

An Exploratory Study on Students' Electricity Consumption in RCE Gombak For Sustainable Communities

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ABSTRACT

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KEYWORDS:

Energy efficiency
Sustainable cities
Awareness
Climate Change

CITATION:

Lee, P. M., Yang, C. C., & Kwong, W. C.
(2023). An Exploratory Study on Students' Electricity Consumption in RCE Gombak For Sustainable Communities. *Malaysian Journal of Social Sciences and Humanities (MJSSH)*, 8(3), e002170.
<https://doi.org/10.47405/mjssh.v8i3.2170>

Rising energy demand in Malaysia has become an increasing concern. Malaysia uses more energy to produce a unit of GDP over time; when more energy is needed to create an output of similar value, this impacts the overall cost of production and may contribute to increased environmental degradation. In line with SDG 11: Sustainable Cities and Communities and SDG 12: Responsible Consumption and Production, this study aims to understand the electricity consumption of students and their knowledge of energy efficiency. The study was conducted at *Sekolah Berasrama Penuh Integrasi Gombak* in the year 2022. A questionnaire was distributed to the students containing questions about basic knowledge of climate change and energy efficiency. The survey also contained questions to gauge the students' electricity consumption behaviour. Some of the questions were formulated based on Malaysia's National Energy Efficiency Action Plan 2016-2025. The purpose is to discover to what extent secondary school students are aware of government initiatives to reduce energy consumption.

Contribution/Originality: This study contributes to existing literature about the electricity consumption behaviour of school children and their understanding of energy efficiency. The findings provide valuable insights for policy makers to better grasp the level of school children's understanding of different government initiatives to promote energy efficiency that may allow policy makers to make relevant adjustments to existing measures and strategies.

1. Introduction

Energy has become an inextricable part of human life. Energy is needed to power industrial plants, machines or vehicles, to light up buildings, to heat homes, and to serve

many other purposes. Therefore, sufficient energy supply is crucial for economic development and to improve human well-being. Yet the surge in global demand on energy has put great pressure on energy supply. According to the 2014 World Energy Outlook Report, it is estimated that by 2040 the world's energy demand would increase by 37% ([International Energy Agency, 2014](#)). The report also outlined fears that existing energy supply could not meet the growing demand because of several problems: 1) political volatility in the oil-rich Middle East; 2) the high cost of developing alternative energy sources to oil such as nuclear energy, and; 3) war.

As the conflict between Ukraine and Russia persists, energy security has become a primary concern for countries around the globe. Russia is one of the world's largest oil and gas producers, exporting about 4.5% of the global share of crude in 2021 ([Cahill, 2022](#)). The Russian invasion of Ukraine has disrupted oil and gas supply worldwide. Many countries responded to Russian aggression by sanctioning Russian oil, sending prices up, and increasing the costs of other commodities. Consequently, many countries are facing high inflation and energy security issues. European countries in particular have relied heavily on imports of Russian oil and gas, and the invasion of Ukraine prompted European countries to seek alternatives to replace Russian fuel ([Flanagan et. al, 2022](#)). As a result, some EU countries pushed for a faster transition to clean energy to reduce EU reliance on energy imports.

The richer countries, such as those that comprise the EU, are in a better position to transition much more quickly to domestically produced clean energy to cushion the impact of oil price volatility. In Malaysia, one of Southeast Asia's largest oil and gas producers, consumers mainly rely on petroleum and other liquids, along with natural gas (37% and 36%) ([U.S. Energy Information and Administration, 2021](#)). As such, the increase in oil prices due to the war in Ukraine has squeezed consumer spending and led to a higher cost of living. Though the government has provided fuel and cooking oil subsidies, B40, M40, and small businesses are still very much affected because higher oil prices drive inflation ([Dhesi, 2022](#)). While rising oil prices have increased Malaysia's government revenues (Malaysia is an oil exporter), the money spent on subsidies offset the greater revenues generated by selling oil. Even more problematic, the subsidies channelled to fuel were wasted because of excessive and unnecessary consumption. Maintaining the energy subsidies is therefore not a sustainable long-term solution for the Malaysian government. One feasible solution would be to minimise wastage and use energy efficiently.

