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Electricity Savings and Consumers' Behaviours towards Electricity Consumption

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Abstract

Electricity consumption is one of the main issues that Malaysian is facing currently especially during pandemic disease where people worked from home and many household appliances were used. High electricity usage will cause more sources to be generated and increase tariff rate because the provider needs to bear operational costs to provide the services. Hence, consumers need to lessen electricity consumption in order to have electricity savings and many electricity reserves in future. This study was conducted to investigate the pattern and consumers' behaviors towards electricity consumption in Malaysia using questionnaires as the research instruments. This study found that 89.7% of respondents were aware of electricity usage and savings. This can be proven by the respondents' behaviours towards electricity consumption where more than 50% avoided using heated household appliances. Nevertheless, air conditioners usage was very high (84.6%) that caused excessive electricity bills. The monthly electricity bills for low-income earners can reached up to 20% of their monthly income and this will possibly cause financial difficulties for basic needs. 65.4% of the respondents claimed that they are the electricity savers in the house, followed by the spouse (29.5%). Energy efficiency (65.4%), quality and price (65.3%), brand (60.3%) and design and appearance (59.7%) were the characteristics that the respondents were looking at when they purchased the household appliances. These characteristics indicated the positive behaviours towards electricity savings in the long term. 76% of the respondents were aware of solar panel that can be more likely to reduce electricity bills but high amount of installment obstructed them from using it. The implications are important for household manufacturers, energy and solar panel providers and individuals.

Introduction

Tenaga Nasional Berhad (TNB) is the Malaysian multinational electricity company with core activities of generation, transmission and distribution of electricity to industry and residents in Malaysia. TNB is the only company that provides electricity. Therefore, it strives to improve the quality of the service to ensure there is no power interruption and consumers are happy with energy consumption. TNB had been working diligently to ensure there is a continuous supply of electricity especially during pandemic disease where there was a sudden request to fix breakdown at hospitals or treatment centres around Malaysia. Additionally, swift floods caused electricity poles and cables to be damaged and caused TNB to repair and restore the services. TNB need to mobilize teams from various states to manage the flood-engulfed areas.

The total population of Malaysia is estimated at 32.7 million as compared to 32.6 million in 2021, with an increment of 0.2 percent. Before 2021, the average increment is 1.3%. The less increment is probably due to pandemic disease that caused reported death of around 36 398 people. The projection of Malaysian in 2050 is 40.5 million. Is TNB has sufficient resources to provide electricity to Malaysians? Are Malaysian citizens' electricity consumption use omnisciently?

Problem Statement

Despite the robust performance, TNB encountered a drop in electricity demand in 2020 due to pandemic disease because many industries were required to be lockdown to ensure the safety and well-being of employees. Due to the infectious disease caused by coronavirus, many employees either from public or private organizations were asked to work from home. This was done to prevent the spread of the virus and to protect the employees and their families from the killing disease. Lockdown caused a reduction of electricity consumption for industries but increased the household consumptions especially those with many household appliances such air conditioners, water heaters, washers and dryers, electric ovens, computers, refrigerators, freezers, etc. Lockdown also caused all family members to stay at home including children and teachers that needs to use computers or gadgets for teaching and learning.

The tariff rate will gradually change to bear the operational expenses. Increment of tariff rate will cause difficulties for the consumers because huge consumption will cause the bills payment to be high. Therefore, the government and TNB had introduced a discount initiative on electricity bills to reduce the strain on residential and commercial consumers beginning April 2020. The initiative introduced by the government and TNB will assist residential and commercial consumers financially especially to those who have lost their jobs and unemployed residents. However, the consumers should also be aware of methods to reduce their electricity consumption and ultimately reduce the bills payment. There are many questions raised:

1. Are Malaysians individuals having difficulties in paying their bills?
2. Are Malaysians individuals aware of the current pattern of electricity consumption?
3. Do Malaysians individuals know how to reduce electricity bills?
4. How are Malaysians individuals' behaviors towards electricity consumption?

Aims and objectives of the research

The objective of this research is to:

1. Investigate the contemporary pattern of individuals' electricity consumption in Malaysia.
2. Investigate the individuals' behaviors towards electricity consumption in Malaysia.

