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## **A Study of Awareness and Electricity Use Behaviour of On-campus Residence Students in Nigeria**

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### **Abstract**

The study explored the awareness and reported energy use behaviour among higher education students in Southwestern Nigeria; examined the relationship between the level of awareness of the impact of energy use behaviour of students and also provides strategies that could be used to improve the level of awareness of stakeholders. We adopted a quantitative survey and questionnaire as instruments for gathering relevant data from end users in the study area and relevant data were analysed using descriptive statistics. The findings revealed that end users had low level of awareness of the negative impact of energy use behaviour 201(81.4%) and had not been trained on energy saving measures. However, they were more aware of the positive impact of energy use behaviour 194(79.0%). The analysis also showed a significant relationship between awareness and reported energy use behaviour; awareness level and turning off light when not needed ( $r = 0.897$ ,  $p = 0.001$ ), awareness level and shutting down all computers unless in use ( $r = 0.189$ ,  $p = 0.044$ ) and awareness level and leaving computer running overnight ( $r = 0.452$ ,  $p = 0.003$ ). The study concluded that the level of awareness of energy saving measures of electricity end users was very low and consequently a lot of energy could be wasted in return. To maximize energy saving potentials of the students, there is need for authorities in tertiary institutions to make effort to raise the awareness of everyone involved; including the management of institutions through an energy efficiency awareness programme, as this could help higher education institutions to achieve energy sustainability and reduce waste. The study developed a framework for improving and enhancing students' awareness on the impact of energy use behaviour.

**Keywords:** Energy Consumption; Energy Conservation; Awareness; Impact of Energy Use Behaviour; Student's Hostel; Nigeria.

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## **1. Introduction**

Energy consumption is significant for the growth and development of an economy [56]. Its importance stemmed from its effect on infrastructure and socio-economic operations and subsequently on the standard of living of any country. Despite its importance, concerns about its use have been raised [7]. The concerns have been raised because of the increasing worldwide use of energy in building which is causing energy exhaustion and environmental effects (ozone depletion, environmental degradation, global warming, climate change, etc.) [47, 50, 51]. For this reason, energy management in buildings is now a key objective at regional, national and international level [51]. However, student housing is an essential part of facilities provided by higher education institutions to ease accommodation challenges and foster their academic performance [16, 40]. However, this facility or occupancy end up contributing to high energy demand and cost in higher education institutions [16, 21, 29, 34]. This means for higher education institutions to transit to sustainable efficient energy use, energy use in this occupancy must be addressed. Past efforts at addressing this issue had focused on efficient technological approach [4, 6, 9, 39, 55]. Although this approach is useful but literature provides evidence and proof that for higher education institutions to achieve sustainable efficient energy transition, energy users' behaviour must be understood [2, 21, 33, 35]. This is because the behaviour of energy users' equally affect energy use the same way as technology does. In fact, studies have shown that behaviour influences energy use in buildings as much as 50% and even more in some buildings [16, 29, 35, 36]. Studies have also shown that up to 30% of energy could be saved if there is an understanding of the behaviour of energy users [33, 61]. Besides, understanding users' behaviour could enable facility managers to understand other factors, minds and concerns of users that deliberately or unconsciously influence energy use in buildings. Building do not use energy, but the occupants use and their behaviour, norms, attitude, perception and belief can influence how energy is used in buildings [33]. Reference [23] asserted that although energy saving on campus is an increasingly important part of tertiary institutions responses to climate change, but can only be fully realized through partnership between institutions and students. It was also identified that personal consumption patterns (consumer behaviour, household energy use, dietary changes etc.) are crucial elements in the move towards lower carbon emissions, thus efforts to promote energy saving behaviour change form an important part of the policy agenda. It is equally important for users to be aware and know how their energy use behaviour has impact on the economy and environment including other issues that negatively affect human health and comfort [16, 34, 51]. Having an understanding of this, knowledge and awareness of their impact could make them change their behaviour regarding energy use in the study area. Also, by providing a better energy conservation awareness and knowledge, individuals will be able to take steps to conserve energy if they are properly informed on ways in which energy can be conserved and the importance of conserving energy. In the same vein, efficient knowledge and awareness of the effect of inefficient energy use behaviour in student housing will offer authorities of tertiary institutions an understanding of the extent of the problem as an important step to effectively mitigate it. There have been studies that investigated energy use in higher education institutions in Nigeria [3, 45, 47, 48, 50, 57], but there is a dearth of studies regarding residence students' level of awareness and energy use behaviour in Nigerian higher education institutions and as far as the authors of this article is concerned, there are no studies in this domain. Therefore, for higher education institutions in Nigeria to achieve sustainable efficient energy transition, residence students's level of awareness and energy use behaviour needs to be studied. In addition, the students' needs to

be aware of their energy consumption impacts on total energy consumption of higher education institutions and the economy. This is the gap the present study intended to fill. To complement existing studies in higher education institutions in Nigeria, this study investigated residence students' awareness, knowledge, attitude and perception of their consumption impact and energy use behaviour. The worth of this research is that awareness will help provide consumers with tailored advice and information on consistent, sustained and long term knowledge about ways in which behavioural factors influence actual energy savings. The outcome of this study will also be useful in promoting energy conservation behaviour among students thereby contributing immensely to the educational sector's ability to boost national and global economy.

## **2. Literature Review**

A considerable literature exists on the level of awareness of the impact of energy use behaviour within the context of higher education institutions. According to [53], awareness is the state or ability to feel or to be conscious about events, objects or sensory patterns. To be aware means to know, to realize or have knowledge and understanding that something is happening or exists. In view of this, Reference [5] measured and evaluated the degree of Awareness and Behaviour of Electricity Conservation at King Saud University. The study was carried out to study KSU faculty, administrators and students in order to measure their awareness and attitudes towards the negative impact of electricity consumption. The study found a low level of awareness among students towards the negative impact of energy consumption in the institution. Reference [22] mentioned that energy wastage action was due to absence of knowledge among students in public and private universities in Malaysia and no precise pattern was accessible to guide students to enhance the condition. In line with this, [61] also propagates that the issue for high energy consumption behaviour in University of Sheffield buildings was that the occupants cited a lack of awareness about the energy consumption of the building and a lack of personal control and responsibility for energy conservation. In addition, Reference [54] noted that in Kenya Universities, energy wastage occur in the institutions due to student's lack of awareness of the negative impact of energy consumption in the institutions and they have also not been trained on energy saving techniques. Reference [59] pointed that to change the ongoing character of individuals', information, education and awareness raising measures can be used to make the public aware of their behaviour and consumption patterns. Energy awareness can be developed through the transmission of a message of knowledge and understanding that is suitable. Reference [14] argues that awareness of action is an important requirement for proper behaviour and would constitute an important obstacle to action if the amount of awareness is limited. People cannot be concerned about environmental issues unless they are aware of them and cannot act in an environmentally friendly manner unless they understand the consequences of their specific behaviour. On the contrary, Reference [26] pointed that education has played a role in raising awareness of energy efficiency and environmental problems, but did not necessarily result in sustained behavioural modifications across university campuses among students. Reference [22] further emphasized the importance of increasing awareness, but most energy managers are still not paying attention to its advantages because facilities tend to be skeptical of behavioural strategy and have little knowledge of them and their capacity. Reference [58] investigated domestic energy consumption behaviour and public awareness of renewable energy in Qatar. The study found that efficient energy monitoring, usage and environmental impact is dependent on users' education and awareness. This suggests that a greater awareness of the effect of excessive energy use is required through sustainability education to motivate