From a broader perspective, reducing energy demand would help in tackling climate change. Malaysia predominantly relies on fossil fuels to generate electricity, and the burning of fossil fuels emits greenhouse gasses which contribute to global warming. Malaysians experienced stark reminders of the effects of climate change in 2021 and 2022. Though flood incidents are historically not uncommon for some states in Malaysia, the floods in 2021 and 2022 were unusual as peninsular states have not typically been prone to flooding. Considering how severe and widespread the flood was, with more than 50 deaths, climate change expert Dr. Renard Siew noted how Malaysia was experiencing the effects of climate change, and that the government needs to do more to protect the environment ([Zainal, 2022](#); [Taylor, 2022](#)). Climate change is, of course, a global problem. As such, reducing consumption of fossil fuels is essential not only for Malaysia but also for the entire world. Improving energy efficiency or eliminating energy waste is one of the most viable ways to relieve pressure on the energy supply that can be

undertaken by all countries so that everyone can have access to affordable, reliable, and sustainable energy (SDG 7).

2. Literature Review

2.1. The concept of energy efficiency

Scientifically, energy efficiency can be indicated in terms of thermodynamic, physical-thermodynamic, economic-thermodynamic, and pure economic indicators ([Patterson, 1996](#)). In a broad sense, energy efficiency can be defined as the ratio below:

$$\text{Energy Efficiency} = (\text{Usable output from a process})/(\text{Energy input to a process})$$

In the area of thermodynamics, energy efficiency indicates measurements derived from thermodynamics concepts. Physical-thermodynamics refers to a hybrid energy efficiency indicator whereby energy input measurement derives from the thermodynamic unit and the output is measured in the physical unit. Economic-thermodynamics also refers to a hybrid energy efficiency indicator. The energy input measurement is similar to previous thermodynamic units, however the output is measured in terms of market prices. Pure economics indicators are where energy efficiency indicates market values in monetary terms. This means that both the energy input and output are computed in monetary terms ([Patterson, 1996](#)). Regardless of how it is measured, energy efficiency is achieved through the use of technology that requires less energy to perform the same function.

2.2. National Energy Efficiency Action Plan

Many countries across the globe are formulating their own policy-led responses to promote energy efficiency. For the European Union, the plan started in 2006 when the Energy Service Directive (Directive 2006/32) required all EU member states to come up with their own National Energy Efficiency Plans. In the plan, member states had to detail how they planned to achieve a 9% energy efficiency improvement by 2016 ([European Commission, 2020](#)). Accordingly, all member states were required to implement policy measures that improved energy efficiency.

Neighbouring countries such as Thailand also came up with their own Energy Efficiency Development Plan in 2011 ([Thailand Ministry of Energy, 2011](#)). This is a long-term plan with a 20-year timeframe which is guided by five strategic approaches. Of all the approaches listed, raising public awareness and encouraging behavioural change are essential to ensure voluntary participation by the wider public to reduce energy consumption. This is done by providing knowledge to the general public via educational institutions and other activities that can create awareness.

The Malaysian government has introduced energy policies in the past, for instance the National Energy Policy 1979, Four Fuel Diversification Policy 1981, and Five Fuel Diversification Policy 2000 ([Jalal & Bodger, 2009](#)). However, the primary aim of these policies was not to reduce energy demand but simply to reduce over-reliance on oil as the primary source of electricity generation. Moreover, as these policies were introduced and implemented by several different ministries and agencies, the effectiveness of these policies were questionable as the projects were often short-term ([Rahman, Kamaruzzaman & Akashah, 2019](#)).

Due to the lack of a clear national framework, Malaysia came up with its own National Energy Efficiency Action Plan 2016-2025. The plan aims to “Promote energy efficiency to ensure productivity use of energy and minimise waste in order to contribute to sustainable development and increased welfare and competitiveness” (Ministry of Energy, Green Technology and Water [KeTTHA], 2016, p. 6). The four principles guiding the plan are: 1) Sustainable Development; 2) Efficient Use of Energy; 3) Increase Competitiveness and Welfare; and 4) Concerted Participation, all of which are aimed at achieving energy efficiency (Ministry of Energy, Green Technology and Water [KeTTHA], 2016).

According to the cost-benefit analysis conducted by KeTTHA, it is expected that every RM1 spent on the plan will deliver a RM2.90 economic benefit (Ministry of Energy, Green Technology and Water [KeTTHA], 2016). Moreover, the report found that greater savings will be realised in later years compared to the plan’s initial stage. This means that the benefits of energy efficiency will become increasingly evident in the long run. This action plan is deemed important because it not only aims to reduce the energy consumption of residential users but also to encourage industries to adopt more energy-efficient technologies that can boost their competitiveness. The money saved from subsidising electricity consumption could be redirected to other priorities, such as alleviating poverty.

