



Energy saving behavior among university students: A case study of Sokoine University of Agriculture, Tanzania

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Abstract

The purpose of this paper was to establish energy saving behaviour and practices among students living within the university hostels. The study followed a case study and descriptive research designs where data were collected from defined population using self-administered questionnaire. The information was descriptively analyzed by SPSS and qualitative methods were used to judge the interaction patterns. The findings show that students are not aware of the energy cost incurred by the university. It was also revealed that students feel the accommodation bills they pay to be enough to cater for energy utility bills hence no need to be concerned on energy consumption and saving. Generally, students are not sensitive in practicing energy saving behaviour. This is attributed to inexistence of direct incentives and low awareness on importance of energy saving and also the cost associated with the high energy consumption. The paper provides useful insights on how students behave in terms of energy consumption and whether are concerned on saving energy. The findings are very essential in facilitating university in designing a strategy to optimize energy savings. The understanding of typical energy user's behaviour is one of the input necessary to be combined with technical energy consumption aspect to optimize energy saving goal.

Keywords: Behaviour; Energy Saving; Students; University Hostel

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1. Introduction

Higher learning institutions throughout the world are faced with rising utility costs that are increasing faster than the rate of inflation (Marans and Edelstein, 2010.). This is attributed to the proliferation of energy-consuming technologies like personal computers, air condition and many others which has resulted in substantial escalations in energy use and dependence (Scherbaum et al., 2008). Electricity is one of the very important services for the large consumers like universities hence one cannot avoid using the service even with increased high tariffs. The plausible option is to move into more energy conservation practices to reduce energy consumption. While causes of over energy use are acknowledged to be primarily technical, users behaviour, if are effectively implemented, also influences actions to reduce energy use (Woods et al., 2017).

To facilitate energy consumption reduction, most of the institutions with high demand of energy consumption have embarked into installing low energy consumptions equipments like energy efficient bulb, energy saving computers which Scherbaum et al. (2008) refers to structural or operational strategy. The operational strategy largely intends to make the appliance energy efficient rather than making the user conscious by practicing energy conservation behavior. The key argument of this paper is that structural or operational strategy alone cannot help the high energy consumers such as universities to serve energy cost if the energy users are not concise. Therefore, the adoption of energy saving behavior becomes an important element to boost the operational practices. It is from this background, this study assessed the energy saving behavior among student living within the university hostels. Students being one of the major energy consuming groups, their practices of energy saving behavior will have substantial impact in reduction of consumption and ultimately financial cost by institutions.

2. Background of Sokoine University of Agriculture (SUA)

The history of Sokoine University of Agriculture (SUA) dates back to 1965 when it started as an Agricultural College offering diploma training in the discipline of agriculture. Later on following the establishment of the University of Dar es salaam in 1970 the college was transformed into the faculty of Agriculture under the university of Dar es salaam and started offering a bachelor of Science in Agriculture. The division of forestry and veterinary sciences were established in 1974 and 1976 respectively hence led into the changing of the name into the faculty of Agriculture, forestry and veterinary sciences. In 1984 the faculty was transformed by parliament act into full-fledged University and became known as Sokoine University of Agriculture (SUA).

The university has undergone fast growing and now offering a total of 52 PhD and Masters Programmes and 28 undergraduate degree Programmes in various specialization. A number of students have been increasing tremendously were currently the university has a total of 8837 student population of which 42% are accommodated within the university hostels. The increasing number of students goes with an increasing demand of various services and facilities to enhance better learning and living environment. To cater for the increased demand, the university is also striving to expand by establishing more facilities like office, classroom, laboratories and hostels for accommodation. Largely, the increase of facilities and users increases

the consumption and ultimate financial expenditure cost to the university. Water and electricity cost has been reported to consume a large share of university financial expenditure. While the university is experiencing energy cost increase, waste and energy utilization and management is identified as one of dimensional structure for the key factors of a sustainable university (Nejati and Nejati, 2013). Further, though the universities are called to push for sustainability, college campuses are cited as one of the vast majority of energy consumers especially within buildings and the environmental consequences of this consumption are considerable (Petersen et al., 2007).

SUA students living in University dormitories represent a unique consumer who is not directly involved in paying for various utilities bills. The students are required to pay accommodation fees in lump sum. It can be argued that since there is no any economic incentive for the students to engage into energy saving, this style of payments serves as disincentive for students to save energy. On average rooms occupy between 2 to 6 students per room. Thus, the energy consumption behavior practiced by university population becomes an important indicator of sustainability. It is from this background; this study was conducted to assess student energy saving behavior. Specifically, the study wished to answer the following research questions.

