SOLAR STEAM STERILIZER FOR RURAL HOSPITALS

Michael Tyroller
Solare Brücke
G.v.Werdenbergstr.6
89344 Aislingen
Germany
michityroller@web.de

ABSTRACT

Development, test (2003) and installation (2004) of a Solar Steam Steriliser for Rural Hospitals. A 76 l steriliser is running 4 times a day with a 10 m² Scheffler

Reflector which stores the thermal heat directly in the core of a 230 kg iron block which functions as a once-through steam generator. The system is connected straight to the steriliser. The system works hybrid and it is therefore still possible to use the electrical boiler for days with bad radiation.

Positive effects:

Small Hybrid system
High efficiency
Only materials which are locally available are used.
They are designed in a way that makes construction and maintenance easy.

Keywords: steam, heat storage, Scheffler- Reflector, fix-focus-system, sterilizer, autoclave, hybrid, iron block, high temperature

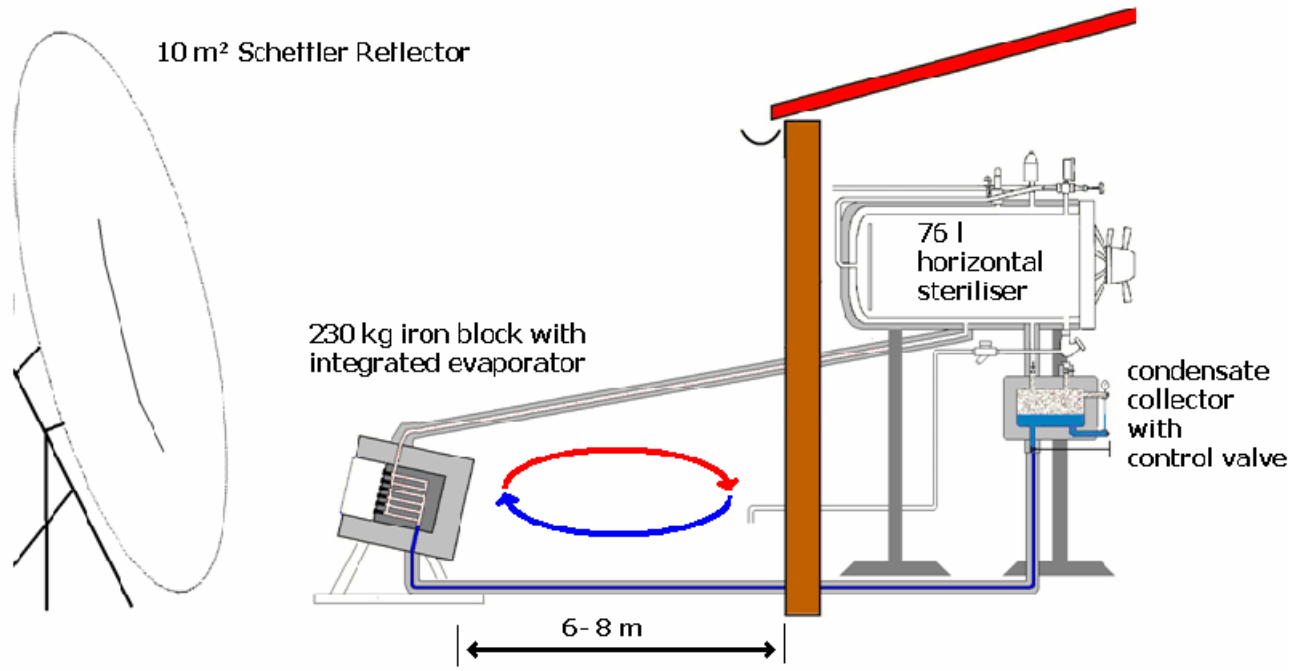

Fig. 1 sketch of the solar steam sterlizer system

1. INTRODUCTION

In rural areas of India institutions depending on oil, gas and electricity are trying to switch to renewable energies. Reasons for this change are the high costs of conventional fuel and the unreliability of the electric grid. Photovoltaic is often too expensive and therefore only used for small applications like lamps or small refrigerators for vaccine. For applications that draw more power, oil burners and diesel generators are used. The high cost of the fuel and the transport of the fuel often present a big problem.

