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Does An Increase in Malaysian Business Sectors' Electricity Tariff Affect the Households? An Input Output Analysis

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Abstract

Purpose: This study aims to investigate the impact of Malaysian electricity tariff increase in 2014 on (1) business sectors' costs of production and eventually (2) households' expenditure.

Design/methodology/approach: This study utilised two different types of datasets namely Malaysian input-output price table 2015 and household expenditure survey report 2014. The impact was analysed using (1) multiplier analysis under input-output tools, (2) mixed endogenous-exogenous input-output price model and (3) harmonisation between two datasets called MSIC-COICOP mapping.

Findings: An increment of 14.69% weighted average electricity tariff on business sectors has increased the cost of production for all 124 business sectors in Malaysian economy indicated by the price impact value of more than 1 with the most affected sector be the 'electricity and gas'. The result also showed that the lowest income group will be impacted most indicated by the largest percentage increase in expenditure level.

Research limitations/ implications: While the analysis conducted are considered comprehensive enough since it covered both economic and social perspectives; many other social dimensions for households could be explored to extensively analyse the impact apart from the standard 11 households' income classes.

Practical implications: The findings can benefit policy makers in designing more well-targeted energy subsidy policies.

Originality/value: The study emphasised on the use of multiplier analysis, a mixed endogenous-exogenous input-output price model and finally MSIC-COICOP mapping to analyse the impact of increasing electricity tariff on business sectors and eventually household expenditure.

Paper type: Research paper

Keywords: Electricity tariff, price impact, cost of production, household expenditure, input-output, multiplier analysis

Introduction

Any decision to increase electricity tariff could possibly affect two main economic players namely electricity suppliers and electricity consumers. From electricity suppliers' perspective i.e., Tenaga Nasional Berhad (TNB), Sabah Electricity Sdn. Bhd. (SESB) and Sarawak Energy Berhad (SEB), the raise in electricity tariff will always be good news to them because the amount paid by consumers are basically their business revenue. Whereas, from electricity consumers' perspective i.e., residential, commercial, and industrial sectors, this will be an unfavourable decision due to higher cost of production and cost of living. Therefore, to ensure a fair tariff rate, Energy Commission has been assigned to review the electricity tariff for every specific regulatory periods mainly in Peninsular Malaysia and Sabah.

In Peninsular Malaysia region, the electricity tariff faced another increase in year 2011 long after its first revision in June 2006. The average tariff increases of 7.12 percent at that time subsequently received mixed response from the public. From government perspective, it was part of Malaysian government's energy subsidy removal policies designed to improve the economy which was previously burdened by high amount of energy subsidy. The rationale behind the decision were the growth in natural gas price to the power sector and the rise in electricity cost of supply since 2006. The two have contributed to the total average tariff increase by 5.12 and 2.0 percent, respectively (Tenaga Nasional Berhad, 2011).

From consumer perspective, any increment in electricity bills is considered as another cost of production to them. Furthermore, since business sectors would not want to cover all the additional cost, they will eventually pass the burden to final users by marking up the price of their products. In the end, the scenario does not only affect business sectors, but also households in term of higher cost of living. Therefore, taking this into consideration, this present study aims to analyse the direct impact of Malaysian electricity tariff increase in 2014 on business sectors' cost of production and its indirect impact on households' expenditure. Through the use of input-output table which made up of 124 business sectors, this present study will only focus on average tariff increase of two main electricity consumer categories namely industrial and commercial. Changes in tariff rate for domestic consumer will be excluded in the analysis as the aim is not to see the direct impact but the indirect impact on household expenditure resulted from the increase of electricity tariff on business sectors and its subsequent rise in businesses' cost of production.

Literature Review

Changes in Malaysian Electricity Supply Industry (MESI)

Malaysia under the Energy Commission Act 2001 has established a statutory body known as the Energy Commission on 1st January 2002. As a regulatory body, the Commission is responsible to taking charge of three main components under the energy market namely economic, technical and safety regulation. With the establishment of this statutory body, the responsibility to regulate electricity and gas industry specifically in Peninsular Malaysia and Sabah lies with the Commission (Energy Commission, 2019). It is noteworthy to mention that one significant role of Energy Commission is to set the electricity price as well as base tariff for each regulatory period. Base tariff is basically revised periodically by government after reviewing and considering the costs incurred by energy supply company, in this case Tenaga Nasional Berhad (TNB).

In addition to the formulation of Energy Commission, the structure of Malaysian Energy Supply Industry (MESI) had undergone few other significant changes before it finally transformed itself into a more liberalised market as it is today. To begin with, the market was initially owned and managed by few private entities before Malaysian first electricity board known as the Central Energy Body (CEB) was established in 1940. It then gradually took over the market, turning itself as the new monopolistic entity in Malaysian electricity market. In 1965, CEB was renamed as National Electricity Board (NEB). Given the responsibility to administer the electricity sector, this entity covered all, from generation, transmission, and distribution (including retail) without much intervention from other entities. In fact, the NEB was in-charge of supplying energy to Peninsular Malaysia until 1980s. In 1990, the government established a successor company to corporatise NEB under the Electricity Supply (Successor Company) Act 1990. The name given was Tenaga Nasional Berhad (TNB). Two years later, the market slowly liberalised by the entrance of few IPPs (particularly in electricity generation), apart from existing entity namely TNB Generation (Poudineh et al., 2021; Aris et al., 2019). Zamin et al. (2013) in their study has further added that IPPs introduction has been strongly motivated by the tragedy of major blackout in 1992. Government was pushed to get other players involved in generating electricity which then ended TNB monopoly status.

To further transform MESI, MESI 1.0 initiatives was launched in year 2009 which took effect from year 2010 until 2014 aiming to transform Malaysian power sector into a more liberalised market with more reliable supply of energy, more competitive tariff as well as with a more effective governance of the industry. However, as summarised by Poudineh et al. (2021) and presented by Yin (2019), there are few key challenges to liberalise the market. This includes electricity market designation where concerns on renewable energy and supply security need to be taken care of for both short- and long-term design and retail market enhancement where wider price differentiation is favored to encourage energy efficiency practices. Yin (2019) also added few more future challenges regarding technologies disruption which has been the motivation and background to the introduction of MESI 2.0. Subsequently, in year 2019, the Minister of Energy, Science, Technology, Environment and Climate Change (MESTECC) launched another series of reform initiatives namely MESI 2.0 for year 2019 until 2025. MESI 2.0 aims to bring in new coal and gas suppliers as well as alternative retailers and gentailers (retail energy providers who also own generation assets), to establish a wholesale market (including a capacity market), as well as to position Single Buyer and Grid System Operators as independent entities (Poudineh et al., 2021).

