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SOLAR THERMOELECTRIC GENERATOR CHARACTERIZATION AS A CO-GENERATION RENEWABLE ENERGY SOURCE AND PHOTOVOLTAIC COOLING SYSTEM

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In the last decades, the demands for energy increased a lot. Therefore, finding new sustainable energy sources or improving the efficiency of the existing ones became a goal for both researchers and industry. Since the solar energy is free, clean and perpetual, it became a very good alternative to the conventional energy sources. Converting the solar energy into useful energy is done based on the photovoltaic effect (photovoltaic-PV panels) or absorbing the solar energy and converting it into thermal energy (using solar thermal collectors, STC). An alternative solution to convert the solar energy into useful energy is the use of a solar thermoelectric generator, STEG, as an electrical energy source. The TEG is also used in hybrid solar systems as a Co-generator and also as a cooling system for the PV panels. There are many studies in literature about the characterization of the STEG systems in normal or in concentrated sunlight. Thereby, in medium concentrated sunlight (<50 suns) the STEG system's efficiency obtained was 3.35%. In this paper, the TEG was studied as a STEG system but also as a part of a hybrid system (concentrated PV CPV-TEG or CPV-TEG-PCM –phase change material) under medium concentrated sunlight. All measurements have been done in Solar Technology Laboratory of Paul Scherrer Institute (PSI), Villigen, Switzerland. The obtained efficiency of the Bi2Te3 based STEG under 56 suns was 3.3% when the STEG was covered with graphite sheet and 1.3% when the STEG was without graphite sheet. In the hybrid systems, the obtained efficiency of the system components under 37 suns was ~23% for CPV and ~1.3% for TEG. The CPV-TEG-PCM hybrid system was studied at maximum 27 suns. The efficiency of the system components was ~23% for CPV and 1.7% for TEG.

Biography

Petru A Cotfas has received his BE degree in Mathematics and Physics and also in Computer science in 1997 and 2001 respectively, and the Masters' degree in Mathematics and Computer science at Transilvania University of Brasov, in 1998. He obtained the PhD degree in Material science engineering at Transilvania University of Brasov, in 2007. In 1999, he joined the Physics Department and from 2011, he became Member of the Electronics and Computers Department. His current research interests include Renewable Energy, Energy Harvesting, Virtual Instrumentation, Remote Engineering and Non-Destructive Testing. He is also a Member of the IEEE, the International Association of Online Engineering and the Romanian Physical Society. He has won three awards at the Graphical System Design Achievement Awards organized by National Instruments in 2013, and gold medal at the European Exhibition of Creativity and Innovation - EUROINVENT2015.

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