- 1- What do students understand about energy consumption by the university in general?
- 2- What types of electrical equipment and appliances do students have in their living rooms (dormitories)
- 3- What kind of energy conserving practices do students engage in within the campus and in their dormitories?

In its five years (2016-2021) corporate strategic plan SUA is targeting to reduce its electricity and water bills by 70% by June, 2018. Therefore, the findings from this study will inform the university on the current student energy serving behavior and practices and steps needed to be taken to influence pro energy serving behavior among students. The findings are useful in designing university strategy for energy conservation which will help to reduce consumption and ultimately saving financial resources.

3. Why focusing on behavioral factor for energy saving?

The world has witnessed a growing public awareness of sustainability and the higher learning institutions are not exceptional (Yuan and Zuo 2013). Foo (2013) refer to higher education as unique intellectual contributor to society's efforts to achieve sustainability through the practices of skills, consultancies, trainings, and exchange of knowledge. Also, universities are regarded as powerful independent institutions and are extremely important in the diffusion and application of the sustainability concept (János, 2011). In spite of a growing concern and an increasing number of universities engaged with sustainable development, it is unfortunate that most higher education institutions (HEIs) continue to be traditional (Lozano et al., 2013). This is why Wu et al. (2013) argue that for any established institution there are numerous incentives to create a culture of sustainability and reduce energy consumption on campus.

It is known that, on college campuses, the vast majority of energy consumption activities are carried within buildings (Petersen et al., 2007) which pose a challenge of making universities sustainable. To be a

champion of environmental sustainability, many colleges and universities are strengthening their efforts to contain utility costs, and are developing new sustainability programs to address the burden of their increasing energy expenses Marans and Edelstein, (2010). In the process of containing the energy cost, the universities like many other institutions have adopted various energy saving measures ranging from technical, financial incentives, regulatory and many others. Mostly, moving to efficient infrastructures and equipments has been one of the most applied approaches. Although this approach focuses more on supply side, in one hand the energy efficient infrastructure and equipments requires substantial financial investment and regular maintenance and repair which most of the institution fail to invest. On the other hand, the users and operators might practice sub optimal behaviour which compromise achievement of the intended level of energy reduction. Pearce and Miller (2006) argue that many universities fail to capitalize on the enviro-economic opportunities primarily because of relative invisibility of operations for decision makers, deferred maintenance backlogs, lack of initial capital/labor, and sub-optimal behavior of building occupants. The first three limiting factors highlighted by Pearce and Miller (2006) fall under supply side management while the last component fall under the demand side management as referred by Vlek and Steg (2007). Behavioral interventions are identified as effective for promoting pro environmental behaviour (Orland, 2014) but Vlek and Steg (2007) uphold that focusing on demand side management alone may have limited effects. Hence, they propose the modifications of choice through supply side management. The combination of supply and demand side management strategies is important given the argument by Lindenberg and Steg (2007) that user's environmental behavior may follow from various no environmental concerns, such as a desire to save money, or a desire for comfort, freedom, or arousal. Therefore, this set a focus of this paper on how students behave in terms of energy consumption practices within the university hostels.

4. Methodology

The data for the study were collected from SUA students who are using university accommodation facilities, both in campus and off campus university hostels. A total of 150 students were selected from various degree programs to form a sample as summarized in Table 1. Few key informants dealing with student's welfare matters were involved. The data were collected through questionnaires which were distribution throughout the campus but indicated to be filled by students who are living in the university hostels. The questionnaire was designed to capture student's reflections on various energy consumption related aspects. The key areas of focus were; firstly, on awareness on energy consumption within the university. Secondly, on energy use and conservation behavior specifically was capturing type of energy equipments and appliances owned by students and self-ranking on energy saving practices by students. Another aspect was on willingness to change energy saving practices which focused more on personal reflections on what they think would motivate students to improve energy saving behavior and readiness to participate in the proposed motivations. The collected data were analyzed quantitatively using statistics analytical package (SPSS for Windows) and the findings are presented in various formats.

