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# THE EFFECTIVENESS OF ENERGY SAVING CAMPAIGN IN CHANGING BEHAVIOR OF UNIVERIST STUDENTS: THE ROLES OF ENVIRONMENTAL AWARENESS AND PERCEIVED BENEFIT OF ENERGY SAVING

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## ABSTRACT

***This study investigated the effectiveness of an energy conservation campaign in promoting energy-saving behavior among university students in Thailand. Drawing on the Theory of Planned Behavior (TPB) and integrating aspects of Value-Belief-Norm (VBN) theory, this study explored the role of environmental awareness and perceived benefits as mediators between campaign awareness and behavioral outcomes. Data were collected from 568 undergraduate students using a cross-sectional survey, and the proposed model was tested using structural equation modeling (SEM). The results indicated that the campaign was successful in raising environmental awareness and perceived benefits associated with energy conservation. However, only perceived benefits were a significant mediator linking campaign participation to actual energy-saving behavior. Students were particularly motivated by tangible outcomes, such as reduced utility bills, convenience, and contributing to a positive social image, rather than perceptions alone. This highlights the important role of emphasizing tangible, self-serve benefits in designing effective sustainability initiatives. This study contributes to behavioral and sustainability research by elucidating the mechanisms through which campaigns influence student actions. Furthermore, there are guidelines for higher education institutions in Southeast Asia and similar contexts, suggesting that campaigns emphasizing explicit benefits are more likely to lead to sustainable behavior change.***

**KEYWORDS:** Energy Conservation Campaigns, Theory Of Planned Behavior (TPB), Structural Equation Modeling (SEM), Sustainable Behavior, University Students.

## 1. INTRODUCTION

Due to global energy instability and environmental degradation, there are serious problems that require systemic responses. Likewise, higher education institutions (HEIs), which are considered key agents of behavioral change and sustainability leadership (Anthony, 2021; Sitompul et al., 2025), is no exception. As social and educational incubators, the universities consume energy for their operation but it also contributes to the shaping of future citizens' environmental awareness and behaviors (Ferrari et al., 2025). Educational institutions, as social and educational incubators, use considerable energy on their campus. However, these institutions have a decisive impact on the environmental awareness of the future citizen (Sitompul et al., 2025). University campuses use energy for lighting, air-conditioning, computing, and modes of transportation. However, the uses could be mismanaged owing to a combination of poor awareness and lack of behavioral responsibility (Fachrudin & Fachrudin, 2021; Zhu et al., 2021). As more and more attention is paid to the global warming and carbon emissions they require more focus towards prudent energy practice that requires an optimal mix of technology-based and behavioral action (Ling & Ling, 2025; Gao et al., 2023). Most HEIs upgraded the infrastructure to include usage of solar energy, energy-efficient appliances, and building automation (Maichum et al., 2023; Mahasarakham University, 2023). However, their success is subject to the behavior of the campus users (Goyal et al., 2023; Pandya, Prajapati, & Gupta, 2022).

The behaviour of energy saving especially university student is a concern for the integration of sustainability into the work and teaching in the universities (Zhou et al., 2023; Valenzuela et al., 2025). According to some studies, knowledge, attitudes, and motivation of students are important predictors of the energy-saving intention and behaviors (Du & Pan, 2021; Espinoza et al., 2025). According to Ajzen (1991) and Du and Pan (2022), the Theory of Planned Behavior (TPB) provides a powerful framework for these interrelationships by linking intention to the behavioral predictors of attitudes, subjective norms, and subjective behavioral control. Extensions of this theory are aimed at expanding energy-related behaviors of youths which include adding in a range of other predictors such as environmental consciousness and benefit beliefs (Erna, Setiawan, & Aos, 2024; Hakuduwal, 2025). Some studies have argued that distinctions in language use may reflect a biocentric framework that values nature for its own sake as opposed to an anthropocentric framework that values nature mainly for its utility. Sustainability initiatives can also be motivated by beliefs that the initiatives bring benefits such as energy expenditure, convenience, health, and ethical satisfaction (Busu et al., 2025; Wang, Han, & Xu, 2020).

Energy conservation campaigns are one of the behavioral methods used by universities to promote energy conservation (Camacho et al., 2025; Cole & Fieselman, 2013). Subsequently, they could be scaled and practical. Energy saving campaigns are planned communication, community involvement and feedbacks that influence behavior (Cornet et al., 2024; Bulunga & Thondhlana, 2018). Unsuitable campaigns use group norms, authority, and social change visual cues to influence behavior for social change (Camacho et al., 2025). But, the success of social campaigns depends on the context factors like the student engagement in the campaign, the relevance of the campaign, cultural norms, and the level of environmental knowledge (Jamaludin et al. 2022; Jamaimool & Chontanawat 2021). This research also stated that behavioral campaigns are more likely to succeed using social norms that respond to the lived experience and aspiration of students (Tiberio et al, 2025; Ling & Ling, 2025). There are not many empirical studies done to investigate the psychological mechanisms of energy use behavior even though the literature on the subject is growing. In particular, little is still known about the mediators, such as perception and perceived benefits, that explain how campaigns lead to behavior change toward sustainability (Nguyen, Nguyen, & Hien, 2024; Zhou et al. 2023; Petersen et al. 2015).

There is a gap in the literature on how institutional campaigns impact the behavior of university students in Thailand and South East Asia through cognitive and motivational mechanisms (Fachrudin & Fachrudin, 2021; Hakuduwal, 2025). Sustainability education, cultural attitudes and institutional policies vary across the globe which makes Western models of behaviour change not generalizable (Duong, 2023; Janmaimool & Chontanawat, 2021). Mahasarakham University (MSU), popularly known as MSU, acts as a public university in Northeastern Thailand. MSU is ranking high in the UI GreenMetric World University Rankings which is an international university ranking for sustainability. Also, MSU has carried out several initiatives and activities related to sustainability which includes the installation of solar panels, launching of electric buses, waste management programs, and digital energy control systems. Real-world learning programs that highlight environmental ethics and awareness have

been established by the administration of the School of Environment and Resource Studies. (Mahasarakham University, 2023). Moreover, involving students using social media, student clubs, and university events is a systematic effort to mobilize students to save energy. Therefore, the context of this study is suitable to test energy campaigns in Southeast Asia universities.

