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SOME CHARACTERISTICS OF HEAT PRODUCTION BY STATIONARY PARABOLIC, CYLINDRICAL SOLAR CONCENTRATOR

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ABSTRACT
Stationary parabolic, cylindrical solar concentrator for heat production consists of the absorber (with water pipes) and parabolic, cylindrical reflector (with metal surface) and has geometrical concentration ratio up to 4. For the concentrator of CP-0A type with infinite length, the paper presents investigation how direct solar radiation approaches the concentrator aperture and the concentrator reflector by computer software CATIA. The solar ray either hits directly absorber or bounces one or several time from the concentrator reflector. In addition the paper would present results of efficiency of use of light rays at concentrator as a function of angles of incident of solar rays and type of reflector surface.

KEY WORDS
Solar energy, Concentrator, Reflector

1. Introduction

Temperature increase has been constantly recorded on the global level. The increase is due to green-house effect because of CO2 emission from different sources in atmosphere. Usually this emission is blamed to combustion of fossil fuels mainly for heating and electricity production. A response to such a situation may be increased use of solar energy for heating, cooling, and electricity production. Solar energy is source of all life on the earth and it is in abundance but dispersed. Here, we propose use of stationary, asymmetric solar concentrator for conversion of solar energy to heat.

The subject of this research (in Centre of heating, air conditioning and solar energy of Mechanical Engineering Faculty at Kragujevac in Kragujevac University in Serbia) is design optimization of stationary asymmetric solar concentrator of CP-0A type for heat and electricity production with geometric concentration of up to 4.

The stationary solar concentrators have advantages over tracking concentrators as they can be part of building façade and used in building and city architecture.

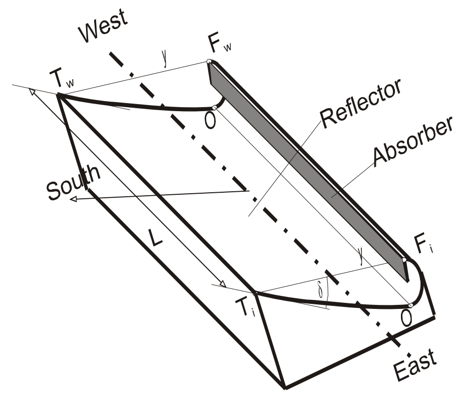

Figure 1. Position of the concentrator of CP-0A type. The concentrator is positioned to have the reflector trough in the direction east-west, while the reflector surface faces south (valid for the north hemisphere)

The conventional solar collectors only use half of their available surface area. The bottom half of the collector faces downward and is in contact with opaque insulation. The heat-transfer fluid within a panel is easily able to accept more energy than is incident on the top surface of a conventional panel. Then, illumination of both sides of the collector with non-imaging reflectors is performed. This allows a single absorber to be used instead of the two standard single-sided absorbers. This represents a substantial cost and materials saving.

Such a design approach has a number of implications: (a) The panel must be substantially thicker because of the necessity for reflective optics to reside underneath. This can be an aesthetic issue. (b) The heat loss mechanism underneath the panel is different to that of the top surface. (c) Additional reflector material must be used. Its cost and pollution must be compared to that of the replaced panel.

Concentrators of similar and the same type were already subject of intensive research [1-5]. This paper investigates how at different angles, direct solar radiation approaches the concentrator aperture and pathways of this radiation inside the concentrator by computer software CATIA. In addition the paper would present results of the efficiency of use of light rays at the concentrator as a