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Highlighting Energy Policies and Strategies for the Residential Sector in Malaysia

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ABSTRACT: Energy is an important catalyst for development. Malaysia is very fortunate to be endowed with oil reserves. However, these reserves are finite and not renewable. Being cognizant of this, the Malaysian government had implemented various energy policies and strategies to manage and safeguard its oil reserves for better energy security as well as to promote prudent use of energy. This paper aims to highlight the electricity sector in Malaysia and the various policies and strategies implemented thus far. By reviewing the existing energy policies and strategies as well as their implications, this paper suggests prospective policy and strategy options towards achieving better energy efficiency and emission reduction in the residential sector. The trends of electricity consumption and underlying factors influencing the growth of electricity consumption are also discussed.

Keywords: residential electricity consumption; energy policies; renewable energy; energy efficiency,
JEL Classifications: C54; Q48; Q54; R41

1. Introduction

Energy, particularly fossil fuels is an essential input for economic development which had powered economic growth ever since the industrial revolution (Saatci and Dumrul, 2013; D'Alessandro *et al*., 2010; Hannesson, 2009). The role of energy in economic development resulted in the world consumption for energy to increase significantly from 7219 Mtoe in 1980 to 13,113 Mtoe in 2011 (International Energy Agency, 2011, 2013a). In the long-run, energy availability could possibly constrain economic growth if the current relative abundance of energy sources is not maintained (Stern, 2011). Since the pioneering work of Kraft and Kraft (1978), the relationship between energy consumption and economic growth becomes a key and hot topic and it is studied by many researchers using various methodologies for different time period and geographical locations. In each study, an energy consumption function consisting of various macroeconomic variables was developed. These macroeconomic variables were studied in terms of elasticity and Granger causality with energy consumption. Understanding the elasticity and direction of Granger causality are very important for policymakers to formulate appropriate policies for sustainable development (Ivy-Yap and Bekhet, 2014).

In particular, electricity is more frequently studied compared to other forms of energy because energy consumption is switching away from traditional fuels to cleaner and safer energy sources such as electricity (Al-Faris, 2002; Amusa, *et al*., 2009). Among the studies in the literature, numerous of them focussed on the residential sector. This is because the residential sector is one of the most electricity consuming sector in an economy and its consumption is anticipated to continue to rise (Cebula, 2012; Dergiades and Tsoulfidis, 2011). Also, the determinants of residential electricity consumption are more amenable to theorization and quantification (Dergiades and Tsoulfidis, 2011).

Due to these reasons, the residential sector is important for the contemplation of energy policy in an economy (Dergiades and Tsoulfidis, 2008).

The growing electricity consumption warrants attention since formulation of wrong policies would adversely affect economic growth (Chandran *et al*., 2010). Many economists believed that resource scarcity, signalled by price increase will stimulate technological progress. However, heavy electricity subsidy in developing countries like Malaysia distorts electricity markets and promotes over-consumption (Sovacool *et al*., 2011). Therefore, one of the most urgent tasks for the authorities is to develop effective, long-term energy policies (Fei *et al*., 2011). This prompted is needed more research into the electricity-economic growth nexus as it has important implications for electricity conservation measures (Adom, 2011). In response to the urgent need for effective, long-term energy policies, the goal of this paper is to highlight the electricity sector in Malaysia; the policies and strategies implemented thus far and their implications; and suggest policy recommendations.

