EXTERNAL FACTORS AFFECTING ENERGY CONSERVATION INTENTION OF VIETNAMESE HOUSEHOLDS

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Abstract: At present, Vietnam is paying paramount attention to sustainable development. Energy conservation is crucial for sustainable development. Vietnam is facing a mismatch between domestic energy demand and energy supply, risking the country to energy shortage. Recently, many studies have found that changing households' energy consumption behaviors can contribute to solving the rising energy crisis. However, the research on energy conservation behavior in Vietnam, especially at residential and household level has not received much attention in the literature. The purpose of this study is to examine the mechanism of direct impact of external barriers on energy conservation intention of Vietnamese households. The results are based on a survey of 208 participants in Vietnam. The propositions were examined using multiple regression analysis. This study confirmed that energy price has the strongest positive impact on Vietnamese households' energy conservation intention, followed by energy-saving policies, social norms and quality of energy-saving products. The unavailability of energy-saving products has a negative correlation with energy conservation intention. Perceived behavior control has no significant correlation with energy conservation intention. These interesting findings fill the literature gap and suggest good recommendations for policy makers to formulate and implement energy conservation and sustainable development policies.

***Keywords*:** Energy conservation intention, Energy-saving, Energy-saving behavior, Households, Vietnam

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I. INTRODUCTION

As with many other developing countries, Vietnam is experiencing the high economic growth with an annual growth rate of 6 – 7% [1]. Vietnam was an economy star during 2020 and 2021 because it was one of the only economies to record two consecutive years of growth since the start of the Covid-19 pandemic. However, since the early year of 21st century, Vietnam was facing the risk of severe air pollution. The rapid economic development, coupled with the high urbanization process, industrialization and population growth has raised the energy demand for industries, transportation, and domestic activities [1] and contributed to high carbon emission [2]. Vietnam is facing two key energy-related issues. First, domestic demand for energy is exceeding the domestic supply. Vietnam will lose its domestic balance, which is a threat to the national energy security [1]. Vietnam has potential energy resources, but this resource is increasingly depleted, so since 2015, Vietnam has had to import electricity from other countries. According to forecasts, along with

economic growth, in 2025, nearly 49% of electricity demand in Vietnam will be met through imports [3]. Dependence on imported electricity leads to an increase in electricity costs as well as a threat to national energy security. Large electricity consumption also leads to the risk that Vietnam will not be able to fulfill its commitments to reduce greenhouse gas emissions and climate change under international agreements [1].

To respond to the potential energy shortage, Vietnam policy makers have taken numerous measures to reduce electricity consumption. The most prominent legal interventions so far are the Law on Economical and Efficient Use of Energy, launched in 2011 and the National Target Program on Economical and Efficient Use of Energy for the period of 2019-2030 (commonly referred to as VNEEP). The Law on Economical and Efficient Use of Energy provides a solid legal basis for the implementation of efficient energy production activities while the goal of the National Target Program aims to improve energy efficiency of organizations, communities and individuals [2].

In order to reduce carbon emission, the group of households should pay special attention. Household, along with manufacture and transportation are the most energy consuming sectors [1, 2]. Under the pressure of increasingly depleting energy resources, energy efficiency has received attention from both practical and academic approach to attain sustainable development [4]. Recently there is a line of inquiry paying attention to energy-saving behavior at household level [5-8]. However, most of studies in the field of residential energy conservation in Vietnam have overlooked the impact of external factors on energy conservation intention. Therefore, the objective of this research is to estimate to what extent external factors influence energy conservation intention of Vietnamese households.

The remainder of the paper is structured as follows: the second section critically review the literature and summarize the proposed hypotheses. Then the third section provides an overview of the research method and data collection procedure. Finally we analyze key findings, provide a comprehensive discussion, implications of this study and set agenda for future research.

II. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. The research backgrounds

Energy efficiency investment and energy saving behaviors, or sometimes termed as energy curtailment behaviors are two types of residential energy behaviors. The distinction is made based on whether the effort requires monetary investment. Energy saving behaviors involves repetitive efforts but no monetary investment. Daily energy behavior is measured by better energy behavior, for example, put a lid on saucepan while boiling and curtailment of comfort behavior, for instance, wearing a jumper instead of turning up the heater [9, 10]. Thus, daily energy behavior is habitual and has automatic nature. However, energy curtailment behaviors require a change in lifestyle. Energy efficiency is divided into two forms, commonly understood as the purchase of energy-saving appliances, such as LED lights and energy efficient retrofits measure investment which requires more investment in money and time, for instance, installing an insultation system for a building [9, 10].

In Vietnam, the amount of empirical research on energy conservation behaviors is limited. Much research to date has focused on the implementation and influence of policies promoting energy conservation behavior and

energy efficiency [1-3] but the research stream on energy conservation behaviors in households is leaving unexplored. Some other studies investigated factors affecting purchase of energy efficiency equipment only [11], resulting in an incomplete picture of energy conservation in Vietnam.

Existing literature has highlighted the role of sociodemographic, policy intervention and psychological factors on energy conservation behavior at household level. Impacts of sociodemographic factors, such as age, gender, income level, education level on energy saving behavior have been confirmed by previous scholars [9] [12]. Psychological factors, such as environmental concern, environmental awareness, knowledge about energy issues, sense of responsibility and attitude also influence energy conservation behaviors [6, 13, 14]. Policy interventions, for example, subsidies and taxes, discounts or rewards, energy audit, commitment and feedback have been evidenced to be positively correlated with energy conservation behavior at households [6, 9]. Previous scholars have incorporated policy interventions into external factors, also known as contextual factors which refer to objective conditions, living environment, or policy environment that an individual cannot control [2, 14, 15]. Other external factors are social norms, perceived behavioral control, the quality of energy-saving products, the availability of energy-saving products [2, 8, 15]. However, the mechanism in which these external factors affecting energy-saving behavior at household is not fully understood.

Previous literature has confirmed behavioral intention as the most direct determinant of behavior, representing the degree to which a person is ready to perform a certain behavior [16, 28]. This research defines energy conservation intention as the willingness to implement the energy conservation behavior. Drawing on the existing literature, the aim of this study is to examine the direct impact of external factors on energy conservation behavior of Vietnamese households. To be specific, this study investigated the correlations between social norms, perceived behavioral control, the quality of energy-saving products, the (un)availability of energy-saving products, energy price and energy-related policies and energy conservation intention at households in Vietnam.

2.1. Energy conservation intention

Energy conservation intention can be understood as a person's motivation to exert effort to enact energy saving behavior [16]. Under TRA or TPB, intentions and behaviors are strongly correlated when measured at the same level of specificity and when the time interval between intention and behavior is short enough [16]. Overall intention exerts a significant positive influence on pro-environmental behavior and on energy-saving behavior in particular [14, 15, 23].

2.2. Social norms

Social norms, commonly known as subjective norm in the Theory of Planned Behavior model, are defined as the perceived social pressure to perform or refrain from behavior [17]. External research has shed light on the influence of social norms on the adoption of energy conservation behavior [28]. Wang, et al. [7], Yue, et al. [9], Tang, et al. [18] highlighted that social norms are positively correlated with electricity-saving behaviors. Nonetheless, in a research about energy saving behavior in student dormitories using an extended theory of planned behavior, social norm was reported having no significant effect on energy saving intention, which contradicts with previous findings [33]. This could be explained as research participants are postgraduate students whom spend the majority of their time in their room and have low social

connection with others, and thus less likely to be impacted by the expectation of others. In this study, we form the hypothesis that social norms have a positive effect on energy-saving intention.

H_1: Social norms are positively correlated with energy conservation intention of Vietnamese households.

2.3. Perceived behavioral control

Perceived behavioral control refers to the degree of convenience or difficulty experienced by an individual when doing something. It is the extent to which an individual feels ready to participate in a specific behavior [19, 20]. It includes time, resources, and the opportunity to perform a specific behavior [20]. The higher level of control an individual has over the energy-saving equipment being considered, the higher level of likelihood an individual will utilize it [21]. In an echoing note, Klöckner and Blöbaum [22] reiterated that perceived behavioral control has a strong and positive impact on energy saving behavioral intentions of households. This point of view has been further verified by Gao, et al. [23] who applied the extended theory of planned behavior to understand individual's energy saving behavior in workplaces. A recent study has also strengthening this relationship by affirming that perceived behavioral control significantly influences consumer intention to purchase energy-saving appliances [24]. The following hypothesis is tested.