Literature Review

Malaysia is rich with energy sources and holds 3.6 billion barrels of proven oil reserves as at 2016. The amount should have been amplified by now due to its exploration in South America, onshore projects in Canada and deep-water drilling in Brunei. The objective is to make a difference in meeting energy needs and to deliver long term value to all their stakeholders. There are two types of energy resources namely renewable and non-renewable energy sources. Renewable energy sources are any natural resources that can replace energy quickly and dependably such as solar energy from the sun, wind energy, geothermal energy from the

heat inside the earth, hydropower from flowing water, ocean energy in the form of wave and tidal and biomass from plants. Non-renewable energy source is a source with limited supply that we can mine or extract from the earth and will eventually run out especially when there is a huge consumption with growing population. Non-renewable energy sources are formed over a thousand of years from the buried remains of ancient sea plant and animals that lived million or billions of years ago but has turn out to be of valuable for today's mankind. The major types of resources of non-renewable energy are petroleum, hydrocarbon gas liquids, natural gas, coal and nuclear energy.

There are many challenges and issues with regard to energy in Malaysia namely energy security, fuel supply and pricing, non-renewable energy, energy efficiency and conservation, sensitivities of nuclear option and the restructuring of electricity supply industry (Tan et al., 2013, Oh et al., 2010). The escalation of electricity consumption in China had affected energy savings in China (Meng and Li, 2022). How to ensure continuous supply of energy at affordable prices in Malaysia? Malaysian jobless residents due to pandemic disease made it difficult for the household to pay electricity bills. Are Malaysian residents aware of the current pattern of their electricity consumption? Are the Malaysian residents control their consumptions to reduce the electricity bill? Karjalainen (2011) found that majority of consumers would like to save electricity consumptions but they were short of information to do that.

Many of Malaysian citizen complaints on having to pay high amount of electricity. However, TNB had included the predetermined amount of electricity usage by the consumers in its website <https://hec.tnb.com.my/Public/UsageCalculator> for home appliances that they have in the house and tips of saving energy. Energy usage calculator provided by TNB is very helpful to the consumers because they can set the type of house that they are living in, whether it is a terrace house with different types of floors, high rise residential which includes flat, apartment and condominium and semidetached or bungalow house with different types of floors. When the consumers have chosen the type of house that they are living in, they can also set how many rooms, types of rooms, number of appliances that they have in the rooms, usage hours per day or per month and the watts for each appliance. This information will fully assist consumers in controlling the amount of energy used monthly and consequently reducing their bills. Has Malaysian consumers use this link to determine their budgeted electricity consumptions?

The problem is many Malaysian citizens are not aware and not concern on this facility designed by TNB and also their distressful behaviours in using the electricity which caused the bills to overestimate their monthly budget. One of the behaviours that is commonly done by the consumers is wasting energy. The consumers did not plug or switch off after using the appliances because they think if the appliances are not used but the electricity is still in standby mode, the cost is not so much and is manageable by the users. Leaving many devices in standby mode can accumulate such a substantial amount of electricity without their recognition because they have been doing that on daily basis. Therefore, this research is conducted to investigate the current pattern and consumer behaviors of electricity consumption in Malaysia.

Methodology

Data for this research was gathered primarily from developing a structured questionnaire to investigate the current patterns of electricity consumption and consumer behaviors of urban household in Malaysia. The questionnaires were randomly distributed to 300 households that stay in urban areas. 187 households responded and 31 questionnaires with insufficient data

were eliminated and not be replaced in order to sustain the originality of data sampling. 156 questionnaires can be used as a sample for this study after the cleaning process was done. SPSS was used to analyze the data quantitatively by using descriptive statistics.

Data Analysis

Data was analyzed using SPSS and the demographic analysis is as per Table 1.1. The respondents were 92 male and 64 female and the percentages were 59% and 41% respectively.

