

**ANALYSIS ON THE RELATIONSHIP BETWEEN SECTORAL ELECTRICITY
CONSUMPTION, ECONOMIC PERFORMANCE AND
ELECTRICITY PRICE IN MALAYSIA**

By

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**Thesis Submitted to
Othman Yeop Abdullah Graduate School of Business,
Universiti Utara Malaysia,
In Partial Fulfillment of the Requirement for the Master of Economics**

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ABSTRACT

Electricity is one of the important sources of energy and is vital for the process of the country's economic growth. The issues of growing electricity consumption and heavy electricity subsidies have raised the attention of the government. However, the majority of the previous studies that specialize on the demand side of electricity were focused on total electricity consumption. Thus, this paper aims to provide the background analysis of electricity consumption trends with the focus on the four main economic sectors in Malaysia such as the industrial, commercial, mining and agricultural. The purposes were to examine the relationship between electricity consumption, Gross Domestic Product (GDP) and price of electricity based on panel data for the period 2002 to 2012. The sectoral electricity consumption model was tested using econometric techniques such as Panel Cointegration, Panel Fully Modified Ordinary Least Square (FMOLS) and Panel Granger Causality tests. The Panel Cointegration Test confirmed an existence of a stable long run relationship among the variables. The results from the panel FMOLS estimation revealed that the electricity consumption in industrial, commercial and mining sectors was positively responsive to GDP changes. In the agricultural sector, GDP had a negative effect on electricity consumption. Moreover, the higher electricity price tended to increase and decrease electricity consumption in the industrial sector and commercial sector respectively. Nonetheless, the results of the electricity price were not significant in the mining and agricultural sectors. For all the sectors, an increase in GDP had a positive effect on electricity consumption. Finally, the Panel Granger Causality Test detected a relationship running from economic growth to electricity consumption. The results obtained indicated that policy maker must be careful in the formulation of energy policy, thus suggesting that the policy should be focused on the electricity consumption in each sector.

ABSTRAK

Elektrik merupakan salah satu sumber tenaga yang penting dan memainkan peranan dalam proses pertumbuhan ekonomi negara. Isu-isu mengenai peningkatan jumlah penggunaan tenaga elektrik dan subsidi elektrik yang tinggi telah mendapat perhatian serius Kerajaan. Bagaimanapun, kebanyakan kajian terdahulu yang mengkhususkan pada sudut permintaan elektrik lebih terarah kepada penggunaan elektrik secara menyeluruh. Maka, kertas kajian ini akan memberi tumpuan kepada analisa corak penggunaan elektrik dengan fokus diberikan kepada empat sektor ekonomi utama di Malaysia iaitu perindustrian, komersial, perlombongan dan pertanian. Tujuannya adalah untuk mengkaji hubungan di antara penggunaan elektrik, Keluaran Dalam Negara Kasar (KDNK) dan harga elektrik berdasarkan pada data panel bagi tahun 2002 hingga 2012. Model penggunaan elektrik oleh sektor-sektor terbabit dijalankan menggunakan teknik-teknik ekonometrik seperti Panel Kointegrasi, Panel Pengubahsuaian Penuh Kaedah Kuasa Dua Terkecil (FMOLS) dan Panel Penyebab Granger. Hasil ujian Panel Kointegrasi mengesahkan bahawa terdapatnya hubungan jangka panjang antara pembolehubah-pembolehubah tersebut. Keputusan daripada Panel FMOLS menunjukkan bahawa penggunaan elektrik di sektor perindustrian, komersial dan perlombongan adalah responsif secara positif terhadap perubahan KDNK. Di sektor pertanian, KDNK memberi kesan negatif ke atas penggunaan elektrik. Selain itu, kenaikan harga elektrik cenderung untuk meningkatkan dan mengurangkan penggunaan elektrik masing-masing di sektor perindustrian dan komersial. Walau bagaimanapun, hasil keputusan tersebut adalah tidak signifikan ke atas sektor perlombongan dan pertanian. Untuk semua sektor pula, peningkatan KDNK memberi kesan positif ke atas penggunaan elektrik. Akhir sekali, ujian Panel Penyebab Granger mengesan terdapatnya hubungan daripada pertumbuhan ekonomi kepada penggunaan elektrik. Keputusan yang diperolehi ini menunjukkan bahawa pembuat dasar haruslah berhati-hati dalam menggubal dasar tenaga, sekaligus mencadangkan supaya dasar yang dibuat perlulah bersandarkan kepada penggunaan elektrik oleh setiap sektor.

