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# THE IMPACT OF PSYCHOLOGICAL AND SOCIO-ECONOMIC VARIABLES ON HOUSEHOLD ENERGY CONSERVATION: A CASE STUDY OF IBADAN CITY, NIGERIA

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**ABSTRACT**

Energy conservation at homes has become a topical issue among policy makers and researchers. This is borne out of the fact that household energy demand constitutes a large portion of the total energy demand in most countries. In Nigeria, the sector accounts for 40% of the total energy demand. Leaning upon the theory of planned behaviour (TPB), this study examines the relationship that exists between energy conservation and psychological variables on one hand and household socio-demographic characteristics on the other hand. Structural equation model was used to model the path diagram of the relationship that exists between the two domains (psychological and socio-demographic variables). Results show that Psychological variables were strongly related to energy conservation while the socio-demographic variables were insignificant in influencing energy conservation.

**Keywords:** energy conservation, psychological variables, socio-demographic variables, structural equation model (SEM).

## 1. INTRODUCTION

Energy is the lifeblood of the global economy, a crucial input to nearly all of the goods and services of the modern world [1]. With rising wealth and affluence in much of the world, energy consumption of households has increased tremendously. Mankind today is faced with a daunting energy challenge. This challenge is in three dimensions. First, it is obvious that the current pattern of energy consumption is environmentally unsustainable. This is based on the fact that majority of households especially in developing countries are still relying on biomass fuel for greater part of their energy need which has a debilitating effect on the earth's climate. Second is the imbalance in the energy access between the haves from the have-nots [2]. The imbalance in energy access is such that an estimated 2 billion people or more do not have access to one or several types of energy services such as electricity and cleaner cooking fuel [3]. Although an accurate projection of the use of biomass fuel and other wastes are difficult to obtain, these energy sources are estimated to account for about 10 % of the overall primary energy use especially in the rural areas of developing countries [2]. The third, which has started receiving attention lately especially in the developed countries is energy conservation and lifestyles. For instance, in their study of 600 Swedish households, Carlsson-Kanyama et al.[4] reported that environmental attitudes towards energy are the major factors influencing the use of appliances in households. Energy efficiency and conservation have long been critical issues in the energy policy dialogue and have taken on a renewed importance as concerns about global climate change and energy security have intensified. Many have argued that reducing the demand for energy is essential to meeting these challenges, and analyses tend to find that demand reductions can be a cost-effective means of addressing these concerns [5]. Energy conservation behaviour has been found to be related with attitude [6]. Lorenzoni et al. [7] observed that in developing a sustainable solution to climate change, providing long - term changes in people's attitude and lifestyles is as important as public involvement in any democratic process. Meaning that before any meaningful progress is made in the area of household energy conservation, people's involvement is needed. Stern [8] noted that energy conservation can be put in to law without an understanding of climate change when it is motivated by economic reasons, but mitigation policies may not be accepted by public lacking an understanding of the whole issue. What this means therefore is that public awareness is equally important as promulgating laws on energy conservation. Although energy conservation may be achieved through advancement in technology and environmental policies that focus on households, it also depends upon the households' demographic profile and behavioural characteristics [9]. Studies have shown that household characteristics such as income, age, household size, educational qualification have influence on household energy consumption [10, 11, 12, 13, and 14]. Socio-demographic factors such as income and education level also affect behavioural choices, because they determine to what extent individuals are able to engage in energy-saving behaviour [15]. Abraham and Steg [13] observed that some studies have examined attitudinal variables only (without including socio-demographics) in relation to energy consumption, while others have included attitudinal variables as well as socio-demographics [16, 17, 18]. The authors noted that these studies included only few psychological variables, and did not use psychological theories to inform the relationships between psychological variables and energy consumption. Hence, some of them concluded in their findings that psychological variables are only weak predictors of household energy use, while in fact the studies did not include a comprehensive set of psychological variables. However, studies looking at the effect of psychological and socio-demographic variables on household energy

conservation in a developing country like Nigeria are few. Most studies on household energy focus on preference of various energy sources which are mainly econometric in nature. The present study deviates from this by looking at the influence of psychological and socio-demographic variables on household energy conservation

