The Economics of Energy Label in The Consumer Market in Malaysia

Mahirah Kamaludin and Muhd Azrin Shah
Faculty of Business, Economics and Social Development
Universiti Malaysia Terengganu
21030 Kuala Nerus, Terengganu, Malaysia
mahirah.k@umt.edu.my, azrinshahrazali@gmail.com

Abstract

Energy efficiency labels are commonly used tools to reduce the energy uses for household appliances for many countries around the world. The energy label targets to fight climate change, protect the environment, and supports Sustainable Development Goals (SDGs). This paper demonstrates the implementations and developments of energy label in Malaysia. Energy label entails the continuous and prolonged efforts and insights towards finding a balance between social welfare, economic development, and environmental impact. In addition, energy label information and the opinions of people around as external factors are also affecting the purchase intention. Interestingly, the energy consumption growth remained below the GDP growth rate. It is an effective approach to reduce greenhouse gas emissions, save consumers' electricity bills in the long run and reduce the dependence on fossil fuel. Through energy label, companies are encouraged to develop and invest in energy-efficient product design. The Energy Commission (EC) issued energy label to manufactures that fulfil energy performance tests, standards, and requirements started development of implementation energy label in Malaysia. The main goal of energy label is to enable consumers to choose products that consume less energy and save money. Additionally, energy label is among several initiatives implemented by the government to support energy efficiency agenda in Malaysia. Furthermore, a great sense of accountability demonstrated with energy label will influence the private and public sectors to adopt energy-efficient behavior when making decisions. This study offers implication of energy label from the sides of policy makers, and consumers, whereas the implementation of the label in the country is significant to support the SDGs.

Keywords
Appliance, energy efficient, energy label, energy saving, Malaysia

1. Introduction

Malaysia is a developing country with growing population and prospering economic activities. The country's manufacturing sector is the key driver behind the rising demand of energy supplies. The growing energy demand is tallied with the electricity energy demand through the process of industrialization. Fossil fuel is the main source of electricity generation in Malaysia which, unfortunately is also the major contributor in greenhouse gas emission (Ashnani et al. 2014). Malaysia continues to experience a strong growth of energy supply and demand in 2018 despite its sluggish economy. The total of primary energy supply recorded an increase of 1.6% to settle at 99,873 ktoe while the final energy consumption continues to grow by 3.5% to register at 64,658 ktoe. Interestingly, the energy consumption growth remained below the GDP growth rate. On the other hand, the final energy elasticity (formulated as the growth rate of final energy consumption divided by the GDP growth rate) was reported at 0.73 in 2018 compared to 1.58 in 2017, indicating Malaysia's ability to generate economy with less energy consumption (National Energy Balance 2019). The disparity ratio between energy demand and GDP reveals that more energy-intensive economic activities are pushing the growth trend and stimulating the efficient use of energy in Malaysia.

In regard to this, the Eleventh Malaysia Plan has strengthened the increasing share of renewable energy mix through the discovery of new renewable energy (RE) sources e.g., geothermal, wind and ocean. Figure 1 exhibits RE capacity

which is expected to achieve 2,080MW by 2020, providing a total of 7.8% installed capacity in Peninsular Malaysia and Sabah to slowly reduce the dependency on non-renewable energy.