Another major reform to the structure of Malaysian electricity supply industry was caused by the introduction of Incentive Based Regulation (IBR) in January 2014. As shown in Figure 1, initially, there were three standard structures in Malaysian electricity supply industry i.e., generation, transmission, and distribution. As the nation inspire to have a more deregulated market, IBR has unbundled the accounts into five entities to provide more transparency (Sulaima et al., 2019). That being the case, two new entities were introduced namely (1) Single Buyer and (2) System Operator (Energy Commission, 2016). For the Single Buyer, the government has given this entity the authority to purchase electricity from IPPs and TNB Generation by adopting least cost dispatch schedules. In brief, it is a system where the lowest marginal cost generating unit will be sent off first, after that the next-lowest marginal cost generating unit, and so on, until all demand is met (Poudineh et al., 2021; Energy Commission, 2016; Zamin et al., 2013). The five separated accounts of (1) TNB Single Buyer, (2) TNB Generation, (3) TNB Transmission, (4) TNB System Operations and (5) TNB Customer Service have appeared together and form a Ring-fenced Single Buyer Model. In a nutshell, all these government's reform initiative particularly MESI 1.0 and IBR are considered as

important background to this study as the reform becomes one of the contributing factors to changes in Malaysian electricity tariff, which will be discussed in detail in the next sub section.

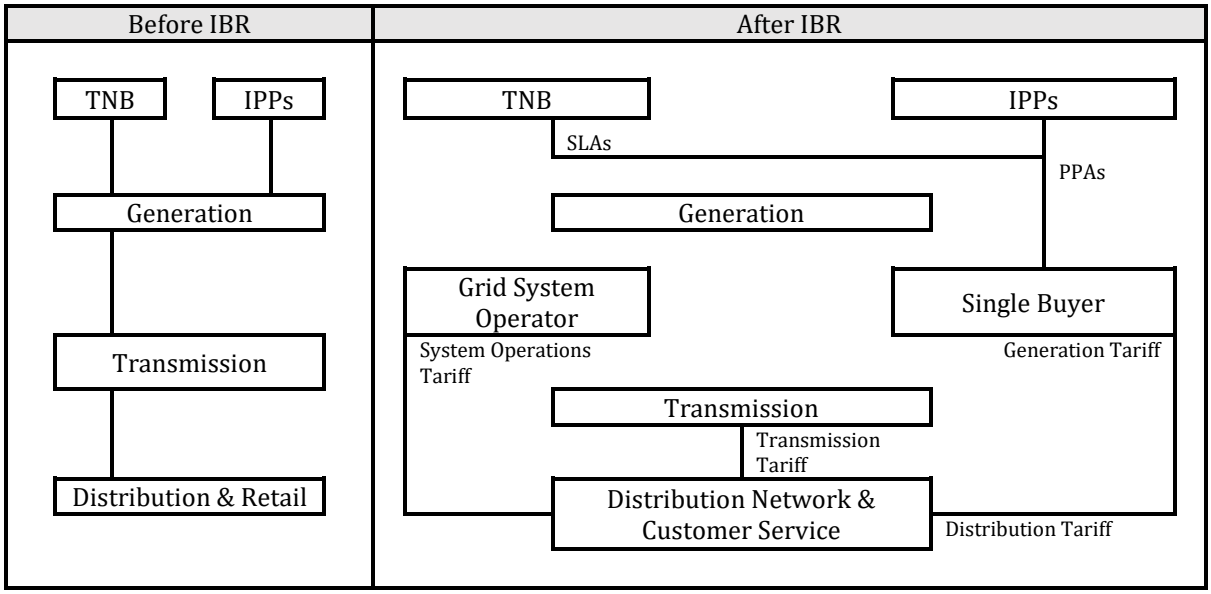

Figure 1: Structure of Malaysian Electricity Supply Industry Before and After IBR Implementation

Changes in Malaysian Electricity Tariff

Prior to year 2011, many significant events occurred, which later contributed towards higher electricity tariff. This subsection is to briefly explain the flow of tariff price increase in Malaysia. In 2011, the government announced an average electricity tariff increase of 2.23 sen/kWh for Peninsular Malaysia where it risen from 31.31 to 33.54 sen/kWh. Whereas for Sabah and Labuan, the government announced an average electricity tariff rise of 3.75 sen/kWh indicated by an increase from 29.25 to 25.50 sen/kWh (Energy Commission, 2011). This decision had been largely motivated by the rise in natural gas price to the power stations. To begin with, natural gas was ranked second in Malaysian primary energy supply mix indicated by 22 percent share apart from 63 share of crude oil in early year of 1978 as illustrated in Figure 2. Malaysia then has shifted its dependency towards crude oil by making natural gas as the fuel of choice since year 1997. In 2010, natural gas had dominated and fueled this nation at nearly-half depicted by 46.15 percent share. The historical pattern for primary energy supply in Malaysia measured in ktoe unit is illustrated in Figure 2 below (Malaysia Energy Information Hub, 2020c).

Since the share of natural gas was predominantly high, questions that might arise are who will be affected and where the demand came from. To answer the first question, it is important to begin with categorisation of natural gas consumers in which there exist three main sectors namely industrial, commercial, and residential. Until now, the number of natural gas consumers is still outstandingly dominated by residential sector. However, this does not mean that the high electricity demand came from residential sector, but rather stipulating that any policy made will affect huge number of residentials. The number of natural gas consumers in Malaysia for year 2004 until 2018 is as depicted in Figure 3 (Malaysia Energy Information Hub, 2020a).