## 2. THEORETICAL UNDERPINING

### 2.1. Theory of planned behaviour (TPB)

The theory of planned behaviour (TPB) has been widely used in explaining behaviour and behaviour change [19, 20]. The extents to which humans are ready and willing to try in performing the behaviour in question indicate their behavioural intentions. However, intentions are presumed to be governed by subjective norms, attitudes and perceived behavioural control. Attitude here means the extent to which an individual has a favourable or unfavourable assessment of a particular behaviour [13]. For example, households may not refrain from putting off their air conditioner to reduce energy consumption for some time because they feel that their comfort will be compromised. Attitude directed towards behaviour is an individual's overall assessment of the behaviour. This has two components that work together: belief regarding the outcome of the behaviour and the corresponding negative or positive judgments about each of these features [21]. Subjective norms deal with an individual's view (perception) of the level to which those at the head or what Abraham and Steg [13] refer as 'important others' would endorse a particular behaviour and the urge by the individual to comply with this social pressure. Important others here could be family members or relations, government, friends etc. There are two components that work together in subjective norms: the belief about how other people that an individual termed to be 'important' would behave (normative beliefs) and the negative and positive judgement on each belief. In other words how an individual evaluates the outcome [21]. Perceived behavioural control implies the perceived ease or difficulty one may encounter in engaging in behaviour. In this instance, an individual may not engage in behaviour due to some presumed challenges that he or she feels that may hinder such an action. For instance, households may not accept the reduction in energy consumption because they feel incapable of doing so. The assumption of TPB is that structural variables like socio- demographics influence behaviour and intentions indirectly [19], meaning that psychological variables are presumed to mediate on the relationship between behaviour and socio demographic variables [13]. The major assumption behind the TPB is that humans make planned, rational decisions that are motivated by self-interest.

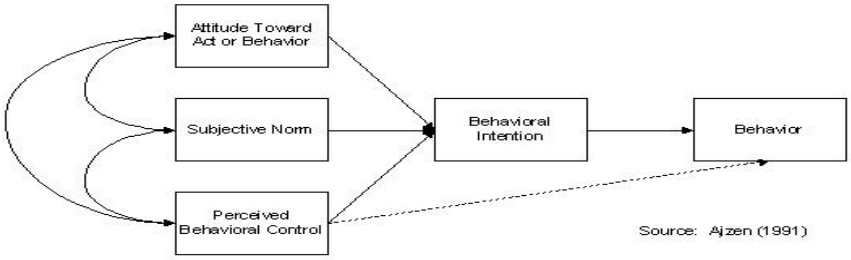


**Figure-1.** TPB model.

## 3. BEHAVIOUR, ATTITUDE AND ENERGY CONSERVATION

The motivation to carry out an action is influenced by beliefs about and evaluation of outcomes of a behaviour which in turn influences the attitudes towards certain behaviour and intention to engage in such behaviour [22]. Behaviour is habitual and guided by automated cognitive processes, rather than being preceded by elaborate reasoning. When people frequently act in the same way in a particular situation, that situation will be mentally associated with the relevant goal-directed behaviour. The more frequently this occurs, the stronger and more accessible the association becomes, and the more likely it is that an individual acts accordingly. Thus, habitual behaviour is triggered by a cognitive structure that is learned, stored in, and retrieved from memory when individuals perceive a particular situation [23]. The intention to perform certain behaviour is influenced by social norms concerning the behaviour. The attitude of most people towards saving energy is positive [22]. However, positive attitude to behaviour do not guarantee that the behaviour will actually be performed [24]. Contextual factors have some effect on behaviour. Stern [8] noted that contextual factors include external influences such as incentives, physical capabilities and constraints, interpersonal influences, legal and institutional factors and public support. According to Stern, when the effect of context is little or neutral, the attitude of the user plays a major role. Also, the influence of attitude on behaviour is little when it is strongly influenced by the context [22]. Attitudinal variables portray an individual's state of mind or feeling. A definition of "attitude" in social psychology is the valuation of a concept or an object [25]. Attitudes have been found to correlate with energy conservation behaviour. However, Psychology-based studies show mixed results [9]. Values such as helping others, concern for the environment and a moral commitment to use energy more efficiently are influencing individuals and groups to adopt energy efficiency measures [26]. In their study on integrated household