To fill these urgent gaps in literature, this study formulates an integrative conceptual model based on an extended theory of planned behavior with environmental consciousness and perceived benefits as mediating variables. This extra literature builds on recent work on sustainability behavior, and it focuses on psychological, social and motivational pathways to behavior change. This study presents a university known for its sustainability activities in higher education in Southeast Asia, which serves as a contextual foundation for investigating the effect of institutional campaigns on energy-related behaviors. An exploratory study utilizing structural equation modeling (SEM) demonstrates the interrelationship between access, cognition, and behavior to reduce energy use. Ultimately, this study will develop a theoretical framework of sustainability action models and design guidelines for universities' effective, and evidence-based energy reduction campaigns while demonstrating the utility of targeting not just data-based but also affective and contextual sustainability action determinants. The findings have broader significance for higher education institutions throughout Southeast Asia and many other developing countries that seek to operationalize sustainability goals via evidence-informed behavioral actions.

## 2. LITERATURE REVIEW

A multidisciplinary literature review is needed to understand energy-saving behavior in higher learning institutions. This segment relies on concept and empirical energy save, environmental consciousness, driver, and institution campaign function that activating student sustainable action.

### *2.1. Energy Conservation in Higher Education Institutions*

Higher education institutions (HEIs) play an increasingly significant role in the global sustainability transition, not only through their educational role but also through their enormous impacts on the environment (Sitompul et al. 2025; O'Donoghue et al. 2025). The campus installations of the university consume a lot of energy from lighting, heating, ventilation and air conditioning (HVAC), computers, and student transportation (Zhu et al., 2021; Fachrudin & Fachrudin, 2021). As a result, universities are implementing strategies for energy saving, including modernization of infrastructures and modification of behaviors (Maganini et al., 2025; Pandya, Prajapati, & Gupa, 2022). In the other words, institutions integrate smart applications, solar panel usage, and green building designs as part of their commitment to sustainability (Moura et al., 2021; Anthony, 2021). The initiative undertaken with the "Green University" Project involves the launch of a solar power system, digital management of energy, and the Campus Sustainability Learning Project. The university's carbon footprint is not just controlled using research energy structures. They also prove to be a platform for experiential knowledge and student involvement towards energy sustainability.

Also, HEIs are social incubators that provide youth with long-term values and behaviors. In this sense, HEIs can become better vehicles for pro-environmental action (Ling & Ling 2025; Ferrari et al. 2025). Efforts to link sustainability knowledge to action for energy saving show promise for shaping energy saving behaviors (Jamaludin et al., 2022; Tiyarattanachai & Hollmann, 2016) through educational intervention. These programs do not only happen in classrooms--they are carried out through campaigns, policy integration, and mobilizations that resound across university campuses to mobilize students for transforming norms (Cornet et al., 2024; Camacho et al., 2025). Energy saving at universities can no longer be framed as a technical efficiency issue. Rather, it is a complex whole involving pedagogy, institutional culture, human behavior etc. according to Zhu et al. (2021) and Shaya et al. (2025). As universities get more caught up with targets for carbon neutrality and bring operations closer to the Sustainable Development Goals (SDGs), figuring out how to add value to campus life by saving energy is coming into sharper focus (Maganini et al., 2025; Sahibzada, Meoli, & Aslam, 2025).

Behavioral Change and Energy-Saving Intentions

To understand saving energy behaviors within the university context, one requires an in-depth understanding of cognitive and motivational mechanisms that drive intentional action. The Theory of Planned Behavior (TPB) is one of the most widely applied models in sustainability research. The TPB was developed by Ajzen (1991) and suggests that behavior is principally predicted by three components: attitude towards the behavior, subjective norms, and perceived behavioral control. The usage of TPB has been examined in various

environmental and energy contexts. Therefore, evaluations of energy-saving outcomes, perceived social pressure, and confident beliefs regarding behavior successfully predict students' intentions to save energy (Du & Pan, 2022; Ling & Ling, 2025).

At university, it is not enough to inform students, behavioral change also involves a psychoanalytical process. Research indicates that students are more likely to form intentions to carry out energy-saving behaviors when they believe these behaviors are personally relevant, socially supported and easy to implement (Petersen et al., 2015; Gao et al., 2023). As Heib, Hildebrand, & Kortsch in 2023 stated, social identity theory and feedback mechanisms are also noted to strengthen behavioral commitment through shared responsibility and accountability within peer networks. The interventions impacting these mechanisms have been shown to be more successful in the long-run than those which are technical or knowledge-based (Fatoki, 2023; Zhang, Zhao, & Yin, 2020).

In this study, besides TPB, the Value-Belief-Norm (VBN) theory helps understand how internalized values and moral obligation are formed to elicit pro-environmental intention. According to VBN, people will undertake action when they view environmental issues as personally relevant and find their behavior consistent with self-transcendent values like altruism or an ecological concern (Stern, 2000; Wang, Hanm & Xu, 2020). When you consider this, adopting the view of VBN into the model of TPB entails a better understanding of perceived benefits and awareness of environment of students that act as the cognitive and in the same time, normative as well as moral drivers of energy-saving intention (Gadenne et al., 2011; Hakuduwal, 2025; Tiberio et al., 2025).

### *2.2. The Role Of Energy Conservation Campaigns*

Energy conservation campaigns are organized behavior interventions that create a pro-environmental message through other means with the use and manipulation of space (Cole & Fieselman, 2013; Camacho et al., 2025). Unlike infrastructural or policy-level solutions, campaigns play a psychological and social role to change beliefs, provide a sense of relevance and responsibility for campus stakeholders through persuasive communication (Cornet et al., 2024; Tiberio et al., 2025). Campaigns that work well often rely on behavioral economics, social marketing and communication theory. They often use norm-based, feedback and emotionally charged narratives (Bulunga & Thondhlana, 2018; Jamaludin et al., 2022). For university students in particular, strategies that include peers within the campaign, frame identity and invoke interactivity mark greater consistency in intention and behavior (Ferrari et al., 2025; Ling & Ling, 2025).

