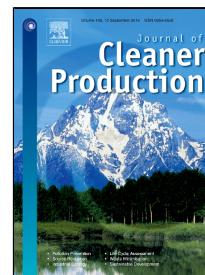


Accepted Manuscript

Numerical investigation of a solar dish concentrator with different cavity receivers and working fluids



R. Loni, E. Askari Asli-Ardeh, B. Ghobadian, Evangelos Bellos, W.G. Le Roux

PII: S0959-6526(18)32048-1
DOI: 10.1016/j.jclepro.2018.07.075
Reference: JCLP 13529
To appear in: *Journal of Cleaner Production*
Received Date: 31 March 2018
Accepted Date: 08 July 2018

Please cite this article as: R. Loni, E. Askari Asli-Ardeh, B. Ghobadian, Evangelos Bellos, W.G. Le Roux, Numerical investigation of a solar dish concentrator with different cavity receivers and working fluids, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.07.075

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Numerical investigation of a solar dish concentrator with different cavity receivers and working fluids

R. Loni^{a,*}, E. Askari Asli-Ardeh^a, B. Ghobadian^b, Evangelos Bellos^c, W.G. Le Roux^d

^a Department of Mechanic of Biosystems Engineering, University of Mohaghegh Ardabili, Ardabil, Iran.

^b Department of Mechanic of Biosystems Engineering, Tarbiat Modares University, Tehran, Iran.

^c Thermal Department, School of Mechanical Engineering, National Technical University of Athens, Zografou, Heroon Polytechniou 9, 15780 Athens, Greece.

^d Department of Mechanical and Aeronautical Engineering, University of Pretoria, Pretoria, South Africa.

Corresponding Author: R. Loni (rloni@uma.ac.ir , Tel: +98-9188480327)

Abstract

Solar concentrating technologies can produce heat for applications such as solar heating, solar cooling, industrial processes, desalination and electric power generation. For a solar dish collector, various solar receivers and working fluids at different flow rates can be used in different applications. In this work, three different cavity receivers are investigated for application in a solar dish collector using either water or Behran oil. A numerical model is used in the analysis, which is validated with experimental results from a hemispherical cavity receiver using oil as working fluid. The model is applied to compare hemispherical, cylindrical and cubical receivers under the same operating conditions using either water or oil, at a volumetric flow rate of 100 ml/s and solar irradiance of 800 W/m², in order to determine the most suitable cavity for a specific solar dish. The system is investigated for inlet temperatures ranging from 40°C to 90°C with water as working fluid, and from 40°C to 300°C with Behran oil as working fluid. Emphasis is placed on the calculation of useful heat production, as well as pressure drop which influences pumping power. The exergetic efficiency criterion and the overall efficiency criterion are used in order to evaluate the useful heat production and the pumping power simultaneously. The high exergetic efficiency of the hemispherical cavity with thermal oil at high temperatures makes this case a promising choice for high-temperature solar dish collector applications. Moreover, water is found to be the best candidate for low-temperature applications since it leads to the higher thermal efficiency with lower pumping power demand.

Keywords

Solar dish, Cavity absorber, Exergy analysis, Pressure drop, Thermal oil

1. Introduction

Solar energy exploitation is important in order to face the recent problems in the energy domain as the fossil fuel depletion, the global warming, the increasing energy demand and the high electricity price [1]. The main advantages of solar energy are its abundance [2] and the

Download English Version:

<https://daneshyari.com/en/article/8093651>

Download Persian Version:

<https://daneshyari.com/article/8093651>

[Daneshyari.com](https://daneshyari.com)