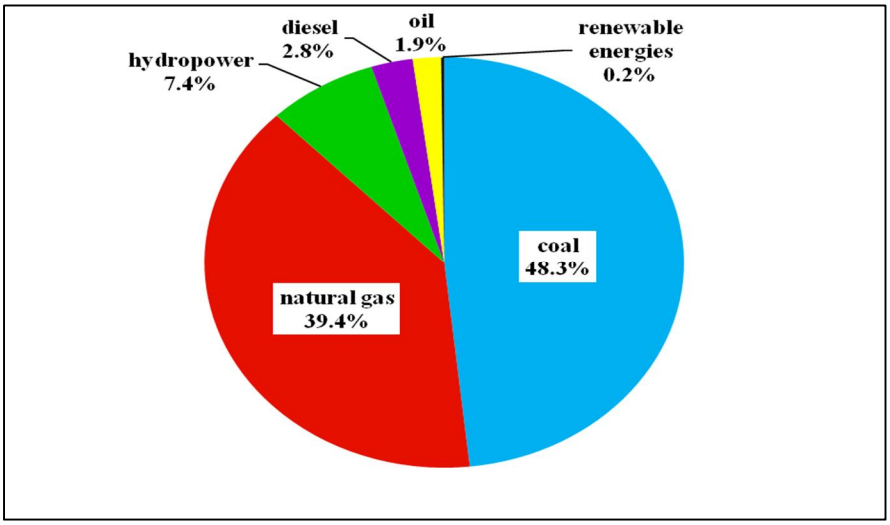
The rest of this paper is organized as follows. Section 2 presents the electricity sector in Malaysia. Section 3 reviews the energy policies and strategies in Malaysia. Section 4 evaluates the policies implications and finally, Section 5 discusses the conclusions and recommendations.

2. Electricity Sector in Malaysia

Malaysia electricity sector is a monopoly market whereby a utility company serve as the sole player in west Malaysia and each state in east Malaysia (Sabah and Sarawak). Tenaga Nasional Berhad (TNB) and its subsidiary Sabah Electricity Sdn. Bhd. (SESB) monopolise the electricity market in west Malaysia and Sabah respectively while Sarawak Energy Berhad (SEB) monopolise the electricity market in Sarawak. Although these companies monopolise the electricity market in Malaysia, they do not generate all the electricity needed but also purchase electricity from independent power producers (IPPs) via power purchase agreement (PPA).

Electricity is a secondary energy usually generated from fossil fuels, which are finite and not renewable. As these fossil fuels reserves continued to deplete, renewable and alternative energy resources were being explored. Malaysia is also diversifying its fuel mix to include more renewable energy in its fuel mix. Figure 1 shows the fuel mix for electricity generation in Malaysia in 2012. Electricity is mostly generated from coal (48.3%) followed by natural gas (39.4%), hydropower (7.4%), diesel (2.8%), oil (1.9%) and renewable energies (0.2%) (Malaysia Energy Commission, 2014b). The renewable energy power plants are powered by biomass, biogas, solid waste, solar, and mini hydro. Apparently, fossil fuels are still the major energy sources in power generation in Malaysia. Nevertheless, Malaysia targets to increase its renewable energy installed capacity from a mere 217MW in 2011 to 11.5GW by 2050. Such high target is believed to be achievable with the implementation of National Renewable Energy Policy (Ministry of Energy; Green Technology and Water, 2011b).

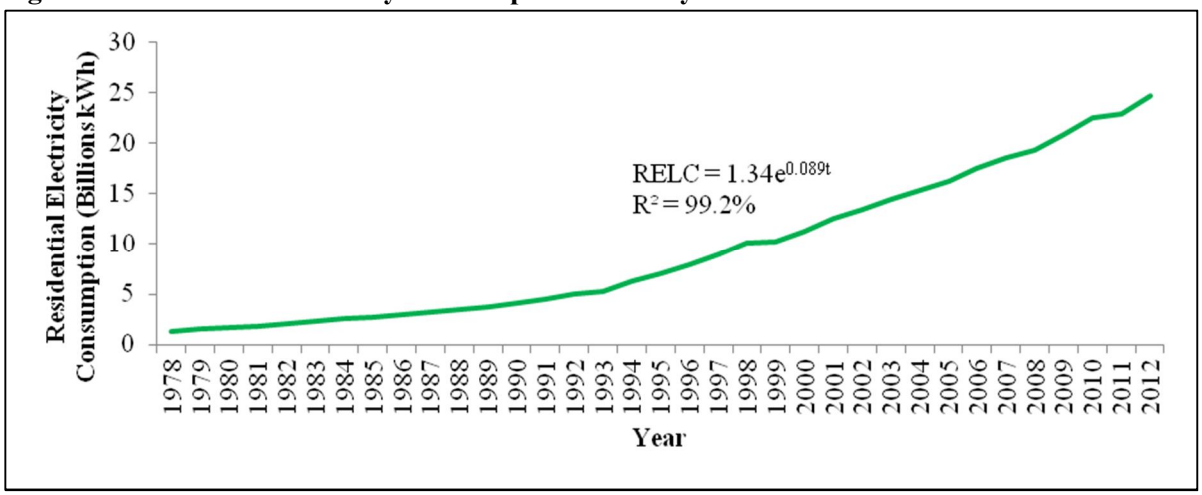
Figure 1. Fuel Mix for Electricity Generation in Malaysia



Source: National Energy Balance 2012.

