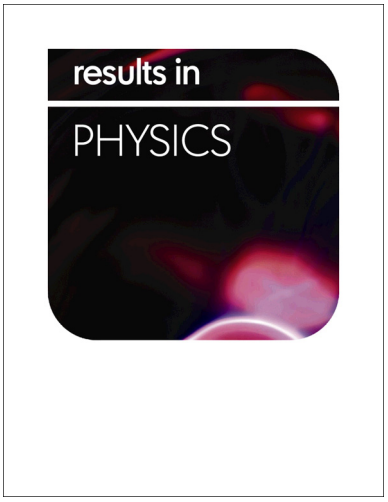

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PII: S2211-3797(18)30290-0
DOI: https://doi.org/10.1016/j.rinp.2018.03.004
Reference: RINP 1315

To appear in: *Results in Physics*

Received Date: 6 February 2018
Revised Date: 4 March 2018
Accepted Date: 4 March 2018

Please cite this article as: Jaaz, A.H., Sopian, K., Gaaz, T.S., Study of the electrical and thermal performances of photovoltaic thermal Collector-Compound parabolic concentrated, *Results in Physics* (2018), doi: https://doi.org/10.1016/j.rinp.2018.03.004

STUDY OF THE ELECTRICAL AND THERMAL PERFORMANCES OF PHOTOVOLTAIC THERMAL COLLECTOR-COMPOUND PARABOLIC CONCENTRATED

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Abstract

The importance of utilizing the solar energy as a very suitable source among multi-source approaches to replace the conventional energy is on the rise in the last four decades. The invention of the photovoltaic module (PV) could be the corner stone in this process. However, the limited amount of energy obtained from PV was and still the main challenge of full utilization of the solar energy. In this paper, the use of the compound parabolic concentrator (CPC) along with the thermal photovoltaic module (PVT) where the cooling process of the CPC is conducted using a novel technique of water jet impingement has applied experimentally and physically tested. The test includes the effect of water jet impingement on the total power, electrical efficiency, thermal efficiency, and total efficiency on CPC-PVT system. The cooling process at the maximum irradiation by water jet impingement resulted in improving the electrical efficiency by 7%, total output power by 31% and the thermal efficiency by 81%. These results outperform the recent highest results recorded by the most recent work.

Keywords: Photovoltaic thermal collectors; electrical performance; thermal performance; compound parabolic concentrator; jet impingement

Nomenclature

A_c	Frontal area solar collector (m^2)
b	Collector width (m)
C_P	Specific heat of working fluid (J/kg ºC)
d	Diameter of nozzle (m)
D_h	Hydraulic diameter (m)
F'	Collector efficiency factor