International Journal of Energy Economics and Policy

ISSN: 2146-4553

available at http: www.econjournals.com

International Journal of Energy Economics and Policy, 2024, 14(6), 80-87.

Explaining the Energy-Saving Behavioral Intention of Workers in Industrial Zones

La Nguyen Thuy Dung, Quoc Nghi Nguyen*, Le Thi Dieu Hien

School of Economics, Can Tho University, Can Tho, Vietnam. *Email: quocnghi@ctu.edu.vn

Received: 23 June 2024 **Accepted:** 26 September 2024 **DOI:** https://doi.org/10.32479/ijeep.17086

ABSTRACT

The objective of this study is to demonstrate the factors influencing the energy-saving behavioral intention of workers employed in industrial zones in Vietnam. The study applies the extended Theory of Planned Behavior (TPB) to explain the energy-saving behavioral intention of workers. Convenience sampling was used to collect data, with an official sample size of 454 workers. The research process includes six steps, combining both qualitative and quantitative research. The research results indicate that the energy-saving intention of workers in industrial zones is positively influenced by factors such as attitude, perceived behavioral control, personal moral norms, injunctive norms, descriptive norms, and perceived benefits. Among these, the attitude factor was evaluated as having the strongest impact on energy-saving intention. The study proposes several managerial implications to enhance the energy-saving intention of workers in industrial zones.

Keywords: Theory of Planned Behavior, Behavioral Intention, Energy-Saving, Workers, Industrial Zones
JEL Classifications: E21, R10, Q4

1. INTRODUCTION

Global energy demand is increasingly rising due to population growth and higher living standards (Bao et al., 2023; Nguyen et al., 2023). In 2021, fossil fuels remained the primary global energy source, accounting for 83.1% of the world's energy consumption structure. Oil led with 31.2%, followed by coal (27.2%), natural gas (24.7%), hydropower (6.9%), renewable energy (5.7%), and nuclear power (4.3%) (Petroleum, 2022). The combustion of fossil fuels generates a significant amount of CO_2 and releases it into the environment, contributing not only to air pollution but also to the greenhouse effect (Hanh, 2022; Nguyen and Hoang, 2023). Moreover, the main causes of excessive energy use are technical and user behavior, which, if effectively adjusted, can influence energy reduction actions (Woods et al., 2017). According to Yeboah and Kaplowitz (2016), efficient energy use can change user behavior, improving energy-saving practices. Changes in individual energy consumption behavior can bring significant benefits, reducing greenhouse gas emissions and minimizing negative environmental impacts (Lokhorst et al., 2015).

As of the end of 2023, Vietnam has 414 industrial zones, including 4 export processing zones. Industrial and export processing zones in Vietnam have provided jobs for approximately 4.15 million direct workers, mainly concentrated in the Southeast and Red River Delta regions, accounting for 41.3% and 30.3% of the workforce in industrial zones nationwide, respectively. In the early years of the 21st century, Vietnam faced severe air pollution risks due to industrialization and urbanization, especially in major cities (Ho et al., 2020; Nguyen et al., 2017). Vietnam is currently facing energy shortages due to high global oil prices and reduced hydropower output due to unfavorable weather conditions (Thanh Nguyen et al., 2021). Therefore, reducing overall societal energy demand will reduce energy development investment costs, decrease the exploitation of energy resources, and reduce pollutant emissions (Hao, 2023). This highlights the importance of studying the energy-saving behavior intentions of workers in industrial

zones in Vietnam. The research results provide a crucial scientific basis, positively contributing to the development of sustainable energy strategies in industrial zones in Vietnam.

Globally, there have been numerous studies on the energy-saving behavioral intention of various economic sectors. Most studies have been conducted in developed countries, while few have been conducted in developing countries with contexts similar to Vietnam (Hien and Chi, 2020). Research is scarce on the energy-saving behavioral intention of workers in industrial zones. Additionally, most studies indicate that in the TPB, the influence of subjective norms on behavioral intention is relatively limited, thus reducing the explanatory power of social norms. Furthermore, social norms are divided into two aspects: Injunctive norms and descriptive norms (Smith and Louis, 2008). Therefore, this study adds two variables: injunctive norms and descriptive norms, into the TPB to extend the explanatory ability of energy-saving behavioral intention of workers in industrial zones. The research results will suggest managerial implications to enhance the energy-saving behavioral intention of workers in industrial zones in Vietnam.

2. THEORETICAL FRAMEWORK AND RESEARCH HYPOTHESES

2.1. Theoretical Framework

2.1.1. Theory of planned behavior - TPB

To demonstrate the factors influencing energy-saving behavioral intention, most studies apply the TPB theory to construct a theoretical model, which includes three important variables: attitude, subjective norms, and perceived behavioral control (Ru et al., 2018; Wang et al., 2018; Ding et al., 2019; Hien and Chi, 2020; Xu et al., 2020; Nguyen et al., 2022; Mai and Nguyen, 2023). The Theory of Planned Behavior (TPB) of Ajzen (1991) was developed from the Theory of Reasoned Action - TRA (Fishbein and Ajzen, 1975). In this theory, the intention to perform a behavior is influenced by three main factors: Attitude, subjective norms, and perceived behavioral control. Additionally, behavioral intention is a measure of the strength of an individual's intention to perform a specified behavior (Fishbein and Ajzen, 1975).

