UNIVERSITI TEKNIKAL MALAYSIA MELAKA

EVALUATING ELECTRIC BOAT WITH INBOARD ENGINE FOR FISHING VESSEL

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DECLARATION

I declare that this Choose an item. entitled “Evaluating Electric Boat with Inboard Engine for Fishing Vessel” is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

Name : MOSES LIAN LAZARUS

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APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Mechanical Engineering Technology (BMMV) with Honours.

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DEDICATION

"I would like to thank my father, Mr. Lazarus, my mother, Mrs. Mbang, and the rest of my family for their support, encouragement, and advice. I would also like to thank the Faculty of Mechanical and Manufacturing Engineering Technology at Universiti Teknikal Malaysia Melaka (UTeM) for providing me with the opportunity to gain knowledge and evaluate the future possibilities for the renewable energy. With the aid and assistance of my supervisor at Universiti Teknikal Malaysia Melaka and close friends who assisted directly or indirectly in the completion of this report, I would like to express my gratitude."

ABSTRACT

The majority of people who use boats today have to deal with higher fuel expenses as a consequence of the increased demand for fuel energy and the imminent depletion of fossil resources. Renewable sources of energy are likely the most effective solution to this problem. As a result, the purpose of these studies was to find a solution to the problem by using renewable solar energy rather than energy derived from fossil fuels. As part of this project, a solar-powered boat will be designed and built from the ground up. The boat will be driven by an electric motor that is supplied by photovoltaic (PV) panels, and it will transform solar energy into electric energy. On the vessel, the photovoltaic panels need to be fitted and mounted in a way that does not compromise the ride quality. This is a fun and inexpensive way to travel across shorter distances, and it also serves as a form of transportation. The proposed design for a solar powerboat would include photovoltaic panels, which would act as sunlight collectors and also as the power generator. These panels would be supplemented by a battery, which would serve as storage for the boat's power, and a direct-current (DC) motor, which would take the place of the boat's traditional gasoline engine. A solar-powered electric watercraft may be constructed with the use of this technology by combining a solar panel, a rechargeable battery, and an electric motor. Solar energy is collected by a solar collector that is connected to a rechargeable battery. This solar energy is then converted into electrical power and sent to the battery so that it may be recharged. An electric motor receives its supply of electrical power from a battery that can be recharged, which is connected to the motor. An operational solar charger controller is going to be in charge of controlling the charging process. The process of turning sunlight into energy will kick off the whole system. This energy will then be transferred to the battery. After then, the dc motor-driven load that was inoperative will become operational again. The process of charging and running the load will take place at the same time. In addition, the amount of power that is used by the solar boat's electric engine will be limited and conserved thanks to the design of this vessel. In addition, the value of solar energy will be maximised in everyday life without being wasted, and the system will subsequently be expanded for use in commercial settings. Through the usage of this solar power technology, humans are able to reduce their use of gasoline. In addition to that, this tactic lessens the amount of carbon dioxide emissions produced by the gasoline engine. In conclusion, photovoltaic panels will be utilised to convert sunlight into electricity that will be used to power the solar-powered electric boat.

ABSTRAK

Majoriti orang yang menggunakan bot hari ini terpaksa berhadapan dengan perbelanjaan bahan api yang lebih tinggi akibat daripada peningkatan permintaan untuk tenaga bahan api dan kehabisan sumber fosil yang akan berlaku. Sumber tenaga boleh diperbaharui mungkin merupakan penyelesaian yang paling berkesan untuk masalah ini. Hasilnya, tujuan kajian ini adalah untuk mencari penyelesaian kepada masalah tersebut dengan menggunakan tenaga suria yang boleh diperbaharui berbanding tenaga yang diperoleh daripada bahan api fosil. Sebagai sebahagian daripada projek ini, bot berkuasa solar akan direka bentuk dan dibina dari bawah. Bot itu akan dipandu oleh motor elektrik yang dibekalkan oleh panel fotovoltaik (PV), dan ia akan mengubah tenaga suria kepada tenaga elektrik. Di atas kapal, panel fotovoltaik perlu dipasang dan dipasang dengan cara yang tidak menjejaskan kualiti tunggangan. Ini adalah cara yang menyeronokkan dan murah untuk mengembara merentasi jarak yang lebih pendek, dan ia juga berfungsi sebagai satu bentuk pengangkutan. Reka bentuk yang dicadangkan untuk bot kuasa solar akan termasuk panel fotovoltaik, yang akan bertindak sebagai pengumpul cahaya matahari dan juga sebagai penjana kuasa. Panel ini akan ditambah dengan bateri, yang akan berfungsi sebagai simpanan untuk kuasa bot, dan motor arus terus (DC), yang akan menggantikan enjin petrol tradisional bot. Sebuah perahu elektrik berkuasa solar boleh dibina menggunakan teknologi ini dengan menggabungkan panel solar, bateri boleh dicas semula dan motor elektrik. Tenaga suria dikumpul oleh pengumpul suria yang disambungkan kepada bateri boleh dicas semula. Tenaga suria ini kemudiannya ditukar kepada kuasa elektrik dan dihantar ke bateri supaya ia boleh dicas semula. Motor elektrik menerima bekalan kuasa elektrik daripada bateri yang boleh dicas semula, yang disambungkan ke motor. Pengawal pengecas suria yang beroperasi akan bertanggungjawab mengawal proses pengecasan. Proses menukar cahaya matahari kepada tenaga akan memulakan keseluruhan sistem. Tenaga ini kemudiannya akan dipindahkan ke bateri. Selepas itu, beban pacuan motor dc yang tidak berfungsi akan beroperasi semula. Proses mengecas dan menjalankan beban akan berlaku pada masa yang sama. Di samping itu, jumlah kuasa yang digunakan oleh enjin elektrik bot solar akan terhad dan dipelihara berkat reka bentuk kapal ini. Di samping itu, nilai tenaga suria akan dimaksimumkan dalam kehidupan seharian tanpa dibazirkan, dan sistem seterusnya akan diperluaskan untuk digunakan dalam tetapan komersial. Melalui penggunaan teknologi tenaga solar ini, manusia dapat mengurangkan penggunaan petrol. Selain itu, taktik ini mengurangkan jumlah pelepasan karbon dioksida yang dihasilkan oleh enjin petrol. Kesimpulannya, panel fotovoltaik akan digunakan untuk menukar cahaya matahari kepada tenaga elektrik yang akan digunakan untuk menggerakkan bot elektrik berkuasa solar.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

