

# A STUDY ON ELECTRIC ENERGY USAGE AT THE RESIDENTIAL AREA

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**Abstract**— Electricity is energy that very important in daily human life. Lack of electricity causes not only inconvenience to domestic consumers due to affect of electrical appliances operation, but also introduces economic losses for industrial and commercial sectors whereby affecting their productions and services. For domestic sector, it is very important for each consumer to manage their daily usage of electricity in proper way. This paper is about electric energy management investigation among the consumers at residential area of Taman Pintas Jaya, Parit Raja, Batu Pahat, Johor. The main reasons of this study are to find out the characteristic of electric energy usage in daily life and investigating the habits of consumers due to usage of common electrical appliances. Questionnaire is the tool that being used for data collection and for analysis purposes. The questionnaire consists of several questions that provided information of the electric energy usage among consumers in their daily life. The finding of this study shows that most of the consumers do not alert how to use electric energy efficiently in their daily life. In other word, the consumers uses electric energy inefficiently in term of the usage of inefficient electrical appliances and the lack of knowledge to use electric energy in daily life efficiently. Therefore this paper reveals the habits of electric energy usage from the consumers' side and the common characteristic of electrical appliances usage in common domestic sector. From the finding obtained, many good advices can be suggested in order to alert consumers to use electric energy efficiently in their daily life.

**Keywords:** electric energy efficient

## L INTRODUCTION

Electric energy is very important in daily life. It is indispensable to factories, commercial establishments, homes, and even most recreational facilities. Lack of electricity causes not only inconvenience, but also economic loss due to reduce of industrial production. It is very important for each consumer to manage the daily use of their electricity usage.

The observation of the electric energy usage is carried out among consumers at Taman Pintas Jaya, Parit Raja, Johor. The residential sector include private households where energy is consumed primarily for water heating, air

conditioning, lighting, refrigeration, cooking, clothes drying and etc.

Most of consumers are unaware of their electric power management. These situations bring to the wasted of electric energy in their daily life. Some focus of this study is to teach the consumers to be smart using electricity in daily life, and also to find alternative ways in reducing the wasted of electric energy consumption.

Anthony J. Pansini in his book, "Guide to Electrical Power Distribution System, Sixth Edition" mentioned previous study about the personal habits of people and the routines of households, offices, stores, and factories, to determine what probable load the utility company will have to supply at any one time. This research is done based on reason if all the electrical appliances in all the consumers' premises in a country were to be turned on at the same time, it would be impossible for the utility company to supply enough necessary energy to run all these appliances. For a utility company to provide energy for this total connected load would be extremely uneconomical since all this appliances actually will not be operating at the same time as illustrate in Figure 1.1.

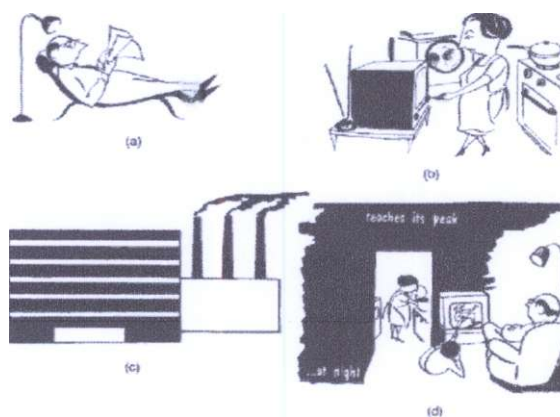


Figure 1.1: (a) Very low demand, consumer only uses one lamp, (b) Higher demand, consumer is cooking, washing, and running a TV. (c) The factory reaches its maximum demand during the day. (d) At night the domestic demand reaches its peak.

## II. METHODOLOGY

### Subject

This study is about power management at demand side among the consumers at residential areas of Taman Pintas Jaya, Parit Raja, Johor. The survey is conducted and involving 50 houses live include categories of family, student, and bachelor. The chosen of the houses have been picked randomly.

### Tool/Equipment

The method that is used to obtain samples of data is by using questionnaire. From the questionnaire, the data is analyzed to calculate the power usage of each house. It consists of questions that provide information of electric energy usage among consumers and also their habits in daily usage of electric energy.

