ABSTRACT

Hydroponic farming has become a popular solution in Indonesia due to limited agricultural land caused by rapid population growth. This system enables cultivation in narrow spaces using water as a growing medium, producing efficient harvests. However, the main challenge of hydroponics lies in the need for a continuous and stable electricity supply to operate water pumps, especially when solar power (PLTS) output is insufficient during the rainy season.

This study designs a hydroponic system that integrates electrolysis-based nutrient delivery and hybrid energy sourced from both the state electricity company (PLN) and solar panels. The system is equipped with an Automatic Transfer Switch (ATS) that automatically shifts the power source between PLN and PLTS to ensure consistent energy availability.

This study successfully designed and tested a hybrid system of PLN and PLTS based on IoT for monitoring the cultivation of red spinach. The system automatically switches between power sources from the battery to PLN when the voltage drops below 12.3 V and exceeds 15.7 V. IoT-based monitoring allows users to track parameters such as pH, nutrient concentration, and water flow rate online. Although the energy cost reaches Rp2,544.07 per kWh, which is higher than the PLN tariff of Rp1,352 per kWh for 900 VA power, this system enhances time efficiency and plant growth supervision. The testing shows that the pH rise time varies from less than 15 minutes to more than 135 minutes with 12V voltage and 3A current usage. Imbalance in pH and PPM can cause damage to plants, such as leaf drying at pH <6 and yellowing of young leaves at pH >7.

Keywords: hydroponics, electrolytic nutrients, hibrida energy, PLTS, PLN, Blynk.