BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINERING

DEPARTMENT OF AGRICULTURAL MECHANISATION AND IRRIGATION ENGINEERING

FINAL YEAR PROJECT REPORT:

DESIGN AND SIMULATION OF A HYBRID SOLAR AND WIND WATER PUMPING SYSTEM FOR BUSITEMA UNIVERSITY

BY

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ABSTRACT

This thesis presents the design of hybrid solar wind turbine system for pumping underground water for Busitema University by utilizing both solar and wind renewable energy to reduce on the high costs of pumping water and inadequate water supply to students. The study was started by investigating the potential ability of both solar and wind energy in the desired location which is Busitema University where the metrological data, mean wind speed and monthly solar irradiance of global radiation horizontal were analyzed. The system was optimally designed for an average of 1000students with water requirement of 60000L/day. wind turbine was simulated to analyze for static pressure, turbulence intensity and stress distribution exposed at 15m/s wind speed. The A cost analysis was done to estimate the total project investment, maintenance and overhead cost, annual net income stream and the payback period. The simulation results showed that the system could effectively operate at speeds of 15m/s without deformation. The net cost value of project is 24859000 UGX with a payback period of 4years.The study will, therefore, be a useful guideline in making investment decisions in hybrids since the system is estimated to have minimum lifetime of 20years.

DECLARATION

I **Akanya Majid** do declare that this report is an original copy of my personal experience for my final year project, and the information in it is my own effort and has never been submitted before to any institution for any award.

NAME: .....

SIGNATURE: .....

DATE: ...../...../.....

APPROVAL

This piece of work has been approved by;

Main Supervisor

MR SSERUMAGA PAUL

Signature.....

Date.....

Co-supervisor

MR SHAFIC SSENYIMBA

Signature.....

Date.....

DEDICATION

I dedicate this report to my beloved brother Mr. Adaku Ismail and the entire family of my late father Mr. Akanya Noah for their great contribution and support towards my studies both financially, spiritually and personal encouragement they offered me. May the almighty God bless their hands.

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CHAPTER ONE

1.0 INTRODUCTION

Water is the source of life, and the availability of water has become more crucial than ever before. The demand for water grows along with the world's population*(Dalvi et al., 2017)*. The need for water to irrigate land, which will then produce more food, as well as clean water for drinking and other domestic purposes, is crucial in coping with the world's population growth. A source of energy to pump water is also a big problem in many developing countries including Uganda and yet these areas suffer water crisis. In the *Global Risks 2015 Report* of the World Economic Forum, water supply crisis was identified as the top 1 high-impact risk for our current times [World Economic Forum, 2015]. Developing a grid system is often too expensive because rural villages are frequently located too far away from existing grid lines. Depending on an imported fuel supply is difficult and risky, even if it's available within the country, transporting that fuel to remote, rural villages can be difficult. In Uganda, a country of about 40million people, it is estimated that less than 4% of the population has access to electricity (Energy and Commission, 2018).

Renewable energy is energy derived from resources that are regenerative or for all practical purposes and cannot be depleted for example from the sun, wind, water, organic waste, and geothermal heat which can be found everywhere on the planet. Hence, every city and town can make use of available renewable energy sources that offer economic opportunity and enhance resilience in the face of global economic crises and environmental change. The use of renewable energy is attractive for water pumping applications in rural areas (Busitema university) of many developing countries. Transportation of renewable energy systems, such as wind machines and photovoltaic (PV) pumps, is much easier than other types because they can be transported in pieces and reassembled on site. Traditional windmills have been used to pump water in the Great Plains of the United States and many developing countries for the last century. These wind pumps are used for irrigation, livestock watering, and domestic water supplies. This technology, with little modification, is still attractive in many developing countries. More recently, the development of electrical wind turbines has become especially attractive for a greater variety of multipurpose applications. These turbines can directly produce alternating current (AC) or direct current (DC) power output. A wind turbine can be designed for one of four output configurations: grid

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