energy conservation policy programme in Singapore, He and kua [27] categorized their respondents in to three groups: leaflet/ sticker group, counseled group and control group. The authors reported that households in the counseled group achieved greater improvements in self - reported energy conservation behaviour but that this did not translate to actual reduction in energy consumptions. They noted that some of the reasons that could be adduced to the variation in self- reported behaviour and actual reductions in energy include: (1) Duration and frequency of actions taken may not be able to impact significantly in reducing the overall energy consumption (2) The likelihood of respondents lying during the interview to provide answers that are socially desirable (3) Change in composition of household during the course of the study (4) Very few households purchased additional appliances during the period the study lasted. What this suggests therefore, is that reported behaviour of people towards energy use may not really reflect their actual reduction in terms of quantity of energy consumed.

## 4. METHOD

### 4.1. Instrument

The study was based on questionnaire survey. The questionnaire is divided into 2 parts. Part A comprises the respondents' demographic profiles such as gender, age group, occupation, monthly income, educational qualification and marital status. Part B relates to the attitude and behaviour of respondents towards energy conservation and environmental concern. Consistent with the research questions posed in the study, the questions asked in this part of the questionnaire were related to attitude and behaviour towards energy conservation and environmental concern. The items in the questionnaire were presented in a 5-point likert scale (1 = strongly disagree, 5 = strongly agree). The items were validated through reliability test. A Cronbach Alpha coefficient of 0.77 was obtained for the Energy conservation construct, 0.78 for PBC construct and 0.68 for ATT construct.

### 4.2. Participants

The research participants were household heads in the three housing density (low, medium, high) of Ibadan city, Nigeria. A total of 580 copies of questionnaire were randomly distributed across the three housing densities of the city, out of which only 540 were retrieved and used for analysis. The breakdown are as follows low density = 136, medium density = 198, high density = 206. The sample is a representative of the entire city because participants were chosen from the three housing density representing the income groups (low, medium, high). 31.5% of the participants earned below 20, 000 monthly, 29.7% between 20 and 40, 000, 16.3% between 41 and 60, 000, 13.1% between 61 and 150, 000, 4.8% between 151 and 250, 000 and 4.6 % above 250, 000. (2012 exchange rate, 165 Naira to 1 U.S Dollar). The high income was underrepresented in the sample. About two-third (66.2%) of the sample were in the age range of between 20 and 40, 19.4% were between 41 and 50 years and 14.4 % were above 50 years. This reflects the age distribution pattern in the country. A little above half (52%) of the respondents were men while the rest (48%) were females. The average household size was 5.4 (Sd = 4.78). About 29.3% or respondents had first degree, 23.1% secondary education, 20.1% Diploma/NCE, 9.2 % maters' degree, 8.6% primary education, 7.9% non- formal education, 1.3% PhD and 0.5% other qualifications. In terms of marital status, 52.9% were married, 37.7% single, 6.1% widowed and 3.3 separated. Those engaged in private business were about 29.5%, 23.9% were civil servants, 10.7% engaged in to professional services, 12.5% were artisans, 4.6% were retirees and 16.3% engaged in other occupations.

