CHAPTER I

INTRODUCTION

1.1. Background Issues

The Government of Libya has appointed Libya electric co. to invest in the development of electric energy. The officer conducted a survey of wind speed and the climate of the Sahara Desert beginning in 2009. The survey showed that wind speeds in the desert of the Sahara are grades 4 and 5. It is also sufficient for wind turbines to generate electrical energy [1] .

The wind turbine production in the Sahara Desert also has a strength of 30 in and a length of the blade of 40 in. The wind turbine could thus generate 2 MW. Cost maintenance for oil gear, however, is due to wind mixing sands that damage the amount of oil [2] .

Sustainable energy is the supply of energy that meets today's needs without undermining future generations' ability to meet their needs. There are two elements of sustainable energy: renewable energy and energy conservation. Renewable energy uses biomass, wind, sun, waves, tides and geothermal heat as renewable sources. Wind power, solar power, wave power, geothermal power, tidal power and biomass-based power are all renewable energy systems. Renewable energy sources, such as wind, ocean waves, solar flow and biomass, provide power and heat generation free of pollution.

An eco-green analysis of a wind turbine includes a review of the flows of energy during its life. This includes the embodied energy associated with the manufacturing process and the subsequent part replacement and repair; the energy needed for service, maintenance and disposal; and the energy produced over the life of the turbine. The emphasis of studies on the life-cycle energy of wind turbines has historically been on energy production. This may be partially due to the conceptual inability to measure the requirements of these processes for life-cycle energy by underestimating the potential significance of embodied energy. Because of the complexities of the supply chain, embodied energy is especially important. This complexity means that for each product and process upstream to the raw materials, the supply chain must be modelled, as shown in Figure 1.1 [3].

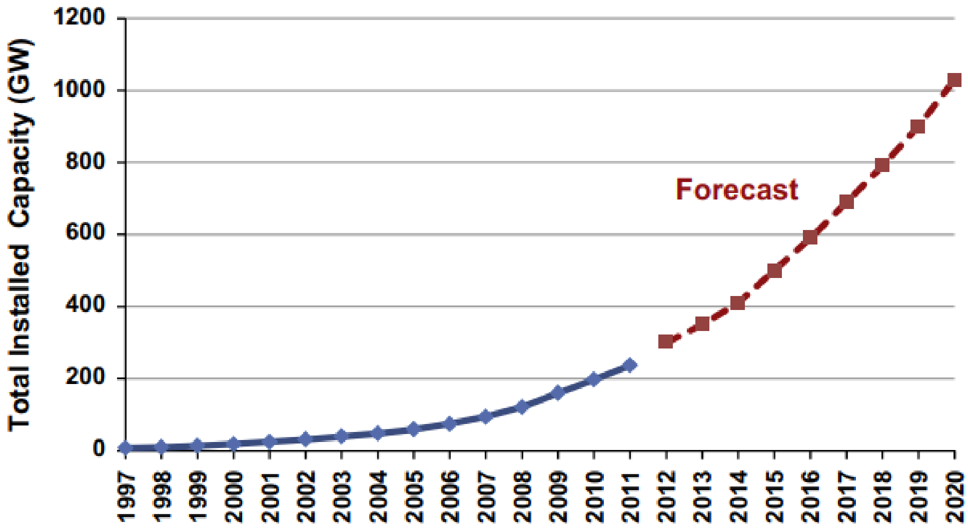

Figure 1.1. Wind energy: global capacity (blue) and forecast (red) [3]

The advancement of cleaner and more effective energy technology and the use of new and renewable energy sources[3] have shown that they can play an important role in the sustainable development of a future energy strategy. Wind turbine power generation is a green and clean technology, but the wind turbine absorbs energy resources from a life-cycle perspective and generates pollution during the manufacture of raw materials, the manufacturing process, the transport of small and large parts of the wind turbines, the repair and disposal of the turbine parts at the end of their life. All components required for the development of electricity, including the tower, nacelle, rotor, base and transmission, should be included in the study in order to evaluate the effect of the generation of electricity using the wind turbine. In the design of eco green wind turbines, the materials are energy intensive with high energy embodies and carbon foot print, the choice of material affects the energy and CO_2 for the production process, the material affects the product weight and its thermal and electrical characteristics, and the energy consumed during use; and the choice of products often influences the capacity at the end of life for recycling or energy recovery. The eco-conscious design of the wind turbine has a two-part strategy: (1) Eco Audit: rapid and estimated evaluation of the distribution of energy demand and carbon emissions over the life of a product; and (2) the choice of materials to reduce energy and carbon over the full life of each period of life, balancing the impact of the choice (selection strategies and eco informed material selection) [3].

