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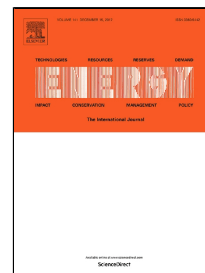
Thermodynamic analysis for a concentrating photovoltaic-photothermochemical hybrid system

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1 **Thermodynamic analysis for a concentrating photovoltaic-**
2 **photothermochemical hybrid system**

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7

8 **Abstract**

9 In this paper, a novel model of a concentrating photovoltaic-photothermochemical (CPV/PTC) hybrid
10 system is proposed. Solar spectrum is separated into several parts to enable photovoltaic (PV) and
11 photothermochemical (PTC) conversion by utilizing the parabolic trough concentrator with a spectral
12 beam splitter. The PV module converts a specific spectral range of solar radiation into electricity directly
13 by the solar cells and the PTC module absorbs the rest solar energy to supply the reaction heat of
14 methanol-steam reforming (MSR) that produces hydrogen for power generation. The energy and exergy
15 analyses on the CPV/PTC hybrid system are carried out. The overall system efficiencies with different
16 splitting wavebands, widths of the solar cells and heat transfer coefficients of the cooling system are
17 investigated. Moreover, the CPV/PTC hybrid system is compared with a single PV or PTC system. The
18 results indicate that the optimal splitting waveband, concentration ratio and heat transfer coefficient of
19 the cooling system are 450nm-870nm, 7.9, and $1500 \text{ W}/(\text{m}^2 \cdot \text{K})$, respectively. With the optimization of
20 the proposed CPV/PTC hybrid system, the overall power generation efficiency can reach 25.3%.

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