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Consumer Awareness in Energy Efficiency for Nigerian Student Residents in India

Nura I. Yusuf[1*], Usha Tiwari[2] and Tarun Varshney[3]

[1]Department of Electrical Electronic and Communication Engineering, Sharda University, Greater Noida, Uttar Pradesh, India. Email: 2023000583.nura@pg.sharda.ac.in
[2]Department of Electrical Electronic and Communication Engineering, Sharda University, Greater Noida, Uttar Pradesh, India. Email: usha.tiwari@sharda.ac.in
[3]Department of Electrical Electronic and Communication Engineering, Sharda University, Greater Noida, Uttar Pradesh, India. Email: tarun.varshney@sharda.ac.in
[*]Corresponding Author

Abstract: Energy has a major role in boosting employment prospects and economic competitiveness, especially in nations that are seeing rapid economic expansion. Today's educational institutions around the world use more energy to run their daily operations. The study aimed to assess the awareness of energy efficiency among Nigerian international students residing in India. A survey was conducted to measure their awareness of energy-efficient practices in using electrical appliances and their willingness to contribute to energy conservation efforts within institutions and hostels. The survey, conducted via questionnaires distributed to Nigerian international students in India, discloses an estimable level of awareness regarding energy efficiency in appliance usage. Evaluations showed that students understand the importance of energy efficiency at a high level. Moreover, a significant number of international students from Nigeria commented that they were willing to help energy conservation efforts by gradually changing their habits to use less energy.

Keywords: Awareness, Energy conservation, Energy efficiency, Energy saving, Nigerian students.

I. Introduction

There is a lot of pressure on educational institutions' budgets due to the high level of electricity usage in these facilities and the resulting rise in energy bills. Gross energy waste from improper electricity use is one reason for the high amount of electricity used in educational institutions. Waste accounts for a sizable portion of the electrical energy utilized in educational facilities [1]. As an illustration, while a classroom is empty, it is typical to find fans running and lamps turned on. Moreover, air conditioners are left on while offices are unoccupied. Therefore, it is necessary to create and put into action strategies to lower electricity use and, consequently, educational institutions' electricity costs. Efficient demand side management (DSM) techniques can lead to a decrease in energy usage [2]. Implementing rules and procedures to regulate, impact, and typically lower the demand for electricity is known as demand-side management (DSM) [3]. In order to implement effective demand-side management in educational institutions, building operations must be managed, equipment must be upgraded, energy management devices must be installed, and faculty, staff, and students must be made aware of the need for change. The first two strategies are behavior-

based, complement one another, and may be put into practice without the need for capital funding. While the second avenue is more explicitly concerned with changing understanding among facilities and custodial workers who control building operations, the first route focuses on changing behavior among all facility users.