H_2: Perceived behavioral control is positively correlated with energy conservation intention of Vietnamese households.

2.4. The energy-related policies

Many countries have introduced a number of policies to promote energy conservations. Abrahamse et al. [25] classified government intervention policies into two categories. Antecedent interventions include setting commitment, goal-setting, information (mass media campaign, energy audit) and modelling. Consequence interventions based on the assumption that pro-environmental behavior will become more attractive when positive consequences are attached to it, for example, providing monetary incentives such as subsidy, taxes, bonuses [17, 25, 26]. Wang, et al. [15] found that the policy environment had a positive impact on daily energy – saving behavior. Hong, et al. [6] put forward this finding by unveiling government subsidy has a positive correlation with energy-saving behavior. We have the third hypothesis.

H_3: Energy – related policies are positively correlated with energy conservation intention of Vietnamese households.

2.5. The quality of energy – saving products

Previous scholars agreed that the two major types of energy conservation behavior are purchase behavior and habitual behavior [2, 9]. Ha and Janda [27] emphasized that purchase behavior of energy efficience product played a significant role in reducing energy consumption. As [2] asserted that there is a positive relationship between the quality of energy – saving product and energy – saving behavior, the below hypothesis is formed.

H_4: The quality of energy – saving products is positively correlated with energy conservation intention of Vietnamese households.

2.6. Energy price

Conflicting results have been reported with respect to the effect of energy price on energy conservation. Webb et al. (2013) [5] unveiled that a rise in energy price would significantly lower the energy consumption of residents. Nonetheless, Wang, et al. [15] in their integrated model of theory of planned behavior and the norm activiation evidenced that as people have

higher income now, they no longer see energy bills as an economic burden on the family. Brounen et al. (2013) [32] evidenced that young households with higher income have lower energy awareness. They don't know how much they are charged for the monthly energy consumption. Older people tend to have higher awareness of their energy bills. Thanh Nguyen et al. [2] in their research with urban residents in Hanoi indicated that energy price has no impact on energy conservation behavior. One possible explanation is because energy price in Hanoi has been fairly stable. The following hypothesis is proposed.

H_5: Energy price is positively correlated with energy saving intention of Vietnamese households.

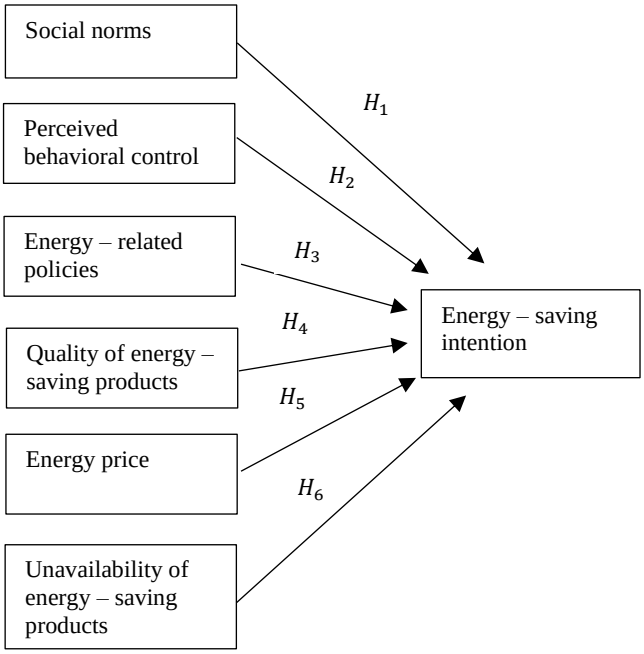
2.7. The (un)availability of energy – saving products

Existing literature has found green product availability can facilitate the relationship between green consumption intention and behavior at least in two ways. Firstly, availability of green products can help lower perceived costs, thus making green offering more attractive [28]. Second, availability of green products can translate intention into actual behavior because it acts as a cue to trigger the action [28]. The following hypothesis is established.

