

A Model-Based Approach for Energy Performance Assessment of a Spherical Stationary Reflector/Tracking Absorber Solar Concentrator

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Abstract : The aim of this study is to analyze the energy performance of a spherical Stationary Reflector / Tracking Absorber (SRTA) solar concentrator. This type of collector consists of a segment of a spherical mirror placed in a stationary position facing the sun and a cylindrical absorber that tracks the sun by a simple pivoting motion about the center of curvature of the reflector. The energy analysis is performed through the development of a dynamic simulation model in TRNSYS software that calculates the annual heat production and the efficiency of the SRTA solar concentrator. The effect of solar concentrator design features and characteristics, such the reflector material, the reflector diameter, the receiver type, the solar radiation level and the concentration ratio, are discussed in details. Moreover, the energy performance curve of the SRTA solar concentrator, for various temperature differences between the mean fluid temperature and the ambient temperature and radiation intensities is drawn. The results are shown in diagrams, visualizing the effect of solar, optical and thermal parameters to the overall performance of the SRTA solar concentrator throughout the year. The analysis indicates that the SRTA solar concentrator can operate efficiently under a wide range of operating conditions.

Keywords : concentrating solar collector, energy analysis , stationary reflector, tracking absorber

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