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Introducing solar power: Pakistan



GENERAL INFORMATION

- ◆ **Implementing institution**

Solar Energy Research Centre (SERC)

- ◆ **Head**

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- ◆ **Details of institution**

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- ◆ **Implementation period**

18 months.

- ◆ **Costs**

US\$2,500: US\$1,000 from the Third World Network of Scientific Organizations (TWNSO), US\$1,000 from the Government of Pakistan, and US\$500 from NGOs and the private sector.

SUMMARY

In the developing world, the availability and cost of power can play a vital role in economic development and people's well-being. As countries become wealthier and their populations grow, demand for energy increases. Traditional sources of energy are often too expensive to satisfy this demand. There are also concerns about the limited reserves of fossil fuels and their environmental costs. Solar energy, in particular, is an excellent alternative to fossil fuels, particularly for such developing countries as Pakistan that receive high levels of solar radiation. More and more countries, therefore, are introducing economically and environmentally sound energy policies and are turning to solar energy for a wide range of uses, including cooking and water heating.

However, people are unlikely to adopt a completely new technology until they know something about it and have seen how it works. They need to have access to clearly presented information that explains the technical and economic benefits of replacing long-established traditional methods with new, innovative ways of doing things. This means that the new technology must be readily available.

When this project began, the Solar Energy Research Centre (SERC) in Pakistan had already developed designs for solar geysers and cookers suited to the country's socio-economic conditions. However, the Centre did not have facilities to manufacture these devices at

affordable prices and of high enough quality. With US\$2,500 in funding, SERC was able to establish an up-to-date facility for the mass production of solar geysers and cookers and provide all the necessary technical support, service implementation and management for such a facility.

BACKGROUND AND JUSTIFICATION

Pakistan covers 796,095 square kilometres of land between latitudes 24° and 36° north and longitudes 61° and 76° east. At present, it faces serious energy problems: 95 per cent of its electricity generation comes from hydropower, which becomes less productive during the driest, hottest months of the year and cannot keep pace with the sharp rise in energy demand.

Also, about 70 per cent of the population live in some 50,000 villages dispersed around the country. Many of these villages are far from the main transmission lines of the national grid and, because of their relatively small populations, it is usually not economically viable to connect these villages to the grid. Solar energy, on the other hand, has excellent potential in areas of Pakistan that receive high levels of solar radiation throughout the year. Every day, for example, the country receives an average of about 19 megajoules per square metre of solar energy.

Solar energy systems have already been developed and tested, and they should now be adopted extensively as a way of supporting the economy of

the country and improving the living standards of its people. Not only can solar systems meet basic needs of rural areas, but they can also reduce the pressure on conventional energy sources in urban areas, leaving more of these valuable resources for other domestic and industrial needs.

Solar geysers and cookers can be installed in remote rural and suburban areas and are a safe, pollution-free alternative to gas, other electricity sources and wood. They can also replace the traditional use of wood or dried dung for domestic cooking, thereby solving significant health and environmental problems. Wood conservation is particularly significant in rural areas, where demand for fuel wood is leading to widespread deforestation. As a result of deforestation and other ecological changes, rainfall has decreased, temperatures have risen, water-table levels have fallen, and agriculture is suffering. At the same time, women and children, in particular, are suffering the health implications of inhaling fumes from dung and other materials.

The effects of the new technology are:

- reduced deforestation;
- improved environmental conditions;
- better health for many rural people;
- less rural to urban migration;
- enhanced agricultural development; and
- poverty alleviation.

DESCRIPTION

As a first step, solar geysers for water heating were introduced in cities, particularly in such large buildings as hospitals, factories, government complexes, industries and hotels. These facilities were already using electricity from conventional sources and paying commercial rates for the energy they consumed. Solar energy was of benefit to them because it represented a cheaper alternative. At a later stage, it is expected that public and private domestic users of conventional electricity supplies will adopt solar geysers for the same reason, i.e., lower fuel bills.