behavioural change. The result of the study was analysed using self-determination and hierarchal needs theories indicating that education and awareness were the best option for domestic energy conservation. Reference [31] determined energy awareness and energy saving behaviour of secondary school students according to socio-demographic characteristics. The result indicated that the secondary school students had a high level of awareness about renewable energy sources and saving; however, they had a moderate level of interest in energy. Evidence by [44] also noted that energy wastage tends to happen in Malaysian University due to lack of energy awareness and inefficient use of energy among the students. In achieving this, the study showed that raising appropriate energy awareness and improving energy use behaviour among students can improve the energy performance of university. Reference [8] analyzed sustainability awareness among higher education faculty members in Saudi Arabia. The study noted that there is no definitive understanding among faculty members about the concept of sustainability in higher education at the university. In addition, the study opined that the role of faculty members is crucial to strengthen the awareness and knowledge about sustainability in higher education among the new generation. Reference [42] assessed the knowledge and awareness of sustainability initiatives among college students. The findings indicates that only minority of the students knew what sustainability was, but 95.8% indicated it was important, while majority of the students were not aware of it. The study concluded that majority of the students were not conversant with sustainability issues and were largely unaware of campus sustainability initiatives. The study recommended more effort to increase sustainability initiatives on campus involving faculty, staff and students in such endeavors and educational programs should incorporate sustainability into their curriculum to increase students' knowledge and consciousness regarding these issues. Based on the foregoing, this study conceptualizes energy use behaviour in the form of awareness level of the impacts of inefficient energy use. Increased awareness on environmental sustainability in individuals is not present only at the global scale, but also on the level of house occupants who are interested in contributing to sustainable living by reducing their energy consumption. Therefore, in order to change consumers' behaviour, consumers first need to become aware of their energy consumption and energy issues and also to provide adequate information. Raising awareness of energy use is then a study issue that pose the challenge of assigning responsibility also to individuals to make the energy system more sustainable and effective. Energy use behaviour refers to human actions that affect the way energy is being consumed. It can also be referred to the way in which energy related technologies are being used and the mental processes that relate to these actions whether positive or negative [35]. Reference [17, 59] carried a study on energy consumption behaviour as cited in studies on energy management intervention. The result revealed that the majority of the students sampled are not very much aware of energy management practices as they don't replace incandescent with CFL lamps, switching off lights when not leaving for a period. Furthermore, Reference [12] found out that students energy use behaviour in higher education institutions in Ghana were attributed to not turning off light in their rooms when not needed, leaving electrical gadgets unplugged, constant boiling of water, not turning down water heater thermostat and not maximizing the use of natural lighting whenever possible by turning off lights in the room when there is adequate daylight. Reference [62] characterised energy saving behaviour of the residence students in Macau as failure to turn off light when going out, turning off air conditioning in dormitory when leaving the room, shutting down computers when going out. Reference [43] mentioned that student's laziness to wake up and switch off light in the room at night, leaving bulbs on when not in use, failure to install energy saving bulbs and purchase of low energy consumption equipment. However,

these studies did not compare their level of awareness among different groups and categories of students. Many studies have also been conducted regarding energy use in Nigeria. For instance, Reference [50] suggested that energy consumption in the University is on the increase and can possibly be reduced by enhancing the efficiency of electrical appliances, utilisation of day-lighting, maximizing natural ventilation and better management practices. It was further concluded that a well- dictated and strongly pursued energy efficiency policies in the university can lead to an estimated annual savings of 16% in electricity consumption. Reference [47] examined the patterns of electricity use and determined the proportion of electricity consumption by various stakeholders in tertiary institutions in Southwestern, Nigeria. The result indicated that lighting, cooking and space cooling are the major electricity consuming activities that are majorly performed in the student's residence. Reference [28] investigated energy demand and its utilization in Federal Polytechnic, Ilaro. The study found that inefficient energy use in the institution occurs as a result of the electrical appliances and gadgets used by students in the dormitories. Reference [37] also mentioned that in students housing in Ramat Polytechnic, Maiduguri, energy use is on the increase in the institution due to increased use of air-conditioning system, lighting and electrical equipment. Reference [49] investigated the level of compliance to electricity energy efficiency practice by residential households in Lagos Metropolis. The result found that the type of appliances used by consumers in households and their compliance to energy efficiency influence energy conservation in the area. Also, the result revealed that consumers in households have poor attitudes towards energy efficiency practices both behaviorally and technologically. Reference [3] conducted a survey on the energy consumption and demand of electricity in University of Lagos. The study categorize electrical energy end-use at the University of Lagos includes space cooling that includes all the energy used for ventilation and air conditioning equipment. Reference [11] also determined the behaviour affecting high energy consumption behaviour among students in Indian higher education institutions students. The result found that the high increase of inefficient energy use in the institutions were attributed to students energy use behaviour such as leaving light on when not occupied, leaving laptops on when not in use, leaving fans and air-conditioning systems on when the rooms are not occupied. However, these studies neither investigate nor compare energy use behaviour and level of awareness as well as the knowledge of the impacts of energy use behaviour among the respondents. This is the gap the present study intended to fill to complement existing studies on energy consumption and its conservation in higher education institutions in Nigeria. Several studies have also revealed how user's awareness on energy issues can be raised or improved. For instance, Reference [52] carried out a research in Sonora University in Mexico found that electricity use was reduced by 32 percent in residences at a US university after a combination of interventions such as feedback on energy performance and incentives for saving energy. Reference [15] similarly found that providing regular feedback and incentives to students resulted in energy savings ranging from 10.7 to 16.2 percent n residences at Otago University, New Zealand. A study by [26] carried out in University of Kent in UK found energy savings of 5-15% via energy feedback meters and real-time electricity feedback display. Reference [38] also found that providing information on energy conservation translated into energy savings in residences at Stellenbosch University, South Africa. According to a research carried out by [10], the provision of rewards for efficient behaviour towards energy consumption seemed to encourage residence based social norms which according to respondents helps to encourage energy users to save energy. Reference [46] affirmed that the provision and importance of incentives encourages change in energy use behaviour of students in hostels at Indiana University, USA. Also, in a

