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Socio-economic Impacts of Rural Energy Poverty on Women and Students in Esa-Oke, Nigeria

Ayomide Samuel Famewo[1*], Vincent Abimbola Uwala[2]

[1,2]Department of Urban and Regional Planning, Faculty of Environmental Design and Management, University of Ibadan, Nigeria
[1,2]Department of Urban and Regional Planning, The Federal Polytechnic Ilaro, Nigeria

**Corresponding author: vincent.uwala@federalpolyilaro.edu.ng*

Abstract: Energy poverty is a growing global challenge with significant adverse effects on well-being and health. However, its social impacts on vulnerable population in deprived communities have been largely ignored. Consequently, this study examines the social-economic impacts of energy poverty among women and students in Esa Oke, a hilly and rural and energy-deprived community in southwestern Nigeria. A cross-sectional survey design approach was adopted, while purposive and random sampling technique was used in selecting respondents. Findings from the study revealed differences in energy consumption behaviour of women and students in rural settings; while women adopt traditional biomass for cooking, students adopt modern energy services. Additionally, the impacts of poor energy access differ per women and students. For instance, on one hand, the use of traditional biomass significantly affects rural women's health, as the majority (95%) of women respondents reported exposure to emissions through indirect combustion of fuelwood. On the other hand, students' academic performance and academic activities were significantly disrupted due to the poor electricity supply in the area. Based on the foregoing, the study recommends an inclusive rural energy policy that captures all social groups affected by energy poverty.

Keywords: *Consumption evidence, Energy poverty, Osun State, Rural women, Tertiary students*

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1. Introduction

Energy poverty (EP) is a growing global challenge with significant threats to well-being, health and environmental sustainability. Despite academic and policy attention, an estimated 1.2 billion people still lack access to electricity. Furthermore, approximately 2.8 billion people still use traditional biomass as their main energy source for cooking and heating (ESMAP, 2002; Pachauri, Mueller, Kemmler & Spreng, 2004). Annually, an estimated 1.5 million people die from fumes and smoke associated with open cooking (ESMAP, 2002).

EP is often conceptualized as fuel poverty and energy burden in the West. Consequently, it is generally referred to as a situation where a household spends more than 10% of its total income on energy services (Boardman, 1991; Gilbertson, Stevens, Stiell, & Thorogood, 2006; Hernandez, 2016). Thus, income is the dominant yardstick for measuring EP, while its effects are seen as lack of access to thermal heat, convenience and comfort. However, in the global south, EP is often conceptualized as energy vulnerability (Nussbaumer, Bazilian, & Modi, 2012), which is lack of modern energy services and low energy consumption (Adusei, 2012; Sher, Abbas, & Awan, 2014; Bouzarovski & Petrova; 2015). Thus, its impact cannot be generally limited to thermal heat and comfort but would extend to essential services such as health and education. Contextualizing EP in Nigeria and more especially in rural settings, EP will imply unavailability of diverse energy resources for households, unavailability of modern, safe and clean energy resources and lack of financial power in accessing energy services.

As affirmed by the International Energy Agency (IEA, 2014) modern energy services have a significant impact on productivity, health outcomes, education, communication, lifestyle and general well-being. Consequently, increased consumption in modern energy services is essential for meeting basic human needs. In addition, access to modern energy services, such as electricity and gas, has been found to help mitigate poverty and essential in achieving the Sustainable Development Goals (SDGs) (Kanagawa & Nakata, 2007; Ouedraogo, 2013).

Recently, there has been increasing attention linking EP with vulnerability (Clancy, Kelkar, Shakya & Ummar 2007; Pachauri and Rao, 2013; Carrere, et. al., 2020). For instance, Olivera et al., (2020) examined the impact of EP on health and health care of women. Their study revealed that older women's health is negatively affected by poor energy services. Similar studies in England and Scotland also affirmed the negative impacts of EP on the elderly, physically challenged and families with children (Matthews, 2014; DECC, 2015). Despite strong evidence revealing the vulnerability of some social groups to energy poverty (Chikaire, Ajaero, & Atoma, 2022). Yet, most of the studies on EP have mainly focused on thermal comfort and income as captured in the West.