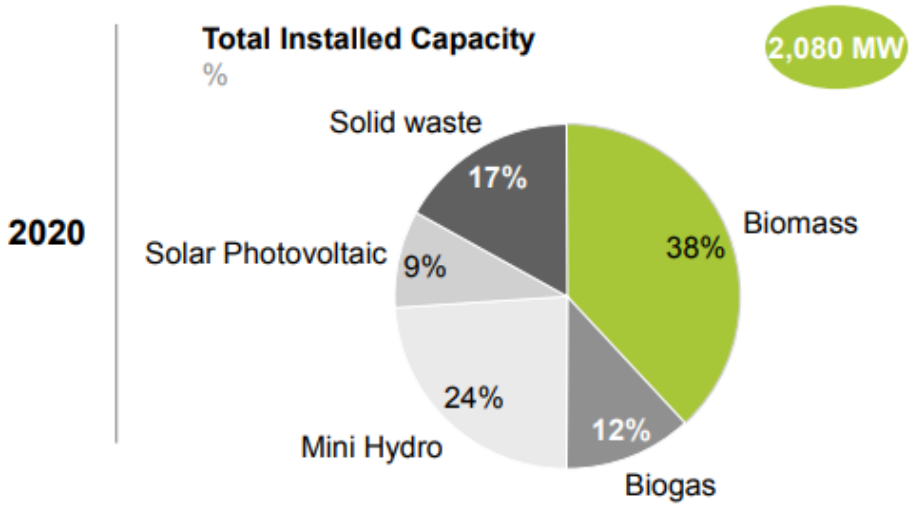

Figure 1: Renewable energy mix in 2020
Source: Sustainable Energy Development Authority (SEDA) Malaysia, Economic Planning Unit

Moreover, the National Energy Efficiency Action Plan (NEEAP) demonstrates a strategy for a well-coordinated and cost-effective implementation of energy efficiency measures in the industrial, commercial, and residential sectors which manage to reduce energy consumption and economic saving for the consumers and the nation. The plan is targeted to encourage energy efficiency, increase people's welfare, and attain sustainable development.

Additionally, energy label is among several initiatives implemented by the government to support energy efficiency agenda in Malaysia. Energy label allows consumers to select appliances that consume less energy and therefore save money. It is an effective approach to reduce greenhouse gas emissions, save consumers' electricity bills in the long run and reduce the dependence on fossil fuel. The label urges businesses to create and invest in inventing energy-efficient products. Dirk and Nils (2010) stated that energy label serves as an additional measure to increase the transparency of the real estate sector's energy use. Furthermore, a great sense of accountability demonstrated using energy label will influence the private and public sectors to adopt energy-efficient behaviour when making decisions.

It is complex to determine whether a product is a good investment just by seeing the price tag. Consumers should estimate the cost of ownership, for instance how much the product will cost to become energy efficient. Consumers should also compare, decide, and obtain accurate and sufficient information on energy efficiency by studying product label to suit their needs and budget. Energy-efficient appliances are frequently perceived as "better in value" as the consumers can save energy and money. Energy-efficient appliances consume less electricity to attain the same level of performance as similar models with the same size or capacity. In other word, the more energy-efficient a product is, the less energy it will consume and the less it will cost to function. There are lots of electrical goods at homes that drain a lot of energy that most consumers do not even know about. If the consumers can discover which appliances are liable for electricity drainage and compare the cost of electricity, then they can save a huge amount of money. Therefore, selecting energy-efficient appliances will help consumers to save money on electricity bills.

2. Literature Review

Energy label has existed since the first energy crisis in the mid-1970s. France mandated labels for various appliances in 1976, and Japan, Canada and the United States followed soon after (Wiel and McMahon 2005). The previous studies showed that energy labelling has already been implemented in household appliances in more than 50 countries globally before voluntary and mandatory environmental or energy certification schemes were gradually introduced in the early 1990s (Wong and Krüger 2017).

The Energy Policy and Conservation Act of 1975 mandated labels for certain appliances beginning in 1980. Changes to the labelling program were made in the Energy Policy Act of 1992, which gave rise to the EnergyGuide label in its current form in the United States. Therefore, energy labelling has become more common in marketplaces around the world and offers considerable promise for reducing the financial costs and environmental damages associated with energy use (Gerarden et al. 2017). The standardization and process of energy label have also created awareness among consumers on how to use energy efficiently. At present, two label labels used by different countries are endorsement label and comparative label. First, endorsement label is the certificate of lower energy consumption and second, comparative label facilitates the product comparison based on electricity consumption. Endorsement label, such as ENERGY STAR, is commonly used in electronic appliances and complements the comparative label for large appliances. There are two types of formats, linear and categorical, in comparative label.

Meanwhile, Harrington et al. (2014) discussed the label design in 45 countries, of which 41 countries have implemented categorical label. In categorical label, the categories are presented in different formats such as bars and stars (Rohling and Schubert 2013). The categories also use different terms, for instance, class in Europe, rank or tier in China, grade in Korea and star rating in Australia, India, and Malaysia. The major barrier to acceptance of energy-efficient products in most countries is the lack of consumer information on techniques or innovation, as well as energy efficiency benefits from the perspective of economy (UNDP 2006). In this case, Shahnaei (2012) supported the idea coined by Rogers (2003) who posited that low level of acceptance for green innovation product occurs due to the lack of knowledge and awareness on the innovation itself, the primary reason for consumers in the developing countries in terms of green purchases. It was found that the process of acceptance of innovation products involves several cognitive stages beginning with knowledge, persuasion or assessment, decision, implementation, and confirmation. Knowledge exists due to socio-economics, personality, behaviour and communication reasons. It is the basic step and foundation that helps individuals in the decision-making process to accept or reject innovation.