The energy sector is an important sector because energy plays a key role in enabling economic growth (Stern, 2011). In Malaysia, energy consumption has increased over the years to meet the social and rapid economic activities (Indati and Bekhet, 2014). One of the main reason for the high growth rate of electricity consumption was due to the development of transport sector such as the railway system, particularly the light rail transit in Klang Valley and inter-city commuter train service (Bekhet and Othman, 2011). The transport sector recorded almost 200% increase in electricity consumption, from 58.15 million kWh in 2005 to 164.18 million kWh in 2006 and subsequently to 244.54 million kWh in 2012 (Malaysia Energy Commission, 2014b). Similarly, the electricity consumption in the residential sector is also increasing significantly as shown in Figure 2.

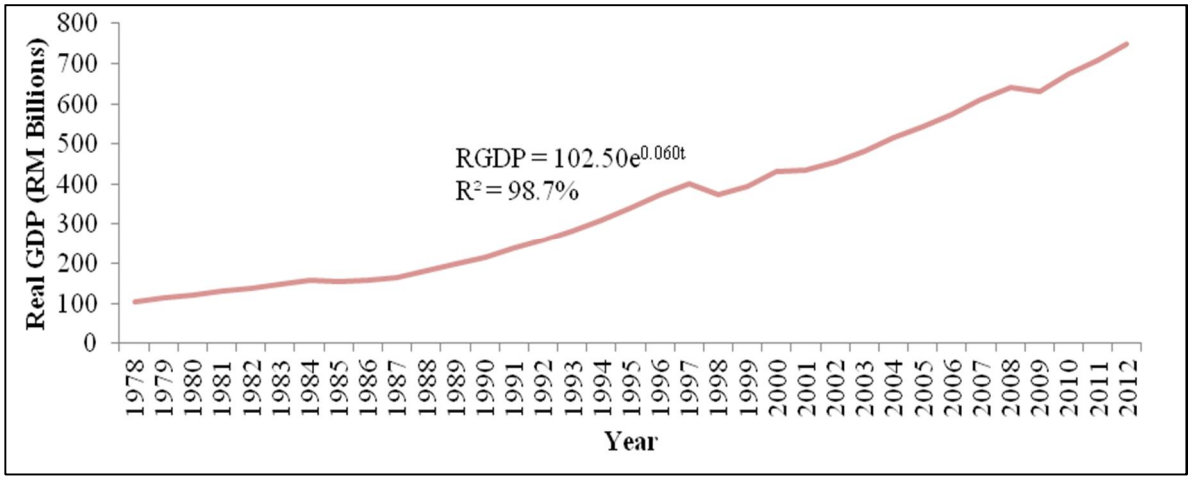
Figure 2. Residential Electricity Consumption in Malaysia.



Source: Malaysia Energy Commission (2014), Statistical database available at http://meih.st.gov.my.

From 1978 to 2012, the residential electricity consumption (RELC) increased rapidly from 1.28 billion kWh in 1978 to 24.73 billion kWh in 2012. This is equivalent to average annual growth rate of 8.9%, surpassing the real GDP growth rate of 6.0% for the same period (see Figure 3). If the growth rates pattern continues, it will pose a potential sustainability issue.

Figure 3. Real GDP in Malaysia



Source: The World Bank (2014), Statistical database available at http://data.worldbank.org/country/malaysia.