Clearly, plans to conserve energy have been adopted by many countries as the benefits greatly outweigh the costs of the initial investment, especially in the long run. Securing the proactive and voluntary participation of the public in energy efficiency efforts is an especially effective strategy (Slupik, Kos-Łabędowicz & Trzęsiok, 2021). Ng, Abdul Shakur and Choong (2010) added that future sustainability relies on users’ energy awareness and energy consumption behaviour. In other words, the behavioural changes necessary for optimum energy efficiency rely on a high level of awareness and belief in the importance of using energy more efficiently. As such, our research aims to find out to what extent secondary school students are aware of the idea of energy efficiency and its importance as well as their energy consumption habits.

3. Methodology

This research employs a mixed-method approach to achieve the research objectives. This study was conducted at *Sekolah Berasrama Penuh Integrasi* (SBPI) Gombak from 2021 to 2022. A public school was chosen because savings made through energy efficiency could positively impact the government’s budget.

Observations were made regarding the students’ behaviour, and through conversation with the headmaster and teachers, the researchers found that students quite frequently waste energy by not switching off the air conditioner, lights, and fans when not in use. The observations and conversations the researchers had with the teachers were useful in formulating the questions for the students. An online questionnaire was then constructed and distributed to the secondary school students at SBPI. A purposive sampling method was used, focusing on secondary school students at SBPI. Some of the questions in the questionnaire were formulated based on Malaysia’s National Energy Efficiency Action Plan 2016 -2025. The purpose is to determine to what extent the students are aware of the initiatives that were implemented by the national plan and, by extension, the idea of energy efficiency.

Three types of data were collected: 1) Demographic information; 2) Knowledge and importance of energy efficiency, and 3) Electricity usage habits. Around 92 students participated in the online survey. The questionnaire data were interpreted using simple statistical analysis.

4. Findings

The aim of this study is to understand the students' knowledge of energy efficiency, including their awareness of government initiatives such as rebates for consumers for purchasing 5-star rated appliances. The study also aims to understand the students' energy consumption behaviour. This study is in line with the direction of the government as the Ministry of Education found that water and electricity wastage in schools was common and has sought to ensure that resources are used optimally (Birruntha, 2022). The questionnaire was completed by secondary school students of SBPI. The researchers managed to collect 92 responses. As seen in Table 1, the age of the respondents ranges from 13 to more than 17 years old. The majority of the respondents are aged 15, accounting for 69.6 % (64 students), followed by 14.1% of respondents aged 13 (13 students), 8.7% of respondents aged 16 (8 students), 6.5% respondents aged 17 (6 students) and 1.1% respondents aged above 17 years old (1 student).

More than half of the respondents were female (54.3%), whereas male respondents stood at 41.3%, and 4.3% did not wish to disclose their gender.

Table 1: Demographic Information of the respondents (n= 100)

General Information	Number	Percentage
Gender		
Male	38	41.3%
Female	50	54.3%
Prefer not to say	4	4.4%
Age		
13	13	14.1%
14	0	0
15	64	69.6%
16	8	8.7%
17	6	6.5%
Others	1	1.1%

5. Discussion

In order to understand to what extent students are aware of or understand energy savings/energy efficiency, the researchers first ask whether the students have come across any content that is related to energy savings. The researchers intentionally replace the term energy efficiency with energy savings (though energy efficiency is

broader than energy savings) because the term energy efficiency is less understood among the students. The researchers thus formulated some questions about energy efficiency without using the term directly so that students could understand what was being asked. For example, 'Are you aware of the 5-star rating label on electrical appliances' and, 'Are you aware that the Government is offering an RM200 voucher to purchase Energy Saving Appliances'?

5.1. Knowledge of energy savings/energy efficiency

This research determines whether the secondary students have been exposed to information about energy saving. Hence, when asked, 'Have you viewed any content related to energy saving?', among the 92 respondents, an overwhelming majority of the students answered yes (88.9%), whereas 12% of the respondents are not sure if they have viewed any related content, and only 1.1% of the respondents said they had not viewed any content related to energy saving (Table 2).

The second question in the survey is 'How do you get information about energy saving? You may choose more than one option.'

