Design approaches for photovoltaic thermal collectors with incorporated phase change materials

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This work reports comprehensive analysis and review of various designs related to the photovoltaic-thermal solar collectors with incorporated phase change material (PVT-PCM collectors). PVT-PCM collectors can produce both electrical and thermal output on the limited surface, however specific design strongly determines electrical and thermal performance of the specific PVT-PCM collector design. This work was mainly focused on the investigations of the experimentally tested solar collector designs in different climates. The various working fluids were also analysed such as water, air or nanofluids. The main characteristics of the usually implemented PCMs in the PVT-PCM collectors were also discussed in detail. The conducted review indicated the importance of the PVT-PCM designs with respect to the overall PVT-PCM solar collector efficiency (electric and thermal), and in general it directed necessity for optimization of the main collector design parameters (such as tube geometry and layout, absorbers, PCM layer, etc.). The economic and environmental evaluation of the PVT-PCM collector designs is weakly discussed in the existing research literature and more serious research work should be conducted in that direction to determine techno-economic and environmental more suitable PVT-PCM collector designs.