Performance comparison of BAPV and BIPV systems with c-Si, CIS and CdTe photovoltaic technologies under tropical weather conditions

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ABSTRACT

This paper compares the performance of photovoltaics (PV) for building applications in two configurations: building applied photovoltaics (BAPV) and building integrated photovoltaics (BIPV). A 32.7 kWp PV capacity is proposed for a roof building and its performance in BAPV and BIPV configurations with three PV technologies namely crystalline (c-Si), CIS, and CdTe is analyzed. The standard methodology with performance parameters such as energy yield (EY), yield factor (YF), capacity utilization factor (CUF), performance ratio (PR), and losses is used. It is found that the EY, YF, and year to year energy production variability of BIPV and BAPV technologies varies from 43,700–46,800 kW h, 1336.39–1431.19 kW h/kWp, and 1910–2100 kW h respectively. The CUF and PR vary from 15.25–16.33%, and 72.23–77.36% respectively. Irrespective of PV configuration and technology, observed losses due to the angle of incidence, spectral effects, effects of change in irradianceand module temperatures are observed to be − 2.8%, − 1 to − 5%, and − 7.4 to − 13.6% respectively. Total system losses range from −22.6 to 27.8% causing a fair amount of loss in the PV efficiency. Among, three PV technologies, CdTe is observed to perform better than CIS, and c-Si.

KEYWORDS:

PV modules; BAPV and BIPV; Performance ratio; Capacity utilization factor;Building integrated photovoltaics; Building applied photovoltaics