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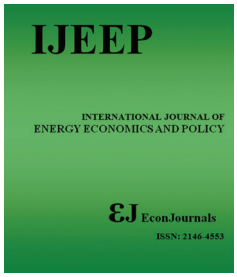

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Unveiling the University Students' Energy Saving Intention Using a Norm Activation Model

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ABSTRACT

The increase in energy demand due to excessive energy consumption and also the consequences of traditional energy generation toward the society and environment have been a global problem that requires immediate action. Besides diversifying the energy sources to renewable energy, reducing energy consumption is also perceived as one of the effective strategies to overcome this issue. Energy conservation or more precisely energy-saving behaviour could alleviate these problems. Empirically, numerous studies have been conducted and offer extensive evidence in this subject area. However, studies that exclusively focus on university students in the university setting are scarce. Moreover, the evidence in the literature has not achieved a consensus regarding the factors that affect a personal's energy-saving behaviours. With that, the objective of the study is to investigate the factors that affect university students' energy-saving behavioural intentions and also to investigate the mediating effect of personal norms (PN) and attitudes (ATT) on their energy-saving behavioural intentions. Through purposive sampling, the responses from 200 university students were gathered and the results from the partial least square-structure equation modelling (PLS-SEM) found that the energy-saving intention of the university students is significantly affected by both PN and ATT. Besides, ascription of responsibility (AR) and awareness of consequences (AC) have substantial effects on PN, while energy-saving knowledge (ESK) and environmental knowledge (EK) also demonstrated significant influence on ATT. Additionally, the study also found that both PN and ATT could be effective mediators in mediating the indirect influence of AR, AC, ESK, and EK on ESI. These findings offer crucial implications as they further enrich the existing knowledge in the subject area and they also provide important references for stakeholders in formulating effective strategies that would further nurture the individual's energy-saving behaviour.

Keywords: Energy Saving Intention, Norm Activation Model, University Students, Energy-saving Knowledge, Environmental Knowledge
JEL Classifications: E21, M10, Q40

1. INTRODUCTION

The energy demand usually is paralleled with the development of the nation, as the energy demand is mainly due to rapid urbanization (Chen and Gou, 2022) and industrialization. The energy demand tends to be higher when the nation experiences high development across sectors, as energy is required in all sectors to fulfil human needs (Do et al., 2023). Since the world continues to develop, energy consumption is expected to grow further and this has caused the increasing energy demand to become a global issue (Han and Cudjoe, 2020), which requires immediate solution. Traditionally, the energy was mainly generated through fossil fuels (Yildiz, 2018). However, these energy sources bring negative consequences for the society and environment as they will release carbon dioxide and also greenhouse gases (United States Environmental Protection Agency, 2021), and the emission of carbon dioxide and greenhouse gases will further cause pollution and global warming. Therefore, to mitigate the negative effects of the excessive energy demand, all parties, including governments, businesses, residential households, and the like, have to take responsibility for reducing the energy demand and further tackle

the environmental degradation problems caused by the excessive usage of energy.

To promote sustainability, governments have formulated certain laws and regulations to lower the dependency on fossil fuels and encourage renewable energy usage. However, as remarked by Park and Kwon (2017), these regulations mainly concentrated on energy consumption in the industrial sectors. Similarly, Han and Cudjoe (2020) also noted that these laws and regulations from the governments are difficult to implement in the residential sectors as it is more effective in regulating industrial energy utilization. Therefore, energy conservation is perceived as an effective practice that would help address energy issues (Hong et al., 2019). Han and Cudjoe (2020) also have a similar tone whereas energy-saving could alleviate the energy shortage problems and further lessen the environmental issues. With that, energy-saving behaviours could lessen the consumption of energy and eventually reduce carbon emissions (Chen and Gou, 2022). Besides, efficient energy usage is essential to harmonize economic growth, energy security and also protect the environment (Son et al., 2022). Hence, energy-saving behaviour plays a crucial role in mitigating the environmental degradation problems caused by excessive energy consumption. Regrettably, the energy-saving behaviour does not receive much attention from all parties (Son et al., 2022), in retarding the negative consequences of energy consumption.

Due to the important role of energy conservation in achieving sustainability, the individual's energy-saving behaviour has received much more attention in academic research (Gao et al., 2017). With that, understanding the factors that will foster individuals to behave in this pro-environmentally behaviour is essential as it might provide crucial implications in both theoretical and practical perspectives. Numerous empirical research have studied the subject area in different settings from different perspectives. For example, Fatoki (2023), Gao et al. (2017) and Xie et al. (2021) have studied the energy-savings behaviour of employees in their workplaces. Besides, the household's energy-saving behaviours are also investigated in the literature (Broek et al., 2019; Duong, 2023; Nguyen et al., 2022; Son et al., 2022; Wang et al., 2018). Similarly, as university students are representing the future consumers that will dominate the market (Ling et al., 2024a), the energy-saving behaviour of the university students or younger generation has also been studied (Chen and Gou, 2022; Duong, 2024; Du and Pan, 2021; Liu et al., 2023). However, these studies are mainly studied on the university students' energy-saving behaviours in the dormitories or residential hostel settings, and not many studies focus on university students' energy-saving behaviour in general university settings, such as classrooms, laboratories, discussion rooms and the like. Different energy-saving behaviours might appear in these different research contexts, as energy consumption in the university setting is considered costless for students as it is paid for by the university. Therefore, this study takes into account the different research settings by exclusively focusing on the energy-saving behaviour of university students in general university settings.