Studies show that targeted campaigns are better at achieving longer-term outcomes than generic awareness ones, as campaigns that take into consideration local values and educational contexts are more effective (Janmaimool & Chontanawat, 2021; Gao et al., 2023). For example, multiple exposure to conservation messages with institutional commitment and visible actions (e.g., energy dashboards, sustainability clubs) significantly increases student engagement (Camacho et al., 2025; Valenzuela et al., 2025). Research conducted in Southeast Asia shows that energy-saving intention and energy-saving behavior can be enhanced through university campaigns that resonate with students' aspirations and community normative (Fachrudin & Fachrudin, 2021; Nguyen et al., 2024). Yet campaigns can give only the effect if demand is created due to cognitive change. Moreover, if motivational triggers and social reinforcement please the consumers then it can give the best results.

### *2.3. Environmental Awareness As A Mediating Mechanism*

Environmental awareness is the cognitive, affective and conative response of people to the environment (Bamberg & Möser, 2007; Zeng, Zhong, & Naz, 2023). Youth environmental knowledge entails awareness of and understanding of environmental phenomena and issues (Lee, 2008; Ahn, Bailenson, & Park, 2014). Environmental awareness is a mediating mechanism that brings the influence of institutional campaigns and behavioral change together through the internalization of motivation and value-based decision-making (Espinoza et al., 2025; Hakuduwal, 2025). Awareness is often enhanced by integrated curricular content, social interaction, and visual prompts (Janmaimool & Chontanawat, 2021; Jamaludin et al., 2022). Awareness is often assessed through validated multi-item Likert scales assessing knowledge, concern, and behavioral relevance (Camacho et al., 2025).

### *2.4. Perceived Benefits and Sustainable Motivation*

Perceived benefits refer to people's beliefs and views about themselves—as well as about society and the environment—when using a certain energy-saving behavior. The cost savings, comfort effects, social recognition, and environmental protection

(Gadenne et al., 2011; Wang, Han, & Xu, 2020). These perceived benefits act as important levers to motivate individuals' behavioural intention and reinforce the attitude-behavior gap (Busu et al., 2025; Ling & Ling, 2025). According to the Value-Belief-Norm theory individuals absorb values and expected outcomes into pro-environmental norms (Stern, 2000; Camacho et al., 2025). When campaigns make clear the tangible and symbolic benefits of actions, students are more likely to adopt and uphold such energy-conserving actions (Alias et al., 2013; Espinoza et al., 2025; Tiberio et al., 2025) The perceived benefits thereby serve cognitive and affective motivators in sustainability-related interventions.

## 3. THEORETICAL FRAMEWORK

This study is fundamentally based on Theory of planned behavior (TPB) which was given by Ajzen (1991). TPB explains behavioral intention through attitude, subjective norm and perceived behavioral control. The model of TPB is extended by the addition of two key mediators, which are namely environmental awareness and perceived benefits, as backed by sustainability literature to enhance explanatory power (Du & Pan, 2022; Camacho et al., 2025; Espinoza et al., 2025). To make the model richer in depth, relevant parts of the VBN theory, particularly the roles of internalized values and perceptions of obligation in motivating pro-environmental behavior (Stern, 2000; Wang, Han, & Xu, 2020), are used. Even though the TPB has been used to source the hypotheses and relationships of variables that you will see in the model, the VBN has demonstrated how the relationships of deeply held values and perceived societal benefits will influence awareness and take-up in energy campaigns (Gadenne et al., 2011; Tiberio, 2025).

### *3.1. Synthesis Of Gaps And Research Contributions*

Many studies have attempted to study the determinants of pro-environmental behavior through the Theory of Planned Behavior (Ajzen, 1991; Du & Pan, 2022), however, there have been few studies that try to understand the combined influence of institutional campaigns, environmental awareness, and perceived benefit through an integrated behavioral model, particularly in a Southeast Asian university context (Fachrudin & Fachrudin, 2021; Janmaimool & Chontanawat, 2021). Prior research frequently analyzes cognitive predictors, but mediation processes are rarely assessed and findings not situated in cultural variables. This study adds to the literature by proposing theoretically coherent mediators into the TPB framework and testing it empirically using SEM. The findings provide not just conceptual and methodological gaps in energy conservation literature but also evidence-based insights for the development of student-centered sustainability interventions in higher education.

### *3.2. Development Of Hypotheses*

Based on the Theory of Planned Behavior (TPB) and with some support from the Value-Belief-Norm (VBN) theory, this study attempts to explain institutional campaigns and students' energy-saving behavior. The model proposes that energy conservation campaigns (EC) will become the main predictor of the outcome variable referring to the behavioral change (BC), while the two other variables, environmental awareness (EA) and perceived benefits (PB) will be considered the psychological mediators. The next hypotheses reflect both direct and indirect pathways, based on these conceptual underpinnings.

#### *3.2.1 Energy Conservation Campaigns And Behavioral Change*

Prior studies show that energy-saving behavior can be effectively influenced through organized in-house environmental campaign (Cornet et al., 2024; Camacho et al., 2025). According to Bulunga and Thondhlana (2018) and Jamaludin et al. (2022), campaigns, social influences, feedback and messaging in the university context lead to more sustainable actions by students. In conclusion, this study shows that energy conservation campaigns which have been designed well would improve the energy-saving behavior of students. Therefore, the hypothesis is:

H1: Energy saving campaign's influence on behavioral change

#### *3.2.2. Energy Conservation Campaigns And Environmental Awareness*

Institutional campaigns are believed to be an educational tool to raise awareness or concern about environmental issues (O'Donoghue et al., 2025; Sitompul et al., 2025). Messaging that resonates with students' values and environmental responsibility, will result in raised level of awareness (Janmaimool & Chontanawat, 2021). For that reason, this study hypothesizes that energy conservation campaigns impact students' environmental awareness. Campaigns for conserving energy raise environmental consciousness. Therefore, the hypothesis is:

H2: Energy conservation campaigns positively

influence environmental awareness.

