

DESIGN AND DEVELOPMENT OF WAVE ENERGY  
CONVERTER DEVICE IN COASTAL AREA

MUHAMMAD TAUFIQ BIN A. RAHMAN

FACULTY OF MARITIME STUDIES AND SCIENCE MARINE  
UNIVERSITY MALAYSIA TERENGGANU

2013

1100087873

Perpustakaan Sultanah Nur Zahirah  
Universiti Malaysia Terengganu (UMT)



bpd

LP 47 FMSM 1 2013



1100087873

Design and development of wave energy converter device in  
coastal area / Muhammad Taufiq A. Rahman.

PERPUSTAKAAN SULTANAH NUR ZAHIRAH  
UNIVERSITI MALAYSIA TERENGGANU (UMT)  
21000 KUALA TERENGGANU

1100087873

1100087873		

Lihat sebelah

**HAK MILIK**  
PERPUSTAKAAN SULTANAH NUR ZAHIRAH UMT

**DESIGN AND DEVELOPMENT OF WAVE ENERGY CONVERTER DEVICE IN  
COASTAL AREA**

**BY  
MUHAMMAD TAUFIQ BIN A.RAHMAN**

**A thesis submitted in partial fulfillment of  
the requirement for the award of the degree of  
Bachelor of Applied Science (Maritime Technology)**

**DEPARTMENT OF MARITIME TECHNOLOGY  
FACULTY OF MARITIME STUDIES AND MARINE SCIENCE  
UNIVERSITI MALAYSIA TERENGGANU**

**2013**



DEPARTMENT OF MARITIME TECHNOLOGY  
 FACULTY OF MARITIME STUDIES AND MARINE SCIENCE  
 UNIVERSITI MALAYSIA TERENGGANU

**DECLARATION AND VERIFICATION REPORT  
 FINAL YEAR RESEARCH PROJECT**

It is hereby declared and verified that this research report entitled:

**Design and Development of Wave Energy Converter Device in Coastal Area by Muhammad Taufiq Bin A.Rahman, Matric No. UK 20423** have been examined and all errors identified have been corrected. This report is submitted to the Department of Maritime Technology as partial fulfillment towards obtaining the **Bachelor Degree of Applied Science (Maritime Technology)**, Faculty of Maritime Studies and Marine Science, Universiti Malaysia Terengganu.

Verified by:

Main Supervisor

14/1/13

Name: **En. Mohd Azlan bin Musa**

**MOHD AZLAN BIN MUSA**  
 PENSYARAH  
 JABATAN TEKNOLOGI MARITIM  
 FAKULTI PENGAJIAN MARITIM DAN SAINS MARIN  
 UNIVERSITI MALAYSIA TERENGGANU  
 21030 KUALA TERENGGANU

Official stamp:

Co-Supervisor

14/1/13

Name: **Assoc. Prof. Dr. Mohamad Fadhli bin Ahmad**

Official stamp:

**ASSOC. PROF. DR. MOHAMMAD FADHLI AHMAD**  
 HEAD  
 DEPARTMENT OF MARITIME TECHNOLOGY  
 FACULTY OF MARITIME STUDIES AND MARINE SCIENCE  
 UNIVERSITI MALAYSIA TERENGGANU (UMT)  
 21030 KUALA TERENGGANU

Head Department of Maritime Technology


Name: **Assoc. Prof. Dr. Mohamad Fadhli bin Ahmad**

Official stamp:

**ASSOC. PROF. DR. MOHAMMAD FADHLI AHMAD**  
 HEAD  
 DEPARTMENT OF MARITIME TECHNOLOGY  
 FACULTY OF MARITIME STUDIES AND MARINE SCIENCE  
 UNIVERSITI MALAYSIA TERENGGANU (UMT)  
 21030 KUALA TERENGGANU

## DECLARATION

I hereby declare that this thesis entitled “Design and Development of Wave Energy Converter Device in Coastal Area” is the result of my own research except as cited in the references.

**Signature** : .....  
  
**Name** : **Muhammad Taufiq Bin A. Rahman**  
**Matrix No.** : **UK 20423**  
**Date** : 13 January 2013

## **ACKNOWLEDGEMENTS**

First of all I would like to express my deepest appreciation and sincere thanks to my research supervisor, En Mohd Azlan bin Musa and co-supervisor, Dr Mohamad Fadhli Bin Ahmad who had gave a lot help in my research project.

Secondly, I am grateful to post-graduate student, Mr. Mohd Afiq bin Zakaria for his help and advice on my project which regarding to electrical system. In addition, I would like to give my appreciation to Maritime Technology Department staff, which giving the permission to use their laboratory and facilities.

Thirdly, my appreciation goes to my entire classmate, especially Noor Muhammad Fareez Bin Fauzi, Zakwan Bin Deraman, Sabri Bin Daud and Muhammad Syafiq Izwan Bin Kamarudin for assisting me during the experiment.

Finally, I would like to thank my beloved family for supporting me in the way of emotion, financial and encourage all my effort during this research. Not forgetting to those who have contributed and giving a hand in this project.

## **DESIGN AND DEVELOPMENT OF WAVE ENERGY CONVERTER DEVICE IN COASTAL AREA**

### **ABSTRACT**

This study is about applying the wave energy converter device on the breakwater in which the nature of the wave in this area either wave speed or wave height is particularly suitable for wave energy renewal. The use of the concept of oscillating water column and wave overtopping was improved to build a new device where this concept was combined into a single device. The amount of energy produced is calculated by using mathematical modeling. Then, to validate the result, the model of new wave energy converter was constructed and tested in Terengganu coastal area. The results indicate that the power can be optimized by using the suitable turbine ratio where the ratio must be suitable for the turbine purpose where for the chamber 1 which used hydro turbine, the suitable ratio is 0.2 meanwhile 0.8 is suitable for chamber 2 which used wind turbine. Combinations of two different methods in capturing wave energy into a single device also increase the turbine power output and have beneficially for application to the breakwater.

# **REKABENTUK DAN PEMBINAAN PERANTI PENUKAR TENAGA OMBAK DI PESISIRAN PANTAI**

## **ABSTRAK**

Kajian ini mengenai mengaplikasikan peranti penukar tenaga ombak pada pemecah ombak dimana sifat ombak pada kawasan ini sama ada kelajuan ataupun ketinggian ombak sangat sesuai digunakan untuk pembaharuan tenaga. Penggunaan konsep oscillating water column dan overtopping wave dipertingkatkan untuk membina peranti yang baru dimana konsep ini digabungkan ke dalam satu peranti. Jumlah tenaga yang terhasil dikira dengan menggunakan mathematical modeling. Kemudian untuk mengesahkan keputusan ini, model ini dibina dan diuji di pesisir pantai Terengganu. Keputusan menunjukkan bahawa kuasa boleh dioptimumkan dengan menggunakan nisbah turbin sesuai di mana nisbah mestilah sesuai untuk kegunaan turbin dimana untuk turbin pada ruang pertama yang menggunakan konsep hidro turbin, ratio turbin yang sesuai adalah 0.2 manakala 0.8 adalah sesuai digunakan pada ruang yang kedua yang menggunakan turbin angin. Gabungan dua kaedah memerangkap tenaga ombak yang berbeza ke dalam satu peranti tunggal juga dapat meningkat keluaran kuasa oleh turbin serta mempunyai faedah sekiranya diaplikasikan kepada pemecah ombak.