



## From Awareness to Action: How Knowledge of Energy-Saving Labels Drives Sustainable Consumer Behavior Towards Energy-Efficient Home Appliances in Indonesia

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### ABSTRACT

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Amid increasing global awareness of the urgency of climate change and limited energy resources, designing strategies to reduce energy consumption and carbon emissions are crucial, especially in developing countries like Indonesia. With its growing per capita energy use and significant carbon emission burden, Indonesia faces a dual challenge: meeting its growing energy needs while minimizing environmental impacts. This study integrates Knowledge of Energy-Saving Labels (KEL) into the Theory of Planned Behavior (TPB) to explore the purchasing behavior of Energy-Efficient Home Appliances (EHAs) on Java Island, which is the region with the highest domestic energy consumption in Indonesia. Data from 239 valid questionnaires were collected and analyzed using the Partial Least Squares (PLS) approach through Smart-PLS version 4 software. The findings show that consumer attitudes (CA), perceived behavioral control (PBC), and subjective norms (SN) significantly influence the intention to purchase EHAs. Likewise, KEL significantly influences CA, PBC, and SN. This research not only confirms the applicability of the TPB in analyzing the behavior of Indonesian consumers towards EHAs but also provides practical insights for policymakers and industry to formulate more effective strategies to increase awareness and adoption of energy-efficient household products.

## 1. INTRODUCTION

Increased global awareness of the impacts of climate change and decreased availability of energy resources have prompted a significant response from the international community [1]. Given the urgency of addressing these issues, a solid scientific consensus supports the view that increased concentrations of greenhouse gases in the atmosphere—especially those resulting from carbon emissions from energy consumption and fossil fuel use—significantly contribute to climate change [2]. Facing this challenge, various countries, including Indonesia, have implemented policies and strategic initiatives to reduce energy consumption and limit carbon emissions. This research is critical as it aligns with global efforts to combat climate change, particularly within the context of Indonesia's policy framework. For instance, by ratifying the Paris Agreement embodied in Law Number 16 of 2016 and adopting the energy sustainability mandate in Law Number 30 of 2009 concerning electricity, Indonesia shows a solid commitment to energy conservation efforts and carbon emission reduction [3]. While the Government's main focus lies on the industrial sector, the contribution of the household sector to energy consumption and carbon emissions is also significant. However, initiatives explicitly aimed at this sector are still limited [4].

Acknowledging the importance of household energy

consumption in efforts to reduce the carbon emissions, the Indonesian Government introduced the “10 Percent Cut Program” in 2016. This program aims to encourage more efficient use of domestic electricity by targeting a 10% reduction in consumption. The initiative is expected to match the energy savings gained from avoiding the construction of new coal-fired power plants with a capacity of 3.5 GW over three years [5]. However, the termination of the program and the lack of evaluation of its effectiveness indicate a gap in the literature relating to the assessment of energy-saving policies. As another effort, Perusahaan Listrik Negara (PLN) has implemented a prepaid meter system to promote energy-saving behavior by providing consumers with a direct understanding of the relationship between energy usage and costs. Nonetheless, the effectiveness of prepaid meter systems in driving energy efficiency still needs to be definitively proven [6]. Furthermore, the Government has introduced several new policies to encourage energy efficiency in household appliances, including the Energy Saving Mark Label. Figure 1 shows the Energy Saving Mark Label used in Indonesia, which is designed to indicate products that meet the Government's energy efficiency requirements and promote consumer awareness of energy-saving practices. The new policy covers five widely used appliances: fans, refrigerators, rice cookers, air conditioners, and LED lights [7]. These

policies aim to eliminate inefficient products from the market, reduce carbon emissions, and lower home energy bills, as evidenced by a 2017 Chinese study, which showed savings of up to 10 billion kWh of electricity per year and a reduction in carbon emissions of 6.5 million tons through the adoption of EHAs [8].

