

Shifting from Conventional to Solar Water Heaters, India

Themes

- ★ Renewable energy
- ❖ Financing mechanisms and private sector involvement
- ❖ Technical capacity development
- ❖ Awareness, culture, and practices

PROJECT DATA

Name: Transformation of Users of Conventional Water Heaters to Solar Water Heaters
Implementing Organization: Sardar Patel Renewable Energy Research Institute, SPRERI (NGO)
Location: Gujarat, India
SGP Contribution: \$23,627 (\$8,555 used for purchase of equipment, which is 28% of total equipment cost for 50 solar water heaters)
Start date: March 2002

ENERGY OVERVIEW

Energy Resource: solar
Technology: solar water heaters
Application: water heating
Sector: commercial, domestic
Cost of the system: average cost \$618 per unit installed through this project
Total capacity per system: 100-750 liters per day (average size is 225 liters per day), at 60 °C
Households/manufacturers served: 50 solar water heaters installed via 3 manufacturers

BACKGROUND

Each year, an additional 15,000 wood-fired water heaters are installed in the Anand District of the Indian state of Gujarat alone. Between 4-6 other districts in Gujarat have similar use levels of wood-fired water heaters. Households usually have 40-liter, wood-fired systems, which cost approximately \$75 each and provide hot water for about 5 people. Larger households might have a 100-liter capacity system, which costs about \$130. Women must collect or purchase the firewood, and burning the wood produces significant indoor air pollution. If 6 kg of firewood are used each day, fuel costs would be \$4 per month. Solar water heaters, on the other hand, have higher capital costs, and generally have a higher capacity, with a minimum of about 100 liters per day. The smallest solar system costs about \$375, about 3 times the cost of a wood-fired heater. However, fuel wood costs are saved, and indoor pollution is reduced.

PROJECT DESCRIPTION

Overview

This project has collected baseline information from wood-fired water heater manufacturers and users, and provided train-

ing to manufacturers and assistance to users to help introduce solar water heaters as an alternative. The goal is to educate both manufacturers and consumers about the advantages of solar water heaters, and to identify the most important barriers to expanding their use more widely.

Implementation

The grantee, Sardar Patel Renewable Energy Research Institute (SPRERI), undertook a survey of more than 55 industrial manufacturers of wood-fired water heaters. The survey collected information about the use pattern, cost, sales and service of these water heaters. An interactive meeting between SPRERI, and manufacturers helped introduce solar water heaters to the manufacturers. In addition, SPRERI identified key users of water heaters, and their needs, and monitored the thermal efficiency and pollution data related to the use of wood-fired water heaters. Two solar-powered systems were obtained from NRG Technologies and Steel Hacks Industries, and SPRERI conducted experiments to assess how these water heaters could meet users' needs. An interactive meeting with users helped develop an appropriate incentive scheme to promote the use of solar water heaters. As a result of these efforts, 12 manufacturers now supply solar water heaters, and 50 solar water heaters have been installed with users contributing about 75% of the cost of the equipment. The subsidy offer was advertised in local newspapers, and beneficiaries were selected after a site visit to determine the feasibility and cost of installation. The subsidy offered was \$111 for a system of up to 150 liters per day, and \$167 for systems above 200 liters per day. If the user was replacing an old wood-fired heater, an additional buyback amount was paid to the user, which ranged from \$78 for a new wood-fired system (which is approximately the market cost of a 40-liter system) to \$11 for a 4-year-old system.

The project sought to overcome certain attitudes and assumptions about solar water heaters through this initial set of installations. For example, many people believed that solar water heaters could not provide hot water on cold or rainy days. On the other hand, many households were unaware of any alternatives to the smoky wood-fired systems that required a constant supply of firewood. The project has since set a goal of disseminating the solar water heaters more widely, to replace 10% of the 15,000 wood-fired water heaters installed in the district every year. In order to achieve this, SPRERI plans to work more closely with government entities.

Technology

The solar water heaters promoted in this project have capacities ranging from 100-750 liters per day. Under good conditions, the water is heated to 60 °C. The system consists of a flat plate collector, a storage tank and a piping system. The collector is made from an array of conduits placed on an absorber plate which is painted black and fitted with a glass cover. It is surrounded by insulation to reduce heat loss. Water is heated by solar rays, moved to the storage tank through a thermosyphonic effect, and stored in the tank for later use. A particular local adaptation is the incorporation of heat exchangers to pre-

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vent mineral deposits, which build up easily in Gujarat due to the high mineral content of the water. In addition, the possibility of damage to glass parts by monkeys had to be taken into consideration in technology design.