2.1.2. Energy-saving behavioral intention

According to Ajzen (1991), there is a strong connection between intention and actual behavior, making intention the best predictor of an individual's behavior. Intention is a factor used to evaluate the likelihood of performing a behavior in the future (Engel et al., 1986). According to Bosnjak et al. (2020), intention is the precursor to behavior and is an important factor leading to behavior. Energy saving is understood as reducing unnecessary energy consumption or consumption that does not correspond to production, utility, services, and daily life (Oikonomou et al., 2009).

2.2. Research Hypotheses

2.2.1. The relationship between attitude and energy-saving intention

Attitude is the tendency to perform or not perform a behavior (Ajzen, 1991). The more positive an individual's attitude toward a behavior, the greater their intention toward that behavior (Jalilvand and Samiei, 2012; Asati et al., 2024). Attitude has a strong impact on behavior intention, and a positive attitude will create an energy-saving intention (Bao et al., 2023). When an individual considers energy-saving behavior at the workplace important and valuable, and when it reduces carbon emissions, they will maintain a positive attitude and likely form an energy-saving intention (Nga, 2022). Several studies have demonstrated that attitude positively affects energy-saving intention (Chen et al., 2017; Ru et al., 2018; Wang et al., 2018; Ding et al., 2019; Hien and Chi, 2020; Chen and Chen, 2021; Hao et al., 2022; Nguyen et al., 2022; Bao et al., 2023; Hien et al., 2023; Mai and Nguyen, 2023). Therefore, the research hypothesis H1 is proposed as follows: *Attitude positively affects the energy-saving intention of workers in industrial zones.*

2.2.2. The relationship between perceived behavioral control and energy-saving intention

Perceived behavioral control reflects an individual's perception of the ease or difficulty of performing a particular behavior (Ajzen, 1991). If individuals perceive a higher level of self-control, they will have a stronger intention to perform a specific behavior, and vice versa (Gao et al., 2017). Perceived behavioral control is a decisive factor influencing energy-saving behavioral intention (Ru et al., 2018). In studying energy-saving behavior intention, many studies have shown a positive correlation between perceived behavioral control and energy-saving behavioral intention (Du and Pan, 2021; Prete et al., 2017; Ru et al., 2018; Wang et al., 2018; Chen and Chen, 2021; Fu et al., 2021; Hao et al., 2022; Nga, 2022; Nguyen et al., 2022; Hien et al., 2023; Mai and Nguyen, 2023). Therefore, the research hypothesis H2 is proposed as follows: *Perceived behavioral control positively impacts the energy-saving intention of workers in industrial zones.*

2.2.3. The relationship between personal moral norms and energy-saving intention

According to Bertoldo and Castro (2016), personal moral norms refer to an individual's actions based on their moral obligations. An individual with a strong moral obligation to reduce human impact on climate change will be motivated to engage in energy-saving behaviors (Chen, 2016). High personal moral norms encourage individuals to perform socially friendly behaviors (Wang et al., 2019), whereas low or nonexistent personal moral norms hinder individuals from engaging in pro-social behaviors (Fornara et al., 2016). Several researchers have argued and demonstrated that personal moral norms positively influence energy-saving behavioral intention (Klöckner, 2013, Schaffner et al., 2017; Shi et al., 2017; Ru et al., 2018; Wang et al., 2018; Hien and Chi, 2020; Fu et al., 2021; Nga, 2022; Hien et al., 2023; Mai and Nguyen, 2023). Hence, the research hypothesis H3 is proposed as follows: *Personal moral norms positively influence the energy-saving intention of workers in industrial zones.*

2.2.4. The relationship between injunctive norms and energy-saving intention

Injunctive norms reflect the extent to which individuals consider the opinions of important others regarding whether they should or should not perform a behavior (Li et al., 2019). An individual's behavioral intention can be based on the approval or disapproval of important others (Chen and Tung, 2014). If an individual

realizes that most important people think they should save energy at work, they will feel pressured and have the intention to save energy (Nga, 2022). Several studies have demonstrated that injunctive norms positively influence energy-saving behavioral intention (Bonan et al., 2020; Xu et al., 2020; Chen and Chen, 2021; Tverskoi et al., 2021; Si-Dai et al., 2021; Hao et al., 2022; Nguyen et al., 2022; Hien et al., 2023; Mai and Nguyen, 2023). Therefore, the research hypothesis H4 is proposed as follows: *Injunctive norms positively affect the energy-saving intention of workers in industrial zones.*

2.2.5. The relationship between descriptive norms and energy-saving intention

Descriptive norms reflect an individual's perception of the actual behavior of important others, which encourages them to follow suit (Li et al., 2019). If important others engage in energy-saving behaviors at the workplace, other individuals will imitate and perform the same behaviors (Nga, 2022). Descriptive norms are an important factor influencing individual behavior (Ajzen, 2002; Rivis and Sheeran, 2003). Several researchers have argued and demonstrated that descriptive norms positively influence energy-saving behavioral intention (Bonan et al., 2020; Xu et al., 2020; Tverskoi et al., 2021; Hao et al., 2022; Nga, 2022). Hence, the research hypothesis H5 is proposed as follows: *Descriptive norms positively influence the energy-saving intention of workers in industrial zones.*

