

**THE DETERMINANTS OF RENEWABLE
ENERGY CONSUMPTION AND THE
DYNAMIC RELATIONSHIPS AMONG
RENEWABLE ENERGY, ECONOMIC GROWTH
AND ENVIRONMENTAL QUALITY IN ASEAN-4
COUNTRIES**

HASNISAH BINTI AZILAH

**DOCTOR OF PHILOSOPHY
UNIVERSITI MALAYSIA TERENGGANU**

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HASNISAH BINTI AZILAH

**Thesis Submitted in Fulfilment of the Requirements for the Degree of Doctor of
Philosophy in the Faculty of Business, Economics and Social Development
Universiti Malaysia Terengganu**

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DEDICATION

Dear Mak and Ayah,

I could never have done this without your faith, support, and constant encouragement. Thank you for everything.

With special gratitude to Amin Ruslan, the best husband I can imagine.

You have been a gift from the beginning.

And, to Siti, Amang and Amek, each of whom has a special place in my heart.

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfilment of the requirements for the degree of Doctor of Philosophy

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Main Supervisor : Associate Professor Azlina Abd. Aziz, Ph.D.

Co-Supervisor : Che Mohd Imran Che Taib, Ph.D.

**Faculty : Faculty of Business, Economics and Social
Development**

Economic growth highly depends on energy from conventional sources which is, unfortunately among the major factors that triggers environmental pollution. Energy demand is continuously increasing and eventually may lead to the depletion of resources. Renewable energy is an alternative to accommodate the current demand and it is more environmentally friendly. This analyzes the extent to which determinants can affect the use of renewable electricity consumption in Malaysia from 1980 until 2014 using Johansen-Juselius co-integration approach. The empirical findings reveal that GDP per capita and trade openness encourage renewable electricity consumption; carbon dioxide (CO₂) emissions, electricity consumption from fossil fuels and oil prices have negative implications on renewable electricity consumption. Next, this study examines the existence of environmental Kuznets curve (EKC) hypothesis by incorporating hydroelectricity consumption and trade openness in Malaysia from 1980 until 2014 via autoregressive distributed lag bounds testing. GDP was found to be positively significant in explaining CO₂ emissions in the long- and short-run but the EKC hypothesis cannot be confirmed. The long-run estimates show that hydroelectricity is insignificant on CO₂ emissions while trade openness has positive impact on the environmental quality. Furthermore, hydroelectricity and trade openness are positively significant on CO₂ emissions in the short-run. Finally, this study investigates the short- and long-run dynamic causality relationship between renewable

electricity consumption, economic growth and environmental quality in ASEAN-4 countries over 35-year period using panel co-integration and Granger causality. The empirical evidence exhibits unidirectional causality running from renewable electricity consumption to CO₂ emissions, GDP per capita, renewable electricity and real exports to real imports in the short-run. Additionally, a unidirectional causality from emissions, income, conventional energy used, real exports and imports to renewable electricity used in the long-run also exists. In conclusion, there are various determinants affecting renewable electricity consumption in different ways, and hydroelectricity consumption is insufficient to reduce pollution in Malaysia. Moreover, the conservation hypothesis is supported in ASEAN-4 countries. In this case, government needs to improve energy efficiency and develop suitable policies related to renewable energy to mitigate climate change.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

FAKTOR-FAKTOR PENGGUNAAN TENAGA BOLEH BAHARU DAN HUBUNGAN DINAMIK ANTARA TENAGA BOLEH BAHARU, PERTUMBUHAN EKONOMI, DAN KUALITI ALAM SEKITAR DI NEGARA-NEGARA ASEAN-4

HASNISAH BINTI AZILAH

2021

Penyelia Utama : Profesor Madya Azlina Abd. Aziz, Ph.D.

Penyelia Bersama : Che Mohd Imran Che Taib, Ph.D.

Fakulti : Fakulti Perniagaan, Ekonomi dan Pembangunan Sosial

Pertumbuhan ekonomi sangat bergantung terhadap tenaga dari sumber konvensional, juga merupakan antara faktor utama yang mencetuskan pencemaran alam sekitar. Permintaan tenaga terus meningkat dan akhirnya boleh menyebabkan berlakunya kekurangan sumber tersebut. Tenaga boleh baharu adalah alternatif untuk menampung permintaan semasa dan lebih mesra alam. Analisis ini adalah sejauh mana faktor-faktor mempengaruhi penggunaan elektrik boleh baharu di Malaysia dari tahun 1980 hingga 2014 menggunakan kaedah kointegrasi Johansen-Juselius. Penemuan empirikal menunjukkan bahawa KDNK per kapita dan keterbukaan perdagangan mendorong penggunaan elektrik boleh baharu; pelepasan karbon dioksida (CO₂), penggunaan elektrik dari bahan bakar fosil dan harga minyak mempunyai implikasi negatif terhadap penggunaan elektrik boleh baharu. Seterusnya, kajian ini meneliti kewujudan hipotesis keluk alam sekitar Kuznets (EKC) dengan merangkumi penggunaan hidroelektrik dan keterbukaan perdagangan di Malaysia dari tahun 1980 hingga 2014 melalui ujian sempadan autoregressive distributed lag. KDNK per kapita didapati signifikan positif dalam menjelaskan pelepasan CO₂ dalam jangka panjang dan jangka pendek namun hipotesis EKC tidak dapat disahkan. Anggaran jangka panjang menunjukkan bahawa hidroelektrik tidak signifikan terhadap pelepasan CO₂

sementara keterbukaan perdagangan mempunyai kesan positif terhadap kualiti alam sekitar. Tambahan pula, hidroelektrik dan keterbukaan perdagangan secara signifikan terhadap pelepasan CO₂ dalam jangka pendek. Kemudian, kajian ini menyelidiki hubungan sebab-akibat dinamik jangka pendek dan jangka panjang antara penggunaan elektrik boleh baharu, pertumbuhan ekonomi dan kualiti alam sekitar di negara-negara ASEAN-4 selama 35 tahun menggunakan penyatuan bersama panel dan penyebab Granger. Penemuan empirikal menunjukkan penggunaan elektrik boleh baharu mendorong pelepasan CO₂, KDNK per kapita, elektrik boleh baharu dan eksport sebenar ke import sebenar dalam jangka masa pendek. Di samping itu, hubungan satu hala dari pelepasan, pendapatan, tenaga konvensional yang digunakan, eksport dan import sebenar kepada elektrik boleh baharu yang digunakan dalam jangka masa panjang. Kesimpulannya, terdapat pelbagai faktor yang mempengaruhi penggunaan elektrik boleh baharu dengan cara yang berbeza, dan penggunaan hidroelektrik tidak mencukupi untuk mengurangkan pencemaran di Malaysia. Tambahan lagi, hipotesis pemuliharaan disokong di negara-negara ASEAN-4. Oleh itu, kerajaan perlu meningkatkan kecekapan tenaga dan merangka dasar yang sesuai berkait dengan tenaga boleh baharu bagi mengurangkan fenomena perubahan iklim.