Additionally, the inconclusive findings on the factors affecting the individual's energy behaviours and thus leaving room for future studies to investigate in this area. Empirically, the individuals' energy-saving behaviours might be influenced by both internal and external factors (Du and Pan, 2021). However, the influence of the university students' personal factors such as their sense of moral responsibility and different types of knowledge (energy saving and environment) is relatively deficient. University students tend to have high moral responsibility (Wu et al., 2019), and concerned with environmental problems (Lee et al., 2024), and are highly educated (Ling et al., 2024a). Therefore, in line with the empirical evidence in other subject areas (e.g. Boo and Tan, 2024; Duong, 2024; Fatoki, 2023; Xie et al., 2021; Wang et al., 2018), it is expected that moral responsibility sense and the knowledge level on energy saving and environment issue of the university students tend to substantially impact their energy-saving behavioural intention. This study consists of two objectives: (1) to identify the factors that influence university students' energy-saving behavioural intentions, and (2) to investigate the mediating effect of personal norms (PN) and attitudes (ATT) on the university students' energy-saving behavioural intentions.

To address the above research gaps, this study utilized the norm activation model (NAM) to underpin the study to develop the research model. The NAM is extended with two types of knowledge, namely energy-saving knowledge (ESK) and environmental knowledge (EK), and ATT as personal factors, besides the ascription of responsibility (AR), awareness of consequences (AC) and PN proposed in the initial NAM. The evidence of the study is anticipated benefit to the extant knowledge as it offers new insight into the university students' energy-saving behaviour in the university context and also offers evidence of the indirect influence of the proposed predictors on energy-saving behaviour. Practically, the findings possibly will be utilised by the stakeholders in promoting the students' energy-saving behaviour and ultimately mitigate the adverse impact of overwhelming energy consumption on the society and environment.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Norm Activation Model

As developed by Schwartz (1977), NAM is designed to predict humans' environmentally friendly behaviours. The PN were the core of the model and it suggests that the behaviours of an individual are mainly predicted by personal norms, while two primary factors will help in forming the PN, namely AR and AC. Due to their specific features in the pro-environmentally behaviours, this model has been widely adopted in prior studies that are related to humans' environmentally friendly behaviour. For example, Oh and Ki (2023) utilized the NAM to study public support towards the organisations' environmental responsibility. Similarly, Mohmed@Wasli et al. (2022) also used NAM to understand the green product purchase intention. In addition, some studies also integrated NAM with other theories or models to establish a more comprehensive research framework. For instance, NAM has been incorporated with the theory of planned behaviour

(TPB) in examining the intention to reduce household food leftover by Generation Z in Indonesia (Setiawan et al., 2024). Zhou et al. (2023) also used a unified model of TPB and NAM to study the purchase intention of prefabricated housing in China. Similarly, Mai and Nguyen (2023) also investigated the farmer's energy-saving intention in Vietnam by using a combined model of TPB and NAM. These prior studies signified the appropriateness of the NAM in predicting the individuals' pro-environmentally behaviour in different research contexts. However, with the limited predictors presented in the NAM, there is a need to extend the model with other additional variables that might capture the unique feature of the study. This is consistent with the previous studies that also integrated NAM with other theories or models, or even extended the NAM with some additional factors. With that, this study also utilised the NAM as the foundation to develop the research model and further extended the model with energy-saving knowledge, environmental knowledge, and attitudes. Figure 1 illustrates the study's proposed research model.