During approximately two months of the year, solar energy is not sufficient to heat water. During these periods, electricity or LPG is used to heat water.

Environmental Benefits

Global: Each household previously used 5-7 kg of firewood every day for water heating. By replacing this with solar water heaters, households save this amount of firewood, thus reducing carbon dioxide emissions.

Local: Wood-fired water heaters produce smoke, which causes local air pollution. The introduction of solar water heaters can help reduce this problem. In addition, local forests may suffer fewer threats as a result of decreased demand for firewood.

Livelihood Benefits

Health: Reduced smoke due to the use of solar water heaters can help reduce respiratory problems, which are experienced primarily by women and children exposed to indoor air pollution. Improved access to hot water can provide additional health benefits.

Savings: Although initially more expensive, solar water heaters may save households money over the longer term, therefore enabling them to use more of their income to meet other needs. However, since solar water heaters seem to be so much more expensive than wood-fired ones, whether solar water heaters actually save money may depend upon the lifetime of the equipment, the local cost of firewood, and other similar factors. A more in-depth analysis would be required to assess this. Project organizers note that solar water heaters are more competitive with electric water heaters than with wood-fired ones.

Beneficiaries

The primary beneficiaries are local users of water heaters. So far, 50 households have installed solar water heaters. In addition, manufacturers benefit from increased awareness about solar water heaters.

Capacity Development

The project provides training to local industries making wood-fired water heaters to encourage them to build solar water heaters. Training includes technical know-how, third party testing, and assistance in quality control.

Partners

SPRERI has partnered closely with manufacturers and users by involving them substantially in the development of plans to promote solar water heaters. Close collaboration with these groups has enabled the project to test solar water heater use in the area, and the initial set of manufacturers and users have

a very important role to play in the further dissemination of solar water heating technology.

LESSONS LEARNED

Environmental Management

By conducting a careful baseline study that documents the thermal efficiency and pollution produced by wood-fired water heaters, this project contributes to a better understanding of how current use patterns are impacting the environment, and how the introduction of solar water heaters can result in improvements. The surveys and meetings with users and manufacturers also gathered critical information necessary to adapt solar water heating technologies to work under local conditions.

Barrier Removal

Information/awareness: This is the primary barrier targeted by this project. Information and awareness barriers have been identified and addressed among users and manufacturers through an interactive approach. SPRERI organized meetings with both groups to learn about their concerns and needs. The project also identified particular awareness barriers, such as the notion that solar water heaters could not work at all on rainy or cold days.

Technical: Local companies that used to produce only wood-fired water heaters are now producing solar water heaters as well. By involving existing local companies, this project helps generate local, sustainable production of this new technology.

Financial: Financial barriers were addressed only for the initial group of 50 households installing solar water heaters. In fact, the SGP grant provided a direct subsidy for the equipment costs. If the benefits of this technology, both financial and otherwise, are very strong and are adequately demonstrated by the initial 50 solar water heaters, using grant funds for a subsidy might be justified. The need to address financial barriers on a wider scale was recognized, but this project does not yet attempt this. It will be important to assess the effectiveness of the subsidy approach in helping to generate a more widespread reduction in financial barriers, since clearly grant funds will not continue to be available for this purpose.

Policy: A lack of appropriate incentives to adopt solar water heaters was also identified as a barrier to their widespread use. The project intends to address this barrier in its next steps.

Scaling Up

Through its activities, this project has been developing a plan for expanding the use of solar water heaters across the district and eventually to other districts as well. This was the intention behind conducting a baseline study, holding meetings with stakeholders, and testing implementation in 50 households. Next steps for this project include the selection of particular segments of consumers who can begin using solar water heaters, and the collection of further information based on their experiences. Attention will be paid to how policies could

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be changed in order to better promote the use of solar water heaters. However, it appears that while solar water heaters are competitive cost-wise with electric water heaters, they are relatively expensive compared to wood-fired water heaters.

SOURCES CONSULTED

SGP Project Record SGP/GEF/IND/02/GUJ03, SGP Project Database, <http://www.undp.org/sgp>

GEF Small Grants Programme, India. "Empowering Communities and Partnerships." Project summary, 2003.

S.K. Philip, Sardar Patel Renewable Energy Research Institute. Email communication, September 1, 2003.

S.K. Philip and Mr. Dipanwita, Sardar Patel Renewable Energy Research Institute. "Details of users who opted to replace wood-fired water heaters by solar water heaters/buy new solar water heaters under the GEF scheme." Project data report, September 23, 2003.
