Available online at www.koozakar.com/journal/gjess

Koozakar

GLOBAL JOURNAL OF ENVIRONMENTAL SCIENCE & SUSTAINABILITY

Energy Conservation Behaviour and Sufficiency among University Hostel Students: An exploratory study

Adeyemi O. Adepoju[1*], Kayode J. Ekundayo[1], Olutoye A. Aladejebi[1], Angela N. Abasilim[2], Olalekan A. Jesuleye[1], and Samson A. Oyetunji[3]

[1]Department of Project Management Technology, Federal University of Technology, Akure, Nigeria
[2]Department of Business Information Technology, Federal University of Technology, Akure, Nigeria
[3]Department of Electrical and Electronic Engineering, Federal University of Technology, Akure, Nigeria

*Corresponding Author:
Email: aoadepoju@futa.edu.ng

Article Information

https://doi.org/10.69798/92924777

ISSN (Online): 3066-3660

Published by: Koozakar LLC. Norcross GA 30071, United States.

Edited by: Oluseye Oludoye PhD

Abstract

Persistent electricity shortages, increasing energy demand, and infrastructural limitations continue to undermine energy sufficiency in Nigerian public universities, especially, student residential facilities. While prior studies have explored energy efficiency and sustainable campus initiatives, limited empirical attention has been given to how students' everyday energy-use behaviours shape energy sufficiency in resource-constrained higher education contexts. This study therefore investigated the behavioural dimensions of students' energy use in university hostels, focusing on the effects of psychological, socio-economic, and contextual determinants on energy conservation behaviour, as well as the mediating role of such behaviour in achieving energy sufficiency. Adopting a quantitative cross-sectional design grounded in the Theory of Planned Behaviour, data were collected through a structured questionnaire administered to undergraduate students residing in hostels at the Federal University of Technology, Akure, Nigeria. Of the 377 questionnaires distributed, 211 valid responses were analysed using Partial Least Squares Structural Equation Modelling. The findings show that the explanatory variables collectively explain a substantial proportion of variance in energy conservation behaviour ($R^2 = 0.491$). Socio-economic factors exerted a strong and statistically significant positive influence on students' energy conservation behaviour, whereas internal psychological and contextual factors were not significant predictors. Gender significantly influenced energy conservation behaviour, while age did not. Energy conservation behaviour was found to have a positive and significant effect on energy sufficiency, although the level of explained variance in energy sufficiency was relatively modest ($R^2 = 0.095$). Mediation analysis further revealed that energy conservation behaviour does not significantly mediate the relationships between the determinants and energy sufficiency. The study concludes that students' energy conservation behaviour contributes directly to improved energy sufficiency in university hostels, but such behaviour is shaped primarily by socio-economic conditions rather than psychological or contextual influences. Consequently, the study recommends that university energy management policies should prioritise socio-economic interventions that includes accountability mechanisms, pricing signals, and effective metering alongside behavioural awareness programmes to enhance energy sufficiency within the university.

Keywords: Energy sufficiency; Energy conservation behaviour; Socio-economic determinants; University hostels; PLS-SEM

INTRODUCTION

Energy use in higher education institutions has emerged as a critical concern within contemporary sustainability and energy policy discourse, particularly in the context of accelerating climate change, rising electricity costs, and increasing pressure to decarbonise institutional operations. Universities operate as energy-intensive environments due to dense occupancy, extended hours of activity, and heavy reliance on electrical appliances for teaching, research, administration, and residential life (Zhou *et al.*, 2023; Hassan *et al.*, 2024; Kwakwa *et al.*, 2024; Li *et al.*, 2024). Globally, there is growing consensus that conventional energy management approaches centred predominantly on technological efficiency are insufficient to deliver the scale of demand reduction required for deep decarbonisation. Recent scholarship increasingly emphasises energy sufficiency as a complementary and necessary paradigm, one that prioritises absolute reductions in energy demand through behavioural moderation, shared use, and changes in everyday practices rather than efficiency improvements alone (Malik *et al.*, 2024; Sahakian *et al.*, 2024; Dablander *et al.*, 2025; Zhang *et al.*, 2025). Energy sufficiency reframes the energy challenge by shifting attention from how energy is supplied or how efficiently devices operate to how much energy is actually needed to deliver essential services within ecological and economic limits. Unlike energy efficiency, which seeks to optimise energy use through improved technologies, energy sufficiency foregrounds behavioural choices, social norms, and institutional contexts that shape consumption patterns (Best & Santarius, 2022; Bertoldi, 2022; Almeida, 2025). Empirical studies across buildings and cities demonstrate that sufficiency-oriented strategies can deliver substantial reductions in energy demand when supported by appropriate behavioural and organisational mechanisms (Bouillet & Grandclément, 2024; Guilbert, 2024; Lall & Sethi, 2024). However, despite its growing prominence in international research, energy sufficiency remains underexplored in institutional settings within the Global South, particularly in African universities.

University hostels represent a critical but understudied site for examining energy sufficiency. Student residential buildings concentrate high levels of electricity use driven by shared living arrangements, multiple appliances per room, prolonged occupancy, and limited individual accountability for consumption (Zhang *et al.*, 2024). Studies from Asia and Europe indicate that student accommodation exhibits distinctive energy-use dynamics shaped by group norms, habitual practices, and institutional constraints, making it a fertile context for behavioural energy research (Du & Pan, 2021; Liu *et al.*, 2023; Zhang *et al.*, 2024; Chen & Lotti, 2025). Evidence from recent hostel-based studies further suggests that behavioural interventions, social influence, and perceived behavioural control play a decisive role in shaping students' energy-saving actions, often outweighing purely technological measures (Kwakwa *et al.*, 2024; Bishoge & Mvile, 2024; Omar *et al.*, 2025). Nevertheless, much of this literature remains focused on energy efficiency or conservation intentions, with limited engagement with energy sufficiency as an outcome in its own right. In Nigeria, the urgency of addressing energy use in universities is heightened by persistent electricity supply constraints, escalating tariffs, and infrastructural limitations that undermine institutional productivity and student wellbeing. Nigerian universities increasingly face difficult trade-offs between maintaining reliable electricity supply and managing rising operational costs, a challenge that is particularly acute in public institutions. Empirical evidence indicates that electricity use in Nigerian residential and institutional settings is often characterised by inefficient practices, low awareness, and limited behavioural compliance, especially where energy costs are not directly borne by users (Olanipekun & Iyiola, 2020; Abolarin *et al.*, 2022; Adepoju *et al.*, 2023). While some intervention-based studies demonstrate that awareness programmes can improve conservation behaviour among students, these efforts are frequently fragmented, short-term, and weakly embedded within broader institutional strategies (Ogbuanya & Nungse, 2021). More critically, Nigerian energy studies have largely concentrated on household consumption patterns, infrastructural deficits, or macro-level policy challenges, with limited attention to behavioural processes within institutional environments such as university hostels (Onisanwa & Adaji, 2020; Abubakar *et al.*, 2024). Where behavioural dimensions are examined, energy use is often treated as a direct outcome of socio-economic or demographic characteristics, without adequately interrogating the mechanisms through which attitudes, norms, and perceived control translate into sustained reductions in energy demand. This gap is significant, as recent behavioural and psychological research demonstrates that awareness or positive attitudes alone do not automatically result in reduced consumption unless mediated by consistent conservation behaviour and supportive contextual conditions (Carrus *et al.*, 2021; Nguyen *et al.*, 2022; Delmas *et al.*, 2024). The Federal University of Technology, Akure (FUTA), provides a compelling institutional context within which to investigate these issues. As a leading public university with a strong technological mandate and a growing student population, FUTA faces mounting pressure to manage electricity demand amid financial constraints and unreliable supply. University hostels, in particular, experience frequent power rationing and consumption restrictions, underscoring the need for evidence-based strategies that move beyond supply-side solutions (Soaga, 2024). Despite this, there remains a paucity of empirical research examining how behavioural, psychosocial, and contextual determinants shape energy conservation behaviour among students in Nigerian hostels, and how such behaviour contributes to achieving energy sufficiency at the institutional level.

This study is grounded on the Theory of Planned Behaviour (TPB), originally developed by Ajzen (1991, 2020), which posits that behaviour is driven by attitudes, subjective norms, and perceived behavioural control. TPB has been widely validated in energy-related contexts and remains one of the most robust frameworks for explaining pro-environmental and energy-saving behaviours (Armitage & Conner, 2001; Du & Pan, 2021; Li *et al.*, 2024). Recent extensions of TPB in student accommodation settings highlight its relevance for understanding how individual intentions are shaped by group dynamics, institutional rules, and infrastructural constraints (Hassan *et al.*, 2024; Kwakwa *et al.*, 2024). In this study, TPB provides a conceptual lens for examining how behavioural determinants influence students' energy conservation behaviour and how such behaviour mediates the relationship between these determinants and energy sufficiency outcomes within university hostels. Empirical studies on energy-related behaviour in student residential settings have expanded in recent years, although their focus has largely remained on energy efficiency and conservation intentions rather than energy sufficiency outcomes. Du and Pan (2021) examined energy-saving behaviours in student dormitories using an expanded Theory of Planned Behaviour framework. Employing a questionnaire survey and structural equation modelling among university students in China, the study found that attitudes, subjective norms, and perceived behavioural control significantly influenced students' intentions and actual energy-saving behaviours. While the study demonstrated the robustness of TPB in explaining student energy behaviour, it did not extend its analysis to energy sufficiency, nor did it examine how conservation behaviour mediates broader demand reduction outcomes, which remains a key concern of the present study. Similarly, Liu *et al.* (2023) investigated the factors influencing college students' energy-use behaviour in dormitories, with particular emphasis on group-level and temporal factors. Using longitudinal survey data and multilevel modelling, the authors revealed that peer influence, shared norms, and time-based routines significantly shaped electricity use patterns. Although the study provided valuable insights into collective behavioural dynamics in student residences, it focused primarily on consumption patterns rather than behavioural pathways leading to sufficiency-oriented reductions in energy demand. Moreover, the absence of a theoretical behavioural mediation framework limits its applicability to energy sufficiency analysis.

Li *et al.* (2024) explored university students' energy-saving behaviours in China using the Theory of Planned Behaviour. The study employed a cross-sectional survey design and Partial Least Squares Structural Equation Modelling to assess the influence of attitudes, norms, and perceived control on energy-saving intentions and behaviours. The findings confirmed that perceived behavioural control was the strongest predictor of actual conservation behaviour. However, the study operationalised energy outcomes narrowly as conservation behaviour and did not examine whether such behaviour translated into broader energy sufficiency outcomes, a limitation that the present study seeks to address by explicitly modelling energy sufficiency as a dependent construct. In a related context, Hassan *et al.* (2024) validated an energy conservation behaviour scale among Malaysian university students using exploratory and confirmatory factor analysis. Their objective was to establish a reliable behavioural measurement instrument rather than to explain behavioural outcomes. While the study contributes methodologically by strengthening behavioural measurement, it does not investigate behavioural determinants or their impact on energy sufficiency, nor does it situate conservation behaviour within a broader institutional or demand-reduction framework.

