FACULTY OF ENGINEERING

DEPARTMENT OF WATER RESOURCES AND MINING ENGINEERING

FINAL YEAR PROJECT REPORT

DESIGN AND CONSTRUCTION OF FOG HARVESTER

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SUPERVISORS

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A final year project report submitted to the Department of Water Resources and Mining Engineering as a partial fulfillment of the requirements for the award of a Bachelor of Science Degree in Water Resources Engineering of Busitema University.

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ABSTRACT

Despite its natural resources and its enormous surface and underground water potential, Uganda is still struggling to implementation for the supply of safe drinking water for even the urban population. Many initiatives to supply these communities through the national water distribution network have remained fruitless. A very high number of people in rural areas risk their health by consuming unsafe water relying on available polluted water sources.

This study therefore aims at designing and constructing a fog harvester that could help in availing safe drinking water to these same rural communities. Two districts were selected according to their elevation, which was above 2000m above sea level that supports fog formation and collection. The potential of harvesting water was investigated over Mbale and Kasese districts in Uganda. Daily air temperature, relative humidity and wind speed were also used. Parameters including atmospheric water vapor pressure, saturated vapor pressure and the absolute and relative humidity of the atmosphere were derived and monthly trend variations in fog water harvesting in the two districts developed. Mbale district was selected due to its potential, accessibility and economic implication to the researcher.

After considerable site selection criteria, Wanale Sub County was selected as a pilot site for testing the performance of the designed fog harvester, which later indicated that it is a promising new technology. It is an integrated, manageable and sustainable water collection system. The system collected approximately a maximum of 2.0 L/m^2 of mesh area per day. A water quality test done revealed that the water was safe enough for drinking. An estimate of implementation cost of Ugx 363700 is provided as part of the discussion on the feasibility of using fog water harvesting as low-cost approaches to securing safe drinking water in Uganda.

DECLARATION

I **SHIFRAH NABISUBI** hereby declare, to the best of my knowledge, that this research project report is an outcome of my original work and that it has not been presented to any institution of learning for an academic award.

Signature: …….. Date: ……....……

APPROVAL

This project report has been submitted to the Faculty of Engineering, Busitema University for examination with approval of my the supervisors mentioned below;

MAIN SUPERVISOR:

Mr. Joseph Ddumba Lwanyaga

Signature…… Date…….

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LIST OF ACRONYMS

UN: United Nations

FWH: Fog Water Harvester

LWC: Large Water Collector

FWC: Fog Water Collector

UV: Ultra Violet

PVC: Polyvinyl Chloride

WHO: World Health Organization

BCA: Benefit Cost Analysis

CBA: Cost Benefit Analysis

DEM: Digital Elevation Model

GIS: Geographical Information Systems

AWH: Atmospheric Water Harvesting

RH: Relative Humidity

TSS: Total Suspended Solids

TDS: Total Dissolved Solids

BOQ: Bill Of Quantities

NASA: National Aeronautics and Space Administration

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1 CHAPTER ONE

1.1 BACKGROUND

Fog is a cloud at the ground level that consists of microscopic droplets of water of 1-40μm in diameter suspended in the air. Because of their small size and lightness, these undergo a free-fall movement of less than 1cm.s-1 to 5cm.s-1 subjected anytime to horizontal transport by the wind (Schemenauer, 2005)

The formation of fog occurs either from the rising and consequent chilling of a portion of air, or from the loss of heat due to radiation, or else from the mixing of two portions of slightly non-saturated air of different temperatures (Schemenauer, 1991). Consequently according to the mode of condensation and the movement of the air masses.

Water is a basic requirement to sustain life for human beings, plants and animals around the world. Approximately 70% of earth's surface is submerged in water and only less than 2% of that water is drinkable and accessible (Aboueleta, 2016). 1.2 billion People lack access to clean drinking water and by 2025, that number is expected to more than double to 2.8 billion. Annual deaths from diseases such as cholera, typhoid and dysentery caused by unsafe drinking water and sanitation sums up to 10 million people (Scott, 2015).

There is scarcity of potable water in Africa. Water scarcity in Africa can be categorized in to two namely, Economical scarcity and physical scarcity where, economic scarcity refers to the fact that finding a reliable source of safe water is time consuming and expensive. On the other hand, physical scarcity means lack of water in a given region. The 2006 United Nations (UN) Commission for Africa shows that there is physical water scarcity especially in the northern part of Africa, which includes countries like Morocco, Algeria, Ethiopia, and Libya among others. Economic water scarcity happens almost in all African countries including Uganda.

Water scarcity in Uganda is mainly caused by climate change for example altered weather patterns, increased pollution and increased human demand and over use of water. Furthermore, lack of infrastructure for safe extraction and distribution to villages has also promoted water scarcity in Uganda.

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