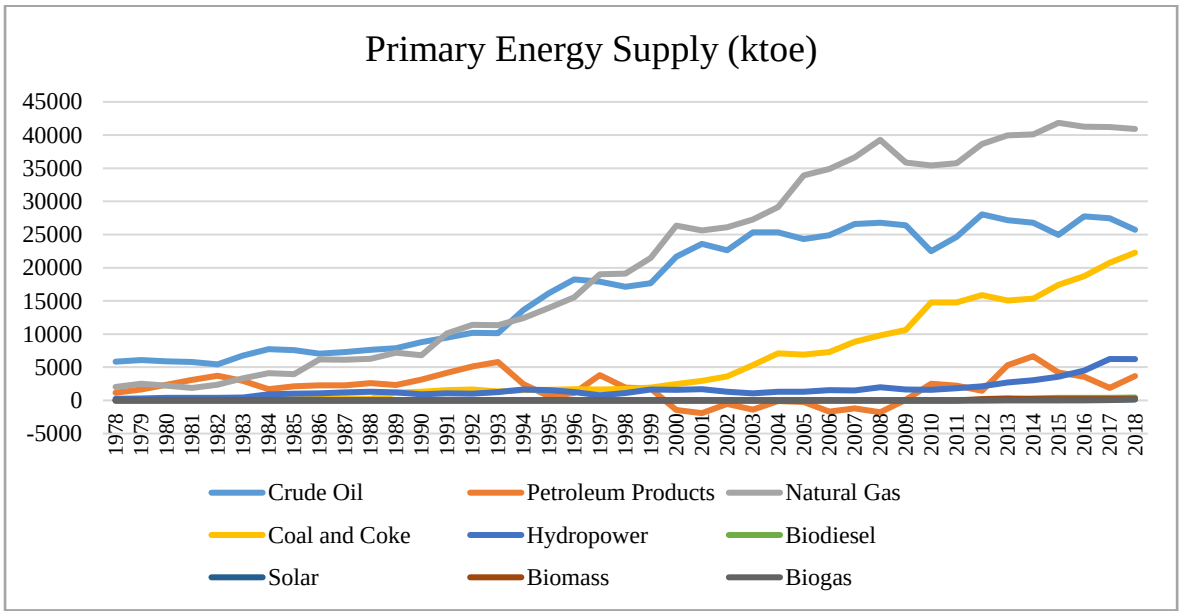

Figure 2: Primary Energy Supply in Malaysia (ktoe)

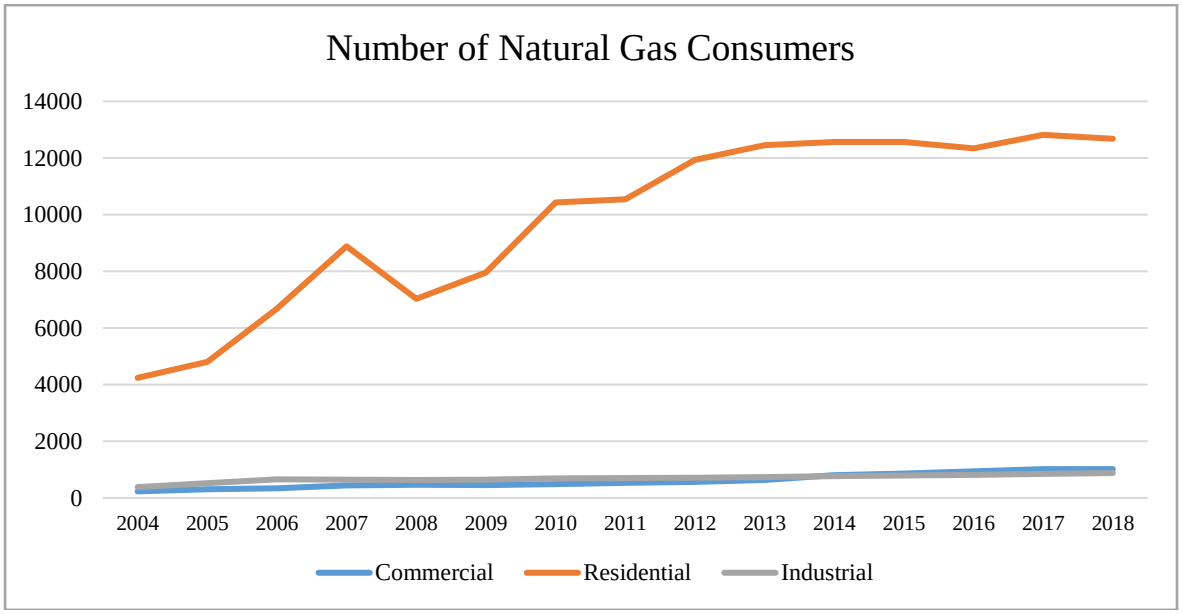

Figure 3: Number of Natural Gas Consumers in Malaysia

To trace the source of demand and to answer the second question, the consumption amount needs to be measured according to sectors in mmBtu unit. The illustration as shown in Figure 4 explained that even if the number of industrials is significantly small as compared to residentials, this sector consumed the largest amount of natural gas in the economy (Malaysia Energy Information Hub, 2020b).

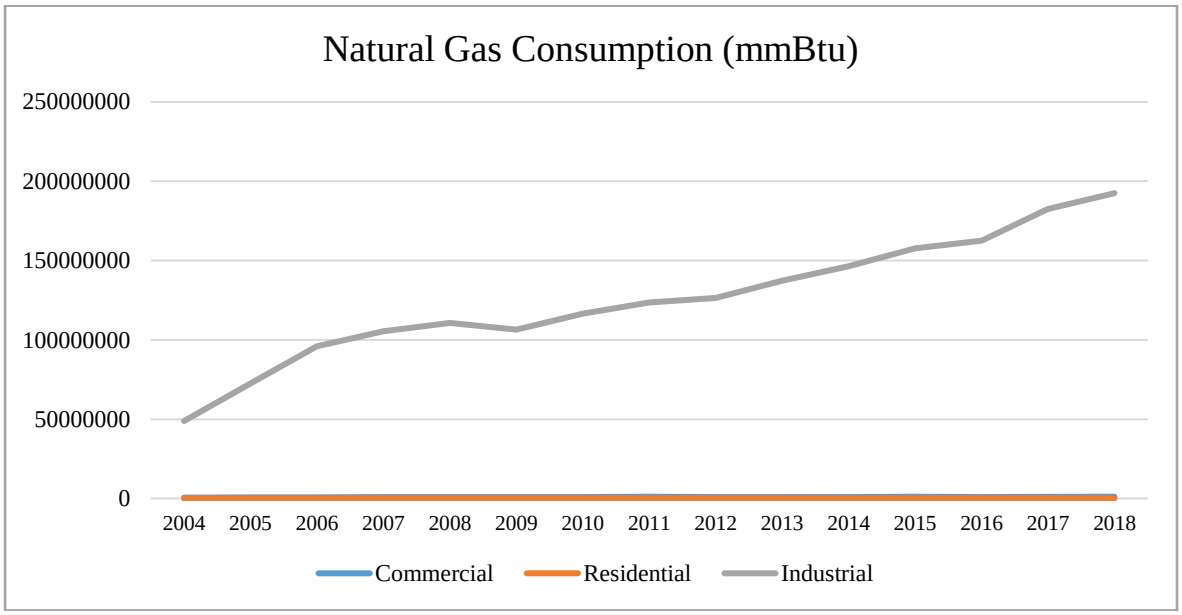

Figure 4: Natural Gas Consumption in Malaysia (mmBtu)

On a different note, speaking from electricity industry perspective, the level of dependence towards natural gas prior to year 2011 was also very high. In fact, natural gas remained as the most dominant fuel input to Malaysian power stations since 1992 until 2009. In year 2010, coal began to take over and exceeded the amount of natural gas. Even so, 45.60 percent of natural gas been supplied to the power stations was still considered high and thus remained as one of essential energy source supplies to keep fueling the economy. To describe the high level of dependency towards natural gas, Figure 5 illustrated the amount of every fuel input to the power stations according to fuel type measured in ktoe unit (Energy Commission, 2021).

