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Analysis Of Community Behavior In Consuming Environmentally Electrical Energy In Simple House Types In Makassar City, Indonesia

Alimuddin Sa'ban Miru[1], Bakhrani A. Rauf[2], Nurlita Pertiwi[3]

[1,2,3]*Department of Environmental Science, Universitas Negeri Makassar*
asmiru63@gmail.com[1], bakhranirauf192@yahoo.com[2], nurlita.pertiwi@unm.ac.id[3]

Abstract

The use of electrical energy in residential in Indonesia dominates national electricity. Energy consumption per capita increases yearly and makes a crucial problem in developing countries. Therefore, a study of the consumption of electrical energy in the household sector is essential for formulating government policies in energy conservation efforts. This study involved 150 families who lived in simple houses in Makassar City. A questionnaire that includes eight independent variables and one dependent variable becomes a data collection tool. Data analysis used eight steps in the stepwise linear regression method. The analysis results show that environmental awareness is the most critical variable in electrical energy consumption. Furthermore, the knowledge variable on the pattern of saving electrical energy and caring attitude towards saving energy became the second and third essential variables. Therefore, regulations to encourage the proper use of electrical power must begin with increasing public knowledge and commitment to energy conservation efforts.

Keywords: awareness, attitude, knowledge.

INTRODUCTION

Consumption of electrical energy increases along with the increase in the types of electronic equipment used by the public. As a result, household-level energy consumption is multiplying (Sukarno et al., 2017). Data from the Ministry of Energy and Mineral Resources of the Republic of Indonesia shows an increase in electricity consumption per capita, the amount of electrical energy used or utilized directly or indirectly from energy sources divided by the number of residents in an area in one year. Electricity consumption per capita per year was 1.06 MWH in 2018, and in 2019 it increased to 1.08 MWH, and in 2020 it reached a value of 1.09 MWH. However, this condition causes problems because the ability to supply energy is limited and coupled with the growth in energy demand in the industry (Pérez-Lombard et al., 2008). The Indonesian government and industry have carried out various energy efficiency strategies at the household level. Many techniques, such as LEDs (Light Emitting Diodes), produce brighter light with less energy use. In addition, the AC industry also provides inverters that work at low speeds with a variety of choices. However, the Indonesian people have not shown any efforts to save electrical energy.

The energy-saving movement is a program directed at residential homes. The use of energy at the household level is carried out to meet the needs of its residents. In general, the use of electrical power in simple homes is divided into artificial lighting functions, temperature control functions, electrical functions related to daily activities, and the function of pumping

clean water. Therefore, electrical energy for simple homes can be easily calculated to predict energy-saving patterns.

The pattern of energy consumption cannot be reduced to a minimum. However, it must adapt to the needs of the community. Low light or dark lighting can worsen occupants' health, causing headaches, insomnia and depression, and suicide. In addition, most workers admit that poor lighting in the workplace causes eye fatigue, work fatigue, headaches, stress, and work accidents. On the other hand, excessive lighting also affects the health and safety of workers, such as glare, headaches, and anxiety. One of the phenomena for householders is that good lighting can make workers or householders able to see work carefully. On the other hand, the lighter condition creates a safe and comfortable work environment. To prevent or reduce the potential for discomfort from poor lighting, the lighting in the workspace must meet the requirements for carrying out activities. Reasonable and appropriate lighting is essential for comfort, safety, and fun in activities.

People's behavior using electrical energy is a serious problem because this behavior strongly influences the level of energy efficiency. Low levels are among a series of behaviors that change very quickly because they are related to people's daily lives in meeting their needs. Behavior about energy consumption is closely related to the user's ability to regulate the function of the room and the use of household appliances. Generally, the behavior of energy consumption is very dependent on the lifestyle of each household (Tran et al., 2021). The family room seems to be prioritized for use in this residential apartment. In contrast, the private room is indicated to be used less frequently. From the aspect that affects behavior, electrical energy use patterns are influenced by knowledge, motivation, attitude, commitment, self-control, concern, and social environment.

This study focuses on describing the energy consumption behavior of people who occupy simple houses. The proportion of simple homes in Indonesia is the most significant percentage. This study can describe the dominant pattern in using electrical energy at the household level.

