WIND ENERGY ASSESSMENT FOR SELECTED SITES IN MALAYSIA AND THE PROPOSED FEED-IN-TARIFF RATES

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DEDICATION

I dedicate this Master dissertation to my parents in Sandakan, Sabah. I extend the dedication to my siblings, my relatives, friends and well-wishers for their endless support in each and every one of my endeavours.

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Wind energy is still not recognized as eligible energy resource in Malaysian Renewable Energy Act 2011. There are only four technologies applicable for Feed-in-Tariff (FiT) which are biomass, biogas, solar and small hydro. Thus, there is no Feed-in-Tariff (FiT) for the wind projects in Malaysia. This thesis presents the identification of Feed-in-Tariff (FiT) based on the Annual Energy Production (AEP) at every selected site: Kuala Terengganu, Mersing, Kudat and Langkawi Island. WindPRO and WAsP software are used for the energy simulation. The wind data are obtained from the Malaysian Meteorological Department (MMD) stations. The Pitch 22 kW wind turbine was selected for energy simulation due to its best capacity factor compared to the other type of wind turbines. Forty six different installed capacity wind farm in range 22 kW till 1.012 MW were simulated based on the 22 kW wind turbine, sites roughness condition and sites wind resources. The Feed-in-Tariff (FiT) is identified by Net Present Value (NPV) analysis, Payback Period (PBP) analysis and degression rate analysis. The result found that the proposed FiT rates are based on the value of NPV is 98.6% from the investment cost with payback period is 10 years. The best degression rate is 5% for every year.

Tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk Ijazah Sarjana Sains

KAJIAN POTENSI TENAGA ANGIN UNTUK KAWASAN TERPILIH DI MALAYSIA DAN CADANGAN KADAR TARIF GALAKAN

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Pusat Pengajian : **Kejuruteraan Kelautan**

Tenaga angin masih lagi belum diterima sebagai sumber tenaga layak didalam Akta Tenaga Keterbaharuan 2011 Malaysia. Hanya empat sahaja teknologi yang telah mengaplikasikan skim tarif galakan (FiT), ia termasuklah sumber biojisim, biogas, solar dan hidro berskala kecil. Oleh sebab itu, tiada tarif galakan (FiT) untuk projek tenaga angin di Malaysia. Tesis ini membentangkan mengenai pengenalpastian tarif galakan (FiT) berdasarkan Pengeluaran Tenaga Tahunan (AEP) untuk setiap kawasan terpilih; Kuala Terengganu, Mersing, Kudat dan Pulau Langkawi. Perisian WindPRO dan WAsP digunakan untuk simulasi tenaga. Data angin diperolehi daripada stesen-stesen Jabatan Meteorologi Malaysia. Turbin angin Pitch 22 kW dipilih untuk simulasi tenaga kerana nilai faktor kapasiti adalah yang terbaik berbanding dengan jenis turbin angin yang lain. Empat puluh enam loji turbin angin dengan julat antara 22 kW hingga 1.012 MW telah diproses dan disimulasi menggunakan turbin angin 22 kW, keadaan kekasaran kawasan dan kualiti sumber angin dikawasan tersebut. Tarif galakan (FiT) dikenalpasti menggunakan analisis Nilai Kini Bersih (NPV), analisis Tempoh Bayar Balik (PBP) dan analisis kadar pengurangan FiT. Hasil kajian menunjukkan cadangan kadar tarif galakan adalah berdasarkan nilai NPV adalah 98.6% daripada kos pelaburan dengan tempoh bayar balik adalah 10 tahun. Nilai kadar penurunan terbaik adalah 5% untuk setiap tahun.