Additionally, while Malaysian power sectors' dependence towards natural gas was evidently high, the price paid for natural gas input to generate electricity had become unfavorably more expensive. This could be measured by observing historical pattern of natural gas price revision for 2006 until 2016 fixed gas price in Table 1 where overall indicated an increasing price trend (Choon, 2016).

Due to the increasing price trend, the government had subsequently raised the electricity tariff with the aim to reduce the burden undergone by the utilities. In 2011, average tariff increases in Peninsular Malaysia and Sabah was announced by the Energy Commission while in 2014, the government once again increased the price for both regions. For Regulatory Period 2 (RP2) the government has decided to maintain the same rate and in year 2021, it was announced that RP2 will be extended for another one year. This made the rate announced in 2014 as the latest electricity tariff rate.

Considering IBR introduced by the Energy Commission in January 2014, the regulatory period timeline is as depicted in Figure 6. Under this incentive, electricity tariff is set under two different parts namely Base Tariff and Imbalance Cost Pass Through (ICPT). The former will be revised every three years while the latter will be revised every six months – based on coal and gas global prices (Energy Commission 2018). With this in mind, this study will investigate the impact of increased price in base tariff and not ICPT. Periods for both IBR and ICPT review is as prescribed below.

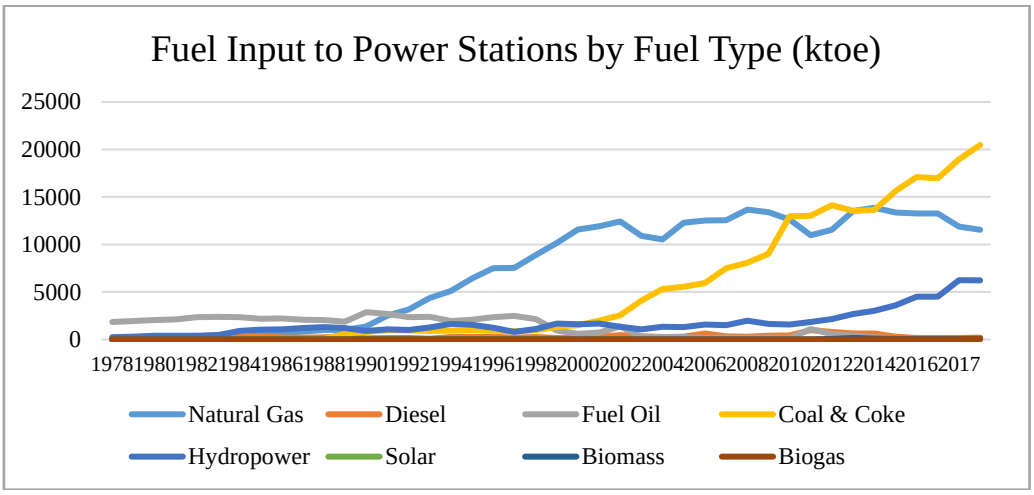

Figure 5: Fuel Input to Power Stations by Fuel Type (ktoe)

Table 1: Revision of Gas Price for Year 2006 - 2016 Fixed Gas Price

Year	With Effect From	RM/ mmBtu
2006	1 May 1997	6.40
2008	1 Jul 2008	14.31
2009	1 Mar 2009	10.70
2011	1 June 2011	13.70
2014	1 Jan 2014	15.20
2015	1 July 2015	16.70
2016	1 Jan 2016	18.20
2016	1 July 2016	19.70

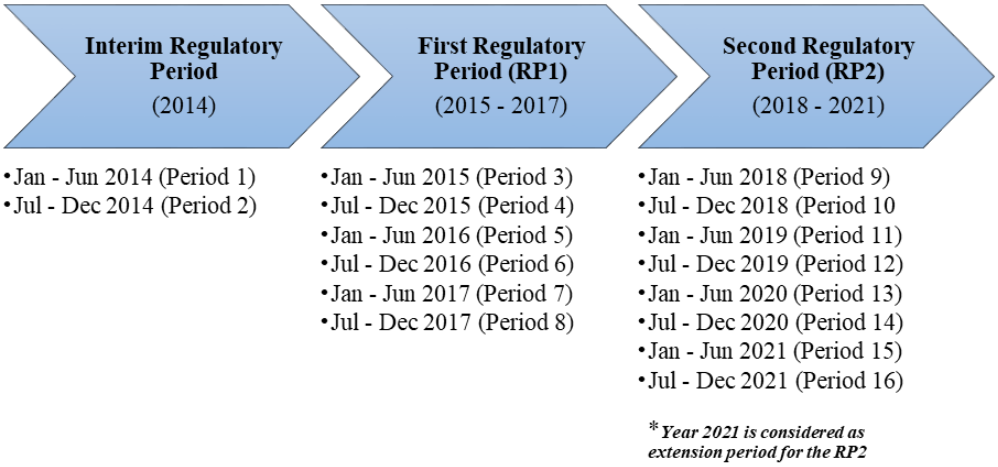

Figure 6: Regulatory Period for IBR and ICPT Review

Previous Studies on the Impact of Energy Subsidy Reform Policies

As electricity is considered part of energy and becomes part of an economy's essential needs, it is always expected that the rise in electricity tariff will subsequently affect the households. However, the magnitude and pattern of the impact may vary among different household groups.

