

ABSTRACT

The use of fossil fuels to meet Indonesia's electricity demand has negative environmental impacts. Therefore, the development of renewable energy sources, such as solar energy, which has significant potential in Indonesia, is necessary. One of the main challenges in utilizing solar energy with photovoltaic (PV) systems is the low conversion efficiency of electrical energy due to fluctuations in temperature and solar radiation. This study aims to design a Maximum Power Point Tracking (MPPT) system using the Incremental Conductance algorithm to optimize the power generated by PV. The scope of this research includes the design of a system using a buck-boost converter and system testing under maximum solar radiation conditions.

The MPPT system design involves the use of a 100 Wp PV module, Arduino Nano, buck-boost converter, current sensor, and voltage sensor. The implementation of the incremental conductance algorithm is intended to control the duty cycle of the buck-boost converter, ensuring that the PV operates at its maximum power point. In addition, MPPT system simulations were carried out to evaluate the performance of the system with the incremental conductance algorithm in maximizing PV output power.

The experimental results show that the non-MPPT system achieved an average efficiency of 64%. In comparison, testing the MPPT system on the PV using the incremental conductance algorithm resulted in an average efficiency of 70%, with a maximum output of 12.35 W when connected to a 12V lamp load. The 6% efficiency improvement demonstrates that the Incremental Conductance algorithm is effective in optimizing the performance of the PV system.

Keywords: Maximum Power Point Tracking, Incremental Conductance, Buck-Boost Converter, Photovoltaic