BUSITEMA UNIVERSITY
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FACULTY OF ENGINEERING

DEPARTMENT OF AGRICULTURAL MECHANISATION AND IRRIGATION ENGINEERING

FINAL YEAR PROJECT REPORT

DESIGN AND SIMULATION OF A SOLAR POWERED SEMI PORTABLE SPRINKLER IRRIGATION SYSTEM FOR TOMATOES

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ABSTRACT

This study was conducted to design an effective solar powered semi- portable sprinkler irrigation system that should be adopted for tomato cultivation so as to keep production continuous even during the dry seasons of the tropical climate of Uganda especially west Nile. The major components of the irrigation system are the sprinklers, movable lateral pipes, fixed sub-main pipes, and fixed main pipes and solar pumping unit. The use of movable lateral pipes lowers the total initial investment of irrigation by up to about 50%.

Design parameters had to be determined so as to design and effective irrigation system for the target area and these were, Crop water requirement of tomatoes, soil infiltration rate, and the topography of the field. The semi-portable sprinkler irrigation system was designed for an area of 1.08 Ha, having a system capacity of 3.775 litres per seond and irrigation frequency of 7 days. A computer simulation was also run to analyze the system performance, and the results showed that for the pump selected, the system would perform normally.

Finally and economic analysis was carried out using the payback period and net present value. This showed that if the system is used effectively with proper agronomic practices, the cost of investment will be regained in the first year. Additionally the same system can also be used for other crops other than tomatoes with a little alteration in the scheduling and time of operation.

DECLARATION

I, BUSH HERBERT OMESON, hereby declare to the best of my knowledge that the piece of this project is as a result of my personal effort and research and has never been presented in any institution of higher learning for the award of any academic reward.

Bush Herbert Omeson

Sign: _____ Date: 2/6/2017

APPROVAL

This design project has been submitted for examination with the approval of the following supervisors

MAIN SUPERVISOR

Mr. Eriau Emmanuel

Sign: _____ Date: _____

CO - SUPERVISOR

Mr. Mugisha Moses

Sign: _____ Date: _____

DEDICATION

I dedicate this project work to my dear parents Mr. Ukuni Paul Omeson and Mrs. Rijoo Florence, for their tireless support rendered to me. May God bless you Abundantly

ACKNOWLEDGEMENT

My sincere thanks goes to the Almighty God For his wisdom, mercy and grace that has been abundant upon me.

With great honour I thank my lovely supervisors, Mr. Eriau Emmanuel and Mr. Mugisha Moses for their tireless technical guidance offered to me as I worked on my final year project design. May the Almighty God richly bless you.

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ACRONYMS

EC	-	Electrical Conductivity
ET	–	Evapotranspiration
ET_c	-	Crop evapotranspiration
FAO	–	Food and Agricultural Organization
DPP	-	District Development Plan
GDP	-	Gross Domestic Product
AGRA	-	Alliance for Green Revolution in Africa
MAAIF	-	Ministry of Agriculture, Animal Industry and Fisheries
PEHD	–	Poly Ethylene High density
pH	-	Potential hydrogen (acidity/alkalinity)
PN	–	Nominal pressure
PVC	–	Poly vinyl chloride
UBOS	-	Uganda Bureau of Statistics
NDP	-	National Development Plan
IPC	-	Integrated Food Security Phase Classification

CHAPTER ONE

1.0 Background of study

Global food demand in 2050 is projected to increase by at least 60 percent above 2006 levels, driven by population and income growth, as well as rapid urbanization(FAO 2016). About 80 percent of the required increase will need to come from higher yields and 10 percent from increases in the number of cropping seasons per year (Alexandratos and Bruinsma, 2012).

On average about 65% of Africa's labour force is employed in agriculture, yet the sector lags for about 32% of GDP, reflecting low productivity(AGRA, 2013).

According to UBOS (2012), the agricultural sector is the main stay of Uganda's economy employing over 66 percent of the labour force and contributing 22.9 percent to the GDP.

Uganda's agriculture is characterized by low yields and this is partly a function of low application of modern technology. The capacity to develop new agricultural technology has to be improved and indeed will be critical to the prosperity of the nation(MAAIF,2010).

The achievement of long-term sustainable economic growth in the face of climate change as a result of increasing emission of carbondioxide and other green house gases is a primary concern in Uganda(NDP II, 2015)

According to IPC report (2014), the first season of the bimodal rainfall pattern of westnile has been observed to be shorter and more unreliable in the last few years.

The westnile region has high potential for solar energy generation due to long sunshine hours, Its also blessed with sustainable source of water(Albert nile) for irrigation and if these natural resources are properly harnessed, productivity could increase.

Moyo District receives about 1267mm of annual rainfall, areas along the nile receive lesser rain (860mm) than the rest of the district and the highest and lowest temperature are 45 and 29 degree Celsius respectively (Moyo DDP 2011/2012-2015/2016).

Tomatoes fall in the group of vegetables, the quantity of vegetables by percentage exported from the year 2011 to 2013 is 0.2, 0.4 and 0.5 respectively (UBOS 2014). This indicates an increase in the demand for vegetables.

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