2.2. Ascription of Responsibility on Personal Norms

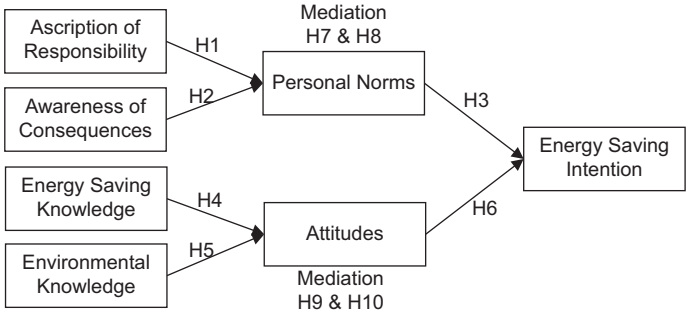
Steg and De Groot (2010) defined the AR as the responsibility sense of an individual on environmental matters. An individual might feel that they have a responsibility and obligation to protect the environment. Usually, the individual will behave pro-environmentally when they feel that they are responsible for the ecological issues (Mohmed@Wasli et al., 2022). With that, this study hypothesizes that PN is significantly affected by AR as the sense of responsibility will further cultivate the PN, and this is supported by the evidence from prior studies (Nguyen, 2023; Setiawan et al., 2024; Zhou et al., 2023). For instance, Wang et al. (2018) revealed a positively significant effect of AR on PN. Likewise, Duong (2024) and Fatoki (2023) also found similar findings whereas AR positively influenced PN. With that, the following hypothesis is formulated.

H_1: Ascription of responsibility is positively significant with personal norms.

2.3. Awareness of Consequences on Personal Norms

AC is referred to the AC as the perception of an individual regarding the consequences of their behaviour on others (Steg and De Groot, 2010). As the behaviour of an individual might bring some negative impact towards others, so, individuals may be more careful in their behaviour individual when they are alert about the consequences of their behaviour. As proven in the prior studies, the PN is positively influenced by AC (Fatoki, 2023; Setiawan et al., 2024; Wang et al., 2018). With that, a similar effect of AC on PN was also postulated in this study. For instance, Nguyen (2023) found that consumers' AC has a positively significant effect on their PN. The positively significant impact of AC on PN was also concluded by Duong (2024), whereas the students' PN is positively influenced by their AC. Thus, the hypothesis below is proposed.

Figure 1: Proposed research model



H_2: Awareness of consequences is positively significant with personal norms.

2.4. Personal Norms on Energy Saving Intention

Schwartz and Howard (1981) defined PN as the individual's feeling of moral responsibility regarding their behaviour. As proposed by NAM, this feeling might be impacted by both AR and AC (Schwartz, 1977). Therefore, it is expected that if individuals felt responsible and obligated with their behaviour it might drive them to behave in certain behaviour, such as energy saving. Consistent with the empirical evidence (Fatoki, 2023; Nguyen, 2023; Setiawan et al., 2024; Zhou et al., 2023), the positively significant effect of PN on behavioural intention is expected. For example, Liu et al. (2023) remarked a positively significant role of PN on the college students' ESI in dormitories. A similar finding on households' energy-saving behavioural intention is also found by Broek et al. (2019) whereas ESI is positively influenced by PN. Duong (2024) also concluded that the PN substantially impacted students' ESI. With that, this study suggested the hypothesis below.

H_3: Personal norms are positively significant with energy-saving intentions.

2.5. Energy Saving Knowledge on Attitudes

Knowledge is defined as the familiarity of an individual with particular concepts or issues (Emekci, 2019). As remarked by numerous studies, knowledge is one of the crucial factors that will form a feeling toward a particular behaviour (Boo and Tan, 2024; Ko and Jin, 2017; Suhartanto et al., 2023). As the study is focused on the students' ESI, therefore, this study further hypothesizes that the ESK might substantially influence the students' ESI. This is supported by the study of Xie et al. (2021), as the positively significant effect of ESK was reported in their study when examined the moderating effect of ESK on the organizational intervention on ATT and perceived behavioural control. The students are expected to have better ATT toward energy-saving behaviour if they possess a high level of knowledge in energy saving. However, very limited studies have examined this relationship in the literature. Hence, the hypothesis below is proposed to add new evidence to this association.

H_4: Energy-saving knowledge is positively significant with attitudes.

2.6. Environmental Knowledge on Attitudes

EK is defined as the level of understanding regarding the issues and problems that are related to the environment (Emekci, 2019). Theoretically, an individual tends to have a greater favourable ATT towards environmentally friendly behaviour if their knowledge level towards environmental issues and problems is high. The

crucial effect of EK on the individual's pro-environmental behaviour has been documented in empirical research (Shimul and Cheah, 2023; Suhartanto et al., 2023; Wang et al., 2020). For instance, Ko and Jin (2017) found that EK is positively significant with ATT in their study on green apparel products. Similarly, Sinha and Annamdevula (2024) also revealed the substantial role of EK on the green ATT in the study on green purchase intentions. The similar positively significant influence of the EK and ATT was also revealed by Boo and Tan (2024) in their study on the purchase intention toward electric vehicles. Therefore, the hypothesis below is formulated.

H_5: Environmental knowledge is positively significant with attitudes.

