BUSITEMA UNIVERSITY

Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING

FINAL YEAR PROJECT REPORT

DESIGN AND SIMULATION OF A MINI HYDROPOWER SCHEME FOR BUSHIKA SUB COUNTY IN BUDUDA DISTRICT

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A final year project proposal Report ***submitted to the Department of Mining and Water Resources Engineering as a partial fulfillment of the requirements for the award of a Bachelor of Science degree in Water Resources Engineering at Busitema University***

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ABSTRACT

Mini-hydro-electric power is both an efficient and reliable form of clean source of renewable energy. It can be an excellent method of harnessing renewable energy from small rivers and streams. The mini-hydro project designed to be a run-of-river type, because it requires very little or no reservoir in order to power the turbine. The water will run straight through the turbine and back into the river or stream to use it for the other purposes. This has a minimal environmental impact on the local ecosystem. The design procedure of mini-hydro power plant was implemented by Visual Basic software to calculate all the design parameters. The choice of the turbine type depending mainly on the site head and flow rate. The turbine power and speed were directly proportional with the site head, but there were specific points for maximum turbine power and speed with the variation of the site water flow rate. The turbine efficiency could range from 80 to 95 percent depending on the turbine type, and the generator efficiency about 97 percent. The design study showed that construction of mini-hydroelectric project was feasible in the project site and there were no major problems apparent at the design and implementation stages of the mini-hydro-electric power plant. Wherever possible, the system components that were designed are also illustrated with AutoCAD.

DECLARATION

I **KASAKYA NDIMULODI** hereby declare that this report is a true work of my hands and has never been presented by any person or institution for an academic award

Signature: .....

Date: 04/06/2018

APPROVAL

This piece of work has been approved by;

Supervisors

DR. MUSINGUZI. B WILSON

Signature……

Date……...

MR. MAKUMBI THOMAS

Signature……

Date……04th/06/2018……...

DEDICATION

This research is dedicated to my dear mother Ms. **Nakirya Edina** appreciation for her love, care and support towards me throughout my entire education life. She has been there for me. May the almighty God bless the works of her hands.

ACKNOWLEDGEMENTS

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I appreciate my parents Miss Nakirya Edina and guardian Mr. Kiisa Amos for the support she has extended to me in order to attain quality education. May the Almighty God bless the work of her hands.

Finally, I give credit to my fellow finalists, Iyega Hamim, Kimera Ismail, Aanyu Caroline Memory, Wataka Emma among others who have always told me inspiring words of counsel and wisdom. May the Good Lord bless and reward them with success.

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LIST OF ACRONYMS

GWh	Giga watt hour
kWh	kilo watt hour
kW	kilo watts
m/ s	meters per second
ERA	Electricity Regulatory Authority
REA	Rural Electrification Agency
EIA	Environmental Impact Assessment
m	meter
mm	millimeters
UBOS	Uganda Bureau of statistics
g	acceleration due to gravity
HPP	Hydro power plant
PHC	population and housing census
DI	Ductile iron
GI	Galvanized Iron
uPVC	Unplasticized polyvinyl chloride
HDPE	High density polyethylene
MWE	Ministry of Water and Environment
GPS	global positioning system
AC	Alternating current
DC	Direct current
FDC	Flow Duration Curve
MAF	Mean Annual Flow
VB	Visio Basic

CHAPTER ONE.

1.0 Introduction

Hydropower plant is the harnessing of energy from falling water to generate electricity. Hydropower is based on simple concepts where moving water turns a turbine, the turbine spins a generator and electricity is produced. Energy is one of the most fundamental elements of our universe. It is inevitability for survival and indispensable for development activities to promote education, health, transportation and infrastructure for attaining a reasonable standard of living and is also a critical factor for economic development and employment. In the last decade, problems related to energy crisis such a soil crisis, climatic change, electrical demand and restrictions of whole sale markets have a risen world-wide. These difficulties are continuously increasing, which suggest the need of technological alternatives to assure their solution. One of these technological alternatives is generating electricity as near as possible of the consumption site, using the renewable energy sources, that do not cause environmental pollutions, such as wind, solar, tidal and hydro-electric power plants. Hydro-electric power is a form of renewable energy resource, which comes from the flowing water. To generate electricity, water must be in motion. When the water is falling by the force of gravity, its potential energy converts into kinetic energy. This kinetic energy of the flowing water turns blades or vanes in a hydraulic turbine; the form of energy is changed to mechanical energy. The turbine turns the generator rotor which then converts this mechanical energy into electrical energy

1.1 BACKGROUND

The energy problem of many developing countries is lack of access to sufficient and sustainable supplies of energy. This affects as much as 90% of the population of many developing countries living in rural areas without efficient, clean energy and people are undermined in their efforts to engage effectively in productive activities or to improve their quality of life. In Uganda the major renewable energy source is hydro power due to its clean energy production followed by solar energy (KAUNDA, 2012.). A mini hydropower scheme is capable of generating capacity between 100 kW and 1MW. The Uganda Government Vision 2040 on Renewable Energy is to make modern renewable energy a substantial part of the national energy consumption(Ferreira et al., 2016). The severe and wide spread lack of connection to sufficient and sustainable electricity

CONCLUSION

The following are the conclusions from the study.

The site reconnaissance was successfully carried and the location of the components obtained together with the projected power demand as 0.409GWh/year.

- The design head (46.785m) and discharge($0.39m^3/s$) of the system were determined.
- The civil and mechanical components were thereafter designed and illustrated using the respective software as discussed in the preceding chapters.
- Finally, the simulation of the project was done using visual studio software and Excel spread sheet.

Although this study was limited by scope to the design of the civil and mechanical components of the mini hydropower scheme (intake, diversion canal, spillway, settling basin, forebay tank, penstock, turbine selection and sizing), hydropower plants have other components such as the electrical and the distribution structures. A detailed study of the electrical and mechanical structures wasn't undertaken due to the limited budget and timescale of the project.

Similarly, the design of various components that were conducted in this study also led to the realization that the design of the system components is very much determined by the location specific factors such as river discharge and head. The mini hydropower plant was designed as a run-of-river type because river Mungoni its source is located in the mountainous Elgon region. The choice of materials was mainly governed by their availability and local topographical conditions. For example, the choice of stone masonry with cement mortar type for the headrace canal was considered because in the topographically hilly reason, mud mortar type would have led to seepage of water from the canal and so would have caused landslides in the longer run which would incur significant costs and damage.

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