Kumar (2020) averred that the impacts of EP will largely be influenced by four main factors: geography, local customs and traditions, weather conditions, and consumption preferences. Expectedly, this conceptual differentiation also influences EP measurements. For instance, in Europe, the commonly used measurements for EP include the Households Budget Surveys (HBS, 2010), EU Statistics on Income and Living conditions (EU-SILC) (Eurostat, 2018) and European Building Stock Observatory (BSO, 2018).

According to the World Bank (2021), there has been significant progress in the quest for global energy access but many African countries including Nigeria, Democratic Republic of Congo, Ethiopia, Madagascar and Ethiopia still top the list of countries without clean fuels and technologies. Thus, more efforts are needed to ensure the targets for SDG 7 are achieved by all countries in 2030. As averred by the United Nations (2021), 789 million people in Sub-Saharan Africa still lack access to electricity and about 3 billion still rely on wood, coal, charcoal or animal waste for cooking and heating. More so, indoor air pollution from using combustible fuels will cause deaths among vulnerable populations.

In Nigeria, the use of traditional biomass in rural areas is largely attributed to the failure of the government to provide clean, safe, affordable, modern energy services. For instance, Nigeria estimated energy needs is put at 98,000MW, while the total installed capacity stood at 12,522MW, which comprises of 142MW from thermal sources and 2,380MW from hydropower sources and the country generates between 3,000MW and 4,000MW, not minding the seasonal fluctuations and management issues (Nwozor et al., 2019). Hence rural areas often get less supply of electricity from the national grid. Thus, the rural populace depends on the rich forest reserves both as a source of energy option for cooking and heating and also as a means of livelihood. However, this has great implication on environmental sustainability, as it threatens the wildlife, timber and fuelwood that are hitherto abundant in the forest. It was estimated that Nigeria recorded a forest cover loss of 400,000 hectares per annum and by 2047, Nigeria forests would have been lost (Nwozor et al., 2019).

Broadly speaking, the socio-economic impacts of EP in many rural areas in developing countries is largely understudy. There are many lessons to be learned from studies that focus on examining the social-economic impacts of EP in rural places in developing societies. First, such studies will help to investigate the magnitude, complexity and impacts of energy poverty in these places (Gouveia, Palma, & Simoes, 2019). In addition, such studies will make it easier to assess the social-economic impacts of EP on the vulnerable population in rural areas. Although, Kanagawa and Nakata (2007a, 2008b), studies attempted to examine socio-economic impacts of EP in rural areas in Assam state, India. Yet, these studies and other similar studies such as Barnes (2007); Brew-Hammond et al. (2012) and Watson et al. (2012) largely focus on the supply side and are largely biased towards rural electrification, leaving much of the demand side unattended to.

Therefore, this study focuses on the demand side by investigating EP in a rural setting and its socio-economic impacts on two socially vulnerable groups to energy poverty; students and women. Similarly, the study conceptualizes social-economic impacts to include socio-cultural, economic, health and educational dimensions, this is with a view to have a robust understanding of the socio-economic impacts of energy poverty on vulnerable population in rural areas of developing countries and to spin-off an efficient rural energy policy framework that can be deployed in addressing the impacts of EP on affected social groups on one hand, and the entire community on the other hand.

2. Materials and methods

2.1. Research locale

The study was conducted in Esa-Oke town, a hilly and rural community in Obokun local government area of Osun State, Nigeria. The town domains ranges from 7^0 45'' 30' N, 40 53'' 00'E, to 7^0 46' 0'N, 40 54'' 00E'. Relatively, the town shares boundary with other neighboring towns such as Oke-Imesi, Imesi-Ile, Ijebu-Ijesa, Esa-Odo and Efon Alaaye. The town belongs to the hilly areas of the South-western Nigeria.

Predominantly, the people were farmers and the women also engage in petty trades serving the student community. The community play host to the Osun State College of Technology (OSCOTECH). The college started as a campus satellite for the Polytechnic of Ibadan in January, 1993. It operates a non-residential policy, thus most of the students lived within the community. Often student lived in areas in close proximity with the school environment. \

2.2. Methods

The study adopts a cross-sectional survey design. Purposive and random sampling techniques were adopted.