METHOD

This study uses a quantitative method with a correlational approach that connects seven independent variables and one dependent variable. The researcher selected all households living in simple houses as the population and assigned 150 heads of families as respondents. The research instrument was developed using a Likert scale for six variables and one variable using the Guttman scale. Data analysis uses the stepwise regression method to find the dominant variables influencing energy consumption behavior. The variables in this study are public knowledge of energy-efficient consumption (X1), public attitudes toward energy-saving consumption (X2), community motivation in energy-saving consumption (X3), and community commitment to energy-saving consumption (X4), public awareness of consuming energy. Energy-saving (X5), community locus of control in energy-efficient consumption (X6), community social environment in energy-efficient consumption (X7), local wisdom (X8), and community behavior in energy-saving consumption (Y).

RESULT AND DISCUSSION

Descriptive Analysis

The descriptive analysis of the behavior of people's electrical energy consumption illustrates that the use of electrical energy for the household level generally aims for lighting, temperature control, cooking, and other activities. The four groups were used as respondents' questions and

resulted in an assessment divided into five categories (Table 1).

Table 1. Frequency Distribution Of People's Energy Consumption Behavior

No	Category	Frequency	Percentage (%)
1	Very low	0	0
2	Low	15	10
3	Medium	105	70
4	High	30	20
5	Very High	0	0
Total		150	100

The distribution results above show that people's behavior in consuming electrical energy is in the moderate category. The description of people's behavior regarding energy consumption shows that it is generally characterized by choice of more LED lamps than incandescent lamps. The respondent's habit of regulating the refrigerator's temperature showed in the medium category. Meanwhile, the community in the medium category of energy consumption is indicated by installing light lamps with high power in the living room and family room. It was also indicated of the habit of cooking water using an electric kettle. This description shows the need for education about the use of environmentally sound energy or the use of power that is by the needs of family members.

Table 2. ANOVA Test on Eight Stages Of Stepwise Regression.

Stage	Number of Independent Variables	Sig.
1	8 variables	0.000
2	7 variables	0.000
3	6 variables	0.000
4	5 variables	0.000
5	4 variables	0.000
6	3 variables	0.000
7	2 variables	0.000
8	1 variable	0.000

The results of testing the effect of the independent variable on the dependent variable found a significant value that is smaller than 0.05 or all stages indicate an influence between the independent variables on the dependent variable. Furthermore, the magnitude of the force together is followed by the Regression presented in table 3.

Table 3. Effect of Independent Variables on The Dependent Variable

Stage	R Square
1	0.996
2	0.990
3	0.981
4	0.927
5	0.936
6	0.916
7	0.651
8	0.548

The analysis results show that the six stages show an extreme correlation coefficient between 0.75 - and 0.99. Two steps show a strong correlation coefficient between variables between categories with a 0.50 - 0.75. The ANOVA and further regression analysis results indicated that the correlation between the independent and dependent variables could be continued in the regression analysis.

Table 4. Stepwise Regression in First and Second Step

Stage	Variable	Beta	Sig.
Stage 1	X1	1.742	0.000
	X2	2.274	0.000
	X3	2.925	0.000
	X4	2.530	0.000
	X5	1.093	0.000
	X6	1.373	0.000
	X7	0.976	0.000
	X8	1.086	0.000
Stage 2	X1	1.228	0.000
	X2	1.300	0.000
	X3	1.497	0.000
	X4	0.904	0.000
	X5	0.559	0.000
	X6	1.328	0.000
	X8	1.154	0.000

Table 5. Stepwise Analysis in Stages Three to Eight

Stage	Variable	Beta	Sig.
Stage 3	X1	0.866	0.000
	X2	0.836	0.000
	X3	-0.834	0.000
	X4	0.311	0.000

	X6	1.230	0.000
	X8	-1.092	0.000
Stage 4	X1	0.870	0.000
	X2	0.680	0.000
	X3	0.540	0.000
	X6	1.543	0.000
	X8	1.256	0.000
Stage 5	X1	0.629	0.000
	X2	0.237	0.000
	X6	1.568	0.000
	X8	1.269	0.000
Stage 6	X1	0.624	0.000
	X6	1.773	0.000
	X8	1.287	0.000
Stage 7	X6	1.269	0.000
	X8	-0.618	0.000
Stage 8	X6	0.740	0.000

The analysis results above show that at stage one, the independent variable with the smallest contribution value is the social environment variable (X7) = 0.976. The X7 variable is excluded in the subsequent multiple regression model. In the second stage, the independent variable with the most negligible contribution is the Locus of the Control variable (X5) = 0.589. Then the X5 variable is excluded in the following multiple regression model. In the third stage, the independent variable with the smallest contribution value is the commitment variable (X4) = 0.311, the X4 variable is excluded from the subsequent multiple regression model.