2.2.6. The relationship between perceived benefits and energy-saving intention

Perceived benefits are a type of emotional perception that positively influences an individual's behavior (Tsujikawa et al., 2016). According to Nguyen et al. (2022), individuals who fully perceive the benefits of energy-saving will be more motivated to engage in energy-saving behavior intentions. In the field of energy-saving research, perceived benefits have been proven to positively influence energy-saving behavioral intention (Wang et al., 2011; Zhang et al., 2014; Steinhorst et al., 2015; Zhou and Yang, 2016; Hien and Chi, 2020; Fu et al., 2021; Ahmad et al., 2022; Mai and Nguyen, 2023). Therefore, the research hypothesis H6 is proposed as follows: *Perceived benefits positively affect the energy-saving intention of workers in industrial zones.*

Based on the literature review and the proposed research hypotheses, the research model on factors influencing the energy-saving behavioral intention of workers in industrial zones is proposed in Figure 1.

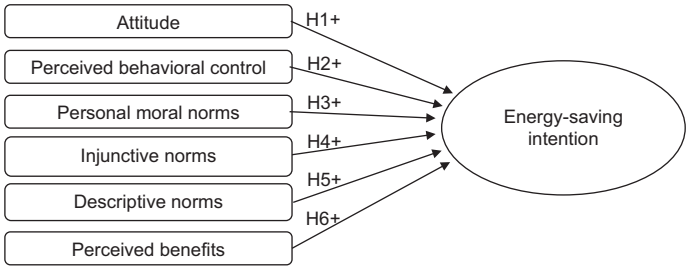
3. RESEARCH HYPOTHESES

The research employs a mixed-methods approach, combining qualitative and quantitative research. The research process is conducted based on the following steps (Figure 2).

Step 1: The research objects are identified as the factors influencing the energy-saving behavioral intention of workers in industrial zones in Vietnam.

Step 2: The study applies the Theory of Planned Behavior to develop the research model. Based on a literature review related to energy-saving behavioral intention, research hypotheses are developed, and the research model is established.

Figure 1: Proposed research model



Step 3: An expert consultation method is employed to identify suitable scales for the research model. The experts consulted include four scientists with experience in researching energy-saving behavioral intention and four human resource managers from industrial zones. The expert consultation has agreed upon seven measurement scales with 28 observed variables (Table 1).

Step 4: Quantitative research data were collected using quota sampling. The survey subjects are workers currently employed in industrial zones in Vietnam. Several large-scale industrial zones in Vietnam are selected as survey points, including Tan Phu Trung Industrial Zone (Ho Chi Minh City), My Phuoc 3 Industrial Zone (Binh Duong Province), Viet Hoa - Duc Hoa 3 Industrial Zone (Long an Province), and Phuoc Dong Industrial Zone (Tay Ninh Province). Research data were collected through online surveys. This method is chosen for its advantages, notably eliminating paper and data entry costs, and its ability to reach survey subjects beyond geographical boundaries (Cobanoglu et al., 2001). The official sample size used to test the hypotheses is 454 observations. Quantitative research methods used include internal consistency reliability testing with Cronbach's alpha, exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modeling (SEM).

Step 5: The study has explained, discussed, and compared the research results with related studies to confirm the relevance and novelty of the research findings.

Step 6: The study has synthesized key findings, identified research limitations, and proposed future research directions to address these limitations.

4. RESEARCH RESULTS AND DISCUSSION

4.1. Description of Survey Respondent Characteristics

Based on Table 2, the demographic characteristics of the research sample are quite diverse in terms of gender, age, education level, and monthly income. The proportion of males and females in the sample is not significantly different, with 44.27% male and 55.73% female. The respondents' ages are quite varied, with the highest proportion in the 26-30 age group (43.39%). In terms of education, most respondents have a high school education (71.37%). The income of the survey subjects is still at an average