First, purposive sampling was used in selecting the sampling frame, which hinges on selecting a rural community with distinct geo-climate, a strong dependency on rural energy system, low-income and with the presence of a non-residential tertiary institution. Thus, Esa-Oke community in Osun State was purposefully selected as it meets all the criteria specified. The second stage of sampling involves dividing the community into fairly homogenous spatial units; based on the dominant residents in these areas; thus, "students' area," where majority of students live was identified and the core areas, where majority of the indigenes lived. According to the European Commission Joint Research Centre work, the total number of female in Esa Oke in 2021 was 8,252. The study takes a sample size of 1.5% (120) of the total female population, as this is a better representative of the population under study than the aggregated population data which does not disaggregate the data based on sex. There was no accurate information on the total number of students in the institution as at the time the research was conducted. Thus, the study depends on several data from bulletins on the number of intakes and graduates within the last two years preceding the research and an estimated student population of 10,000 was adopted. This excludes students that were on sandwich programs. A sample size of 1.2 % of the student population was used for the study. Thus, 120 students and 120 women were randomly selected as respondents for the study.

Several studies have attempted to empirically investigate social-economic impacts of EP (Kanagawa and Nakata, 2006; Kanagawa and Nakata, 2007; Kumar, 2020; Roberto et. al., 2014; Scarpellini, Sanz, Moneva, Portillo-Tarragona & Rodriguez, 2019) and have established different measures in measuring social-economic impacts of EP in rural areas. This study chiefly adopted the methods advocated by Kumar (2020), as the study focuses on rural energy poverty. These methods were expanded in this study to reflect the peculiarity of the study area. The questionnaire was sectionalized into three main sections. The first section captures information on socio-economic characteristics of respondents. The second section sought information on energy, energy demand and consumption evidence. The third section focus on the socio-economic impacts of energy poverty based on the main energy source, its health impacts on rural women and its educational impacts on students.

On educational status, the study adopted the nine year compulsory basic education (six-year primary education plus three year Junior Secondary School education) as advocated by the Universal Basic Education (UBE) as the benchmark to determining educational status. Further, on age cohort, two age cohort was used for rural women; the elderly (those above 65 years) and those below 65 years. Similarly, for students' respondents, two age cohorts were adopted; those less than 20 and those above 20 years. The choice of the age cohorts adopted was largely due to the need to verify effects of EP on vulnerable population such as women, the elderly, children and youths as results on this is still largely inconclusive.

Social-economic characteristics considered for women include, age, occupation, income, marital status, indigene status and educational status. For students, sex, age, students' level, monthly stipends were considered. The primary focus of the study is to assess the socio-economic impacts of energy poverty on women and students in a typical African rural community. The study focuses on local, residential and rural energy consumption spheres of energy poverty. It was difficult to determine the income of respondents in the study area based on the peculiarities of the study respondents; they were largely farmers whose income is influenced by farming seasons. Thus, a preliminary survey was carried out to determine average disposable income based on average monthly expenditure. For students, the majority receive stipends from parents/guardians, while some students also engage in income-generating activities but also finds it difficult to arrive at a stable income range. Thus, the average stipends received by the majority of students was used as a benchmark for student's income. For the two groups, the average income arrived at was the #10,000 naira.