2.7. Attitudes on Energy Saving Intention

Ajzen (1991) defined ATT as the individual's feelings about a certain behaviour. Theoretically, favourable ATT toward a certain behaviour will drive an individual to be involved in that behaviour (Ling et al., 2024b). Therefore, this study assumes that the students will have a high inclination to save energy if they have positive ATT toward energy saving. The evidence in the literature also documented a substantial influence of ATT on behavioural intention (Gao et al., 2017; Ling et al., 2024b; Nguyen, 2023; Setiawan et al., 2024). For instance, Xie et al. (2021) showed that environmental ATT positively affect BI to save energy. Similarly, Liu et al. (2023) also found that the college student's ESI is positively influenced by ATT. The substantial effect of ATT on ESI among the students was also reported in a recent study by Duong (2024). With that, the hypothesis below is proposed.

H_6: Attitude is positively significant with energy-saving intention.

2.8. Personal Norms as a Mediator

Additionally, PN is also proposed as a mediator to mediate the indirect influence of AR and AC on ESI. This supposition is mainly due to the complexity of human behaviour whereas both AR and AC might influence the PN first then only influence ESI. With that, PN could be a significant mediator, as evidenced in prior research (Liu et al., 2023; Munerah et al., 2021; Yeow et al., 2022). For example, Fatoki (2023) revealed that both AR and AC have an indirect influence on ESI in the workplace through the mediator of PN. The significant mediating role of PN was also documented in the study by Nguyen (2023) on the relationships of AC and AR on behavioural intention to bring their shopping bags. Likewise, Duong (2024) also found similar findings, whereas the study concluded that the students' ESI is indirectly impacted by AR and AC, via PN. Therefore, this study also postulates a similar effect and the hypotheses below are proposed.

H_7: PN significantly mediates the influence of AR on ESI.
H_8: PN significantly mediates the influence of AC on ESI.

2.9. Attitudes as Mediator

This study also proposed ATT as the mediator that might mediate the relationships between both ESK and EK on the ESI. As found in the previous studies (Duong, 2023; Irfany et al., 2024; Ling et al., 2024c; Moshood et al., 2023), ATT is not only played as a predictor for outcome variables, but ATT might also react as a mediator that links the influence of other predictors on the outcome variables (Boo and Tan, 2024; Shimul and Cheah, 2023; Sinha and Annamdevula, 2024). For example, Ling et al. (2024b) found that ATT could mediate the association between the university environment and university policy regulation toward the food waste separation intention. Similarly, Nguyen (2023) also found that ATT has a significant mediating influence on the association between AC on behavioural intention to bring own shopping bags. Duong (2024) also concluded the significant mediating effect of ATT on the influence of subjective norms and perceived behavioural control toward ESI. Thus, the hypotheses below were recommended.

H_9: ATT significantly mediates the influence of ESK on ESI.
H_{10}: ATT significantly mediates the influence of EK on ESI.

3. RESEARCH METHODOLOGY

The non-probability purposive sampling approach has been employed to gather the quantitative primary data from the targeted population, which is Malaysian university students. Therefore, only Malaysians who are currently studying at university are eligible for this research. The questionnaire of the study was designed by utilizing the Google Forms platform, as the online survey is convenient for gathering the primary data without any cost (Ling et al., 2024c). The data was collected from February until March 2024, and 200 usable responses were collected in this study. As determined by the power analysis, the minimum sample size for the study will be 107 with the criteria of medium effect size, 95% power level and two predictors. With that, the 200 usable responses are met with the required sample size.

The study adapted 28 validated measurement items from the previous studies (Alomari et al., 2021; Duong, 2023; Duong 2024; Wang et al., 2018; Xie et al., 2021). A dual-language questionnaire in English and Malay was prepared to prevent any confusion. The participating respondents have to use the seven-point Likert scale (1 representing strongly disagree until 7 representing strongly agree), to indicate their agreement and disagreement level.

To statistically validate the proposed hypotheses, the partial least square-structural equation modelling (PLS-SEM) is used as the multivariate kurtosis coefficient value (83.6345) from the Mardia's coefficient procedures showed the collected data is not distributed normally (Byrne, 2013; Kline, 2011). Therefore, this suggests that PLS-SEM is a suitable technique for analysing the unnormal distributed data (Hair et al., 2019).

4. DATA ANALYSIS AND RESULTS

Table 1 presents the demographic profiles of the respondents. Most of the respondents are female students (57%), compared to males. Besides, most of the students who joined this study are in the age range of 21-23 years old (60.50%), followed by 10-20 years old (29%). Regarding the year of study, the largest respondents are

Table 1: Demographic profiles of respondents

Demographic	Sub-groups	Frequency	Percentage
Gender	Male	86	43.00
	Female	114	57.00
Age Range	18-20	58	29.00
	21-23	121	60.50
	24-26	18	9.00
	27 and above	3	1.50
Year of Study	Year 1	83	41.50
	Year 2	69	34.50
	Year 3	37	18.50
	Year 4	11	5.50
Level of Study	Foundation	32	16.00
	Degree	168	84.00

Source: Authors

students in Year 1 (41.50%), followed by Year 2 (34.50) and Year 3 (18.50). Additionally, 84% of the respondents are students at the degree level and the rest are foundation students.

