

Community lifestyle patterns and household electrical energy consumption behavior to reduce carbon emissions

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Abstract

Indonesia is a gas emitting country which ranks 6th in the world with carbon dioxide emissions of 1.98 billion tons of emissions per year. According to data from the Ministry of Energy and Mineral Resources (ESDM), the household sector accounts for around 36 percent of total energy. Energy demand in the household sector is estimated to increase to 70.6 million in line with the increase in the number of households in 2025. Given the threat of climate change and environmental problems and strengthened by the increase in the number of public outreach, people today have more information and knowledge about carbon emissions. This study will investigate the impact of subjective factors on household carbon emissions and further explore the relationship between the impact of consumer lifestyle using household electrical appliances and awareness on household carbon emissions in Lhokseumawe and North Aceh. The purpose of this study is to provide empirical evidence of the influence of perception factors, learning factors, and attitude factors on people's behavior regarding awareness of the impact of carbon emissions. Sampling using nonprobability sampling method and the number of samples used in this study were 200 respondents. Data analysis in this study used multiple linear regression analysis, to see the influence of Perception, Learning and attitude factors on people's behavior regarding awareness of the impact of carbon emissions. The test results in this study indicate that the perception factor and the attitude factor have a positive and significant effect on people's behavior regarding awareness of the impact of carbon emissions, while the learning variable has no significant effect on community behavior regarding awareness of the impact of carbon emissions.

Keywords : *Electricity usage behavior, Social awareness, perception, Learning, Attitude, Carbon emission, Lifestyle.*

JEL Classification :

1. INTRODUCTION

Extreme and gradual climate change has an impact on carbon emissions and endangers humans and ecosystems globally. Average global temperatures rose 1.3°C higher in 2016 and are expected to rise to 6.4°C this century, causing sea levels to rise by 16.5–53.8 cm. Atmospheric gases are absorbed and emitted to the earth's surface which then warms up through the greenhouse effect, this causes the earth's surface temperature to be 33°C higher on average globally (WMO, 2019). With this climate change, the danger of greenhouse gas (GHG) emissions has a global impact on humans and ecosystems. Carbon dioxide (CO₂) as the main ingredient is greenhouse gas (GHG) which leads to global warming and climate change (World Bank, 2020).

Indonesia was the fourth largest GHG producer in the world in 2015, where the highest sources of emissions came from deforestation and peat forest fires, followed by emissions from burning fossil fuels for energy and energy use in the household sector (Carbon Brief, 2019). Along with the increase in population followed by economic growth, the industrial sector began to develop. Population growth, economic development and also increasing urbanization have led to increased energy consumption so that the trend of increasing carbon emissions is increasing in the housing sector, especially in developing countries (Nejat et al., 2015). According to the Ministry of Energy and Mineral Resources (ESDM), Indonesia as one of the developing countries contributes about 36% of the total energy in the household sector (KESDM, 2017). This growth in household energy use is projected to continue to increase in the coming year (EIA, 2015). Household expenditure or increase in income, number of human population, lifestyle, and also household size are the main factors that affect household energy consumption (Niu et al., 2019). Energy demand in the household sector is increasing in line with the increase in the number of households which is expected to reach 70.6 million in 2025. Research on electrical energy consumption in the household sector has been widely studied and has identified several influencing factors such as occupancy rates and ownership of electrical equipment (Fong et al., 2007; Chen et al., 2013; Wijaya and Tezuka, 2012; Sugiura et al., 2013), household behavior (Mohammad et al., 2013; Chen et al., 2012; Ouyang and Hokao, 2009), household behavior related to fuel use in urban areas (Pranadji et al., 2010; Sukarno et al., 2015). Although many researchers conducted studies on energy consumption in the housing sector, most of the studies focused on developed countries and only a few conducted studies in developing countries, especially in Indonesia. However, only a few studies have considered aspects of household lifestyle, such as family pattern, income level, ownership of household appliances, and housing location.

Based on behavioral economic theory (Kahneman and Tversky, 1979) shows that subjective factors, such as beliefs and preferences, can influence individual decision making. Given the threat of climate change and environmental concerns and amplified by an increasing number of public outreach, people today have more information and knowledge than ever about carbon emissions. However, the fundamental question is whether this social awareness will actually lead to a reduction in carbon emissions. This study will investigate the impact of community behavioral factors on household carbon emissions and further explore the impact of consumer lifestyles on the relationship between awareness and household carbon emissions.

Given the threat of climate change and environmental problems and amplified by the increasing number of public outreach, people now have more information and knowledge about carbon emissions. This study will investigate the impact of subjective factors on household carbon emissions and further explore the relationship between the impact of consumer lifestyle using household electrical appliances and awareness on household carbon emissions in Lhokseumawe and North Aceh. The results of this study can provide information about the role of consumer lifestyles in influencing carbon emissions and also facilitate decision makers to establish rational carbon reduction policies in the household sector.

