 10.00 a.m. to 4.00 p.m. during the months of October to March, and from 9am to 4.30pm during the summer months. This timing suits most of schools and aanganwadis.
- The size of the cooker that is currently being installed (4 sqm aperture) can effectively cook for about 30 adults (or 50 students) in one hour. If the cooker usage can be extended in two or more batches, then it can cater to larger numbers. However it was noted that most of the cooks in the school were reluctant to cook food in two batches. We may need some convincing or some other incentive mechanism to extend working hours of the cooker.

PRINCE-40 Community Solar Parabolic Cooker Installed at Village Wankute, Sangamner Taluka.



All cooks at present use open pot cooking. With open pot cooking up to 6 kg of rice is cooked without any problems. Batches bigger than 6 kg needs regular stirring otherwise some part of rice gets overcooked and some remains partially cooked. Use of pressure cooker may solve this problem, but it may need some convincing to the cooks. Larger pots will require added assistance for lifting it, as

generally women do the cooking.

- LPG saving to the tune of 15 kg to 25 kg has been reported per month at different locations. This saving is with usage time of 45 minute to 90 minutes per day.

User Feedback

User feedbacks are most important to understand the acceptance of technology by the end users. Many feedbacks gave us new dimensions on utility of this beautiful natural energy source. These feedbacks also guide us on future course of action. Following are the feedbacks from different users.

- Most of the schools where these cookers are installed are using them as main source of energy for the mid-day meals. LPG is used only on rainy, cloudy days and foggy days of winter.
- With the money saved on fuel, few of the schools like Karjule Pathar and Varudi Pathar are buying more vegetables and fruits for school children.
- A point on the convenience of usage is that there was no need for match-boxes and lighters. Although comparatively small, these were definitely additional savings in terms of effort required and money.
- Also related to savings is that according to the school in Gunjalwadi, solar cooking tended to use much less water. We are yet to test this out and measure it though.
- Another point related to drudgery reduction was that – sourcing of LPG cylinders does lead to a lot of stress for the schools. In schools like Sarole Pathar and Wankute (which have about 120 students each), a gas cylinder lasts for about 10 days. The closest town where these cylinders are available is Sangamner, located approximately 25-40 kilometres from school. Often it is the school teachers who have to do this, leading to long absences from the school, fetching cylinders on motorcycle etc. The situation worsens in small schools where there are only one or two teachers. Users of solar cookers with such schools are more than happy.
- The lady who does the cooking also noted a big relief in not having to worry about food getting burnt. Even if the food was on the solar cooker for an extra half hour, it would not burn the food.
- One of the most unexpected of feedbacks was that the food from the solar cooker was much tastier! A number of schools – Kauthe Khurd, Gunjalwadi,

Sarole Pathar have mentioned this independently to us. The tastier food and the better variety in terms of the extra vegetables served has apparently been a big hit among the children.

- With conventional cooking, the bottom part of pot always gets more heat leading to a layer of over burnt food at the bottom. This is not only loss of some food, but cleaning this burnt food takes quite an effort which is not the case with the solar cooker, and thus cleaning up post-cooking is much easier. Also it requires less water and detergent for cleaning.

- Varudi Pathar and Kauthe Khurd report that cooking is now fun and enjoyable. While the food cooks, they also get plenty of time to chit-chat and do other work within the school premises. Cooks who are residing beside school premises can take care of their home also.

Other benefits of the Community Solar Cooker project as perceived by WOTR

This project has a number of direct and indirect benefits. In addition to the observations we made on the field and the feedback from the users, here are some additional benefits perceived by WOTR having observed this project closely for over a year.

- Saving in fuel – as the world debates on strategies to address issues such as depletion of fossil fuels and their growing costs, this project is a simple yet firm step towards making these schools self-reliant in terms of their energy needs.



A field demonstration and training

- Awareness to issues such as Renewable Energy and Environment – children from schools using solar cookers have gone home and discussed these with their parents. There have been many instances of parents enquiring about these cookers, costs, sizes etc from the teachers. Hundreds of school children see the food being cooked on solar cookers and eat the same food in their lunch. This brings in confidence in these students that the technology is there, which works. We perceive this as one of our

biggest gains to teach our future generation, by practicing the green technology for their own use.

- Reduction of CO₂ and other green house gases – Schools have reported LPG saving of 15 to 25 kg per month, depending on strength of students. This is equivalent to saving of CO₂ emission of 45 to 75 kg per month.
- Economic benefits – Considering LPG saving as above financial saving varies from Rs. 500 to Rs. 1000 at subsidized rate and Rs. 900 to Rs. 1600 per month at market rate.

Way ahead

WOTR is pleased with the initial response of the project. There is definitely the opportunity to take this to a larger area as many schools in the vicinity of our project villages have been enquiring about these cookers. We have received considerable interest from the local administration and district authorities. The district collector of Ahmednagar, Dr. Sanjeev Kumar, highly appreciated the initiative after having personally seen a few of our project locations and has taken a keen interest in exploring possibilities of scaling up this project to a wider network of schools in the district. Many of the ashram schools have also shown plenty of interest in this project. Considering their firewood usage is more than 10 times that of a day school or aanganwaadi, the savings in terms of firewood can be huge if this is successful.

In addition to the installation of the cookers in more schools, the areas of work where WOTR is keen to focus in future are:

- Localised fabrication centers as a skill development and an income generating scheme.
- Training and capacity building – utilizing the cooker most effectively, its maintenance, livelihoods training for village youth (women and men) in additional ways of using the cooker, save fuel, and generate supplementary sources of income. Current usage for most of the solar cookers is less than 90 minutes. Cookers are idle after 11.30 a.m. or so. We are working on possibilities of using the solar cookers as a heat source for income generation through some cottage industries for manufacturing candles, snacks, biscuits, cakes, papad or similar stuff through women self help groups.
- We are looking for the scale up of the project and exploring possibilities to get subsidies from MNRE, which will allow us to use our funds more judiciously and reach to more number of schools.

- We would like to explore the other possible applications of the solar parabolic such as for autoclaving and cooking at public health centers.
- We would like to explore possibility of using pressure cookers in all the schools where the solar cookers have been given.
- Recently we were introduced to a new solar cooker PRINCE-60, which is 6 sqm solar-cooker and may suffice for up to 100 students. This new design has few unique features – steps from rear side so that the pots can be accessed easily, stirring is easy, and the cook has some shade to stand under. We will like to put the new design as pilot project at some of our sites.

Acknowledgements

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Most importantly, we thank the people of the villages we have worked in, the schools and their staff for volunteering to be a part of this unique experiment and contribute in such an important way to our learnings.

And last but not least, we thank the field operating teams at WOTR for tirelessly working in ensuring the timely delivery, assembly and support throughout the project.

With our experience on these solar cookers we strongly recommend these PRINCE-40 solar concentrators for use in rural schools without any reservations.

Observing the precaution of wearing dark-glasses while the cooker