II. Literature Review

Recent emphasis has been placed on energy conservation, with existing research examining the awareness of Malaysian households on this issue. However, there remains a lack of concrete understanding regarding energy awareness among students and staff at Malaysian universities. The current level of awareness regarding high energy consumption is insufficiently developed, hindering the development of effective energy conservation programs within university settings [4]. Three main areas were the focus of Syed Hussein's study on energy awareness among University Utara Malaysia (UUM) students: knowledge, attitudes, and behaviors. The results showed that UUM students generally had inadequate awareness of energy conservation, which put a heavy financial burden on the institution because of high electricity costs. Hussein said that putting more extensive programs into place could raise awareness and motivate UUM students to adopt energy-saving behaviors. [5]. Results of a survey intended to assess students' knowledge of energy-saving techniques about the use of electrical devices and their readiness to assist in reducing energy waste in educational settings. In order to conduct the survey, 970 resident students at Kwame Nkrumah University of Science and Technology in Kumasi were given questionnaires. The results show significant awareness of energy saving when using various consumer appliances. Additionally, a sizable percentage of students indicated that they were willing to take part in programs designed to reduce energy waste [6]. Nigeria's rapidly growing population has led to a shift in the energy consumption patterns of the educational institution buildings sector. This notable expansion is mostly due to population growth and the demand for enhanced academic functionality; as a result, it requires a lot more energy than other economic sectors. Energy is essential to this business for several reasons, such as the provision of lab equipment, lighting, heating, and air conditioning, as well as instructional materials. Equipment needed for teaching, research, practical demonstrations, and other support services is also powered by it [7]. Research suggests that behavioral factors such as individual and social norms, emotions, attitudes, trust, and competence significantly influence the decision-making process when it comes to energy regulations on a global scale [8]. It has been proposed that the interplay between material culture, energy practices, and norms is a crucial determinant that shapes and reinforces the energy-related behaviors of occupants [9]. The substantial electricity consumption observed in academic settings can be partly attributed to considerable energy wastage resulting from ineffective use of electricity. This inefficiency is evident in a notable percentage of electrical energy being wasted within educational settings [10]. Carried out in Nigeria, a study focused on exploring the factors impacting energy efficiency within selected housing samples. The results uncovered a strong connection between attitudes and behaviors concerning energy efficiency in residential dwellings. Furthermore, the identical investigators conducted a social survey addressing comparable issues, but with a particular emphasis on the implications of implementing energy efficiency measures in Bauchi town, Nigeria [11]. A proposal from Kuwait University is that all higher education institutions launch continuous environmental education campaigns to raise awareness of energy-saving practices and encourage a culture of energy conservation. This plan seeks to guarantee a consistent and ongoing endeavor to raise awareness of the significance of energy resource conservation [12]. Several American institutions have launched a variety of initiatives to support education in sustainability and self-management. The participants' efforts to save energy have increased noticeably as a result of these campaigns. There is a clear discrepancy between the students' initial proficiency and consumption and their subsequent consumption following seminars and training sessions [13]. In a few African nations, Okwanya and Abah conducted research to assess the

relationship between energy use and the decrease of poverty. Based on the availability of data, they selected twelve African countries and used a panel structure to analyze them. Through the use of the fully adjusted approach of ordinary least squares, the researchers determine that differences in energy consumption had the least effect on reducing poverty in any of the African nations they assessed [14]. They integrate energy simulation into their investigation of house energy request in Nigeria. Their study involves gathering a dataset consisting of 40 data points spanning from 1971 to 2011, specifically examining energy demand patterns in Nigeria and subjecting it to Analysis of logistic regression. Furthermore, they utilize a questionnaire with some structure to interview 501 houses in Ibadan between 2014 and 2015, providing additional evidence to reinforce their main conclusions [15]. Data from the International Energy Agency aids in analyzing business-as-usual (BAU), exploratory, and normative scenarios. These scenarios are designed to suggest potential paths for the global energy transition and pinpoint the factors that impact their effectiveness. These factors include investments in money, uncertainties surrounding industrial progress, governmental scheme, and the impact of behavioral interventions [16]. with support from the Indian government, the Green Terre Foundation launched the U75 initiative, which aims to convert 75 yards into net-zero entities. The initiative sets a goal for all university campuses in India to achieve net-zero status by 2030. Positioned as leaders in the country, these campuses can have a crucial impact on advancing research and development (R&D) endeavors and molding future leaders. Ultimately, this initiative is expected to greatly contribute to India's efforts to achieve its net-zero targets [17]. Study assessing the impact various retrofitting techniques to improve buildings' energy efficiency was carried out, with particular emphasis on an educational facility at Kazakh–German University. The findings showed that implementing small-scale retrofitting modifications resulted in savings of up to 36.9 kWh/m^2 on electricity. With major retrofitting measures, the savings rose to 77.76 kWh/m^2, leading to an impressive 82% reduction in CO_2 emissions [18]. Energy plays a pivotal role as a primary physical infrastructure necessary for the advancement and progress of various sectors. Particularly in developing economies, the use of energy serves as a vital driver for stimulating macroeconomic activities. It is apparent that every sector of the economy heavily depends on energy for efficient operation [19].

III. Objectives

The primary goal of the current investigation is as follows:

- To evaluate the awareness of energy conservation among the Nigerian international student residents in India.
- To evaluate the behavior on energy consumption within the Nigerian international student residents in India.
- To ascertain the connection between the Energy consumption and consciousness behavior among the Nigerian student residents in India.