Recent hostel-focused studies in Africa provide further insights but also reveal important gaps. Kwakwa *et al.* (2024) assessed electricity conservation intentions among university students in northern Ghana, focusing on specific electrical appliances. Using a survey-based design grounded in behavioural theory, the authors found that attitudes, perceived benefits, and social influence significantly shaped students' intentions to conserve electricity. However, the study focused on intention rather than actual behaviour and did not examine energy sufficiency as an outcome, leaving unanswered questions about whether expressed intentions lead to meaningful reductions in energy demand. Yakubu *et al.* (2024) examined the potential of energy efficiency and conservation measures in a student hostel in Ghana using a case study approach that combined observational assessment and descriptive analysis. The findings suggested that both technological measures and behavioural adjustments could reduce electricity consumption. Nonetheless, the study adopted a largely descriptive approach and did not employ a behavioural theory or causal modelling framework, limiting its ability to explain how behavioural determinants influence sufficiency-oriented outcomes.

Beyond Africa, Bishoge and Mvile (2024) investigated energy-saving practices among postgraduate students at the Pan African University using survey data and descriptive statistics. The study found moderate levels of awareness and inconsistent conservation practices among students. While the findings highlight behavioural challenges in postgraduate accommodation, the study does not examine causal relationships or the mediating role of conservation behaviour in achieving energy sufficiency, which is central to the present research. More recently, Chen and Lotti (2025) evaluated the effectiveness of behavioural nudges in reducing energy consumption in student accommodation using a quasi-experimental design. Their findings demonstrated that feedback mechanisms and normative messaging produced short-term reductions in electricity use. However, the study focused on intervention effectiveness rather than underlying behavioural determinants and did not conceptualise energy sufficiency as a sustained outcome, limiting its theoretical contribution to sufficiency-oriented research. Within the broader energy sufficiency literature, Malik *et al.* (2024) and Sahakian *et al.* (2024) emphasised that behavioural change is indispensable for deep decarbonisation in buildings, arguing that efficiency gains alone are insufficient to curb rising energy demand. Although these studies provide strong conceptual and policy-level arguments for energy sufficiency, they are largely macro-oriented and do not empirically test behavioural mechanisms in specific institutional contexts such as university hostels.

In the Nigerian context, empirical studies remain limited and fragmented. Olanipekun and Iyiola (2020) examined awareness and electricity use behaviour among on-campus students using a descriptive survey approach. Their findings revealed low levels of energy awareness and widespread wasteful practices. However, the study did not employ a behavioural theory or examine energy sufficiency outcomes. Similarly, Abolarin *et al.* (2022) assessed students' knowledge, attitudes, and practices regarding energy conservation in a Nigerian university, finding that knowledge did not consistently translate into conservation behaviour. While informative, the study did not model behavioural pathways or link conservation behaviour to energy sufficiency. Ogbuanya and Nungse (2021) evaluated the effectiveness of an energy conservation awareness package among Nigerian university students using an experimental design. The results showed that awareness interventions significantly improved conservation behaviour. Nevertheless, the study focused narrowly on intervention outcomes and did not investigate how behavioural changes contribute to sustained reductions in energy demand or institutional energy sufficiency. Household-focused Nigerian studies further illustrate the research gap.

Adepoju *et al.* (2023) and Abubakar *et al.* (2024) examined the socio-economic determinants of household energy conservation and consumption using econometric and survey-based approaches. While these studies identified income, education, and household characteristics as significant predictors, their household orientation and lack of institutional context limit their applicability to university hostels, where collective norms and centralised energy management prevail. In sum, empirical literature demonstrates substantial progress in understanding energy conservation behaviour among students and households, yet reveals a persistent gap in linking behavioural determinants to energy sufficiency outcomes, particularly within Nigerian university hostels. Most studies either focus on intentions, awareness, or descriptive consumption patterns, or treat conservation behaviour as an end in itself rather than as a mediating mechanism for achieving sufficiency. This study addresses this gap by empirically examining energy conservation behaviour as a mediator between behavioural determinants and energy sufficiency within the hostel context of a Nigerian public university, thereby extending both the behavioural energy literature and the emerging field of energy sufficiency research.

Against this backdrop, the study is guided by the question of how behavioural, psychosocial, and contextual determinants influence students' energy conservation behaviour and how such behaviour affects energy sufficiency in university hostels. Addressing this question is important for advancing theoretical understanding of energy sufficiency in institutional settings and for informing practical strategies to support sustainable campus energy management in resource-constrained environments. Methodologically, the study adopts a quantitative, theory-driven approach using Partial Least Squares Structural Equation Modelling (PLS-SEM) to examine the mediating role of energy conservation behaviour in the relationship between its determinants and energy sufficiency among hostel residents at the Federal University of Technology, Akure (FUTA). By focusing on behavioural mechanisms rather than energy auditing or technological assessment, the study provides empirical evidence that extends energy sufficiency research to a Nigerian university context and validates behavioural pathways grounded in the Theory of Planned Behaviour (TPB). More broadly, the study contributes to the literature by responding to calls for greater integration of behavioural perspectives into energy sufficiency research and by reinforcing the role of universities as critical sites for advancing sustainable energy transitions in the Global South.
Grounded in the Theory of Planned Behaviour and empirical evidence from behavioural energy studies, the hypotheses reflect the expected relationships between behavioural and psychosocial determinants, energy conservation behaviour, and energy sufficiency in university hostel environments. In line with the first objective, which examines the effect of behavioural determinants on energy conservation behaviour, prior studies suggest that attitudes, subjective norms, and perceived behavioural control are positively associated with students' energy-saving actions in residential settings (Ajzen, 1991; Du & Pan, 2021; Li *et al.*, 2024). Accordingly, the first hypothesis is proposed:

H_{1a}: Determinant (Internal, Socio-economic, and Contextual) factors have a significant positive effect on energy conservation behaviour in the instance of first path;

H_{1b}: Energy conservation behaviour has a significant positive effect on the energy sufficiency among students residing in university hostels.

The second objective evaluates the mediating role of energy conservation behaviour in the relationship between behavioural determinants and energy sufficiency. Drawing on energy sufficiency literature that highlights behavioural pathways as mechanisms for reducing energy demand (Sahakian *et al.*, 2024; Malik *et al.*, 2024; Dablander *et al.*, 2025), the study proposes the following hypothesis:

H2: Energy conservation behaviour significantly mediates the relationship between behavioural and psychosocial determinants and energy sufficiency among students in university hostels.

The hypotheses were controlled by age and gender of the respondents. Overall, the study advances a behaviourally grounded examination of energy sufficiency within a Nigerian public university. By empirically testing the influence of behavioural and psychosocial determinants on energy conservation behaviour and its mediating role in achieving energy sufficiency, the study fills identified gaps in the energy sufficiency and institutional energy behaviour literature. The findings provide context-specific insights relevant to institutional energy governance, behavioural intervention design, and sustainable campus energy management in the Global South.

METHODS

This study adopted a quantitative approach to examine how behavioural and psychosocial determinants influence students' energy conservation behaviour and how such behaviour, in turn, affects energy sufficiency within university hostel settings. The methodological design was guided by the need to empirically test theoretically derived relationships using a robust behavioural modelling framework capable of handling latent constructs and mediation effects. The study was conducted at the Federal University of Technology, Akure, a public technology-oriented university in southwestern Nigeria. The focus was on students residing in on-campus hostels, as these residential environments represent concentrated sites of electricity use characterised by shared facilities, collective norms, and limited individual accountability for consumption. Data were collected during the academic session specified in the earlier approved proposal, ensuring that respondents had sufficient residential experience to meaningfully report their energy-related behaviours. The target population comprised all undergraduate students residing in FUTA hostels, which is about 3,000 bedspaces. The sample size (377) was determined using the Krejcie and Morgan (1970) sample size table, which provides statistically adequate samples for finite populations. The specified sample size for hostel residents was therefore adopted to ensure representativeness and sufficient statistical power for multivariate analysis. A structured questionnaire was administered to students using a stratified approach across hostel blocks to ensure proportional representation of respondents. The study employed a cross-sectional survey design, which is widely used in behavioural energy research to capture attitudes, perceptions, and self-reported behaviours at a specific point in time. This design is particularly appropriate for theory-driven studies grounded in the Theory of Planned Behaviour, as it allows for simultaneous estimation of relationships between latent psychological constructs and behavioural outcomes (Ajzen, 1991; Armitage & Conner, 2001; Ajzen, 2020). Primary data were collected using a self-administered questionnaire developed from validated scales in prior energy behaviour studies. Items measuring attitudes, subjective norms, perceived behavioural control, and energy conservation behaviour were adapted from established TPB-based instruments used in student and household energy research (Du & Pan, 2021; Li *et al.*, 2024; Hassan *et al.*, 2024). Measures of energy sufficiency were operationalised to reflect demand-reduction outcomes associated with moderated use, shared practices, and avoidance of unnecessary electricity consumption, drawing on recent conceptual and empirical work on energy sufficiency in buildings (Malik *et al.*, 2024; Sahakian *et al.*, 2024; Dablander *et al.*, 2025). All items were measured using a five-point Likert scale ranging from strong disagreement to strong agreement. The primary outcome variables measured in this study were energy conservation behaviour and energy sufficiency. Energy conservation behaviour captured students' habitual and intentional actions aimed at reducing electricity use, while energy sufficiency reflected broader outcomes associated with reduced demand and restrained consumption consistent with sufficiency principles. Behavioural determinants derived from the Theory of Planned Behaviour served as the exogenous constructs (Lundgren and Schultzberg, 2019).