research carried out by [41] in Saudi Arabia, interviewee identified the unavailability of incentives as a barrier for green buildings in Saudi Arabia. It was noted that the existence of incentives is as important as the existence of penalties. In the same vein, Reference [18] found that competition was a good motivator among students in encouraging efficient energy conserving behaviour. Activities such as competitions, challenges and contests combined with award programs could encourage and motivate students to participate in the program. Award program can also help build momentum, generate interest and motivate behavioural change. This suggests that provision of incentives can potentially enhance energy use behaviour among students in order to achieve a collective goal. Awards can range from small items such as compact fluorescent lamps, T-shirt, setback thermostats, etc. Reference [10] carried out a study on action for increasing energy saving behaviour in student residences at Rhodes University, South Africa. The result reviewed that feedback on energy saving performance was given to students of FT group. The result shows lower energy consumption rates in the FT group. The result suggests that behaviour change interventions can be an important tool for encouraging energy use behaviour in common spaces such as university residences. The result further suggested competition among residences and provision of rewards to residences demonstrating good environmental practices as this would be important for the students to decide the form of rewards they want as this may enable the incentives to be in line with student's needs. Reference [34] further carried out a research in Bowdoin and Colby College in Brunswick, Maine in 2015 in which the university decided to launch a contest to decrease the quantity of electricity used by students in the university hostels for some weeks, the electricity use between the schools was monitored and analyzed to know which school could conserve electricity more. Colby College was able to decrease its consumption of electricity by 7%, while Bowdoin College was able to decrease its consumption by 8.7%. Reference [24] research in Williams College, Williamston, Maine increased environmental literacy and reduced energy consumption through an energy conservation project called the 'Do it in the Dark Energy Saving Competition'. This project was designed to reap short-term reductions in energy consumption and to creating general environmental awareness that could promote further reductions. The Williams program involved an energy competition between individual residential houses and spanned a one month period. Energy consumption was reduced by 40% in the first phase. In the second phase, energy consumption was reduced by 12%. Reference [63] examined effective education for energy efficiency on 321 students and their parents. The paper describes the result of an energy thrift information and education project taking place at different levels of education in Crete-Greece. The result proves that this behaviour changes to a more energy efficient one after the dissemination of relevant information and the participation of individuals in the energy education projects. Reference [17] reviewed a study on Intrinsic Changes on Energy Saving Behaviour among Resident University Students. The result revealed that student's feedback on the ecoMeter promoted a greater awareness of appliance energy consumption and a reminder to perform the selected behaviours, commonly switching off unused appliances or lights. Students indicated that the ecoMeter helped to reduce energy consumption but had a greater impact on helping the students understand the importance and ease of reducing energy. The result suggested that the ecoMeter contributed to a greater awareness of energy usage and facilitate reduced energy consumption. The success of the above mentioned interventions in promoting energy savings is attributed to awareness raising and increasing knowledge on the environmental benefits of engaging in pro-environmental behaviour and provision of tips for saving energy which cultivates positive attitudes towards the environment. From the foregoing, the literature has shown the importance of awareness and energy use behaviour of residence

students. Therefore, it is equally important and necessary to domicile this in the Nigeria context and find reasons behind unsustainable use of energy in student's halls of residence in tertiary institutions in Nigeria.

### **3. Methodology**

A multi-stage sampling technique was used for the study. In the first stage, purposive sampling was used to select relatively tertiary institutions and students' halls of residences. In this regard, Obafemi Awolowo University (OAU); Rufus Giwa Polytechnic, Owo (RUGIPO); and Adeyemi College of Education (ACE) were selected. The second stage was the stratification of electricity users in students' hostels. Student halls were categorized into two: undergraduate and postgraduate hostels. Student hostels were purposively selected to capture variation in gender and levels of study. In OAU, RUGIPO and ACE, Awolowo hall, Male hall 8 and Kiladejo male hall respectively were selected as representatives of male undergraduate hostels in the three tertiary institutions, while Moremi hall, Female hall A and Cafe female hall were selected as female undergraduate students in OAU, RUGIPO and ACE, respectively. Muritala Muhammed Postgraduate hall in OAU for both Male and Female students were also sampled. The population of students occupying these hostels earlier determined were 1021, 184 and 170 for Moremi, Female hall A and Cafe female hall, respectively; 1120, 228 and 128 for Awolowo, Male hall 8 and Kiladejo male hall, respectively, while there were 1013 students in Muritala Muhammed PG hall. Five percent (5%) of the students was selected in OAU and twenty percent (20%) of the students was selected in RUGIPO and ACE. Using this method, 157, 83 and 60 students were sampled in OAU, RUGIPO and ACE respectively. The sample size determined for students in OAU, RUGIPO and ACE were 157, 83 and 60 respectively. We adopted quantitative survey and questionnaire as instrument to gather relevant data from electricity end users in the study area. The data were compiled and analyzed using SPSS 17.0.

### **4. Results and Discussion**

The general information about the respondents in the sampled tertiary institutions is presented in Table 1. Over half (50.6%) of the entire respondents were male and 49.4% were female. Over half (81.4%) of respondents that participated in the survey were between 20- 29 years, followed by age group 30-39 years (18.2%) while the least age group was 50 years and above (0.0%). Also, 24.7% of the respondents earns income of about #5000-10000, 32.4% of the respondents earns income of about #10000-15000 while the least income level was #20000 and above (16.2%). Meanwhile, more than half (70.9%) of the entire respondents were Yoruba's; 24.7% of the respondents were from the Igbo tribe while 4.0% of respondents that participated in the survey were from the Hausa tribe.

