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INDIA TURNS ON THE SUN

by Rajiv Gupta

The total solar energy received by India's land mass is several thousand times more than the total energy India consumes every day. In the years to come, this energy from the sun will be used to meet a large part of the energy needs of the country's households, agriculture and industry.

India is one of the few developing countries to have launched a substantial solar energy programme. About 40 institutes are carrying out basic and applied research in this field. India has established a vast nationwide network to collect data on solar radiation.

The simplest way of using solar energy is to heat water with it. The Department of Science and Technology is launching a major demonstration programme under which solar water heating systems will be installed at textile mills, hospitals, hotels and dairies. The aim is to encourage industries to meet their heat requirements through solar energy. And the government has provided tax incentives for solar energy users in its 1981-82 budget.

Solar energy is now almost economically competitive, says Mr. Maheshwar Dayal, a senior adviser at the Department. Simple flat plate solar collectors can be easily used to heat water up to about 100°C. With the

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help of booster mirrors, temperatures of up to 150°C can also be reached.

Since the mid-1970s several leading companies have also become involved in solar energy research and development in the public sector.

Hot water heaters manufactured by the publicly-owned Bharat Heavy Electricals (BHEL) company are today working at Qutab Hotel in New Delhi, and at BHEL's own plant at Hardwar where 200-megawatt turbogenerators are manufactured. At Hardwar, the solar water heaters are used to keep the building warm during winter. Some 200 solar collectors are used to heat water which is then stored in an insulated underground reservoir. At night, the air in the building is heated by circulating it around the stored hot water. This is the first experiment in India which has used solar energy for large scale space heating. Solar water heating systems are also being used at Maurya Hotel in New Delhi to keep the swimming pool water at a temperature of 25°C.

In all those industries where hot water is needed, solar energy can be easily used to heat it to 90-100°C, saving large quantities of fuel oil. According to Mr. B.C. Jain of Jyoti Limited at Vadodra, a substantial part of India's industrial heat requirements are at relatively low temperatures. For example all the heat needed for coffee drying is below 100°C; similarly, 85 percent of all thermal energy used in the dairy industry and 74 percent of all the thermal energy used in cotton textile mills is used at less than 100°C.

Mr. Dayal estimates that by the year 2000, nearly a quarter of all fuel oil and about 40 percent of coal required in industry for low and medium temperature process heat applications can be replaced by solar water heaters. This would save well over 50 million tonnes of coal in that year.

Several types of solar dryers have also been developed in India.

A solar air heater is being used for drying milk at the Amul Dairy in Anand, a one tonne per day grain dryer is working at the State Seed Farm in Ludhiana and a half-tonne per day crop dryer has been installed at the Small Industries Service Institute in Gauhati. Solar heat can also be used to operate irrigation pumps and air conditioners, and to generate power. With the help of solar collectors in which special devices are used to concentrate the heat of the sun, water can be heated to temperatures even above 150°C . This steam can be directly used to operate a pump or a turbine or it can be used to vapourise a volatile fluid that turns into gas at relatively low temperatures. This gas can in turn be used to operate a pump or a turbine. These types of solar devices are called solar thermal conversion devices as they convert solar heat into mechanical work (in the case of a pump) or into electricity (in the case of a small generator).

BHEL, in collaboration with the West German firm MBB, has set up a 10 kilowatt solar thermal power plant near the Indian Institute of Technology at Madras. Such plants may be able to meet the small domestic, agricultural and industrial energy needs of a medium-sized village in the not-too-distant future. The Department of Science and Technology is now considering the construction of a larger, 20 kilowatt solar power plant which will be developed entirely by Indian scientists.

Meanwhile, a project to fabricate a 1 kilowatt solar pump has been started by BHEL. There is considerable growth taking place in the use of irrigation pumps in India. More than 10 million pumps are likely to be installed in the next two to three decades.

Research on solar refrigeration is being conducted at the Indian Institute of Technology at New Delhi. At IIT, Delhi, a system suitable for tropical climates has been evolved which attains temperatures around 15°C with ordinary flat plate collectors. According to Dr. R.S. Agarwal of the Institute's mechanical engineering department, the reliability of the system is still a major constraint.

In fact, solar heaters will likely continue to play a more important role in Indian industry and hotels than in households. Indian families do not use much hot water for domestic purposes like bathing or washing clothes and utensils. Moreover, the initial investment required for buying solar water heating devices is still too high for individual families, feels Dr. G.D. Sootha, a specialist in solar water heating systems. More research is needed to reduce the costs of domestic water heaters.

The cost of a normal domestic solar hot water system with a 100-litre capacity now ranges between Rs.2500-3000. The maintenance costs are minimal however, and the life span of the system is about ten years.

Dr. R.L. Dutta, former president of the International Solar Energy Society argues that solar energy can become an important energy source for India's villages. He points out that the cost of power delivered to a village five kilometres away from a power plant is twice the cost of generating it, and at a village 10 kilometres away the cost is tripled. The cost of supplying electricity to a village 80 kilometres away would be over 20 times the cost of generating it. Therefore, even though the cost of using solar energy remains high, it should become economically competitive soon for several applications in remote regions.