**a b s t r a c t**

In this study, a paraffin/aluminum foam (AF) composite for thermal regulation of a photovoltaic (PV) system was performed. A comparative performance evaluation of three PV systems, i.e., PV without any modifications, PV incorporated with paraffin wax as phase change material PCM (PV-PCM), and PV incorporated with enhanced PCM comprising AF embedded in PCM (PV-PCM/AF) was performed. Outdoor experiments were conducted in summer and winter weather conditions of Benha city, Egypt, located at (latitude 30.466 North and longitude 31.185 East). The comparative analysis of the three PV configurations based on electrical efficiency, exergy efficiency, energy payback time, exergoeconomic, and enviroeconomic parameters was presented and discussed. The findings revealed that, against the unmodified PV configuration, the electrical efficiency of PV-PCM and PV-PCM/AF systems in summer was enhanced by 9% and 14%, respectively. While, the corresponding enhancement in winter was 3.7% and 4.8%, respectively. Also, it was found that the cost of electricity generation for PV-PCM and PV-PCM/AF systems was 0.1165 and 0.1145 $/kWh, respectively, against 0.1162 $/kWh for the PV system. Finally, it can be concluded that PV-PCM/AF is the most effective system based on exergy efficiency, exergy cost, and CO2 avoidance rates.