Past empirical studies had attempted to identify the factors affecting residential electricity consumption as well as the relationship between these factors with residential electricity consumption. Unconstrained by data limitations, empirical model of residential demand for electricity based on household production theory should be expressed as a function of own price, price of substitute source of energy, real income, price of household appliances and other factors that may influence household

preferences, such as temperature (Narayan *et al*., 2007). Obviously, price is an important factor affecting residential electricity consumption. Therefore, the Malaysian government employed pricing mechanism to control the residential electricity consumption in all the energy efficiency programmes in the residential sector (see Section 3).

3. Energy Policies and Strategies in Malaysia

Malaysia is a blessed country endowed with oil reserves. Nevertheless, these oil reserves need to be used carefully since they are finite and not renewable. Being cognizant of this, the Malaysian government implemented various energy policies and strategies since the early stage of energy sector development to manage and safeguard its oil reserves for better energy security. In the 70's, Malaysia experienced high economy growth via the expansion of the manufacturing and commercial sectors, particularly the development of power intensive industries such as steel, petro-chemical and cement, which results in the demand for power to increase by 13.5% per annum from 1971 to 1975 (Economic Planning Unit, 1975). Therefore, adequate and reliable supply of electricity was very important to meet the demand of these industries in order to keep the economy growing. This led to the introduction of the first National Energy Policy (1979). This policy was formulated with three broad objectives, namely supply objective, utilization objective and environment objective. Supply objective is to ensure adequate, secure and cost-effective supply of energy, while the utilization objective is to promote efficient utilization of energy and discourage wasteful and non-productive patterns of energy consumption, and finally the environmental objective is to minimise the negative environmental impact resulting from the electricity sector (Ministry of Energy; Water and Communications, 2005). Through this policy, Malaysia aimed to ensure an efficient, secure and environmentally sustainable supply of energy in the future.

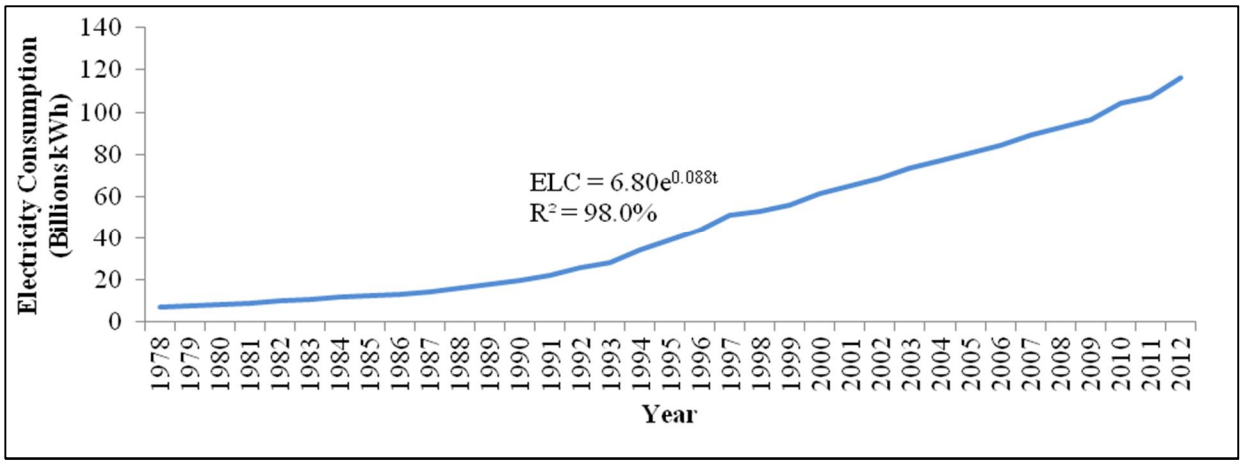
Subsequent to the introduction of National Energy Policy (1979), several energy policies were introduced, i.e. National Depletion Policy (1980), Four Fuel Diversification Policy (1981), Fifth Fuel Policy (2000) and National Renewable Energy Policy (2011). These policies were generally concerned with the depleting fossil fuels and energy security. However, these policies did not mention anything on energy efficiency despite energy efficiency is able to extend energy supplies, increase energy security, lower carbon emissions and generally supports sustainable economic growth (International Energy Agency, 2013b). Hence, the energy efficiency agenda is only addressed in National Energy Policy (1979). Although the vital role of energy efficiency in ensuring optimum use of energy and to prevent their rapid depletion was mentioned in the 7th Malaysian Plan (1996-2000); and energy efficiency programmes were subsequently intensified in the 8th Malaysian Plan (2001-2005) and 9th Malaysian Plan (2006-2010) with emphasis on the industrial and commercial sectors, the total electricity consumption continued to increase steadily (see Figure 4). Apparently, the total electricity consumption was not maintained at its initial level, let alone a decrease from its initial level, after the implementation of the various energy efficiency programmes mentioned in the 7th, 8th and 9th Malaysian Plan.

