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TECHNO-ECONOMIC AND SENSITIVITY ANALYSIS FOR HYBRID PV-GRID CONNECTED ELECTRIC BOAT CHARGING STATION IN KUALA TERENGGANU

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Thesis Submitted in Fulfillment of the Requirement
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DEDICATION

"Appreciation can make a day – even change a life. Your willingness to put it into words is all that is necessary…"

I dedicate this Master dissertation to my beloved father, Salleh bin Mat Nor and my mother, Putri Yatimah binti Megat Yahya. To my motherly supervisor who is giving me this opportunity to gain my knowledge, Dr Wan Mariam binti Wan Muda. I extend the dedication to my siblings, lecturers and friends for their endless support in each and every of my endeavors.

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfillment of the requirement for the degree of Master of Science

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Co- Supervisor : Siti Salina binti Abdullah, Ph.D.

Faculty : School of Ocean Engineering

To encourage the use of green technology in the transportation sector and reducing the reliance on subsidy given by the government in fisheries sector, this study is aimed to evaluate the feasibility of developing grid-connected renewable energy (RE) electric boat charging stations for the fishermen in Terengganu using a simulation-based method. To achieve the objectives of this research, five-years data of solar radiation and wind speed were collected at Universiti Sultan Zainal Abidin's weather station. Then, information regarding fishing activities and the amount of subsidy spent by the government were obtained from interview sessions with fishermen which were validated by Lembaga Kemajuan Ikan Malaysia. After data collection, a simulation was done using the Hybrid Optimization Model for Electric Renewable (HOMER) software. The performance of the proposed system is compared to the existing system in terms of net present cost (NPC), operational cost, electricity production and consumption, emission of greenhouse gasses and payback period. A sensitivity analysis was also done to find the minimal Feed-in Tariff (FiT) rate which can be implemented in order to encourage the usage of the RE system in this sector. Then, the relationship between FiT and NPC

together with payback period and emission of pollutants were analyzed. The final step was developing an algorithm of control strategy to minimize the excess power and maximize the power sold to the grid obtained from HOMER. There are four modes of operation assigned and the system was simulated in Matrix Laboratory (MATLAB)/Simulink. From the HOMER simulation results, it is found that at FiT rates RM 0.86/kWh, hybrid grid-photovoltaic system manages to achieve its optimal in generating high income from selling the power to the grid with convincing amount of electricity production and short payback period. From MATLAB/Simulink results, it can be observed that 2899.79 kW of excess power managed to be reduced from 3349.79 kW in HOMER and the grid sell increased to 14560.92 kW from 10801.96 kW. It is concluded, with an appropriate value of FiT, the grid-connected RE system can be developed in selected areas due to its performance which shows a better outcome compared to the grid-only system.