**Table 1:** General information of respondents

<b>Socio-demographic characteristics</b>	<b>Frequency (n)</b>	<b>Percentage (%)</b>
<b>Gender</b>		
Male	122	49.4
Female	125	50.6
<b>Age Group (Years)</b>		
20-29yrs	201	81.4
30-39yrs	45	18.2
40-49yrs	1	0.4
50 and above	0	0.0
<b>Academic Qualification</b>		
OND	41	16.6
HND	27	10.9
NCE	42	17.0
B.A.	12	4.9
B.Ed.	27	10.9
B.Sc.	56	22.7
M.Sc.	31	12.6
Ph.D.	11	4.5
<b>Marital Status</b>		
Single	235	95.1
Married	0	0.0
Separated/Divorced	2	0.8
Others	0	0.0
<b>Income level</b>		
#5000-10000	61	24.7
#10000-15000	80	32.4
#15000-20000	66	26.7
#20000 and above	40	16.2
<b>Ethnic Group</b>		
Yoruba	175	70.9
Hausa	10	4.0
Igbo	61	24.7
Urhobo	0	0.0
Isekiri	0	0.0
Others	1	0.4

#### 4.1. Positive Impacts of Energy Use Behaviour



Table 2 below showed the positive impact of energy use behaviour of respondents in the tertiary institutions sampled. The result of the analysis as presented showed that 194(79.0%) of the respondents were aware that energy efficiency have positive impact on the environment while 53(21.5%) of the respondents revealed that they were not aware that energy efficiency have positive impact on the environment.

**Table 2:** Positive impact of energy use behaviour

Positive Impacts	Frequency (n)	Percentage (%)
Yes	194	79.0
No	53	21.5

The result was also supported by some comments made by some respondents in the study area:

*Akinlade Oluwanifemi*

*“I think that energy efficiency will help alleviate poverty, energy affordability and access as energy demand and bills are reduced for the poor, households will have the ability to acquire more and better energy services, as well as free up income to spend on satisfying other critical needs”.*

*Babajide Damilare*

*“I believe that investment in energy efficiency and the increased income can lead to direct and indirect job creation in energy and other sectors. It can also make energy efficiency an important part of the governments green growth strategies”.*

*Akinpelu Daniel “I am of the opinion that if energy demand is reduced significantly across several markets, energy prices and bills can be reduced thereby improving the finances and budget of tertiary institutions and also the economic welfare of the country and the availability of resources for other expenditures”.*

Therefore, the result implied that students were more aware of the positive impact of energy use behaviour to the environment and the society at large.

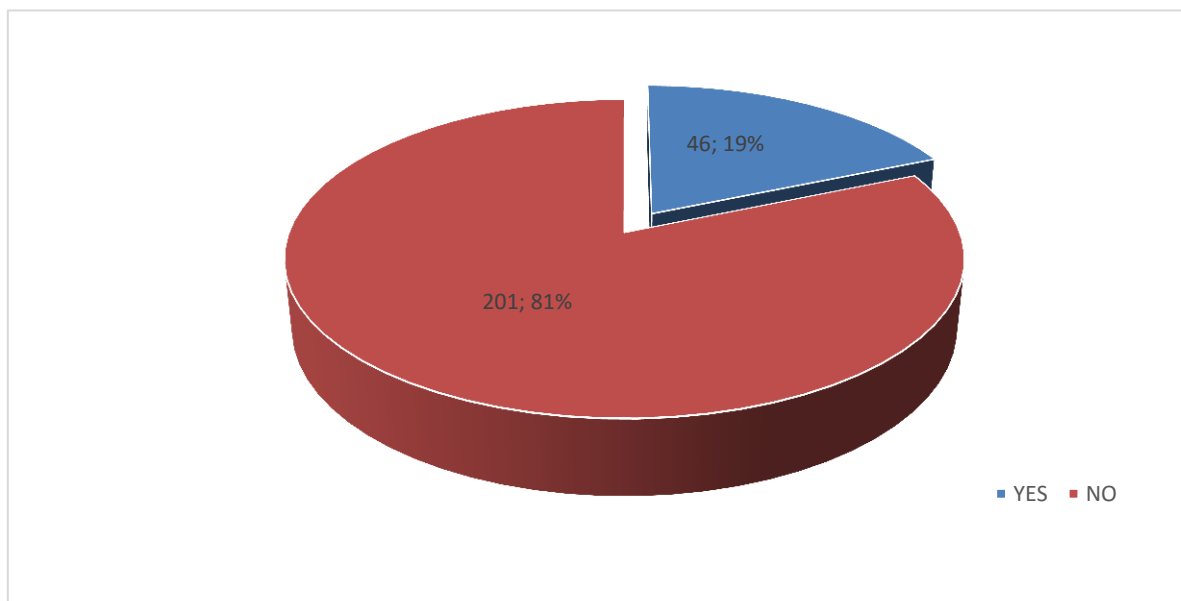
#### **4.2. Negative impact of energy use behaviour**

Table 3 showed the negative impact of energy use behaviour of respondents in the tertiary institutions sampled. The result of the analysis as presented showed that 46(18.6%) of the respondents were aware that energy use behaviour have negative impact on the environment while 201(81.4%) of the respondents revealed that they were not aware that their energy use behaviour have negative effect on the environment. The result implied that

majority of the students in the sampled tertiary institutions were not aware that their energy use behaviour could cause negative effects to the environment.

**Table 3:** Negative impact of energy use behaviour

Negative Impacts	Frequency (n)	Percentage (%)
Yes	46	18.6
No	201	81.4



**Figure 1:** Awareness of the negative impact of energy use behaviour

#### **4.3. Level of awareness of the negative impact of energy use behaviour**

Table 4 showed the level at which respondents were aware of the identified negative impact of energy use behaviour in the tertiary institutions sampled. The respondents (students) were required to provide information on the level of awareness of all the 9 identified negative effect of energy use behaviour using a 5-point likert scale of 1-not aware, 2-slightly aware, 3-somewhat aware, 4-moderately aware and 5-extremely aware. The result of the survey as presented showed that the majority of the respondents had a low level of awareness of at least one type of the identified negative impact of energy use behaviour in student's housing with maintenance problem (MIS = 4.78), blackout (MIS = 4.65) and burden on institutions finance and budget (MIS = 4.44) having highest level of awareness in their descending order of magnitude. The least level of awareness of the negative impact of energy use behaviour were global warming (MIS = 3.85), exhaustion of energy resources (MIS = 3.22) and increase in institution's energy bills (MIS = 3.00).