### 4.3. Socio-demographic variables

Household heads were asked to indicate their total monthly income in Naira the local currency. This was done on a six point scale, with [1] < ₦20, 000 [2] ₦20-40, 000 [3] ₦41- 80, 000 [4] ₦81-150, 000 [5] ₦151- 250, 000 [6] > ₦ 250, 000. Age was measured on five point scale with [1] 20-30 [2] 31-40 [3] 41-50 [4]51-60' [5] > 60. The educational qualification of respondents was measured on eight point scale in order to capture all the segments in the society [1] non-formal education [2] primary education [3] secondary education [4] Diploma/NCE [5] 'first degree [6 masters 'degree [7] PhD [8] other qualifications. Psychological variables were measured on five-point Likert scales, and scores ranged from 1 'strongly disagree' to 5 'strongly agree'. Gender measured as dummy 1 male and 0 otherwise.

## 5. MEASUREMENT OF CONSTRUCTS

### 5.1. Energy conservation variables

Five items were used to measure respondents' attitude towards energy conservation ("I make every effort to save energy at home", "I only switch on lights when am in the house", "As I leave the room, I make sure I switch all appliances except the fridge", "Energy conservation will reduce my quality of life" and "Energy conservation is not very enjoyable"). On average, households had a positive evaluation of energy conservation ($\alpha$ = .77; M = 3.8, Sd = 1 .26).

### 5.2. Perceived behavioural control (PBC) variables

Perceived behavioural control (PBC) referred to the extent to which respondents felt concern for the environment with respect to their energy use at home ("I feel I should change my habit towards energy use for the sake of the environment", "Energy consumption by households constitute very little to $CO_2$ emission", "I am conscious of the way and manner I use energy at home because of its impact on the environment," Climate change and global warming is a serious problem for our society'', "My use of generating set for electricity generation has an impact on the environment''). On average, households had positive evaluation towards environment ($\alpha$ = .78; M = 3.5, Sd = 1.2).


### 5.3. Attitude variables

Attitude of the respondents with regard to adoption of energy efficiency measures were measured by these questions 'Using energy efficient appliances at home is another way of conserving energy', 'When I buy home appliances I look for those that are energy efficient', 'I would be willing to pay higher for home appliances that consume less energy', 'Using energy efficient appliances at home contributes little in reducing household energy consumption', 'Energy efficiency as a strategy cannot promote energy conservation' ($\alpha$ =.68, M = 3.57, Sd = 1.1)

## 6. STATISTICAL TECHNIQUE

The structural equation model (SEM) was used in examining the relationship that exist between household energy conservation and attitude and concern for environment on the one hand and socio-demographic variables on the other. Unlike regression analysis that examines a single relationship at a time, SEM provides a series of separate regression equations simultaneously [28]. It allows for specification and testing of complex path models and therefore is considered more rigorous and flexible than the comparable techniques based on multiple regression analysis [29].

### 6.1. Model fit indices

The use of Structural Equation Modelling (SEM) has gained prominence among researchers across disciplines and increasingly is a 'must' for researchers in the social sciences. However, the issue of how the model that best represents the data known as model fit is a subject that researchers have not reached a consensus on [30]. Owing to too many fit indices available in SEM and varied opinions among researchers on which one to report and also their cut off, there is need therefore for a researcher using the technique to be grounded in the area of his/her interest of research, since assessing whether a specified model fits the data is one important aspect of SEM [31]. The traditional measure for assessing the overall model fit (the discrepancy between the sample and fitted covariance matrices is through the chi - square [32]. Any model with an insignificant result at 5% level of significance is adjudged a good one, hence the Chi - square statistic is often referred to as either 'a badness of fit' [33] or a lack of fit measure [34].