Table 1. Respondents characteristics (n=150)

Characteristics	Frequency	Percentage
Year of study		
First year	48	32.0
Second year	37	24.7
Third year	57	38.0
Forth year	8	5.3
Sex		
Male	83	55.3
Female	67	44.7
Degree program		
BA Rural development	14	9.3
BSc geography mathematics	11	7.3
BSc Applied agricultural and extension	16	10.7
BSc agriculture general	15	10.0
BSc irrigation engineering	11	7.3
BSc Bioprocessing and post harvesting	15	10.0
BSc Human nutrition	14	9.3
BSc Informatics	8	5.3
BSc Environmental science and management	9	6.0
BSc Agriculture Economics and Agribusiness	8	5.3
BSc Wildlife	7	4.7
BSc Forest	1	.7
BSc Horticulture	2	1.3
BSc Animal science	8	5.3
BSc Laboratory Science	1	.7
BSc Veterinary Medicine	6	4.0
BSc in Education	4	2.6
Place of living		
University hostel within campus	116	77.3
University hostel outside the campus (off campus)	34	22.7

5. Results and discussion

5.1. Students awareness about energy consumption cost

In this aspect, data were collected to assess students' awareness on energy cost in their living places and university at large and the results are summarized in Table 2. Given the accommodation agreement between the students as tenants and university, payment structure requires students to pay on lump sum basis. Bills for rooms are calculated on daily basis and paid based on the number of days in a semester. Given this modality student do not know how much in the accommodation bills cater for various components like electricity and water cost. One could expect that students would be interested to ask for the breakdown of the bills but it was found that only 18.7 of the respondents take initiative to ask. This limited awareness of

how much in the combined bills cater for various cost might create room for the students to overconsume the energy since there is no direct felt need to consumers. Failure of the university to share the cost paid for various utilities might limit student consciousness on serving energy and other expenditures hence increasing the resource consumption cost to the university. When students were asked to why they are not interested to know the breakdown of the accommodation cost specifically on how much goes to energy and water bills they provided various reasons. The mode of payment was the most leading where 34.1% of students indicate that since the accommodation cost is paid in lump sum, they do not see the reason to ask for the breakdown of expenditure in various items. No any incentive to ask for the breakdown given that the university is responsible to pay for the bills.

Nonexistence of proper communication channels between the university and students was cited by 28.8% of students. This finding implies that some students would like to make follow up to know accommodation fee breakdowns and specifically how much exactly goes to the energy bills from their accommodation cost but they fail because of not being informed on the right channel to get such information. If the university would have a mechanism to share the expenditure of various items and communicate to students, it would trigger student's conciseness in saving energy by practicing more of energy saving behaviors. The study by Delmas and Lessem (2014) on the effectiveness of private versus public information in saving power found that public information combined with private information motivate consumers to reduce up to 20 percent in electricity consumption. This calls for the university to establish proper communication channels between students' organization and the responsible unit dealing with students' welfare. The finding further shows that 25.8% of students do not bother to ask for accommodation bills breakdown since they feel to be satisfied with the cost paid for accommodation.

Do you think the cost paid for accommodation is enough to cater for the other utility costs?

When students were asked of their opinion on whether the cost they pay for accommodation is enough to cater for all utilities in their rooms, more than half (58%) of respondents said yes. This is an interesting finding because while the university is complaining about an increase of energy cost at alarming rate, the major category of users does not feel such high cost incurred. The opposing opinion between the clients (students) and university (service provider) can be attributed to the miss communication between the two sides which make students to take advantage and consider themselves as not a part of the problem.

The discussion with a key informant dealing with student's accommodation matters on criteria used to charge the accommodation fees revealed that the guiding principle for setting a minimum cost is based on amount allotted for student's accommodation and meals allowances which is set by the government through the Tanzania Higher Education Student Loan Board. It was reported that since 2015/16 academic year, each students is obliged to pay a total of 630 TSH equivalent to 0.32USD per day as accommodation fee. This amount caters for the all services provided in a room including water and electricity. In each room the minimum number of students is 2 and the maximum is 6. There is a concern that this amount paid by students is not enough to cater for all services based on consumption. When the key informant was asked of the opinion on the same aspect reported that;

.... We would wish to increase the accommodation cost but being a public institution we are limited by the amount of money students receive from the Loan Board.....the minimum amount students receive is used a reference to set accommodation fee.....