### *3.2.3. Energy Conservation Campaigns And Perceived Benefits*

Perceived benefits, like energy saving, convenience and ethical satisfaction are all key motivators of behavior (Wang, Han, & Xu, 2020; Busu et al., 2025). If campaigns clarify the value of people- and planet-friendly deeds, they are more effective (Camacho et al., 2025; Ling & Ling, 2025). This is how the study predicts that exposure to EC campaigns strengthen the perceived benefits of energy conservation. Campaigns on energy conservation impact perceived benefits positively. Therefore, the hypothesis is:

H3: Energy conservation campaigns positively influence perceived benefit.

### *3.2.4. Environmental Awareness And Behavioral Change*

Being aware of the environment brings about a change in behavior. Environmental Awareness of students is all the knowledge, concern and commitment they have towards ecological issues. These are basic sets for inducing change in behavior (Bamberg & Möser, 2007; Zeng, Zhong, & Naz, 2023). People with more awareness tend to show more pro-environmental intentions and actions (Lee, 2008; Heib, Hildebrand, & Kortsch, 2023). The hypothesis proposes that students knowledgeable of environmentally friendly issues are likely to change. Environmental awareness promotes a positive behavioral change. Therefore, the hypothesis is:

H4: Environmental awareness positively influences behavioral change

### *3.2.5.Perceived Benefits And Behavioral Change*

According to motivational theories, individuals are likely to adopt sustainable behavior when they realize the benefits to themselves or socially (Gadenne et al., 2011; Alias et al., 2013). Discounts or the possibility to assist with environmental objectives can act as a reinforcement for not wasting energy (Tiberio et al., 2025). Accordingly, this study predicted that there is a positive relationship. Benefits people think they make them change their behavior for the better. Therefore, the hypotheses are:

H5: Perceived benefits positively influence behavioral change.

H6: Environmental awareness mediates the relationship between energy conservation campaigns and behavioral change.

Campaigns change attitudes that will change behavior indirectly by making the people more environmentally concerned (Du & Pan, 2021). Environment awareness (EA) serves as a mediator that directs the influence of campaign exposure into aware behavioral responses (Espinoza et al., 2025). Thus, this study asserts that EA acts as a mediating mechanism between energy conservation (EC) campaigns and behavioral changes (BC). Therefore, the hypothesis is:

H7: Perceived benefits mediate the relationship between energy conservation campaigns and behavioral change.

According to Stern (2000) and Fatoki (2023), perceived gains strengthen people's motivation and intention to act sustainably. When students can see both personal and collective benefits from conservation efforts, they respond more positively to campaigns (Zhou et al., 2023). The study hypothesizes that the intervention of the campaign influences behavior.

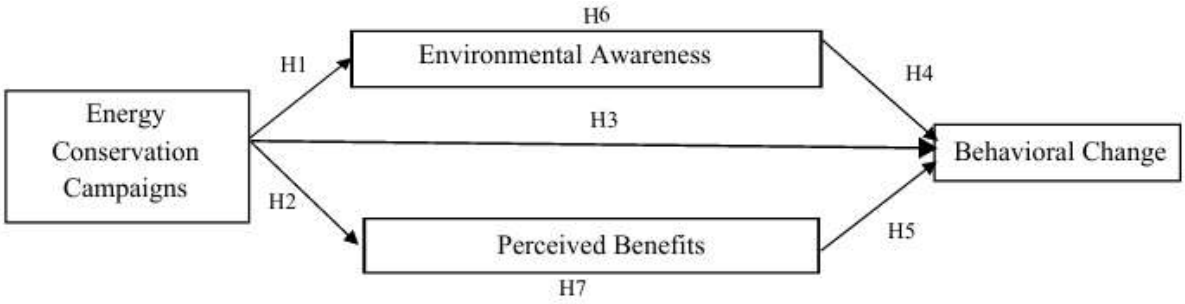


***Figure 1: Conceptual Framework.***

## 3. METHODOLOGY

### *3.1. Research Design*

This study utilizes quantitative research to test behavioral changes caused by energy conservation campaigns. An administration design survey technique is used in this study with a cross-sectional making collection of data at a single point in time. The environmental awareness and the benefit

perceived as mediating variables will be tested via the Structural Equation Modeling SEM via Jamovi software.

### *3.2. Sample And Data Collection*

The target population was the 42,563 undergraduates of Mahasarakham University in the 2024 academic year. The sample size for this research has been calculated according to the formula recommended by Yamane (1967) which is as bellows.

$$n = N/ (1+Ne2)$$

where,

n = size of the sample

N = population

e2 = probability of error

Therefore, the sample size is:

$$n = 42,563/ [1 + 42,563(0.03)2 ]$$

with N = 42,563, e = 0.03 (at the 3% level of significance)thus, the sample size is 1,083.

The error probability of this study calculates as four percent (e = 0.04), while 42,563 is the total number of population (N = 42,563). The calculating has given the sample size 616 students are considered sufficient for data analysis (Hair et al., 2019). To obtain accurate results of behavioral data from structural equation model (SEM) analysis, in this study the sample size is set to 616 students used a stratified random sampling method. Sample allocations were divided by faculty group in the proportions. The questionnaire was collected by taking into account the number of students in each group. The groups consisting of Science and Technology Group (9,454 students), Health Sciences Group (1,864 students), and Humanities and Social Sciences Group (31,245 students) had a sample of 240, 48, and 795 students, respectively. The questionnaires were then distributed online via social media channels such as the Facebook pages of universities' units, such as the faculties, student organizations, and others' activity groups. A total of 568 completed questionnaires were returned, consisting of 36 from the Science and Technology Group, 13 from the Health Sciences Group, and 519 from the Humanities and Social Sciences Group. These completed questionnaires were sufficient for quantitative data analysis and suitable for model analysis, as shown in Table 1.