Data analysis was conducted using Partial Least Squares Structural Equation Modelling, which is well suited for theory development, prediction-oriented research, and complex models involving latent variables and mediation effects. PLS-SEM has been widely applied in behavioural energy studies due to its robustness with non-normal data and moderate sample sizes (Hair *et al.*, 2017, 2019, 2021). The analysis followed a two-stage procedure involving assessment of the measurement model and the structural model. The evaluation of the measurement model was conducted in line with established guidelines for formative construct assessment within the Partial Least Squares Structural Equation Modelling framework. Given that the constructs and their indicators were formatively specified, the assessment did not rely on traditional reflective criteria such as internal consistency reliability, convergent validity, or discriminant validity. Instead, measurement model evaluation focused on examining the relevance and statistical significance of indicator weights, the absolute importance of indicator loadings, and the presence of multicollinearity among indicators, as assessed using the variance inflation factor. In accordance with recommendations by Hair *et al.* (2017, 2019, 2021), indicator weights were evaluated using bootstrapped T statistics and p values to determine their relative contribution to the formation of each construct. Where indicator weights were not statistically significant but exhibited substantial loadings, such indicators were assessed for absolute importance and retained when conceptually justified. Multicollinearity was examined to ensure that no indicator exhibited problematic redundancy, with variance inflation factor values maintained within acceptable thresholds. Collectively, these procedures ensured that the formative measurement model was both statistically sound and theoretically meaningful, thereby providing a robust foundation for subsequent structural path analysis. The structural model assessment involved evaluating path coefficients, coefficients of determination, effect sizes, and predictive relevance using bootstrapping procedures to test the significance of hypothesised relationships.

Descriptive statistics were used to summarise respondents' demographic characteristics and general patterns of energy-related behaviour. Inferential analysis relied on bootstrapped t-statistics and p-values to test the stated hypotheses at conventional significance levels. Mediation effects were assessed using indirect effect estimation within the PLS-SEM framework, consistent with contemporary recommendations for behavioural modelling. Ethical considerations were observed throughout the study. Participation was voluntary, and respondents were informed of the purpose of the research, assured of confidentiality, and informed of their right to withdraw at any stage without penalty. No personal identifiers were collected, and all data were used strictly for academic research purposes in line with institutional ethical guidelines.

RESULTS

Response Rate

A total of three hundred and seventy-seven questionnaires were distributed to students residing in on-campus hostels at the Federal University of Technology, Akure. Out of this number, two hundred and eleven completed questionnaires were found suitable for analysis, representing a response rate of 56 percent. The remaining questionnaires were either not returned or excluded due to incomplete or inconsistent responses. The distribution and retrieval of the questionnaires are summarised in Table 1. According to survey research standards, a response rate above 30-40 percent is considered acceptable for behavioural and social science studies, particularly in institutional settings (Moser & Kalton, 2017). The response rate achieved in this study therefore exceeds the recommended minimum threshold, indicating adequate participation and sufficient data quality for subsequent statistical analysis. This level of response suggests that the findings reasonably reflect the views and experiences of students residing in FUTA hostels and provides a reliable basis for further analysis.

Table 1: Response Rate of Questionnaire

Description	Frequency	Percentage (%)
Questionnaires distributed	377	100
Questionnaires retrieved and used	211	56
Questionnaires not Retrieved	108	29
Questionnaires not used	58	15

Descriptive Analysis

Descriptive statistics were used to summarise respondents’ demographic characteristics and their responses across the study constructs derived from Sections B to F of the questionnaire. Detailed item-level statistics, including frequencies, means, medians, modes, and standard deviations, are presented in the Appendix. This section provides a concise statistical interpretation of the major behavioural, psychological, socio-economic, contextual, and energy sufficiency constructs examined in the study. The demographic profile indicates that out of the 211 valid responses, 115 respondents (54.5%) were male and 96 (45.5%) were female, while a larger proportion of respondents were aged above 20 years. This distribution reflects the typical composition of students residing in university hostels and supports the adequacy and representativeness of the sample for behavioural analysis. Energy conservation behaviour was operationalised using six behavioural dimensions, namely price sensitivity (bPS), cutting or behavioural restraint (bCBR), upgrading or efficiency improvement (bUEI), monitoring (bM), trimming or fine-tuning operations (bTFTO), and switching to sustainable alternatives (bSSA). Overall, respondents demonstrated moderate to high engagement across most behavioural categories. Price sensitivity recorded mean scores ranging from 3.73 to 4.19, with a composite mean of 3.96 and a median of 4, indicating that electricity costs significantly influence students’ energy use decisions. Cutting or behavioural restraint behaviours, such as switching off lights and unplugging appliances, showed relatively high engagement, with mean values between 3.63 and 4.29 and a composite mean of 4.04, suggesting that routine conservation practices are widely adopted. Upgrading or efficiency improvement behaviours recorded mean scores ranging from 3.63 to 4.10, with a composite mean of 3.93, reflecting favourable attitudes towards energy-efficient appliances and institutional efficiency initiatives. Monitoring behaviours showed comparatively lower engagement, with mean values between 3.19 and 3.91 and a composite mean of 3.54, indicating moderate awareness and tracking of electricity consumption. Trimming behaviours recorded a composite mean of 3.93, while switching to sustainable alternatives recorded a composite mean of 3.67, suggesting that behaviours requiring greater lifestyle adjustments are adopted to a lesser extent.

For the internal and psychological determinants, attitude toward energy conservation (cATB) exhibited strong positive orientations, with item mean scores ranging from 3.92 to 4.23 and a composite mean of 4.17, accompanied by low variability. This indicates a strong personal commitment to energy conservation among respondents. Awareness of consequences (cAC) similarly recorded high agreement, with a composite mean of 4.08, reflecting strong recognition of the environmental and financial implications of excessive electricity use. Personal values related to conservation (cPV) recorded a composite mean of 3.93, suggesting alignment between respondents’ moral values and energy-saving practices. Subjective norms (cSN) recorded a moderate composite mean of 3.59, indicating that social influence supports, but does not strongly drive, conservation behaviour. Perceived behavioural control (cPBC) recorded a composite mean of 3.76, suggesting that respondents generally feel capable of conserving energy, although some constraints remain. Among socio-economic factors, energy price (dEP) recorded a composite mean of 3.76, reinforcing the importance of cost considerations in shaping conservation behaviour. Age (dAO) and gender-related perceptions (dG) recorded moderate mean values of 3.59 and 3.35, respectively, indicating that while demographic attributes influence energy behaviour, their effects are not strongly pronounced. The number of appliances (dNA) and weather conditions (dWC) recorded composite means of 3.50 and 3.93, respectively, highlighting the influence of appliance ownership and climatic conditions on electricity consumption. The number of occupants in a room or building (dNOR) recorded a relatively high composite mean of 4.01, suggesting strong agreement that shared occupancy intensifies energy use and complicates conservation efforts.

Contextual factors revealed mixed perceptions. Institutional policies (eIP) recorded a composite mean of 3.53, indicating moderate awareness and compliance with university energy policies. Infrastructure adequacy (eINFR) recorded a composite mean of 3.55, suggesting variability in the availability and quality of energy-supportive infrastructure. Energy literacy (eEL) recorded one of the lower composite means at 3.26, indicating gaps in formal knowledge and training related to energy management. Availability of resources (eAR) recorded a composite mean of 3.44, suggesting that limited access to energy-saving tools may constrain conservation efforts. Energy sufficiency was assessed through four dimensions: per capita energy consumption, energy equity, energy demand management, and sustainability of energy practices. Per capita energy consumption (fPCEC) recorded a composite mean of 3.15, indicating moderate recognition of excessive individual energy use. Energy equity (fEE) recorded a composite mean of 3.74, reflecting support for fair and balanced energy distribution across the university. Energy demand management (fEDM) recorded a composite mean of 3.41, suggesting moderate awareness of load-shifting and peak demand reduction strategies. Sustainability of energy practices (fSEP) recorded a composite mean of 3.92, indicating strong agreement that conservation and renewable energy adoption are essential for a sustainable campus environment. Overall, the descriptive statistics reveal strong pro-conservation attitudes and moderate-to-high engagement in basic energy-saving behaviours, alongside institutional, infrastructural, and informational constraints that may limit the attainment of broader energy sufficiency goals. These patterns provide a statistically grounded foundation for the subsequent measurement and structural model analyses.

Measurement Model Assessment

Before examining the structural relationships among the study variables, it was necessary to assess the adequacy and robustness of the measurement model. This step ensured that the constructs and indicators employed in the analysis accurately represented the theoretical concepts underpinning the study. The assessment focused on energy conservation behaviour, its behavioural, psychological, socio-economic, and contextual determinants, as well as energy sufficiency outcomes among students residing in university hostels at the Federal University of Technology, Akure. All constructs in the model were specified as formative except the energy conservation behaviour (bENCSV) as shown in Figure 1. Accordingly, the evaluation of the measurement model followed the procedures recommended by Hair *et al.* (2017, 2020) and Hair and Alamer (2022). These authors emphasise that formative indicators contribute causally to the construct and should therefore be assessed based on the significance and relevance of indicator weights, the absolute importance of indicator loadings, and the absence of multicollinearity, as indicated by the variance inflation factor (Table 2). Whereas, the reflective measurement model should consider the construct reliability and validity, as well as the discriminant validity, which are presented in Tables 3a to 3d.

The internal and psychological determinants construct comprised attitude toward the behaviour, subjective norms, perceived behavioural control, personal values, and awareness of consequences. The formative assessment revealed that perceived behavioural control and subjective norms had statistically significant weights and were therefore retained as relatively important indicators.

Perceived behavioural control recorded the highest weight within this construct, underscoring the importance of students' perceived ability and confidence to engage in energy-saving practices. Attitude toward the behaviour, although not statistically significant in its weight, exhibited a loading above 0.50 and was consequently classified as absolutely important, in line with the recommendations of Hair *et al.* (2017). This suggests that while attitude may not independently drive the construct, it remains conceptually and empirically relevant. In contrast, awareness of consequences and personal values recorded non-significant weights below the 0.10 threshold and were therefore excluded from the final formative model. Their removal indicates that these indicators did not make sufficient unique contributions beyond other psychological factors within the model. The socio-economic determinants construct consisted of energy price, age of occupant, gender, number of appliances, weather conditions, and number of occupants.

The results show that energy price emerged as a dominant determinant, recording a strong and statistically significant weight, thereby qualifying as relatively important.

