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Energy Management in the Balance of System Components in a Stand-Alone Building Integrated Photovoltaic System

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Only 17% of South Africa's energy comes from renewable sources even though this country is endowed with rich solar resources of 220 W/m2 as compared to Europe's 120 W/m2 and the USA's resource of 100 W/m2. The use of Building Integrated Photovoltaic (BIPV) systems for its three decades of existence has claimed only a 1% share of the total photovoltaic installations worldwide. Very little of this technology has been reported in South Africa. The aim of this work is to evaluate the performance of the balance of system components in a stand-alone BIPV system, and to account for the energy flow in the system. It is imperative to have an in-depth understanding of the underlying factors governing the charging and discharging regimes of the battery, the low voltage disconnect and high voltage reconnect regimes of the load and type of charging regimes under the maximum power point tracking (MPPT) algorithm on the modules.
This paper disseminates the intricate relations between the various regimes in detail. Results obtained show that, with a demand of 4.5 kWh/day, just 58.4% of this system's potential is used. If this system is connected to the grid, it will feed energy worth R623,40/month to the grid, which is unused (wasted) due to the MPPT charge controller regulations. This amount is based on the local municipality tariff. Also, the inverter's peak efficiency is 80.5%. This efficiency goes down to 31.2% when operated at 0.8% of its capacity. The battery round trip efficiency is 93%.

Summary

Building Integrated Photovoltaic System, Renewable Energy Feed-in Tariffs, Stand-alone Photovoltaic System, inverter Peak Efficiency

Apply to be
 considered for a student
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Yes

Level for award
 (Hons, MSc,
   PhD, N/A)?

MSc

Main supervisor (name and email)
and his / her institution

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Would you like to
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Yes

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