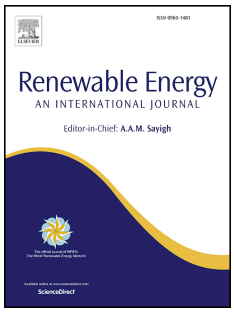
Accepted Manuscript



Two-dimensional unsteady state performance analysis of a hybrid photovoltaic-thermoelectric generator

P. Motiei, M. Yaghoubi, E. GoshtashbiRad, A. Vadiee

PII: S0960-1481(17)31193-X

DOI: 10.1016/j.renene.2017.11.092

Reference: RENE 9494

To appear in: *Renewable Energy*

Received Date: 16 July 2017

Revised Date: 14 November 2017

Accepted Date: 30 November 2017

Please cite this article as: Motiei P, Yaghoubi M, GoshtashbiRad E, Vadiee A, Two-dimensional unsteady state performance analysis of a hybrid photovoltaic-thermoelectric generator, *Renewable Energy* (2018), doi: 10.1016/j.renene.2017.11.092.

Two-dimensional unsteady state performance analysis of a hybrid photovoltaic-thermoelectric generator

P. Motiei, M. Yaghoubi*, E. GoshtashbiRad, A. Vadiee

Abstract

This paper presents an unsteady, two-dimensional numerical model of a hybrid solar power generation system (STEG) that integrates photovoltaic (PV) and thermoelectric generator (TEG) technologies to harvest more solar energy under typical environmental and operating conditions. The model takes into account solar irradiation, wind speed and ambient temperature in addition to convective and radiative heat losses from the front and rear surfaces of the system .The governing equations are discretized using finite volume method and a fully implicit formulation is adopted for the time dependent terms. Results of each part of the numerical modeling were compared with the available experimental measurements and satisfactory agreements were observed. In addition, the effects of wind speed and ambient temperature, PN couples' height and external load resistance variations on the STEG performance are investigated. A monocrystalline photovoltaic cell (PV) is used and a commercial TE module is selected. Meteorological information of the 6th of July for the city of Shiraz, Iran with a latitude of $29.39° N$ are used which contain ambient air temperature and average wind speed. Computation is made with the developed code for a duration of 24 hours. Results show that adding TE module at the back of PV can improve PV efficiency and PV electrical output power by 0.59% and 5.06%, respectively. Furthermore, it is found that as the wind speed increases, the PV efficiency improves and the TEG efficiency decreases. Also, a rise in the ambient temperature causes the PV efficiency to decrease but increases the TEG efficiency.

Nomenclature

*Corresponding author. Tel.: +98 917 1184335; Fax: +98 713 6473538.
E-mail address: yaghoubi@shirazu.ac.ir (M.Yaghoubi)