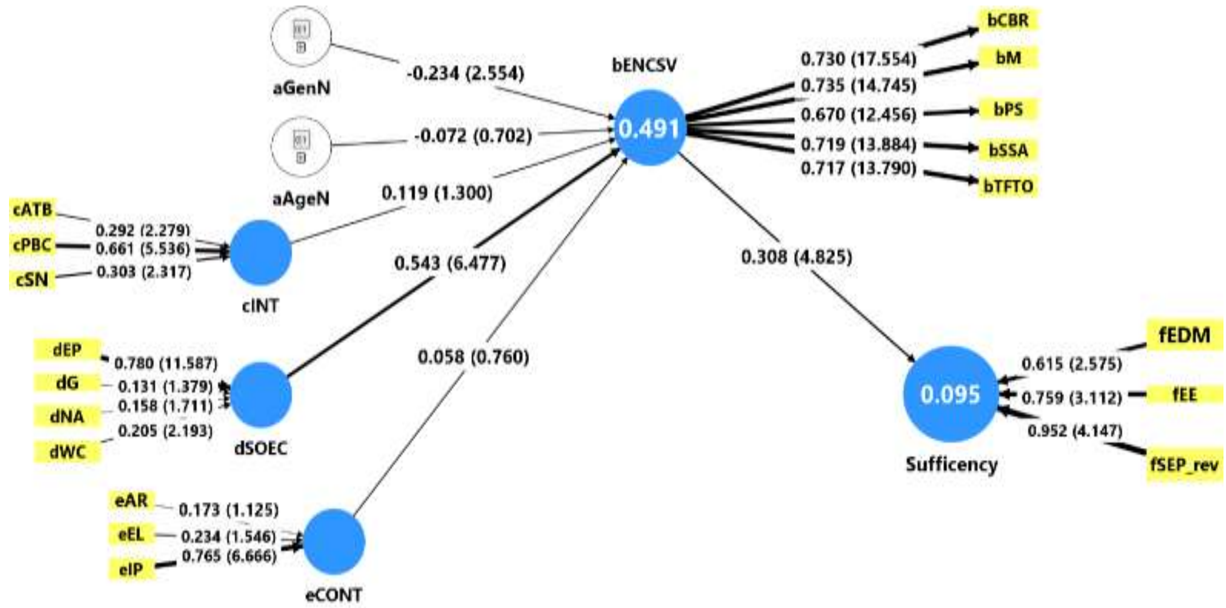

Figure 1: Measurement Model for Indicators

Table 2: Relevance and Significance of Indicators (Formative assessment)

	Weight	T stat	*p*-values	VIF	Loadings	T stat	*p*-values	Relevance	Reason
aAgeN <- aAgeN	1.000	n/a	n/a	1.000	1.000	n/a	n/a		
aGenN <- aGenN	1.000	n/a	n/a	1.000	1.000	n/a	n/a		
bCBR <- Bencsv	0.272	8.216	0.000	1.468	0.722	16.471	0.000	RI	
bM <- bENCSV	0.292	8.891	0.000	1.438	0.737	14.254	0.000	RI	
bPS <- bENCSV	0.250	8.512	0.000	1.366	0.669	12.458	0.000	RI	
bSSA <- bENCSV	0.308	10.036	0.000	1.386	0.725	14.166	0.000	RI	
bTFTO <- bENCSV	0.277	8.734	0.000	1.436	0.718	13.861	0.000	RI	
cAC -> cINT	0.027	0.161	0.872	1.665	0.597	5.077	0.000	Delete	< 0.1
cATB -> cINT	0.190	0.984	0.325	1.463	0.599	4.358	0.000	AI	
cPBC -> cINT	0.653	3.815	0.000	1.848	0.937	14.773	0.000	RI	
cPV -> cINT	0.091	0.513	0.608	1.570	0.622	5.022	0.000	Delete	< 0.1
cSN -> cINT	0.305	2.145	0.032	1.260	0.662	5.496	0.000	RI	
dAO -> dSOEC	-0.057	0.445	0.656	1.768	0.420	3.517	0.000	Delete	
dEP -> dSOEC	0.783	10.026	0.000	1.410	0.944	27.795	0.000	RI	
dG -> dSOEC	0.185	1.536	0.125	1.641	0.411	3.956	0.000	AI	
dNA -> dSOEC	0.201	1.798	0.072	1.514	0.644	7.699	0.000	AI	
dNOR -> dSOEC	0.015	0.131	0.896	1.417	0.465	4.767	0.000	Delete	< 0.1
dWC -> dSOEC	0.142	1.372	0.170	1.399	0.510	5.070	0.000	AI	
eAR -> eCONT	0.299	1.939	0.053	1.858	0.733	6.996	0.000	AI	
eEL -> eCONT	0.487	3.103	0.002	1.884	0.843	9.603	0.000	RI	
eInfre -> eCONT	-0.194	1.202	0.229	1.456	0.505	4.073	0.000	AI	
eIP -> eCONT	0.567	3.370	0.001	1.690	0.825	8.425	0.000	RI	
fEDM -> Sufficency	0.800	4.063	0.000	1.510	0.730	3.832	0.000	RI	
fEE -> Sufficency	0.189	0.598	0.550	1.613	0.317	1.652	0.098	Delete	
fPCEC -> Sufficency	0.473	2.250	0.024	1.331	0.538	2.695	0.007	RI	
fSEP_rev -> Sufficency	0.796	2.251	0.024	1.616	0.128	0.492	0.623	RI	

This finding highlights the central role of cost considerations in shaping energy conservation behaviour within student hostels. Gender, number of appliances, and weather conditions exhibited acceptable loadings above 0.50 but non-significant weights and were therefore classified as absolutely important, indicating that these factors remain relevant but exert weaker independent influence. Conversely, age of occupant and number of occupants recorded weights below the minimum relevance threshold of 0.10 and were consequently deleted from the formative construct. This suggests that these variables do not contribute uniquely to socio-economic influences on conservation behaviour within the study context. All variance inflation factor values for socio-economic indicators were below 1.80, confirming the absence of multicollinearity. Contextual determinants of energy conservation behaviour were measured using institutional policies, energy literacy, infrastructure, and availability of resources. The formative assessment shows that institutional policies and energy literacy recorded statistically significant weights and were therefore retained as relatively important indicators. These findings underscore the importance of formal rules, guidelines, and knowledge dissemination in shaping students' conservation behaviour. Availability of resources and infrastructure recorded acceptable loadings above 0.50 but non-significant weights, and were thus classified as absolutely important. Although their direct contribution was weaker, these indicators remain theoretically relevant in enabling or constraining energy-saving actions. None of the contextual indicators exceeded the recommended VIF threshold, confirming acceptable levels of collinearity.

Energy sufficiency was operationalised using four dimensions: energy demand management, energy equity, per capita energy consumption, and sustainability of energy practices. The results indicate that energy demand management, per capita energy consumption, and sustainability of energy practices recorded statistically significant weights and were therefore considered relatively important indicators of energy sufficiency. In contrast, energy equity recorded a non-significant weight below the 0.10 threshold and was consequently removed from the final formative model. This suggests that equity-related perceptions, while conceptually relevant, did not independently contribute to explaining energy sufficiency outcomes within the hostel context examined. All VIF values for the energy sufficiency indicators were within acceptable limits, confirming that the retained indicators provided distinct and non-redundant contributions to the construct.

Overall, the formative measurement model demonstrated strong empirical adequacy and theoretical coherence. Indicators with statistically significant weights were retained as relatively important, while indicators with strong loadings but non-significant weights were retained as absolutely important, consistent with the guidance of Hair *et al.* (2017, 2020). Indicators with weights below 0.10 were excluded due to insufficient relevance. The acceptable variance inflation factor values across all constructs further confirm the absence of multicollinearity and the stability of the measurement model. These results confirm that the retained formative indicators adequately capture the multidimensional nature of energy conservation behaviour and energy sufficiency within university hostel environments. The validated measurement model therefore provides a robust foundation for the subsequent structural model and hypothesis testing.

Energy conservation behaviour was modelled as a reflective construct composed of five behavioural dimensions, namely cutting or behavioural restraint, monitoring, price sensitivity, switching to sustainable alternatives, and trimming or fine-tuning operations. The results presented in Table 3a to 3d show that the Cronbach's alpha exceed the recommended 0.7 threshold and likewise the average variance extracted as 0.511, which is above the recommended value of 0.5. The study further examined the discriminant analysis which include the HTMT, Fornell-Larcker, and Cross-Loadings. The results obtained showed that the recommended thresholds were achieved. HTMT values are not above 0.85, the square root of AVE of a construct are greater than the highest latent variable correlations. The average of the cross-loadings is also adequate as the loadings ranges from 0.670 to 0.735. The study has found no issues with both reflective and formative measurement model presented.

Table 3: Reflective Measurement Model

(a) Construct reliability and validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
bENCSV	0.760	0.762	0.839	0.511

(b) Heterotrait-monotrait ratio (HTMT)

	aAgeN	aGenN	bENCSV
aAgeN			
aGenN	0.097		
bENCSV	0.163	0.278	

(c) Fornell-Larcker criterion

	aAgeN	aGenN	bENCSV
aAgeN	1.000		
aGenN	0.097	1.000	
bENCSV	-0.142	-0.242	0.715

(d) Cross loadings

	Sufficency	aAgeN	aGenN	bENCSV	cINT	dSOEC	eCONT
aAgeN	0.003	1.000	0.097	-0.142	-0.097	-0.152	-0.005
aGenN	-0.102	0.097	1.000	-0.242	-0.145	-0.171	-0.196
bCBR	0.156	-0.151	-0.285	**0.730**	0.444	0.492	0.322
bM	0.312	-0.164	-0.113	**0.735**	0.257	0.484	0.402
bPS	0.154	-0.092	-0.164	**0.670**	0.383	0.440	0.319
bSSA	0.292	-0.037	-0.132	**0.719**	0.379	0.498	0.440
bTFTO	0.174	-0.063	-0.172	**0.717**	0.372	0.510	0.252
cATB	-0.033	-0.097	-0.067	0.335	0.654	0.385	0.290
cPBC	0.106	-0.034	-0.148	0.476	0.928	0.561	0.517
cSN	0.006	-0.153	-0.091	0.331	0.647	0.471	0.460
dEP	0.247	-0.130	-0.115	0.642	0.546	0.946	0.543
dG	0.102	-0.106	-0.047	0.263	0.255	0.388	0.363
dNA	0.121	-0.134	-0.084	0.423	0.455	0.622	0.504
dWC	0.095	-0.077	-0.303	0.374	0.460	0.551	0.368
eAR	0.243	0.062	-0.066	0.310	0.325	0.390	0.636
eEL	0.273	-0.045	0.036	0.345	0.337	0.427	0.706
eIP	0.290	-0.007	-0.252	0.463	0.563	0.600	0.947
fEDM	0.558	0.048	0.085	0.172	0.176	0.214	0.352
fEE	0.543	0.068	0.049	0.167	0.132	0.158	0.154
fSEP_rev	0.257	-0.083	-0.201	0.079	-0.153	-0.006	-0.006

Structural Path Analysis

Following the satisfactory assessment of the formative measurement model, the structural model was estimated using Partial Least Squares Structural Equation Modelling to examine the relationships among demographic controls, behavioural determinants, energy conservation behaviour, and energy sufficiency. The structural results are presented in Table 4, with the corresponding path diagram illustrated in Figure 2, while Table 4 reports the mediation analysis results. Interpretation of statistical significance follows established conventions in the PLS-SEM literature, where T statistics greater than 1.96 indicate significance at the 95 per cent confidence level, and values above 1.65 indicate moderate significance at the 90 per cent level (Hair *et al.*, 2017; Hair *et al.*, 2019). Effect sizes were interpreted using Cohen's guidelines, where f-square values of 0.02, 0.15, and 0.35 represent small, medium, and large effects respectively. The results in Table 4 show that socio-economic factors exert the strongest influence on energy conservation behaviour. The path from socio-economic factors to energy conservation behaviour is positive, highly significant, and substantial in magnitude ($\beta = 0.543$, $T = 6.477$, $p < 0.001$), with a medium-to-large effect size ($f^2 = 0.281$). This finding indicates that socio-economic conditions, particularly energy price as identified in the measurement model, are the dominant drivers of students' conservation behaviour in university hostels.