3. Results and discussion

3.1. Social-economic characteristics of sampled women and students

Table 1 shows socio-economic characteristics of respondents. The study revealed that the majority (62.5%) of rural women participants were above 65 years, while a majority (60.0%) of students' participants were above 20 years. The study investigated occupational status of women respondents. Investigations revealed that a majority (72.5%) of women respondents were farmers, while about one-third (27.5%) engages in non-farming activities. It was difficult to assess and ascertain average monthly income of rural women and students, because a majority of women engage largely in agricultural practices and trading activities. For agricultural practices, income is often seasonal and cannot be determined on a monthly basis, and the trading activities are only done to meet daily needs. Further, the average monthly income of the women respondents and average monthly stipends received by student were respectively examined. A majority (74.2%) of women respondents reported that they earn below 10,000 naira, while 25.8% respondents earn above 10,000 naira. Similarly, a majority (70.0%) of students' participants reported that they receive about 10,000 naira as a monthly stipend, while about one third (30.0%) of student participants reported that they receive above 10,000 naira on as monthly stipends. Marital status of participants was also assessed. A majority (87.5%) of the women respondents were married, while only 15% of students' participants were married. Further interrogations with the married students revealed that none of them were living with their couples. About two-thirds (65.0%) of sampled students were male, while 35% were female. On educational status, only the educational status of women was assessed. The study revealed that a majority (82.5%)

of women respondents were illiterate while 15.5% were literate. For the students, it was found that 63.3% of respondents were running their national diploma programs, while 36.7% respondents were running their higher national diploma programs.

3.2. Energy demand and consumption evidence of respondents

Table 2 shows energy demand and energy consumption evidence of women and student respondents. On the main source of energy used for cooking, the study revealed that about two-thirds (66.7%) of women respondents uses traditional stove, while about 31.7% of them uses stove. On the contrary, half (50.0%) of the students' respondents use LPG (liquefied petroleum gas), while about two-fifths (37.5%) of students use electric stove. At a glance, the results revealed broad differences between the main source of energy used for cooking by women and students. For women, the traditional stove which relies on traditional biomass fuel still remains their dominant choice, while students use modern cooking energy options. Traditional biomass has been reported to be responsible for fumes, smoke and poor air quality as well as an estimated annual mortality of about 1.5 million people (ESMAP, 2002, Gunnigham, 2013; Pachauri, et. al., 2004). Similarly, its continuous use by rural women will affect the attainment of targets of the Sustainable Development Goal (SDG 7) on universal access to affordable and clean energy, which is expected to be achieved by 2030. This will also have negative effects on climate change, human health and leads to loss of biodiversity and deforestation.

Furthermore, the study assessed the type of cooking fuel used. More than half (55.8%) of women respondents use forest produce, about two-fifths (35%) women respondents use kerosene. For sampled students, the study revealed that more than half (54.2%) sampled students reported that they use LPG, 39.2% uses electricity and 6.6% uses kerosene. This evidence suggests the complexity of energy poverty in rural areas of developing countries. Rural women adopted natural forest products that are easily available and free to gather, while students who adopted LPG. As averred by Quartey (2014), in rural areas of Ghana, fuelwood accounted for 90% energy consumption for cooking. Its adoption has been based on its availability and cost-free. Though the health and climate implications of biomass fuels are grave, yet its relative availability and free access made it become the choice for rural women. The study assessed the main source of energy for lightning in the study area. For the women participants, a majority (98.3%) respondents use electricity as their main energy source for lightning, similarly, a majority (93.3%) of students' participants also use electricity as the main energy source for lightning. Chiefly, a majority (95.8%) of all respondents use electricity as the main energy source for lightning. This finding suggests that electricity is adopted for lightning purposes by the rural women and but not for cooking.

Furthermore, the study assessed the main energy source adopted by respondents. It was revealed that all the rural women adopted electricity as their main source of household energy, while a majority (91.7%) of students' respondents also reported that electricity was their main source of energy. Thus, it can be averred that electricity is the main source of energy use in the study area. Household/electrical appliances were assessed and documented in Table 3. A majority of (95.8%) rural women respondents reported that they have a radio set, while only one-quarter (25%) of students have a radio set. Generally, about two-thirds (60.4%) of respondents have a radio set. On ownership of TV set, a majority (94.2%) of women respondents do not have a TV, while a majority of (80.8%) sampled students also do not have a TV set.

