KOLOKIUM STATISTIK & SCIENTIFIC POSTER DOSM 2019

ENERGY MULTIPLIER IN MALAYSIA: AN INPUT - OUTPUT ANALYSIS

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INTRODUCTION

Energy

- Energy plays a critical role in facilitating development of a country.
- Energy will grows in line with the growing population and expanding economic sectors.
- Nation has transformed from relying on fossil fuels to energy mix with renewable energy sources and reflects the country's energy policies and strategies over the years to meet the national development goals.

- Energy landscape in Malaysia has gradually grown and evolved. During the last decade, Malaysia has seen almost 20% increases in energy generating capacity.
- Electricity generation in Malaysia is projected to grow further at an average annual rate of 4.7% (Energy Commission, 2016).
- It is crucial for Malaysia to maintain a balance in the fuel mix, while it is currently still heavily dependent on coal and natural gas.

- Malaysia's government is focusing on how to deliver clean and sustainable energy with cost-effective improvements in energy efficiency or the reduction in energy intensity.
- Lower energy intensity can promote energy conservation and help to deliver low-cost greenhouse gas abatement.
- Government introduced various initiatives eg. National Energy Policy, Fuel Policy in Malaysia Plans (2001-2010), new energy model in Malaysia Plan (2011-2020).

OBJECTIVES

1. To investigate which economy sector in Malaysia used energy intensively.

2. To measure the direct and indirect impact caused by the changes in demand on all economy sectors.

LITERATURE REVIEW

Rahman and Lee (2006)	Energy demands in Malaysia increasing expeditiously. Indicators of industrial energy intensity and ratio of energy cost input to industrial output are often used as a basis for policy decisions.
Sarbapriya (2011)	Energy intensity is an indicator to show how efficiently energy is used in the economy.
Priambodo and Kuma (2001)	Investigated energy use intensity in Indonesian industrial sectors for the year 1993. Food sector recorded the highest energy intensity while textile sector registered as lowest energy intensity.
Raa (2006)	Input-output analysis is used to measure the effect on changes in economy elements such as household consumption, government spending, gross fixed capital formation and exports to the model of that economy.
Bekhet and Yasmin (2014)	Applied input-output analysis to study the effect of the Malaysian government's incentive plans for economic renewal. They found that the decrease in exports led to a 13% decrease in GDP and a 16% reduction in energy consumption. Thus, the incentive plans led to the increases in economic growth (1.83%) and energy consumption (4.64%).

DATA DESCRIPTION

End use of energy data:

i. MySEEA PSUT Energy 2015
ii. MySEEA PSUT Energy 2010 (Limited Circulation)

Jabatan Perangkaan MALAYSIA

Data Sources :

Department of Statistics, Malaysia

Input-Output data:

i. Input-Output Tables 2015
ii. Input-Output Tables 2010

Note:
All data has been regroup according to Malaysia Standard Industrial Classification (MSIC) into five main sectors which are Agriculture, Mining, Manufacturing, Construction and Services sector.

ENERGY INTENSITY

- Measures how much of energy benefits the economy.
- Ratio of final energy use to gross domestic product (GDP) at constant price.
- Value will indicate how effectively an economy used their energy product (eg. natural gas, LNG, crude oil, coal, petrol etc.).
- **Low energy intensity indicate a lower price or cost of converting energy into GDP** and vice versa.

MULTIPLIER ANALYSIS

- Used to assess the impact of final demands growth on energy use.
- Measures interdependency across sectors in the economy.
- Examine the direct and indirect effect when the changes occur in final demand, households and exports components.

The basic multiplier model in input-output is written as follows:

$$X_t = (I-A)^{-1} * f_t \qquad (1)$$

Where:

- x - Vector of domestic product
- I - Identity Matrix
- A - Domestic input coefficient matrix
- f - Vector of final demand
- t - 2010, 2015