Table 4: Path Analysis for Determinants, Energy Conservation Behaviour and Sufficiency

Path	Beta	STD	T stat	P values	f-square	VIF
aAgeN -> bENCSV	-0.072	0.103	0.702	0.483	0.002	1.047
aGenN -> bENCSV	-0.234	0.091	2.554	0.011	0.025	1.052
cINT -> bENCSV	0.119	0.092	1.300	0.194	0.016	1.792
dSOEC -> bENCSV	0.543	0.084	6.477	0.000	0.281	2.057
eCONT -> bENCSV	0.058	0.076	0.760	0.448	0.004	1.844
bENCSV -> Sufficency	0.308	0.064	4.825	0.000	0.105	1.000
bENCSV R-Square	0.491					
Sufficency R-Square	0.095					

In contrast, internal and psychological factors show a positive but statistically non-significant relationship with energy conservation behaviour (β = 0.119, T = 1.300, $p = 0.194$), with a small effect size ($f^2 = 0.016$). Similarly, contextual factors exhibit a weak and non-significant relationship with energy conservation behaviour (β = 0.058, T = 0.760, $p = 0.448$), indicating that institutional and infrastructural conditions alone are insufficient to directly stimulate behavioural change without stronger socio-economic pressures.

Among the control variables, age does not significantly predict energy conservation behaviour (β = −0.072, T = 0.702, $p = 0.483$), and its effect size is negligible. Gender, however, demonstrates a statistically significant negative relationship with energy conservation behaviour (β = −0.234, T = 2.554, $p = 0.011$), although the effect size is small ($f^2 = 0.025$). This suggests that gender differences exist in conservation practices among students, but their overall contribution to explaining behavioural variation is limited. Energy conservation behaviour itself has a positive and statistically significant effect on energy sufficiency (β = 0.308, T = 4.825, $p < 0.001$), with a medium effect size ($f^2 = 0.105$). This finding confirms that higher engagement in conservation behaviours such as monitoring, cutting, trimming, and switching directly enhances energy sufficiency outcomes in university hostels. As illustrated in Figure 2 and supported by the measurement model results, monitoring and cutting behaviours emerge as the most influential behavioural dimensions contributing to this effect.

The explanatory power of the model is further evidenced by the coefficients of determination. The R-square value for energy conservation behaviour is 0.491, indicating that approximately 49.1 per cent of the variance in students' conservation behaviour is jointly explained by demographic, psychological, socio-economic, and contextual factors. According to Cohen's (1992) benchmarks, this represents a substantial level of explained variance, particularly for behavioural research in institutional settings. In contrast, the R-square value for energy sufficiency is 0.095, which falls within the weak range. This suggests that while energy conservation behaviour significantly contributes to sufficiency outcomes, additional factors beyond those included in the present model may be necessary to more fully explain variations in energy sufficiency within the university context. Effect size analysis provides further insight into the relative importance of predictors. Socio-economic factors exhibit the largest contribution to the explained variance in energy conservation behaviour, while energy conservation behaviour itself demonstrates a meaningful contribution to energy sufficiency. The remaining predictors display small or negligible effect sizes, reinforcing the conclusion that behavioural responses are primarily shaped by socio-economic pressures rather than psychological dispositions or contextual arrangements alone. Variance inflation factor values across all paths remain below the recommended threshold of 5.0, indicating the absence of multicollinearity and confirming the stability of the structural estimates.

The mediation analysis reported in Table 5 reveals that energy conservation behaviour does not mediate the relationships between the determinants and energy sufficiency. None of the indirect effects through energy conservation behaviour are statistically significant, as indicated by low T statistics and p-values well above 0.05. This finding suggests that although energy conservation behaviour directly enhances energy sufficiency, the effects of internal, socio-economic, contextual, and demographic factors on energy sufficiency are not transmitted indirectly through behavioural pathways within the present model. Instead, contextual factors exert a strong and direct influence on energy sufficiency (β = 0.544, T = 6.291, $p < 0.001$), highlighting the importance of institutional arrangements, policies, and infrastructure in shaping sufficiency outcomes independently of individual behaviour. Thus, the structural results indicate a clear hierarchy of influences. Socio-economic factors, particularly energy price, are the most powerful predictors of energy conservation behaviour, while energy conservation behaviour itself plays a significant but partial role in achieving energy sufficiency.

Contextual factors, on the other hand, directly influence energy sufficiency without operating through behavioural mediation. These findings align with emerging energy sufficiency literature, which emphasises that behavioural change alone may be insufficient to achieve sufficiency outcomes without supportive institutional and structural conditions.

Table 5: Path Analysis for Energy Conservation as a Mediator

Path	Direct Effect	T Stat	*p*-values	f-square	VIF
aAgeN -> bENCSV	-0.069	0.668	0.504	0.002	1.042
aGenN -> bENCSV	-0.255	2.689	0.007	0.031	1.036
bENCSV -> Sufficency	0.039	0.332	0.740	0.001	1.910
cINT -> bENCSV	0.116	1.303	0.193	0.015	1.725
cINT -> Sufficency	-0.233	1.754	0.079	0.042	1.750
dSOEC -> bENCSV	0.532	6.393	0.000	0.279	2.005
dSOEC -> Sufficency	0.044	0.381	0.704	0.001	2.532
eCONT -> bENCSV	0.083	1.220	0.223	0.008	1.632
eCONT -> Sufficency	0.544	6.291	0.000	0.244	1.625
Path	**Indirect Effect**	**T Stat**	***p*-values**		
cINT -> bENCSV -> Sufficency	0.005	0.247	0.805		
dSOEC -> bENCSV -> Sufficency	0.021	0.332	0.740		
eCONT -> bENCSV -> Sufficency	0.003	0.227	0.820		
aAgeN -> bENCSV -> Sufficency	-0.003	0.175	0.861		
aGenN -> bENCSV -> Sufficency	-0.010	0.298	0.766		

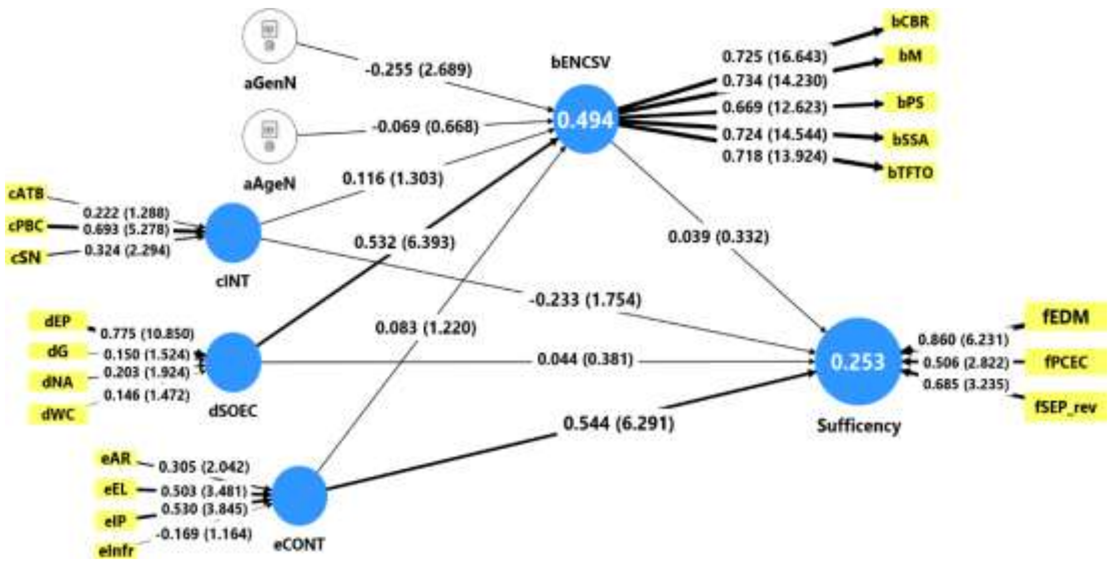

Figure 2: Path Analysis for Determinants, Energy Conservation Behaviour and Sufficiency

From a theoretical perspective, the results extend the application of the Theory of Planned Behaviour by demonstrating that while behavioural intentions and actions matter, socio-economic constraints and contextual structures can override psychological drivers in resource-constrained environments. Practically, the findings suggest that interventions aimed at improving energy sufficiency in a Nigerian university hostel should prioritise price-responsive mechanisms, demand management strategies, and institutional policy enforcement alongside behavioural awareness programmes. Strengthening monitoring practices and encouraging routine cutting behaviours may yield immediate gains, but long-term sufficiency outcomes are more likely when behavioural interventions are complemented by robust institutional and economic frameworks.

Table 6 presents the summary of hypotheses outcomes for the study. The hypotheses testing results indicate mixed support for the proposed relationships in the study. The first hypothesis, which posited that behavioural and psychosocial determinants have a significant positive effect on students' energy conservation behaviour, was partially supported. While socio-economic factors emerged as a strong and statistically significant predictor of energy conservation behaviour, internal psychological and contextual factors did not exhibit significant effects. This suggests that students' energy-saving actions in university hostels are influenced more by socio-economic conditions than by individual attitudes or perceptions alone. The second hypothesis, which proposed that energy conservation behaviour mediates the relationship between behavioural determinants and energy sufficiency, was not supported. The mediation analysis showed that none of the indirect effects through energy conservation behaviour were statistically significant. This finding indicates that, although energy conservation behaviour directly contributes to energy sufficiency, it does not act as a transmission mechanism through which behavioural, socio-economic, or contextual determinants influence sufficiency outcomes in the study context.