However, the use of Chi- square statistics has some shortcomings. This is based on the fact that it is sensitive to sample size; models with large samples most times are rejected [35, 36]. On the other hand, when models have small samples the Chi-Square statistic lacks power and because of this may not discriminate between good fitting models and poor fitting models [37]. Root mean square error of approximation (RMSEA) is another model fit indices that are used in evaluating how good the model without known but optimally selected parameter values would match the covariance matrix of the population [38]. RMSEA values below 0.10 indicate a good fit to the data and below 0.05 considered a very good fit [39]. Goodness-of-Fit statistic (GFI) represents the squared residuals from prediction compared with the actual data. Its value range from 0 to 1, lower values indicate a poor fit while higher values indicate better fit [28]. The Comparative Fit Index (CFI) is a revised form of NFI [35] and it is sensitive to sample size [38] with small sample size the performance is better [40]. As with the GFI, values for this statistic range between 0.0 and 1.0 with values closer to 1.0 indicating good fit. The normed - fit index (NFI) evaluates the model by comparing its Chi-square value with that of the null model. Its value ranges between 0 and 1 with higher values indicating good fit.

**Table-1.** Fit indices for the model.

| $X^2$ | *Df* | GFI | RMSEA | NFI | CFI | IFI |
|---|---|---|---|---|---|---|
| 121.47 | 42 | 0.91 | 0.09 | 0.81 | 0.90 | 0.91 |

Note: df = degree of freedom
GFI = Goodness-of-Fit statistic
RMSEA = Root mean square error of approximation
NFI = Normed fit index
CFI = Comparative fit index
IFI = Bollen fit index
Recommended value for RMSEA <0.10, GFI, NFI, CFI values between 0.8- 1.0

Looking at the fit indices for the model (Table-1), with an RMSEA value of 0.09, it could be adjudged a fair one for the data. With GFI, CFI and IFI value of 0.9, the model shows a good fit.

## 7. RESULTS

The aim of this study is to assess the relationship that exists between household attitude, environmental concern, socio-demographic variables and energy conservation. Hence, we hypothesized in the study that:

$H_0$) Psychological variables (attitude, concern for environment) do not have any significant effect on household energy conservation
$H_0$) Socio-demographic variables (age, income) do not have any significant effect on household energy conservation.

**Table-2.** Path statistical results (standardized coefficients).

| | | | Estimate | S.E. | C.R. | P |
|---|---|---|---|---|---|---|
| EC | <--- | ATT | .203 | .081 | 2.427 | * |
| EC | <--- | PCB | .645 | .110 | 6.088 | *** |
| EC | <--- | Income | .028 | .029 | .411 | .681 |
| EC | <--- | Age | -.042 | .080 | -.621 | .535 |
| B1 | <--- | ATT | .685 | | | |
| B2 | <--- | ATT | .617 | .144 | 6.569 | *** |
| B3 | <--- | ATT | .739 | .169 | 6.584 | *** |
| A1 | <--- | EC | .673 | | | |
| A2 | <--- | EC | .754 | .145 | 7.767 | *** |
| A3 | <--- | EC | .620 | .140 | 7.093 | *** |
| C3 | <--- | PCB | .673 | | | |
| C2 | <--- | PCB | .633 | .119 | 7.805 | *** |
| C1 | <--- | PCB | .858 | .149 | 8.699 | *** |

*Significant at P <0.05, **Significant at P<0.01 ***Significant at P< 0.001
ATT = Attitude, PCB = Perceived behavioural control, EC = Energy conservation, A1- C3 = items measuring each of the constructs (see Table-3 for their description).

The parameters standardized coefficients and standard errors are presented in Table-2. The graphic representation of the model with the standardized path coefficients is displayed in Figure-1. Overall the model provides a good understanding of the factors that influence household energy conservation in an indigenous African city, Ibadan, Nigeria. The model explains about 0.876 (87%) variance in energy conservation by households. What this means therefore, is that psychological and demographic characteristics have a significant influence on energy conservation (P< 0.05). Although a relationship has been found to exist between energy conservation, psychological and demographic variables, the major thrust of this study is to examine which domain (psychological or demographic) has much influence on household energy conservation. This is achieved by looking at the contribution of the variables in the path diagram (Figure-2). Only three items with the highest factor loadings were used for each of the constructs in the final model. This was done in order to maintain uniformity among the constructs.

