

Membrane FixFocus mirror as multifunctional solar power station for diverse village applications

Jürgen Kleinwächter

'Free-Lab' for Solar Village Technologies, Healing Biotope Tamera, Monte de Cerro, 7630-303
Colos, Portugal

[e-mail: j.kleinwaechter@hotmail.de](mailto:j.kleinwaechter@hotmail.de)

Abstract: Solar radiation is by far the strongest and cleanest energy source on earth. Due to the high surface temperature of 5500°C of the Sun and its room-angle of half a degree seen from earth, the solar rays reach practically in parallel our planet. This means, that by using a paraboloid reflector tracking in two axes the sun, very high energy densities of over one MW/m² are reached in the focus. Consequently usable temperatures up to 1500°C can be reached (and by using a CPC as secondary optic the concentration can be further enhanced, making even higher temperatures possible). This reachable temperature spectrum corresponds to the full process temperature range used today by centralised industries. The corresponding products (Ceramics, metal alloys, chemical products, medical products, food processing and many more) are normally considered to be only economically producible by great industries using fossil fuels or electricity. This means not only that the classical production of process heat contributes to a large extent to the global greenhouse gas emissions, but that a large population in the villages of the south are not enough wealthy to buy this products-consequently the scissor of disparity between the rich and the poor nations is growing. To prevent this negative fact, the author and his late father developed in the eighties of last century to the demonstration stage a novel type of light weight membrane concentrator, the 'FixFocus' (FF), with following characteristics: stationary focus at ground level, formation of the required excentric paraboloid reflectors by pneumatic deformation of thin reflective and transparent membranes, low overall material requirement (and therefore low 'Grey Energy' to produce the system), locally producible and job creation.

Recently the 'Free Lab' in Tamera simplified the Prototype in such a way, that local production can be executed with relative simple meanings, all by maintaining high efficiency ('Eco-Hightech').

Colleagues of the author (Fernando Chacon, Douglas Baillie, Daniel Müller, Paul Gießler) will report in conference CONSOLFOOD2018 about the praxis experiences to cook, bake and fry all type of meals very efficiently around the clock with the FF. It is evident, that temperatures above 300°C are not useful for food processing; however, the high optical accuracy of the FF mirror makes possible cavity receivers, which due to their minimal radiative, transmission and convective losses allow to store process heat day and night. This represents the key element for local autonomy and to tape into the 'Solar Abundance' represented by the photonic solar energy stream reaching the most distant places. A FF mirror of only 3,5 m² aperture area is capable to replace in average in sunny countries per year about 8 tons of cooking wood.

Free Lab Tamera and the SunOrbit R+D Company (www.sun-orbit.de) are working to combine the FF Concentrator, beside its food processing capacity, on following realizations: i) Coupling with the sunpulse Stirling Engine for 24 hr, ii) creation of power (electrical and mechanical) and heat (co-generation), iii) processing of ceramics, metals, building materials, iv) lighting rooms and caves using special light pipes, v) photocatalytic water cleaning and vi) photocatalytic water splitting.

Keywords: Air deformed membranes; FixFocus; Cavity receiver; Eco Hightech; Around the clock storage of process heat; Extreme light weight-low 'Grey Energy'; Abundance; Local autonomy.