

“ Development of a high temperature air solar receiver based on compact heat exchanger technology ”

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Hybrid Solar Gas Turbine (HSGT) technology for electricity generation offers some significant advantages for the development of Concentrated Solar Power (CSP): high conversion efficiency, low-cost solar electricity and low environmental impact. The objective of the RS-Pégase project is to develop an air solar receiver, a critical component of the overall system, with an absorber based on compact heat exchanger technology. These technologies, developed for aerospace and automotive applications, allow efficient thermal exchange and incorporate enhanced heat transfer surfaces, and are now under consideration in nuclear research and development for high temperature applications.

A bibliographical review has been completed comparing air solar receivers with, in particular, the French Sirocco project, during the 1970's. Then, a review of the different technologies of compact heat exchanger available has been made to select those better fitting solar absorber criteria: corrugated plates, plate-fins or Compact Plate Heat Exchanger (PCHE) with straight or wavy channels (herringbone pattern).

One key-point of the development of the absorber is the mechanical and material resistance. Utilizing results from the Sirocco project and laboratory knowledge, nickel base super alloys (Haynes, Inconel) and ceramics are considered in the absorber design. Two 10 kW modules are being developed, manufactured by Heatric, and will be experimentally tested.

The work is divided between an experimental phase at LETH (CEA of Grenoble) on the "Clairette" air loop equipped with a 10 kW radiative oven and then at the solar furnace of the CNRS in Odeillo, and a simulation approach (CFD and thermomechanical simulations). Technological state of the art, design approach and experimental facilities will be presented.