**Table 4:** Level of awareness of the negative impact of energy use behaviour

Level of Awareness	NA	SA	SO	MA	EA	MIS	SD	RANK
Maintenance problems	138	80	23	6	0	4.78	0.835	1 <sup>st</sup>
	(55.9)	(32.4)	(9.3)	(2.4)	(0.0)			
Blackouts	146	71	23	7	0	4.65	0.778	2 <sup>nd</sup>
	(59.1)	(28.7)	(9.3)	(2.8)	(0.0)			
Burden on institutions finance and budget	129	83	24	10	1	4.44	0.777	3 <sup>rd</sup>
	(52.2)	(33.6)	(9.7)	(4.0)	(0.4)			
Ozone layer depletion	177	50	9	8	3	4.30	0.720	4 <sup>th</sup>
	(71.7)	(20.2)	(3.6)	(3.2)	(1.2)			
Scarcity in electricity supply	158	56	22	11	0	4.22	0.843	5 <sup>th</sup>
	(64.0)	(22.7)	(8.9)	(4.5)	(0.0)			
Degradation of the environment	126	85	27	9	0	4.00	0.813	6 <sup>th</sup>
	(51.0)	(34.4)	(10.9)	(3.6)	(0.0)			
Global warming	146	76	21	4	0	3.85	0.760	7 <sup>th</sup>
	(59.1)	(30.8)	(8.5)	(1.6)	(0.0)			
Exhaustion of energy resources	140	82	17	7	1	3.22	0.812	8 <sup>th</sup>
	(56.7)	(33.2)	(6.9)	(2.8)	(0.4)			
Increase of institution energy bills	135	69	33	7	3	3.00	0.897	9 <sup>th</sup>
	(54.7)	(27.9)	(13.4)	(2.8)	(1.2)			

#### 4.4. Energy use behaviour of students

Table 5 showed the response of students' energy use behaviour that influence high energy use in the study area. Using the Yes or No response, the result showed that 63(25.5%) of the students turn off light when not needed while 184(74.5%) of the students do not. 96(38.9%) of the students also shut down all computers unless in use while 151(61.1%) of the students claimed they do not. 87(35.2%) leave computers running overnight while 161(65.2%) of the students claimed they do not. Also, 74(30.0%) of the students turn off or unplug electrical equipment when not in use while 173(70.0%) of the students do not turn off or unplug electrical equipment when not in use. In the same vein, 134(54.3%) of the students set their laptops to hibernate or sleep mode at night while 113(45.7%) of the students do not set their laptops to hibernate or sleep mode at night. Therefore, it can be concluded that the following energy use behaviour influence high energy use: putting electrical

equipment and appliances on standby mode, leaving appliances on the temperature, the humidity and speed velocity in when they are not needed, not turning off light when not needed, not shutting down computers unless in use, leaving computer running overnight, unplugging electrical equipment and appliances when not in use. The result implied that a large number of students do not engage in energy saving measures.

**Table 5:** Response of students' energy use behaviour

Do you turn off light when not needed		
	Frequency	Percentage
Yes	63	25.5
No	184	74.5
Total	247	100.0
Do you shut down all computers unless in use		
Yes	96	38.9
No	151	61.1
Total	247	100.0
Do you leave computer running overnight		
Yes	87	35.2
No	161	65.2
Total	247	100.0
Do you turn off or unplug electrical equipment when not in use		
Yes	74	30.0
No	173	70.0
Total	247	100.0
Do you set your laptop to hibernate or sleep mode at night		
Yes	134	54.3
No	113	45.7
Total	247	100.0

#### **4.5. Relationship between awareness level and energy use behaviour of students**

The study examined the relationship between awareness level and energy use behaviour of students. This was necessary to enhance understanding of specific energy use behaviour of students associated with level of awareness in students' hostels. Pearson's Correlation was employed for this analysis. This statistical technique was adopted to test the proposed relationship. The correlation analysis showed a significant relationship between awareness level and turning off light when not needed ( $r = 0.897$ ,  $p = 0.001$ ), awareness level and shutting down all computers unless in use ( $r = 0.189$ ,  $p = 0.044$ ) and awareness level and leaving computer running overnight ( $r = 0.452$ ,  $p = 0.003$ ). During the course of this research, some of the respondents reported that lack of awareness is the reason why they have refused to turn off light when not needed, not shutting down computers when not in use, leaving computers running overnight, not unplugging electrical equipment when not in use etc. This indicated that awareness is related to the behaviour of energy users which means awareness is prior to

effective consumer's behaviour while lack of awareness leads to ignorant and energy wastage. From the result in Table 6, awareness level correlates with energy use behaviour. Therefore, it is necessary to make sure students are aware of the negative impact of energy use behaviour and various strategies should be inculcated to curb the excessive use of energy by students in the hostels.

**Table 6:** Correlation analysis between awareness level and energy use behaviour

		Awareness level	Turning off lights when not needed
Awareness level	Pearson Correlation	1	0.897**
	Sig. (2-tailed)		0.001
	N	201	201
Turning off lights when not needed	Pearson Correlation	0.897**	1
	Sig. (2-tailed)	0.001	
	N	201	201
		Awareness level	Shutting down all computers unless in use
Awareness level	Pearson Correlation	1	0.189**
	Sig. (2-tailed)		0.044
	N	201	201
Shutting down all computers unless in use	Pearson Correlation	0.189**	1
	Sig. (2-tailed)	0.044	
	N	201	201
		Awareness level	Leaving computer running overnight
Awareness level	Pearson Correlation	1	0.452**
	Sig. (2-tailed)		0.003
	N	201	201
Leaving computer running overnight	Pearson Correlation	0.452**	1
	Sig. (2-tailed)	0.003	
	N	201	201

\*\*Correlation is significant at the 0.01 level (2-tailed)

Here are some comments made by respondents below to support this point;

*Olumakin Tosin*

*"I have not been trained on energy saving measures, I am not even aware of the impacts of wasting energy".*

*Ayoola Deji*

*"I believe that energy is a necessity and should be free and readily available. At least it is part of the amenities that one should enjoy in the country which is why I don't consider the need for energy conservation".*

*Makinde Olamide*

*"In all my four years in school, I have not heard anything about energy saving measures, I don't even know that my energy use behaviour causes increase in the institution energy bills".*

*From this comments, it can be deduced that students have not been trained on energy saving measures or how energy can be conserved.*

#### **4.6. Differences in Awareness Level**

In this section, the test of differences between respondents' awareness level across socio-demographic attributes was determined. This was achieved using Kruskal-Wallis and Mann-Whitney U test. Table 7 indicated that the respondents' awareness differed significantly across different age groups ( $\chi^2 = 5.348$ ,  $p = 0.048$ ). The result showed a significant difference in the means of awareness across age groups. A mean rank of 131.88 suggested that respondents between the age group 27-32yrs had the greatest exposure to awareness of energy use behaviour. This could be because younger people tends to have lesser knowledge about environmental issues than the older ones.