Table 2: List of sources from which students obtained information on energy saving

Option	Number
Parents	52
Social media	85
School education	82
Printed materials (such as newspapers, posters, magazines etc)	42
Workshop/Seminar outside school	27
Do not receive information	0
Other	1

Among the options available, most secondary school students obtained content related to energy saving from social media, followed by school education. From the results, it could be said that parents also played an important role in passing on knowledge about energy saving. Among the 92 respondents, less than half have received content about energy saving from printed materials (such as newspapers, posters, magazines etc). The results imply that printed materials are no longer the dominant source of information they once were as the world moves towards digitisation. Therefore, it is important to focus on sharing and spreading information online, especially if it is to reach Generation Z (Faughnder, 2022). According to a study by We Are Social and Hootsuite, most people use the internet for chat and messaging services, while more than 60% of the respondents use internet to find information (The Star, 2022). Relatively few students have received content from workshops or seminars organised outside of school; out of 92 respondents, only 27 have received such content. One respondent has chosen 'other' and has said that the campaign was one way to gain content related to energy saving.

The next question is, 'Are you aware of the 5-star rating label on electrical appliances?'. This question is asked in order to understand whether the students have noticed how electrical appliances have been categorised based on their energy consumption. A picture is attached (see [Figure 1](#)) so students can quickly grasp what is being asked.

Figure 1: Energy consumption of electrical appliances



Interestingly, 83 respondents, or approximately 90.2%, have chosen, 'Yes', whereas only three respondents (3.3%) have chosen, 'No'. The remaining 6.5% are unsure. The results mean that the majority of the respondents are highly aware of the 5-star rating label on electrical appliances.

However, the researchers believe that being aware of the 5-star rating label does not necessarily infer an understanding of what the label actually means. Hence, the researchers included the next question, which was meant to test whether the respondents knew the purpose of the 5-star rating label. The statement is intentionally designed to be false. The question asked is: 'Electrical appliances are rated based on a 5-star rating system to show how much electricity the appliance consumes. A refrigerator with a 5-star rating means it would consume the most energy when used. Do you agree with this statement?'

Surprisingly, although more than 90% of the respondents were aware of the 5-star rating label, only slightly more than half of the respondents (54.3%) answered this question correctly. These 50 respondents were correct in disagreeing with the statement. 22 respondents, or 23.9%, answered incorrectly by agreeing with the statement, while 21.7% of the respondents or 20 respondents were unsure.

Next, the researchers wanted to determine to what extent the respondents were aware of the government's various initiatives to ensure energy efficiency and savings. To achieve this, they posed the question, 'Are you aware that the Government is offering RM200 vouchers to purchase energy saving appliances?' Surprisingly, not many students were aware of this initiative. More than 80% of the respondents either answered 'Not sure' (25%) or 'No' (56.5%). Only 18.5% of respondents were aware of

this policy. This means that the promotion of the initiative had been insufficient and the students' parents were probably not aware of it.

The researchers then asked the respondents whether the RM200 voucher program effectively influences the public to purchase electrical appliances that save electricity. More than 50% of the respondents agreed that the program is effective (55.4%), whereas a smaller percentage of the respondents (18.5%) thought that it is ineffective. 26.1% of the respondents are unsure of the effectiveness of the program.

5.2. Electricity consumption behaviour

In this section, the students were asked to answer questions designed to shed light on their electricity consumption behaviour. First, the students were asked if they think energy saving is important. 100% of the respondents answered 'Yes'. This implies that they understand the importance of not wasting electricity. The following questions aim to determine whether the understanding of the importance of saving energy is translated into action.

As the respondents are students and commonly use laptops to search for information and complete their assignments, the follow-up question in the survey is, 'How frequently do you leave your laptop on while doing other things?' 50% of the respondents chose 'Always', whereas 40.2% chose 'Sometimes', and less than 10% of respondents have 'Never' left their laptop on when doing other things. The results showed it is common among the sampled students to leave their laptops on while they undertake other activities. This is concerning, considering that students use laptops frequently and that they could easily save electricity simply by turning off the laptop when not in use.

Next, the researchers aim to understand the students' personal choices when making purchases. Would the students choose a higher-priced laptop that uses less energy, or a cheaper laptop that consumes more energy? 83.7% of the respondents were willing to spend more to get a laptop that saves energy, and only 16.3% would choose a cheaper laptop.

The next question aims to understand the electricity usage of the students more broadly, particularly when they are at home. The question is, 'Do you have the habit of turning off home appliances when you are not using them? (Eg: fan, light, television, water heater etc)'. The results show the majority of the students (72.8%) always turn off the home appliances when not in use, while only 27.2% of the students sometimes do not turn them off. Surprisingly, no student typically leaves home appliances on when not using them. This suggests that when at home, the students are conscious of not wasting electricity.