Table 1.1
Demographic of Respondents

| Items | Categories | Frequency | | | Percent (%) | | |
|-----------|---------------|-----------|--------|-------|-------------|--------|-------|
| | | Male | Female | Total | Male | Female | Total |
| Age | 20-30 | 38 | 8 | 46 | 41.3 | 12.5 | 29.5 |
| | 31-40 | 8 | 16 | 24 | 8.7 | 25.0 | 15.4 |
| | 41-50 | 46 | 32 | 78 | 50.0 | 50.0 | 50.0 |
| | >50 | 0 | 8 | 8 | 0.0 | 12.5 | 5.1 |
| Education | Degree | 22 | 8 | 30 | 23.9 | 12.5 | 19.2 |
| | Master | 0 | 16 | 16 | 0.0 | 25.0 | 10.3 |
| | PhD | 8 | 24 | 32 | 8.7 | 37.5 | 20.5 |
| | Others | 62 | 16 | 78 | 67.4 | 25.0 | 50.0 |
| Income | < RM 2000 | 24 | 16 | 40 | 26.1 | 25.0 | 25.6 |
| | RM 2001-5000 | 52 | 16 | 68 | 56.5 | 25.0 | 43.6 |
| | RM 5001-10000 | 16 | 8 | 24 | 17.4 | 12.5 | 15.4 |
| | >RM 10000 | 0 | 24 | 24 | 0.0 | 37.5 | 15.4 |

Table 1.2 shows that majority of the respondents resided with their parents (44.9%), 39.8% resided at their own house and the remaining balance of 15.4% rented accommodations. Majority of the respondents' monthly electricity bill is between RM 201-300 (29.5%), followed by RM 50-100 (19.2%) and more than RM 500 (15.4%). 55.1% of the respondents were the payers and followed by the spouses (29.5%). This revealed that although majority of the respondents resided with their parents, they had taken the responsibility of paying the electricity bills. Therefore, 65.4% of the respondents claimed that they were the electricity savers in the house, followed by the spouses (29.5%). Since majority of the respondents were the payers, they were aware of the bill amount (89.7%) and tariff rate (74.4%).

Table 1.2

Respondents' awareness of electricity bills and usage

| Items | Description | Frequency | | | Percent (%) | | |
|-------------------|-------------|-----------|--------|-------|-------------|--------|-------|
| | | Male | Female | Total | Male | Female | Total |
| House | Own | 38 | 24 | 62 | 41.3 | 37.5 | 39.7 |
| | Parent | 54 | 16 | 70 | 58.7 | 25.0 | 44.9 |
| | Rental | 0 | 24 | 24 | 0.0 | 37.5 | 15.4 |
| Bill amount | < RM 50 | 8 | 8 | 16 | 8.7 | 12.5 | 10.3 |
| | RM 50 -100 | 22 | 8 | 30 | 23.9 | 12.5 | 19.2 |
| | RM 101-200 | 16 | 8 | 24 | 17.4 | 12.5 | 15.4 |
| | RM 201-300 | 22 | 24 | 46 | 23.9 | 37.5 | 29.5 |
| | RM 301-400 | 8 | 0 | 8 | 8.7 | 0.0 | 5.1 |
| | RM 401-500 | 0 | 8 | 8 | 0.0 | 12.5 | 5.1 |
| | >RM 500 | 16 | 8 | 24 | 17.4 | 12.5 | 15.4 |
| Electricity Payer | Me | 54 | 32 | 86 | 58.7 | 50.0 | 55.1 |
| | Spouse | 22 | 24 | 46 | 23.9 | 37.5 | 29.5 |
| | Parents | 16 | 0 | 16 | 17.4 | 0.0 | 10.3 |
| | Others | 0 | 8 | 8 | 0.0 | 12.5 | 5.1 |
| Electricity Saver | Me | 54 | 48 | 102 | 58.7 | 75.0 | 65.4 |
| | Spouse | 30 | 16 | 46 | 32.6 | 25.0 | 29.5 |
| | Parents | 8 | 0 | 8 | 8.7 | 0.0 | 5.1 |
| | Others | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 |

As exhibited in Table 1.3, the monthly electricity bill was ranged from RM 101 to RM 300 for respondents who resided at their own house. The respondents who lived with their parents either have a low or high amount of electricity bills. Low amount was possibly due to a low number of persons staying in the house or have the mindset of electricity savings and high amount is of the opposite reasons. Respondents with rented accommodation have quite a low amount of electricity. This is possibly due to saving electricity as rental accommodations usually exclude utilities bills.