Although there has been research on consumer purchase intentions towards EHAs in developed countries, this research is still in its early stages in many developing countries, including the Asian region [9]. As one of Southeast Asia's largest economies, Indonesia faces more complex energy challenges than global challenges. As a developing middle-income country, a significant correlation exists between increased energy use—particularly electricity—and income growth [10]. Over the past decade, Indonesia has recorded an increase in per capita energy consumption of about 24%, while total carbon emissions increased by about 5.2% from 2017, contributing 1.5% to total global emissions [11]. Facing the energy trilemma of balancing energy security, energy poverty, and climate change mitigation, research on energy consumption in Indonesia is critical [12]. Currently, primary energy consumption in the country is still heavily dependent on fossil fuels, with only about 9.17% coming from renewables [13]. If the current energy consumption and production trend continues without innovative solutions, it is estimated that all fossil energy resources will soon be exhausted [14]. Therefore, EHAs are considered an inevitable solution to reducing the total impact of energy consumption [15] by making a significant contribution through efficient electricity consumption and having labels and certifications of energy-saving products [16].



**Figure 1.** Energy saving sign labels in Indonesia

Recent research shows that various factors play a role in motivating consumers to choose Energy-Efficient Home Appliances. These factors include the socioeconomic conditions of consumers [17], psychographic characteristics [18], information initiatives [19], and awareness of the importance of actions that support environmental sustainability [20]. In addition, the influence of ecological knowledge on purchasing decisions for Energy-Efficient Home Appliances is also a significant topic for researchers [21]. However, there needs to be more literature on how consumers' knowledge of energy-efficient home appliance labels affects their purchasing decisions. While studies have explored energy-saving labels and consumer attitudes, little has addressed their relationship to perceived behavioral control and subjective consumer norms [22]. Therefore, this study will explore the relationship between Knowledge of Energy-Saving Labels and the three main components of

Planned Behavior Theory (attitudes towards behavior, subjective norms, and perceived behavioral control) as an attempt to fill the gaps that exist in the literature.

Understanding energy-saving labels not only enhances consumer awareness of energy-efficient home appliance products but also facilitates more informed decision-making [22]. In this context, knowledge of energy-efficient labels plays a distinct role, separate from general environmental knowledge, significantly influencing consumers' purchasing decisions [9]. Integrating this knowledge into the Theory of Planned Behavior framework provides new insights into environmental marketing literature and supports more conscious and responsible purchasing practices.

This study aims to address the following research questions:

1. How does better Knowledge of Energy-Saving Labels influence consumer attitudes, strengthen subjective norms, and increase perceived control regarding purchasing EHAs?
2. How do consumer attitudes, subjective norms, and perceived control improvements significantly increase consumers' intentions to purchase EHAs?

The findings of this research are expected to provide valuable insight for marketers in designing more effective energy-saving label campaigns and policymakers in developing regulations that promote energy-efficient purchasing behaviors. Marketers and government entities can foster a more sustainable market for EHAs by enhancing consumer understanding and influence through targeted strategies.

The structure of this paper provides a clear roadmap for this research: Part 2 reviews the relevant literature and theoretical framework; Part 3 describes the research methodology; Part 4 presents data analysis, findings, and discussions; and Section 5 discusses conclusions, research implications, and limitations.

## 2. THEORETICAL BACKGROUND

### 2.1 Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) proposed by Ajzen [23] provides a robust framework for understanding the factors that influence individual actions. Based on the TPB, a person's actions are guided by attitude towards behavior, subjective norms, and perceived behavior control. Consumer attitudes (CA) reflect an individual's positive or negative evaluation of the implementation of a particular behavior, as well as their beliefs about the outcome of that behavior and its evaluation [24]. Subjective norms (SNs) involve the perceived social pressure to perform or not perform certain behaviors, highlighting the influence of social expectations and the motivation to comply with those expectations [25]. Perceived behavioral control (PBC) refers to the ease or difficulty felt in performing the behavior and includes the individual's confidence in carrying out the behavior, considering internal and external constraints [26]. The TPB argues that these three factors collectively shape the individual's behavioral intent, predicting actual behavior [27].

This theory is particularly relevant to our research on adopting energy-efficient household appliances in Indonesia because it provides a comprehensive framework for understanding the psychological processes that drive consumer behavior. This allows us to research how attitudes,

social influences, and perceived control influence purchasing decisions. In contrast to other studies that may only focus on economic or demographic factors, our research integrates a psychological dimension, making the TPB an appropriate and informative foundation to explore the complex motivations behind consumer resistance or acceptance of energy-efficient technologies. In addition, we are expanding the TPB framework by including Knowledge of Energy Low Labels as an additional factor. It recognizes that awareness and understanding of energy labels can significantly influence consumer decisions by recognizing that informed consumers are better equipped to make environmentally responsible choices [28]. This extension thus increases the explanatory power of the TPB in the context of promoting energy-efficient products.

