An Overview of the Contributions under Systems Topic

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Many different TPV systems have been presented for a broad range of applications using different power sources (fuel, radioisotope and sun radiation). For deep space missions, radioisotope powered TPV (RTPV) systems seem to be a promising alternative for replacing thermoelectric ones due to their higher specific power and higher efficiency. Solar powered TPV (STPV) for near sun missions also offers several advantages compared to conventional PV generators. For the furnace market, TPV arises as a promising technology capable to allow self-powered furnaces or CHP (combined heat and power). New solar greenhouses based on TPV could combine both cooling and energy supply decreasing drastically its energy consumption. Also general purpose TPV system prototypes have been presented based on solar powered and fuel powered emitters. Analysis of the main loss contributions and propositions for future improvements are also given. Furthermore, two advanced concepts have been presented in order to increase the power transmission between the emitter and the TPV cells: Light Pipe TPV (LTPV) concept uses higher refraction index materials as a medium between the cells and the emitter, resulting in a very interesting way for using lower emitter temperatures with higher useful radiation power impinging the cells. In addition, nanogap-TPV concept, which is based on the location of cells at sub-wavelength distance from the emitter, has been experimentally demonstrated. The concept allows the contribution of the evanescent wave to the power transmitted from the emitter to the cell with the cell-to emitter distance working as a selective filter tuning the resonator.

Two different strategies have appeared concerning the TPV system designs: Low efficiency and low cost or high efficiency and high cost solutions. The strategic choice depends on the frame in which the system is designed. Promising applications for high efficiency TPV systems are in space missions, for which higher costs can be assumed. In this context, NASA projects seem to be continued in the future concerning RTPV and STPV. On the other hand, low-cost and low-efficiency systems are very interesting for manufacturing self-powered furnaces and CHP systems. In this context, JX Crystals has been developing systems which integrate TPV devices in commercial furnaces.

In the renewable energy context, there are two main TPV contributions: STPV and advanced greenhouses. The very high theoretical STPV system efficiency of 85.4%

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could make this concept considered together with other photovoltaic concepts for future research projects in the solar energy topic. Nowadays, the main contribution to this activity is being carried out in the frame of the European Community funded project FULLSPECTRUM, which ends in 2008 and which final aim is to develop a hybrid solar-fuel TPV system.