Mahlia and Saidur (2010) believed the main purpose of introducing energy label is to enable consumers to take into account of the operating energy cost of an appliance and to minimise the total life cycle cost of the appliance whichever possible. One of the information provided on energy label is energy consumption which is about how much electricity a model uses. Buyers can refer to the numbers that represent the kilowatts of annual consumption which vary according to the capacity of the appliance models. An appliance with lower energy consumption helps consumers to save their electricity bill.

2.1 Development of Implementation Energy Label in Malaysia

In Malaysia, the Energy Commission (EC) issues energy label to manufactures that fulfil energy performance tests, standards, and requirements. Figure 2 shows the label has been marketed since 2009 and entirely applied in 2013. It illustrates the estimated energy consumption of electrical appliances according to a star rating system i.e., 5-star is the most efficient and 1-star is the least efficient. Consumers refer to the star rating system to determine how much electricity (kWh) an appliance generates. To date, seven household appliances are mandatory to use the label i.e. refrigerator, television, air-conditioner, microwave, rice cooker, fan and washing machine. This labelling is planned to be extended for more electrical appliances in the future.

Figure 2: Comparative label

Consumers can obtain good information about energy use through star rating system as it is easy to be distinguished i.e. 1-star is the least efficient and 5-star is most efficient. The Electricity Regulation 1994 (Amendments 2013) Regulation 101A (3) stated that "any equipment that meets all the requirements of efficient use of electricity must be affixed with an efficiency rating label" (Attorney General's Chambers 2013). The amendment was known as Electricity (Amendment) Regulations 2013 that incorporates the standards and requirements for the implementation and enforcement of the minimum energy performance standard (MEPS) for five domestic electrical equipment i.e., refrigerator, air-conditioner, television, domestic fan, and lighting.

MEPS specifies the minimum level of energy performance that electrical appliances must meet or exceed. Therefore, all manufacturers and importers of these electrical appliances must affix the energy label onto products before they can be sold in the market. Energy label system is a good way to promote sustainable energy consumption to consumers. It contains information about energy rating, appliance type, appliance energy rating, energy consumption, energy savings compared to the lowest 2-star rated product, and the testing standards used. The mechanism of approval is through the issuance of the certificate of approval (COA) issued by Energy Commission.

All manufacturers and importers of refrigerator, television, domestic fan, air conditioner and washing machine must affix the energy label onto the products before these products can be sold and follow the correct font specification, colour specification and must have 2-star rating until 5-star rating.

Figure 3: Previous version of energy label in Malaysia

Figure 3 illustrates the previous star rating energy label in Malaysia that indicates higher star rating product is relatively better in energy saving over the period of one year. Moreover, for those who like to compare products side-by-side, the label highlights how much energy a product consumes based on the star rating system. In 2020, Energy Commission has improved the energy label by adding more information such as COA number, year of rating revise and QR code to help consumers obtain the right information and make the right purchasing decision. The new label is shown in Figure 4 below.