Table 6: Summary of Hypotheses Testing Results

Hypothesis	Statement	Path Tested	Result	Decision
H_{1a}	Determinant (Internal, Socio-economic, and Contextual) factors have a significant positive effect on energy conservation behaviour	Determinants -> Energy Conservation Behaviour	Socio-economic factors significant; internal and contextual factors not significant	**Partially accepted**
H_{1b}	Energy conservation behaviour has a significant positive effect on the energy sufficiency among students residing in university hostels.	Energy Conservation Behaviour -> Energy Sufficiency	Significant	**Accepted**
H_2	Energy conservation behaviour significantly mediates the relationship between behavioural and psychosocial determinants and energy sufficiency among students in university hostels	Determinants -> Energy Conservation Behaviour -> Energy Sufficiency	All indirect effects not significant	**Rejected**

DISCUSSION

The central contribution of this study lies in its empirical clarification of how behavioural, socio-economic, and contextual factors interact to shape energy conservation behaviour and energy sufficiency within university hostel environments in a resource-constrained Nigerian context. The findings demonstrate that while energy conservation behaviour plays a meaningful role in improving energy sufficiency, its capacity to act as a mediating mechanism between determinants and sufficiency outcomes is limited. Instead, socio-economic and contextual conditions emerge as more decisive influences, underscoring the importance of structural and institutional factors in shaping sufficiency-oriented energy outcomes. The results show that socio-economic factors exert a strong, positive, and highly significant influence on energy conservation behaviour, whereas internal psychological factors and contextual factors do not significantly predict such behaviour. Gender shows a statistically significant but small effect, while age is not a meaningful predictor. Energy conservation behaviour itself positively and significantly influences energy sufficiency, confirming that students who actively monitor, cut, and manage energy use experience better sufficiency outcomes. However, the mediation analysis reveals that energy conservation behaviour does not transmit the effects of the determinants to energy sufficiency, indicating the absence of a behavioural mediation mechanism in the model.

These findings are broadly consistent with, and extend, existing literature on energy sufficiency and behavioural energy studies. Prior studies conducted in student housing and institutional settings have similarly found socio-economic drivers, particularly energy cost and affordability, to be among the strongest predictors of conservation behaviour (Du and Pan, 2021; Malik *et al.*, 2024; Sahakian *et al.*, 2024). The strong effect of socio-economic factors observed in this study reinforces arguments that energy-saving behaviour in low- and middle-income contexts is often motivated less by pro-environmental attitudes and more by economic necessity. In contrast, the non-significant effects of internal psychological factors diverge from findings reported in several studies from high-income contexts, where attitudes, norms, and perceived behavioural control play a more prominent role (Ajzen, 1991; Li *et al.*, 2024). This divergence suggests that the explanatory power of psychological constructs may be context-dependent and constrained by material realities such as unreliable power supply and limited individual control over energy infrastructure. The absence of mediation further aligns with emerging sufficiency literature that questions the assumption that behavioural change alone can deliver sufficiency outcomes in institutional settings.

Recent studies emphasise that sufficiency is often shaped directly by contextual arrangements, such as infrastructure quality, institutional rules, and energy governance frameworks, rather than indirectly through individual behaviour (Dablander *et al.*, 2025; Sahakian *et al.*, 2024). The strong direct effect of contextual factors on energy sufficiency observed in this study supports this position and highlights the limits of behaviour-centred interventions in environments where students have restricted autonomy over energy systems.

From a theoretical standpoint, the findings refine the application of the Theory of Planned Behaviour within energy sufficiency research by demonstrating that while behaviour matters, its role is conditional and bounded by socio-economic and institutional constraints. The partial acceptance of the first hypothesis indicates that behavioural determinants are not uniformly influential, while the rejection of the second hypothesis underscores the need to integrate behavioural theories with structural and contextual perspectives when studying sufficiency outcomes in the Global South. The implications of these findings are both policy-relevant and practical. For university administrators and energy managers within the institutions, we derived implications from empirical point of view as reflected in the Appendix table where ‘conserving energy is a personal conviction’ leading to ‘unplugging electrical appliances when not in use’ is the most efficient way of energy conservation behaviour. This behaviour, unplugging appliances when not in use is a straightforward yet effective strategy for conserving energy. This habit can have a significant impact, particularly when considering the cumulative effect of multiple appliances and devices. According to the United States Environmental Protection Agency (EPA), many appliances continue to draw power even when turned off but still plugged in, a phenomenon known as "standby power" or "vampire power" (EPA, 2020). This can account for up to 10% of a household's energy consumption. Studies have shown that unplugging appliances can save around 5-10% of energy consumption, resulting in significant reductions in greenhouse gas emissions and energy costs (Meyers *et al.*, 2010). Such appliances that benefit from being unplugged include TVs, computers, printers, chargers, microwave ovens, and phone chargers (NESP, 2015). The Nigerian Energy Support Programme (NESP) recommends unplugging appliances as a key energy-saving measure, highlighting its potential to reduce energy waste and promote energy efficiency (NESP, 2015). Generally, by adopting this simple habit, individuals can contribute to a more energy-efficient lifestyle and reduce their energy bills. Meanwhile, the outcomes of the multivariate analysis suggest that efforts to improve energy sufficiency should not rely solely on awareness campaigns or attitude change programmes. Instead, interventions should prioritise socio-economic levers, such as pricing signals, usage feedback mechanisms, and demand management strategies, alongside improvements in institutional energy governance. Behavioural initiatives focused on monitoring and cutting energy use can yield incremental gains, but these gains are likely to be modest unless supported by enabling infrastructure and enforceable institutional policies. For policymakers, the findings reinforce the importance of integrating energy sufficiency considerations into campus energy planning, particularly in publicly funded universities facing persistent supply constraints.

Despite its contributions, the study has some limitations. The use of cross-sectional survey data restricts the ability to infer causality or capture behavioural changes over time. Self-reported measures of energy conservation behaviour may also be subject to social desirability bias. In addition, the relatively low explained variance in energy sufficiency suggests that important determinants, such as technical infrastructure performance, energy management practices, and institutional enforcement mechanisms, were not explicitly modelled. These limitations should be considered when interpreting the findings. Based on these limitations, future research could adopt longitudinal or mixed-methods designs to better capture dynamic behavioural changes and contextual influences on energy sufficiency. Further studies could also integrate technical and behavioural data, such as metered energy use, to strengthen causal inference. Comparative studies across multiple universities or regions would be valuable in assessing the generalisability of the findings and in identifying context-specific versus universal drivers of energy sufficiency.

In conclusion, this study provides empirical evidence that energy conservation behaviour contributes positively to energy sufficiency in university hostels, but it does not function as a mediating pathway between behavioural determinants and sufficiency outcomes. Socio-economic and contextual factors play a more decisive role in shaping both behaviour and sufficiency, highlighting the limits of behaviour-only approaches in resource-constrained institutional settings. By extending energy sufficiency research to a Nigerian university context and applying a theory-driven modelling approach, the study contributes context-specific insights that advance both theory and practice. Ultimately, achieving energy sufficiency in higher education institutions in the Global South will require an integrated approach that combines behavioural interventions with robust socio-economic and institutional reforms.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the financial support provided by TETFund and FUTA (TETF/DR&D/CE/UNI/AKURE/IBR/2024), which made this research possible.

REFERENCES

Abolarin, S. K., Gamawa, U. A., & Ago, M. M. (2022). Energy conservation metrics: knowledge, attitude and practice among students in ATBU, Bauchi, Nigeria. African Journal of Environmental Sciences and Renewable Energy, 5(1), 58-70.

Abubakar, I. R., Alola, A. A., Bekun, F. V., & Onifade, S. T. (2024). Investigating the determinants of household energy consumption in Nigeria: insights and implications. Energy, Sustainability and Society, 14(1), 29.

Adepoju, A., Ekundayo, K., & Oladiipo, A. (2023). Household energy conservation behaviour: A socio-economic perspective. Journal of Digital Food, Energy & Water Systems, 4(1).

Ajzen, I. (1991). Theory of planned behaviour. Organisational Behaviour and Human Decision Processes, 50(2), 179–211.

Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. Human behavior and emerging technologies, 2(4), 314-324.

Almeida, L. Dr. (2025). Energy: From efficiency to sufficiency. CIB Conferences, 1(1), 31.

Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. British journal of social psychology, 40(4), 471-499.

Bertoldi, P. (2022). Policies for energy conservation and sufficiency: Review of existing policies and recommendations for new and effective policies in OECD countries. Energy and Buildings, 264, 112075.

Best, B., & Santarius, T. (2022). Exploring energy sufficiency: New challenges and options in times of crisis.

Available at: https://epub.wupperinst.org/files/7997/7997_Best.pdf

Bishoge, O. K., & Mvile, B. N. (2024). Energy-saving practices among postgraduate students: A case study at the Pan African University. Aquademia, 8(2), ep24009. https://doi.org/10.29333/aquademia/15037

Bouillet, Q., & Grandclément, C. (2024). Sufficiency, consumption patterns and limits: A survey of French households. Buildings and Cities, 5(1), 675–691.

Carrus, G., Tiberio, L., Mastandrea, S., Chokrai, P., Fritsche, I., Klöckner, C.A., Masson, T., Vesely, S. and Panno, A., (2021). Psychological predictors of energy saving behavior: A meta-analytic approach. Frontiers in Psychology, 12, 648221.

Chen, Y., & Lotti, L. (2025). Evaluating the effectiveness of behavioural nudges in reducing energy consumption in student accommodation: a quasi-experimental approach. UCL Open Environment, 7, e3412.

Dablander, F., Hickey, C., Sandberg, M., Zell-Ziegler, C., & Grin, J. (2025). Embracing sufficiency to accelerate the energy transition. Energy Research & Social Science, 120, Article 103907. https://doi.org/10.1016/j.erss.2024.103907

Delmas, M. A., Giottonini, P., & Teng, G. (2024). Adolescents as energy conservation stewards. Sustainable Environment, 10(1), 2408926.

Du, J., & Pan, W. (2021). Examining energy saving behaviors in student dormitories using an expanded theory of planned behaviour. Habitat International, 107, 102308. https://doi.org/10.1016/j.habitatint.2020.102308.

Guilbert, J. (2024). Energy sufficiency and recognition justice: A study of household consumption. Buildings and Cities, 5(1), 489–505.

Hair, J. F., Astrachan, C. B., Moisescu, O. I., Radomir, L., Sarstedt, M., Vaithilingam, S., & Ringle, C. M. (2021). Executing and interpreting applications of PLS-SEM: Updates for family business researchers. Journal of Family Business Strategy, 12(3), 100392.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. European business review, 31(1), 2-24.

Hair, J., Hollingsworth, C. L., Randolph, A. B., & Chong, A. Y. L. (2017). An updated and expanded assessment of PLS-SEM in information systems research. Industrial management & data systems, 117(3), 442-458.

Hassan, N. A., Singh, D., & Hassan, R. M. (2024). Validation of energy conservation behaviour for Malaysia university students using exploratory and confirmatory factor analysis. EDUCATUM Journal of Social Sciences, 10(2), 104–115. https://doi.org/10.37134/ejoss.vol10.2.10.2024

Krejcie, R. V., & Morgan, D. W. (1970). Sample size determination. Educational and Psychological Measurement, 30, 607–610.

