ABSTRAK

OPTIMASI PANEL SURYA DENGAN PENDINGIN PASIF BERBAHAN SERABUT SAWIT UNTUK MENINGKATKAN EFISIENSI

(2025:XIV+70 halaman+42 gambar+12 tabel+1 Daftar Pustaka+ 7 Lmpirian)

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Energi matahari merupakan salah satu sumber energi terbarukan yang banyak dimanfaatkan, namun efisiensi panel surya sangat dipengaruhi oleh suhu operasionalnya. Penelitian ini bertujuan untuk meningkatkan efektivitas panel surya dengan menerapkan sistem pendingin pasif menggunakan serabut sawit serta mengintegrasikannya dengan sistem lampu jalan berbasis *Internet of Things.* Serabut sawit dipilih karena memiliki kemampuan menyerap dan mempertahankan kelembapan, sehingga dapat menurunkan suhu panel melalui proses *evaporasi.* Sistem dirancang menggunakan panel surya polikristalin 100Wp, *sensor* suhu *(DHT22 dan DS18B20), sensor* cahaya *(BH1750), sensor* hujan, serta *mikrokontroler ESP32* yang terhubung ke aplikasi *MIT App Inventor*. Pengukuran dilakukan untuk membandingkan efisiensi panel dengan dan tanpa pendingin serabut sawit. Hasil menunjukkan bahwa penggunaan serabut sawit mampu menurunkan suhu panel dan meningkatkan efisiensi konversi energi. Sistem *Internet of Things* yang dikembangkan juga memungkinkan pemantauan dan pengendalian lampu jalan secara *real-time* melalui *smartphone*. Dengan integrasi teknologi ini, penelitian membuktikan bahwa pemanfaatan limbah serabut sawit tidak hanya ramah lingkungan, tetapi juga efektif meningkatkan kinerja panel surya dalam aplikasi penerangan jalan otomatis.

Kata kunci: serabut sawit, panel surya, pendingin pasif*, Internet of Things*, efisiensi energi, lampu jalan.

ABSTRACT

OPTIMIZATION OF SOLAR PANELS WITH PALM FIBER PASSIVE COOLING TO IMPROVE EFFICIENCY

(2025:XIV+70 pages+42 figures+12 tables+1 Bibliography+7 Appendices)

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Solar energy is one of the most widely used renewable energy sources, but the efficiency of solar panels is greatly influenced by their operating temperature. This study aims to increase the effectiveness of solar panels by implementing a passive cooling system using palm fibers and integrating it with an Internet of Things (IoT)-based street lighting system. Palm fibers were chosen because they have the ability to absorb and retain moisture, thereby reducing the panel temperature through the evaporation process. The system was designed using a 100Wp polycrystalline solar panel, temperature sensors (DHT22 and DS18B20), a light sensor (BH1750), a rain sensor, and an ESP32 microcontroller connected to the MIT App Inventor application. Measurements were conducted to compare the efficiency of the panels with and without palm fiber cooling. The results show that the use of palm fibers can reduce panel temperature and increase energy conversion efficiency. The developed IoT system also allows real-time monitoring and control of street lights via smartphone. With the integration of this technology, the study proves that the use of palm fiber waste is not only environmentally friendly but also effectively improves the performance of solar panels in automated street lighting applications.

Keywords: *palm fiber, solar panel, passive cooling, Internet of Things, energy efficiency, street lighting.*