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# The Impact of the Composite Expanded Graphite PCM on the PV Panel Whole Year Electric Output: Case Study Milan

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**Abstract :** Integrating the phase change material (PCM) with photovoltaic (PV) panels is one of the effective techniques to minimize the PV panel temperature and increase their electric output. In order to investigate the impact of the PCM on the electric output of the PV panels for a whole year, a lumped-distributed parameter model for the PV-PCM module has been developed. This development has considered the impact of the PCM density variation between the solid phase and liquid phase. This contribution will increase the assessment accuracy of the electric output of the PV-PCM module. The second contribution is to assess the impact of the expanded composite graphite-PCM on the PV electric output in Milan for a whole year. The novel one-dimensional model has been solved using MATLAB software. The results of this model have been validated against literature experiment work. The weather and the solar radiation data have been collected. The impact of expanded graphite-PCM on the electric output of the PV panel for a whole year has been investigated. The results indicate this impact has an enhancement rate of 2.39% for the electric output of the PV panel in Milan for a whole year.

**Keywords :** PV panel efficiency, PCM, numerical model, solar energy
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