**Table-3.** Description of items used in the model.

| Code | Variables |
|---|---|
| A1 | I only switch on lights when I am in the house |
| A2 | I make sure I switch off all appliances when not in use except the fridge |
| A3 | Energy conservation will reduce my quality of life |
| C1 | I feel I should change my habit towards energy use for the sake of the environment |
| C2 | Energy consumption by households constitute very little to $CO_2$ emission |
| C3 | I am conscious of the way and manner I use energy at home because of its impact on the environment |
| B1 | Using energy efficient appliances at home is another way of conserving energy |
| B2 | When I buy home appliances I look for those that are energy efficient |
| B3 | Using energy efficient appliances at home contributes little in reducing household energy consumption |

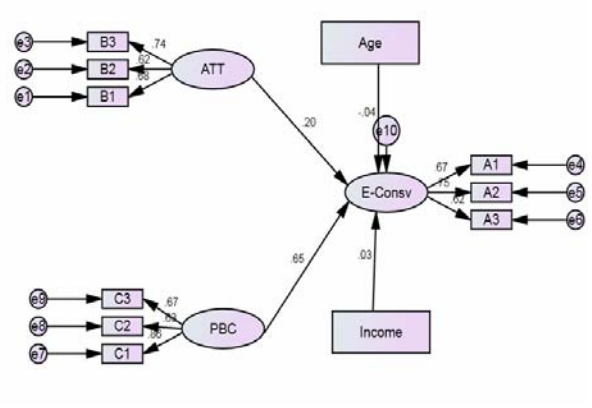


**Figure-2.** Household energy conservation path diagram.

### 7.1. Psychological variables

In the structural model (Figure-2), e1-e10 represents measurement error with arrows pointing to each item in a construct. Arrows from each construct (PCB, ATT, E- Consv) pointing to the items (A1- C3) shows how changes in the construct directly cause changes in the assigned items. The items in a construct must be highly correlated [41]. The results (Figure-2) show that concern for the environment (PCB) is strongly related to energy conservation ($\beta = 0.65$, $P<0.05$). What this implies is that any additional effort with regard environmental concern by a household would bring about 0.65 or 65 % variation in energy conservation when other factors are held constant. Similarly, results (Figure-1) show that attitude of households is strongly related to energy conservation ($\beta = 0.20$, $P< 0.05$). An additional effort made by households in terms of their attitude towards adopting energy efficiency measures would bring about 0.20 or 20% variation in energy conservation when other variables are held constant.

### 7.2. Demographic variables

Only two demographic variables income and age were considered in the model. The inclusion of the others (educational qualification and gender) affected the model fit hence they were removed since they had no significant contribution in the model. Results (Figure-2) reveal that no significant relationship exist between energy conservation and household income ($\beta = .028$, $P> 0.05$). What this means in essence is that income of household head does not really have any influence energy conservation. This suggests therefore, that whether a household is rich or poor does not really matter when it comes to adopting energy conservation measures. As could be seen, income accounted for only about 0.3% variation in the model. The second demographic variable age has an insignificant relationship with household energy consumption ($\beta = -0.042$, $P> 0.05$). The decision to imbibe in some energy conservation measures as revealed by this result is not influenced by age. In other words, whether a household head is young or old does not really determine his/her desire to conserve energy at home. Its contribution in explaining the variation in household energy conservation in the model is very little (about 4.2%).

## DISCUSSIONS

The results obtained from the SEM path diagram on household energy conservation reveals that the demographic variables (age, income) had insignificant influence on energy conservation. In contrast, the psychological variables which were measured by two constructs PBC and attitude had very significant influence on household energy conservation. Conserving energy at home as shown by the results of this study is strongly influenced by the concern a household has for the environment (PBC construct). Those households that take in to account the effect their actions would have on the environment tended to make more effort at home in conserving energy. Again, attitude of the household is another important factor that contributes significantly in influencing household energy conservation in this study. Attitude implies the household's behaviour towards energy conservation measures. A household could have a negative or positive attitude towards energy conservation at home. For instance, a household may look at energy conservation as a form of restriction to its freedom to enjoyment while another household may welcome it. Verhallen and Raaij [42] observed in their study that energy -conscious persons conserve more effectively in energy systems that require active involvement of the user while less energy -conscious persons do not. Consciousness in conserving energy is tied to the household's world view about energy conservation. Behavioural intentions require a certain amount of conscious effort, due to the fact that they involve a certain amount of planning and deliberation and are therefore strongly related to psychological variables [13].