In the fourth stage, the independent variable whose contribution value is the smallest is the motivation variable (X3) = 0.540. The X3 variable is excluded in the following multiple regression model. In the fifth stage, the most negligible independent variable contribution is the attitude variable (X2) = 0.237. The X2 variable is excluded in the subsequent multiple regression model. At the stage of six independent variables whose contribution value is the smallest is knowledge (X1) = 0.624. The X1 variable is excluded in the next regression model. At stage seven, the independent variable whose contribution value is the smallest is the local wisdom variable (X8) = 0.618, and then the X8 variable is excluded in the next regression model. In the last stage, or stage eight, the concern variable (X6) becomes the variable that most influences people's behavior in consuming electrical energy.

Stepwise analysis shows that the social environment variable has a minor contribution to the pattern of energy consumption. The social interaction between residents does not affect the choice of household electronic equipment and other electrical energy. Respondents generally determine the electricity consumption pattern without being influenced by other people. Furthermore, in the second stage, the lowest is the Locus of the control variable. The Locus of control variable in energy consumption is indicated by the respondent's belief in being able to save energy or a commitment to invite all family members to take energy-saving actions. However, this belief has a low contribution to the use of electrical energy in households. Self-control ability depends on knowledge of good energy-saving patterns. Someone who has good

knowledge will impact his control in using electrical equipment carefully.

The third stage analysis produces the value of the commitment variable with a minor contribution to electrical energy consumption in a simple house. This variable is reviewed on two indicators: internal commitment and external commitment. The study results indicate that the respondent's commitment to creating convenience and comfort in the home has a low effect on selecting energy-efficient electrical equipment. Furthermore, in the fourth stage, the most subordinate variable is motivation. People's motivation to use electrical energy has little effect on energy consumption in simple houses. Respondents generally indicated economic motivation as the reason for choosing energy-saving patterns. However, this reason does not significantly influence the choice of electrical appliances in the household.

In the fifth stage, it is found that the attitude towards energy-efficient consumption greatly influences the pattern of energy consumption. Furthermore, in the sixth stage, it was found that the knowledge variable had a great influence on energy consumption. In the seventh stage, local wisdom had a high impact on energy-saving consumption. The one that had the greatest effect on energy-saving consumption was the concern variable.

DISCUSSION

Environmental concern has a major contribution to the behavior of electrical energy consumption. This variable is used to predict the possibility of behavior formation. In this research, public concern is manifested by their anxiety about the electrical energy crisis and the risk of environmental degradation due to excessive use of electrical energy. With this concern, the community will try to minimize energy use. Several references describe that concern for the environment is a commitment and or emotional condition of the community towards various issues in the surrounding environment. Another reference states that concern is formed by paying attention to the facts of environmental damage due to one's behavior. Knowledge of environmental facts is formed through experience.

The second important factor after the concern is knowledge about the efficient use of electrical energy. Based on the respondents' answers, it was revealed that most people do not understand how to use electrical equipment wisely. Lamps with low power measures cannot be considered a cost-effective measure if they do not meet the user's activity requirements. The need for lighting for reading is higher than the need for watching TV.

The use of Lights must adapt to human visual needs, such as to avoid the risk of falling or the need for temporal orientation throughout the day. Light is very influential on impaired human mobility, such as in the elderly group with limited spatio-temporal exposure and needing brighter lights (Clement et al., 2014).

Efforts to save electrical energy in residential homes can be overcome by having equipment to monitor the activities and needs of residents for electrical power. The use of sensor equipment allows residents to automatically adjust electricity usage according to user needs. Even remote monitoring can be done quickly. Innovative home technology or technology-based homes allow users to regulate and control the use of electrical energy automatically remotely using an internet connection with a mobile device (Balta-Ozkan et al., 2013; Ding et al., 2011).

Various choices of technology for the use of electrical energy can be applied to residential homes. However, the use of environmentally friendly electrical energy depends on their care, knowledge and commitment to the environment. Therefore, regulations to encourage the proper use of electrical energy must begin with increasing public knowledge and commitment to energy conservation efforts.

CONCLUSION

A stepwise analysis is used to find important factors influencing energy consumption patterns in residential homes in Makassar City, Indonesia. The study results found that attitudes, knowledge and public awareness were the three most important factors in the use of electrical energy. Users generally show patterns of energy consumption that are not environmentally sound. Most of the respondents use electrical equipment without adjusting their needs.

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