## 2.2 Knowledge of Energy-Saving Labels (KEL)

Using eco-friendly labels is a crucial marketing strategy to spread awareness about sustainable products [29]. These labels, which serve as information tools about use, waste management, consumption, and production processes, allow marketers to efficiently convey the ecological value of their products [30]. Viewed from a green marketing perspective, these labels are essential for communication or promotion, providing consumers insight into products and environmental issues [31]. Along with the increasing consumer awareness of environmental problems, the tendency to choose products equipped with eco-friendly labels has also increased [30]. In addition, presenting information on energy efficiency through well-designed energy labels has increased consumer preference [32]. Given the limited general environmental knowledge, this label becomes vital, influencing pro-environmental behavior [33]. Research suggests that a more specific understanding of the environment can influence sustainable product purchasing decisions, as conveyed through energy-saving labels [34].

## 2.3 Hypothesis development

### 2.3.1 Elements of TPB

According to Ajzen and Fishbein [35], a person's view of an object—both positive and negative—is a critical component of TPB Theory. This view, which can be interpreted as an attitude, reflects a positive or negative consumer evaluation of a particular situation or object. Andika et al. [36] reinforced this view by stating that an overall favorable evaluation tends to lead to the formation of an intention to act. Liao et al. [37] has stressed the importance of a positive attitude in initiatives such as energy conservation. Hossain et al. [9] and Waris and Hameed [38] also showed a significant correlation between positive consumer attitudes and the purchasing decisions of EHAs. Current literature, as revealed by Lin and Dong [18] and Zhang and Luo [39], also confirmed the positive influence of attitudes on the purchase decision of EHAs. Based on the arguments presented, it can be assumed that consumers' positive attitudes towards EHAs will affect their desire to buy. So, our hypothesis is:

**H1:** Positive CA significantly affects the purchase intention of EHAs.

According to Ajzen [23], the concept of subjective norms explains how social pressure can influence a person's decision to act in a given situation. This pressure often comes from groups of friends, family members, or coworkers, which

indirectly influences individual choices [40]. Previous research has examined the influence of subjective norms on diverse behaviors, including in the context of energy conservation. Various studies show that this perception can encourage more responsible consumption behavior, as demonstrated by findings linking Subjective Norms to environmentally friendly purchasing behavior. For example, Waris et al. [22] and Li et al. [41] found that subjective norms can influence the acceptance of energy-efficient appliances. Furthermore, recent research confirms the positive influence of Subjective Norms on the purchase intention of energy-efficient equipment products [9]. However, Li et al. [21] pointed out that the influence of Subjective Norms on the purchase intention of energy-efficient appliances is only sometimes significant, emphasizing the need for further research to identify the conditions under which these social norms have the most effective impact. Given the varying findings, it becomes essential to explore further how Subjective Norms can influence sustainable purchasing decisions, which triggers the following research hypotheses:

**H2:** SN has a significant effect on the purchase intention of EHAs.

The perception of behavioral control as a factor influencing a person's decisions suggests that an individual's belief in their ability to get the job done plays an essential role in shaping their intentions [42]. In this case, the inability of the individual to perform specific actions directly precludes the formation of the intention to perform such actions. In energy efficiency, behavioral control refers to how easy or difficult it is to purchase energy-efficient equipment [43]. Research conducted by Xu et al. [44] showed that behavioral control positively influenced intentions for household energy savings. Research has shown that a positive perception of behavioral control increases the propensity to purchase energy-efficient appliances [43]. In addition, Hossain et al. [45] identified a favorable relationship between control of worker behavior and the desire to buy energy-efficient equipment. Recent research by Kaur et al. [46] also confirmed the positive influence of consumer Behavioral control on the willingness to purchase Energy-Efficient Home Appliances. Based on these findings, perceived behavioral control promotes the purchase intent of EHAs. Thus, we propose the following hypothesis:

**H3:** PBC has a significant effect on the purchase intent of EHAs.

### 2.3.2 Knowledge of Energy-Saving Labels and elements of TPB

To facilitate environmentally responsible purchasing decisions, research shows that information conveyed through energy-saving labels plays a crucial role in motivating consumers to choose energy-efficient appliances [47]. This decision is influenced by various sources of information, including eco-friendly product etiquette, promotions, and environmental awareness initiatives [48]. Hossain et al. [9] and Studi Li et al. [41] found that energy-saving labels significantly influence attitudes to purchasing energy-efficient appliances, emphasizing the importance of effective communication about the environmental benefits of products. Further research from Waris et al. [22] and Andika et al. [47] supported the idea that energy-saving labels influence not only consumer attitudes toward energy-efficient products but also subjective norms and perceptions of control over purchasing behavior. Based on this evidence, energy-saving labels are assumed to play a significant role in increasing environmental

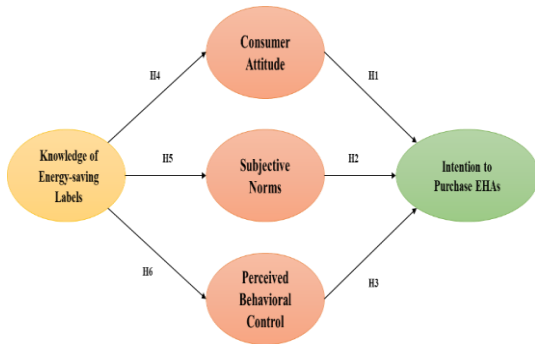
awareness and influencing consumer choices, so we hypothesize that:

**H4:** KEL has a significant effect on consumer attitudes.

**H5:** KEL has a significant effect on subjective norms.

**H6:** KEL has a significant effect on perceived behavioral control.

Figure 2 below illustrates the hypothesized relationships between KEL, CA, SN, PBC, and the intention to purchase EHAs. Based on a review of previous literature, we predict that all elements of the TPB, including KEL, have a positive and significant relationship, as depicted in the figure.



**Figure 2.** Conceptual model proposed

### 3. METHOD

#### 3.1 Sample and data collection

This study aims to understand and improve the purchasing behavior of EHAs in Java, Indonesia, by integrating knowledge about energy-saving labels into the Theory of Planned Behavior. Using quantitative methods and survey techniques, this study collected data from respondents in various regions of Java Island, including East Java, Central Java, West Java, Jabodetabek, and the Special Region of Yogyakarta. This location was chosen because Java Island is Indonesia’s most significant energy consumption center, contributing 73.5% to national energy consumption [49]. This makes the island a strategic location to research energy-efficient equipment purchasing behavior dynamics, particularly relevant in this context. With its high population

density and vast socioeconomic and cultural diversity, the island of Java provides a rich and diverse database.

Integrating into Planned Behavior Theory allows for a comprehensive analysis of how energy-saving labels can influence purchasing Behavior. This approach not only facilitates a deep understanding of the motivations behind the adoption of energy-efficient appliances but also has the potential to provide applicative insights for developing effective strategies for improving environmental sustainability, both at regional and national levels. Previous studies, such as one conducted in China in 2017, have shown that using energy-efficient appliances can reduce carbon emissions and cut household energy bills, indicating energy savings of up to 10 billion kWh per year and reducing carbon emissions by 6.5 million tons [8].

Given the unknown number of consumers interested in purchasing EHAs in Java, the minimum sample size for this study was determined based on the methodology recommended by Chin [50], which emphasizes the importance of statistical power analysis. Using G\*Power software [28], It was found that at least 193 respondents were needed to achieve a statistical strength of 0.80.

Data was collected using purposive sampling, and digital questionnaires were distributed via social media platforms such as WhatsApp and Instagram. The target respondents were individuals aged 17 years and older residing in Java. The questionnaire, consisting of 17 questions, utilized a four-point Likert scale ranging from ‘strongly disagree’ to ‘strongly agree,’ as adopted from Croasmun and Ostrom [51]. A test was conducted on 30 respondents to confirm and validate the questionnaire before it was disseminated more widely. The trial results showed high reliability with Cronbach’s alpha above 0.80, and slight adjustments were made to improve clarity and relevance. After confirming that there were no significant problems in the trial, the questionnaire was widely distributed from January to February 2024. The questionnaire was disseminated through a structured campaign on social media platforms with specific target groups and communities interested in environmental sustainability and energy efficiency. In addition, reminders are sent out regularly to encourage participation and increase the return rate of questionnaires. Of the 250 respondents who filled out the questionnaire, 239 responses were considered valid after removing the outliers.