Kwakwa, P. A., Alhassan, H., Aboagye, S., & Asale, M. A. (2024). Electricity conservation intention among university students in northern Ghana: An assessment of the drivers for some electrical appliances. Cleaner and Responsible Consumption, 12, 100171. https://doi.org/10.1016/j.clrc.2024.100171

Lall, S., & Sethi, M. (2024). Operationalising energy sufficiency for low-carbon built environments in urbanising India. Buildings and Cities, 5(1), 645–661.

Li, J., Zeng, Y., Gu, Z., Chen, H., Chen, X., Zou, D., Liu, Y. and Deng, L. (2024). Research on the energy saving behaviors of university students based on TPB in a hot summer–cold winter area in China. Heliyon, 10(17). https://doi.org/10.1016/j.heliyon.2024.e36995

Liu, X., Yang, Y., Guo, L., Liao, L., & Xiao, L. (2023). Research on the factors influencing college students' energy-use behavior in dormitories: group-level factors and time factors. International Journal of Low-Carbon Technologies, 18, 836-849. https://doi.org/10.1093/ijlct/ctad071

Lundgren, B., & Schultzberg, M. (2019). Application of the economic theory of self-control to model energy conservation behavioral change in households. Energy, 183, 536-546.

Malik, J., Hong, T., Wei, M., & Rotmann, S. (2024). Prioritize energy sufficiency to decarbonize our buildings. Nature human behaviour, 8(3), 406-410.

Meyers, S., *et al.* (2010). Energy Consumption and Standby Power in California Homes. Lawrence Berkeley National Laboratory.

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

Nigerian Energy Support Programme (NESP). (2015). Energy Efficiency Guidelines for Households.

Ogbuanya, T. C., & Nungse, N. I. (2021). Effectiveness of energy conservation awareness package on energy conservation behaviors of off-campus students in Nigerian universities. Energy Exploration & Exploitation, 39(5), 1415-1428.

Olanipekun, E. A., & Iyiola, C. O. (2020).Awareness and electricity use behaviour of on-campus residence students in Nigeria. International Journal of Sciences: Basic and Applied Research, 54(2), 19–43.

Omar, S. R., Fukata, Y., Mohd Tahir, M., Ahmad, S. S., Sedek, M., & Shariff, T. I. S. (2025). Promoting energy efficiency in higher education: A study of behavioural and technological interventions. International Journal of Academic Research in Business and Social Sciences, 15(3), 2189–2200.

Onisanwa, I. D., & Adaji, M. O. (2020). Electricity consumption and its determinants in Nigeria. Journal of Economics and Management, (41), 87-104.

Sahakian, M., Fawcett, T., & Darby, S. (2024). Energy sufficiency in buildings and cities: Current research, future directions. Buildings and Cities, 5(1), 692–703. https://doi.org/10.5334/bc.519

Soaga, O. (2024, April 20). Over tariff hike, FUTA can no longer give students enough power. FIJ. Available at: https://fij.ng/article/over-tariff-hike-futa-can-no-longer-give-students-enough-power/

United States Environmental Protection Agency (EPA). (2020). Standby Power and Energy Star.

Yakubu, S., Abdulai, A. S., Maclar, M., Kuranchie, F. A., Latio, T. P. B., & Ladu, N. S. D. (2024). Potential of energy efficiency and conservation measures in residential buildings: Case study of student hostel in Ghana. Journal of Energy Conservation, 1(4), 23–41. https://doi.org/10.14302/issn.2642-3146.jec-24-4935

Zhang, J., Johnson-Wang, M., Khanna, N., Wei, M., Shoai-Tehrani, B., & Zhou, N. (2025). Energy sufficiency for deep decarbonization: A modelling framework. Nexus, 2(1), 100055. https://doi.org/10.1016/j.ynexs.2025.100055

Zhang, Y., Zhang, B., & Hou, J. (2024). Simulation study on student residential energy use behaviors: University dormitories in Sichuan, China. Buildings, 14(5), 1484. https://doi.org/10.3390/buildings14051484.

Zhou, Y., Sun, L., Hu, X., & Ma, L. (2021). Clustering and statistical analyses of electricity consumption for university dormitories: A case study from China. Energy and Buildings, 245, 110862.

APPENDIX: Descriptive Characteristics of Data Collected

Item	**Female/Age <20**	**Male/ Age>20**	**Median**	**Mode**						
aGenN	96	115	1	1						
aAgeN	123	88	0	0						
Item	**Description**	SD	DA	NDA	AG	SA	Median	Mode	Mean	STD
bPS1	I reduce electricity usage when electricity bills increase.	8	10	38	56	99	4	5	4.081	1.086
bPS2	I pay attention to electricity costs before using certain appliances.	9	16	45	88	53	4	4	3.758	1.048
bPS3	I avoid using high-energy-consuming appliances during peak billing periods.	7	9	51	62	82	4	5	3.962	1.050
bPS4	I am more likely to switch off unused devices to reduce my electricity bill.	4	14	26	62	105	4	5	4.185	1.014
bPS5	Electricity price influences how long I use electrical devices daily.	11	20	50	65	65	4	5	3.725	1.151
bPS	MEDIAN PS	4	6	49	87	65	4	4	3.962	0.909
bCBR1	I switch off lights when not in use.	9	10	27	59	106	5	5	4.152	1.089
bCBR2	I unplug electrical appliances when they are not in use.	5	2	28	67	109	5	5	4.294	0.904
bCBR3	I minimize the use of air conditioners and fans to save electricity.	8	15	41	76	71	4	4	3.886	1.072
bCBR4	I make conscious efforts to reduce energy wastage in my office/room.	10	18	42	67	74	4	5	3.839	1.139
bCBR5	I limit the number of electrical appliances I use daily to conserve energy.	9	22	63	62	55	4	3	3.626	1.107
bCBR	MEDIAN CBR	3	9	39	86	74	4	4	4.038	0.915
bUEI1	I prefer energy-efficient appliances even if they are more expensive.	12	18	46	61	74	4	5	3.791	1.177
bUEI2	I encourage the replacement of old appliances with energy-saving models.	6	7	51	76	71	4	4	3.943	0.984
bUEI3	I have upgraded lighting systems (e.g., to LED bulbs) in my space.	11	25	57	56	62	4	5	3.630	1.173
bUEI4	I consider energy efficiency when requesting new equipment.	10	24	43	65	69	4	5	3.754	1.165
bUEI5	I support university policies that promote upgrading to energy-efficient technologies.	8	4	40	66	93	4	5	4.100	1.021
bUEI	MEDIAN UEI	4	7	50	89	61	4	4	3.929	0.910
bM1	I monitor how much electricity I consume regularly.	20	28	45	64	54	4	4	3.493	1.266
bM2	I am aware of which appliances consume the most energy in my space.	7	17	38	76	73	4	4	3.905	1.069
bM3	I adjust my usage based on past energy bills or usage reports.	15	25	56	64	51	4	4	3.526	1.184
bM4	I discuss energy consumption with colleagues or roommates.	19	38	56	62	36	3	4	3.275	1.203
bM5	I use energy meters or indicators to track electricity consumption.	36	37	41	45	52	3	5	3.190	1.425
bM	MEDIAN MON	11	24	53	87	36	4	4	3.536	1.066
bTFTO1	I use appliances only when absolutely necessary.	7	4	35	67	98	4	5	4.161	0.992
bTFTO2	I consciously reduce the duration of using energy-consuming devices.	7	12	55	75	62	4	4	3.820	1.026
bTFTO3	I minimize the brightness level or settings of devices to reduce energy use.	9	17	54	72	59	4	4	3.735	1.085
bTFTO4	I ensure that only necessary lights or equipment are switched on.	5	9	38	69	90	4	5	4.090	0.994
bTFTO5	I share appliances (e.g., printers, fans) with others to reduce usage.	34	36	59	40	42	3	3	3.095	1.342
bTFTO	MEDIAN TFTO	3	5	56	87	60	4	4	3.929	0.878

bSSA1	I have replaced high-energy-consuming appliances with more efficient alternatives.	11	23	37	53	87	4	5	3.863	1.217
bSSA2	I opt for manual alternatives (e.g., using a hand fan) instead of electric devices when possible.	37	26	41	69	38	4	4	3.213	1.355
bSSA3	I prefer using natural lighting during the day instead of electric bulbs.	12	17	55	54	73	4	5	3.754	1.178
bSSA4	I have changed some daily routines to align with electricity-saving goals.	6	32	50	73	50	4	4	3.611	1.091
bSSA5	I encourage my peers or colleagues to adopt energy-saving practices.	14	24	54	58	61	4	5	3.607	1.204
bSSA	MEDIAN SSA	5	21	59	80	46	4	4	3.668	1.002
cATB1	Conserving energy is a worthwhile personal responsibility.	5	6	26	72	102	4	5	4.232	0.940
cATB2	I believe energy conservation enhances the university's sustainability.	7	13	32	91	68	4	4	3.948	1.010
cATB3	I feel good when I engage in energy-saving practices.	3	9	58	72	69	4	4	3.924	0.948
cATB4	Saving energy is a smart and beneficial practice.	4	8	31	78	90	4	5	4.147	0.937
cATB5	Energy conservation is important for future generations.	2	13	33	67	96	4	5	4.147	0.962
cATB	MEDIAN ATB	1	4	34	91	81	4	4	4.171	0.798
cSN1	My colleagues or friends expect me to conserve electricity.	16	34	53	57	51	4	4	3.441	1.231
cSN2	People who are important to me support energy-saving behaviour.	7	19	57	76	52	4	4	3.697	1.043
cSN3	I try to save energy because others in my environment do so.	10	37	64	62	38	3	3	3.384	1.112
cSN4	I would feel uncomfortable if I ignored energy-saving norms.	11	28	56	65	51	4	4	3.555	1.147
cSN5	Energy conservation is a socially encouraged practice in FUTA.	15	22	55	60	59	4	4	3.597	1.201
cSN	MEDIAN SN	3	23	69	78	38	4	4	3.592	0.954
cPBC1	I find it easy to conserve energy in my workplace/residence.	12	11	49	70	69	4	4	3.820	1.119
cPBC2	I have sufficient knowledge to make energy-saving decisions.	5	20	51	90	45	4	4	3.711	0.984
cPBC3	I can influence energy use in my environment.	5	23	66	65	52	4	3	3.645	1.043
cPBC4	I know what actions to take to reduce energy use.	3	20	52	77	59	4	4	3.801	0.999
cPBC5	I feel confident in my ability to consistently save energy.	10	12	62	70	57	4	4	3.720	1.070
cPBC	MEDIAN PBC	2	12	65	87	45	4	4	3.763	0.884
cPV1	I value conserving energy to protect the environment.	2	10	39	61	99	4	5	4.161	0.952
cPV2	I believe living simply and saving energy are morally right.	0	10	42	93	66	4	4	4.019	0.839
cPV3	I support energy policies aligned with fairness and equity.	1	11	61	69	69	4	4	3.919	0.930
cPV4	My personal values align with energy conservation efforts.	1	16	67	70	57	4	4	3.787	0.945
cPV5	I would adjust my comfort to help save energy.	19	20	60	56	56	4	3	3.521	1.232
cPV	MEDIAN PV	0	5	62	87	57	4	4	3.929	0.810
cAC1	I am aware that overconsumption of energy affects the environment.	5	9	26	65	106	5	5	4.223	0.982
cAC2	I understand the financial implications of high electricity usage.	2	10	38	85	76	4	4	4.057	0.903
cAC3	I know that energy conservation reduces carbon emissions.	6	11	52	62	80	4	5	3.943	1.045
cAC4	I am aware that my actions impact the university's energy costs.	7	17	41	70	76	4	5	3.905	1.083
cAC5	I realize that unnecessary energy use contributes to power shortages.	8	26	39	70	68	4	4	3.777	1.139
cAC	MEDIAN AC	1	6	39	95	70	4	4	4.076	0.819
dEP1	I am aware of the electricity rates charged within the university.	22	32	41	52	64	4	5	3.493	1.339
dP2	Electricity price influences the way I manage power usage.	7	20	70	53	61	4	3	3.668	1.093
dEP3	I reduce usage of high-power devices due to cost concerns.	7	20	50	70	64	4	4	3.777	1.083
dEP4	I seek cheaper alternatives when electricity becomes expensive.	9	25	60	67	50	4	4	3.588	1.102
dEP5	The high cost of electricity makes me consider conservation options.	9	17	48	81	56	4	4	3.749	1.068
dEP	MEDIAN EP	4	17	56	82	52	4	4	3.763	0.976
dAO1	My age influences my attitude toward conserving electricity.	19	29	47	55	61	4	5	3.521	1.285