The socio-demographic variables used in the study had little impact in predicting household energy conservation.[13] (2011) observed that socio-demographic variables influence possibilities and constraints that people face and that this invariably has effect on energy use (consumption). For instance, the high income group can afford to buy more appliances, and live in bigger apartments which results to more energy consumption. However, this may not be same with the intention to reduce energy (energy conservation) as it is strongly related to psychological variables. Household's decision to imbibe in energy conservation measures is something that is voluntary in nature and may be less constrained by socio-demographic variables as in energy use. In other words, studies that have found socio-demographic variables to be the major predictors and psychological variables weak focused on energy use [43, 18]. We argue therefore, that intention to reduce energy (energy conservation) at home is strongly related to psychological variables. While socio-demographic variables may significantly influence energy use at homes, energy conservation is something that has to do with behaviour and attitude of people which is dependent upon their perceived benefits and costs for engaging in it. The


findings are in line with previous studies [44, 13]. In this study, we measured household's energy conservation on household level, whereas the socio-demographic variables (age, income) and psychological variables were measured on an individual level (household head) because it was not possible to interview all the members in a household. Moreover, in African setting, the decision on energy use and preferences is to a large extent determined by the head of the household. In conclusion, the results of the present study suggest that household energy conservation is strongly related to psychological variables that influence the behaviour and attitude of individuals towards adopting measures that could reduce the quantity of energy they use at homes. Household energy conservation thus can be achieved through behavioural changes. The findings of this study suggest that creating awareness on the impact human activities especially as it relates to energy use could have on the environment will go a long way in promoting energy conservation.

In the past, issues relating to household energy have be hinged upon income especially in developing countries where majority lack access to cleaner fuels. Whenever, the issue of household energy is mentioned, all attention is focused on income as the major determining factor in the choice of fuel being used and the quantity of energy consumed. Although this may be true, however, the findings of this study suggest that issues relating to energy conservation do not follow the same path like the energy ladder hypothesis where income is the major 'driver'. Our findings show that government and policy makers should embark on intervention measures aimed at enlightening and encouraging households to incorporate some measures to reduce their daily energy consumption. Intervention measures have been identified to be effective in energy reduction. For example, Kua and Wong [45] in their study on energy conservation program in Singapore titled "Eco-living" reported that the intervention program was able to bring about 2% reductions in energy consumption in 37 out of 62 households survey during the study. Presently in the country, electricity supply from the grid is very low and erratic; through the culture of energy conservation at homes some measure of balance could be achieved between the demand and supply. During the time of the survey, it was observed that some households did not even care to switch of their light during the day even when nobody was at home. When asked why, one of them maintained that they are paying for the services. What this shows in essence is that people's behaviour and attitude towards energy conservation is still low in a developing country like Nigeria. It is important therefore, to enhance household's perceived possibilities to conserve energy and to let them know the impact their actions with regard to adopting some energy saving measures would have on the environment. Saving energy through energy efficiency improvements can cost less than generating, transmitting, and distributing energy from power plants, and provides multiple economic and environmental benefits [46]. Adopting energy saving measures by households could help in the reduction of CO2 emission that accompanies energy use at homes. Steg and Vlek [47] noted that most of the environmental problems posing a threat to mankind today such as global warming, loss of biodiversity and so on are as a result of poor pro-environmental behaviours. These problems have been found to be rooted in human behaviour [48, 49, 47] and can thus be managed by changing the relevant behaviour so as to reduce its environmental impacts.