2. LITERATURE REVIEW

Perception is how people see or interpret events, objects, and humans (Lubis, 2010). Meanwhile, according to Gerald (2012) perception is the process by which a person selects, organizes, and information to form an image of the world. Therefore, it is important to examine more deeply how consumers perceive social awareness about the impact of carbon emissions on the environment. The better the perception and understanding of the community in responding to the impact of carbon emissions, the better the level of public social awareness of the impacts that can be caused by carbon emissions, on the contrary, the worse the public

perception and understanding of carbon emissions, the lower the level of social awareness of the impact of carbon emissions environment.

According to (Syah, 2010) learning is a form of effort made by someone so that other people learn. In terms of public awareness of carbon emissions, learning is important to do to the community in order to increase public knowledge and understanding of the impact of carbon emissions because the better the level of learning received by the community. The community will have a better understanding and social awareness of the impact of carbon emissions and it is hoped that the community will be able to control or minimize the use of electricity at home and increase greenery around the location of the house.

Attitude is one of the terms in the field of psychology that deals with perception and behavior. According to Schiffman and Kanuk in Susanta (2008) "Attitude is a learned tendency to behave in a pleasant or unpleasant way towards a particular object." Attitudes occur in certain situations, the meaning of the situation here is a variety of events or circumstances that at a certain stage and time, affect the relationship between attitudes and consumer behavior. This is in line with research conducted by Yayat Suharyat (2009) which states that attitudes affect behavior through a careful decision-making process. Specific attitudes that can influence behavior are social attitudes that are expressed repeatedly in the same or more common activities. called habits, motives are impulses, desires and desires that come from within, values are subjective norms, while the driving and restraining forces are in the form of advice or counseling and information.

According to Kurt Lewin, behavior is a function of individual characteristics (motives, values, personality traits, etc.) and the environment, environmental factors have great power in determining behavior. Behavior is a concrete reflection that appears in attitudes, actions and words that arise due to the learning process, stimuli and the environment. In terms of awareness of the impact of carbon emissions, public awareness can be influenced by people's behavior towards the use of household electrical appliances, this is in line with a study conducted by Bai and Liu (2013) using a sample of respondents in Tianjin, China which explored the relationship between low carbon awareness and behavior and found that the level of behavior was higher than the level of awareness, indicating a gap between behavior and awareness of carbon emissions.

Research on carbon emissions has been extensively researched and has identified several factors that influence the occupancy rate and ownership of electrical equipment (Fong et al., 2007; Chen et al., 2013; Wijaya and Tezuka, 2012; Sugiura et al., 2013), behavior household (Mohammad et al., 2013; Chen et al., 2012; Ouyang and Hokao, 2009), household behavior related to fuel use in urban areas (Pranadji et al., 2010; Sukarno et al., 2015). In the literature, only a few studies have investigated the relationship between awareness and household emissions from a micro perspective. For example, Wilson et al. (2013) on Canadian respondents found that carbon emissions and subjective well-being are not closely related. The same result was also found by Andersson et al. (2014) in a survey of respondents in Sweden, and Sekulova and van den Bergh (2013) using a sample of respondents in Spain. Meanwhile, Bai and Liu (2013) used a sample of respondents in Tianjin, China who explored the relationship between low-carbon awareness and behavior and found that the level of behavior was higher than the level of awareness, indicating a gap between awareness and low-carbon behavior. This finding is in line with the results of other studies—that the level of awareness exceeds behavior (Van Raaij and Verhallen, 1983; Owens and Driffill, 2008).

This study aims to fill the gap by studying the impact of subjective factors on household carbon emissions and focusing on the emission reduction effects of various subjective

household measures and further exploring the impact of consumer lifestyle on the relationship between awareness and household carbon emissions.

3. RESEARCH METHOD

This research took place in Lhokseumawe City, Aceh. The city of Lhokseumawe is a densely populated city. The city is divided into 4 (four) sub-districts, namely, Muara Satu, Muara Dua, Banda Sakti and Blang Mangat. Of the four sub-districts, the city is further divided into several different postal codes in each sub-district. In this study, the distribution of the questionnaire was divided into four districts, namely, Muara Satu with 40 respondents, Muara Dua with 50 respondents, Banda Sakti with 70 respondents and Blang Mangat with 40 respondents. So that the total number of respondents in this study were 200 people. This study aims to look at the lifestyle behavior of consumers on the relationship between awareness and household carbon emissions in Lhokseumawe City. The implementation of research increases public awareness in the use of household appliances to reduce carbon emission mitigation.