Figure 2: Research process

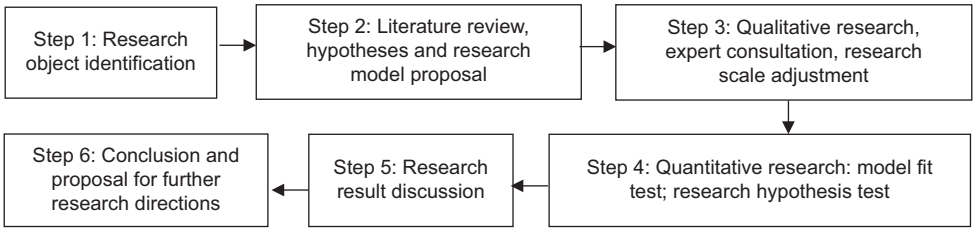


Table 1: Scales in the research model

Factor	Observed variables	Scale
Attitude	AT1: Saving energy in businesses is necessary.	Likert 1-5
	AT2: Reducing energy use in businesses is important.	Likert 1-5
	AT3: Reducing energy use in businesses is a good action.	Likert 1-5
	AT4: Saving energy protects the environment.	Likert 1-5
	Resources: Wang et al. (2018), Hao et al. (2022)	
Perceived behavioral control	PBC1: Whether I save energy or not is up to me.	Likert 1-5
	PBC2: I think it is not too difficult to reduce energy use.	Likert 1-5
	PBC3: Adjusting energy-saving actions is within my control.	Likert 1-5
	PBC4: I am confident that I can save energy if I want to.	Likert 1-5
	Resources: Wang et al. (2018), Hao et al. (2022)	
Personal moral norms	PMN1: Saving energy is the duty of every worker.	Likert 1-5
	PMN2: Using energy without saving is a waste.	Likert 1-5
	PMN3: I think I have a moral responsibility to save energy.	Likert 1-5
	PMN4: I feel unhappy if I do not save energy.	Likert 1-5
	Resources: Nga (2022), Nguyen et al. (2022)	
Injunctive norms	IN1: My colleagues think I should save energy.	Likert 1-5
	IN2: My manager wants me to practice energy saving.	Likert 1-5
	IN3: My friends think I should save energy.	Likert 1-5
	IN4: My family members think I should save energy.	Likert 1-5
	Resources: Wang et al. (2018), Nga (2022)	
Descriptive norms	DN1: My colleagues have engaged in energy-saving.	Likert 1-5
	DN2: My manager has engaged in energy-saving.	Likert 1-5
	DN3: My friends have engaged in energy-saving.	Likert 1-5
	DN4: My family members have engaged in energy-saving.	Likert 1-5
	Resources: Hao et al. (2022); Nga (2022)	
Perceived benefits	PB1: Saving energy reduces costs for businesses.	Likert 1-5
	PB2: Saving energy brings many benefits to businesses.	Likert 1-5
	PB3: Saving energy creates a better working environment.	Likert 1-5
	PB4: Saving energy benefits the whole society.	Likert 1-5
	Resources: Zhang et al. (2014); Nguyen et al. (2022)	
Energy-saving intention	EI1: I will plan to save energy.	Likert 1-5
	EI2: I always think about ways to save energy.	Likert 1-5
	EI3: I will try to save energy in the future.	Likert 1-5
	EI4: I will use energy-saving appliances wisely to save energy in the future.	Likert 1-5
	Resources: Hien and Chi (2020); Hao et al. (2022)	

level, with the majority earning between 6 and 10 million VND per month (43.17%).

4.2. Evaluation of the Research Model's Suitability

Cronbach's alpha coefficient is used to assess the reliability of the scales (Hair et al., 2010). According to the test results in Table 3, the scales and observed variables are reliable. The Cronbach's alpha values for the scales range from 0.805 to 0.891 (Nunnally and Bernstein, 1994), and the item-total correlation of observed variables ranges from 0.586 to 0.654 (Nunnally, 1978; Peterson, 1994; Slater, 1995). Next, the study applies the Principal axis factoring with Promax rotation (Kaiser, 1974). The EFA analysis results of the research scales are satisfactory. Bartlett's test shows Sig = 0.000 < 0.05 (Hair et al., 1998). The KMO value reaches 0.898, and the factor loadings of observed variables are all >0.5 (Hair et al., 1998). The lowest Eigenvalue = 1.029, and the total variance extracted = 69.771% >50%. Thus, the research scales are accepted and ensure reliability.

The CFA results in Table 4 show that the model achieves compatibility with the market: CMIN/df = 1.979 <3. The indices CFI, TLI, and GFI are 0.949, 0.941, and 0.911, respectively, all >0.9. The RSMEA coefficient is 0.046 < 0.08 (Hu and Bentler, 1999; Hair et al., 2014). This indicates that the research model is suitable for market data.

Based on the test results in Table 5, the composite reliability (CR) of the concepts is all >0.7, indicating that the scales are reliable (Jöreskog, 1971). The AVE index is all >0.5, ensuring the convergent validity of the scale (Fornell and Larcker, 1981).

Table 2: Research sample structure (n=454)

Gender	Frequency	%	Age	Frequency	%
Male	201	44.27	Under 25	165	36.35
Female	253	55.73	26-30	197	43.39
Education	Frequency	%	Above 31	92	20.26
Middle School	36	7.93	Monthly income (VND)	Frequency	%
High School	324	71.37	Under 6 million	172	37.89
Intermediate	49	10.79	6 million-10 million	196	43.17
College	45	9.91	Above 10 million	86	18.94

Table 3: Results of scale reliability analysis and exploratory factor analysis

Scale	Number of observed variables	Cronbach's alpha	Corrected Item-total correlation		Factor loading	
			Min	Max	Min	Max
Attitude	4	0.805	0.591	0.654	0.731	0.762
Perceived behavioral control	4	0.828	0.632	0.677	0.701	0.771
Personal moral norms	4	0.844	0.652	0.705	0.700	0.795
Injunctive norms	4	0.879	0.717	0.756	0.773	0.825
Descriptive norms	4	0.859	0.652	0.747	0.712	0.811
Perceived benefits	4	0.808	0.586	0.658	0.644	0.751
Energy-saving intention	4	0.891	0.743	0.770	0.726	0.777

Table 4: Model fit test result

Criteria	CFA	Comparison index	Resources
CMIN/df	1.979	≤3	Hu and Bentler (1999), Hair et al. (2014)
P-value	0.000	<0.05	
GFI	0.911	≥0.9	
TLI	0.941	≥0.9	
CFI	0.949	≥0.9	
RMSEA	0.046	≤0.08	

The MSV value for all research scales is smaller than the AVE value, and the square root of AVE is greater than the correlations between concepts (values outside the diagonal), indicating that the model reaches discriminant validity (Fornell and Larcker, 1981). Thus, it can be confirmed that the model's scales are significant.