IV. Methodology

The study examined Nigerian international students enrolled in different universities across India to explore the connection between their awareness of energy conservation and their behaviors within their respective accommodations. The sample was drawn from a population of Nigerian international students studying in India.

A. Research Instrument

The primary tool utilized for gathering data in this study was a questionnaire developed through Google Forms. This questionnaire encompassed sections for demographic details, the extent of awareness regarding energy conservation, and the energy-efficient behaviors exhibited by students, all rated on a 5-point scale. a comprehensive analysis of the body of current literature was conducted beforehand to ensure the questions' reliability and effectiveness in establishing the correlation between behavior and awareness.

B. Data Collection

Data collection is carried out via an online platform with a target of 90 respondents. However, 90 individuals have completed the survey questionnaires. Following data analysis, each questionnaire has been classified based on gender, age, and the name of the institute.

C. Data Analysis

Standard deviation and mean were two examples of descriptive statistics that were used to analyze the results, aiming to explore the correlation between awareness and behavior among Nigerian international students.

$$mean = \frac{\sum fx}{\sum f} \quad (1)$$

$$Standard\ deviation = \sqrt{\frac{\sum F(x-\bar{x})^2}{\sum F}} \quad (2)$$

V. Results and Discussion

The study received a total of 90 responses during the data collection period. Among these respondents, 60 were male and 30 were female. Additionally, participants belonged to various age categories. Fig. 1 illustrates the demographic distribution of the respondents.