H_6: Unavailability of energy – saving products is negatively correlated with energy conservation intention of Vietnamese households.

The research model is presented in Figure 1.

Figure 1. Conceptual model



III. RESEARCH METHOD

3.1. Sampling and data collection

Data was collected using questionnaire survey. Questionnaire is a research method of gathering information from respondents. This method is commonly used in social science because it can collect information, especially people's attitudes and perceptions, that are not captured by official statistical data. The final number of usable questionnaires in this research was 208 which ensured sufficient input for data collection and following data analysis. The data was collected by a combination of convenience sampling method and quota sampling method using three different communication techniques: face – to – face survey, Internet survey and direct survey by phone. However, because of lack of access, only residents in Hanoi participated in the survey. The survey was sent to residents living in the residential quarter of Hanoi's urban area. Table 1 shows the descriptive statistics of the survey data. It can be seen that the majority of respondents are young people (88% of them are from under 28 to 42 years old) and 47.1% of them are females. 61.6% of respondents have an education background of university level or

higher. The proportion between male and female in this research is similar to the proportion reported by the General Statistics Office of Vietnam in 2019.

3.2. Scale measurements

The measures in this research are all operationalized from previous studies. Measures for key variables in our model, including social norms, quality of energy-saving products, energy price, energy-related policies were adopted from the work of Thanh Nguyen et al. [2] and Zhang et al. [29]. Items to measure energy conservation intention were adopted from Zhang et al. [29]. Items to measure perceived behavioral control was adopted from Du and Pan (2021) [33]. All the items were measured using a 5 – point Likert scale, which ranged from 1 for "Strongly disagree" to 5 for "Strong agree". Regression analysis with the use of statistical package SPSS would be employed for data analysis.

Table 1. Descriptive statistics of survey sample

Demographic variables	Category	No. of people	Percent
Gender	Male	110	52.9
	Female	98	47.1
Age	Under 28	51	24.5
	28 – 42	81	38.9
	43 – 56	42	20.2
	57 – 70	34	16.3
Education background	High school	33	15.9
	College	47	22.6
	Bachelor degree	32	15.4
	Master degree or above	96	46.2
Income	Under 5m	12	5.8
	5 – 10 m	46	22.1
	10 – 20 m	69	33.2
	Over 20 m	81	38.9
Marriage status	Single	80	38.5
	Married with kids	44	21.2
	Married with no kids	42	20.2
	Others	42	20.2

IV. ANALYSIS RESULT

4.1. Reliability test

First, the study needs to assess the reliability and validity of the measurement model. Exploratory factor analysis (EFA) was carried out and Cronbach's alpha was evaluated. As shown in Table 2 and Table 3, the Cronbach's alpha coefficients of all the variables including social norms, perceived behavioral control, energy – related policies, quality of energy – saving products, energy price, the unavailability of energy – saving products and energy conservation intention of households were larger than 0.7 after eliminating one item with Correlated items – total Correlation smaller than 0.3 are reliable. The results of the EFA suggested six factors with Eigenvalues larger than 1 explained over 70% of the variance. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.752, indicating that the sample was adequate, and Bartlett's Test of Sphericity gave a *p*-value of <0.05.

Table 2. Independent variable – exploratory factor analysis (EFA) and reliability analysis results

Factor	Items	Factor loading	Cronbach's alpha
Social norms	You think that households need to be aware of energy – saving behavior	0.818	0.774
	You must take action to save energy because of mandatory regulations	0.809	
	If eneryone around you engages in energy saving you will be more involved in energy saving	0.794	
Perceived behavioral control	You know you can save energy at home	0.745	0.754
	You have sufficient resource, time and opportunity for energy – saving	0.799	
	You have sufficient knowledge and skills for energy – saving	0.821	
Energy – related policies	Policies and regulations play an important role in promoting and encouraging me to improve and change energy-saving behaviors	0.887	0.749
	Your energy-saving behavior because of the relevant policies and regulations	0.847	
Quality of energy – saving products	You will choose to purchase energy-labeled equipment firstly	0.853	0.610
	Customer feedback on energy – efficient products is an important factor in your choice of purchasing the product	0.859	
Energy price	You will change transportation if gasoline or oil prices rise	0.762	0.810
	You will change the habit of using electrical equipment when electricity prices rise	0.758	
	The main reason for your energy – saving behavior is to reduce electricity bills	0.768	
	Reducing energy consumption will reduce economic burden on your family	0.787	

