

LARGEST SOLAR STEAM COOKING SYSTEM

Today there is a growing concern in the world about ever increasing pollution of the environment. As people are slowly becoming aware of definite threat to their very existence as a consequence of environmental pollution, world bodies are making concerted endeavors to check this growing menace."

Some major effects of environmental pollution are:

1. Depletion of ozone layer
2. Acid rain
3. Green House Effect

Green House effect is the phenomena attributed to the rise in global temperature due to the increase in carbon-di-oxide level is the use of fossil fuel. A long term effect of this is rise in sea-level to dangerous limit thus making habitations situated in the proximity of oceans inhabitable.

About 16% of the commercial energy and 80% of non-commercial energy used in India goes for domestic sector. A part of this is used for cooking and heating of water. One half of the world cooks its meal over an open fire. Even if 3% of Indians could be influenced to cook with solar cookers it could result in saving of approximately 3.2 million tons of fire wood per year and reduce emission of 6.7 million tons of carbon dioxide which is a major contributor to global warming.

Many large institutions do not turn towards solar energy for cooking because of the lack of a reliable system that can be shown to work. To dispel any doubt, The Brahma Kumari Organisation headquartered at Mount Abu is a institution where more than 10,000 people daily visit, stay and have meals. They have established the world's largest solar cooking system that uses parabolic concentrators of large surface area that focus solar energy to receivers that convert the water in the pipes to steam is then used for cooking. Excellent results have been achieved. This technology is worthy of replication.

Recent studies by the World Health Organization (WHO) in Mexico, Nepal and South Africa have shown that non-smoking women who cook on biomass stoves or open fires in homes have seven times more chance of contracting obstructive lung diseases as compared to those who use other sources of heat.

Solar cooking is one of the most interesting application in the field of renewable energies. During the last 20 years many designs and concepts have been developed and tested especially in the field of family cooking. Box type solar cookers are not new to India and are being promoted by various agencies within the country.

Now Swiss technology (Parabolic Concentrator) has come to complement the box cookers. These box cookers, Flat plate collectors used in water heating and parabolic concentrators are available in most developing countries to help reduce the consumption of costly liquefied petroleum gas, kerosene, fire wood etc. However the problem of heat storage has not yet been satisfactorily solved and this is one of the reasons that solar cookers are not in every day use.

with the Swiss technology it is possible to cook for larger number of persons with solar energy within a short span of time. Transfer of this technology in India has taken place through M/s Gadhia Solar Systems Pvt. Ltd. Valsad.

At present the Prajapita Brahma Kumaris Ishwariya Vishwa Vidyalaya an International Spiritual Educational Institution, recognised by UNO under the class-1 status which operating with its headquarters at Mount Abu, India. Is holding the privilege of having manufactured in their own workshop at their Premises and installed the world's largest solar steam cooking system at their headquarters Shantivan complex, Abu Road and dedicated to the service of humanity in February 1999.

TECHNICAL DETAILS OF THE SYSTEM: The solar steam cooking system in Shantivan is Jointly designed by wolfgang Scheffler a scientist from Switzerland (design of parabolic concentrators) and M/s High Temperature Technology, Vermany, a world leader in heat transfer technology (design of receiver, header pipe etc.) This system consists of 84 improved version of parabolic concentrators each of 9.2 sq mtr. reflective surface area. Each concentrator is fitted to a rotating support which itself rests on a stand. The whole construction is made out of mild steel. Reflective surface area. is more of special white glass with optical reflective efficiency close to 94% . These glasses were imported from Germany.

The design is such that one parabola reflects from higher position to the front side of the receiver and other parabola from lower position to the back side of the receiver so that the reflected sunlight from 84 concentrators is focused on to 42 (shell type) receivers each of 35 cm. in diameter made out of boiler grade steel.

Each concentrator gives a maximum output of energy equivalent 4 KW at 1000 Watts/sq. mtr. solar radiation and the temperature at the focus reaches up to 700 c. A. maximum of 3500 kg steam can be generated per day.

The mirrors are arranged in accurate East-West alignment. Tracking of the concentrators is controlled by a semi automatic centralized system by means of 6 winches, dc motors, an electronic timer and a small photo voltaic system. Every day in the evening the system has to be manually reset to the morning position.

Working Principle

The system works on thermosyphon principle, treated water in the receiver gets heated by 2 concentrators focusing from the front and rear sides of the receiver. The hot water immediately shoots up into the very well insulated header pipe and heats the water there, cool water immediately flows through an integrated 1/2 inch diameter stainless steel pipe. As this cycle repeats starts generating and collecting in the top half portion of the header pipe. Here the header pipe itself works as a steam reservoir

As the whole system works on thermosyphon principle there is no need for a separate steam generator, heat exchanger or any circulation pump. This increases efficiency and there is no interruption from power cuts.

A WORD ABOUT MODULAR DESIGN

The system is modular in design each module consists of 14 parabolic con-

centrators focusing on 7 receivers. Steam collected in the 6 steam reservoirs from all the 6 modules are interconnected to a common steam drum from where steam is carried by insulated pipes to the kitchen.

FEED WATER AND BACKUP SYSTEM

A water softening system is incorporated which supplies the treated feed water for steam generation in order to avoid formation of any scales in the header pipe and receivers.

Steam traps and a pressure reducer station ensure good quality steam. The steam is used for cooking water sterilization in milk and tea kitchen.

SYSTEM SAFETY:

The system is protected against excess pressure by safety valves and an automatic shutdown mechanism. The status of the whole system is monitored by temperature and pressure meters and a computerized 6 channel data logger.

Though the system is designed for 20,000 meals per day, so far it has provided steam to cook 33,500 meals during peak solar radiation period and it seems its maximum capability can still be stretched.

In between the gatherings the output and the sorting capability of the system was excellent so that even at 4.00 am sufficient steam for tea preparation for 15,000 people was available. During such periods the back up system could be switched off completely.

In the monsoon season usually a period of 10 weeks it is not practical to run the system. The overall handling of the system is easy. Operation and maintenance is carried out by 3 dedicated trained staff members.

The main goal of the project is:

- 1: Transfer of technology
- 2: demonstration of such a system in India
- 3: Evaluation of the efficiency of solar steam cooking system of this size under practical conditions.

CONCLUSION

It is very much appropriate to mention here that this massive creation would not have been a reality without the hard work, hearty co-operation and the heartfelt well wishes by each and every Brahma Kumaris and Brahma Kumaris from all over the world. We believe firmly that ultimately only non conventional energy could become usable out of all the other sources in the coming millennium.