Table 1.3

Monthly electricity bills of respondents

| House/ Electricity bill | Own | | Parents | | Rental | |
|----------------------------|------|--------|---------|--------|--------|--------|
| | Male | Female | Male | Female | Male | Female |
| < RM 50 | | | 8 | | | 8 |
| RM 50 -100 | | | 22 | | | 8 |
| RM 101-200 | 16 | | | | | 8 |
| RM 201-300 | 22 | 24 | | | | |
| RM 301-400 | | | 8 | | | |
| RM 401-500 | | | | 8 | | |
| >RM 500 | | | 16 | 8 | | |

Table 1.4 presents the ratio of monthly electricity bills to monthly income of respondents. Majority of respondents' income is between RM 2001 to RM 5000 per month. The ratios range from 2.5% to more than 20% for income less than RM 2000; between 1% to more than 10% for monthly income between RM 2001-RM 5000; between 1.0% to 3% for monthly income between income o RM 5001-RM 10000; and between 2% to more than 5% for monthly

income of more than RM 10000. The percentage is manageable for high-income respondents but quite high for low-income respondents, reaching 20% of their monthly income. Low-income respondents need to control their electricity consumption in order to balance their basic living standards especially after pandemic disease where inflation is increasing.

Table 1.4
Ratio of monthly electricity bills to income

| House/ Electricity bill | <RM2000 | | Ratio | RM2001-5000 | | Ratio | RM5001-10000 | | Ratio | >RM10000 | |
|----------------------------|---------|--------|------------|-------------|--------|----------|--------------|--------|---------|----------|--------|
| | Male | Female | | Male | Female | | Male | Female | | Male | Female |
| < RM 50 | 8 | | 2.5 | | 8 | 1.0 | | | 0.5 | | |
| RM 50 -100 | | 8 | 2.5-5.0 | 22 | | 1.0-2.0 | | | 0.5-1.0 | | |
| RM 101-200 | | | 5.0-10.0 | | 8 | 2.0-4.0 | 16 | | 1.0-2.0 | | |
| RM 201-300 | | 8 | 10.00-15.0 | 22 | | 4.0-6.0 | | 8 | 2.0-3.0 | | 8 |
| RM 301-400 | 8 | | 15.0-20.0 | | | 6.0-8.0 | | | 3.0-4.0 | | |
| RM 401-500 | | | 20.0-25.0 | | | 8.0-10.0 | | | 4.0-5.0 | | 8 |
| >RM 500 | | | >25.0 | 8 | | >10.0 | | | >5.0 | | 8 |

The frequency of using household appliances were investigated in order to understand the respondents' behaviours towards electricity consumption. Table 1.5 displays the household appliances that commonly used by the respondents. Refrigerators, fans, televisions, cooking appliances, washing machines, computers and air conditioners were household appliances that commonly used by the respondents and the usage ranged from 65.4% to 100%. The appliances that required to be heated such as kettle, water heater and tumble dryer usage is less than 50% usage. This is possibly due to several factors such as the existence of new appliances such as Coway and Cuckoo that can purify and filter water and provide cold and hot water at the same time which is convenient to the users; hot weather that caused people not to use hot water to bath; and cheaper to dry clothes at laundry rather than buying the dryer and use it at home. Additionally, people might be aware of high amount of electricity charged if heat household appliances are used. However, air conditioner still has a high percentage of usage for the respondents (84.6%).

Table 1.5

Household appliances of respondents

| Household Appliances | Oftenly used | | Household Appliances | Rarely used | |
|----------------------|--------------|------|----------------------|-------------|------|
| | Numbers | % | | Numbers | % |
| Refrigerator | 156 | 100 | Humidifier | 108 | 69.2 |
| Fan | 156 | 100 | Water heater | 84 | 53.8 |
| Television | 148 | 94.9 | Kettle | 78 | 50 |
| Rice cooker | 140 | 89.7 | Computers | 54 | 34.6 |
| Air conditioner | 132 | 84.6 | Microwave | 54 | 34.6 |
| Washing machine | 126 | 80.8 | Tumble Dryer | 100 | 64.1 |
| Computers | 102 | 65.4 | Washing machine | 30 | 19.2 |
| Microwave | 102 | 65.4 | Air conditioner | 24 | 15.4 |
| Kettle | 78 | 50 | Rice cooker | 16 | 10.3 |
| Water heater | 72 | 46.2 | Television | 8 | 5.1 |
| Tumble Dryer | 56 | 35.9 | Refrigerator | 0 | 0 |
| Humidifier | 48 | 30.8 | Fan | 0 | 0 |