Table 2. Energy consumption awareness by students

Response	Frequency	Percent
whether knows how much cost in accommodation cater for energy		
Yes	0.0	0.0
No	127	88.8
No response	16	11.2
Total	143	100.0
If ever asked about the breakdown of accommodation cost (bills)		
yes	26	18.7
no	113	81.3
	139	100.0
Reasons for not asking		
Cost for accommodation is paid in lump sum (including other bills)	45	34.1
No proper communication channel	38	28.8
Satisfaction with cost for accommodation	34	25.8
no need	13	9.8
Tight time table (Schedules)	2	1.5
Total	132	100.0
If Cost paid for accommodation enough to cater for energy consumed		
Yes	87	58.0
No	63	42.0
Total	150	100.0
Rating cost of accommodations with the services provided in the room		
Very low cost in comparison to services	26	17.6
Moderate cost	89	60.5
very high cost	32	21.8
Total	147	100.0

5.2. Ownership of energy consuming appliances by students

The assessment on student's ownership of various energy consumption appliances revealed that students own assorted types of appliances. The assessment excluded some energy items like bulb which are not personally owned by students (tenants) but they are fixed by the university. The findings in Table 3 indicate that in every living room student reported to own an average of 13 assorted energy consuming appliances with a minimum of 2 and maximum of 31 appliances per room. The leading appliances includes mobile phones (42.3%) and electrical iron (34.8%).

Table 3. Type of energy appliances own by students

Type of the appliance	Frequency	Percentage
mobile phones	142	42.3%
electrical iron	117	34.8%
heater	29	8.6%
computer desktop	28	8.3%
computer laptop	15	4.5%
iPod	1	0.3%
Printer	3	0.9%
fridge	1	0.3%
Total	336	100.0%
Number of appliances per room		
Minimum	2	
Maximum	31	
Mean	12.9	

5.3. Practice of energy saving behaviors

The study underscored the behaviors on various practices which can lead to energy saving. The focus was on the type of energy serving appliance used, the practice of switching off appliances when are not in use. The findings in Table 4 reveal that 42.2% of the students do not use energy serving bulb which could reduce electricity consumption in the dormitories. Although the university through its Students Accommodation Bureau (SUASAB) is responsible for furnishing the rooms with all basic facilities before the tenant board in for the first time, it is a practice for the students to incur some tear and wear cost like replacing bulbs in their rooms. Since students do not have direct economic incentive for saving energy, they don't give priority on buying energy saving bulb. Likewise, the study found that the practice of switching off light when they leave their rooms is not much common. Only 30% reported to switch off lights always.

In assessing the frequency of practicing various energy serving behaviors, students were asked how frequently in a week have involved themselves in switching off any of energy consuming appliance in their rooms and university premises. The findings in figure 1 show that 60% of the respondents demonstrated to engage in this behaviour at least once a week. This implies that students do not give much priority on switching off energy appliances in their rooms and other premises which may affect the energy consumption and ultimately increase the cost of energy.

Table 4. Energy serving behaviors practiced by students

Practice	Frequency	Percentage
Type of bulb		
Energy saving bulbs	50.7	52.8
Traditional bulbs	45.3	47.2
Practice of switching off light when last leave the room		
Always	45	30.0
Sometimes I do	80	53.0
No at all	19	12.7

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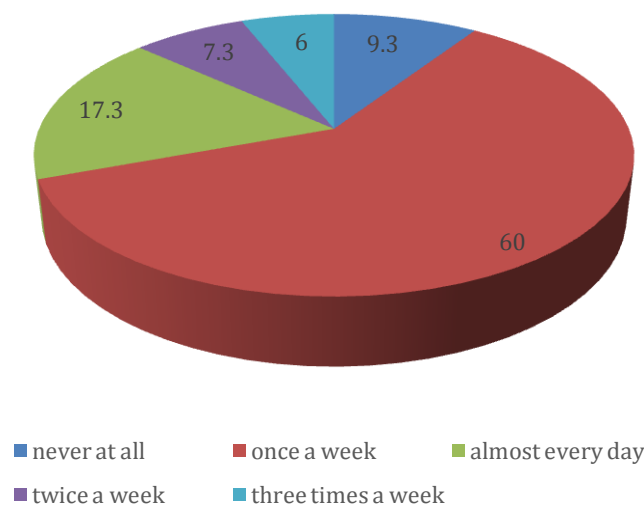


Figure 1. Self-involvement in switching off energy appliances in a room

It was found that two third of students reported to switch off their own computers most of the time when the computers are not in use (Table 5). This result highlights the disparity between the behaviour practiced by student for the communal facilities used and the personal properties. Since students do not pay for the electricity consumed by their computers, it can be argued that student’s practices at least optimal behaviour

of switching off personal properties like computers because they try to avoid the damage rather than saving energy. Students who indicated sometimes to leave their computer on might be due to the desire to be connected all the time or avoiding to switching on once in need of use. These findings concur with the pilot study conducted at the Tufts University, USA on making the campus cool. The study identified that most of the students were not switching off their computers to avoid power surges associated with being frequently switched on and off (Marcell, Agyeman, and Rappaport, 2004). This was attributed to limited knowledge on the advancement of technology in personal computers.

