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Research on Factors Affecting the Energy-Saving Behavior of Household Customers in Thai Nguyen Province

MA Phung Thi Kim Phuong
Hanoi University of Industry
Email address: phuongptk1@gmail.com

Abstract— *Saving electricity is no longer only an urgent requirement of socio-economic life, but also needs to be urgently implemented in all aspects of socio-economic life, both immediate and long-term. High and new requirements in electricity saving have been set out in the Prime Minister's Directive No. 20/CT-TTg dated June 8, 2023 on enhancing electricity saving in the period of 2023 - 2025 and subsequent years. The most important requirement set out in the Prime Minister's Directive is that economical and efficient use of electricity must be considered as an important and urgent solution to continue maintaining energy security, sustainable development and national economic growth in the coming time.*

Keywords— *Electricity, Power saving behavior.*

I. INTRODUCTION

According to Directive No. 171/CT-TTg dated 26/01/2011 on enhancing the implementation of electricity saving, electricity is a popular, essential and useful form of energy in production and household activities, which needs to be used economically and efficiently. Economical and efficient use of electricity helps people, families and households pay less for electricity but still enjoy all the benefits and comfort that people desire when using electricity, [1]

Ščasný & Urban (2009) argue that intentional, behavioral, electricity use are motivational factors that influence the behavior of each individual in using electricity economically and efficiently [2].

Government programs as well as research on the electricity industry in Vietnam still do not have many studies on factors related to electricity consumption behavior of electricity customers who are electricity households, most of the current research on energy-saving behavior focuses on energy-saving behavior in the context of developed nations. Therefore, the topic "Research on factors affecting electricity saving behavior of customers who are households in Thai Nguyen province" is carried out with the aim of focusing on analyzing factors affecting electricity consumption behavior of households in Thai Nguyen province, from there, there are some policy suggestions that affect behavior, help change electricity usage behavior and encourage customers to raise their awareness of saving electricity during use.

II. THEORETICAL BASIS AND RESEARCH MODEL

a. *Overview of the model for measuring factors affecting energy-saving behavior*

Wang et al (2011) found that the electricity saving awareness index (understanding how to save electricity, recognizing energy labels, knowing electricity saving policies and regulations) is positively correlated with willingness to save electricity [3].

According to Abrahamse & Steg (2011), two theories commonly used to explain the relationship between factors of attitude, cognition, environmental concern, and energy-saving behavior are the theory of planned behavior (TPB) and the theory of Value-Belief-Norm (VBN) [4].

Research by Nguyen Trong Hoai (2014) conducted in Ho Chi Minh City has shown some evidence of the positive impact of education and concern for the environment on some energy-saving behaviors; Research has also shown that environmental awareness is inversely correlated with energy-saving behavior [5].

Research by Nguyen Viet Quang (2015) et al. conducted in Da Nang has shown that education, raising awareness about electricity saving behaviors and prices have an impact on people's energy-saving behaviors [6].

b. *Research models and proposed research hypotheses*

Price: Price is the amount of money paid for a product or service. Price is a factor that affects electricity consumers, consumers are always concerned about the price of electricity they buy. Expensive or cheap or an acceptable price. Therefore, H1 is proposed: Prices positively affect electricity consumption behavior.

Customers' attitude toward electricity use: The attitude that leads them to decide whether to like or dislike an object, to come to it or to leave it. Attitudes that make people behave fairly consistently towards similar things, Attitudes towards products and services are consumers' feelings towards products and services and the benefits they bring to individual consumers. Therefore, hypothesis H2 is proposed: Consumer attitudes towards electricity use positively affect electricity consumption behavior.

Environmental awareness: Research by Ščasný & Urban (2009), has shown that energy-saving behavior when using electrical appliances is positively correlated with the index of environmental concerns, and found evidence of a positive impact of environmental concern on energy-saving behavior when using electrical appliances and investing into energy-efficient appliances [7]. Therefore, H3 is proposed:

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Environmental awareness positively affects electricity consumption behavior.

Using new technology: Currently, in order to reduce the load of electricity use of customers, there have been many inventions and electrical equipment using modern technology (using high-tech electrical equipment such as solar energy, household appliances using inverter technology, environmental protection technology, avoiding power loss, etc.) One of the useful tools in explaining the intention to adopt a new product is the TAM technology acceptance model. According to Teo et al (2008, p. 266), the TAM model successfully predicted about 40% of the use of a new system [8]. Therefore, H4 is proposed: Adopt new technology that positively affects electricity consumption behavior.

From the above research overview, the author proposes the following research model:

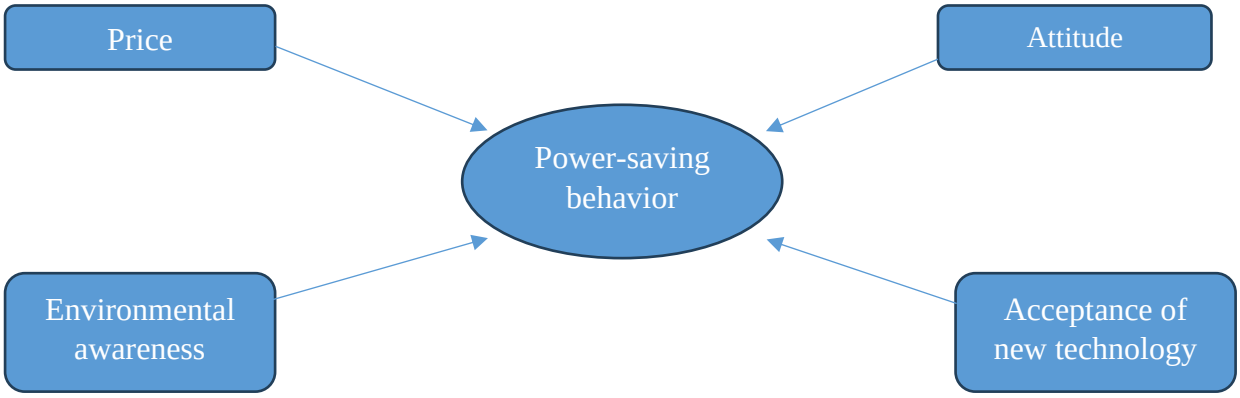

Figure 1: Research model on electricity consumption behavior

Source: Suggested Author

III. Research Methodology

1) Research scale and sample

The scales are built and developed from the theoretical basis and research model. These scales are translated into Vietnamese from those already used in previously published studies. The scale used in the study was the Likert scale with 5 prevalence as follows: very agree, agree, normal, disagree and strongly disagree. The use of this scale in socio-economic research because socio-economic problems are multi-aspect.

2) Data analysis methods

Survey results analyzed with SPSS 20 statistical software include: descriptive statistics, exploratory factor analysis, scale verification (Cronbach's Alpha), Pearson correlation coefficient test.

During January 2023 – June 2023, the authors issued 350 questionnaires, collected 328 votes and had 328 valid votes, a validity rate for using the analysis reached 93.71%. This study uses probability and non-probability sampling techniques; with random sampling method: The subjects of the survey are households in Thai Nguyen province.

IV. Research Results

A. Sample descriptive statistics

The results of the official survey after cleaning the data included 328 households according to the observed variables: living area, home status, number of family members, average household income by month, average electricity consumption by month.

TABLE 1: Statistics describing demographic variables

Characteristic		Amount	Percent	Cumulative (%)
Area	Town	126	38.4	38.4
	Rural	202	61.6	100
Home Condition	Private home	275	83.8	83.8
	Rented Housing	53	16.2	100
Number of family members	Less than 5 people	181	55.2	55.2
	5 people or more	147	44.8	100
Electricity consumption/month (1000 VND)	<=200	<=200	78	23.8
	201 -500	89	27.1	50.9
	501 -1000	131	39.9	90.9
	>1.000	30	9.1	100
Average monthly income	From 5 to 10 million VND	70	21.3	21.3
	From 10 to 15 million VND	102	31.1	52.4
	From 15 to 20 million VND	129	39.3	91.8
	From VND 20 million or more	27	8.2	100

Source: The author synthesizes from the processing results on SPSS 20.0 software.

B. Scale reliability testing

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The reliability of the scales is determined by Cronbach's Alpha coefficient. The results obtained from Cronbach's Alpha confidence are both greater than 0.7 and the total variable correlation coefficient is both greater than 0.5; That shows that the scale of concepts all meets the reliability requirement.

TABLE 2: Results of analysis of Cronbach's alpha coefficient

Element	Number of observed variables	Cronbach's Alpha coefficient	Smallest total variable correlation coefficient
Price	5	0,783	0,774
Attitude	3	0,800	0,634
Environmental awareness	5	0,892	0,536
Acceptance of new technology	2	0,763	0.699
Power-saving behavior	2	0,835	0,757

Source: The author synthesizes from the processing results on SPSS 20.0 software.

C. Regression analysis

The results of the analysis (Table 3) show that the independent variable included in the model Price, Attitude, Environmental Perception, Acceptance of New Technology) all have a sig. ≤ 0.05; the regression coefficients are all greater than 0, so these factors all affect the variable depending on the Power saving behavior. However, the Attitude variable has a value sig. = 0.139 > 0.05 so there is no impact on Power Saving Behavior at a meaningful level of 5%, 95% reliability; the VIF variance magnification coefficient of the independent variables is between (1.162 - 1.361) < 2 indicating that these independent variables are not closely related to each other, so no linear multi-addition occurs. Based on the magnitude of the Beta regression coefficient, the order of impact from strongest to weakest of the independent variables on the dependent variable HQ is: GC ($\beta1 = 0.91$) > MT ($\beta2 = 0.190$) > CN ($\beta3 = 0.142$). From the above results, the normalized multiples linear regression model is constructed as follows:

$$HV = 0.091GC + 0.190MT + 0.142CN$$

TABLE 3: Results of multiples linear regression analysis

R2 correction = 51.1%	Non-normalized coefficients		Normalized coefficients	t	Sig Significance Level	Linear multi-plus statistics	
	B	Standard error	Beta			Tolerance	VIF
Constant	-0.904	0.354		-2.551			
Price	0.093	0.066	0.091	1.465	0.003	0.860	1.163
Attitude	0.124	0.062	0.129	2.082	**0.139**	0.858	1.165
Environmental awareness	0.171	0.057	0.190	3.080	0.002	0.860	1.162
Acceptance of new technology	0.153	0.075	0.142	2.117	0.036	0.735	1.361

(Source: From author's survey data.)

V. CONCLUSION

The results of this study have contributed to the system of scales measuring people's intentions to save electricity behavior including 4 dependent variables "Price, attitude, environmental awareness, acceptance of using new technology equipment and independent variable "Consumer behavior to save electricity". This is the basis for forming a unified scale system in studies on raising people's awareness of electricity use. This research result also contributes to the theoretical system of assessing people's behavioral intentions in raising the awareness of economical use of electricity. Currently, Vietnam Electricity (EVN) still has a monopoly on buying and selling electricity, there is no competition from other suppliers, the selling price of electricity is the only EVN proposes, the selling price of electricity is continuously increasing year by year. In the future, when the Government allows other investors to invest in power transmission systems, then there will be many suppliers and there will certainly be competitive electricity prices, people will be able to use electricity at competitive electricity prices and variables in the study model will have changes leading to changes in electricity consumption behavior in the future.

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