Looking at the energy needs of a rural hospital it is clear that most of the energy provided by diesel generators is used in form of thermal energy. Laundry and autoclaves (run by steam) are the main consumers.

For those applications thermal solar devices like flat plate collectors or concentrating solar reflectors are ideal, as they transform solar energy into thermal energy at the necessary temperature level.

To sterilize medical equipment, saturated steam at a minimum temperature of 121 °C is needed. Flat plate collectors can only provide water up to 80°C. For sterilization vacuum, tube collectors or concentrating systems have to be used.

Since 2002 a sterilizer at a Hospital in Patna is run with steam produced by 4 Scheffler- Reflectors of 8m² each. This system was installed by Solar Alternatives, based on the experience with large steam kitchens.

For rural hospitals a smaller system was developed by the author. The idea was to optimize the efficiency and to provide a system that does not store energy in form of pressurized steam. One Scheffler- Reflector of 10m² heats an iron block of 230kg up to 500°C. At any time of the day steam can be created by the hot iron block to run a 76 liter standard autoclave. Clouds will not interfere the sterilization process, as the energy is extracted from the storage.

Training of the technical staff to solve any upcoming problems

2. BACKGROUND

Together with Solar Alternatives (India) a solar steriliser was developed in 2003. A prototype of a steam generator was built which is able to run an ordinary autoclave of 67l volume 3 to 4 times a day.

The first system got designed and installed for the Holy Family Hospital in Mandar (150 beds) in winter 2004.

Reflector

The system gets heated in the focal point of a 10 m² Scheffler Reflectors

Fig. 2 Training of the technical staff to solve any upcoming problems

Hybrid system:

When the weather is bad the gas or electric boiler of the autoclave can be used. The solar system is simple integrated in a classic steriliser without important changes.

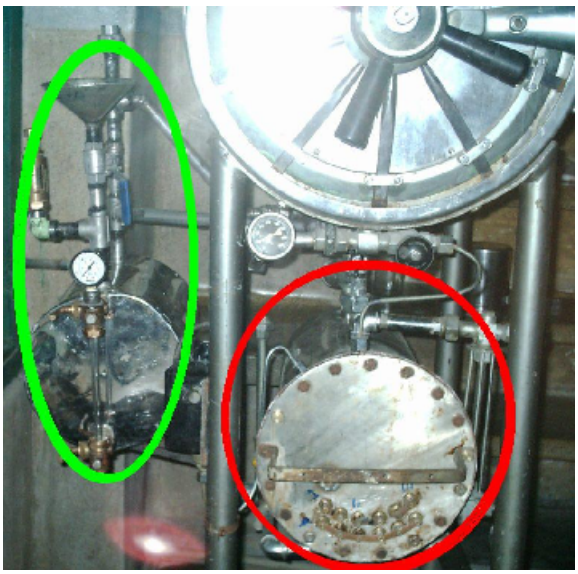

Fig. 3 hyprid system
green: the solar condensate collector;
red: original electrical boiler

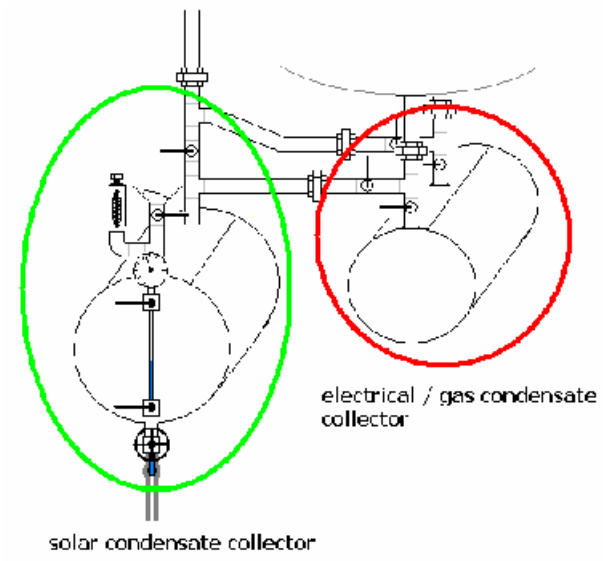

Fig. 4 sketch of the hyprid system

The core: design and idea of the heat storage iron block

- The high specific heat capacity of iron reduces the attended storage volume and so the surface. According to this fact the heat losses is kept small.