### Data Finding

Surveys have been conducted by distributing 50 questionnaires at Taman Pintas Jaya residential area. In each house, each electric appliance used by every house and average total of electricity bill in every month are recorded. The data collection only focused on the appliances that are often used by the consumers. The average total of real power for each house is calculated by summing the individual appliance. The knowledge of each consumer about their knowledge of consumption electricity in efficient also recorded.

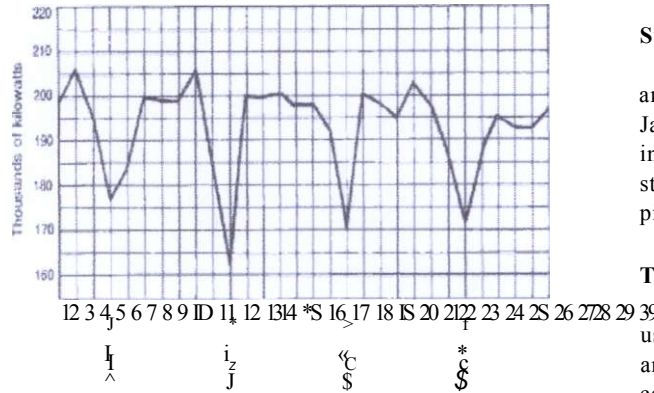


Figure 1.2: Daily peak load for a typical month. How many kilowatts typical utility company supplies consumers in an average month.

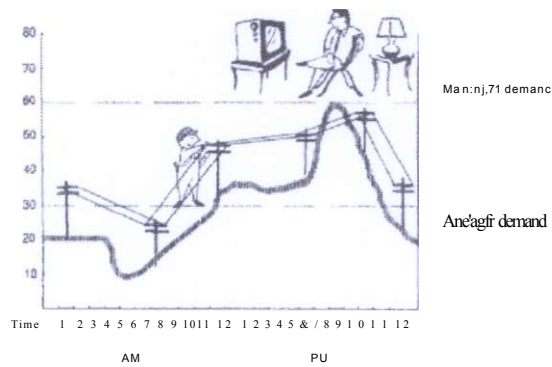


Figure 1.3: The utility company must be equipped to meet the consumer's maximum demand.

This study is more focus on how to provide electrical energy to the consumers in effective way according to their habits in daily life. Consequently, consumers become more alert and appreciate the electric energy usage.

### Power Factor

Power Factor is a parameter that to measure on how efficiently electrical power is consumed. The ideal Power Factor would be unity or 1. Unfortunately in the real world, Power Factor is reduced by highly inductive loads to 0.7 or less. This induction is caused by equipment such as lightly loaded electric motors, induction motor, power transformers, fluorescent lighting ballasts, welding sets, and induction furnace. Capacitive Power Factor correction (PFC) is applied to electric circuits as a means of minimizing the inductive component of the current and thereby reducing the losses in the supply. Reactive power charges can be made significantly smaller by the Power Factor Correction Capacitors which is a widely recognized method of reducing an electrical load and minimizing wasted energy, improving the efficiency of a plant and reducing the electricity bill. It is not always necessary to reach a power factor of 1.

## III. ANALYSIS

Figure 1.4 shows that the majority of respondents are students and bachelor.

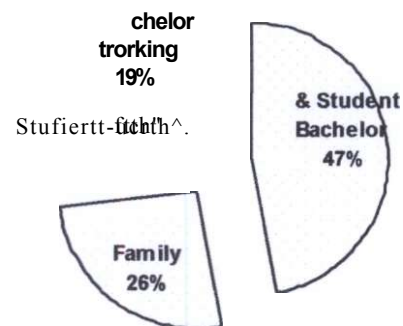


Figure 1.4: The categories of respondent

There are about 275 kW electric power consumed by these 50 residents during morning (7.00 am to 12.00 pm), Refer Figure 1.5. At the evening (12.01 pm to 6.00 pm), the power consumed are about 184 kW. The highest power consumed during night, about 365 kW.

From this result, the power that consumed by respondents high at the morning because they used a lot of heating appliances during this time like iron, electric kettle, shower heater. Then electric power usages drop at the evening because they are not at home. The highest electric power consumed at night because majority of houses' member stayed at home and used most of the electric appliances.