Table 2 presents the summary results of the validity and reliability tests. Except for AR2 and AC4, all items have a loading value which exceeds 0.7080, and this signified that the convergent validity is confirmed (Hair et al., 2017). Likewise, the average variance extracted (AVE) values for all constructs also indicated the establishment of convergent validity as all AVE values exceeded 0.5000 (Bagozzi and Yi, 1988). In addition, internal consistency is also achieved as all constructs have a composite reliability (CR) value that is more than the 0.7000 level (Gefen et al., 2000). Furthermore, the result of hetero-trait mono-trait ratio of correlation (HTMT) in Table 3 also showed that the discriminant validity is also accomplished, as all the HTMT values do not exceed the 0.9000 level (Gold et al., 2001). Therefore, all these tests have shown that the collected data were reliable and valid for subsequent analysis.

The study also employed Harman's single factor and variance inflation factors (VIF) through full collinearity to assess the common method bias (CMB). The result of Harman's single factor indicated that all remaining items were only predicted appropriately at 48.97% (< 50%) of the variation in a single factor, therefore, CMB is considered absent (Podsakoff et al., 2003). Likewise, the VIF values in Table 2 also suggested that the CMB is not an issue in the study, as all constructs have a VIF that is lower than 5 (Anwar et al., 2021; Hair et al., 2017).

Table 4 and Figure 2 summarized the results of hypotheses testing for all six proposed direct hypotheses, and it showed that all six direct hypotheses were supported. Specifically, both AR ($\beta = 0.4055$) and AC ($\beta = 0.4324$) are positively significant with PN, and supporting H1 and H2. Besides, ESK ($\beta = 0.2859$) and EK ($\beta = 0.2984$) also played a substantial effect on ATT, and thus, H4 and H5 are supported. For the students' ESI, both H3 and H6 are supported as the result showed that it is affected by both PN ($\beta = 0.6723$) and ATT ($\beta = 0.2187$). Therefore, the results validated all proposed direct hypotheses.

Additionally, the results of indirect hypotheses testing are presented in Table 5. As summarized in Table 5, both PN and

Table 2: Summary results of the validity, reliability and CMB tests

Constructs	Items	Loading	AVE	CR	VIF
Ascription of Responsibility	AR1	0.9251	0.8623	0.9494	3.8790
	AR3	0.9217			
	AR4	0.9388			
Awareness of Consequences	AC1	0.9045	0.8408	0.9406	3.6910
	AC2	0.9290			
	AC3	0.9172			
Personal Norms	PN1	0.9124	0.7405	0.9192	3.8350
	PN2	0.8929			
	PN3	0.8320			
	PN4	0.8000			
Energy Saving Knowledge	ESK1	0.8093	0.6459	0.8454	2.1940
	ESK2	0.8227			
	ESK3	0.7784			
Environmental Knowledge	EK1	0.7093	0.5909	0.8780	2.2890
	EK2	0.8003			
	EK3	0.8252			
	EK4	0.7735			
	EK5	0.7291			
Attitudes	ATT1	0.9088	0.7843	0.9357	1.5320
	ATT2	0.8899			
	ATT3	0.8771			
	ATT4	0.8661			
Energy Saving Intention	ESI1	0.9077	0.8004	0.9413	3.5340
	ESI2	0.9095			
	ESI3	0.9055			
	ESI4	0.8548			

