***Efficiency Analysis of a Solar–Biogas Hybrid Power System Applied to Deep Flow Technique (DFT) Hydroponics at RPH Kaliwates***

Zeni Ulma, S.ST., M.Eng. (*Undergraduated Thesis*)

Dela Nikmatul Maulidah

*Renewable Energy Engineering Study Program*

*Department Of Engineering*

## *ABSTRACT*

*The Kaliwates Slaughterhouse generates cattle rumen waste that may cause environmental pollution if improperly managed, yet it has potential to be utilized as a renewable energy source through biogas production. Meanwhile, the Deep Flow Technique (DFT) hydroponic system requires a continuous and stable electricity supply to operate nutrient circulation pumps. This study aims to evaluate the performance and efficiency of a hybrid energy system combining a Solar Power Plant (PLTS) and a Biogas Power Plant (PLTBg) to support DFT hydroponic operation at the Kaliwates Slaughterhouse. A quantitative field experimental method was applied by measuring electrical parameters, including voltage, current, power output, system efficiency, and power losses. The hybrid system was designed to supply a 13 W nutrient pump operating continuously for 24 hours, with PLTS as the primary energy source during daytime and PLTBg operating at night. The results indicate that PLTS efficiency ranged from* 2,31–90%*, with peak efficiency exceeding 90% under specific conditions due to reduced input power. The PLTBg system showed efficiency values between 8.62% and 64.66%. Power losses in the PLTS system ranged from −0,579 to 3,466 kWh/kWp, where negative values occurred due to low daily solar irradiation below the reference level of 1000 W/m². Overall, the solar–biogas hybrid system demonstrated reliable and sustainable energy supply for DFT hydroponic applications while reducing dependence on conventional energy sources.*

*Key words: Hybrid energy system, biogas energy, Deep Flow Technique (DFT) hydroponics, energy efficiency, solar photovoltaic.*