On ownership of laptop/computer set, a majority (99.2%) of women respondents do not own a laptop/computer, while a majority (95.8%) students reported that they have a laptop/computer set. It is plausible that students will need ICT gadgets such as laptops for studying and researching. The study revealed that majority (98.3%) of women respondents do not use fluorescent lamp but a majority (99.2%) of them uses the energy bulb. For students, the study revealed that a majority (91.7%) of students uses fluorescent bulb, while, (93.3%) does not use the light bulb. The fluorescent tube is energy-saving and more fashionable, hence might appeal to students. On kerosene lamp, majority of rural women (95%) still uses the kerosene lamp, while no student uses the kerosene lamp. Availability of table fan was assessed in the study area. The study revealed that a about two-thirds (62.5%) women do not have fan, while about 37.5% have ceiling fan. For student, about two-thirds (65%) reported that they have table fan and similarly, about two-thirds (68.3%) of students reported to having ceiling fan. The choice of adaptive comfort and thermal responses in rural areas might largely depends on income, socio-cultural factors and local-climate conditions of residents. For instance, study conducted by Wong, et. al., (2017) affirmed that in urban center of Kuala Lumpur, more than half of households adopted the use of air conditioners and fans as cooling devices. Lastly, on the use of internet-enabled mobile phone/ modem, the study revealed that majority (94.2%) women respondents do not have an internet-enabled mobile phone/modem, while a majority (96.7%) students have internet-enabled phone/modem. Broadly speaking, the results revealed that students have higher energy demand than rural women. Based on the foregoing, it is evident that the women are disproportionately more prone to energy poverty. As averred in the previous analysis, the energy poverty status of rural people, in this case, women and students might not be attributed to economic factors alone. Similarly, the findings from these results agree with previous studies such as (Papada & Kaliampakos, 2016) which affirmed that habits, cultural beliefs, household appliances energy use and constraints on energy expenditure will influence energy demands of different household and create differentiation in resident energy demand.

3.3. Social-economic impacts of energy poverty on respondents

Social-impacts of energy poverty based on main energy source

Table 3 reveals the summary of social-economic impacts in relation to cooking with a main energy source. The concept of opportunity cost, which assesses the best alternative forgo in making a choice, was adopted to examine the social impacts of the main energy source for cooking adopted by respondents. The study adopted a simplified model for examining opportunity cost based on the available data available. A 2hr benchmark adopted from the World Health Organization (WHO) for an efficient cooking device was used as a parameter to assess the opportunity cost of respondents' main cooking source. The study revealed that for women using stove, a majority (78.9%) reported that they spent more than two hours on average for cooking activities. For those cooking with fuelwood, a majority (83.7%) reported that they spent more than two hours for each cooking activity. However, women who use gas spent less than two hours. For students, who uses stove, 86.7% reported that they spent more than two hours for cooking, a majority (75.0%) of students who use LPG reported that they spent less than two hours on average for cooking, similarly, a majority (73.3%) of students who uses electric devices averred that they spent less than two hours on average for cooking. The results indicated that the opportunity cost for cooking was higher for the women who adopted traditional means of cooking as compared to students who adopted modern energy cooking options. This finding agrees with similar works done such by several researchers (Kumar, 2020; Roberto, et. al., 2014; Scarpellini, et.al., 2015). These works affirmed that poor energy is proportional to inefficiency and increase indoor air pollution. As posited by the WHO, an efficient energy source for cooking requires 4h /week for fuel collection.

Health impacts of energy poverty on rural women

Table 4 presents information on health impacts of energy poverty on rural women. Health impacts captured in the study are in line with those captured in similar studies. The 4hr WHO benchmark for collecting fuel was used as a benchmark in assessing the physical impacts of such activity on health. In rural areas of developing countries, the task of collecting fuelwood largely falls on children and women who are also responsible for cooking. The study revealed that more than two-fifths (46.7%) of women reported spending between 4-8hrs collecting fuelwood, about 34.1% spend above 8 hours, while only about one fifth (19.2%) spend less than 4h per week in collecting fuelwood for cooking. It is expected that the longer time spent on wood collection will have negative impacts on the health of rural women, especially for the aged women who are the majority in this study. To ascertain exposure to emission as a result of cooking with traditional biomass, the study adopted the World Health Organization (WHO, 1979) and United Nations Development Programme UNDP (UNDP, 2004; 2010b) benchmarks. According to the WHO/UNDP cooking with fuelwood and wood stove exposes residents to hazardous components such as Respirable Suspended Particulate Matter, Carbon monoxide, and Nitrogen oxide. These pollutants are capable of causing respiratory problems. The WHO specified 30mg/m3 for 24hr period as maximum concentration for Carbon monoxide and 10mg3for 8hr as minimum exposure. Thus, the study assumes that women who use traditional mass for more than 5 days/ week have been exposed to these pollutants. The study revealed that more than nine-tenths (95%) of women respondents reported to have been exposed to emission through indirect combustion of fuelwood, while 5% were fairly exposed to emission through cooking. Lastly, tiredness as a result of long time in gathering wood and cutting wood for fuelwood was assessed. Investigations from the study revealed a majority (81.7%) of women reported to be very tired, while about one-fifth (18.3%) women reported to be fairly tired. The result is similar to evidence presented by Kanagawa and Nakata (2007b) who found a similar pattern of longer time spent on collecting wood, exposure to emission from fuelwood and tiredness/drudgery as a result of long time in collecting and cutting wood for fuel among rural women in India.

