Project: Retrofitted PV/T collector

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Aims & Objectives

•To design and construct a PV/T collector with the optimum D/W ratio.

•To Set-up a data-logging system in order to obtain experimental results from the retrofitted PV/T collector.

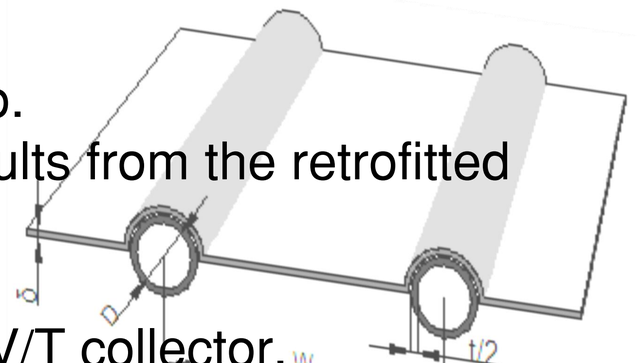
Expected outcomes

•To create a 1D steady-state mathematical model of the retrofitted PV/T collector.

•To assess the energy potential and the energy efficiency of the retrofitted PV/T collector.

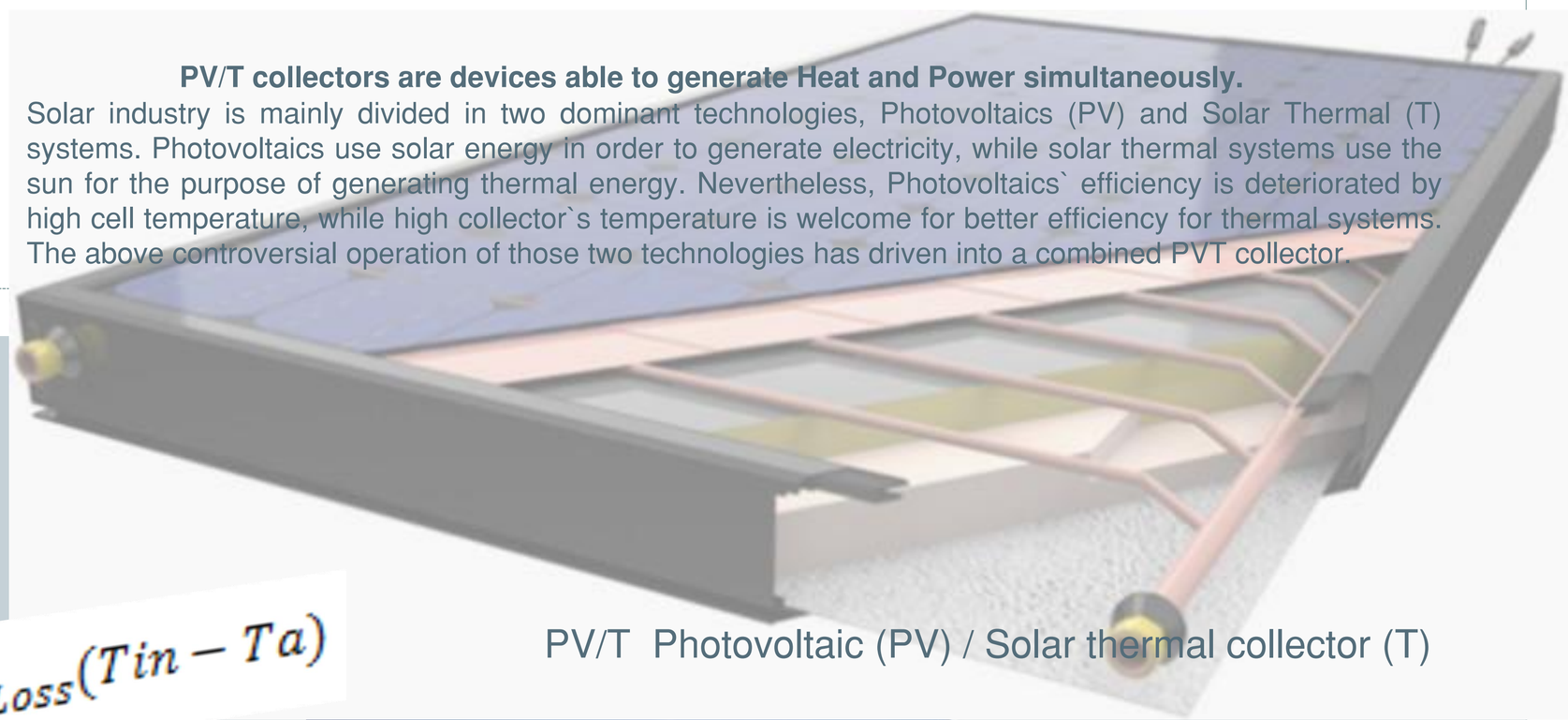
•To study the potentials of a PV/T retrofitted system in order to generate adequate amount of energy for space heating.