According to Saari (2014) and Saari et al. (2016), energy expenses are regressive in structure where lower income groups will spend relatively higher portion of their income on energy. As a result, when the energy price increases, it impacted lower income households regressively. In other words, budget of the lower income groups will be affected more as compared to the higher income groups. In addition, a study also suggested that households consume energy both directly and indirectly. Therefore, the rise in energy price will made them experience both sides of the impact (Bacon et al., 2010). In the case of electricity, households will experience the direct impact from higher electricity bill and the indirect impact from higher price of products bought from businesses who also consume electricity. According to Khazanah Research Institute (2014), each household received an annual subsidy of RM625 per year for electricity and RM885 per year for fuel. However, the largest portion or around 80 percent of them went to the high-income households. Meaning that, those who have more cars and air-conditioned enjoyed subsidy more than those who only have motorcycle and ceiling fans. As supported by Saari et al. (2016), energy subsidies are typically regressive in nature and therefore majority of them will go to businesses rather than individuals.

Based on the above literature, it is apparent that government should pay more attention to the low-income groups. In the case of Malaysia, previous government prior to 2014 had provided many alternatives to resolve this matter. Normally, they were done in the form of cash transfer. For example, BR1M which covered all households with income less than RM4,000 per month and singles over 21 who earn less than RM2,000 per month, Skim Bantuan Kebajikan under the Social Welfare Department (JKM) which targeted the elderly, single mothers, children, and disaster victims from low-income families and Kumpulan Wang Amanah Pelajar Miskin (KWAPM) which focused on primary and secondary school students (Khazanah Research Institute, 2014).

In a nutshell, findings from previous impact studies have shown that any future changes in energy prices should come together with initiatives for highly affected groups. From the authors view, this study will be able to assist policy makers to identify the most affected groups that should be given special attention by the government prior to any announcement on changes in electricity tariff.

Input-Output Analysis and Energy Studies

Input-Output analysis, founded by Professor Wassily Leontief in the late 1930s, is a form of general equilibrium model which accounted and captured interdependencies between all production sectors in the economy. Acknowledging its comprehensiveness and usefulness, this model has been extended by many scholars and experts and often being adopted for policy making purpose (Miller & Blaire, 2009). Even so, input-output still is not a perfect tool and has few limitations. These include the data being published less frequently, assumption of a perfectly elastic supply curve, fixed production structure, largely heterogeneous within each sector and interdependencies between countries that could not be captured (Khazanah Research Institute, 2018). However, despite all the limitations being listed, some studies also pointed out the advantages of using this model, which later highlighted and recognised its advantages among any other economic tools. According to Bekhet and Yasmin (2014), this table is more than just a table. Instead, it could investigate production-consumption link at each sectoral level. In other words, it could track the incorporated resource in any goods and services based on sectors (Mukarramah et al., 2018).

Input-output analysis has been a popular tool among energy-based studies. This also includes the use of extension models of input-output itself. Among energy related studies that have utilised input-output analysis are Saari (2014), Bekhet and Yasmin (2014), Bekhet et al. (2016), Abdullah (2016), Bekhet and Abdullah (2018) and Dzulkefli and Saad (2020). Bekhet and

Abdullah (2018), for example, use structural decomposition analysis to analyse changes in energy intensity for three sub-periods i.e., 1991-2000, 2000-2005 and 2005-2010. The study found there was a sharp increase of energy intensity in the first sub-period, a decrease in the second sub-period followed by another decrease in the final sub-period. Additionally, the study also found final demand structure as the strongest factor responsible for the changes during first and second sub-periods while final demand components contributed to the decrease under the third sub-period. Among all these studies, the study conducted by Saari (2014) is considered as highly relevant to this present study due to the use of mixed endo-exogenous input-output price model, similar to the one utilised for this present study. Saari (2014) investigated the direct and indirect impact of energy price changes i.e., electricity and petroleum on Malaysian households. The findings show the most affected household groups, if there are changes in energy prices, will be the lower income groups. The study also found energy price changes will have a regressive impact and not progressive one.

Taking into consideration the fact that input-output is a comprehensive model and proven to be useful in energy related studies (including electricity), this technique was chosen to help achieve the objective of this present study. Additionally, the review has also shown that, despite energy covers both electricity and gas, a study that put a specific focus on the impact of electricity is still lacking. There has also been limited number of studies that look at the indirect impact of changes in electricity tariff on households. This is understandable as input-output table itself only provides data across different level of business sectors and not directly to the household. To do this, it may require a harmonisation of input-output data with data related to household consumption. To the knowledge of this present study, only Saari (2014) has taken the initiative to look at the impact of electricity price changes on household expenditure. The study, however, was conducted based on electricity tariff year 2010.

Therefore, taking into consideration the potential impact the most recent change of electricity tariff has on business sectors which then would be passed to the households, it is the aim of this present study to analyse the direct impact of 2014 electricity tariff increase on business sectors' cost of production and subsequently the indirect impact on households' expenditure. Like Saari (2014), this present study utilised a multiplier analysis under the input-output model to investigate the direct impact on all 124 production sectors in the economy and the indirect impact on households. To identify the most affected business sector and household income group, this present study will explain the findings based on sectoral price impact value and percentage change in expenditure level according to different level of households' income groups. As highlighted before, this study will only focus on the indirect impact to households, not the direct impact. The direct impact was on companies' cost of production that will be transferred to the household (indirect impact).

Methods

This study utilised two different types of datasets published by the Department of Statistics Malaysia (DOSM) namely input-output price table 2015 and household expenditure survey report 2014. A mixed endogenous-exogenous input-output price model has been developed and a multiplier analysis has been fully utilised to investigate the direct and the indirect impact of electricity tariff changes in 2014 on Malaysian business sectors and households, respectively. Prior to that, the data on weighted average tariff changes amounted to 14.69 percent experienced by both commercial and industrial sectors in Peninsular Malaysia, Sabah and Sarawak has been fed into the model and contributed to the exogenous cost of electricity in the economy. For better understanding, Table 2 illustrates how the value of weighted average tariff change was derived.

Table 2: Derivation of the Weighted Average Tariff Change

Region	Customer Category	Tariff Change	Electricity Consumption by Sectors at GWh		Weighted-Average Tariff Changes
Peninsular Malaysia	Industrial	1.169	46,755	0.47	0.5444
	Commercial	1.169	37,108	0.37	0.4321
Sabah	Industrial	1.172	1,230	0.01	0.0144
	Commercial	1.176	2,043	0.02	0.0239
Sarawak	Industrial	1.000	10,966	0.11	0.1092
	Commercial	1.000	2,290	0.02	0.0228
		TOTAL	**100,392**	**1.00**	**1.1469**

As highlighted in previous section, under RP2 which began in year 2018, government decided to maintain the tariff rate, which is then extended for another one year due to COVID-19 pandemic. Therefore, up to the time this present study was conducted, tariff rate from year 2014 is currently used. Moreover, while electricity consumers are composed of three main sectors namely industrial, commercial, and residential, this study will only focus on the average tariff increase of the first two sectors to derive the impact of electricity tariff increase on business sectors in the input-output table. The analysis of the indirect impact on households will come afterwards.