Social-economic impacts of energy poverty on students' education

Table 5 is the results of the social-economic impacts of energy poverty on education. Energy poverty in this context was conceived as the average electricity supply per day. A 6hr/day benchmark was adopted based on the average supply per day during the period of the survey. An index was created to measure students perceived impacts of electricity supply on their education. This was referred to as Education Perception Index (EPI). This index is in line with similar studies such as Central Connecticut State University Research (CCSR, 2005) and Afon (2007) that developed perception indices using Likert scales to measure the perception of respondents on different attributes. The study revealed that the greatest impacts of energy poverty on the education of students is on the utilization of ICT for learning purposes. The next ranked was on its impact on overall academic performance, as well as, making night reading difficult. Lastly, poor energy supply gives students little time to study was ranked 4th. These findings strongly posit that energy poverty will have negative impacts on education.

Table 1: Socio-economic characteristics of rural women and student

Variable	Distribution	Respondents	Percent	Student	Distribution	Respondent	Percent
Age	Age cohort(years)				Age cohort (years)		
	Below 65	45	37.5		Less than 20	48	40.0
	Above 65	75	62.5		Above 20	72	60.0
	N	120	100.0		N	120	100.0
Main Occupation							
	Farm	87	72.5	Students' Level			
	Non-farm	33	27.5		National Diploma	76	63.3
					Higher national diploma	44	56.7
	N	120	100.0		N	120	100.0
Income				**Monthly stipend**			
	Less than 10,000	89	74.2	Less than 10,000		84	70.0
	Above 10,000	31	25.8	Above 10,000		36	30.0
	N	120	100.0	N		120	100.0
Marital Status							
	Married	105	87.5	Married/cohabiting		18	15.0
	Single	15	12.5	Single		102	85.0
	N	120	100.0	N		120	100.0
				Gender			
Educational status							
	Educated	21	17.5		Male	78	65.0
	Not educated	99	82.5		Female	42	35.0
	N	120	100.0		N	120	100.0

Table 2: Energy demands of rural women and student respondents

Indicators	Women		Students		Overall	%
Main energy for cooking	Res	%	Res	%		
Stove	38	31.7	15	12.5	53	22.1
Gas	1	0.8	60	50.0	61	25.4
Electricity (i.e. Hot plate)	1	0.8	45	37.5	46	19.2
Traditional wooden stove	80	66.7	-	-	80	33.3
N	120	100.0	120	100.0	240	100.0
Type of cooking fuel used						
Kerosene	42	35.0	8	6.6	50	20.9
Forest produce	67	55.8	-	-	67	27.9
Liquefied Petroleum Gas(LPG)	2	1.7	65	54.2	67	27.9
Electricity	9	7.5	47	39.2	56	23.3
	120	100.0	120		240	
Main energy source for lightning						
Electricity	118	98.3	112	93.3	230	95.8