The data used in primary data research, namely Observation, is a data collection activity based on direct observations to every sub-district in Lhokseumawe City with a focus on observing people who are married and distributing questionnaires, which is the stage of collecting data taking directly to the community or other parties. related to the sample of this study.

To measure the knowledge variable using the questions developed by Maloney et al. (1975) and as has been applied by studies such as that of Polonsky et al. (2012), measuring attitudes and related behaviors using a series of questions that have been applied in the study by Cotton et al. (2015a, 2015b) and by Paço et al. (2015). While on the perception variable regarding energy issues in this case, we chose to apply the questions developed for the study by Cotton et al. (2015a, 2015b). In this research, the writer uses multiple linear regression statistical analysis. Multiple Linear Regression is intended to determine the linear relationship between several independent variables and the dependent variable. To determine the effectiveness of the questionnaire items, the validity test can be used to ensure the validity of the questionnaire survey. The reliability of the questionnaire is reflected by Cronbach's alpha coefficient and this test determines the consistency of a research instrument. Validity is a measure that states the level of validity/validity of an instrument. Valid instruments can be used to measure what is being measured. Reliability concerns the degree of accuracy and precision or accuracy shown by the measuring instrument. A measuring instrument is said to have high reliability and can be trusted if the measuring instrument is steady, stable, and reliable (Sekaran, 2003). The model used in this study can be declared valid if it is fulfilled with classical regression assumptions. The classical assumption test that was carried out in this study was the normality test, multicollinearity test, autocorrelation test, and heteroscedasticity test. Hypothesis Testing In this study, the F test, where the f test is used to test the model in the study and the t-test where the t test is used to test the significance of each independent variable on the dependent variable.

4. RESULTS AND ANALYSIS

From the results of the study, it was found that the characteristics of respondents based on education were known that the frequency of respondents as much as 3.5% had elementary school education, 12.2% of respondents graduated from junior high school, 52.2% graduated from high school, 6.1% respondents graduated from D-III. Then, 22.6% are undergraduate

graduates, and the remaining 3.5% are postgraduate graduates. So from the frequency above it can be concluded that if the analysis is in terms of education, the majority of respondents in this study are high school graduates.

Characteristics of respondents based on income, it is known that as many as 40.9% of respondents have an income of less than or equal to Rp. 1,000,000/month, as many as 37.4% have an income of Rp. 1,000,000-Rp. 3,000,000, as many as 17.4% have income of Rp.3,000,000-Rp.5,000,000, and the remaining 4.3% have income of more than Rp.5,000,000. So from the frequency above, it can be concluded that if the analysis in terms of income, most respondents in this study are those who have incomes less than or equal to Rp. 1,000,000.

Based on the electricity payment method installed in the respondent's house, the characteristics of the respondent are 56.5% paying for electricity using the prepaid method, then 41.7% using the Postpaid payment method, and 1.7% electricity financing is borne by the company. Based on the number of respondents' family members, the characteristics of respondents as much as 5.2% have family members equal to or less than 3 people, as many as 61.7% of respondents have family members 3-5 people, and 33% of respondents have family members more than or equal to 6 people.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.583 ^a	.339	.350	2.457

Based on the calculation of the correlation value (R) the result is 0.583, where this value shows the strong relationship between Perception, Learning, and Attitudes factors towards community behavior. While the coefficient of determination or R Square of 0.339 means that the Perception, Learning, and Attitude factors have the ability to explain their influence on people's behavior by 33% and the remaining 67% is influenced by other factors not examined or outside this research model.

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	10.509	1.421		7.396	.000		
	Persepsi (X1)	.256	.087	.311	2.960	.004	.540	1.851
	Pembelajaran (X2)	-.058	.077	-.071	-.746	.457	.649	1.541
	Sikap (X3)	.289	.076	.381	3.790	.000	.590	1.695

a. Dependent Variable: Perilaku

Based on the table above, the multiple linear regression equations that can be arranged in this study are as follows: $Y = 10.509 + 0.256X1 - 0.058X2 + 0.289X3$

The value of the regression coefficient X1 is positive and indicates that perception has a significant effect on people's behavior. Then, the value of the regression coefficient X2 is negative and indicates that the learning variable has a negative and insignificant effect on people's behavior. Finally, the value of the regression coefficient X3 is positive and also attitudes have a significant effect on people's behavior.

Statistically, the average value (mean) of the perception variable is 3.57. From this value, it shows that the level of public perception of environmentally friendly energy-saving products is still in the not good category. Then the learning variable with the mean value is 2.68. The mean value of the learning variable shows that the level of community learning towards environmentally friendly energy-saving products is in the bad category. The average value of the attitude variable is 3.87. These results indicate that the level of public attitudes towards environmentally friendly energy-saving products is still in the not good category. Finally, the mean value of the community behavior variable is 4.00, these results indicate that the level of community behavior in the use of energy-efficient and environmentally friendly electricity is in the good category.

