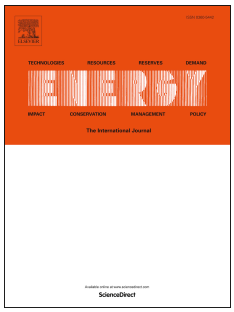
Accepted Manuscript



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PII: S0360-5442(17)30784-3

DOI: 10.1016/j.energy.2017.05.028

Reference: EGY 10835

To appear in: *Energy*

Received Date: 31 January 2017

Revised Date: 7 April 2017

Accepted Date: 4 May 2017

Please cite this article as: Contento G, Lorenzi B, Rizzo A, Narducci D, Efficiency enhancement of a-Si and CZTS solar cells using different thermoelectric hybridization strategies, *Energy* (2017), doi: 10.1016/j.energy.2017.05.028.

Efficiency enhancement of a-Si and CZTS solar cells using different thermoelectric hybridization strategies

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Abstract

The performances of two hybrid thermoelectric photovoltaic systems are compared. In the first instance, a photovoltaic (PV) device and a thermoelectric generator (TEG) are optically coupled using a vacuum–sealed compound parabolic concentrator (CPC). As an alternative, PV and TEG devices are thermally coupled putting them directly in contact to each other. Single–junction a–Si and heterojunction Cu_2ZnSnS_4 (CZTS) have been considered as PV systems. The two systems are studied by varying the heat transfer coefficient of the cooling system between the TEG cold side and the ambient, the TEG device fill factor, and the optical concentration. Hybridization, in both configurations, always enhances the efficiencies, up to $\approx 57\%$ for single-junction a-Si and up to $\approx 35\%$ for the heterojunction CZTS. It will be shown that while direct thermal contact enables larger efficiencies, optical coupling grants lower temperatures at the PV side, enhancing reliability and lifetime. Further advantages and limitations of both configurations will be discussed.

Keywords: Photovoltaics, Thermoelectricity, Solar energy

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