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INTRODUCTION

1.1 Background of Study

Industrial raising of farm animal indoors under conditions of extremely restricted mobility is commonly known as factory farming. It is done as part of industrial agriculture which is set as a method that changes as laws and technology change. Industrial agriculture which is designed to produce the highest output at the lowest cost, using economics of scale, modern machinery, modern medicine, and global trade for financing, purchasing and sales. The economic growth of industrial agriculture crucially depends on the long-term availability of energy from sources that are affordable, accessible, and environmentally friendly. Security, climate change, and public health are closely interrelated with energy. On the other hand, Energy is an important factor in all the sectors of any country's economy. The standard of living of a given country can be directly related to the *per capita* energy consumption. The recent world's energy crisis is due to two reasons: the rapid population growth and the increase in the living standard of whole societies. Energy supports the provision of basic needs such as cooked food, a comfortable living temperature, lighting, the use of appliances, piped water or sewerage, essential health care (refrigerated vaccines, emergency, and intensive care), educational aids, communication (radio, television, electronic mail, the World Wide Web), and transport. Nigeria is Africa's energy giant [Oyedepo, 2012]. It is the continent's most prolific oil-producing country, which, along with Libya, accounts for two-thirds of Africa's crude oil reserves. It ranks second to Algeria in natural gas. Most of Africa's bitumen and lignite reserves are found in Nigeria. In its mix of conventional energy reserves, Nigeria is simply unmatched by any other country on the African continent. It is not surprising therefore that energy export is the mainstay of the Nigerian economy. Also, primary energy resources dominate the nation's industrial raw material endowment.

Several energy resources are available in Nigeria in abundant proportions. The sun is considered the best alternative source of energy because;

-It is there in plenty and free of charge.

-It is non-pollutant and clean.

-It is available everywhere even in the North Pole where solar voltaic can be used.

The available solar energy depends on the position of the sun, weather condition especially the clouds and location. Nigeria has significant biomass resources to meet both traditional and modern energy uses, including electricity generation. There has been a supply and demand gap as a result of the inadequate development and inefficient management of the energy sector. The supply of electricity, the country's most used energy resource, has been erratic.

The rural areas, which are generally inaccessible due to the absence of good road networks, have little access to conventional energy such as electricity and petroleum products. The most suitable place for solar energy in Nigeria are the rural areas where there are difficult terrains, no easy access to fossil fuel energy source. Effective harnessing of solar radiation using solar energy technologies would enhance availability of energy for socio-economic activities and to improve the standard of livelihood of the people by harnessing it in the agricultural sector.

Although solar energy is available in abundance and free of charge, it is very discouraging to note that the initial capital cost of installing a solar powered system is very constraining. Such capital cost can only make sense if the running cost of the solar energy is so low as to lead to a high saving to repay the high initial capital cost in a reasonable period of time. This can only be achieved by having good knowledge of the amount of energy being tapped. This would help in deciding the location where the system should be installed to operate with the highest possible efficiency and lowest possible fabrication, installation and operation costs.

The application of energy in poultry production (egg incubation as case study) has not received comparable attention especially in developing countries. The world's population is growing at an alarming rate and so is the demand for protein especially in rural areas. Poultry is a good source of protein if it is affordable. The production level is limited with natural incubation because the number of eggs an adult female bird lays in a year varies from 0 to 365 or one per day [French, 1981]. Nevertheless a broody hen (a hen that wants to set

and hatch eggs and raise its chicks) can hatch just about 10-12 eggs at once in 21 days [French, 1981]. This reduces its productivity as it takes to incubate and hatch the chicks. For the world growing population, relying on this natural type of incubation is not enough. Hence, the need for artificial incubation process became necessary in agricultural production of chicks. Therefore in order to ameliorate these problems, there is need to design and fabricate a solar powered incubator that can meet the poultry need of the growing population.

1.2 Statement of the Problem

Poultry egg incubation is an activity that requires sustainable energy supply for efficient performance, operation and profitability.

With the Nigeria Government's inability to supply adequate and reliable energy to ensure energy security in the urban areas, it then becomes extremely unlikely that the rural areas will be considered in the short term especially considering their low load factor and the economy of grid connection. Rural areas that are not economically viable for grid extension will therefore have to be served by an alternative source of energy such as solar energy that is abundant, non-polluting and inexhaustible. A special feature of solar powered incubator is that it could harness solar energy by using available material and is adaptable to both rural and urban poultry production.

Some energy and other related problems which affect poultry production in Nigeria among others includes:

- Unavailable and insufficient power from the energy grid.
- Expensive cost of running electricity
- Low quality of chicks produced
- Pollution of environment for poultry breeding as a result of emission from burning fossil fuels
- Lack of commercially owned hatchery machines

These problems will be addressed by this present project.

1.3 Aim and Objectives

Aim

The aim of this project is to design and fabricate an incubator that is powered by solar energy source.

Objectives

The objectives of this project include to:

- Design a solar powered egg incubator
- Fabricate the incubator with more of locally source materials
- Hatch eggs in a clean environment devoid of any energy related pollution
- Encourage the youth to venture into agriculture (poultry farm), small and large scale

1.4 Justification/Relevance of the project

The purpose of this project mainly is to construct an incubator system that will be powered by energy from sunlight through the use of solar power equipment. Most important, with our project we intend improving the process of hatching egg and also create an environment that is free from pollution and good for incubating egg. This project will help to fast track meeting the protein needs of the country and the world using locally available materials. It will equally motivate youth's to venture into agriculture (poultry farming) in small and large scale.

1.5 Scope of the Work

The scope of this work is limited to design and fabrication of a small size solar-powered egg incubator. Its capacity is limited to fifty eggs per time. It covers design, component fabrication and assembly of the various components to form the incubator.

1.6 Report Organization

This report presents the combination of various chapters that contain the introduction, literature review, methodology, result and discussion and the last chapter is a conclusion and recommendation of the project.

Chapter 1 is an introduction of the project. In this chapter, we will explain the background and objectives of the project. The concept of the project and the overall overview of the project also will be discussed in this chapter.

Chapter 2 focuses on the literature review and the project flow for the development of the Automatic Egg

Incubator System for Various Types of Egg.

Chapter 3 will explain the methodologies of the project. The project development consists of three parts which are mechanical design, hardware design and software design.

Chapter 4 discusses all the results obtained and the discussion of the project. Chapter 5 captures the conclusion and recommendation of the project.

Design and Fabrication of an Automatic Egg Incubator

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