A. Age and Gender

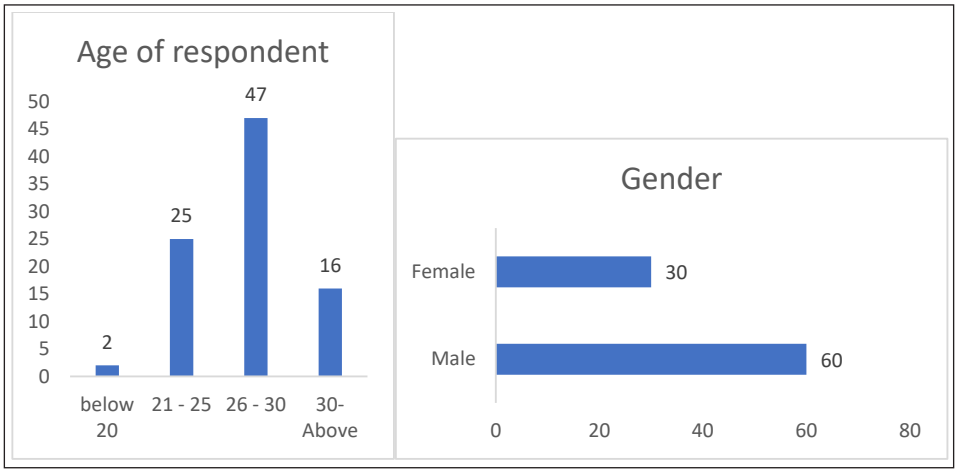

Fig. 1: Background of Respondent for Age and Gender

B.Awareness Assessment

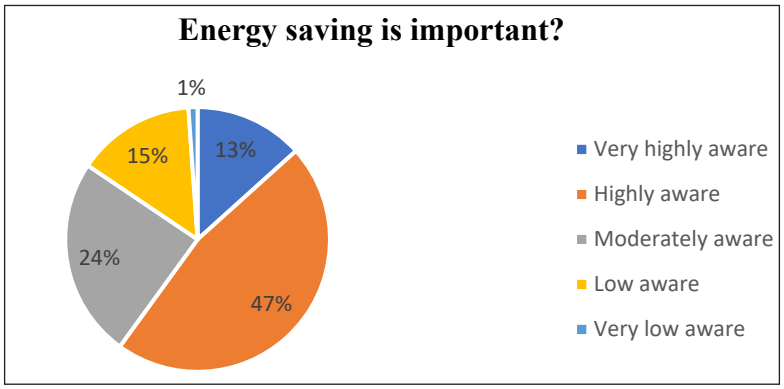

Fig. 2: Energy Saving is Important

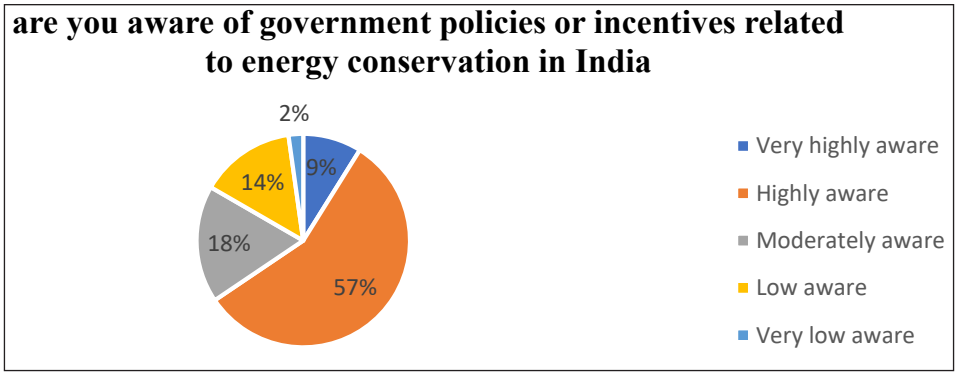

Fig. 3: Are You Aware of Government Policies or Incentives Related to Energy Conservation in India

Table I: Result of Awareness Assessment

Sr. No.	Question	5	4	3	2	1	Mean
1.	Are you aware of the important of energy efficiency?	12	42	22	13	1	3.5667
2.	Are your electrical appliances energy efficient?	12	45	19	14	0	3.6111
3.	Are you aware that Energy efficiency practice reduce overall bill expenses?	10	49	18	12	1	3.6111
4.	Are you aware of government policies or incentives related to energy conservation in India?	8	51	16	13	2	3.5555
5.	Are you aware of the concept of energy efficiency?	9	50	17	12	2	3.5777
6.	Are you aware A few of our behavior can aid in the world's energy efficiency?	13	42	20	15	0	3.5888
7.	Are you aware Equipment have different energy consumption depending on power rating?	11	45	19	14	1	3.5667
8.	Are you aware of renewable energy can be saved by using energy efficient appliances?	7	48	21	13	1	3.5222

Table II: Result Interpretation of Likert-Scale

Mean Range	Descriptive Interpretation
4.51 – 5.00	Very highly aware
3.51 – 4.50	Highly aware
2.51 – 3.50	Moderately aware
1.51 – 2.50	Low aware
1.00 – 1.50	Very low aware

The initial phase of the inspection involves gauging respondents' awareness levels regarding energy saving. They are asked to provide their responses to 8 Likert-scale questions, ranging from 1 to 5, where 5 indicates the highest awareness level and 1 the lowest. Subsequently, mean values are calculated for each question as well as an overall mean for all 8 items. This data is then used to interpret the degree of consciousness for each assertion as well as the collective recognition towards energy efficiency, categorized according to the mean ranges, as outlined in Table II.

On the whole, the average mean for all items stands at 3.5750, signifying a noteworthy level of awareness among Nigerian international students regarding energy efficiency. This suggests that a majority of respondents understand the significance of energy efficiency, with an average mean of 3.5667 falling within the high awareness range. Additionally, respondents demonstrate a general awareness regarding the energy efficiency of their electrical appliances, the cost-saving benefits of energy-efficient practices, and governmental policies aimed at energy conservation in Nigeria. Moreover, the data indicates that respondents acknowledge their individual behaviors' potential impact on global energy efficiency. The collective awareness regarding energy efficiency significantly

influences the overall high level of awareness, with mean scores of 3.6111, 3.5555, and 3.5888 recorded for understanding the importance of energy efficiency, awareness of the energy consumption rates of various equipment, and familiarity with the concept of energy efficiency, respectively. Following closely are awareness levels related to understanding different energy consumption rates (mean = 3.5667), grasping the concept of energy efficiency (mean = 3.5777), and knowing methods for conserving energy (mean = 3.5222). The lowest recorded mean of 3.5222 is attributed to awareness of how renewable energy can be conserved by using energy-efficient appliances.