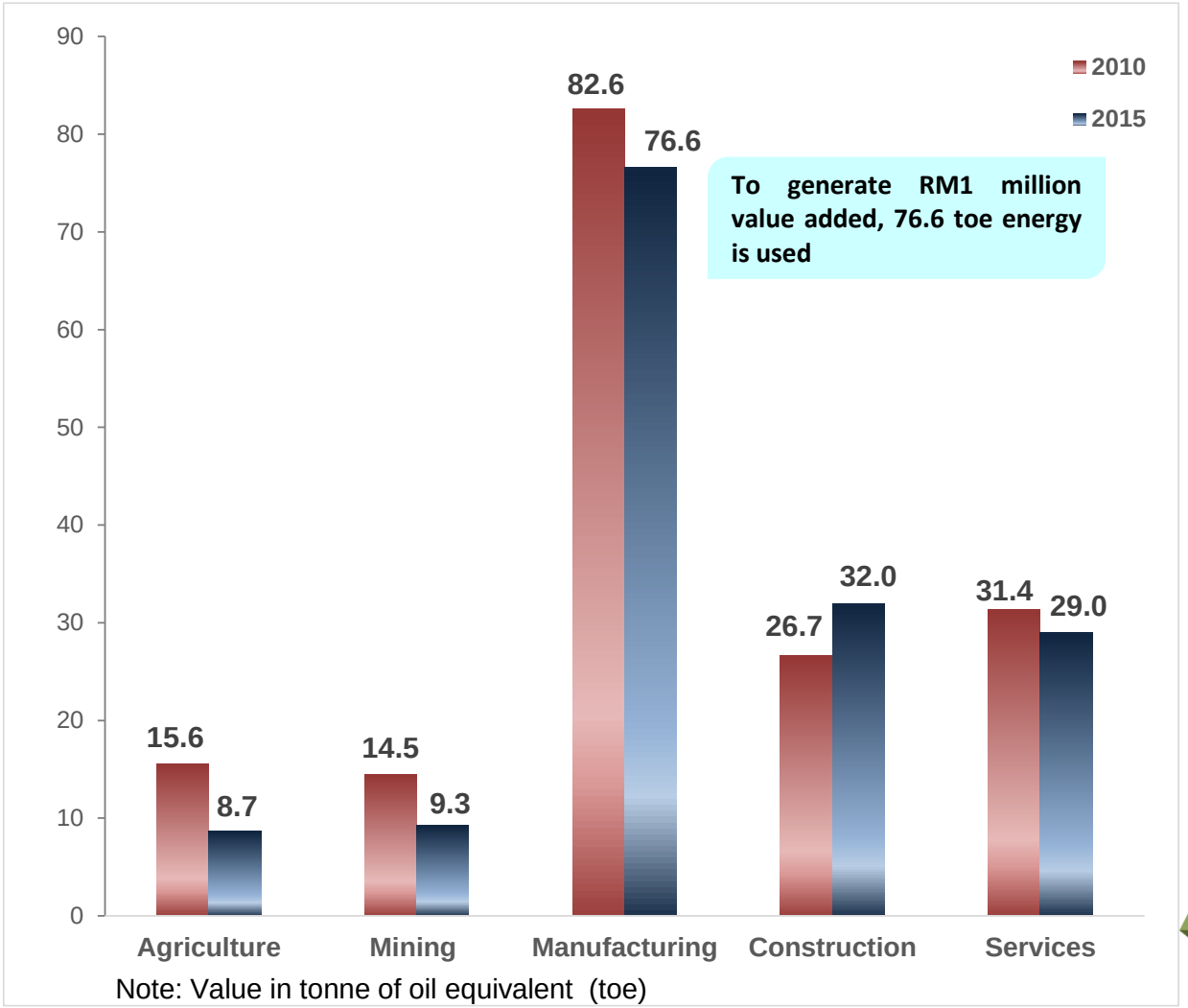
From equation (1), it is extended to estimate energy multiplier which model is written as follows:

$$E_t = (I-A)^{-1} * f_t * e_t \qquad (2)$$

Where:

- e - Vector of energy divided by total demand
- E - New energy use

Energy intensity by sectors for 2010 and 2015



Note: Value in tonne of oil equivalent (toe)

Energy intensity in all sectors except Construction decreased over the period.

This implies that Agriculture, Mining, Manufacturing and Services sectors were more energy efficient in 2015 as compared to 2010.

Manufacturing sector was the most intensive energy used in the Malaysia's economy at 76.6 tonne of oil equivalent (toe) per RM1 million production of value-added.

It can be said that producers are more efficiently producing finished products or they are using less energy due to shifting production towards finished products that requires less energy when there is a noticeable decrease in energy intensity of a sector.