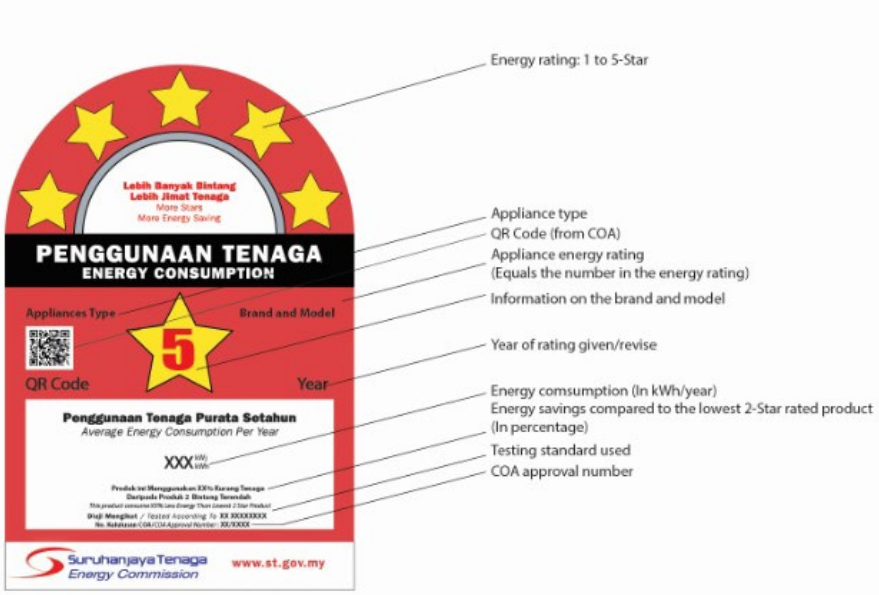

Figure 4: New version of energy label in Malaysia

2.2 Requirement for Labelling in Malaysia

In Malaysia, it is compulsory for electrical appliances such as television, refrigerator, domestic fan, and air-conditioner to attach energy label before it can be sold in the market. Manufacturers and importers that have attained COA must print out the label by referring to Energy Commission guidelines (Energy Commission 2018). For example, refrigerator has the highest energy consumption in a household as it is used for 24 hours. Hence, according to Energy Commission (2018) assuming the size of a refrigerator with energy label is 300L-400L, the electricity price can be determined using the following simple equation;

$$\text{Energy cost} = (\text{Average energy consumption})\ (\text{Average tariff})$$

Energy label helps the consumers to estimate the operational cost of electrical appliances before making purchases. In the Peninsular Malaysia, a private, government-linked company, Tenaga Nasional Berhad where in Table 1 illustrates the tariff for domestic consumers is charged differently according to total kilowatt usage per hour (kWh), supplies electricity.

Table 1: Current domestic tariff in Malaysia

Tariff category	Current rate since 1st January 2018
Tariff A: Domestic tariff	
The first 200 kWh (1-200 kWh) per month	0.218
For the next 100 kWh (201-300 kWh) per month	0.334
For the next 300 kWh (301-600 kWh) per month	0.516
For the next 300 kWh (601-900 kWh) per month	0.546
For the next kWh (900 kWh onwards) per month	0.571
The minimum monthly charge is RM3	

Source: Tenaga Nasional Berhad (2021)

The number of stars given indicates how efficient an electrical appliance is—the higher the better. For instance, Table 2 shows the estimate of electricity costs for annual consumption of a refrigerator. Refrigerator with 5-star label is most energy-efficient at 39.75% compared to 2-star label at -14.83% (no saving at all).

Table 2: Calculation of estimated electricity cost

	Average energy consumption (kWh/year)	Tariff	Estimated electricity bill (AEC x tariff)	Saving percentage (%)
	562	= (200 x 0.218) + (100 x 0.334) + (262 x 0.516)	RM212.192	-14.83
	529	= (200 x 0.218) + (100 x 0.334) + (229 x 0.516)	RM195.164	8.59
	467	= (200 x 0.218) + (100 x 0.334) + (167 x 0.516)	RM163.172	21.35
	416	= (200 x 0.218) + (100 x 0.334) + (116 x 0.516)	RM136.856	39.75

Source: Energy Commission Malaysia (2020)

Next, the following equation shows how to obtain the percentage of annual energy saving of a refrigerator compared to the lowest 2-star model.

$$\text{Percentage of energy saving compared to the lowest 2-star model} = 100\% - \left(100 \times \frac{0.0016\,x\,(screen\ Area,cm2)+8.8}{EEF\ Tested}\right)$$

Where EEF_{Tested} can be obtained from the test report.

2.3 Implication for Policy Makers

The government has mandated for electrical appliances to be labelled with energy star rating to give consumers the idea of how much each product costs them in the long run such as the electricity bill. Many examples from different countries around the world have shown that different stages of development will bring different impacts to resource efficiency across various sectors and economic activities. Therefore, the main challenge for policymakers is to keep improving and scale up the good manufacturing practices, as well as to conceive and implement a set of transformative policies suitable to countries' specific circumstances.