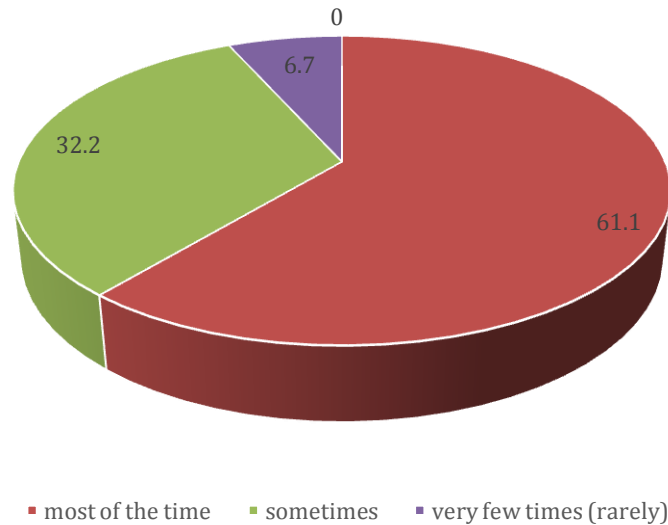


Figure 2. Behaviour of switching off personal computers when are not in use

Table 5. Students Self-rating on energy saving in campus

Rate	Frequency	Percentage
not concern at all	78	52.7
somehow concern	30	20.3
very concern	34	21.6
little concern	8	5.4
Total	150	100.0

The findings on self-ranking on how much students are concerned into energy saving practices within the campus (Table 5) reveal that 52.7% of respondents ranked themselves to be not concern at all while the rest are either little concern or sometimes concern. Only 21.6% indicate to be concern about saving energy. The limited concern is attributed to the facts that students are neither informed on cost of energy nor directly involved in paying for the energy bills. Feedback on cost of energy is one of the incentive to embark on energy conservation behaviour. The study by Dixon et al. (2015) reports that using comparative feedback

influences workplace energy conservation behaviour and ultimately reduce the energy consumption in participating buildings.

5.4. Incentives for engaging students in energy saving behaviour

Given the low level of energy saving practices, students were asked to propose what should be done to improve energy saving behaviour among students. As presented in Table 6, 32.7% of students were of the opinion that seminar and training should be given to students on importance of energy conservation. The design of this kind of program will facilitate personal understanding on energy footprints within the university and also economic, social and environmental impact of high energy consumption on the sustainability of the university. Likewise, students proposed energy awareness campaign to be organized within the university. Raising awareness is the first step to influence social behavior (Wu et al., 2013). Thus, it is important for the university through different channels to organize campaign to increase awareness on energy issues.

Table 6. Proposed incentive for students to be engage into energy saving practices

Proposed incentive	Frequency	Percentages
seminar and training on importance of energy conservation	48	32.7
award people/ students saving energy	37	25.2
energy saving awareness campaigns	32	21.8
reduce number of people in rooms	19	12.9
No idea	11	7.5
Total	150	100.0

6. Conclusion and recommendations

The study concludes that students are not aware of high energy cost reported to be incurred by the university. This is due to the operational structure where students pay accommodation fee in lump sum. Since student pay in lump sum, they believe the accommodation cost paid is enough to cater for all utilities cost. Lack of clear communication channel between the university and students on various unit costs accrued from their stays in hostels has been identified as one of the limitations that influence energy saving behaviour among students. Students own various appliances which require energy (electricity) in its operation. Given the fact that students demonstrate very limited energy saving practices, it is likely that the consumption of energy will be inflated by the user's practices than the item itself. There is no economic and social incentive for students to engage into energy saving practices.

The study recommends that the current energy using practices demonstrated by students have implications for the university sustainability. There is a need for the university to have a strategy which lies on environmental and behavioral issues along with technical aspect to reduce energy consumption. Since students have no direct interest for saving energy, it is also recommended that active engagement of students will have valuable impact in changing energy consumption behaviour. The university should first identify the best practices which have demonstrated success in other institutions and start a program that will facilitate behaviour change and saving energy in campus. Establishment of various green intervention programs for students and staff will add value in reducing energy consumption and promoting energy conservation behaviour. Students can be engaged, through the students organization, by organizing some event during orientation weeks and other days. The university should also use existing media channels to publicize various energy issues and let the SUA community be aware on energy foot prints.

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