Source: Authors

Table 3: Summary result of HTMT

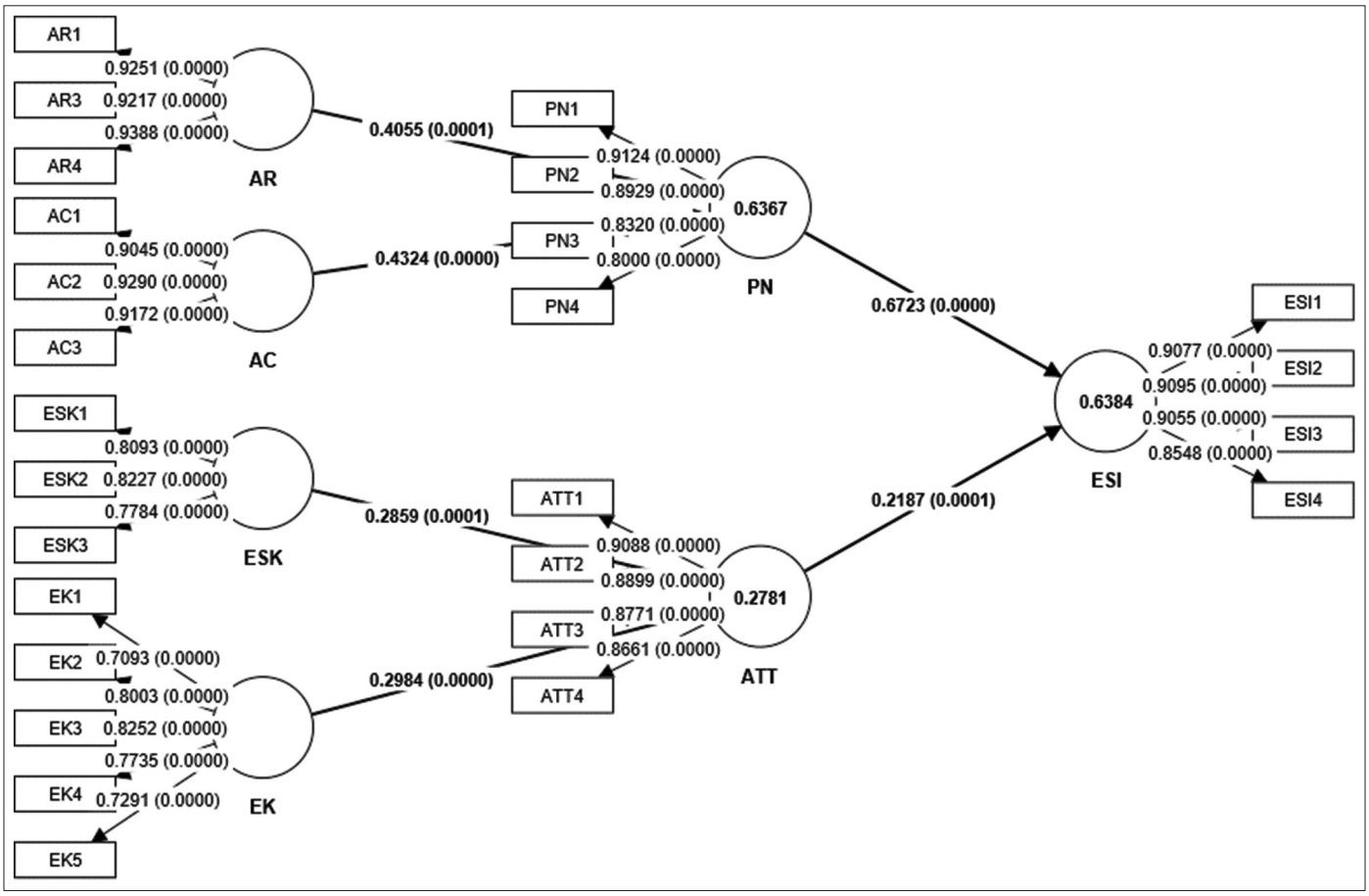
	AR	AC	PN	ESK	EK	ATT	ESI
AR							
AC	0.8888						
PN	0.8383	0.8506					
ESK	0.7664	0.6761	0.7971				
EK	0.6172	0.6257	0.8136	0.7692			
ATT	0.5144	0.5555	0.5220	0.5806	0.4752		
ESI	0.8283	0.8075	0.8576	0.8070	0.7289	0.5818	

Source: Authors

ATT are found to have significant mediating effects in the association between AR, AC, ESK and EK on ESI. Precisely, PN significantly mediated the influence of AR and AC on ESI, while the associations between ESK and EK on ESI are significantly mediated by ATT. These findings confirmed that all four exogenous constructs (AR, AC, ESK and EK) have an indirect influence on ESI, through PN and/or ATT.

Table 6 provides the summary of the coefficient of determination (R^2), predictive relevancy (Q^2) and effect size (f^2). The R^2 values for PN (0.6367), ATT (0.2781), and ESI (0.6384) suggested that AR and AC could predict around 63.67% of the variation in PN, while 27.81% of variances in ATT are explained by ESK and EK. Besides, both PN and ATT predict around 63.84% of the variation in ESI. Moreover, as PN (0.4613), ATT (0.2123), and ESI (0.5015) have Q^2 values that are greater than zero, this further confirmed the predictive ability of the endogenous variables on the exogenous variable (Hair et al., 2017). Additionally, according to Cohen (1988), both AR and AC have a medium effect size on PN, while ESK and EK only have a small effect size on ATT.

Figure 2: Research model generated from PLS-SEM through SmartPLS



Source: SmartPLS

Table 4: Summary results of direct hypotheses testing

Hypo.	Path	Coeff.	Std. Dev.	T-stat	P-value	Remark
H1	AR -> PN	0.4055	0.1058	3.8334	0.0001	Supported
H2	AC -> PN	0.4324	0.0970	4.4577	0.0000	Supported
H3	PN -> ESI	0.6723	0.0543	12.3745	0.0000	Supported
H4	ESK -> ATT	0.2859	0.0764	3.7412	0.0001	Supported
H5	EK -> ATT	0.2984	0.0734	4.0631	0.0000	Supported
H6	ATT -> ESI	0.2187	0.0603	3.6290	0.0001	Supported