Morever[4] pointed out that a wind turbine is a rotating device which draws energy from the wind. The wind turbine's mechanical energy is transformed to electricity (wind turbine generator). A horizontal (Horizontal Axis Wind Turbine-HAWT) or vertical (VAWT) axis will rotate the wind turbine. The majority of modern wind turbines belong to these two fundamental groups: HAWT and VAWT. The direction of the turbine can either be upwind or downwind for the HAWT. For a horizontal upwind turbine, when it reaches the tower, the wind hits the turbine blade. The wind reaches the tower first in the case of the horizontal downwind turbine. The basic advantages of the vertical axis wind turbine are (1) that it is possible to position the generator and gear box on the ground and (2) that a tower is not needed. The drawbacks of the VAWT are: (1) the wind speeds are very low near ground level, so while a tower can be saved, the wind speeds on the lower part of the rotor would be very low, and (2) the overall performance of the vertical axis wind turbine is not impressive.

It was shown in [5] that the energy yield ratios of 21 and 23 for a small and large-scale wind turbine were found. This reflects an 11 percent improvement in the larger turbine's energy yield ratio over that of the smaller turbine. Due to the revolutionary use of a hybrid embodied energy analysis system, the embodied energy aspect was found to be more important than in previous studies, emphasized here. The requirements for life-cycle energy were shown to be offset by the energy provided during the first 12 months of service.

Where, as shown[6], the energy embodied in the production, design, installation, repair, and replacement of components is a significant component of the energy requirements of a wind turbine. A large proportion of life-cycle energy needs for individual goods can be compensated for by this embodied energy.

In addition,[7] has achieved that while turbine size, materials used, energy intensity and position will have an impact, the key explanation for the inconsistency in embodied energy figures is because of the selected form of evaluation. Previous studies have traditionally used process-based methods of assessment when measuring the embodied energy of wind turbines. These methods take into account the energy requirements for only a small number of inputs, typically the main components, and do not account for other inputs, comprising up to 80% of the overall energy consumption.

As a result, in the field of WT maintenance and repair strategies for the wind energy industry, Futhermore[18] has developed significant improvements using condition monitoring (CM) integrated into supervisory control and data acquisition (SCADA) systems. In order to provide early warning of structural, mechanical and electrical faults, fault detection and diagnosis (FDD), CM and fault detection algorithms are used to allow wind farm operators to carry out predictive maintenance and thus reduce failure rates.

Futhermore[19] has carried out the use of predictive maintenance in combination with preventive maintenance, all of which are very relevant for offshore WTs where maintenance workers work at the mercy of the weather. More preventive maintenance is needed by larger WTs than by smaller ones.

The Libyan population is growing from year to year, reaching 6,871,292 by 2020, as shown in Table 1.1:

Table 1.1 Population Of People in Libya [19]

Year	Population	Yearly % change	Yearly Change	Migrants (net)	Median Age	Fertility Rate
2020	6,871,292	1.38%	93,840	-1,999	28.8	2.25
2019	6,777,452	1.48%	98,893	-1,999	27.4	2.41
2018	6,678,559	1.49%	97,835	-1,999	27.4	2.41
2017	6,580,724	1.36%	88,562	-1,999	27.4	2.41
2016	6,492,162	1.15%	73,847	-1,999	27.4	2.41
2015	6,418,615	0.70%	44,130	-60,000	27.1	2.45

With a total population of 6 million people, this is why repetition is important. Consumption of electricity at 1 KVA = 1 600 VA and 1 MVA = 1 000 000 VA. If 1 family consists of a father, a mother, and 2 children, 1,300 VA or equal to 10 KVA with a yield of 2,400 W is used. Minimum wind turbine consumption of 5 MVA.

The issue is that Libyan wind turbines have not yet been installed, but Libya has already had wind capacity. It takes some effort to perform wind turbine research studies in the Sahara Desert. A detailed study is therefore necessary to provide accurate information on the design, installation and production of VAWT that is acceptable for the Sahara Desert climate. An analysis study is done using simulation analysis to conduct this research. Choose VAWT over HAWT because it has the benefit of high torque so that it can spin at low wind speeds, so that the generator can be positioned at the bottom of the turbine to allow the maintenance and work of the turbine that is not influenced by the direction of the wind. Another issue is the decrease in access to electricity in Libya, as seen in figure 1.2 in the graph below :