In summary, this study intended to assess the impact of year 2014 tariff announcement where government announced that commercial and industrial sectors in Peninsular Malaysia and Sabah will experience a tariff increase. The data year for each dataset was chosen according to the nearest year available so that each could fairly resemble economic and social condition most relevant to the effective year, which is 2014. The details of each data year chosen are as summarised in Table 3.

Table 3: Data Year Chosen for Each Dataset

Data Name	Data Year	Remarks	Source
Average tariff increase	2014	1. Out of three main electricity consumers i.e., industrial, commercial, and residential, only the first two segments were considered. 2. The average tariff increased for both commercial and industrial sectors is 16.9% each for Peninsular Malaysia, 17.6% and 17.2% respectively for Sabah and no change for Sarawak. 3. The weighted average tariff change in year 2014 is 14.69%. 4. Represented in percentage (%).	Energy Commission (2017) and Tenaga Nasional Berhad (2013)
Input-output price table	2015	1. Classified according to Malaysia Standard Industrial Classification (MSIC). 2. Consist of 124 sectors. 3. Represented in RM thousand.	Department of Statistics Malaysia (2018)

Household expenditure survey report	2014	1. Classified according to 12 main groups of goods and services based on the Classification of Individual Consumption According to Purpose (COICOP). 2. Grouped based on standard 11 income classes. 3. Represented in RM.	Department of Statistics Malaysia (2015)

Due to different classification between input-output price table and household expenditure survey report, MSIC-COICOP mapping, which referred to the mapping between 124 input-output sectors classified according to MSIC and 12 main groups of goods and services classified based on COICOP has been conducted prior to arriving at household expenditure effect simulation process. In essence, this mapping intended to harmonise the two datasets above as well as to enable the translation of the price impact from business sectors to households. Overall, the simulation process utilised by this present study followed a series of sequential events as illustrated in Figure 7.

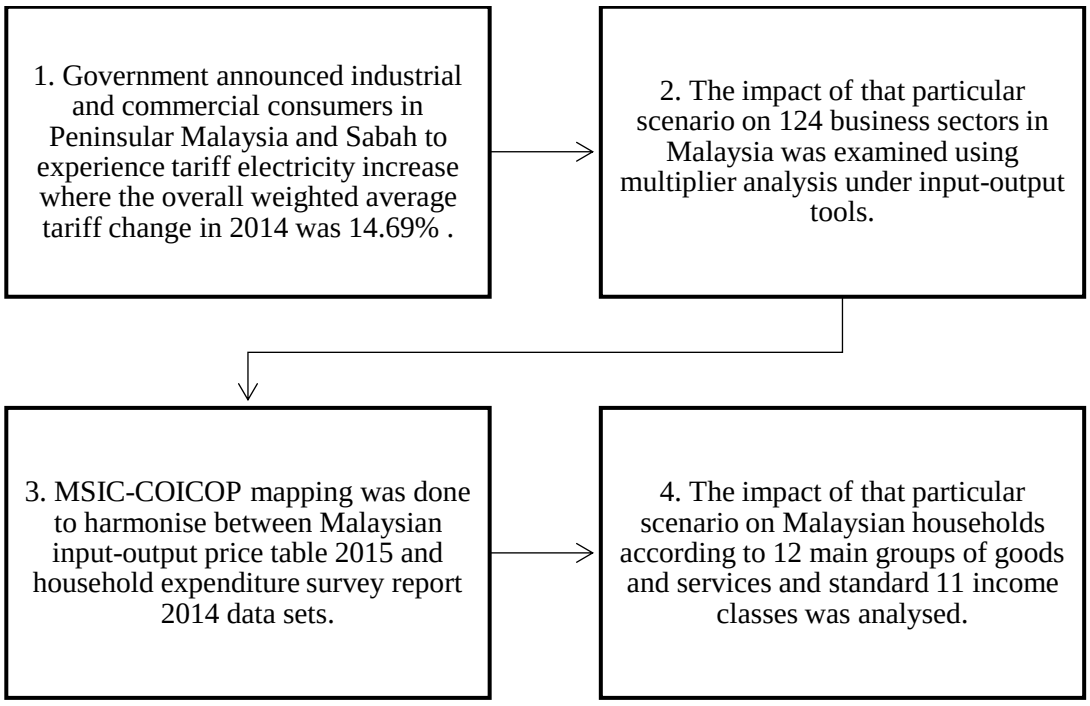

Figure 7: A Series of Sequential Events Leading to the Simulation Process

Findings

Based on input-output model, each sector will always depend on other sectors based on its backward linkage value while at the same time affect other sectors based on its forward linkage value. In the case of this present study, the electricity tariff changes as announced by government in 2014 had subsequently impacted all Malaysian business sectors and households because electricity product is considered as essential component for any country's economic development as no one could operate their businesses without electricity. The findings are divided into three subsections namely price impact on 124 business sectors in the economy, price impact on 12 main groups of goods and services, and household expenditure effect.

Price Impact on 124 Production Sectors in the Economy

As mentioned before, this study analysed the change in cost of production for all 124 business sectors in the economy using a multiplier analysis to capture the impact from economic perspective. Figure 8 presents the multiplier effect based on sectoral order beginning from the least affected sector at the left-end side to the most affected one at the right-end side. In other words, when 2014 weighted average tariff increase of 14.69 percent was injected into 2015 Malaysian input-output price table, the price impact on 124 business sectors in the economy is as shown in Figure 8.