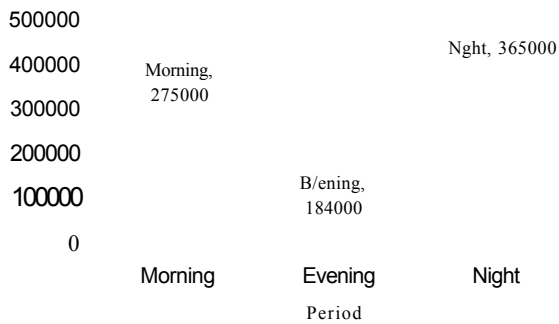


Figure 1.5: Total power usage per day by the respondents.

Table 1.1 shows common of electric appliances that being used by the respondents. Electric appliances can be categorized into three types; resistive, inductive and capacitive loads.

Electric appliances based on resistive load usually consist of heating elements such as electric kettle, shower heater, rice cooker and toaster. From this survey, the heating element loads requires high power compared to other electrical appliances.

The load that consists of inductive or capacitive elements are said to be reactive load. In this survey, the appliances that categorized to be reactive load such as refrigerator, washing machine, air conditioning, fan and vacuum cleaner. These type of appliances consumed lower power as compared to the heating elements load.

Nevertheless, electric appliances that containing heating elements (resistive load) have power factor of 1.0 meanwhile reactive element loads often provide power factor below than 1.0. If very low power factor introduce, the load needs more current in order to meet the real power requirement of the load. The consumers did not really notice this phenomenon because the electricity bills are measured in Watt.

Table 1.1: Common Appliances Used by the Respondents

N	Appliances	Power (W)
1	Pendaflour Lamp	36
2	Refrigerator (220 L)	500
3	Iron	1200- 1400
4	Television	75
5	Washing Machine (5kg)	240 - 380
	Washing Machine (7kg)	480 - 700
6	Air-Conditioner	1200
7	Microwave Oven	1100- 1200
8	Personal Computer (CRT)	750
9	Laptop	65
10	Electric Kettle (4L)	2000-2200
11	Shower Heater (4kg)	3600
12	Rice Cooker (2.8L - 3.3L)	600 - 700
13	Fan (Ceiling)	100
	Fan (Stand/Wall)	50-60
	Fan (Table)	35
14	Vacuum Cleaner	1200- 1600
15	Hair Dryer	1200
16	Toaster	700

The respondents that have normal family consumed more electric power as compared to the other categories. According to the study, this type of respondents using more electric appliances at their house like shower heater, air conditional and other appliances as compared to other respondents.

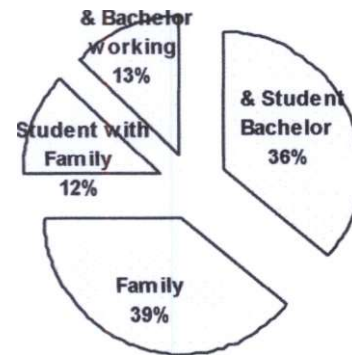


Figure 1.6: Power usage by the respondents according to the categories

From the survey, it is founded that most of the respondents paying their monthly bill from RM 100 to RM 150, refer Figure 1.7.

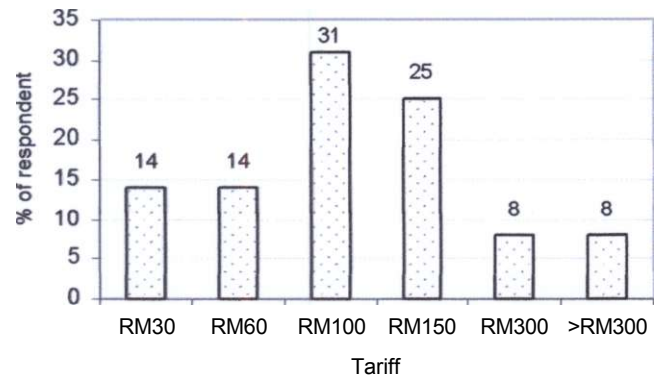


Figure 1.7: Monthly electric tariff in average

The Figure 1.8 showed that most of the respondents alert of energy waste in their house. The initiative taken to save electric energy is by switch off all of unused electric appliances

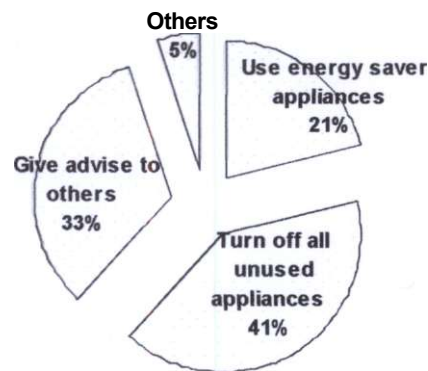


Figure 1.8: Initiative that taken by the respondents in order to save the electric power.