Energy efficiency reduces energy costs and helps people save money. Likewise, small business owners across the country want to do their part in the national effort to fight climate change. For instance, Canada recognizes that small- and medium-sized businesses are the backbone of the economy, hence the government reduces their business tax rate to 9%, making it the lowest among G7 countries (United States, France, Germany, Italy, Japan, United Kingdom and Canada).

In relation to this, Malaysia has also given small- and medium-sized businesses some incentives to reduce pollution, save energy and boost business productivity. In the future, the government may want to organize more energy label programs to create more awareness about energy efficiency, money saving and the necessary actions to reduce environmental damages. Through energy label, companies are encouraged to develop and invest in energy-efficient product design (Ottawa 2019). Finally, Wiel and McMahon (2003) believed that a well-designed energy label and standard can reduce the unnecessary electricity and fuel consumption by household appliances. This enhances a country's economic efficiency by reducing capital investment in energy supply infrastructure.

2.4 Implication for Consumers

Electricity cost at home relies on the hours of usage, consumption pattern, family size, quantity, and age of appliances. Electricity bills definitely put a hole in the wallet, for people probably paying far more than their needs if they use inefficient appliances. Selecting the right energy-efficient products is important for the consumers because they want to use the products for a long term. The main goal of energy label is to enable them to choose products that consume less energy and save money. Consumers will take into account how much an appliance will cost to run when deciding which model to buy. At the same time, this provides an opportunity for the public sector to enhance consumer welfare by lowering the energy bills.

Consumers' willingness to pay for energy-efficient appliances is influenced by their own moral constraints (personal norms). In addition, energy label information and the opinions of people around (subjective norms) as external factors also affect the purchase intention. On the other hand, energy label can guide residents to purchase energy-efficient home appliances and have the utmost impact on residents' intention. Consumers' willingness to read the label information when purchasing home appliances may also promote their purchase of energy-saving products. Next, Wang et al. (2019) stated that consumers will pay more attention to their own economic interest when choosing products. If labels can intuitively express to consumers that choosing energy-saving products can save their electricity costs, it is more likely to stimulate their willingness to purchase. Additionally, the purpose of energy label is to reduce the information asymmetry and information cost to consumers.

3. Conclusion

Energy label entails the continuous and prolonged efforts and insights towards finding a balance between social welfare, economic development, and environmental impact. Consumers' knowledge on energy label posits a significant role in lessening the global carbon emissions. Mismatching information between sellers and buyers may hinder the objectives of energy label and to decide what is best in making purchasing decisions. Sellers should be able to create value, have extensive knowledge about electrical appliances and understand and certain brands' capabilities. Meanwhile, buyers expect the sellers to cater their unique needs. Thus, the unique information about number of energy stars stated on the label can give a clear picture about energy-efficient appliances. This can assist the consumers to gauge which models or brands of electrical appliances consume a lot of electricity. And they can make plan for their budget before purchase the appliances. In addition, the energy label targets to fight climate change, protect the environment and able to achieve Sustainable Development Goals (SDGs) 7, 12 and 13. The implementation of energy label on selected household appliances should be comprised and supported by the citizens to ensure the energy-saving agendas are achieved. Furthermore, the government has portrayed its effort in promoting energy efficiency as stated in 12th Malaysia Plan which is focusing on energy efficiency and conservation to regulate energy consumption. Cooperation between both parties is effective if the main objective of energy efficiency can be achieved and can reduce the environmental impacts.

Acknowledgements

We would like to thank the Ministry of Higher Education, Malaysia (MOHE) for supporting this research under Fundamental Research Grant Scheme, with reference no. FRGS/1/2019/SS08/UMT/03/1.

References

Ashnani, M. H. M., Johari, A., Hashim, H. and Hasani, E., A source of renewable energy in Malaysia, why biodiesel?, *Renewable and Sustainable Energy Reviews*, vol. 35, pp. 244-257, 2014.