**Table 1.** Respondent demographics (total N: 239)

Category	Subcategory	Frequency	Percentage
<b>Gender</b>	Male	88	37
	Female	151	63
<b>Age</b>	17-26	163	68
	27-42	38	16
	43-58	31	13
	>58	7	3
<b>Education Level</b>	≤ High School	77	32
	Bachelor’s degree	129	54
	Master/Doctoral	33	14
<b>Income Level</b>	IDR <1.500.000	122	51
	IDR 1.500.000-2.500.000	45	19
	IDR 2.500.000-3.500.000	22	9
	IDR >3.500.000	50	21
<b>Interested in Using EHA?</b>	Very Interested	129	54
	Undecided	77	32
	Not Interested Yet	33	14
<b>Total</b>		239	100

Based on Table 1, 239 respondents were surveyed, 63% of whom were female, while males accounted for 37%. The most represented age group is 17-26 years old, covering 68% of the total sample, followed by the age range of 27-42 years of age of 16%, the range of 43-58 years of age of 13%, and the age of >58 years of age as much as 3%. In terms of income, half of the respondents (51%) have an income of less than IDR 1,500,000 per month, and 21% have an income of more than IDR 3,500,000, followed by an income of IDR 1,500,000-2,500,000 and IDR 2,500,000-3,500,000 of 19% and 9% respectively. In terms of education, almost half (54%) have completed undergraduate education, while the rest consist of high school graduates, as many as 32%, and S2/Doctoral graduates, as much as 14%. Another interesting fact is that more than half of the respondents (54%) showed interest in using Energy Saving Devices (EHAs) such as LED lights, followed by fans (23%), rice cookers (11%), and air conditioners (8%). Geographically, most respondents (39%) are from the Special Region of Yogyakarta.

### 3.2 Research instrument

This study assesses five proposed constructs using previously validated scales. Knowledge about energy-saving labels was measured through four items adapted from Shah et al. [52]. Consumer attitudes were evaluated using three items from Zhang and Liu [53]. Subjective norms were assessed using three items adopted from the studies [18, 54]. Perceived behavioral control was measured using three items from Zhang and Luo [55]. Finally, the intention to purchase energy-efficient household appliances was measured using items adapted from Pham and Nguyen [56].

### 3.3 Data analysis

Partial Least Square (PLS) is a Structural Equation Modeling (SEM) method that uses an iterative approach to maximize the variance described by endogenous constructs [57]. Unlike Covariance-Based SEM (CB-SEM), which focuses on confirming the theory by assessing the model's conformity with the covariance matrix of sample data, PLS-SEM operates similarly to multiple regression analysis [58]. This characteristic makes PLS-SEM particularly suitable for exploratory research. PLS-SEM offers several advantages for researchers using structural equation models. Despite the popularity of CB-SEM, researchers often need to justify the

choice of PLS-SEM [57].

Additionally, PLS-SEM is frequently applied to data that is not normally distributed, small sample sizes, and constructs measured formatively. Researchers must follow several steps when applying PLS-SEM, including determining the inner and outer models, collecting and examining data, estimating the actual model, and evaluating the results. The evaluation of the outer model includes convergent validity, internal consistency reliability, and discriminant validity. In contrast, the assessment of the inner model consists of the variance inflation factor, determination coefficient ( $R^2$ ), path coefficient, effect size, and  $Q^2$  [59].

## 4. RESULT

### 4.1 Common Method Bias

The primary purpose of the Common Method Bias (CMB) Analysis is to evaluate the extent to which bias in the spread of the questionnaire affects the data obtained, as well as to ensure that the data is accessible from the influence of bias. We used two statistical tests to identify the presence of CMB in the collected data. First, we conducted an exploratory factor analysis (EFA) to test Harman's single factor [55], with the accepted value below the 50% limit. Based on the study, the identified components accounted for only 46.94% of the total variation. This was below the 50% limit, suggesting that CMB was not a significant problem in the study. Second, by estimating the variance inflation factor (VIF) for each variable, all were found to be less than 3, indicating no multicollinearity problem at the observed coefficients [60].