Source: Authors

Table 5: Summary results of indirect hypotheses testing

Hypo.	Path	Coeff.	Standard Deviation	T-stat	P-value	Remark
H7	AR -> PN -> ESI	0.2726	0.0779	3.5002	0.0005	Supported
H8	AC -> PN -> ESI	0.2907	0.0678	4.2881	0.0000	Supported
H9	ESK -> ATT -> ESI	0.0625	0.0253	2.4723	0.0135	Supported
H10	EK -> ATT -> ESI	0.0653	0.0264	2.4759	0.0133	Supported

Source: Authors

Table 6: Summary of R^2, Q^2, and f^2

Constructs	R^2	Q^2	f^2 (PN)	f^2 (ATT)	f^2 (ESI)
AR			0.1530		
AC			0.1739		
PN	0.6367	0.4613			0.9723
ESK				0.0684	
EK				0.0746	
ATT	0.2781	0.2123			0.1029
ESI	0.6384	0.5015			

Source: Authors

Likewise, ATT possess a small effect size on ESI, but PN has a large effect size on ESI.

5. DISCUSSION

The study first concluded the substantial influence of AR and AC on PN, and this is parallelled with Duong (2024), Fatoki (2023), and Wang et al. (2018). These indicated that the student's sense of moral responsibility is affected by their responsibility for

ecological issues and also their perception of the negative outcomes of their behaviour. When university students feel accountable and obligated to environmental matters and understand the adverse effects of their behaviour, they will be more responsible towards their behaviour. With that, greater AR and AC might promote a higher PN, which will eventually influence their ESI. Besides, consistent with Broek et al. (2019), Duong (2024), and Liu et al. (2025), the significant role of PN on the students' BI, or more precisely ESI in this study was also documented. This suggested that the higher PN will cultivate students' intention to save energy. Therefore, the greater feeling of moral responsibility tends to cultivate greater ESI. With that, it concluded that the students' ESI were significantly cultivated by their PN, and both AR and AC were crucial in establishing greater PN.

Moreover, the study further added new evidence on the influence of ESK on students' ATT toward energy saving, which is relatively scarce in the previous studies. This is supported by Xie et al. (2021), which showed that students' favourable ATT is positively affected by their knowledge of energy saving. If students have a high knowledge level on energy saving, they tend to have positive ATT on energy saving. Besides, consistent with Boo and Tan (2024), Sinha and Annamdevula (2024), and Suhartanto et al. (2023), the positively influenced of EK on students ATT has also been concluded in this study. This further signified that not only knowledge of energy saving is important, but knowledge of environmental issues also crucial in promoting favourable ATT on energy saving. Therefore, both knowledge of energy saving and the environment is constantly important in forming an individual's favourable ATT toward environmental behaviour such as energy saving in this study. Additionally, the positively substantial influence of students' ATT on their ESI was also found, and this finding is parallelled with the findings of Ling et al. (2024b), Setiawan et al. (2024), and Xie et al. (2021), in different study contexts. This confirmed that students have high intention to participate in pro-environmentally behaviour such as energy saving if they have favourable ATT on this behaviour. Hence, this study revealed that both ESK and EK are important in shaping students' favourable and positive ATT toward energy saving, this favourable feeling would further drive them to take part in this pro-environmentally behaviour, such as energy saving.

Furthermore, the study also revealed the significant mediating role of PN and ATT, and this also suggests the indirect influence of the four predictors (AR, AC, ESK and EK) on students' ESI. The significant mediating role of PN is consistent with Duong (2024) and Fatoki (2023), where ATT has significantly mediated the influence of AR and AC on ESI. Besides, in agreement with Duong (2024), Ling et al. (2024b), and Nguyen (2023), ATT has also been found to have a significant mediating effect. Therefore, these mediating influences of PN and ATT not only suggest that both factors could influence students' ESI directly but both PN and ATT also could be mediators in between the influence of four predictors (AR, AC, ESK and EK) on students' intention to save energy. These findings further signified that AR, AC, ESK and EK might influence students' ESI indirectly through PN or ATT, although no direct effect on ESI was examined in this study. These findings are particularly importance as the study concluded that all proposed factors, including AR, AC, ESK and EK, and also the PN and ATT played a significant effect in affecting students' ESI, either directly or indirectly through mediators of PN and ATT.

6. CONCLUSIONS

This study intends to identify the factors that influence students' energy-saving intention by extending the NAM with ESK, EK and ATT. The results from the 200 university students validated all proposed hypotheses. Specifically, AR and AC significantly affect the PN, and eventually, PN significantly influences students' ESI. These findings have confirmed the appropriateness of the NAM in explaining human pro-environmental behaviours. Besides, the study also found that all additional variables also played a significant role in predicting students' ESI, as the results revealed that both ESK and EK significantly affect ATT, and ATT has a significant impact on ESI. Furthermore, the mediating analysis also showed that both PN and ATT would significantly mediate the influence of the four predictors (AR, AC, ESK and EK) on the ESI. This further signified that the four predictors would indirectly affect students' ESI, through PN or ATT. The study's findings offer some vital implications to the current state of knowledge as it added new evidence on this subject matter through an extended NAM framework and also based on the university students in developing countries. Moreover, the findings are also crucial for stakeholders in cultivating students' ESI as the study proved that all predictors are important in promoting students' ESI.