**Table 7:** Kruskal-Wallis test of differences between age and awareness level

Age	N	Mean Rank	$\chi^2$	df	Sig.
Under 20yrs	45	131.19	5.348	3	0.048
21-26yrs	111	116.58			
27-32yrs	64	131.88			
33-38yrs	27	123.87			

Significant level of  $p < 0.05$

Mann-Whitney U test was conducted to determine the differences of respondents' awareness level across gender and awareness level of respondents. Table 8 indicated that the respondents' awareness does not differ significantly across gender ( $U = 7289.00$ ,  $p = 0.375$ ). However, this study agrees with [32] that found no significant difference between gender and level of awareness of individuals.

**Table 8:** Mann-Whitney U test of difference between gender and awareness level

	Gender	N	Mean Rank	Mann-Whitney U	Sig.
Awareness Level	Male	122	121.25	7289.00	0.375
	Female	125	126.69		

Mann-Whitney U test was conducted to determine the differences of respondents' awareness level across gender and awareness level of respondents. Table 9 showed that there was no significant difference between students' academic qualification (U = 147.50, p = 0.333) for Ph.D./M.Sc., (U = 858.00, p = 0.901) for M.Sc./B.Sc. (U = 165.00, p = 0.895) for NCE/B.Ed. and (U = 545.50, p = 0.879) for those with OND/HND. The result indicated that academic differences of respondents does not necessarily mean that energy will be conserved.

**Table 9:** Mann-Whitney U test of difference between academic qualification and awareness level

	Academic qualification	N	Mean Rank	Mann-Whitney U	Sig.
Awareness Level	Ph.D.	11	19.41	147.50	0.333
	M.Sc.	31	22.24		
	Total	42			
	M.Sc.	31	44.32	858.00	0.901
	B.Sc.	56	43.82		
	Total	87			
	NCE	42	25.57	165.00	0.895
	B.Ed.	8	25.13		
	Total	50			
	OND	41	34.30	545.50	0.879
	HND	27	34.80		
	Total	68			

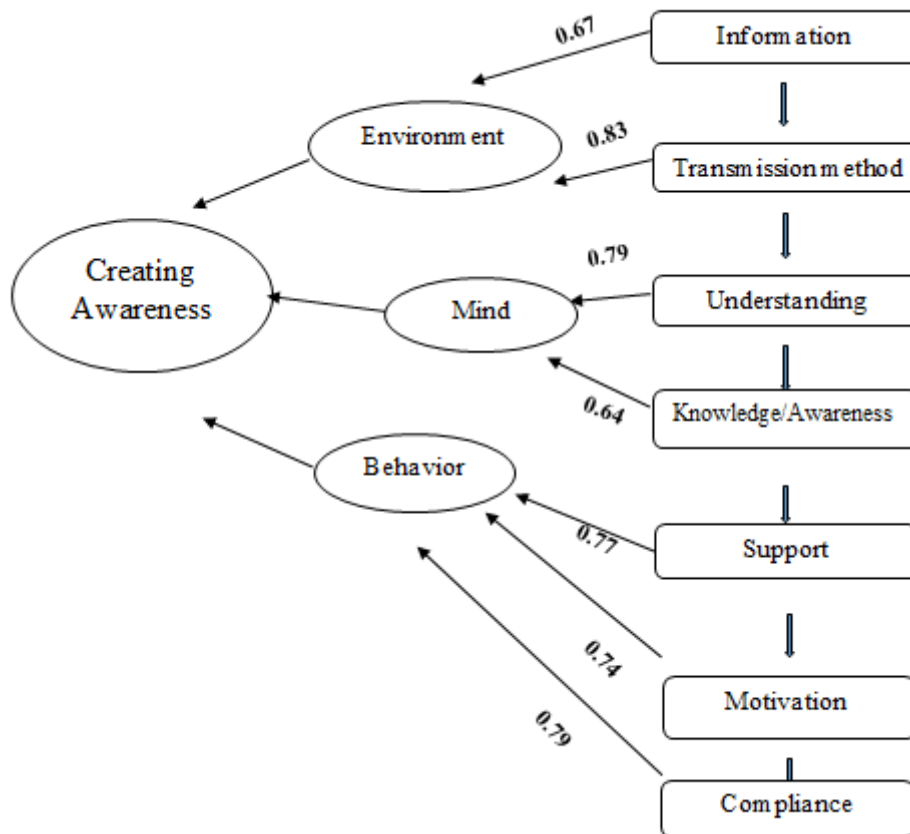
The differences between the ethnic group of respondents and awareness level was tested using Kruskal-Wallis test. Table 10 showed that there was a significant difference between awareness level and the ethnic group of respondents ( $\chi^2 = 5.976$ , p = 0.011). A mean rank of 224.50 suggested that respondents of ethnic group (Yoruba) had the greatest level of awareness.

**Table 10:** Kruskal-Wallis test of association between ethnic group and level of awareness

Ethnic group	N	Mean Rank	$\chi^2$	df	Sig.
Yoruba	175	224.50	5.976	3	0.011
Igbo	61	127.32			
Hausa	10	138.05			
Others	1	127.21			

#### 4.7. Strategies for improving the level of awareness of students

Figure 2 showed the strategies that could be used for improving the level of awareness of students in the study area.