### 4.2 Measurement model

Measurement of the outer model validates the reliability and validity of the construct. Cronbach alpha ( $\alpha$ ) and Composite Reliability (CR) measure reliability. Based on the data in Table 2, the lowest  $\alpha$  value is 0.761, and the lowest CR is 0.848, indicating that both values exceed the threshold of 0.70 [59]. Convergent validity is determined through factor load for all items and Average Variance Extracted (AVE). Factor loads ranged between 0.737 and 0.901, exceeding the minimum accepted limit of 0.60. Meanwhile, the AVE value was between 0.583 and 0.766, exceeding the minimum threshold of 0.50 [59].

**Table 2.** Results of the model measurement test

Variables	Loading	$\alpha$	CR	AVE	HTMT				
					CA	ITP	KEL	PBC	SN
CA	0.82-0.883	0.812	0.889	0.727					
ITP	0.708-0.808	0.761	0.848	0.583	0.747				
KEL	0.737-0.852	0.871	0.907	0.661	0.815	0.73			
PBC	0.863-0.898	0.847	0.908	0.766	0.642	0.795	0.576		
SN	0.828-0.901	0.846	0.907	0.765	0.68	0.621	0.794	0.547	

Furthermore, to evaluate discriminant reliability, the study adopted the Heterotrait-Monotrait (HTMT) method as an evaluative framework, responding to criticism of the Fornell-Larcker criterion for reliability [61]. Hair et al. [60] stated that HTMT values lower than 0.85 indicate sufficient discriminant validity. The results of our analysis, summarized in Table 2, suggest that all HTMT values are below a threshold of 0.85, validating the presence of significant discriminant validity

between the analyzed constructs.

### 4.3 Structural model assessment

In this study, we adopted the path coefficients of the structural model to evaluate the model's performance. Based on the recommendations of Hair et al. [60], three types of tests were applied: the determination coefficient ( $R^2$ ) to measure the



predictive ability of the model, Q<sup>2</sup> to assess the predictive relevance, and SRMR to determine the model's suitability. The analysis showed that the R<sup>2</sup> values for CA (0.471), PBC (0.247), SN (0.468), and ITP (0.512) were considered adequate, according to Hair et al. [62], with CA, SN, and PBC showing low predictions, while ITP showing moderate predictions (Table 3). The Q<sup>2</sup> evaluation, which used a blindfolding technique with data elimination every 7 units, revealed that CA (0.338), SN (0.351), and ITP (0.286) had moderate predictions, while PBC (0.185) was low [60]. In addition, SRMR measurements were made to ensure the model's fit using PLS-SEM, with an SRMR value of less than 0.09, indicating a good fit [63]. In the context of this study, the model showed a good match with an SRMR value of 0.085, confirming the model's accuracy in evaluating endogenous variables.

#### 4.4 Hypothesis testing

The assessment of the significance of the direct relationship was carried out through the use of 5,000 bootstrap subsamples [64], with a two-sided critical t-value exceeding 1.96. The