In the variable of public perception of environmentally friendly energy-saving products, there are indicators on question items that have low results, namely indicators regarding the use of energy-efficient and environmentally friendly electrical equipment products and indicators regarding the concept of carbon emissions. From these results, it shows that the results are in accordance with the characteristics of the respondents which indicate the income side of the respondents, so the perception of environmentally friendly energy-saving products can occur due to the low income of the respondents making it difficult to buy environmentally friendly energy-saving products.

In the community learning variable on environmentally friendly energy-saving products, all indicators in the question items obtained low results such as indicators regarding participation in energy-saving and environmentally friendly events, indicators regarding events, news or promotion of learning about energy-saving and environmentally friendly products and as well as indicators on energy saving lessons that have an impact on the environment. From these results, almost all respondents stated that there were deficiencies in learning about environmentally friendly energy-saving products in any form so that learning was needed to strengthen so that people could understand the concept of energy-saving which had an impact on the environment.

In the variable of people's attitudes towards environmentally friendly energy-saving products, there are indicators on the question item which have low results, namely on indicators regarding attitudes towards energy-efficient and environmentally friendly electrical equipment products, and on indicators regarding reluctance to buy energy-efficient and environmentally friendly electrical equipment products. . From these results it can be stated that in general respondents have a level of reluctance in buying which is still in the average stage by looking at the conditions that occur, if energy saving activities are needed, respondents will buy because the effect is beneficial for them.

The last variable, the behavior of using energy-saving products that are environmentally friendly, there are indicators that have low results, namely indicators of energy-saving activities that have an impact on the environment, which are not a priority for the respondents, then on indicators that show electrical energy saving behavior has not been carried out optimally and the last is indicators which shows the

respondent's sense of innocence in the behavior of energy wasting activities. This shows that the level of behavior of the community as a whole is still low in saving energy, especially in electrical equipment that has an impact on environmental changes that can reduce carbon emissions.

5. CONCLUSION

1. The perception factor has a significant effect on people's behavior regarding awareness of the impact of carbon emissions. The better the public's perception and understanding in responding to the impact of carbon emissions, the better the level of public social awareness of the impacts that can be caused by carbon emissions, on the contrary, the worse the perception and understanding society towards carbon emissions, the lower the level of social awareness of the impact caused by carbon emissions to the environment.
2. Learning factors do not affect people's behavior regarding awareness of the impact of carbon emissions, learning given to the community cannot change people's lifestyles and behavior related to the habit of using household electrical appliances, so that people's behavior remains the same.
3. Attitude factor has a significant effect on people's behavior regarding awareness of the impact of carbon emissions. Attitudes can affect a person's behavior, social attitudes expressed repeatedly in the same activity or more commonly called habits, this can be associated with repetitive behavior and people's habits in using electricity can affect people's social awareness about the impact of carbon emissions.
4. Perception variables, learning variables and attitudes together have a positive and significant influence on people's behavior.

Suggestions for research

1. Learning about the importance of saving electrical energy and its impact on carbon emissions should be more directed and affect the community in this case the relevant agencies can provide massive and continuous socialization or news
2. Knowledge about environmentally friendly energy-saving products needs to be increased and explained about the real benefits in everyday life so that people's reluctance to buy energy-efficient products is reduced and switch to energy-efficient and environmentally friendly products
3. Adjustment of the price of energy-saving products that are environmentally friendly so that they can be affordable by the community and also the availability of these products, making it easier for people to choose and buy these products.
4. Go green campaigns or energy savings for the sake of reducing carbon emissions are carried out regularly so that they can become daily behaviors.
5. Suggestions to the community to be wiser in using energy and making the best use of resources, household communities are expected to be able to participate in reducing carbon emissions caused by community activities, be wise to use energy and other resources, plant trees and carry out activities. reforestation and increasing awareness

about energy saving, it is hoped that the community will be able to reduce carbon emissions that occur in the environment through awareness and raising awareness and improvement of household spending or increasing income, the number of human population, lifestyle, and also the size of the household are the main factors that affects household energy consumption, because currently Indonesia is the 6th largest contributor to carbon emissions in the world, and hopes for the community and also researchers that Indonesia is able to really slowly reduce and be wise in matters relating to pens. tackling carbon emissions.

6. The absence of changes in community behavior or habits after being given socialization/learning indicates that public behavior towards social awareness regarding carbon emissions needs to be addressed further, in this case the role of the community and government is needed. The government is expected to be firm in setting rational carbon reduction policies in the household sector as well as the government's role in developing policies regarding spatial and urban planning, transportation, and also supporting the perspective of purchasing green products in which social roles and styles are expected. live on carbon emission mitigation.

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