PERFORMANCE EVALUATION OF HAND TRACTOR TRAILER MOUNTED REMOTE CONTROLLED RETRACTABLE PV-PANEL WATER PUMP

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ACCEPTANCE SHEET

This undergraduate thesis entitled **"PERFORMANCE EVALUATION OF HAND TRACTOR TRAILER MOUNTED REMOTE CONTROLLED RETRACTABLE PV-PANEL WATER PUMP,"** prepared and submitted by **ANGELO M. EUGENIO**, in partial fulfillment of the requirements for the degree of **BACHELOR OF SCIENCE IN AGRICULTURAL AND BIOSYSTEMS ENGINEERING (AB MACHINERY AND POWER ENGINEERING)** is hereby accepted:

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BIOGRAPHICAL SKETCH

Angelo M. Eugenio was born on July 30, 2002 in Bugallon Norte, Ramon, Isabela. From a young age, Angelo displayed a remarkable enthusiasm towards agriculture and passion on farming specially on rice production due to his family's field of interest in agriculture.

Angelo began his educational journey at Bugallon Norte, Ramon, Isabela in his home province Ramon, Isabela. It was here that his commitment to his academics became apparent, earning him academic honors and extracellular accolades. Continuing his educational pursuits, Angelo Eugenio attended Jet Montessori School of Ramon, Inc. for his Highschool education. During these years, he continues to showcase his commitment and unwavering perseverance towards his academics. He once again excelled academically, graduating with honors and having awards for his Taekwondo participation for different competitions.

Currently, Angelo is a passionate and dedicated student of Agricultural and Biosystems Engineering, currently navigating through his college journey. From the beginning of semester of face-to-face classes, has exhibited a profound fascination with technology for agriculture. Angelo was excited about the opportunities that lie ahead in the field of agricultural engineering. His academic background, combined with his passion for machinery and rice production, positions him to make significant contributions to the industry.

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ABSTRACT

EUGENIO, ANGELO M., Department of Agricultural and Biosystems Engineering, College of Engineering, Central Luzon State University, Science City of Muñoz, Nueva Ecija, Philippines, **July 2024**, **PERFORMANCE EVALUATION OF HAND TRACTOR TRAILER MOUNTED REMOTE CONTROLLED RETRACTABLE PV-PANEL WATER PUMP**

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Nowadays, using photovoltaic (PV) systems to power water pumps is a relatively new and accepted technology, though it faces challenges such as high initial costs and lower system efficiency. The hand tractor trailer-mounted retractable PV-panel (RCRPV) system offers an innovative solution for water pumping in agricultural and remote settings. This study was conducted to determine the performance of the machine using three suction lift levels (2m, 3m, and 4m) across different water sources (open water and shallow well), with the experiment laid out in a Completely Randomized Design (CRD). Key performance parameters; including pump discharge, system efficiency, and pumpset efficiency, were analyzed using two-way Analysis of Variance (ANOVA)

The study revealed that the discharge rates of the RCRPV water pump vary significantly with different water sources and suction lift levels. Shallow wells obtained higher discharge rates than open water sources, with the maximum rate of 322.15 m^3/day at a 2m suction lift. Both water source and suction lift levels significantly affected the discharge rates however, there is no significant effect between the water source and suction lift. Pumpset efficiency was highest at 27.96% at a 4m suction lift from a surface water source and lowest at 20.02% at a 2m suction lift from a shallow well. The findings suggest that higher suction lifts are associated with increased pumpset efficiency, aligning with the

behavior of centrifugal pumps, where increased total head reduces flow rate but enhances efficiency.

System efficiency was also significantly influenced by suction lift height and water source, with higher efficiencies observed at greater suction lifts and from shallow well sources. However, the overall energy conversion efficiency from solar incident energy to hydraulic power was low, primarily due to inherent inefficiencies in solar panel energy conversion and additional losses from wiring resistance.

The hand tractor trailer-mounted RCRPV water pump was better choice for sustainable and cost-effective irrigation, especially in remote agricultural locations which lacks electricity access. It has lower operational costs of Php 12,549.22/year and custom rate of Php 3.33/day due to reliance on solar energy making it economical.

Keywords: Photovoltaic; RCRPV, Water sources, Suction lift, discharge, efficiency

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