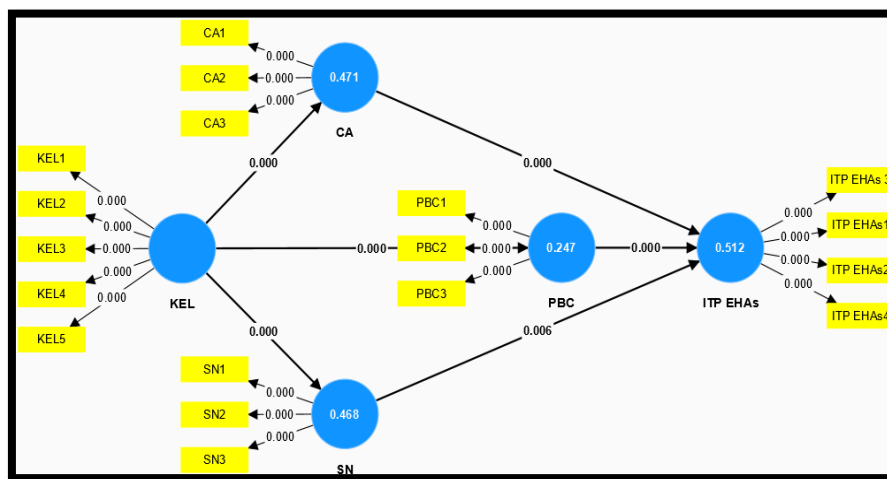
analysis presented in Table 4 and Figure 3 shows that the entire hypothesis is accepted and statistically significant at  $p < 0.01$ . These findings indicate that consumer attitudes towards EHAs ( $\beta = 0.275$ ;  $t = 3.793$ ;  $p < 0.00$ ), perception of behavioral control ( $\beta = 0.430$ ;  $t = 6.278$ ;  $p < 0.00$ ), and subjective norms ( $\beta = 0.146$ ;  $t = 2.751$ ;  $p < 0.006$ ) positively and significantly affect purchase intention towards EHAs, confirming H1, H2, and H3. In addition, the results of the study also showed that knowledge related to energy-saving labels had a significant favorable influence on consumer attitudes towards EHAs ( $\beta = 0.686$ ;  $t = 15.930$ ;  $p < 0.00$ ), perception of behavioral control ( $\beta = 0.497$ ;  $t = 8.789$ ;  $p < 0.00$ ), and subjective norms ( $\beta = 0.684$ ;  $t = 16.816$ ;  $p < 0.000$ ), supporting H4, H5, and H6.

**Table 3.** Results of R<sup>2</sup>, Q<sup>2</sup>, and SRMR tests

Variables	R <sup>2</sup>	Q <sup>2</sup>	SRMR
CA	0.471	0.523	0.085
ITP	0.512	0.348	
PBC	0.247	0.382	
SN	0.468	0.39	

**Table 4.** Results of a hypothesis test

Relationship Path	Original Sample	STDEV	T Statistics	P Values	Accepted
H1 CA -> ITP EHAs	0.275	0.073	3.793	0.000	Yes
H2 PBC -> ITP EHAs	0.43	0.069	6.278	0.000	Yes
H3 SN -> ITP EHAs	0.146	0.053	2.751	0.006	Yes
H4 KEL -> CA	0.686	0.043	15.93	0.000	Yes
H5 KEL -> PBC	0.497	0.057	8.789	0.000	Yes
H6 KEL -> SN	0.684	0.041	16.816	0.000	Yes



**Figure 3.** Results of bootstrapping test

## 5. DISCUSSION

The conceptual model proposed six hypotheses, which illustrate the application of the Theory of Planned Behavior in the context of purchasing energy-efficient household appliances in Indonesia. The first hypothesis (H1) shows a significant influence of CA on the purchase intent of EHAs, according to the studies [18, 39]. The second (H2) and third (H3) hypotheses show a significant impact of SN and PBC on purchase intent, supported by studies [18, 22, 41, 46]. These findings affirm that consumers' favorable attitudes toward EHAs, the influence of subjective norms, and their perceived

purchasing capability are crucial in determining their purchase intent. Moreover, the analysis reveals that these three factors interact synergistically, fostering an environment encouraging consumers to adopt energy-efficient products.

This study emphasizes the importance of understanding psychological and social factors in encouraging environmentally friendly consumer behavior. Consumers' attitudes towards EHAs are shaped by their belief in the product's energy efficiency and environmental benefits. This belief logically motivates them to choose products that are considered more cost-effective in the long run. Social norms underscore the critical role of social support and peer influence

in motivating environmentally friendly purchasing decisions. Perceived behavioral control significantly impacts purchase intent, suggesting that consumers' confidence in their ability to purchase and use EHAs increases the likelihood of adopting these products. This conclusion underscores the need for a more strategic marketing approach. It focuses on removing barriers perceived by consumers, such as difficulties in use or high costs, which can increase the adoption of energy-efficient appliances and contribute to environmental sustainability.

Furthermore, H4, H5, and H6 confirmed the significant impact of energy-saving labels on consumer attitudes, subjective norms, and behavioral control perceptions related to energy-efficient household appliances. These findings are consistent with previous studies [9, 22, 41, 47], which indicates that energy-efficient labels substantially affect consumers' positive attitudes toward the product. With a high  $\beta$  value and a convincing level of significance on the three relationships, it can be concluded that the existence of energy-saving labels on products not only increases consumers' awareness and positive attitudes but also strengthens social pressure through subjective norms and beliefs in their ability to use the product efficiently through the perception of behavioral control.