#### IV. CONCLUSION

From this study, characteristic of electric power usage among the consumers in their daily life are obtained and analyzed. Some of them know how to save in usage of electric energy in term of individual behavior. But most of respondents do not know the available efficient electric appliances in the market. They only buy the electric appliances if the price is very cheap without alert about the efficiency of the appliances. Therefore several programme about the usage of efficient electric appliances and how to use electric appliances efficiently need to be organized and disseminated to the society. Consequently, society will alert and becomes smart in usage of electric energy in their daily life.

Power factor is always being monitor by the TNB in demand side because it extremely important. Power Factor is a measure of how efficiently electrical power is consumed. The ideal Power Factor would be unity or one. High inductive loads cause reducing power factor. This induction element is introduced by equipment such as electric appliances consists of electric motor, transformer, fluorescent lighting ballast, welding set, fan, and etc. The lower of power factor the more power need to be generated.

#### V. SUGGESTIONS FOR SAMRT USAGE OF TYPICAL ELECTRIC APPLIANCES

##### Refrigerator

Refrigerator is used throughout the year and is considered as the most expensive item. Therefore, the energy saving potential is high for these appliances. The lower energy costs of the more efficient, newer refrigerators can often justify replacement even if existing ones are still in good service. Suggestions for smart usage:

- Keep the condenser coils at the rear of the refrigerator clean. Dust and dirt on the condenser coils will reduce the working efficiency of the refrigerator.
- The compartments should be kept full to avoid unnecessary cold air loss on door opening.
- Arrange foods in the refrigerator slightly apart to allow free air circulation. Always cool hot food before storing it in the refrigerator.
- Avoid frequent opening of the refrigerator, or leaving the door open unnecessarily.

##### Washing Machine

It is a waste of electricity and water to use the washing machine to do the part loads of, say, a pair of trousers or few shirts. Gather the laundry, so that the machine can be filled up. The electricity consumption is almost the same. Suggestions for smart usage:

- Wash only with full loads. The washing machine uses the same amount of energy for full load as for a part load.
- Do not overload the washing machine.
- Choose the correct wash cycle.

##### Water Heater

Electric water heaters are of two types, "instant water heaters" (very common now) which heat the water as it is used, and "storage water heaters" (less common), which store heated water for later use. The storage type of heaters tend to waste energy as they attempt to keep the stored water hot all the time, even when the water is not in used. It is encourage those quick showers instead of baths; for less hot water is used in taking a shower.

##### Air Conditioning

Home air conditioning, which was once a luxury, is now becoming a necessity, or an affordable convenience to the middle income population, as air conditioners become cheaper and more energy efficient. The cheaper, window type air conditioners are now losing out to the "split" type, which have the advantage of separating the compressor from the cooling unit, thus reducing the noise level in the cooled room. The lower energy costs of the more efficient, newer air conditioners can often justify replacement even if existing ones are still in good service. Suggestions for smart usage:

- Do not block air conditioner vents with drapes or furniture.
- Roof, or ceiling insulation, and minimization of air leaks from under doors and through windows can help to reduce the cooling energy consumption.
- Glaze your window with heat reflective glass — some glazing has selective reflective coatings where heat is reflected but light is allowed in.
- On a hot day, close your curtains and blinds. This helps to keep sunshine heat away.
- Landscaping - trees and shrubs next to the house help in reducing the cooling load.
- Shade screens, glass tints, and window/wall awnings are another way of cutting down on heat gain.

##### Lighting

Suggestions for smart usage:

- Dust your light bulbs and lamp shades once every 1 or 2 months. Keeping them clean increases the amount of light emitted.
- Use the compact fluorescent lamps because:
  - i. Incandescent lamp  
Generate a high amount of heat and are typically used with a rating of 60 W. They are inefficient artificial light source and their light intensity efficiency is about 18 lumens / watt.
  - ii. Fluorescent lamps  
Generate bright light and are most often used with a rating of 32 W/36 W. These lamps come together with ballasts, normally rated at 8 W loss, although low loss ballasts (up to 6 W) or high frequency electronic ballasts (nominally less than 2 W) are also available.

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