4.3. Research Hypothesis Test

Table 6 shows that all research hypotheses are accepted at the 1% significance level. This shows that the energy-saving behavioral intention of industrial workers is influenced by factors such as attitude, perceived behavioral control, personal moral norms, injunctive norms, descriptive norms, and perceived benefits. All factors are positively correlated with the energy-saving behavioral intention of workers. Among these, the attitude factor is evaluated as having the most impact on the energy-saving intention.

4.4. Discussion

The study has demonstrated the positive influence of attitude on the intention to save energy among industrial workers. This shows that if workers have a positive attitude towards saving energy, their intention to engage in energy-saving behaviors increases. Attitude is the strongest influencing factor and plays a crucial role in the intention to save energy (Hien et al., 2023). Individuals with a positive attitude towards energy-saving are more likely to form the intention to engage in this behavior (Hao et al., 2022). In the field of research on energy-saving behavioral intention, the result is consistent with studies proposed by (Chen et al., 2017; Ru et al., 2018; Wang et al., 2018; Ding et al., 2019; Hien and Chi, 2020; Chen and Chen, 2021; Hao et al., 2022; Nguyen et al., 2022; Bao et al., 2023; Hien et al., 2023; and Mai and Nguyen, 2023).

An important finding of this study shows that descriptive norms positively influence the intention to save energy among industrial workers. This indicates that the energy-saving actions of those around them (leaders, colleagues, friends, and family members) positively influence and change the energy-saving intentions of industrial workers. The study result confirms that descriptive norms are a crucial factor that positively impacts workers' energy-saving behavioral intention at the workplace (Nga, 2022). The result is consistent with several studies proposed by (Bonan et al., 2020; Xu et al., 2020; Tverskoi et al., 2021; Hao et al., 2022; and Nga, 2022).

The study indicates that perceived behavioral control positively influences the intention to save energy among industrial workers. The test result implies that the higher the workers' self-control in performing energy-saving behaviors, the stronger their intention to save energy. Indeed, if individuals feel capable and have suitable methods for saving energy, their likelihood of forming an energy-saving intention increases (Mai and Nguyen, 2023). This result is similar to studies proposed by (Du and Pan, 2021; Prete et al., 2017; Ru et al., 2018; Wang et al., 2018; Chen and Chen, 2021; Fu et al., 2021; Hao et al., 2022; Nga, 2022; Nguyen et al., 2022; Hien et al., 2023; and Mai and Nguyen, 2023).

The finding also shows that personal moral norms positively influence the intention to save energy among industrial workers. The result indicates that a high level of personal moral norms contributes to the intention to save energy. When a person has high personal moral norms, it will promote their intention to save energy (Wang et al., 2019; Nguyen et al., 2022). The result is consistent with studies proposed by (Klöckner, 2013; Schaffner et al., 2017; Shi et al., 2017; Ru et al., 2018; Wang et al., 2018; Hien and Chi, 2020; Fu et al., 2021; Nga, 2022; Hien et al., 2023; and Mai and Nguyen, 2023).

Table 5: Correlation matrix between conceptual structures

CR	AVE	MSV		DN	IN	PBC	PMN	PB	AT	EI
0.860	0.606	0.297	DN	0.779						
0.879	0.645	0.281	IN	0.501	0.803					
0.829	0.549	0.202	PBC	0.233	0.199	0.741				
0.844	0.575	0.327	PMN	0.210	0.337	0.436	0.758			
0.808	0.514	0.310	PB	0.379	0.444	0.097	0.367	0.717		
0.805	0.509	0.436	AT	0.283	0.323	0.324	0.441	0.439	0.713	
0.891	0.672	0.436	EI	0.545	0.530	0.449	0.572	0.557	0.660	0.820

Table 6: Research hypothesis test

Hypothesis	Expectation	Estimate	P-value	Results
H1: AT → EI	+	0.337	0.000	Accepted
H2: PBC → EI	+	0.155	0.000	Accepted
H3: PMN → EI	+	0.198	0.000	Accepted
H4: IN → EI	+	0.124	0.007	Accepted
H5: DN → EI	+	0.243	0.000	Accepted
H6: PB → EI	+	0.174	0.000	Accepted

The study has demonstrated a positive relationship between injunctive norms and the intention to save energy among industrial workers. This indicates that family members, friends, colleagues, and leaders, who are important people, positively influence the energy-saving intentions of workers. Injunctive norms can strongly impact energy-saving behavioral intention and reduce energy consumption (Nguyen et al., 2022). In the research field of energy-saving behavioral intention, the study's result is consistent with studies proposed by (Bonan et al., 2020; Xu et al., 2020; Chen and Chen, 2021; Tverskoi et al., 2021; Si-Dai et al., 2021; Hao et al., 2022; Nguyen et al., 2022; Hien et al., 2023; and Mai and Nguyen, 2023).