Figure 1.1 signifies the imperative characteristics of household appliances consumed by the respondents which are energy efficiency, quality, price, brand and design and appearance. Majority of respondents found that all these characteristics were important when they purchase the household appliances. Energy efficiency is the utmost characteristics that the respondents were looking at when they purchased household appliances (65.4%), followed by quality and price (65.3%), brand (60.3%) and design and appearance (59.7%).

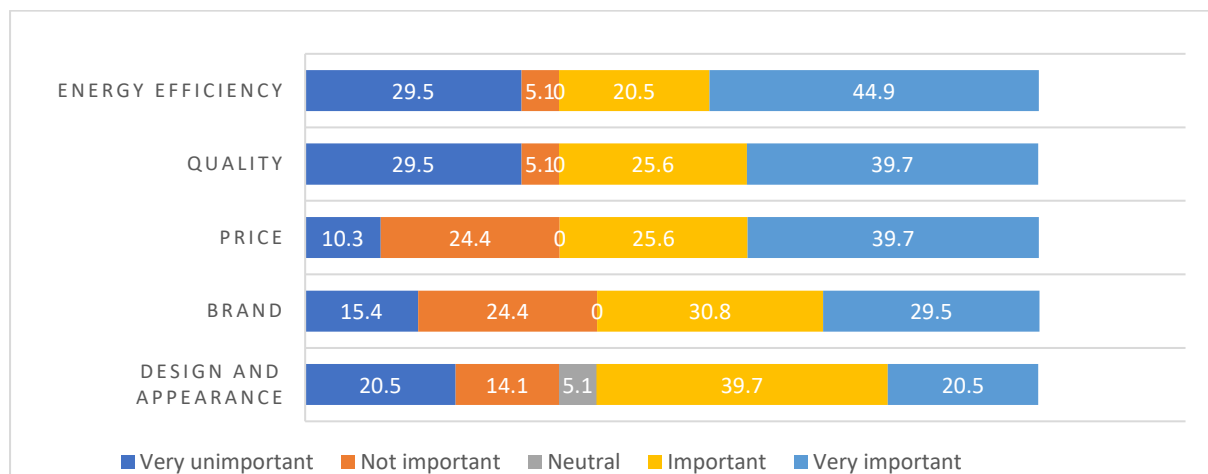


Figure 1.1 Characteristics of household appliances

Conclusion

Electricity consumption is important to be observed for the households especially if there are a large number of people staying together in a house. This research found that a majority of the respondents were aware of electricity usage and savings (89.7%). This is evidenced by more than 50% of respondents avoided using household appliances that require to be heated because there are alternative appliances to be used such as Coway and Cuckoo. However, air conditioners usage was still high for a majority of respondents (84.6%) that caused excessive monthly bills especially low-income earners that can reached up to 20% of their monthly income. 65.4% of the respondents claimed that they were the electricity savers in the house,

followed by the spouse (29.5%). The characteristics that the respondents were looking at when purchasing household appliances had also assist in energy savings and the characteristics were energy efficiency (65.4%), quality and price (65.3%), brand (60.3%) and design and appearance (59.7%). 76% of the respondents were aware of the new technology of solar panel that can reduce the payment of electricity bill in the long term. Nevertheless, a high amount of initial payment impedes the respondents of using the solar panel. The implications of this research are for the household manufacturers to increase the energy efficiency for household appliances in order to reduce energy usage; attractive installment to purchase solar panel to instill users; and awareness of not wasting energy for individuals. The future research should investigate the customers' satisfaction in using solar panel parallel to high cost to install it and reliability to provide powers in line with the customers' needs.

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