Generating set	-				8		6.7		8		3.3	
Others(Traditional lamp, torches, rechargeable lamps)	2		1.7		-				2		0.8	
N	120		100.0		120		100.0		240		100.0	
Main source of household energy												
Electricity	120		100.0		110		91.7		230		95.8	
Generating set	-		-		8		6.7		8		3.3	
Solar panels	-		-		2		1.6		2		0.8	
N	120		100.0		120		100.0		120		100.0	
Household Appliances	A		NA		A		NA		Overall A		Overall NA	
Radio	115	95.8	5	4.2	30	25.0	90	75.0	145	60.4	95	39.6
TV	7	5.8	113	94.2	23	19.2	97	80.8	30	25.0	210	87.5
A laptop/computer	1	0.8	119	99.2	115	95.8	5	4.2	116	48.3	124	51.7
Fluorescent lamb	2	1.7	118	98.3	110	91.7	10	8.3	112	46.7	128	53.3
Light bulb	119	99.2	1	0.8	8	6.7	112	93.3	113	52.9	127	47.1
Kerosene lamb	114	95.0	6	5.0	-	-	120	100.0	114	47.5	126	52.5
Fan	45	37.5	75	62.5	82	68.3	38	31.7	127	52.9	113	47.1
Refrigerator	15	12.5	105	87.5	9	7.5	111	92.5	24	10.0	216	90.0
An internet-enabled mobile phone	7	5.8	113	94.2	116	96.7	4	3.3	123	51.3	117	48.7

Table 3: Opportunity cost of cooking with main energy source (estimated in hrs/day)

Indicators	**Women**					**Indicators**	**Students**				
Cooking device	2hrs	%	Above2hrs	%	N		2hrs	%	Above2hrs	%	N
Stove	8	21.1	30	78.9	38	Stove	2	13.3	13	86.7	15
Fuelwood	13	16.3	67	83.7	80	Gas	45	75.0	15	25.0	60
Gas/Electricity	2	100.0		-	2	Electricity	33	73.3	12	26.7	45
N	23	19.2	97	80.8	120		80	66.7	40	33.3	120

Table 4: Health impacts of energy poverty

Impacts	**Indicators**	**Res**	**%**
*Time spent on collecting fuelwood			
	Below 4h	23	19.2
	4-8 hrs	56	46.7
	Above 8hrs	41	34.1
	N	120	100.0
**Expose to emission through indirect combustion of fuelwood			

	Exposed	114	95.0
	Fairly exposed	6	5.0
	N	120	100.0
Tiredness as a result of long time in gathering woods and cutting wood for firewood			
	Very Tired	98	81.7
	Fairly tired	22	18.3
	N	120	100.0

*4h was specified as benchmark by WHO as maximum needed to get fuelwood for cooking. **Uses wood stove of fuelwood for more than 5 days a week

Table 5: Social economic impacts of energy poverty on education

Education impacts Rank	**SD** (1)	**D** (2)	**A** (3)	**SA** (4)	**SWV**	**μ=SWV/n**	**(μ-A)**	**(μ-A)^2**	**Rank**
Little time to study	2	3	5	100	423	3.53	-0.12	0.0144	4th
Make reading difficult at night	3	7	36	78	437	3.64	-0.01	0.0001	2nd
Makes utilization of ICT for learning purpose difficult	1	1	23	95	452	3.77	0.12	0.0144	1st
Affects overall academic performance	1	1	38	80	437	3.64	-0.01	0.0001	2nd
N						14.58		0.029	

4. Conclusion

The study revealed different consumption patterns for women and students; while rural women prefer traditional fuels to cooking and electricity for lighting. One of the main findings from revealed the health implications of the unavailability of modern energy services and lack of financial resources to obtain energy services on rural people. The continuous depletion of forest resources in the area also portends danger for environmental and energy sustainability. Students studying in an energy-poor rural community will largely also be affected as lack of electricity supply and other modern services will limit learning potential and outcomes of students. Therefore, the study suggests increased awareness in rural areas on the dangers of traditional fuels and its negative impacts on health and well-being. Also, government and energy providers need to make modern energy services easily affordable for rural dwellers, so as to discourage the use of traditional fuels. Lastly, efforts by the government in tapping into more renewable energy sources such as wind, small hydroelectric projects, and waste-to-energy can be used in resolving energy poverty in rural areas.

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