- Heat losses were reduced by using 200mm thick rock wool insulation and an exact calculated suspension of the iron block with strips of stainless steel.

- Heat resistant glass is reducing the energy loss through convection at the focal point.

- At night the absorber area is closed with an insulated lid.

- Safety first: the system is only under pressure when steam is needed

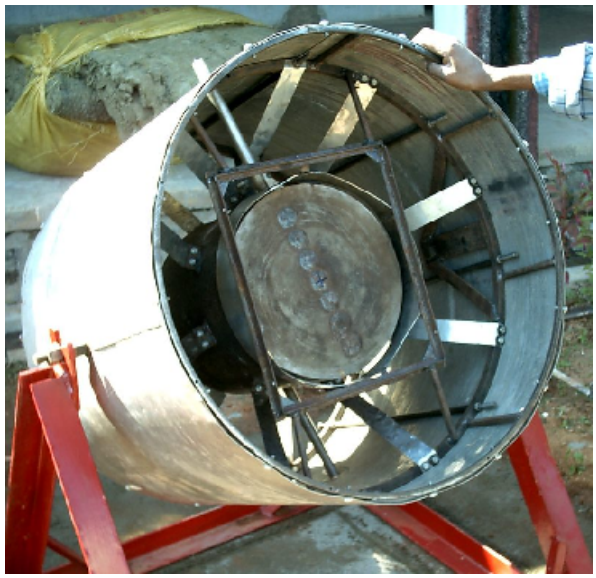

Fig. 5 instalation: iron block without rockwool isolation

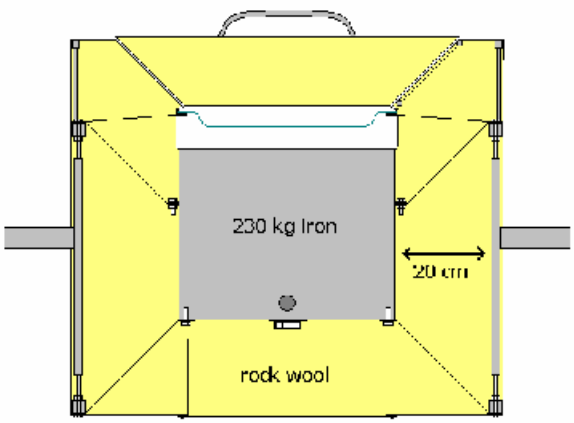

Fig. 6 sketch of the iron block

Fig. 7 total isolated iron block with heat resistant glas

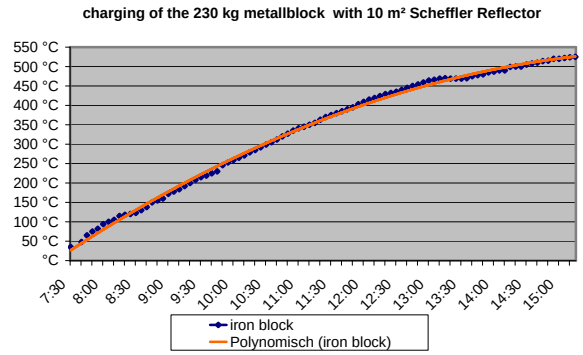

Fig. 8 charging curve of the system

Including all losses, the efficiency from sun power to heat storage iron block is:

250C 61 %
300C 56 %
350C 50 %
400C 42 %

3. THIS PROJECT

Build in cooperation with Solare Brücke (Germany) and Solar Alternative (India).

The first system was installed in Holy Family Hospital in Mandar (150 beds) in winter 2004