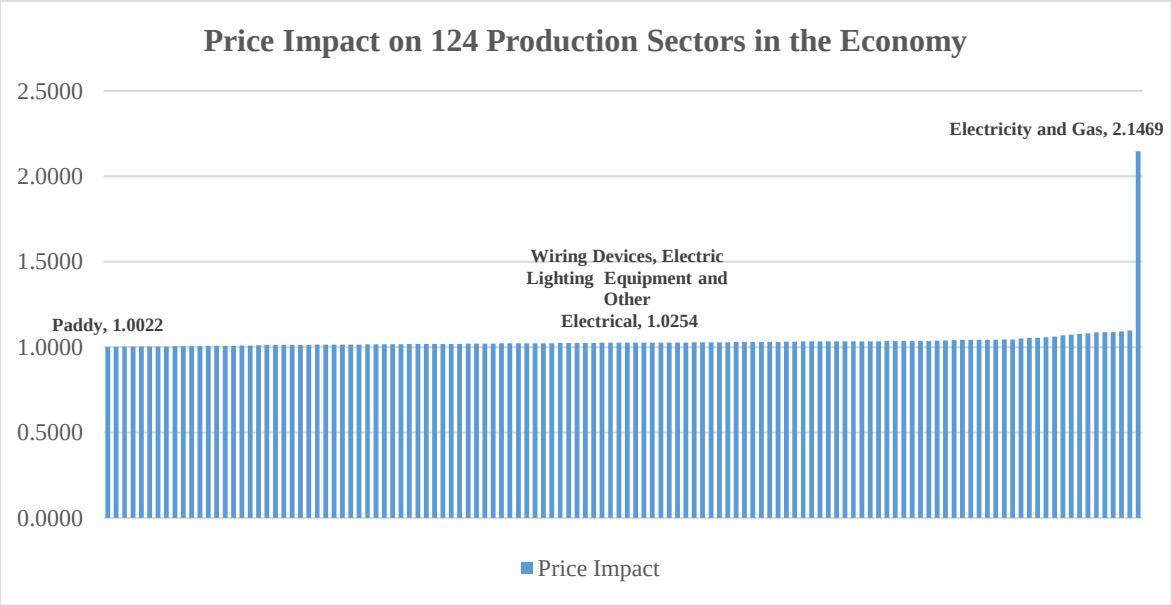

Figure 8: Price Impact on 124 Business Sectors in the Economy

Based on Figure 8, it can be summarised that each sector in the economy was affected by the electricity price increase indicated by price impact value of more than 1. The most impacted sector is electricity & gas measured by the highest price impact value of 2.1469 which simply signifies this sector's highest dependency towards electricity in the economy. In contrast, paddy sector was the least affected one with the price impact value recorded at 1.0022. This implies that paddy sector's dependency towards electricity is the least. In addition, it is also interesting to note that wiring devices, electric lighting equipment & other electrical sector was affected at 1.0254 which means that in relative to others, this sector only depends on electricity at a moderate level. Overall, this finding provides strong evidence that an increase of electricity tariff in year 2014 has caused business sectors' cost of production to rise with the price impact value of all business sectors be more than 1. While almost all sectors are impacted at similar level, electricity & gas sector recorded the highest impact with the price impact value of more than double as compared to other sectors.

Price Impact on 12 Main Groups of Goods and Services

The mapping of MSIC-COICOP was needed to translate the economic perspective into social perspective. In other words, the aftermath of the increase in production costs of business sectors is the increase in price of goods and services to consumers. The former was from economic viewpoint while the latter was from social viewpoint. To achieve this, the price impact values were first interpreted based on 12 main groups as illustrated in Figure 9.

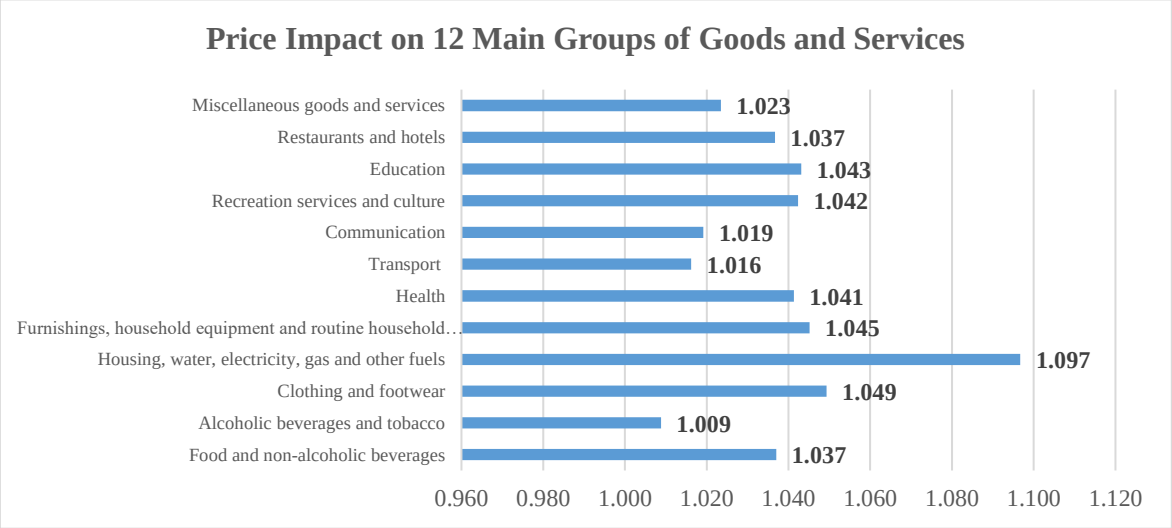

Figure 9: Price Impact on 12 Main Groups of Goods and Services

Based on Figure 9, this study found the dispersion between each main group were not big except for one outlier namely the housing, water, electricity, gas & other fuels group, which recorded the highest price impact value of 1.097 making it the most impacted group. Whereas alcoholic, beverages & tobacco group recorded the lowest price impact value at only 1.009. The results also indicates that all groups were affected by the increase of electricity tariff depicted by price impact value of more than 1.

Household Expenditure Effect

To achieve the second objective of this study, the price impact on 12 main groups of goods and services were subsequently translated into households' spending, which were measured based on standard 11 income classes. By doing this, household expenditure effect can be obtained from both perspectives (1) 12 main groups of goods and services and (2) income classes. The standard 11 income classes were based on 2014 household expenditure survey report i.e., RM1,999 and below, RM2,000 to RM2,999, RM3,000 to RM3,999, RM4,000 to RM4,999, RM5,000 to RM5,999, RM6,000 to RM6,999, RM7,000 to RM7,999, RM8,000 to RM8,999, RM9,000 to RM9,999, RM10,000 to RM14,999, and RM15,000 and over. The result of household expenditure effect measured in percentage changes in expenditure level is shown in Figure 10.