Given the fact that stand-alone energy efficiency programmes are not fruitful in the government's quest to achieve its energy efficiency goals, the government decided to develop the National Energy Efficiency Master Plan (NEEMP) within the 10th Malaysian Plan (2011-2015). NEEMP is envisaged to be a holistic implementation roadmap to drive efficiency measures across all sectors. Concurrent to the drafting and finalization of NEEMP, several energy efficiency programmes in the residential sector are implemented as discussed in the following sub-sections.

3.1 Tiered Electricity Tariffs Structure

In the 3rd Malaysian Plan (1976-1980), an electricity pricing policy was introduced to ensure the tariffs reflect the actual after-subsidy-costs of supplying power. The tariffs were structured so as to ensure that the poor have effective access to electricity. Consequent to the electricity pricing policy, Malaysia practices tiered electricity tariffs to date. With tiered electricity tariffs structure, the price of electricity for the first tier is way below the actual cost due to the heavy subsidy by the government. However, the subsidy is reduced gradually in higher tiers resulting in higher electricity prices in these tiers. The effect of tiered tariffs to consumers is that the average price per unit of electricity increases with consumption. This will deter over consumption and promote the practice of energy efficiency and conservation since a rise in energy prices will decrease residential energy consumption (Araghi and Barkhordari, 2012).

Figure 4. Electricity Consumption in Malaysia



Source: Malaysia Energy Commission (2014), Statistical database available at http://meih.st.gov.my.

3.2 Electricity Bills Rebate

To further encourage energy efficiency and conservation practices in the residential sector, the government announced rebate for household with monthly electricity bills equal or less than RM20 in October 2008 (Tenaga Nasional Berhad, 2013b). Realising that giving free electricity is counter-productive in encouraging prudent use of electricity, conditions was placed on the eligibility of the rebate i.e. the electricity consumption within a month must not exceed RM20. This means that if the monthly electricity bill is RM20 or below, they are exempted from paying the bill. However, if the monthly electricity bill is above RM20, they are required to pay the bill in full, not just the additional difference. Through this programme, it is envisaged that consumers will use electricity more prudently. On average, about one million households manage to keep their monthly electricity bills below RM20 (Sulaiman, 2013).

3.3 Sustainability Achieved Via Energy Efficiency (SAVE) Rebate Programme

One of the measures to reduce electricity consumption in the residential sector is promoting the diffusion of energy efficient appliances (Mizobuchi and Takeuchi, 2012). Although energy efficient appliances consume less energy, they are usually more expensive (Mcneil *et al*., 2008; Melo et al., 2010). The high initial investment in these energy efficient appliances is compared with the perceived amount of savings in return before the consumers decide to buy them. However, even if the return over investment is considered high enough, some people may not be able to invest because they cannot afford it (Zhao *et al*., 2012). In order to make energy efficient appliances more affordable, some countries offered financial incentives to ease the high initial cost of energy efficient products since early 1980's (Gadenne *et al*., 2011). In Malaysia, such financial incentive was given under the Sustainability Achieved Via Energy Efficiency (SAVE) Rebate Programme, which was launched on 7 July 2011 (Tenaga Nasional Berhad, 2013c). In this programme, each household is entitled for a rebate of RM200 and RM100 for the purchase of highly energy efficient refrigerator and air-conditioner, respectively. The aim of this programme was to instigate households to choose energy efficient appliances over the less efficient ones by using the rebate to reduce the price difference. Generally, consumer will prefer eco-friendly solutions if they do not cost anything extra or the price difference is small (Throne-Holst *et al*., 2008). Nevertheless, only limited number of such rebate can be given (Menanteau and Lefebvre, 2000). A total of 100,000 and 65,000 rebate vouchers were allocated for refrigerator and air-conditioner, respectively. These rebate vouchers were given on a first-come-first-served basis until all the rebate vouchers were exhausted. The rebate is given for the purchase of refrigerators and air-conditioners because they are the main electricity consuming appliances in a typical Malaysian household (Saidur *et al*., 2007).