***Table 1: Summary of Questionnaire Response Divided by Faculty Group.***

| Faculty Group | Population (Students) | Proportion (%) | Sample Size (Students) | Response Sample (Students) | Response Rate (%) |
|---|---|---|---|---|---|
| Science and Technology | 9,454 | 22.21 | 240 | 36 | 15.00 |
| Health Sciences | 1,864 | 4.38 | 48 | 13 | 27.08 |
| Humanities and Social Sciences | 31,245 | 73.41 | 795 | 519 | 65.28 |
| **Total** | **42,563** | **100.00** | **1,083** | **568** | **52.45** |

### *3.2. Research Instrument*

The researchers used an online questionnaire as the main research instrument of this study. The instrument consisted of 5 sections: demographic section, awareness of energy conservation campaigns, perception of benefits, environmental awareness, and energy conservation behavior. All variables were created from the literature, namely Energy Conservation Campaigns (Jamaludin et al., 2022; Camacho et al., 2025), Environmental Awareness (Zeng, Zhong, & Naz, 2023), Perceived Benefits (Busu et al., 2025), and Behavior Change (Du & Pan, 2022). The questionnaire that was developed used the predetermined scale integration of five constructs of research model. Three experts, management and marketing experts, were invited to validate the measurement items which were modified to suit the focus of this study. They checked the tool and told them what the study was for. They evaluated the item-to-objective congruence (IOC) of each item by marking +1 for meeting the criteria, 0 for neutral, and -1 for not meeting the criteria. After collecting these scored, finally calculated the IOC score for each item by three experts with a score of 0.92, indicating high content validity. To test the reliability of the questionnaire, 30 participants were assessed randomly in a pilot test. Participants rated their responses on a 5-point Likert scale. The Likert scale is a psychological scale used in questionnaires to get a respondent's opinion. Typically, respondents receive statements and indicate their level of agreement or disagreement on a five-point scale from 1 (Strongly Disagree) to 5 (Strongly Agree) (McLeod, 2023; Likert, 1932). The internal consistency of the questionnaire was determined using Cronbach's alpha. The Human Research Ethics Committee of Mahasarakham University approved the research instrument.

### *3.3. Data Analysis*

In this study, data analysis was performed using the Jamovi software package, which is appropriate for the analysis of complex quantitative data. The causal relationship between the variables was tested using Structural Equation Modeling (SEM) as per the defined concepts. In order to estimate the structural

model instrumental was validated by confirmatory factor analysis (CFA) to test the consistency of the indicators with latent variable structure. This study used Cronbach's alpha and composite reliability to analyze the internal consistency of the questionnaire. In addition, the Heterotrait-Monotrait Ratio (HTMT) was analyzed. All analyses were conducted to validate the correctness of the model and investigate the causal relationship between energy conservation campaign, environmental awareness, perceived benefits and energy conservation behavior among students.

The structural equation modeling, commonly known as SEM, is a first-generation path model that is widely used by researchers and practitioners today to analyze the relationship between variables in a model. SEM was first applied in the social sciences. Academic research has found that SEM is a powerful statistical technique that creates measurement and structural models to test conceptual models. It is also widely used in multivariate data analysis (Hair et al., 2014; Nusair & Hua, 2010). SEM is referred to as a hybrid analytical tool, which has the fundamental advantage of incorporating latent variables into the analysis while taking measurement error into account in the estimation process (Hair et al., 2014). In addition, SEM is most appropriate when the research involves multiple latent constructs, each represented by multiple observable and measured variables (Hair et al., 2014). After testing and concluding the measurement results and hypothesized structural models, the next step is to identify the causal relationships between the latent variables using path analysis. SEM theory states that some latent variables influence other latent variables, either directly or indirectly. In a conceptual model (Byrne, 2001), which provides estimation results indicating how these latent variables are related, it is therefore appropriate to use SEM in this study.

## 4. RESULTS

Table 2 shows the demographic data for the respondents. Most of them were female students. Also, most of the students that participated in this study were aged between 18 to 20 years (63.90%), followed by 21 to 23 years (35.40%). The data shows a trend in academic year among the respondents as shown in table 4.1. Most of the respondents were first-year students (41.00%), followed by third-year students (35%) and second-year students (16%). Besides, 91% of the sample belonged to the stream of social sciences and humanities.

***Table 2: Demographic Profile Of Respondents.***

| Demographics | Sub-group | Frequency | Percentage |
|---|---|---|---|
| Gender | Male | 108 | 19.00 |
| | Female | 439 | 77.30 |
| | Alternative gender | 21 | 3.70 |
| Age | 18-20 Years | 363 | 63.90 |
| | 21-23 Years | 201 | 35.40 |
| | 24 years and over | 4 | 0.70 |
| Education level | Undergraduate 1st Year | 233 | 41.00 |
| | Undergraduate 2nd Year | 91 | 16.00 |
| | Undergraduate 3rd Year | 199 | 35.00 |
| | Undergraduate 4th Year or higher | 45 | 8.00 |
| Faculty Group | Humanities and Social Sciences | 519 | 91.40 |
| | Health Sciences | 13 | 2.30 |
| | Science and Technology | 36 | 6.30 |

According to result in Table 3, the examination of validity and reliability has been performed. All items loadings were between 0.513 and 0.813, confirming the convergent validity (Hair et al., 2017). Also, the average variance extracted (AVE) from all the constructs indicated that they were valid since all AVE values were more than 0.50. Similarly, all of the variables had internal consistency—each had a composite reliability (CR) above 0.70 (Gefen, Straub, & Boudreau, 2000). The results of the heterotrophic a decade correlation ratio (HTMT) showed that the different assumptions were differentiated from each other. By which all HTMT are smaller than 90. As a result, all these tests confirmed that the obtained data were reliable and valid for further analysis. To check common method bias (CMB), this research also performed Harman's one-factor analysis and variance inflation factor (VIF) to look for a fully linear relationship. Harman's one-factor result shows that the rest of the item can only explain 25.71% variance on the one-factor which is less than 50%. Hence, CMB is not a problem. According to the VIF results shown in Table 3, CMB was not a concern in the study as the VIF for all constructs was below 5, which demonstrates a good fit.