Based on Figure 10, the increment in electricity tariff in 2014 has affected the lowest income class the most. This result is consistent with the study conducted by Saari (2014) where an increase in tariff in year 2010 has also affecting the lower income group more. In other words, it caused changes in expenditure level for household with income of RM1,999 and below with the highest change of 5.05 percent as compared to other income classes. This shows that their composition of spending for goods and services with higher price impact value were relatively higher. Whereas the least affected group will be household with income class between RM7,000 to RM7,999 indicated by 4.50 percent changes in expenditure level. This implies that they consumed goods and services with higher price impact values relatively less. This situation could also suggest that with limited resources as compared to those from higher income groups, lower income groups may have little option to switch to other types of products that may have been less affected by the increase in business sectors' electricity tariff such as foreign based product. On the other hand, it is also notable that the second most affected income class are those with income RM15,000 and more. While the impact here is higher as compared

to other lower income groups, it is expected that the higher impact is attributable to higher amount of spending being made due to their higher income status. Therefore, unlike the lower income group who rely on goods and services with higher impact values due to necessity, an increase in electricity tariff of Malaysian business sectors can also indirectly increase household expenditure of those with the highest income at one time worsen their financial position. This is on top of potential impact households need to face if there is also an increase in electricity tariff for residential.

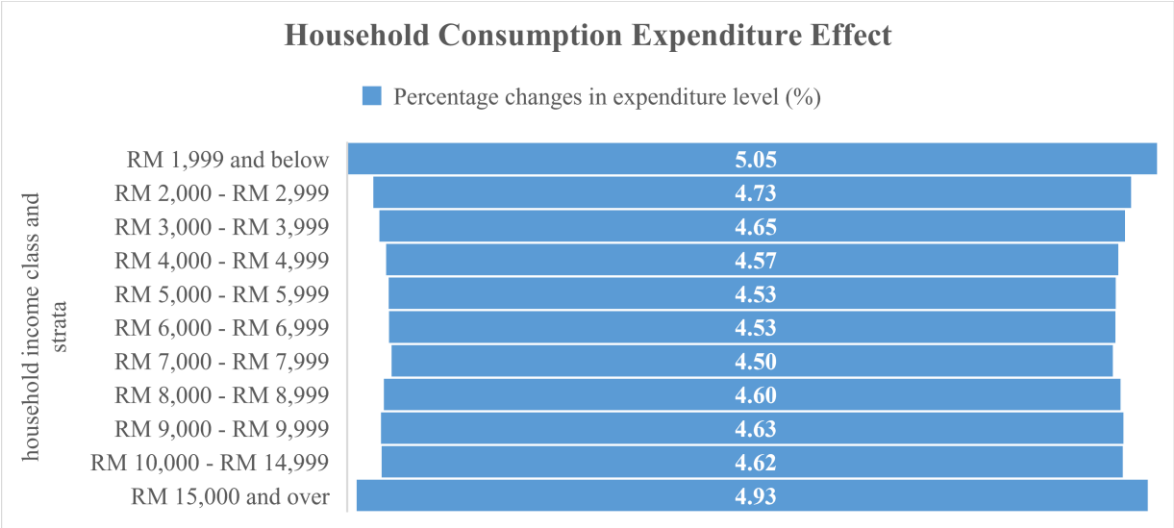

Figure 6: Household Consumption Expenditure Effect

Discussion and Conclusion

This study set out to investigate the direct impact of 2014 Malaysian electricity tariff increase on business sectors' costs of production and eventually the indirect impact on households' expenditure using a multiplier analysis, a mixed endogenous-exogenous input-output price model and harmonisation of two datasets called MSIC-COICOP mapping. The use of input-output price table in this study is considered advantageous and comprehensive because it covered the whole sectors in the economy. Moreover, the adoption of multiplier analysis has enabled this study to identify the price impact of increasing electricity tariff from both economic and social perspectives. Additionally, the utilisation of two datasets published by DOSM supported by MSIC-COICOP mapping to harmonise between the two has enabled this study to translate the price impact on both business sectors and households.

In conclusion, the findings show the increment made by Malaysian government on commercial and industrial electricity tariff had subsequently raised the cost of production borne by every business sector reflecting the critical role played by electricity cost in Malaysian economy. The impact borne by each sector depends wholly on its level of dependency on electricity in producing outputs. As such, with the results presented in previous section, it could be concluded that all sectors were impacted but electricity & gas sector was the most sensitive and has been badly affected indicated by the largest price impact value as compared to other sector. What is more important is that this burden was eventually passed from producers in term of cost of production to consumers in term of price of products. As a result of the increase in cost of production, from consumer perspective, the most affected goods and services was housing, water, electricity, gas & other fuels indicated by the highest price impact value. Therefore, the tariff increases eventually lifted the price of goods and services under this group relatively more compared to others. The impact was then translated to household expenditure where it has been found that the most vulnerable group towards the electricity tariff increase were

households coming from the lowest income group indicated by highest percentage change in expenditure level. In short, while the move made by government to increase the electricity tariff was undeniably good for Malaysian economy and could encourage energy efficiency practices, assessment on its social impact must also be done to ensure affordability among business sectors particularly small and medium-sized enterprises (SMEs) and accessibility of energy among the poor especially those from low-income earners group.

Theoretical Implications

To the knowledge of this present study, there has been very little evidence available on the impact of change in electricity price on business sectors' cost of production and eventually household expenditure. Therefore, findings from this study will be beneficial for future studies particularly those conducted within the context of Malaysian environment. Additionally, the utilisation of two datasets namely Malaysian input-output price table 2015 and household expenditure survey report 2014 as well as the use of multiplier analysis, mixed endogenous-exogenous input-output price model and harmonisation of two datasets called MSIC-COICOP mapping also offer potential techniques that could be used by future studies.

Practical and Social Implications

This study is expected to benefit policy makers and government planning units particularly in strengthening and improving current energy subsidy mechanism. In other words, by identifying electricity-intensive sectors and highly affected income earner groups, this study is believed to contribute to the process of designing more well-targeted energy subsidy policies so that the decision of changing the electricity tariff for the next regulatory period would not jeopardise these groups. Moreover, this study is also expected to benefit utility companies in their business planning, guiding them to make a more informed decision with an ability to recognise different level of dependencies towards electricity.

Limitations and Suggestions for Future Research

In this study, an input-output analysis has been mainly utilised to achieve the objective from economic perspective. As to achieve second objective, which is from social perspective, this model unfortunately is not fully interconnected with household. In this case, it can be argued that Social Accounting Matrix (SAM) and Computable General Equilibrium (CGE) could also help to achieve the objectives of this study as both models are said to offer more extensive version of input-output that also account for households. However, at this stage of this study, the lack of connection with household data in input-output has been compensated with the MSIC-COICOP mapping to discover the indirect impact of electricity tariff increase on households. While this technique is considered as sufficient to achieve the objectives of this study, future research may consider to use either SAM or CGE. Furthermore, it is also acknowledged that this study only investigated the impact of the electricity price increase on households based on income classes. The model could be further extended to other dimensions such as state-based analysis or a comparison between urban and rural areas.

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