•To present the outcomes with a publication in a scientific journal.



PV/T collectors are devices able to generate Heat and Power simultaneously.

Solar industry is mainly divided in two dominant technologies, Photovoltaics (PV) and Solar Thermal (T) systems. Photovoltaics use solar energy in order to generate electricity, while solar thermal systems use the sun for the purpose of generating thermal energy. Nevertheless, Photovoltaics` efficiency is deteriorated by high cell temperature, while high collector`s temperature is welcome for better efficiency for thermal systems. The above controversial operation of those two technologies has driven into a combined PVT collector.



PV/T Photovoltaic (PV) / Solar thermal collector (T)

Methodology

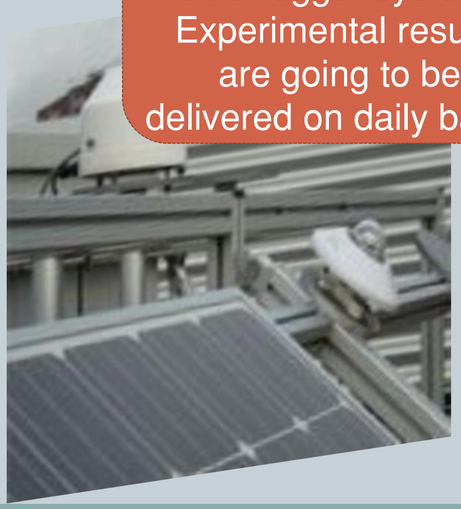
Step 1. Literature review on PV/T water based collectors

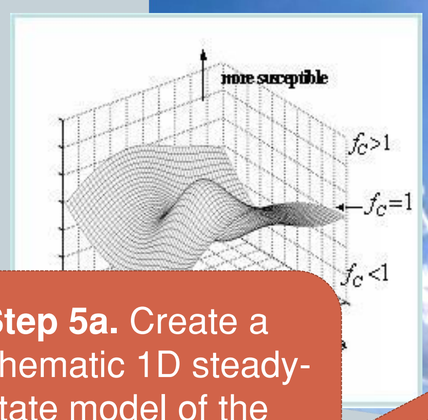
$$Qu = A_{PV}F_R((\tau\alpha - \tau\eta e_{el})G - U_{Loss}(Tin - Ta)$$

Step 2. Study and design the optimum D/W ratio for the PV/T collector

Step 3. construct the PV/T collector by placing a copper made serpentine heat exchanger at the rear side of a PV panel.

Step 4. Install the PV/T collector along with a data-logger system. Experimental results are going to be delivered on daily basis.





Step 5a. Create a Mathematic 1D steady-state model of the retrofitted PV/T collector.

Step 5b. Assessing the experimental results and assisting to calibrate the PV/T`s model.

	Thermal efficiency	Electrical efficiency
PV panel	–	0.097
Sheet and tube PV/T, no cover	0.52	0.097
Sheet and tube PV/T, 1 cover	0.58	0.089
Sheet and tube PV/T, 2 covers	0.58	0.081
PV/T collector with cannel above PV	0.65	0.084
PV/T collector with cannel below opaque PV	0.60	0.090
PV/T collector with cannel below transparent PV	0.63	0.090
Free flow PV/T collector	0.64	0.086
Two-absorber PV/T collector (insulated type)	0.66	0.085
Two-absorber PV/T collector (noninsulated type)	0.65	0.084
Thermal collector	0.83	–

Step 6.

•PV/T energy evaluation. The energy potentials of a retrofitted PV/T collector to fulfill the energy demand for space heating and domestic hot water are going to be investigated.

• A ratio of collector surface per energy output is going to be extracted from the simulation process.

•The experimental results and the outcomes are going to be published in a scientific journal.

Outstanding References

•*P.G. Charalambous, S.A. Kalogirou, G.G. Maidment, K. Yiakoumetti. Optimization of the photovoltaic thermal (PV/T) collector absorber. Solar Energy 85 (2011) 871–880*

•*H.A. Zondag. Flat-plate PV-Thermal collectors and systems: A review. Renewable and Sustainable Energy Reviews 12 (2008) 891–959*

•*R. Daghigh, M.H. Ruslan, K. Sopian. Advances in liquid based photovoltaic/thermal (PV/T) collectors. Renewable and Sustainable Energy Reviews 15 (2011) 4156–4170*

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