***Table 3: Validity and Reliability for Constructs.***

| Variable | Indicator | Factor Loadings | AVE | CR | Cronbach's Alpha | VIF |
|---|---|---|---|---|---|---|
| EC | | | 0.534 | 0.939 | 0.818 | |
| | ec1 | 0.513 | | | | 3.717 |
| | ec2 | 0.774 | | | | 1.783 |
| | ec3 | 0.807 | | | | 1.692 |
| | ec4 | 0.790 | | | | 1.721 |
| EA | | | 0.543 | 0.961 | 0.865 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | ea1 | 0.724 | | | | 1.818 |
| | ea2 | 0.775 | | | | 1.695 |
| | ea3 | 0.630 | | | | 2.242 |
| | ea4 | 0.764 | | | | 1.603 |
| | ea5 | 0.781 | | | | 1.513 |
| PB | | | 0.600 | 0.962 | 0.891 | |
| | pb1 | 0.694 | | | | 2.123 |
| | pb2 | 0.764 | | | | 1.647 |
| | pb3 | 0.799 | | | | 1.536 |
| | pb4 | 0.798 | | | | 1.475 |
| | pb5 | 0.813 | | | | 1.410 |
| BC | | | 0.538 | 0.961 | 0.862 | |
| | bc1 | 0.606 | | | | 2.703 |
| | bc2 | 0.692 | | | | 2.119 |
| | bc3 | 0.750 | | | | 1.805 |
| | bc4 | 0.803 | | | | 1.460 |
| | bc5 | 0.800 | | | | 1.443 |

***Table 4: Summary Result Of HTMT.***

| | EC | BC | PB | EA |
|---|---|---|---|---|
| **EC** | 1.000 | | | |
| **BC** | .702 | 1.000 | | |
| **PB** | .649 | .822 | 1.000 | |
| **EA** | .741 | .800 | .888 | 1.000 |

Table 4 exhibits the results of the Heterotrait-Monotrait Ratio of correlations (HTMT) analysis which is a method proposed by Henseler et al. (2015) to signal if the variables are significantly different from each other. Table 3 shows the HTMT correlation values for all pairs of variables was between 0.649 and 0.888, less than the limit 0.90 suggested by Hair et al. (2017). This indicates that all of the variables are clearly different and there is no multicollinearity problem. It can be concluded that all the variables in the study possess an adequate level of discriminant validity. Furthermore, these variables are sufficiently fit for the SEM analysis in the following section.

***Table 5: Summary Results of Direct Hypothesis Testing.***

| Hypo | Path | Coefficient | SD | Z-stat | p-value | Result |
|---|---|---|---|---|---|---|
| H1 | EC ---> EA | 0.892 | 0.146 | 9.93 | .001*** | Supported |
| H2 | EC ---> PB | 0.864 | 0.276 | 9.61 | .001*** | Supported |
| H3 | EC ---> BC | 0.317 | 0.115 | 1.89 | .058* | Supported |
| H4 | EA ---> BC | 0.130 | 0.177 | 1.14 | .252 | Not Supported |
| H5 | PB ---> BC | 0.383 | 0.097 | 4.40 | .001*** | Supported |

**Note: ***, **, * Significance Levels At 0.01, 0.05, And 0.10, Respectively.**

Table 5 and Figure 2 present the hypothesis testing results concerning the five proposed direct hypotheses. A summary of them indicates that four hypotheses are supported. In particular, EC influences EA (β = 0.892), PB (β = 0.864), and BC (β = 0.317) which lends support to H1, H2, and H3. EA (β = 0.130) is insignificant when compared to BC, which implies that H4 is not supported. This means that H5 is supported by BC which means that PB affects H5 as the result is β = 0.383. Thus, the results prove all the proposed direct hypotheses. As shown in Table 5, PB significantly mediates the relationship between EC and BC. Conversely, EA does not significantly mediate the relationship between EC and BC. Specifically, PB plays a vital role in influencing EC on BC. The similarities with R2 values for EA = 0.732, PB = 0.666 and BC = 0.689 show that EC can explain about 73.20% variance of EA and about 66.66% variance PB. EA and PB both account for an estimated 68.90% variance in BC.

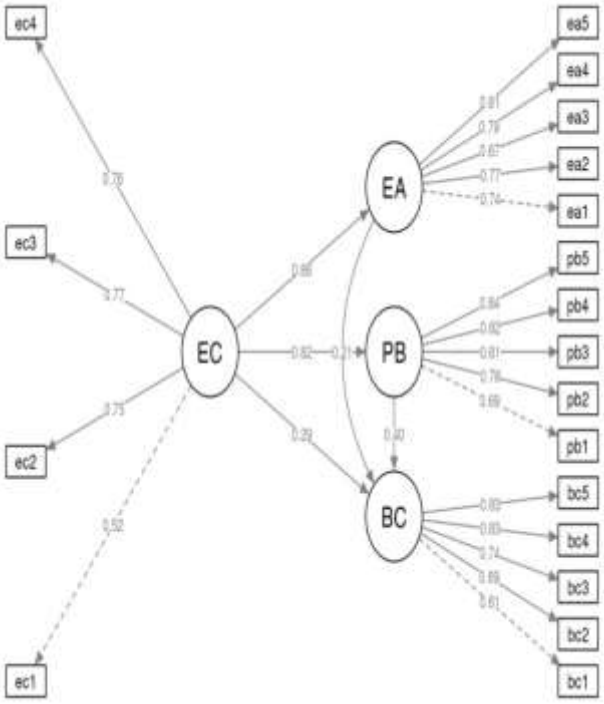


***Figure 2: Research Model Generated From SEM Through Jamovi.***

***Table 6: Summary Results Of Indirect Hypothesis Testing.***

| Hypothesis | Path | Coefficient | SD | Z-stat | p-value | Results |
|---|---|---|---|---|---|---|
| H6 | EC---> PB ---> BC | 0.367 | 0.096 | 4.176 | .001*** | Supported |
| H7 | EC---> EA ---> BC | 0.116 | 0.111 | 1.146 | .252 | Not supported |

**Note: ***, **, * significance levels at 0.01, 0.05, and 0.10, respectively**

The intention of this study is to analyze the effectiveness of energy conservation campaign (EC)

in changing energy behavior by enhancing environmental awareness (EA) and perceived benefits (PB). In the hypothesis 6 (H6), this study found that the β (coefficient value) of PB is 0.367 with a standard deviation of 0.096, a Z-stat value of 4.176, and a p-value of 0.001. All these values show it to be significantly positive which in turn confirms supporting of our mediating role. In contrast, the hypothesis 7 (H7) coefficient – 0.116 (Z-stat: 1.146; p-value: 0.252) show that mediation of EA was not significant. The findings indicate that PB plays an important role in mediating the EC campaign BC effect, while EA reveals no mediation effect in this study. These findings show how perceived benefits dictate the sustainable behavior of college students. Even though it is relevant, environmental consciousness may not matter much in this context.