ACKNOWLEDGEMENT

Glory to Allah S.W.T, the Most Gracious, the Most Merciful and peace upon His Messenger Holy Prophet Muhammad S.A.W. All the worship belongs to only Allah. I also give praise to Allah S.W.T for giving me strength, patience and knowledge to complete this program successfully.

First and foremost, I would like to express my deepest gratitude to my supervisors, Dr. Bakti Hasan Basri and Associate Professor Dr. Sallahudin Hassan for their time, constructive comments, valuable suggestions and continuous guidance. I equally thank them for their kindness and necessary encouragement. It would be impossible to complete this program without their assistance and supervision.

I am also grateful to my lectures at University Utara Malaysia who gave me a lot of knowledge, cultivated my interest in economics and thus led me to the field of academic research.

I would like to express my heartiest appreciation to my family especially my beloved wife Afifah Abd. Samad, my lovely son and daughter for their continuous support and encouragement during my difficult time to complete my postgraduate study in UUM. Special thanks to my father and my mother for their prayers, supports and encourage me during my master program. My thanks also go to my friends for their assistance and moral support.

Lastly, I sincerely would like to extend my gratitude to all the people involved either direct or indirectly for their kindness in helping me to complete this program. Thank you and may Allah bless all of you.

Mohd Hafiz Aswad bin Nadzri

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LIST OF ABBREVIATION

ADF	Augmented Dickey-Fuller
ASEAN	Association of South-East Asian Nations
Sen/kWh	Sen per kilowatts hour
CI	Capital Investment
CONS	Number of Consumers
CPI	Consumer Price Index
EC	Electricity Consumption
ECM	Error Correction Model
ECT	Error Correction Term
EMP	Employment
FMOLS	Fully Modified Ordinary Least Square
GDP	Gross Domestic Product
GW	Gigawatts
GWh	Gigawatts per hour
IEA	International Energy Agency
IPP	Independent Power Producer
kWh	kilowatts per hour
LLC	Levin, Lin and Chu
MIEEIP	Malaysian Industrial Energy Efficiency Improvement Project
MW	Megawatts
OLS	Ordinary Least Square
PE	Price of Electricity
RE	Renewable Energy
SEB	Sarawak Energy Berhad
SESB	Sabah Electricity Sdn Bhd

SUR	Seemingly Unrelated Regression
TNB	Tenaga Nasional Berhad
TWh	Terawatts per hour
UK	United Kingdom
US	United States

CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

Electricity is a man-made source of energy. As it is non-durable, electricity compliments durable goods like electrical appliances or electrical machinery (Rebensteiner, 2013). It helps directly by running consumer durables in terms of services and running machines which help directly or indirectly to produce consumer goods. Electricity is an exceptional energy because the consumption of electricity has to be simultaneous once it is been generated, thus electricity cannot be economically stored. Furthermore, electricity has a unique position among other different types of energy because electricity is clean energy, is easy to transfer and can be transformed into other kinds of energy. The demand of electricity varies hourly, daily, weekly and across the seasons (Ranci & Cervigni, 2013). It cannot be fully controlled and it is practically impossible to prevent market participants from consuming more or less electricity.

Electricity plays an important role in the process of economic growth and is required for both commercial and non-commercial usage. Commercial usage of electricity refers to the use of electric power in the industrial, commercial, mining and agricultural sectors. For non-commercial, the principal use of electricity energy is for public lighting and by residential consumer. Winkler, Simoes, Rovere, Rahman & Mwakasonda (2011) stated that electricity is a vital input together with machinery,

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