While all students agree that saving energy is important, the researchers wanted to know if the students truly understand the implications of using energy excessively. The researchers argue that if the students truly understand the implications of consuming energy generated by burning fossil fuels, then it is more likely that the students will make efforts to save energy. As such, the next question is, 'Energy saving will reduce carbon dioxide emissions. Do you agree?' The majority of the students, 81.5 %, agree with the statement, while close to 19% disagree (14.1%) or are unsure (4.4%).

Next, the students were asked to rate the following statement: 'Energy saving will prevent global warming. Do you agree?' About 91.3% of the respondents agree, while 2.2% of the respondents disagree, and 6.5% of the students are unsure.

The following question is, 'Energy saving will increase global temperatures. Do you agree?' This question is intended to contrast with the earlier question to test if the students understand the relationship between carbon emissions, global warming and the increase in global temperature. The findings show that only 77.2% of the respondents rightly disagree with the statement, whereas 13% agree and 9.8% are unsure.

Lastly, the students were asked to give their opinion or offer suggestions on energy savings. Several students suggested installing solar panels at home. This kind of solar initiative has actually been implemented in SBPI Gombak through the government's support. This means the students have applied ideas about energy saving/energy efficiency they learned in school to their domestic context. This proves that education in school is one of the best places to influence students' behaviour. Other suggestions included advocating for the use of public transport, changing lifestyles and making installing sensor lights common. Most importantly, students believe that people should be educated at a young age about saving energy.

This suggestion is also in line with the recommendations of the researcher. When comparing Thailand's 20-Year Energy Efficiency Development Plan ([Thailand Ministry of Energy, 2011](#)) with Malaysia's National Energy Efficiency Action Plan, the former has come up with five key strategic approaches, one of which is related to raising public awareness and promoting behavioural change. This approach is meant to raise awareness among the public and young people through educational institutions. It is also designed to promote ideas and activities that encourage the development of a low-carbon society and a low-carbon economy. However, Malaysia's plan does not include any measures that aim to induce behavioural change through awareness. As such, it is not a surprise that many students are not even aware of the meaning and usage of the 5-star rating system as well as the RM200 voucher program that was included in the National Energy Efficiency Action Plan. As such, the researchers argue that to make the goals of saving energy or energy efficiency more achievable, the government must get voluntary cooperation from all stakeholders. The current national plan focuses on inducing behaviour by offering incentives. The researchers argue that with this approach, behavioural changes would last only as long as the incentives are in place. When the incentives are phased out, the consumers would revert to their old consumption habits.

Though in the past there have been initiatives aiming to raise awareness, these have been pursued through the Centre for Education and Training in Energy Efficiency and Renewable Energy. The researchers' suggestion is to revise the national curriculum and include courses and activities about energy savings/energy efficiency in schools. The researchers argue that this would induce permanent change in students' behaviour, which is the most effective way to achieve energy efficiency.

6. Conclusion

There were 92 respondents for this research ranging in age from 13 to 17+, and more than half were female. The findings show that students at SBPI Gombak have a high level

of awareness about energy savings/energy efficiency. The students mostly gained information on energy savings from social media, school education, and their parents.

The research also shows that the students have seen the 5-star rating label on electrical appliances, but they do not necessarily understand the meaning of the 5-star rating. Only slightly more than 50% of the respondents truly understand what a 5-star rating on electrical appliances means. The study also found that students are hardly aware of the rebate given by the government to promote the purchase of energy-saving appliances. More than 80% either did not know of the initiative or were unsure. Therefore, when asked about the effectiveness of the RM200 voucher program, close to 45% of the respondents think it is either ineffective or unsure about the effectiveness of the program.

Regarding the students' electricity consumption, the research found that 83.7% of the students were willing to pay more to buy a more energy-efficient laptop, and 72.8% of the students always turned off home appliances when not using them. However, the study also found that the students are quite aware of how their electricity consumption may lead to carbon dioxide emissions, global warming and an increase in global temperature. Finally, the students were able to offer several constructive suggestions regarding pursuing and promoting energy efficiency.

Ethics Approval and Consent to Participate

All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee. Informed consent was obtained from all participants according to the Declaration of Helsinki.

Acknowledgement

We would like to express our gratitude to the Headmaster of Sekolah Berasrama Penuh Integrasi Gombak, Tuan Haji Ahmad Shafrin Bin Abdul Aziz, for help in disseminating the questionnaires to the students. Also, special thanks to Faizatul Huda for being of such great assistance.

Funding

This study is funded by IIUM Research Management Centre Grant 2020 (RMCG) (RMCG20-053-0053).

Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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