MULTIPLIER EFFECT – Final Demand

10% Increased of Final Demand on Energy Consumption in five main Malaysia's economy sectors for 2010 & 2015

	Agriculture				Mining				Manufacturing				Construction				Services			
	2010		2015		2010		2015		2010		2015		2010		2015		2010		2015	
	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%
Agriculture	**41,113.3**	**3.2**	**36,929.7**	**4.5**	**337.6**	**0.0**	245.5	0.0	71,183.2	5.5	30,588.0	3.7	3,186.9	0.2	3,275.1	0.4	13,333.9	1.0	11,025.5	1.3
Mining	604.6	0.0	400.1	0.0	**52,868.6**	**4.1**	**41,946.6**	**4.7**	63,822.7	4.9	33,381.0	3.8	5,102.1	0.4	5,813.4	0.7	7,790.6	0.6	6,989.5	0.8
Manufacturing	63,046.0	0.1	83,187.3	0.1	30,885.8	0.0	40,652.2	0.0	**7,064,512.5**	**8.6**	**7,261,767.9**	**7.8**	301,445.4	0.4	658,379.5	0.7	771,995.7	0.9	1,297,013.0	1.4
Construction	337.0	0.0	199.5	0.0	342.6	0.0	559.2	0.0	5,142.5	0.7	4,685.9	0.3	**63,078.5**	**8.4**	**125,729.9**	**8.4**	6,319.8	0.8	18,300.5	1.2
Services	42,381.7	0.1	29,166.3	0.1	19,138.0	0.0	24,580.5	0.0	**826,669.9**	**1.8**	829,335.2	1.6	98,359.4	0.2	213,907.3	0.4	**3,680,326.2**	**7.9**	**4,077,733.4**	**7.9**
TOTAL	**147,482.6**		**149,882.9**		**103,572.7**		**107,984.0**		**8,031,330.8**		**8,159,758.1**		**471,172.1**		**1,007,105.0**		**4,479,766.3**		**5,411,061.9**	

Note : Direct effect

Value is in kilo tonne of oil equivalent (ktoe)

The increase on final demand in the **Manufacturing sector** will have the **highest impact** on energy consumption in 2015 and 2010. As for 2015, an increase of 10% on the final demand for the Manufacturing sector will **effect directly the increase of energy consumption in the sector by 7,261.8 ktoe** or 7.8%. Concurrently, it will also **indirectly effect the increase in energy consumption in the Mining sector (3.8%), Agriculture (3.7%), Services (1.6%) and Construction sector (0.3%)**.

Highest

Mining sector will have the **smallest impact** on energy consumption. In 2015, 10% growth of final demand in Mining sector will **effect directly the use of energy in the sector with an increase by 41.9 ktoe** (4.7%). Simultaneously, it also has an **indirect effect** to the rate of increase in energy consumption in **Manufacturing sector (40.7 ktoe), Services (24.6 ktoe), Construction (0.6 ktoe) and Agriculture sector (0.2 ktoe).**

Smallest

MULTIPLIER EFFECT – Household Consumptions

10% Increased of Household Consumption on Energy Use in five main Malaysia's economy sectors for 2010 & 2015

	Agriculture				Mining				Manufacturing				Construction				Services			
	2010		2015		2010		2015		2010		2015		2010		2015		2010		2015	
	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%
Agriculture	**22,218.0**	**1.7**	**26,632.7**	**3.2**	**1.2**	**0.0**	1.1	0.0	10,204.5	0.8	8,269.9	1.0	313.8	0.0	3.0	0.0	6,942.6	0.5	5,750.2	0.7
Mining	326.7	0.0	288.5	0.0	**194.1**	**0.0**	**180.5**	**0.0**	9,149.3	0.7	9,025.0	1.0	502.4	0.0	5.4	0.0	4,056.3	0.3	3,645.3	0.4
Manufacturing	34,070.6	0.0	59,992.5	0.1	113.4	0.0	174.9	0.0	**1,012,734.6**	**1.2**	**1,963,315.6**	**2.1**	29,680.3	0.0	609.1	0.0	401,955.1	0.5	676,443.5	0.7
Construction	182.1	0.0	143.9	0.0	1.3	0.0	2.4	0.0	737.2	0.1	1,266.9	0.1	**6,210.7**	**0.8**	**116.3**	**0.0**	3,290.6	0.4	9,544.4	0.6
Services	22,903.4	0.0	21,034.0	0.0	70.3	0.0	105.8	0.0	**118,507.4**	**0.3**	224,221.8	0.4	9,684.5	0.0	197.9	0.0	**1,916,235.7**	**4.1**	**2,126,699.0**	**4.1**
TOTAL	**79,700.9**		**108,091.6**		**380.3**		**464.7**		**1,151,333.0**		**2,206,099.2**		**46,391.6**		**931.7**		**2,332,480.2**		**2,822,082.5**	

Note : Direct effect

Value is in kilo tonne of oil equivalent (ktoe)