**Figure 2:** Framework for Energy Efficiency Awareness Process

## 5. Discussion and Implications

From the results, it was revealed that majority of the students were not conversant with the negative impact of their energy use behaviour and were largely unaware of the issues that their energy use behaviour could cause to the institution and the environment at large. This result is also in accordance to the study of [61, 43] which pointed that lot of energy wastage occurred in the University of Sheffield and Kenya Universities due to lack of



awareness among students. Therefore, the significance of this study have been justified which implies that awareness and knowledge are the first stumbling block that must be conquered in achieving sustained energy use in tertiary institutions and the society at large. According to [19], consumer's awareness (either consciously or unconsciously) precedes the control, amendment, eradication and modification in consumer's behaviour. Thus, effective consumer behaviour can only be assured through awareness. Therefore, in order to maximize energy saving potential of the students, there is need to make effort to raise the awareness of everyone involved including the management in institutions through an energy efficiency awareness program. In doing this, a well thought out and executed communication plan is an effective tool for implementing an energy efficiency awareness program. Authorities in tertiary institutions can make use of internal resources by forming a team comprising of employees who are experienced in communications to help develop a plan by encouraging and assigning specific tasks to team members and by ensuring that roles and responsibilities are understood and accepted by all. There is need to select communication tools that will deliver the message in the most effective way. While it is convenient to use the existing line of communication, other innovative ways of communicating to the students can also be considered, For example, the use of printed materials such as posters, bulletin, pamphlets, memos and newsletters and the use of internet based packages such as email, blogs and social media such as facebook and twitters because almost all the students have a phone and have access to the internet on daily basis. Also, public channels such as displays and booths, public address system and intercom announcements, bulletin board and word of mouth can also be used. Also, promotional items such as t-shirt, coffee mugs, hats and stickers can also be used to motivate students' in enhancing energy conserving behaviours in institutions and also improves their level of awareness. This goes in line with the findings of [41] Individuals can make a difference because everyone has a role to play. The success of the program depends on everybody's contribution and participation. Management in tertiary institutions should make the messages real by providing context for the information to be communicated. For instance, if lighting represents 20 to 40% of the institutions energy bill, the messages could communicate that a 40% savings from turning off light when not in use could save specific amount every year and the savings could be related to equivalent such as teaching supplies, an upgraded lobby in the hostels, an investment in medical programs, increased laboratory facilities etc. In my opinion, students or the society as a whole (Nigerians) are more likely to "buy into" energy efficiency when potential cost savings are translated into concrete benefits that they can relate to i.e. for them to give their supports, they might need to know how they will be affected. In my opinion, enhancing or encouraging Nigerians or the students to inculcate behaviour that conserve energy by increasing their awareness level will help increase productivity, an improved environment through lowered harmful emissions and air pollutants, decreased various health challenges that are attributed to energy use, increased energy users understanding of the benefits of energy efficiency, changed behaviours of how building users consume energy, improved workplace comfort, behaviours learned in the workplace or schools are transferred to the home and community and also make students build a feeling of friendship, togetherness and morale as a result of working together to achieve a common goal. Therefore, to achieve all these benefits, regular communication with the audience is needed, repeating the message and varying the presentation of the message so that they do not lose interest [1]. Activities such as competitions, challenges and contests combined with awards programs can encourage and motivate students to participate in the program and also increase their level of awareness. Awards program can also help build momentum, generate interest and motivate behavioural change. Authorities in Tertiary

Institutions can give awards as prizes for contests, as incentives for participating in activities or to recognize significant contributions, Institutions can also solicit for local sponsors to obtain awards. Awards can range from small items such as compact fluorescent lamps, T-shirts, setback thermostats, etc. The authorities in tertiary institution authorities have the ability to educate and empower students to believe in and take the necessary steps and action to promote economic, environmental and societal change that brings about healthier and sustainable world. Therefore, policy makers should adopt more programs to increase consumer's (students) awareness in order to create effective and efficient energy use in tertiary institutions. The result of the analysis thereby demonstrated that awareness is prior to effective consumer's behaviour while lack of awareness leads to ignorant and energy wastage. Reference [26] asserted that an underlying premise to solving the challenges of energy conservation in student halls of residence is with education and raising awareness. Reference [30] also revealed that the importance of integrating energy courses into academic curriculum of tertiary institutions in existence is very important and effective to enhance public awareness of energy use behaviour in the educational system. In addition, integrating energy courses into academic curriculum of higher learning institutions (universities, polytechnics, colleges of education and other training institutes) is also important to ensure sustainable growth of the power sector. This is in accordance to the findings of [24, 25, 30, 52]. This is due to the fact that sustained energy conservation depends on the availability of talents to meet with the industry's needs. Obviously, the challenge can only be eradicated by producing more qualified people through educational system. This is also to ensure that management in institutions are able to produce graduates with skills and specialism that the power sector needs. Therefore, it can be concluded that by integrating energy courses into educational system (academic curriculum), the level of awareness on energy use behaviour will improve. The lack of awareness can also be attributed to poor implementation of the energy efficiency awareness programme in various tertiary institutions which might be due to lack of commitment of management and policy makers which was in line with the findings of [24]. Implementing the program takes commitment, energy, time, imagination and enthusiasm because building awareness is an ongoing work. To maintain interest in the program, there is need for continuity in communication by providing regular updates to energy users. These updates will sustain the momentum of the program, reinforce new behaviours and lead to the continuous improvement of the overall awareness processes. As the awareness level changes, so should the communication, meaning that if a particular method to promote energy efficiency awareness is used and the tracking shows that awareness has not increased, there is need to consider using another method. In view of these, involving students and motivating a change in students' behaviours, energy consumption in student hostels can be reduced and operating costs can be lowered. These savings can be reinvested into the institution in a variety of ways. Aside from reaping financial benefits, awareness creation will contribute to healthier environment for the students and the society by reducing harmful emissions and pollutants. Students' morale will be strengthened, and behaviour learned in the school can be transferred to the home and community.

### ***5.1. Awareness and demographic variables***

The result showed that the age of the respondents is a determinant of the level of awareness. Probably, younger people tends to have more interpersonal interaction regarding energy conservation with others and mainly because of their exposure to the internet and other social platforms, but lacks energy saving action because of their attitudes. The communication with others could help them find more ways to conduct energy saving, but

their attitude might impede their behavioural intentions of energy saving. This corroborates with the findings of [13, 27]. Also, for respondents with different educational qualification, there seems to be no significant differences in their level of awareness. This might be because there are lack of courses concerning energy consumption and conservation in Nigeria's current education system. Also, this could be attributed to the attitude and behaviour that were being exhibited by various individuals. This implied that educational levels does not necessarily mean that energy will be conserved but the attitude and behaviour of individuals needs to be reviewed. As a result, it is necessary to upgrade the educational system in Nigerian tertiary institutions to strengthen energy saving measures. This corroborates with the findings of [60]. In view of this, there should be some policy for students' energy use behaviour. An education system for energy conservation and related information should be provided to strengthen energy saving measures. Incorporating energy saving measures in the curriculum could improve awareness about energy conservation and related practices [20]. The education content could focus on both energy saving skills and other related information to raise people's understanding and concerns regarding energy crisis and environmental issues. However, there is no significant difference in the level of awareness between the genders of respondents. This agrees with [32] that found no significant association between gender and level of awareness of individuals.