6.1. Implications

The findings of the study offered some vital implications from both theoretical and practical perspectives that would be beneficial to the prevailing literature in the subject area and also for stakeholders to further foster the students' ESI. Theoretically, the study's findings enrich the extant literature by providing new evidence on the university students' ESI in the general university setting, especially from the perspective of the extended NAM framework. Next, the study again confirmed that NAM is applicable in understanding the university students' energy-saving behaviour, as the study found that all factors in NAM, including AR, AC, and PN are significantly affecting students' ESI, either directly or indirectly via PN. Besides, the extension of the NAM framework with ESK, EK and ATT further contributed to the literature, as all three additional factors are found to be significant with the students' ESI, either directly or indirectly. Likewise, although the direct effect of ESK on ATT, and also the indirect effect of ESK on ESI is limited, this study provided evidence of the influence of ESK on ATT and ESI. This could further contribute theoretically, as it might inspire further study to examine the different types of knowledge (energy saving and environment) on individual's ATT and BI. Lastly, the mediating effect of both PN and ATT has again been validated in this study, as it demonstrated that AR, AC, ESK and EK would indirectly affect students' intention to save energy, through PN and/or ATT.

Practically, the study findings offer some important implications for stakeholders to increase the student's intention to save energy. As proved in this study, both AR and AC were significant in affecting

PN. Therefore, stakeholders such as local government, university management, and the electricity providers have to nurture students' obligation towards the environmental problems and also promote their understanding and consciousness towards the consequences of their behaviour on the society and environment. For instance, the current environmental issues have to be widely disseminated to students and the public to increase their responsibility sense. Moreover, the education or marketing campaign that will increase students' awareness and understanding regarding the consequences of not saving energy also has to be organised by the stakeholders as it will increase awareness among the university students. Education and awareness programs regarding the carbon emissions from electricity or energy usage have to be organised as well as this might further increase their understanding regarding the consequences of their behaviour, which is not saving energy. When students feel obligated to the environmental issues and also aware and conscious of the outcomes of their behaviour toward the community and the environment, they will have a greater moral responsibility sense, which will ultimately determine their ESI. Additionally, the students also have a high likelihood to engage in energy-saving behaviour if they feel accountable for the ecological issues and when they are alert to the adverse outcomes of their behaviour.

Additionally, both types of knowledge were also found to be important in determining students' positive ATT toward energy saving. Therefore, the education providers such as the university and also the stakeholders like electricity providers have to concentrate on enhancing the student's knowledge level, especially on energy saving and environmental issues. For instance, the Sustainable Development Goals (SDGs) should be incorporated into the academic syllabus to increase students' knowledge of sustainability. Besides, the steps and practices on saving energy could be disseminated to the students and also the public as this might further improve their knowledge on energy saving, forming a positive ATT toward energy saving and eventually leading them to exercise this behaviour. Likewise, stakeholders like local government and non-profit organizations have to actively publish information about the current environmental condition as this will increase the students' EK, creating favourable ATT on energy saving, and further encouraging them to take part in environmentally friendly behaviour like energy saving. Also, increasing the knowledge of energy saving and environmental issues would indirectly be cultivating students' ESI, through ATT. By considering all the suggested practical implications above, it might be anticipated that university students will take part in energy saving and further corresponding to the SDGs, especially in SDGs 12.

6.2. Limitations and Suggestions for Future Research

Some limitations are presented in the study and might limit the applicability of the study's findings, and these limitations have to be considered in future research to obtain more robust findings. For example, the data were collected only from university students in Malaysia, and this might lower the generalizability of the study's findings, whereas the findings might not be extended to other countries. Upcoming research is suggested to collect primary responses from university students in different countries as it would increase the finding's generalizability, and a comparison study between countries with different energy usage might be considered. Besides, the study focused on university students only and did not consider the other groups of consumers in the country. University students only a unique types of energy users, and other groups of users such as employees in the workplace, households in residential areas, and the like may possess different perspectives on this subject matter. Hence, expanding the targeted population to other types of energy users will produce more thorough findings as the different perspectives of users are considered in the upcoming study. Moreover, this study only extends NAM with ESK, EK and ATT. However, many other factors might directly or indirectly influence the individuals' energy-saving behaviour. With that, other predictors such as incentives or energy tariffs, different types of consumption values and motives and environmental sensitivity have to be proposed in future studies. Not only that, as the individual's behaviour involved complex decision-making processes, therefore, future studies might also include some variables as moderators to strengthening the individual's ESI.

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