Energy-efficient labels are an essential information tool in helping consumers make more informed and wise decisions. This label increases consumers' understanding of the product's environmental benefits, thus forming a more positive attitude towards the product. Increasing subjective norms indicate significant social influence, where consumers feel driven by social views that favor using energy-efficient products. The perception of more robust behavioral control indicates that consumers feel more confident in using products correctly and efficiently. These findings confirm that energy-efficient labels are not only a symbol of quality but also an educational instrument that shapes consumer perceptions and behaviors, which is crucial in driving the adoption of sustainable products in society.

## 6. CONCLUSION

This study strengthens the application of the Theory of Planned Behavior in the context of purchasing energy-efficient household appliances in Indonesia. It offers insights into the psychological and social factors influencing consumer purchasing intentions. The results show that consumers' positive attitudes towards EHAs, subjective norms, and perceived behavioral control significantly impact their purchase intentions. Positive attitudes are shaped by consumer beliefs regarding the energy efficiency of products and environmental benefits, while subjective norms reflect social influences and peer pressure. In addition, perceived behavioral control shows that consumers' confidence in their ability to purchase and use EHAs effectively increases the likelihood of adopting these products. Energy-efficient labels also play an essential role by significantly influencing consumer attitudes, subjective norms, and perceived behavioral control, serving as an information tool that increases environmental awareness, social support, and consumer confidence in the use of products. Therefore, this study provides a strong foundation for developing more effective policies and educational campaigns to encourage eco-friendly consumer behavior in Indonesia, emphasizing the importance of marketing strategies that consider psychological and social factors as well as the role of

accurate information and social support.

### 6.1 Managerial implication

Based on the findings of this study, there are several practical insights for policymakers and industry to formulate more effective strategies in increasing awareness and adoption of energy-efficient household products. It is necessary to emphasize consumers' positive attitudes towards EHAs, subjective norms, and behavioral control perceptions in shaping purchase intentions. Policymakers can step up public education campaigns highlighting these products' energy efficiency and environmental benefits to influence consumer attitudes. In addition, strengthening social support and peer group influence through social media and community campaigns can reinforce subjective norms that encourage environmentally friendly behavior. On the industry side, eliminating perceived barriers by consumers, such as difficulties in use or high costs, is essential. Providing financial incentives, such as subsidies or rebates and easy-to-understand usage guidelines, can improve the perception of behavioral control and encourage the adoption of energy-efficient products. Further, emphasizing explicit and informative energy-efficient labels can increase consumer awareness, positive attitudes, and confidence in using the product, thereby spurring broader and more sustainable adoption.

### 6.2 Limitations and suggestions for future research

Although this study provides valuable insights into the psychological and social factors influencing the intention to purchase energy-efficient household appliances in Indonesia, some limitations must be considered. First, this research is limited to the geographical context of Indonesia, so the results may not be generalized to other regions with different social and economic conditions. Future research should include comparative studies in countries with different cultural backgrounds to gain a more comprehensive understanding. Second, cross-sectional data cannot capture changes in consumer behavior over time, which impacts a need to understand the long-term dynamics of adopting energy-efficient equipment. Therefore, a longitudinal approach is recommended to monitor consumer purchasing intention and behavior changes over time.

Third, the survey method used is susceptible to respondent bias, including social desire bias, which can affect the accuracy of the data collected. To gain deeper insights into consumer perceptions and motivations that may not be able to be captured through questionnaires alone, it is recommended to integrate qualitative research methods. Fourth, the study does not consider external factors such as government policies and price fluctuations, which may limit understanding consumer purchasing intentions and behaviors. Including these external variables in future research will provide a more comprehensive view of the factors influencing the application of energy-efficient equipment. Finally, media and marketing campaigns' role in shaping consumer perceptions must be considered, potentially ignoring significant factors that affect purchase intent and behavior. Future research should consider the impact of media and marketing campaigns to present a more holistic picture of the factors driving the use of energy-efficient equipment.

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