The standard deviation of the averages of the 8 unit is 0.0276, indicating significant deviation of each unit mean from the overall average mean of 3.5750.

$$\frac{0.0276}{3.5750} \times 100\% = 0.7370\% \quad (3)$$

Put differently, the level of awareness among Nigerian international students varies across the statements presented in Table I. While some students may be well-informed about certain aspects of energy conservation, they may lack knowledge in other areas.

C. Usage Assessment

The respondent's behavior toward energy saving was accessed and evaluated as presented in the table below.

Table III: Outcome of Energy Use Behavior Evaluation

Sr. No.	Question	Yes	Yes	No	No	Mean
1.	Are you switching off your light at day time?	62	69%	28	31%	0.6889
2.	Are you practice energy saving at hostel?	58	64%	32	36%	0.6444
3.	Do you turning off the electrical appliances after used?	61	68%	29	32%	0.6778
4.	Do not leave laptop charging overnight?	52	58%	38	42%	0.5778
5.	Do you attended any workshops or seminars related to energy efficiency?	55	61%	35	39%	0.6111
6.	Do you actively use energy efficient appliances?	56	62%	34	38%	0.6222
7.	Do you use any smartphone apps to monitor energy consumption?	54	60%	36	40%	0.6000
8.	Before you leave the classroom, make sure the lights and air conditioner are off.	64	70%	26	30%	0.7111

Examining respondents' general behavior regarding energy usage reveals an overall mean of 0.6417 out of 1.0, indicating that the real actions taken to conserve energy are not particularly admirable. Translating this value to fit the scale provided in Table II yields 3.2085, categorizing it within the moderate behavioral level. Factors contributing to the lower mean value include leaving laptops charging overnight (42%), not utilizing smartphone apps to monitor energy consumption (40%), lack of participation in workshops or seminars related to energy efficiency (39%), failure to actively use energy-efficient appliances (38%), neglecting energy-saving practices in hostels (36%), failure to turn off electrical appliances after use (32%), and not switching off lights during daytime (31%). These actions are relatively simple and can be implemented quickly. However, it is encouraging to note that respondents ensure both air conditioners and lights are switched off before leaving the classroom, with a notable percentage of 70%. It's puzzling that activities scoring both extremely low and high marks don't significantly differ in the time required or the effort needed to perform them to save your energy.

The overall aggregate mean's standard deviation is 0.0440.

$$\frac{0.0440}{0.6417} \times 100\% = 6.86\% \quad (4)$$

This indicates a notable inconsistency in the behavior of the respondents. There isn't a clear pattern explaining why they don't consistently engage in similar actions to reduce energy consumption. For instance, while a significant majority (70%) ensure to switch off the air conditioner and lights before leaving the classroom, this behavior doesn't seem to extend uniformly across other energy-saving practices.

Table IV: Evaluation on Respondents' Readiness to Engage in Energy Conservation Efforts

Sr. No.	Question	Yes	Yes	No	No
1.	Changing habit for energy efficiency.	83	92%	7	8%
2.	Spending time learning about energy efficiency.	80	89%	10	11%

The strong correlation observed between the high awareness level of energy efficiency and the proactive behavior towards energy conservation among Nigerian international students suggests that while they possess ample knowledge and understanding of energy conservation, their actions in practicing energy efficiency lag. The greater energy consumption standard deviation value behavior (6.86%) in contrast to that of energy efficiency perception (0.7370%) indicates that respondents are selective in their energy conservation efforts despite their extensive knowledge of the subject. Table IV illustrates those responders in general inclined to take measures toward energy efficiency by altering habits or investing time to learn more about energy conservation.

VI. Conclusion

In summary, this research evaluates the awareness level and energy usage behavior and discusses the relationship between the two. Overall, the data shows that international students from Nigeria are highly conscious of the need to save energy. Yet, these same respondents only exhibit a modest level of conduct when using electricity generally. The respondents exhibit strong enthusiasm and desire to start energy-saving practices, even if there is no direct linear relationship between awareness level and behavior in this area. Perhaps as a result, international students from Nigeria are more conscious of the need to conserve electricity in both their dorms and schools. They can start by making lifestyle and habit changes as part of energy-saving activities.

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