MRE	-	Marine Renewable Energy
PV	-	Photovoltaic
MPPT	-	Maximum Power Point Tracking
DC	-	Direct Current
AC	-	Alternating Current
MATLAB	-	Matrix Laboratory
SCC	-	Solar Charger Controller
MI	-	Micro Inverter
Li-ion	-	Lithium Ion
Ni-Cd	-	Nickel-Cadmium
DWL	-	Design Waterline
LOA	-	Length Overall
BOA	-	Beam Overall
HP	-	Horse Power
EP	-	Electric Propulsion
kW	-	Kilo Watt
Vdc	-	Voltage Direct Current
Ah	-	Ampere Hour
PTC	-	PVUSA Test Conditions
STC	-	Standard Test Conditions

PVUSA	-	Photovoltaics for Utility Scale Applications
kWh	-	Kilo Watt Hour
rad/s	-	Radians per Second
rpm	-	Rotations per Minute
Nm	-	Newton meter
W	-	Watt
	-	

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

A fishing vessel, commonly, is a boat or a ship that are used to catch fish either in the sea, river, and lake. The fishing activities may involve saltwater and freshwater fishing. A traditional fishing vessel usually incorporated with marine engine and propulsion system. These marine engine and propulsion system include outboard engines, inboard engines, sterndrive, and jet propulsion. What this traditional fishing vessels have in common is that all this fishing vessels engines are powered by diesel. These powered diesel engines are great for any fishing vessels since these engines have been around for so long, they are able to withstand the rigorous circumstances of commercial fishing. But diesel fuel will not last long, so an alternative such as integrating ships or boats to fully electric or even hybrid has come to light.

Eco Marine Power, a Japanese firm that designs and manufactures wind and solar energy systems, is a good example of integrating electric power to either boats or ships (Carbery, D. 2019). One of their many projects included is the Aquarius Eco Ship with Aquarius Marine Renewable Energy (MRE). The Aquarius MRE is a hybrid power supply for ships that utilizes both wind and solar energy. This cutting-edge wind and solar system offer a solution to the problem of ships having to work around the limitations imposed by rigid sails and rigid solar panels. Any ship that is fitted with Aquarius MRE will have the capability to harvest energy from the sun and water. This comprises vessels that transport

passengers and cruise passengers as well as bulk cargo, survey vessels, and oil tankers (Atkinson, G. 2016).

Figure 1. 1 The first system with a rigid sail and solar power used in 2018. (Safety4Sea, 2017)

Nowadays, it is not feasible to put a stop to the development of new technologies regarding boat engines. The marine sector, which is akin to the automotive industry in many areas, is devoting a substantial amount of attention to the implementation of electric power and propulsion systems in boats. The idea of "becoming electric," which is a prominent trend in many other industries now, is now being examined by several firms in the boating industry. In other words, electric boats are becoming increasingly popular. Leonard I. Sweet once says "The future is not something we enter. The future is something we create.".

1.2 Problem Statement

In accordance with fuel source keep depleting, affecting millions, changing to fully electric powered boat have been one of the best alternatives. In addition, the consumption rate keeps on rising except in the year 2020 as Covid-19 pandemic strike affecting worldwide economy but the rise in demand never falls behind as it keeps on rising. Based on the graph shown in Figure 1.2, total consumption is rising even after the pandemic hit the world and in Figure 1.3 shown that the oil reserves will be estimated to last until 2051.