Dirk Brounen and Nils Kok, On the Economics of Energy Labels in the Housing Market, *Journal of Environmental Economics and Management,* vol. 62, no. 2, pp. 166-179, 2010.
Gerarden, T. D., Newell, R. G. and Stavins, R. N., Assessing the energy-efficiency gap, *Journal of Economic Literature*, vol. 55, no. 4, pp. 1486-1525, 2017.
Harrington, L., Brown, J. and Caithness, M., Energy standards and labelling programs throughout the world in 2013, *Report commissioned by department of industry, Australia,* 2014.
Mahlia, T. M. I. and Saidur, R., A review on test procedure, energy efficiency standards and energy labels for room air conditioners and refrigerator–freezers, *Renewable and Sustainable Energy Reviews*, vol. 14, no. 7, pp. 1888-1900, 2010.
Ottawa, Ontario., Canada to help small businesses invest in energy-saving equipment and retrofits, Available: https://www.canada.ca/en/environment-climate-change/news/2019/05/canada-to-help-small-businesses-invest-in-energy-saving-equipment-and-retrofits.html, May 30, 2019.
Rogers, E., *Diffusion of Innovations*, 5th edition, Free Press, New York, NY, 2003.
Rohling, M. and Schubert, R., Energy labels for household appliances and their disclosure format: A literature review, *Institute for Environmental Decisions (IED), ETH Zurich, www. ied. ethz. ch/pub/pdf/IED_WP21_Rohling_Schubert. Pdf,* 2013.
Shahnaei, S., The impact of individual differences on green purchasing of Malaysian consumers, *International Journal of Business and Social Science,* vol. 3(16), 2012.
Suruhanjaya Tenaga, National Energy Balance 2019, Available: https://www.st.gov.my/en/contents/files/download/111/National_Energy_Balance_2019.pdf/, 2019.
Suruhanjaya Tenaga, Guideline for Approval of Electrical Equipment (Electricity Regulations 1994) 6th Edition, Available: https://www.st.gov.my/en/contents/files/download/158/Guidelines_for_the_Approval_of_Electrical_Equipment_2018.pdf/, 2018.
Sustainable Energy Development Authority, Energy Audit Conditional Grant for Commercial (2021), Available: http://www.seda.gov.my/energy-demand-management-edm/energy-audit-conditional-grant-commercial-building/, 2020.
Wang, Z., Sun, Q., Wang, B. and Zhang, B., Purchasing intentions of Chinese consumers on energy-efficient appliances: Is the energy efficiency label effective?, *Journal of Cleaner Production*, 238, 117896, 2019.
Wiel, S. and McMahon, J. E., *Energy-Efficiency Labels and Standards: A Guidebook for Appliances, Equipment, and Lighting* (No. LBNL-45387-2nd-Edition; LBNL-45387). Ernest Orlando Lawrence Berkeley National Laboratory, Berkeley, CA (US), 2005.
Wiel, S. and McMahon, J. E., Governments should implement energy-efficiency standards and labels—cautiously. *Energy Policy,* vol. 31(13), pp. 1403-1415, 2003.
Wong, L. and Krüger, E., Comparing energy efficiency labelling systems in the EU and Brazil: Implications, challenges, barriers and opportunities, *Energy Policy*, vol. 109, pp. 310-323, 2017.

Biographies

Mahirah Kamaludin, Ph.D. is currently as an Associate Professor at the Faculty of Business, Economics and Social Development, Universiti Malaysia Terengganu. Currently, she serves as Head of Program for Bachelor of Economics at the faculty. She obtained a PhD in Natural Resources Development and Policy from Universiti Putra Malaysia, Serdang, Malaysia in 2013. Her research interests include economic valuation, non-market valuation, energy economics, environmental and natural resources economics, sustainability, and conservation of endangered species. She has produced a significant number of academic journals in the area of environmental and natural resource economics published by Web of Science, Scopus and MyCite journals. She is a committee member of Malaysia Environmental Economics Association (MEEA) from 2016 until present. She joins several associations related to Environmental Economics such as the Economy and Environment Partnership for Southeast Asia (EEPSEA Partnership), the South Asian Network for Development and Environmental Economics (SANDEE), the International Society for Ecological Economics (ISEE), and the Asian Association of Environmental and Resource Economics (AAERE).

Muhd Azrin Shah received his Bachelor of Economics from Universiti Malaysia Terengganu. At present, he pursues Master of Science (Economics) at Universiti Malaysia Terengganu. He serves as Graduate Research Assistant (GRA) throughout his Master study and actively writes papers with his supervisor.