Unavailablity of energy – saving products	You actually don't know where energy – saving products are sold	0.810	0..749
	Energy – saving products are not sold at stores close to where I live	0.843	
	I cannot easily find energy – saving products unless I look for them carefully	0.795	

Table 3. Dependent variable - EFA and reliability analysis results

Factor	Items	Factor loading	Cronbach's alpha
Energy conservation intention of households in Vietnam	I am willing to join energy – saving of households in the next few weeks	0.793	0.774
	You are willing to think whether you are using energy efficiently at households	0.843	
	You are willing to take to other family members about energy – saving in the next few weeks	0.855	

4.2. Correlation coefficient

The Pearson correlation coefficients test show all independent variables have a statistically significant relationship with the dependent variables (p.value < 0.05). The direction of the relationship is positive between social norms, perceived behavioral control, energy price, energy – related policies and the quality of energy – saving products and energy conservation intention of households, meaning these variables tend to increase together. The diection of the relationship is negative between the unavailability of energy – saving products and energy conservation intention.

4.3. Regression analysis

Hypothesis testes were carried out by using multiple regression to reveal their level of significance. The variance inflation factors were examined and all were found to be within the range of 1.17 to 1.24. Thus the result is not contaminated by multicollinearity. Table 4 summaries the regression test results. The regression results pointed out that energy price and energy – related policies had the strongest and most positive correlation with energy conservation intention (beta = 0.449 and 0.353, p – value = 0.000 respectively). Subsequently, social norms had the second strongest and most positive correlation with energy conservation intention (beta = 0.114, p – value = 0.008), followed by the quality of energy – saving products (beta = 0.088, p – value = 0.034). The unavailability of energy – saving products has a significantly negative relationship with energy conservation intention (beta = -0.294, p – value = 0.000), implying that availability of energy – saving products would have a positive impact on energy conservation intention. As a conclusion, the hypotheses H_1, H_3, H_4, H_5, H_6 are supported. The hypothesis H_2 is not supported. R2 is 0.696, indicating that up to 70% of fluctuation of energy conservation intention could be explained by the independent variables in the model.

Table 4. Regression results

Variables	Model (standardized)
Social norms	0.114*
Perceived behavioral control	0.075
Enery – related policies	0.353****
Quality of energy – saving products	0.088**
Energy price	0.449****
Unavailability of energy – saving products	-0.294****
R2	0.696
Adjusted R2	0.687
Note: *p < 0.1, **p< 0.05, ***p < 0.01, ****p < 0.001	

V. IMPLICATIONS AND CONCLUSION

This paper has introduced a model to examine the direct impact of external factors on energy conservation intention of households in Vietnam. The results highlight the key role of energy price and energy – related policies in determining energy conservation intention of households in Vietnam, followed by social norms and the quality of energy – saving products. This could be because during the pandemic outbreak, the unemployment rate increased and average income level decreased [30], coupled with the recent surge in oil and gas price [31], making household try to trim their expenses at home. Social norms' significant impact on household energy conservation intention could be explained as when the government runs energy-related policies through infomation and publicity campaign, these can become social norms. The quality of energy saving products also has a positive influence on energy conservation intention as when residents realize the use of energy saving appliances do not reduce their comfort or quality of living, they are more likely to purchase these equipments.

An interesting finding is in contrast with previous literature [22-24], perceived behavioral control has no significant correlation with energy conservation intention. One possible explanation for this is the research was conducted during summertime in Vietnam. In summer, because of the typical tropical climate weather, individual consume more electricity equipments to maintain physical comfort, such as fan, air – conditioner. During summertime, children have school break and stay at home more, therefore parents are unlikely to sacrifice their children' comfort for perceived benefits of energy conservation. Thus, residents may feel lack of opportunities and time to save energy.