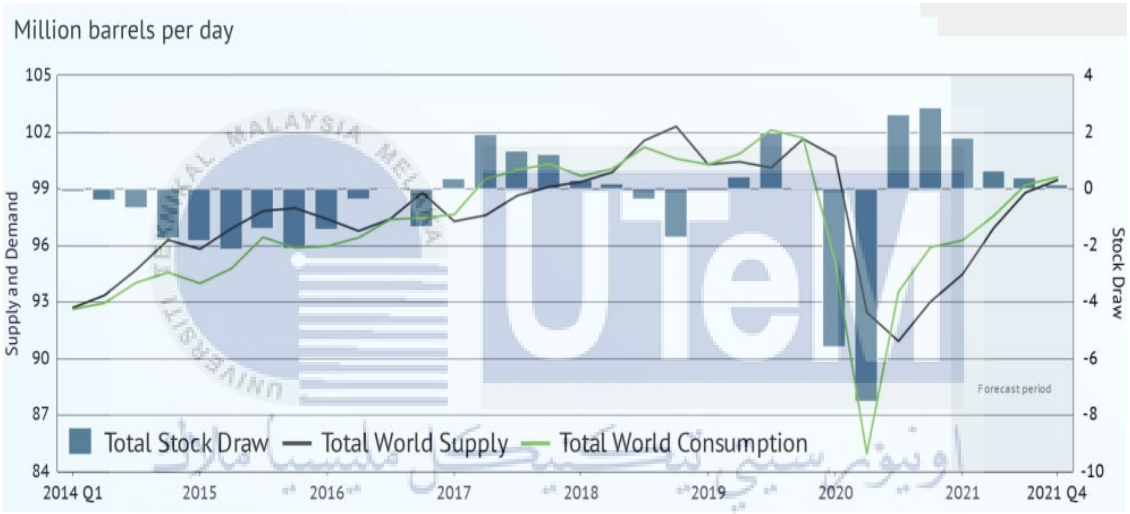

Figure 1. 2 World crude oil supply and demand forecast graph (U.S. Energy Information Administration, 2022).

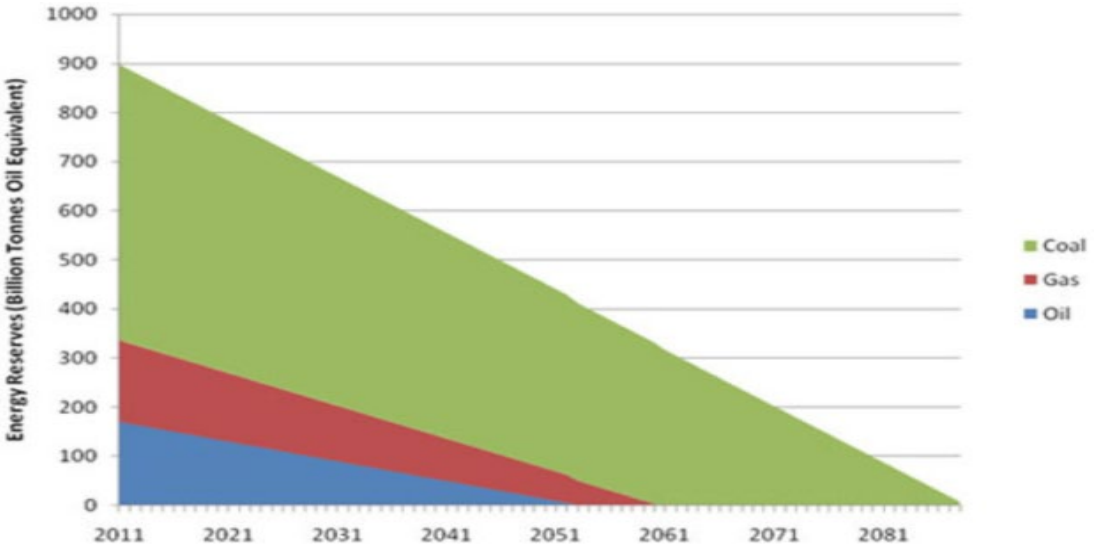

Figure 1. 3 Oil reserves estimation chart (Kuo, G., 2021).

An alternative method implementation is necessary as it can help to avoid fishing activities rendered inactive and relying on renewable energy like solar energy are one of those alternatives.

1.3 Research Objective

The main aim of this research is to evaluate electric boat with inboard engine for fishing vessels. Specifically, the objectives are as follows:

a) To design a photovoltaic (PV) system for fishing boat with inboard engine using computer simulation software.

b) To determine the size of PV system with minimum cost using computer simulation software.