3.4 Suria 1000 Programme

The introduction of the Fifth Fuel Policy in 2000 led to the development of renewable energy in Malaysia. On 22 June 2007, the Suria 1000 programme was launched. Under this programme, electricity customers can bid for price rebates on photovoltaic (PV) systems. The PV generation is traded on a net metering basis, whereby the PV owners only pay for the net amount between on-site

consumption and PV generation. The utility provider i.e. TNB will not make any payment to the PV owners if the PV generation is higher than the on-site consumption. Any excess of PV generation in a particular month will be carried forward to the transaction of the following month. Subsequent to this programme, the government introduced the Feed-in-Tariff (FiT) in 2011 to make PV more viable by guaranteeing access to the grid and setting a favourable price per unit of electricity generated from renewable sources such as PV (Ministry of Energy; Green Technology and Water, 2011a).

3.5 Goods and Services Tax (GST)

Besides using the incentive-based approach, the government is also embarking on the penalty-based approach to encourage prudent use of electricity. In the Budget 2014, government announced that goods and services tax (GST) of 6% will be chargeable to the 201st unit of electricity and above consumed by the residential sector in a month beginning 1 April 2015 (Ministry of Finance, 2013). The implementation of GST will result in higher cost of electricity to households that consume more than 200 units of electricity per month. Coupled with the tariff adjustment in 2014, the GST will amplify the additional cost for not using electricity carefully and give a greater push for consumer to save electricity.

4. Policy Implications

The Malaysian government had implemented various energy policies and strategies to achieve its energy goals. Although these policies and strategies might not fully achieve the intended goals, they definitely affected the energy sector as a whole in one way or another. Positive implication is always preferred compared to negative implication. This reiterates the importance of careful policy formulation to avoid negative policy implication.

Tiered electricity tariffs are practiced in Malaysia as well as in many other countries. The basic principle of the structure is to assign a higher price to higher consumption. Nevertheless, the difference between tiers should be significant for the policy to be effective. This is because minimal increase in the tariffs is not likely to make consumers to use electricity more cautiously, since those who consume a lot of electricity are usually the wealthier people with low price elasticity of electricity demand (Sun and Lin, 2013). The electricity tariffs rates had been adjusted from time to time due to the increased costs of electricity generation, transmission and distribution. The latest adjustment to the electricity tariffs rates, which took effect from 1 January 2014, sees an average increase of 10.6% to the domestic customers (Tenaga Nasional Berhad, 2013a). Prior to the latest adjustment to the electricity tariffs rates, the difference between each subsequent tier is very small, especially from the 4th tier onwards. For example, the difference between the 3rd and 4th tier is only RM0.002 per kWh, which is equivalent to a mere 0.5% increase. Although the government's decision to adjust the electricity tariffs rates effective beginning 1 January 2014 is a plausible move to make the purpose of having a tiered electricity tariffs structure more justified and effective in promoting energy efficiency and conservation, it suggested that the tariffs rates for the 3rd, 4th and 5th tiers to be increased further to make the difference between these tiers more significant. The high rates and significant increment of these tiers will deter overconsumption of electricity as well as to cross subsidise low rates of the 1st and 2nd tier. With such pricing mechanism the government can reduce the energy subsidy, which had been given for decades. Furthermore, those who use electricity wastefully should be penalised for their squanderer behaviour by charging high tariffs rates.

