

PILOT STUDY AND COMPARISON OF GREEN
HOUSE GASES EMISSION AND QUANTIFICATION
METHOD FROM MARINE VESSELS

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**PILOT STUDY AND COMPARISON OF GREEN HOUSE GASES EMISSION AND
QUANTIFICATION METHOD FROM MARINE VESSELS**

BY

NURUL AKMAR IZZATI BINTI DZULKIFLI

**A thesis Submitted in Partial Fulfillment of the Requirements for the Award of
Degree of Bachelor of Applied Science (Maritime Technology)**

**Department of Maritime Technology
FACULTY OF MARINE SCIENCE AND MARITIME STUDY
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: **PILOT STUDY AND COMPARISON OF GREEN HOUSE GASES EMISSION AND QUANTIFICATION METHOD FROM MARINE VESSELS** by **NURUL AKMAR IZZATI BINTI DZULKIFLI**, Matric No. **UK 21476** 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.

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DECLARATION

I hereby declare that this thesis entitled **PILOT STUDY AND COMPARISON OF GREEN HOUSE GASES EMISSION AND QUANTIFICATION METHOD FROM MARINE VESSELS** is the result of my own research except as cited in the references.

Signature : 

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ABSTRACT

Air pollution is the on demand case as it has been debated all over the world. The sources of air pollution are varies starting from the individual pollutants to the huge industrial activities. Maritime industry responsible in this issue since there are many types of maritime transports sailing at the sea. The Green House Gas (GHG) emissions from maritime transport must be reduced because it is expected to increase if no mitigations are taken. This study investigate the emission of GHG of two different maritime transports system which are the Discovery II, a boat belongs to University Malaysia of Terengganu and the oil tanker. The different methods are used to determine the amount of GHG emissions for both maritime transports. The pilot study was conducted to determine the types and the concentration of gases emitted from the boat (Discovery II) exhaust by using the Gas detector IQ-1000. Based on the pilot study, two types of gases are successfully detected by the equipment which is Carbon Dioxide (CO₂) and Nitrogen Dioxide (NO₂). Based on the result, the highest amount of CO₂ concentration and NO₂ concentration emitted from Discovery II are 2000 ppm and 20 ppm respectively. For the oil tanker, the GHG emission (CO₂, CH₄, and N₂O) is calculated based on Marine Emission Inventory Tool (MEIT) emission estimation formula. From the result, the emission of CO₂ is the highest which are 504.7 tonne for voyage 1, 403.9 tonne for voyage 2 and 355 tonne for voyage 3. The Energy Efficiency Operational Indicator (EEOI) and Energy Efficiency Design Index (EEDI) for this oil tanker are calculated and the result between emission estimation and Energy Efficiency Design Index (EEDI) is discussed. The EEDI and EEOI of three different oil tankers (MATTHEOUS I, NAVIG8 STEALTH, and ATHINEA) are also calculated. The EEDI between the oil tankers is then compared. From the result, the EEDI for MATTHEOUS I is the highest which is 6.651 gram CO₂ per tonne nautical mile. This study also discussed the using of Energy Efficiency Design Index (EEDI), Energy Efficiency Operational Indicator (EEOI) and Ship Energy Efficiency Management Plan (SEEMP) that are applied to shipping to control GHG emissions.

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ABSTRAK

Pencemaran udara adalah kes yang paling utama di mana ia sering didebatkan di seluruh dunia. Punca pencemaran udara adalah pelbagai bermula dari bahan pencemaran individu sehinggalah ke aktiviti industri yang luas. Industri maritim bertanggungjawab ke atas isu ini memandangkan pelbagai jenis pengangkutan maritim yang belayar di lautan. Pelepasan gas rumah hijau daripada pengangkutan maritim haruslah dibendung kerana ia diramalkan meningkat jika tiada tindakan diambil. Kajian ini membantu untuk menyiasat pelepasan gas oleh dua pengangkutan maritim yang berbeza iaitu Discovery II, bot milik Universiti Malaysia Terengganu (UMT) dan kapal tangki. Langkah yang berbeza digunakan untuk mengenalpasti jumlah pelepasan gas dari kedua-duanya. Pilot study telah dijalankan untuk mengenalpasti jenis dan konsentrasi gas yang dilepaskan dari ekzos Discovery II menggunakan Gas Detector IQ-1000. Berdasarkan pilot study, dua jenis gas telah berjaya dikesan oleh alat tersebut iaitu Karbon Dioksida (CO₂) dan Nitrogen Dioksida (NO₂). Berdasarkan keputusan, jumlah konsentrasi Karbon Dioksida dan Nitrogen Dioksida yang tertinggi masing-masing mencatatkan 2000 ppm dan 20 ppm. Bagi kapal tangki, pelepasan gas rumah hijau (CO₂, CH₄, and N₂O) dikira berdasarkan formula anggaran pelepasan Marine Emission Inventory Tool (MEIT). Keputusan menunjukkan pelepasan CO₂ adalah yang tertinggi iaitu 504.7 ton untuk pelayaran 1, 403.9 ton untuk pelayaran 2 dan 355 ton untuk pelayaran 3. Energy Efficiency Operational Indicator (EEOI) dan Energy Efficiency Design Index (EEDI) bagi kapal tangki ini turut dikira dan keputusan antara anggaran pelepasan dan EEDI dibincangkan. EEDI dan EEOI bagi tiga kapal tangki yang berbeza (MATTHEOUS I, NAVIG8 STEALTH, and ATHINEA) juga dikira. EEDI antara ketiga-tiga kapal tangki dibandingkan. Keputusan menunjukkan MATTHEOUS I mencatatkan EEDI yang tertinggi iaitu 6.651 gram CO₂ per batu nautika. Kajian ini turut membincangkan penggunaan Energy Efficiency Design Index (EEDI), Energy Efficiency Operational Indicator (EEOI) dan Ship Energy Efficiency Management Plan (SEEMP) yang diaplikasikan pada perkapalan bagi mengurangkan pelepasan gas rumah hijau.