The findings of this study suggest that in order to promote energy conservation intention of households in Vietnam, energy – related policies should be communicated to the public. These public communication campaigns should emphasize advantages of cutting energy price to household. Specific solutions should be made clear. For example, households should be educated on how to save energy in daily heavy energy-consuming activities, such as cooking. The positive correlation between availability of energy – saving products and energy conservation intention can help recommends strategis for firms in their marketing. Firms should focus on increasing availability of energy – saving products. They should fine-tune their shelf product strategies, including detailed energy rating information on the package of their products. In addition, the importance of quality of energy – saving products also suggests that Vietnam government needs to create good purchase experience of energy efficient appliances. Although residential energy-consuming products have recently been labeled with energy for classification, many consumers are still unable to identify the benefits of using

energy-saving products due to a lack of knowledge, or simply because the market is still infested with replicated products with inferior quality that have been stamped with energy-saving labels. This results in a loss of trust from consumers.

This research has made two contributions. First, it complements the current body of knowledge on energy conservation, especially in the context of Vietnam which received little attention from past literature. Second, according to the findings, it recommends policy makers and energy – saving appliance producers appropriate strategies to encourage energy conservation at household level.

Future research should expand this study by surveying households in other regions of Vietnam, or a comparison between energy conservation intention of urban and rural residents would be interesting. Furthermore, the indirect influence mechanism between external factors and energy conservation intention should be explored.

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NHỮNG NHÂN TỐ NGOẠI CẢNH ẢNH HƯỞNG ĐẾN Ý ĐỊNH TIẾT KIỆM ĐIỆN CỦA CÁC HỘ GIA ĐÌNH TẠI VIỆT NAM

Tóm tắt: Hiện nay, Việt Nam đang quan tâm hàng đầu đến phát triển bền vững. Tiết kiệm năng lượng là rất quan trọng để phát triển bền vững. Việt Nam đang đối mặt với sự thiếu cân đối giữa nhu cầu năng lượng trong nước và nguồn cung năng lượng, dẫn đến nguy cơ khiến Việt Nam bị thiếu hụt năng lượng. Gần đây, nhiều nghiên cứu đã phát hiện ra rằng việc thay đổi hành vi tiêu thụ năng lượng của các hộ gia đình có thể góp phần giải quyết cuộc khủng hoảng năng lượng đang gia tăng. Tuy nhiên, các nghiên cứu về hành vi tiết kiệm năng lượng ở Việt Nam, đặc biệt là ở cấp độ dân cư và hộ gia đình vẫn chưa được quan tâm nhiều. Mục đích của nghiên cứu này là xem xét cơ chế tác động trực tiếp của các yếu tố bên ngoài đến ý định tiết kiệm năng lượng của các hộ gia đình Việt Nam. Kết quả dựa trên cuộc khảo sát với 208 người tham gia tại Việt Nam. Các giả thuyết đã được kiểm định bằng cách sử dụng phân tích hồi quy đa biến. Nghiên cứu này khẳng định rằng giá năng lượng có tác động tích cực có ý nghĩa thống kê mạnh nhất đến ý định tiết kiệm năng lượng của các hộ gia đình Việt Nam, tiếp theo là các chính sách tiết kiệm năng lượng, chuẩn mực xã hội và chất lượng của các sản phẩm tiết kiệm

năng lượng. Việc không có các sản phẩm tiết kiệm năng lượng có mối tương quan ngược chiều với ý định tiết kiệm năng lượng. Nhận thức kiểm soát hành vi không có mối tương quan đáng kể với ý định tiết kiệm năng lượng. Những phát hiện thú vị này đóng góp vào việc lấp khoảng trống trong tài liệu và gợi ý các khuyến nghị cho các nhà hoạch định chính sách trong việc xây dựng và thực hiện các chính sách bảo tồn năng lượng và phát triển bền vững.

Từ khoá: Hành vi tiết kiệm năng lượng, hộ gia đình, ý định tiết kiệm năng lượng, Việt Nam.

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