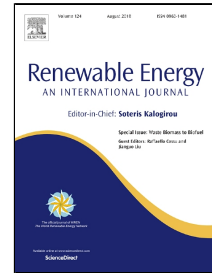


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Possibility of using PCMs in temperature control and performance enhancements of free stand and building integrated PV modules

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1 **Possibility of using PCMs in temperature control and performance enhancements of**
2 **free stand and building integrated PV modules**

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7 **Abstract**

8 Recently, phase change materials (PCMs) are suggested for the temperature control and
9 the performance enhancement of PV modules. However, the thermal conductivity of the
10 PCMs is very low and integrating the PV with PCM can adversely affect its performance.
11 In the present work, the effectiveness of using PCM in thermal regulation and efficiency
12 enhancement of free stand and building integrated PV modules are investigated. Four
13 different PV modules; free stand, building integrated, PCM integrated, and Al₂O₃
14 nanoparticles enhanced PCM integrated are experimentally investigated. Temperatures
15 distributions, open-circuit voltage, short-circuit current, output power and the efficiency
16 of the modules were recorded and analyzed. The results show that (i) integrating the PV
17 module to the building wall dramatically rise the temperature of the module where the
18 daily maximum temperature increased from 50 °C to 75 °C, (ii) integrating the free stand
19 module with PCM box can adversely affect its performance where the maximum daily
20 temperature increased from 50 °C to 62 °C and adding nanoparticles to the PCM can
21 improve the performance where the temperature is reduced to 59 °C, and (iii) integrating
22 the building integrated PV module with PCM box enhances its daily average efficiency
23 by 7.1 % and the enhancement ratio increases to 14.2 by improving the thermal
24 conductivity of the PCM by adding 2% Al₂O₃ nanoparticles.

25 **Keywords**

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