The solar cooker technology was introduced in a slightly different way: through a management system that involves non-governmental organizations (NGOs) with experience in this field. Initially, solar cookers were supplied to rural people who had no previous experience of using and paying for electricity. This meant that the costs to users had to be kept to an absolute minimum. Moreover, one of the first aims of the solar-cooker project was to increase people's awareness of and confidence in the new technology. Solar systems require a certain amount of open space for the solar panels, but while rural areas are more appropriate for their use than crowded cities, the cookers and geysers can also be installed in urban areas.

Solar power improves the living conditions of people in areas that have no other sources of electricity. It also allows

rural people to carry out income-earning activities that need electricity, thereby contributing to the country's economic development, especially in rural areas, and reducing the urban-rural divide and rural-urban migration. Rural people who can earn money at home are less likely to migrate to cities in search of work.

PATENTING AND COMMERCIALIZATION

Work is under way to register patents for the solar geyser and the solar cooker. The technology is simple to replicate and easy to adopt, so its commercialization is likely to prove successful. Many institutions and individuals have already expressed an interest in obtaining SERC solar systems for cooking and water heating.

PARTNERSHIPS

Collaboration with the public and private sectors is essential for wider adoption of the technology, its efficient operation and improved management. SERC has also sent a proposal for collaboration to China.

REPLICABILITY

As the worldwide energy crisis grows and conventional sources of energy become increasingly limited, more and more countries are turning to renewable energy

technologies, particularly for remote and rural areas. Among the countries that have developed new renewable energy technologies are China, Greece, Israel and Jordan. The SERC experience in Pakistan could be applied to these and many other countries where electricity is not available in many villages and rural areas.

LESSONS LEARNED

While the technical aspects of the SERC project are relatively problem-free, financing is the major obstacle to the widespread adoption of the new technology. The project would benefit from subsidies for supplying solar geysers and cookers and for providing after-sale servicing. Until such funds become available, the technology is being introduced in a limited way only to those areas where it is easiest to monitor and maintain it. These tend to be areas that are relatively close to SERC headquarters in Hyderabad.

Many rural people are unaware of both the need to conserve conventional fuels and the advantages of using renewable energy technology. With this in mind, SERC is promoting renewable energy technology among people living in remote rural areas through demonstrations and information dissemination. In urban areas, it is easier to encourage people to adopt renewable energy because of the savings in energy expenditure that it allows.

IMPACT

Unemployment is increasing, and its effects are particularly severe in rural areas, where there are few opportunities for alternative income generation. Introducing simple solar power technologies can alleviate this problem by providing people with the means to start up their own small, electricity-driven enterprises. Solar cookers reduce the time that people have to spend gathering wood, allowing more time for them to carry out income-earning activities. Better health from the cleaner air in homes has equally beneficial effects, while reduced deforestation helps to improve agricultural production by creating healthier soil and better controlling water flows, thus enhancing the opportunities that agriculture offers to rural people.

FUTURE PLANS

SERC plans to modify the design of other solar thermal devices to make them more efficient and less costly to manufacture. Efforts will be made to commercialize these devices in both the public and private sectors. A media campaign, using both print and electronic communication, will also be carried out to help to develop widespread awareness of solar geysers and cookers.

SERC is planning workshops and seminars to inform other institutions in Pakistan and elsewhere about the new technology. The Centre is looking

for opportunities to collaborate with other countries on joint ventures to manufacture solar thermal devices.

PUBLICATIONS

Arbo., R.S. (1994). Recognition of passive cooling techniques. In *Proceedings of World Renewable Energy Congress III*, Reading, United Kingdom, 11-16 September 1994.

Pitts, A.C. and Arbo, R.S. (1992) Clean energy resources in Pakistan. In *Congresso Internazionale Energia, Ambiente e Innovazione Tecnologica*, Rome, Italy, 12-16 October 1992.

_____ (1993). New and renewable energy sources and Pakistan. In *Proceedings of ENERGEX 1993, the Fifth International Energy Conference*, Seoul, Republic of Korea, 18-22 October 1993.

_____ (1994). Photovoltaic power-assisted building ventilation for comfort in hot climates. In *Proceedings of the Twelfth European Photovoltaic Solar Energy Conference and Exhibition*, Amsterdam, the Netherlands, 11-15 April 1994.

Raja, I.A. and Twidell, J.W. (1990). Distribution of global insulation over Pakistan. *Solar Energy Journal*, 44: 71.