The $R^2$ values of the dependent constructs are all strong (EA = 0.732, PB = 0.666, BC = 0.689). This indicated that the proposed model can explain student behavior well. In addition, this finding confirms that the proposed model is powerful enough to predict the outcome in the context of the campaign-based intervention. Moreover, this outcome further justifies the appropriateness of the structural equation modelling (SEM) techniques. Above all, it shows the robustness of the framework in the context of a Thai university.

### *4.1. Discussion*

The discovery of this study provides evidence for a conceptualization based upon the theory of planned behavior, extended through the addition of elements of the value-belief-norm (VBN) framework. This study furthers existing research on energy-saving behavior in colleges by adding environmental awareness (EA) and perceived benefits (PB) to the mix. In particular, this study examines Mahasarakham University (MSU), which is famous for sustainability in Thailand.

The result shows that energy conservation campaigns play a significant role in improving both environmental awareness (EA) and perceived benefits (PB) among students. Moreover, it can strengthen the claim that energy conservation campaigns initiated by the university must be effectively designed and can be powerful tools to generate cognitive and emotional responses toward sustainability. Various previous researches (Camacho et al., 2025; Jamaludin et al., 2022) have shown that campaigns combining Institutional Trust, Emotionally Involving and Repeated Awareness can significantly alter attitudes toward Sustainability. MSU uses images, the community and social media to catch the attention of students and influence their evaluative beliefs about energy-saving behaviors. It uses things available in the environment, physical places, buildings and student-run activities to catch the attention of students. It supports Cornet et al. (2024)'s work which shows that contextualized messages that relate directly to the individual will bring a greater campaign response. Further, the outputs of this study are consistent with the works of Wang, Han, and Xu (2020) and Busu et al. (2025) that claimed the role of perceived benefits like cost savings; convenience; and ethical alignment in linking awareness to behavior tendencies. Consequently, this study not only supports the suggestion of similarly parallel cognitive and motivational effects of EC, but also establishes campus-based campaign as a fundamental mechanism to promote sustainability knowledge and action.

According to hypothesis 5, perceived benefits significantly drive behavior change according to other studies. More specifically, previous studies showed that individuals often engage in energy-saving behavior for benefits that include cost savings, convenience and personal satisfaction (Gadenne et al., 2011; Busu et al., 2025). This study shows that students are motivated by real-world advantages rather than just environmental ones. Similar to Ling and Ling (2025) campaigns, campaigns highlighting that energy conservation is personally beneficial might encourage people to participate more sustainably (Tiberio et al., 2025)

The H4 effects was insignificant, meaning EC campaigns and environmental awareness do not have a direct impact behavior change. Earlier research has already highlighted the necessity of awareness for environmentally-friendly behavior (Zeng, Zhong, & Naz, 2023; Heib, Hildebrand, & Kortsch, 2023), this study does confirm but suggests that awareness is not adequate to spur action if it is not backed with motivational reinforcement (Espinoza et al., 2025). As per Janmaimool and Chontanawat (2021), in the Southeast Asian Setting, informational campaigns alone usually do not lead to behavioral change, unless they are complemented with motives that are meaningful on a personal level. This study shows how significant it is to create information mediations that encourage affective and practical motivations.

The insignificance of environmental awareness (H4 and H6) in predicting behavior can be understood from the well-documented awareness-action gap. This gap highlights the difference between knowledge about environmental issues and

actual action. While many students may conceptually understand issues such as climate change, pollution, or resource scarcity, this awareness often remains abstract and detached from everyday activities. For example, a student may agree that global warming is a serious problem, yet leave the lights or air conditioner on unnecessarily because the personal inconvenience of changing habits outweighs the perceived environmental benefits. Moreover, awareness alone does not automatically provide a reason to act. This is consistent with Esakkimuthu and Banupriya (2023) who stated that without motivational reinforcement, such as cost savings, social acceptance, or institutional incentives, awareness often leads only to passive agreement or attitudinal support rather than tangible behavioral change (Etim, 2024). In this sense, awareness is necessary but not sufficient: it creates a basis for concern but lacks the practical motivation to move individuals from intention to action. This finding also aligns with criticisms of purely educational or informational campaigns, which may succeed in raising concern or increasing knowledge but often fail to change everyday behavior. If awareness is not linked to tangible benefits, emotional engagement, or social norms, awareness remains at the level of perception. And unable to overcome the deep-rooted inertia of habit.

The findings in this study also suggested that perceived benefits facilitate the relationship between energy conservation programs and behavioral changes. As for environmental consciousness, the results were not so, which supports the arguments of Stern (2000) and Gadenne et al. (2011) that intrinsic motivation and perceived rewards mattered for sustainable environmentally friendly behavior. Unlike studies that tend to see perception as a direct driver (Zeng, Zhong, & Naz, 2023) the findings of this study show that a good campaign can turn an abstract signifier into a concrete benefit. This finding is similar to Tiberio et al. (2025), which found tangible and meaningful motivations are more impactful on behavioral engagement than cognitive perceptions.

The results suggest that to enhance the TPB theoretical framework in sustainability studies, one needs to focus on motivational drivers like PB instead of focusing purely on cognitive variables like EA in students. These results imply that on higher education institutions, communicating personal benefit should be a priority in developing behavior change campaigns. Such findings align with those of Petersen et al. (2015) and Camacho et al. (2025) who recommended that value framing and feedback loops are key for sustaining behavior.

