

# Accepted Manuscript

Thermal analysis of porous volumetric receiver of concentrated solar dish and tower system

K.S. Reddy, Sundarraj Nataraj



PII: S0960-1481(18)30980-7

DOI: [10.1016/j.renene.2018.08.030](https://doi.org/10.1016/j.renene.2018.08.030)

Reference: RENE 10457

To appear in: *Renewable Energy*

Received Date: 16 November 2017

Revised Date: 20 June 2018

Accepted Date: 7 August 2018

Please cite this article as: Reddy KS, Nataraj S, Thermal analysis of porous volumetric receiver of concentrated solar dish and tower system, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.08.030.

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.

# Thermal analysis of porous volumetric receiver of concentrated solar dish and tower system

KS Reddy<sup>1,\*</sup>, Sundarraaj Nataraj<sup>1</sup>

*<sup>1</sup> Department of mechanical engineering, Indian Institute of Technology Madras, Chennai 600036, India.*

---

## Abstract

1 In this article, thermal analysis of Solar volumetric receiver used in concentrated solar thermal power systems  
2 is studied. A cylindrical volumetric receiver used in the parabolic dish collector and solar power tower is  
3 analyzed using a finite element method based tool COMSOL multiphysics software. A non uniform Gaussian  
4 distribution based heat influx is applied at the receiver to mimic the actual conditions. The steady state  
5 operation of the receiver is studied for various porosity and thermal conductivity of the solid phase. Different  
6 parameters of Gaussian distributions corresponding to different flux profile conditions are studied. The  
7 Gaussian profile heat flux amounting to  $1MW/m^2$  results in the Gaussian like temperature distribution of  
8 the fluid phase near the receiver exit region. Higher thermal conductivity of  $200W/(m.K)$  coupled with  
9 the high porosity of 0.7 leads to the better operational efficiency of the receiver. Lower porosity results in  
10 higher peak temperature in the fluid phase and higher thermal conductivity laterally spreads the temperature  
11 across the receiver. The intermittent solar flux condition is realized through transient response study of flux  
12 conditions. The temperature gain rate in transient case is found to be approximately 24 K/s while the  
13 temperature drop is around 29 K/s.

---

**Keywords :** Concentrating solar power; Surface volumetric receivers; Thermal optimization; Porous flow modeling; Gaussian flux analysis

---

\*Corresponding author

<sup>1</sup>ksreddy@iitm.ac.in; <https://home.iitm.ac.in/ksreddy/>

Download English Version:

<https://daneshyari.com/en/article/11001186>

Download Persian Version:

<https://daneshyari.com/article/11001186>

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