Finally, the study has discovered a positive relationship between perceived benefits and the intention to save energy among industrial workers. This indicates that the more workers perceive the benefits of saving energy, the stronger their intention to save energy. In particular, the perception of economic and environmental benefits is an essential factor that promotes energy-saving behavioral intention (Wang et al., 2011; Zhang et al., 2014). In the field of energy-saving behavioral intention research, the study's result is consistent with studies proposed by (Wang et al., 2011; Zhang et al., 2014; Steinhorst et al., 2015; Zhou and Yang, 2016; Hien and Chi, 2020; Fu et al., 2021; Ahmad et al., 2022; and Mai and Nguyen, 2023).

5. CONCLUSION

The study applied the extended Theory of Planned Behavior to demonstrate the factors influencing the energy-saving intention of industrial workers in Vietnam. The research results indicate that the energy-saving intention of industrial workers is positively influenced by factors such as attitude, perceived behavioral control, personal moral norms, injunctive norms, descriptive norms, and perceived benefits. Among these, attitude is the strongest factor influencing the energy-saving intention of industrial workers in Vietnam.

5.1. Theoretical Implications

The study further confirms the applicability of Ajzen's Theory of Planned Behavior (1991) to research related to energy-saving behavioral intention. However, to increase the explanatory power of energy-saving behavioral intention in specific research contexts, researchers should consider extending the Theory of Planned Behavior by adding factors that are relevant to the study subjects and the research context. Specifically, in this research context, an important finding of the study shows that descriptive norms positively influence the energy-saving intentions of industrial workers.

5.2. Managerial Implications

Several managerial implications to enhance the energy-saving behavioral intention of industrial workers are proposed as follows: First, increase the dissemination of knowledge to raise personal moral norms and perceived benefits of energy-saving practices among workers. Second, leaders and important figures should promote the roles of injunctive norms and descriptive norms in practicing energy-saving. Third, encourage, motivate, and empower workers to practice energy-saving behaviors in the workplace.

5.3. Limitations and Future Research Directions

The study has certain limitations, including the use of convenience sampling, which limits the representativeness of the sample. The study does not address differences in the energy-saving intention of workers based on demographic characteristics. Therefore, future research should delve deeper into the energy-saving intention of workers based on demographic characteristics and use probability sampling to increase the representativeness of the research sample.

REFERENCES

Ahmad, B., Irfan, M., Salem, S., Asif, M.H. (2022), Energy efficiency in the post-COVID-19 era: Exploring the determinants of energy-saving intentions and behaviors. Frontiers in Energy Research, 9, 824318.

Ajzen, I. (1991), The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179-211.

Ajzen, I. (2002), Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. Journal of Applied Social Psychology, 32(4), 665-683.

Asati, P., Raghuwanshi, S., Vashisht, A., Muley, D., Khare, V.K. (2024), Exploring the green energy: Factors influencing battery electric vehicles adoption in Madhya Pradesh region. International Review of Management and Marketing, 14(5), 151-157.

Bao, N.D., Phuong, N.H., Mai, N.T., Son, B.G., Tuan, N.A., Nguyen, T.T., Huong, N.T.L. (2023), Factors influencing the intention of energy saving and the sustainable energy use of Vietnamese youth. Journal of Economics and Development, 307, 85-94.

Bertoldo, R., Castro, P. (2016), The outer influence inside us: Exploring the relation between social and personal norms. Resources, Conservation and Recycling, 112, 45-53.

Bonan, J., Cattaneo, C., d'Adda, G., Tavoni, M. (2020), The interaction of descriptive and injunctive social norms in promoting energy conservation. Nature Energy, 5(11), 900-909.

Bosnjak, M., Ajzen, I., Schmidt, P. (2020), The theory of planned behavior: Selected recent advances and applications. Europes Journal of Psychology, 16(3), 352-356.

Chen, C.F., Xu, X., Day, J.K. (2017), Thermal comfort or money-saving? Exploring intentions to conserve energy among low-income households in the United States. Energy Research and Social Science, 26, 61-71.

Chen, C.H.V., Chen, Y.C. (2021), Assessment of enhancing employee engagement in energy-saving behavior at the workplace: An empirical study. Sustainability, 13(5), 2457.

Chen, M.F. (2016), Extending the theory of planned behavior model to explain people's energy savings and carbon reduction behavioral intentions to mitigate climate change in Taiwan-moral obligation matters. Journal of Cleaner Production, 112, 1746-1753.

Chen, M.F., Tung, P.J. (2014), Developing an extended theory of planned behavior model to predict consumers' intention to visit green hotels. International Journal of Hospitality Management, 36, 221-230.

Cobanoglu, C., Moreo, P., Warde, B. (2001), A comparison of mail, fax and web-based survey methods. International Journal of Market Research, 43(4), 1-15.

Ding, Z.H., Li, Y.Q., Zhao, C., Liu, Y., Li, R. (2019), Factors affecting heating energy-saving behavior of residents in hot summer and cold winter regions. Natural Hazards, 95(1), 193-206.