Services sector will have the highest impact on energy consumption in 2015 and 2010. Increase of 10% on household consumption for the **Services sector**, the energy consumption in the sector is **directly affected by an increase of 4.1%.** This also **indirectly affects an increase in energy consumption in Agriculture, Manufacturing sector (0.7%), Construction (0.6%) and Mining sector (0.4%)**

Highest

Mining sector has been the least impacted from the energy consumption increase for the referenced years. For 2015, the 10% gain in household consumption in the **Mining Sector directly affected energy use in the sector by an increase of about 0.2 ktoe.** Moreover this has an **indirect effect to the increased rate of energy consumption in Manufacturing sector (0.2 ktoe), Services (0.1 ktoe), Construction (2.4 toe) and Agriculture sector (1.1 toe).**

Smallest

MULTIPLIER EFFECT – Exports

10% Increased of Exports on Energy Use in five main Malaysia's economy sectors for 2010 & 2015

	Agriculture				Mining				Manufacturing				Construction				Services			
	2010		2015		2010		2015		2010		2015		2010		2015		2010		2015	
	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%	Value	%
Agriculture	**14,574.9**	**1.1**	**7,470.9**	**0.9**	**339.4**	**0.0**	222.5	0.0	57,542.5	4.5	21,792.8	2.7	246.5	0.0	92.7	0.0	2,972.9	0.2	2,247.2	0.3
Mining	214.3	0.0	80.9	0.0	**53,150.0**	**4.1**	**38,016.1**	**4.3**	51,592.4	4.0	23,782.7	2.7	394.7	0.0	164.5	0.0	1,737.0	0.1	1,424.6	0.2
Manufacturing	22,350.2	0.0	16,828.8	0.0	31,050.2	0.0	36,843.0	0.0	**5,710,747.7**	**6.9**	**5,173,733.1**	**5.5**	23,318.0	0.0	18,625.7	0.0	172,124.6	0.2	264,353.8	0.3
Construction	119.5	0.0	40.4	0.0	344.5	0.0	506.8	0.0	4,157.1	0.6	3,338.5	0.2	**4,879.4**	**0.6**	**3,556.9**	**0.2**	1,409.1	0.2	3,730.0	0.2
Services	15,024.5	0.0	5,900.4	0.0	19,239.9	0.0	22,277.3	0.0	**668,256.0**	**1.4**	590,869.7	1.1	7,608.5	0.0	6,051.5	0.0	**820,567.4**	**1.8**	**831,113.1**	**1.6**
TOTAL	**52,283.4**		**30,321.3**		**104,123.9**		**97,865.8**		**6,492,295.7**		**5,813,516.9**		**36,447.1**		**28,491.2**		**998,810.9**		**1,102,868.7**	

Note : Direct effect

Value is in kilo tonne of oil equivalent (ktoe)

The Manufacturing sector will have the biggest impact on energy consumption in 2015 and 2010. In 2015, 10% increase on exports in the **Manufacturing** sector will **affect** the increase of energy consumption in the sector **directly by 5,173.7 ktoe or 5.5%.** This will also **indirectly** lead to the increase in energy consumption in the **Agriculture, Mining sector (2.7%), Services (1.1%) and Construction sector (0.2%).**

Highest

Construction sector will be impacted the least by the increase of energy consumption for the years that are under study. 10% increase of exports in the **Mining Sector** in 2015 will **directly lead** to an **increase of energy consumption by 3.6 ktoe**. In addition, this has an **indirect effect** for the rate of increase in energy consumption **Manufacturing sector (18.6 ktoe), Services (6.1 ktoe), Mining (0.2 ktoe) and Agriculture sector (92.7 toe).**

Smallest

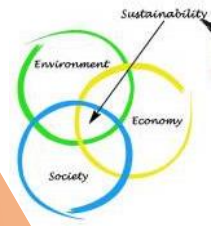
CONCLUSION

- **Manufacturing sector** remains as the sector which **uses energy intensively**.
- The **increase on final demand and exports in the Manufacturing sector will result in the highest impact on energy consumption** for 2015 and 2010.
- **Services sector will give the highest impact on energy consumption when household consumption increase.**

Economic Development
VS
Environmental Problems

Energy consumption in Malaysia - five main economy sectors

Pursuit development & sacrifice the nature?



- **Energy leads to economic and social development** as well as **improving the quality of life** of the citizens of a country.
- Energy also resulted **environmental problems** in a country and as such energy and the environment can be considered as closely related concepts.

- To what extent the country will be immersed in pursuit of development and sacrifice of nature.
- The higher energy is consume the higher pollution on air emissions which will cause climate change.

TERIMA KASIH & THANK YOU

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