The theory of planned behavior (TPB), attitude is often understood as an individual's positive or negative evaluation of a behavior. In this study, environmental awareness is a form of attitudinal perception, meaning students know and believe that saving energy is good for the environment. However, statistical results show that this awareness is not significant in predicting behavioral intentions. This finding suggests that attitude alone cannot clearly predict outcomes unless reinforced by perceived behavioral control (PBC), which refers to the belief that one has the ability, resources, or opportunity to act. For example, a student may know that saving electricity is beneficial but may feel that their actions are too small to make a difference, weakening their intentions. Nanggong and Rahmatia (2019), Singh et al. (2022), and Chen, Mei, and Sun (2025) similarly stated that outcome expectancy (benefit), which refers to the belief that engaging in a behavior will lead to tangible and desirable outcomes, students are motivated more by perceived personal benefits (e.g., lower electricity bills, increased convenience, or peer acceptance) than by intangible environmental benefits, which is consistent with this study.

Thus, sustainability knowledge (awareness), even if positive, does not automatically translate into confidence or motivation to act. Without the perception that their actions are both feasible and rewarding, awareness remains a passive belief.

### *4.2. Implications*

This study enhances the understanding of energy-saving behavior in higher education institutions by extending the theory of planned behavior. Some of the mediating variables that have been added include environmental awareness and perceived benefits of energy-saving behavior. The results show that perceived benefits are important mediating factors in the behavior change process, and that something tangible and not just cognition is needed as a motivator. This finding displaces traditional theories and leaves room for new conceptual frameworks to be developed that link knowledge-feeling-motivation in a systematic way.

This study reveals that of the designer of Energy savings campaign such as environmental officer, project instructor, university corporate communication merely providing inputs or creating awareness is not sufficient to create a lasting behavioral change in them. Instead, they should work to develop campaigns that focus on the benefits that the students will receive like lower costs, greater convenience in their lives, or doing well for society. Similarly, university managers can use this

information to draw up internal guidelines or project plans that better suit the interests of students.

This study will help in the development of macro-level policies that will help educational institutions or government campaigns save energy. It notes that policy instruments must promote and reward behavior concretely as a complement to their focus on public relations and compliance with regulations. Using these research results, things like funding for campaign materials that show perceived value or adding energy learning to after-school offerings could help create lasting changes at the level of the university that ultimately trickle to the federal level.

Base on the findings, this study has shown that communication strategies are most effective when they focus on tangible benefits. Environmental policy development and campaigns should emphasize the personal and societal benefits of energy savings, such as lower electricity bills, increased convenience, and the enhanced reputation of green institutions, rather than relying solely on abstract environmental awareness messages. Emphasizing these direct benefits makes policies more relevant, actionable, clear, and understandable (Schulte et al., 2022).

Policymakers can promote energy saving or conservation by creating incentive programs that reward those who take action. This could include subsidies and rebates that reduce the cost of purchasing energy-efficient appliances, tax credits for households or businesses that reduce energy use, or reward programs such as utility bill rebates for consistent savings. By reducing initial costs, these programs make it easier for individuals and organizations to invest in energy-saving solutions such as LED light bulbs, smart meters, or renewable energy systems. At the same time, policies should clearly demonstrate the long-term financial benefits, such as the amount of money saved on electricity bills each year (Ukpene & Apaokueze, 2024). These mechanisms not only reduce financial barriers but also reinforce people's perception that energy savings are worthwhile. When people see both immediate rewards and future savings, they are more motivated to change their behavior and maintain it over the long term (Azizi et al., 2019).

## 5. CONCLUSIONS

This study aims to enhance understanding of changes in student behavior in a sustainability context by analyzing the effects of an energy conservation (EC) program through the mediating effects of environmental awareness (EA) and perceived benefits (PB) in a particular extension of planned behavior (PB). According to the findings, the PB has significant impact on students' engagement in energy conservation behavior. Thus, it highlights the importance of individual motivations in adopting energy conservation behavior. Although EA and EC alone do not have any direct effects, the effect of EA and EC through cognitive and affective channels suggests that information campaigns ought to be supplemented with value-oriented and instrumental appeals. Our results enhance the Theory of Planned Behavior (TPB) by incorporating cognitive and motivational factors. This study shows it is strategically important for institutions to develop behavior change interventions or policies that resonate with students' experiences and benefits in their lives. As a result, this study proposes an adaptive model based on theory to guide and direct university and sustainability stakeholders in improving student engagement taking into account the context. Future investigations should assess this framework in various institutions and cultures to increase its applicability.

### *5.1. Limitations And Furure Research Suggestions*

This study has significant findings, but it is also limited. Initially, a quantitative research method was applied through an online questionnaire. Although it is convenient and can collect data on a broad scale, it has limited data depth, such as the lack of qualitative data that can deeply explain students' attitudes or internal motivations. The future research may extend the sample to other universities in other regions or other countries in Southeast Asia to compare the findings in different cultures and energy policy structures, including mixed methods study designs to have quantitative and qualitative data.

The second limitation is that the whole sample came from only one university (Mahasarakham University). The policies, budgets, and organizational culture may be different from others. The findings of the study may not be completely applicable to universities in different regions or countries. The method used to measure energy conservation behavior was self-reports which may be affected by social desirability bias, in which responses are more in acceptance with those of society rather than actual behavior which reduces response quality. In the future, it is suggested to collect data from other universities and use different behavioral measures that can enhance precision and reduce bias and generalizability of study.

The third limitation about the sample composition was highly skewed towards students in the humanities and social sciences (over 90% □

(519/568)x100), with fewer participants from science and technology and health sciences group of faculties. This imbalance may have influenced the results, as subject background can shape students' perceptions of sustainability concepts and attitudes towards energy-saving behaviors. A more evenly distributed sample, or stratified comparisons across subject areas, would have provided a more detailed understanding of the drivers of behavior.

More research could look more into how things like personal motivations, aspects of campaigns how they are presented, the media used, campaign impacts on behavior over time, and so on, through longitudinal studies could help with the creation of models which are more robust and useful for policy.

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