Du, J., Pan, W. (2021), Examining energy-saving behaviors in student dormitories using an expanded theory of planned behavior. Habitat International, 107, 102308.

Engel, J.F., Blackwell, R.D., Miniard, P.W. (1986), Consumer Behavior. United States: Dryden Press.

Fishbein, M., Ajzen, I. (1975), Beliefs, Attitude, Intention, and Behavior: An Introduction to Theory and Research. Boston: Addison-Wesley.

Fornara, F., Pattitoni, P., Mura, M., Strazzera, E. (2016), Predicting intention to improve household energy efficiency: The role of value-belief-norm theory, normative and informational influence, and specific attitude. Journal of Environmental Psychology, 45, 1-10.

Fornell, C., Larcker, D.F. (1981), Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(1), 39-50.

Fu, W., Zhou, Y., Li, L., Yang, R. (2021), Understanding household electricity-saving behavior: Exploring the effects of perception and cognition factors. Sustainable Production and Consumption, 28, 116-128.

Gao, L., Wang, S., Li, J., Li, H. (2017), Application of the extended theory of planned behavior to understand individual's energy-saving behavior in workplaces. Resources, Conservation and Recycling, 127, 107-113.

Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E. (2010), Multivariate Data Analysis. Upper Saddle River, NJ: Prentice Hall.

Hair, J.F., Gabriel, M., Patel, V. (2014), AMOS covariance-based structural equation modeling (CB-SEM): Guidelines on its application as a marketing research tool. Brazilian Journal of Marketing, 13(2), 44-55.

Hair, J.F., Tatham, R.L., Anderson, R.E., Black, W.C. (1998), Multivariate Data Analysis. 5th ed. New Jersey: Prentice-Hall.

Hanh, B.T.M. (2022), The electricity saving behaviors of young people in an Giang province: Application of the theory of planned behavior. Thu Dau Mot University Journal of Science, 2(57), 27-39.

Hao, H.V. (2023), Officers' electricity saving in open offices: Exploring the role of perceived behavior control and accessibility to control. VNU Journal of Economics and Business, 3(1), 112-120.

Hao, H.V., Sy, H.V., Thu, N.H. (2022), Using the extended theory of planned behavior to explain office staff's intention of electricity saving. Journal of Economics and Development, 299(2), 86-94.

Hien, L.T.D., Huyen, K.N., Hoang, T.H.L. (2023), Factors affecting energy-saving intentions among youth in Vietnam. International Journal of Energy Economics and Policy, 13(6), 603-609.

Hien, N.N., Chi, P.H. (2020), The factors affecting household electricity saving behavior: A study in Vietnam. International Journal of Sustainable Development Planning, 15, 1241-1250.

Ho, T.N., Bui, A.T., Nguyen, V.D., Dao, T.K., Nguyen, N.D. (2020), Analyzing the impact of FDI and urbanization on CO_2 emission in Vietnam. International Journal of Business, 12(1), 1-19.

Hu, L.T., Bentler, P.M. (1999), Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal, 6(1), 1-55.

Jalilvand, M.R., Samiei, N. (2012), The impact of electronic word of mouth on a tourism destination choice: Testing the Theory of Planned Behavior (TPB). Internet Research, 22(5), 591-612.

Jöreskog, K.G. (1971), Statistical analysis of sets of congeneric tests. Psychometrika, 36(2), 109-133.

Kaiser, H.F. (1974), An index of factorial simplicity. Psychometrika, 39, 31-36.

Klöckner, C.A. (2013), A comprehensive model of the psychology of environmental behavior a meta-analysis. Global Environmental Change, 23(5), 1028-1138.

Li, D., Xu, X., Chen, C.F., Menassa, C. (2019), Understanding energy-saving behaviors in the American workplace: A unified theory of motivation, opportunity, and ability. Energy Research and Social Science, 51, 198-209.

Lokhorst, A.M., Staats, H., Van Iterson, J. (2015), Energy saving in office buildings: Are feedback and commitment-making useful instruments to trigger change? Human Ecology, 43(5), 759-768.

Mai, V.N., Nguyen, Q.N. (2023), Electricity: Saving behavioral intention of farmers. International Journal of Energy Economics and Policy, 13(5), 15-23.

Nga, N.T. (2022), The roles of norms in explaining individual' electricity saving behavior at workplaces. Journal of Economics and Development, 300, 54-63.

Nguyen, Q.N., Hoang, T.H.L. (2023), Acceptance of solar technology by enterprises in the Mekong Delta Region, Vietnam. Journal of Law and Sustainable Development, 11(5), e428.

Nguyen, Q.N., Hoang, T.H.L., Mai, V.N. (2022), Applying the theory of planned behavior to analyze household energy-saving behavior. International Journal of Energy Economics and Policy, 12(5), 287-293.

Nguyen, Q.N., Mai, V.N., Hoang, T.H.L. (2023), Acceptance of solar technology by farmers in Vietnam. International Journal of Energy Economics and Policy, 13(6), 93-101.

Nguyen, T.N., Lobo, A., Greenland, S. (2017), The influence of Vietnamese consumers' altruistic values on their purchase of energy-efficient appliances. Asia Pacific Journal of Marketing and Logistics, 29(4), 759-777.