### ***5.2. Strategies to promoting energy efficiency awareness***

The framework (Figure 2) for efficient energy awareness was developed based on different results obtained from this study. It showed the pattern and flow of accomplishing efficient energy use behaviour in tertiary institutions in Southwestern, Nigeria. From the previous discussion and the literature review, the study concluded that there are three major stages to develop awareness. The first is the environmental stage (input) where external stimuli functions as the primary input. The theory of learning states that a person will change behaviour because of his experiences with the environment [22], second is the mind stage (process). Here, perception and cognition plays important roles for handling, selecting and interpreting information acquired. The third (output) is behavioural stage where all the information received will be reflected in the receiver's behaviour. Therefore, this section discusses the framework of energy efficiency awareness process. The entire awareness process was divided into seven phases – energy information, transmission method, understanding, knowledge/awareness, support, motivation, and compliance. The first phase of the energy efficiency awareness process is the availability of energy information. In energy awareness development process, energy information should cover criteria such as clear, understanding, interesting and strongly impress. Different communities will need different kind of information, therefore appropriate information must be carefully considered before further steps are taken. In practice, during the first phase of awareness process, authorities in tertiary institutions can utilize various types of energy information such as energy tips and energy problems. Energy tips are very important in showing the building users (students) how easy they can conserve energy. Simultaneously, this raises their knowledge about the importance of energy. Examples of energy saving tips are turning computer off when not in use, switch off the light when not in use, turning off and unplugging electrical equipments. Such simple energy tips will encourage and provide the respondents a better way to conserve energy in their daily activities. Considering the second types of information - energy problems, I believe that bringing people's attention closer to the energy problems, students may take energy conservation as a responsibility if they realized the energy wastage that they make every day. Summarizing from [26], energy users can be stimulated

to support an energy management program if they are informed of the amount of energy they are using, the cost involved, the seriousness of the energy problem and its potential effects upon a nation's economy in the future. Also, between energy awareness information and interpretation phase, transmission method is a technique or tool to effectively transfer the information to the receiver or in other words, to distribute the information. To develop energy awareness, both transferor and receiver have to be available. The responsibility of the transferor is to effectively transfer the information while the responsibility of the receiver is to successfully receive the information. The function of the transference method is to help transferor convey the information to the receiver. There are several transmission methods that have been identified. Such methods are; Posters and Banners, Booklets, Pamphlets, Brochures or Leaflets are easiest way to distribute the information to building users. Also, seminar, talks or presentation are also methods that can be used. In this case, the speaker (transferor) plays an important role in conducting the speech and the designation of the speech must be suitable for the audience. The third phase of the energy awareness process is understanding, it refers to the process of how receivers explains and clarify the information that was received. Often, the receiver will operate and integrate the new knowledge by using past experience, available knowledge and believe. The fourth phase is knowledge/awareness. Motivation is whatever activities that make people to act voluntarily in a certain way and then to persist in the face of difficulty. Critical determinant of motivation is the cost of compliance. Cost can be any expenditure of effort, time, and money. If a person perceives the costs of complying is greater than the benefits of complying, he or she is less likely to comply than if the benefits appears to outweigh the cost. The social influence is another motivational factor affecting compliance, if people see another person comply with warning, thus they are more likely to comply. Although there are a lot of factors that influence human behaviour, the basic of motivation which control the great majority of human behaviour are rewards and incentives. There are various types of reward and incentives, transferor or energy manager may offer rewards such as; prizes, money and recognition. For the benefit of energy conservation, long term motivation must be carried out. Although the receiver may have already buy the practice of energy conservation but continuous practice of energy conservation is thus another challenge. However, some students with very short memories for these things may easily forget and drop back to their old ways. Therefore, authorities in tertiary institutions should offer long term motivation to the receivers so they can continuously practice energy conservation.

## **6. Conclusion and Recommendations**

Awareness of the impact of energy use behaviour among higher education students in Nigeria was investigated. The analysis indicated that a large number of students were conversant with the positive impact of energy efficiency while majority of the students have low level of awareness of the negative impact of energy use behaviour. It is therefore clear that the level of awareness of electricity end users is very low and consequently a lot of energy will be wasted in return. The analysis also show a significant relationship between awareness and consumer behaviour. The result demonstrated that effective consumer behaviour can only be assured through awareness. i.e. if students were aware of the implications of their actions, habits, attitudes and norms, they could be motivated to inculcate behaviour that conserves energy. Therefore, in order to maximize energy saving potential of the students, there is need to make effort to raise the awareness of everyone involved including the management in institutions through an energy efficiency awareness program. Finally, awareness creation will help students to better understand energy issues and also make them take energy conservation as a responsibility

if they realized the energy wastage that they make every day. Based on the findings, we made a number of recommendations that tertiary institutions could follow to enhance awareness and knowledge; integrating energy courses to academic curriculum of tertiary institutions and training institutes at respective institutions is important. This is to ensure that qualification providers are able to provide graduates with skills and specialism that the energy industry needs. Also, introducing the concept of green environment, environmental protection and sustained energy use in schools and institutions curricula can raise awareness. Also, conferences and exhibitions on efficient energy use in buildings will assist in raising public awareness. These awareness raising measure will help create a society and environment for sustained energy use and provide opportunity for collaboration and knowledge sharing. In addition, there is need for proper efficient energy use behaviour education and training program which should be encouraged and taken seriously in tertiary institutions because a higher level of skills required for a complete efficient energy use behaviour can be achieved comparatively fast through appropriate education and training. One of the limitations of this study is that it is based on reported energy use behaviour. Further study is recommended to include actual measurement of the behaviour. Also, findings from this study was adapted for the educational sector, there is a need to replicate this study in other sectors to establish the possible differences in the way energy use behaviour affects the sectors. For instance, the prevalence of energy use behaviour of students in tertiary institutions may not be the case in the business, health and commercial and manufacturing sector. The study was also limited to 247 participants in the selected tertiary institutions; further studies may consider a larger sample size and wider scope. It is also important to compare results of findings on level of awareness of the impact of energy use behaviour in tertiary institutions to other sectors such as the health and business sectors. This will facilitate a multi-sector comparison with implications for future developments in tertiary institutions. Findings from this study are confined to the views of students alone. Knowledge on level of awareness of the impact of energy use behaviour may be broadened by considering the views of staffs and other stakeholders in tertiary institutions. This will facilitate useful comparisons and better approach to mitigating inefficient energy use behaviour in the society.

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