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# EVOLUTION OF THE HYBRID SYSTEMS FOR RENEWABLE ENERGY

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Nowadays renewable energy is a very attractive domain for both researchers and manufacturers. It is also a very dynamic and innovative domain. Each subdomain of the renewable energy, such as: photovoltaic, thermal, wind, geothermal, waves, etc achieved a maturity level. The realizing of hybridization is a way to innovate, to assure the energy needed and to improve the efficiency of the systems. There are hybrid systems which provide energy from two or more independent sources or other types of hybrid systems providing energy from sources that are influenced by one another, when they work together. The photovoltaic-thermoelectric or photovoltaic-thermoelectric-solar collector is the hybrid systems from the last category. Using these systems the electric and thermal energy can be obtained in almost the same space. The behaviour of photovoltaic-thermoelectric hybrid system in open circuit and in load is analysed in this paper. The photovoltaic cell (PV) is illuminated at different levels, such as: 800, 1000, 1500 and 2000 W/m2 using nine halogen bulbs which assure a quasi-homogenous illumination. The sizes of the monocrystalline silicon PV are 8cm x 8cm and for the $Bi_2Te_3$ thermoelectric generator (TEG) are 6.2 cm x 6.2 cm. The characterization of the PV and the TEG is made using the current-voltage characteristic, I-V which allows determining the important parameters of both components of the hybrid system. The I-V characteristics of the two components of the hybrid system are measured using the capacitor technique. The temperatures of the PV and the hot and cold side of the TEG are measured using thermocouples. The results obtained when the TEG works in load show a decreasing of the maximum power generated by the thermoelectric generator with 1/3 as against the maximum power when the TEG works in open circuit. This decreasing leads to a PV temperature decrease which means an increase in the maximum power generated by the PV.

## Biography

Daniel T Cotfas has received his B E degree in Mathematics and Physics at the Transilvania University of Brasov, Romania, in 1995. He obtained his PhD degree in Industrial Engineering at the Transilvania University of Brasov, Romania in 2008. In 2011, he joined the Electronics and Computers Department and in 2015 became Associate Professor. His current research interests include Renewable Energy, Energy Harvesting, Virtual Instrumentation, Remote Engineering and Nondestructive 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-Euroinvent 2015. He has authored and co-authored 80+ publications in international journals, conference papers, books and book chapters and has two patent applications.

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