In Malaysia, there are about 7.32 million households but only 1.1 million households are enjoying the electricity bill rebate (Malaysia Energy Commission, 2014a; Sulaiman, 2013). This is equivalent to a mere 15% of the total households in Malaysia. The impact of this programme is still relatively small even if all the households enjoying this rebate are assumed to consume more than RM20 of electricity prior to this programme. Moreover, such assumption is very much unlikely because there are households already consuming less than RM20 of electricity prior to this programme. This means that the actual impact is way lesser. Obviously, this programme only managed to attract a small portion of the residential sector. Although the mechanism of this rebate is effective hypothetically, it should be noted that based on current domestic electricity tariffs, RM20 is equivalent to only 91.7kWh of electricity, which is too low to most households to support a normal lifestyle. This explains the reason for this policy to be effective only on a small portion of households. Alternatively, reduced rebate can be given to attract a larger portion of households to reduce their electricity consumption. Reduced rebate means the percentage of electricity bills waived decreases as the

consumption increases. Through reduced rebate, households in all consumption categories are always being offered with a higher rebate in return for using energy efficiently. Thus, this policy will not be limited to certain households but covers the entire residential sector.

It is undeniable that rebate incentives can catalyse the penetration of energy efficient appliances which consume less energy and ideally, this will reduce the overall energy consumption. Unfortunately, ideal scenarios are often impossible to achieve. This happens when the incentive results in rebound effects. The rebound effect denominates the situation when an energy efficiency programme does not bring about a reduction in energy demand or even results in an increase in energy demand (Linares and Labandeira, 2010). In the case of SAVE Rebate Programme, the rebound effect occurs if the incentive is used for additional purchases instead of replacement of existing inefficient appliances. Assuming that there is no rebound effect and every household owns a refrigerator and air-conditioner, the incentive given only causes 1.1% transition from inefficiency to efficiency because such incentive cannot be given in a large scale (Menanteau and Lefebvre, 2000). Therefore, it is suggested that this incentive with implemented along with measures to discourage additional purchases (Mizobuchi and Takeuchi, 2012).

The Suria 1000 programme was aimed at increasing the penetration of PV systems and there is no element on energy efficiency. Hence, it is not expected to reduce residential electricity consumption, even if the programme was successful. Moreover, under the Suria 1000 net-metering mechanism, owners of PV systems are not able to make any financial return on their investment of the PV systems even after the government has provided a subsidy of up to 70%, resulting in a low adoption of PV (Seng *et al*., 2008). Subsequent to the Suria 1000 programme, the FiT was introduced to serve as a catalyst in the growth of renewable energy, whereby the grid system operators are obliged to purchase, transmit and distribute the entire available quantity of electricity from renewable energy sources at a fixed FiT level (Tveten *et al*., 2013). Such mechanisms are necessary because electricity generation from renewable energy requires financial support and purchasing obligation in order to compete with those from classical energy sources such as coal and natural gas (Gözen, 2014). Generally, two generation metering strategies are used, namely gross and net metering (Ayompe and Duffy, 2013). Malaysia practices gross metering whereby the meter records the total electricity produced by the PV system. Although such system may be useful in safeguarding energy security and protection of the environment via the use of renewable energy, it may not reduce electricity consumption since all electricity generated from renewable sources is sold to the grid at premium prices regardless of the consumption. Therefore, it is suggested that FiT is implemented using net metering mechanism, whereby the meter records the difference between the total amount of electricity produced by the PV system and the portion that is used on-site. When the output power from the PV system is more than that consumed on-site, the excess is exported to the grid at premium FiT prices. This means that the PV owner will only get paid if the PV generation is higher than the on-site consumption. Consequently, households with PV system installed on their rooftops will be incentivised to reduce their electricity consumption.

5. Conclusion and Recommendations

Malaysia is very lucky to be blessed with oil reserves. However, this does not permit Malaysians to consume energy carelessly because these oil reserves will be exhausted eventually. In order to reduce the depletion rate of these reserves, the Malaysian government had implemented various policies and strategies to exploit the use of renewable energy and energy efficiency. This paper highlights and reviews the energy policies and strategies implemented by the government. Policy improvement strategies are also suggested and discussed. The government should review its policies and strategies from time to time so that appropriate amendments can be made to these policies and strategies to ensure that they remain relevant and effective. Any new policy and strategy need to be studied carefully and thoroughly before being implemented because inappropriate policies and strategies will affect the economy adversely.

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