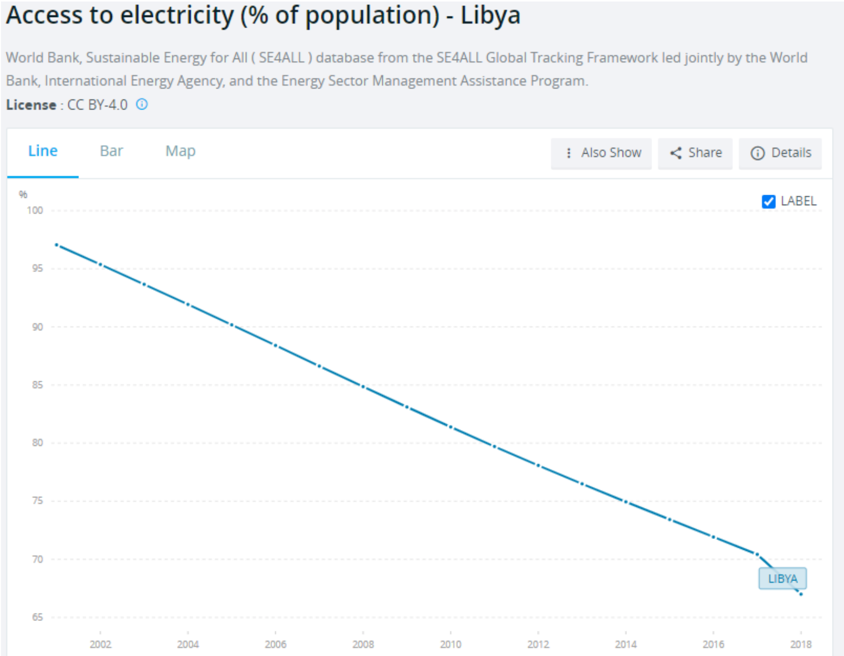

Figure 1.2 Access To Electricity Of Libya

Therefore, in line with the demographic conditions of Libya, the alternative is to construct a power plant, including a wind power plant. The solution is to build a wind turbine in the Sahara Desert and to use Fuzzy Logic applied to the eco-green wind turbine as a trend solution.

The benefits of the analysis are to provide empirical evidence on going green and using Fuzzy Logic to build the wind turbine in Sahara Dessert. This research, based on the above statement, is entitled: “**POTENTIAL CAPACITY OF WIND TURBIN USING FUZZY LOGIC ON SAHARA DESERT”.**

1.2. Formulation of the problems

1. What are the wind turbine and eco-green wind turbine parameters?
2. Why fuzzy logic is implemented in the Desert's wind turbine architecture to eco green.

1.3. Research Objectives & Benefits

The aims of this analysis are:

1. Conducting studies and research on the prospect of using wind turbines to generate electrical energy in the desert.
2. How to select any wind turbine design suitable for the Sahara Desert, including the wind turbine capital.
3. Study of the wind turbines and whether they are appropriate for using MATLAB to generate electricity from the desert.

Thesis on contributions are

1. Analysis Benefits (practical benefit):

   Providing a detailed review of the possibility of benefiting from the Sahara Desert in the production of wind turbine electricity and the possibility of growing the growth and investment opportunities of the Libyan Sahara Desert.
2. Theoretical Benefits

   Presenting an observational analysis in the Sahara Desert on how to select turbine design and turbine productivity.

1.4. Authenticity of Research

The rotary system that extracts energy from the wind is the implementation of fuzzy logic eco green on wind turbines. The wind turbine's mechanical energy is transformed to electricity (wind turbine generator). A horizontal (Horizontal Axis Wind Turbine-HAWT) or vertical (VAWT) axis will rotate the wind turbine. The majority of modern wind turbines belong to these two fundamental groups: HAWT and VAWT. The direction of the turbine can either be upwind or downwind for the HAWT. For a horizontal upwind turbine, when it reaches the tower, the wind hits the turbine blade. The wind reaches the tower first for the horizontal downwind turbine [4].

For small- and large-scale wind turbines, energy yield ratios of 21 and 23 were found, respectively. This reflects an 11 percent improvement in the larger turbine's energy yield ratio over that of the smaller turbine. Due to the revolutionary use of a hybrid embodied energy analysis system, the embodied energy aspect was found to be more important than in previous studies, emphasized here. The requirements for life-cycle energy were shown to be offset by the energy provided during the first 12 months of service [5].

The validity of this thesis is to provide empirical proof of the production of wind turbines in the Sahara Desert using Fuzzy Logic. And the reason for using fuzzy logic is that Fuzzy logic is an extension of classical logic that enables data imperfections to be modelled and, to some degree, approaches to the flexibility of human reasoning can also be made for the method of decision making.

1.5. Writing system

CHAPTER I: INTRODUCTION:

Background Issues, Formulation of the problem, Research Objectives & Benefits, Authenticity of Research, and Writing system

CHAPTER II: LITEREATURE REVIEW & BASIC THEORY

The development of research results that have been carried out by other researchers (from journal reports, proceedings, papers, seminars or other references). Write down the strengths and weaknesses of each. Basic Theory used.

CHAPTER III: METODOLOGY

Research Model, Tools and materials used, Research procedure, Methodology, Software / Hardware used, and Research Flow Stages

CHAPTER IV: RESULT AND DISCUSSION

This chapter will describe the result and discussion.

CHAPTER V: CONCLUSION AND RECOMMENDATION

This last chapter including the conclusion and recommendation.