dAO2	I believe older people are more energy-conscious than the young.	6	23	49	77	56	4	4	3.730	1.059
dAO3	Energy-saving practices are more common among certain age groups.	10	33	60	69	39	4	4	3.445	1.104
dAO4	I have developed energy-saving habits over the years.	6	24	60	72	49	4	4	3.635	1.049
dAO5	Younger generations are more open to using energy-saving technology.	15	17	56	67	56	4	4	3.626	1.166
dAO	MEDIAN AO	3	23	69	79	37	4	4	3.588	0.949
dG1	Gender plays a role in how energy is used in my environment.	32	39	45	51	44	3	4	3.171	1.359
dG2	I believe women are more attentive to switching off unused devices.	14	27	69	53	48	3	3	3.445	1.167
dG3	Energy conservation behaviours differ between males and females.	12	36	69	42	52	3	3	3.408	1.193
dG4	Gender-based roles influence how appliances are used.	18	37	64	58	34	3	3	3.251	1.175
dG5	I observe that energy-saving habits vary across genders in my unit.	20	38	57	51	45	3	3	3.299	1.254
dG	MEDIAN GENDER	10	34	73	60	34	3	3	3.351	1.078
dNA1	The more appliances I have, the harder it is to save electricity.	13	13	56	64	65	4	5	3.735	1.145
dNA2	I try to reduce the number of appliances to cut energy use.	11	23	74	68	35	3	3	3.441	1.056
dNA3	I prioritize energy-efficient appliances when purchasing.	6	32	70	52	51	3	3	3.521	1.101
dNA4	Having multiple devices increases my electricity bill significantly.	3	28	69	68	43	4	3	3.569	1.004
dNA5	I keep track of how many energy-consuming devices I use.	15	32	74	47	43	3	3	3.336	1.169
dNA	MEDIAN NA	2	21	85	75	28	3	3	3.502	0.880
dWC1	I use more electricity during extreme weather (e.g., heat).	6	15	32	72	86	4	5	4.028	1.051
dWC2	Weather conditions affect how long I run cooling or heating appliances.	3	14	41	88	65	4	4	3.938	0.947
dWC3	I increase fan or AC use during the hot season.	6	15	41	68	81	4	5	3.962	1.059
dWC4	Cold or wet weather prompts me to use energy-consuming appliances more.	10	20	54	73	54	4	4	3.668	1.101
dWC5	The weather influences my daily energy usage decisions.	5	12	60	65	69	4	5	3.858	1.018
dWC	MEDIAN WC	2	9	52	86	62	4	4	3.934	0.892
dNOR1	Electricity use increases with more people in a space.	5	3	22	52	129	5	5	4.408	0.908
dNOR2	It is harder to manage energy use when sharing a room/office.	5	5	48	89	64	4	4	3.957	0.917
dNOR3	I encourage co-occupants to adopt energy-saving practices.	3	16	69	69	54	4	3	3.735	0.974
dNOR4	We set collective rules in our office/room to reduce energy waste.	9	38	63	62	39	3	3	3.398	1.110
dNOR5	More people in a building mean appliance are used more often.	6	9	42	76	78	4	5	4.000	1.000
dNOR	MEDIAN NOR	1	4	48	98	60	4	4	4.005	0.796
eIP1	FUTA has clear policies promoting energy conservation.	16	13	53	62	67	4	5	3.716	1.193
eIP2	I am aware of the university's energy management guidelines.	14	28	59	65	45	4	4	3.469	1.160
eIP3	Energy-related policies are well communicated across departments.	23	24	76	46	42	3	3	3.284	1.221
eIP4	The university enforces energy-saving measures.	13	26	67	66	39	3	3	3.436	1.112
eIP5	I comply with institutional rules that encourage efficient energy use.	12	16	64	57	62	4	3	3.668	1.144
eIP	MEDIAN IP	8	18	73	78	34	4	4	3.531	0.987
eInfr1	Buildings in FUTA are equipped with energy-efficient systems.	13	21	69	59	49	4	3	3.521	1.135
eInfr2	The electrical infrastructure in my building supports conservation.	11	23	81	59	37	3	3	3.417	1.063
eInfr3	I have access to switches, timers, or automation tools to reduce energy use.	25	25	59	62	40	3	4	3.318	1.245
eInfr4	Poor infrastructure makes it difficult to conserve electricity.	4	26	57	64	60	4	4	3.711	1.068
eInfre5	Infrastructure upgrades are necessary for better energy management.	7	17	41	61	85	4	5	3.948	1.105
eInfre	MEDIAN INFRA	7	14	79	79	32	4	3	3.545	0.942
eEL1	I understand how electricity is billed and measured.	26	30	60	44	51	3	3	3.303	1.314

eEL2	I know the energy ratings of appliances commonly used in FUTA.	26	40	67	49	29	3	3	3.071	1.211
eEL3	I have learned how to reduce energy use through training or orientation.	19	41	75	36	40	3	3	3.175	1.208
eEL4	I can identify wasteful energy behaviours in daily operations.	9	29	69	62	42	3	3	3.469	1.088
eEL5	I feel adequately informed about best practices in energy conservation.	15	26	75	48	47	3	3	3.408	1.169
eEL	MEDIAN EL	11	36	81	53	30	3	3	3.261	1.066
eAR1	Energy-efficient devices are available for use in my department or office.	11	34	55	52	59	4	5	3.540	1.204
eAR2	My environment provides sufficient tools to help reduce electricity usage.	10	36	73	59	33	3	3	3.327	1.079
eAR3	I have access to support or technical help when managing energy issues.	11	45	75	41	39	3	3	3.246	1.141
eAR4	Lack of resources (e.g., meters, efficient bulbs) hinders energy-saving efforts.	10	28	57	66	50	4	4	3.559	1.130
eAR5	If given the right resources, I can do more to save energy.	16	15	42	62	76	4	5	3.791	1.221
eAR	MEDIAN AR	4	28	82	65	32	3	3	3.441	0.966
fPCEC1	I believe electricity use per person in my building is high.	19	34	54	45	59	3	5	3.431	1.294
fPCEC2	The number of appliances per person is excessive in my area.	25	47	55	53	31	3	3	3.085	1.239
fPCEC3	We can reduce individual energy consumption without affecting productivity.	20	30	66	50	45	3	3	3.332	1.228
fPCEC4	My daily energy use is higher than necessary.	41	56	54	34	26	3	2	2.754	1.282
fPCEC5	Per person energy consumption should be monitored and controlled.	28	28	68	56	31	3	3	3.161	1.224
fPCEC	MEDIAN PCEC	21	32	79	53	26	3	3	3.147	1.131
fEE1	Access to energy resources is fairly distributed across all departments.	18	32	51	69	41	4	4	3.393	1.204
fEE2	Some offices or units have more electricity supply than others. (reverse-coded)	19	36	48	68	40	4	4	3.351	1.223
fEE3	Everyone in FUTA should have equitable access to energy services.	11	19	52	60	69	4	5	3.744	1.159
fEE4	Differences in power allocation affect fairness and satisfaction in the university.	14	19	49	66	63	4	4	3.687	1.182
fEE5	The university should ensure that energy access is balanced for all users.	16	18	30	59	88	4	5	3.877	1.255
fEE	Median EE	11	14	45	89	52	4	4	3.744	1.065
fEDM1	FUTA has strategies in place to manage energy demand effectively.	16	30	61	51	53	3	3	3.450	1.223
fEDM2	I am aware of measures to shift energy use to off-peak periods.	19	46	60	54	32	3	3	3.161	1.192
fEDM3	Reducing peak demand is a major goal in university energy management.	15	28	75	54	39	3	3	3.351	1.138
fEDM4	I adjust my use of high-energy devices to avoid demand spikes.	11	30	70	56	44	3	3	3.436	1.125
fEDM5	I believe energy use can be better scheduled across the day.	17	20	47	57	70	4	5	3.678	1.250
fEDM	Median EDM	10	23	81	65	32	3	3	3.408	1.026
fSEP1	Current electricity practices in FUTA are not sustainable. (reverse-coded)	19	22	46	49	75	4	5	3.659	1.301
fSEP2	Energy-saving measures will benefit the university in the long run.	13	21	51	63	63	4	5	3.673	1.180
fSEP3	We need to adopt renewable energy options in FUTA.	13	8	42	52	96	4	5	3.995	1.169
fSEP4	Energy conservation is key to a sustainable campus environment.	13	10	45	68	75	4	5	3.863	1.140
fSEP5	The university is making progress toward long-term energy sustainability.	20	17	58	57	59	4	5	3.559	1.242
fSEP	Median SEP	11	6	43	80	71	4	4	3.919	1.059