Nunnally, J.C. (1978), Psychometric Theory. New York: McGraw-Hill.

Nunnally, J.C., Bernstein, I.H. (1994), Psychometric Theory. New York: McGraw.

Oikonomou, V., Becchis, F., Steg, L., Russolillo, D. (2009), Energy saving and energy efficiency concepts for policy making. Energy Policy, 37(11), 4787-4796.

Peterson, R.A. (1994), A meta-analysis of Cronbach's coefficient alpha. Journal of Consumer Research, 21(2), 381-391.

Petroleum, B. (2020), Statistical Review of World Energy 2021. Available from: https://www.bp.com/content/dam/bp/businesssites/en/global/corporate/pdfs/energyeconomics/statistical-review/bp-stats-review-

2021-full-report.pdf
Prete, M.I., Piper, L., Rizzo, C., Pino, G., Capestro, M., Mileti, A., Pichierri, M., Amatulli, C., Peluso, A.M., Guido, G. (2017), Determinants of Southern Italian households' intention to adopt energy efficiency measures in residential buildings. Journal of Cleaner Production, 153, 83-91.
Rivis, A., Sheeran, P. (2003), Descriptive norms as an additional predictor in the theory of planned behavior: A meta-analysis. Current Psychology, 22, 218-233.
Ru, X., Wang, S., Yan, S. (2018), Exploring the effects of normative factors and perceived behavioral control on individual's energy-saving intention: An empirical study in Eastern China. Resources, Conservation and Recycling, 134, 91-99.
Schaffner, D., Ohnmacht, T., Weibel, C., Mahrer, M. (2017), Moving into energy-efficient homes: A dynamic approach to understanding residents' decision-making. Building and Environment, 123, 211-222.
Shi, H., Fan, J., Zhao, D. (2017), Predicting household PM2. 5-reduction behavior in Chinese Urban areas: An integrative model of theory of planned behavior and norm activation theory. Journal of Cleaner Production, 145, 64-73.
Si-Dai, G., Cheng-Peng, L., Hang, L., Ning, Z. (2021), Influence mechanism of energy efficiency label on consumers' purchasing behavior of energy-saving household appliances. Frontiers in Psychology, 12, 711854.
Slater, S.F. (1995), Issues in conducting marketing strategy research. Journal of Strategic Marketing, 3(4), 257-270.
Smith, J.R., Louis, W.R. (2008), Do as we say and as we do: The interplay of descriptive and injunctive group norms in the attitude-behavior relationship. British Journal of Social Psychology, 47(4), 647-666.
Steinhorst, J., Klöckner, C.A., Matthies, E. (2015), Saving electricity-For the money or the environment? Risks of limiting pro-environmental spillover when using monetary framing. Journal of Environmental Psychology, 43, 125-135.
Thanh Nguyen, T., Trung Duong, K., Anh Do, T. (2021), Situational factor affecting energy-saving behavior in direct approaches in Hanoi City. The role of socio-demographics. Cogent Psychology, 8(1), 1978634.
Tsujikawa, N., Tsuchida, S., Shiotani, T. (2016), Changes in the factors influencing public acceptance of nuclear power generation in Japan since the 2011 Fukushima Daiichi nuclear disaster. Risk Anal, 36(1), 98-113.
Tverskoi, D., Xu, X., Nelson, H., Menassa, C., Gavrilets, S., Chen, C.F. (2021), Energy saving at work: Understanding the roles of normative values and perceived benefits and costs in single-person and shared offices in the United States. Energy Research and Social Science, 79, 102173.
Wang, S., Lin, S., Li, J. (2018), Exploring the effects of non-cognitive and emotional factors on household electricity saving behavior. Energy Policy, 115, 171-180.
Wang, S., Wang, J., Lin, S., Li, J. (2019), Public perceptions and acceptance of nuclear energy in China: The role of public knowledge, perceived benefit, perceived risk, and public engagement. Energy Policy, 126, 352-360.
Wang, Z., Zhang, B., Yin, J., Zhang, Y. (2011), Determinants and policy implications for household electricity-saving behaviour: Evidence from Beijing, China. Energy Policy, 39(6), 3550-3557.
Woods, R., Skeie, K.S., Haase, M. (2017), The influence of user behavior on energy use in European shopping centers. Sustainable Development, 25(1), 11-24.
Xu, X., Chen, C.F., Li, D., Menassa, C. (2020), Energy saving at work: Exploring the role of social norms, perceived control and ascribed responsibility in different office layouts. Frontiers in Built Environment, 6(16), 1-16.
Yeboah, F.K., Kaplowitz, M.D. (2016), Explaining energy conservation and environmental citizenship behaviors using the value-belief-norm framework. Human Ecology Review, 22(2), 137-159.
Zhang, Y., Wang, Z., Zhou, G. (2014), Determinants of employee electricity saving: The role of social benefits, personal benefits and organizational electricity saving climate. Journal of Cleaner Production, 66, 280-287.
Zhou, K., Yang, S. (2016), Understanding household energy consumption behavior: The contribution of energy big data analytics. Renewable and Sustainable Energy Reviews, 56, 810-819.