**Limitation of the study**

In assessing any intervention towards energy conservation, two approaches are normally adopted; self-reported behaviour and actual consumption. However, in this study, we only used the self-reported behaviour. The inability to incorporate the actual consumption was due to time and financial constraint.

**REFERENCES**

[1] Eberhard A., V. Foster, C. Briceno-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan. 2008. Underpowered: The State of the Power Sector in Sub-Saharan Africa. Africa Infrastructure Country Diagnostic Background Paper. World Bank, Washington DC., USA.

[2] Ahuja D and Tatsutani M. 2009. Sustainable Energy for Developing Countries. S.A.P.I.EN.S. 2(1).

[3] UNDP. 2004. World Energy Assessment. United Nations Development Program, New York, USA. ISBN: 92-1-126167-8, www.undp.org/energy.

[4] Carlsson-Kanyama A., A-L Lindén and B. Eriksson. 2003. Hushållskunder på energimarknaden. värderingar och beteenden. Forskningsgruppen för miljöstrategiska studier, Sociologiska institutionen, Fms-rapport 181, Stockholm.

[5] Gillingham K, Newell R. G. and Palmer K. 2009. Energy Efficiency Economics and Policy. Resources for the Future Discussion Papers 1616 P St. NW Washington, DC 20036.

[6] Kriström B. 2008. Residential Energy Demand. OECD Report Household Behaviour and the Environment: Reviewing the Evidence.

[7] Lorenzoni I, Nicholson-Cole and Whitmarsh L. 2007. Barriers Perceived to Engaging with Climate change among the UK public and their policy implications. Global Environmental Change. 17: 445-459.

[8] Stern P. C. 2000. Towards a Coherent Theory of Environmentally Significant Behaviour. Journal of Social Issues. 56(3): 407-424.

[9] OECD. 2008. Household Behaviour and the Environment Reviewing the Evidence.

[10] Genjo K, Tanabe S, Matsumoto S, Hasegawa K and Yoshino H. 2005. Relationship between possession of electric appliances and electricity for lighting and others in Japanese households. Energy and Buildings. 37: 259-272.

[11] Nugroho S.B, Fajiwara. A, Zhang. J, Kanemoto. K, Moersidik S.S and Abas. S. 2011. Development of a Household Energy Consumption Model for Megacities in Asia.

[12] Cai. J and Jaing. Z. 2010. Energy Consumption Patterns by Local Residents in Four Nature Reserves in the Subtropical Broadleaved Forest zone of China. Renewable and sustainable Energy Reviews. 14: 826-834.

[13] Abrahamse W and Steg. L. 2011. Factors Related to Household Energy Use and Intention to Reduce It: The Role of Psychological and Socio-Demographic Variables. Human Ecology Review. 18(1).

[14] Eluwa S.E and Ho Chin Siong. 2012. Household Energy Consumption and Carbon Foot Print in Ibadan city, Nigeria. Paper presented at 6th APGS Seminar, 4th December 2012, Kuala Lumpur, Malaysia.

[15] Keizer M, Steg L and de Groot J. Quantitative Consumer survey. Integrated National Reports, Energy Research in the 7th Framework Programme.

[16] Brandon G. and Lewis A. 1999. Reducing household energy consumption: A qualitative and quantitative field study. Journal of Environmental Psychology. 19: 75-85.

[17] Gasterleben B., Steg L. and Vlek C. 2002. Measurement and determinants of environmentally significant consumer behaviour, Environment and Behaviour. 34(3): 335-362.

[18] Poortinga W., Steg L. and Vlek C. 2004. Values, Environmental Concern and Environmental Behaviour: A study into household energy use. Environment and Behaviour. 36: 70-93.

[19] Ajzen I. and Fishbein M. 1980. Understanding Attitudes and Predicting Social Behaviour. Englewood Cliffs, NJ: Prentice Hall.

[20] Ajzen I. 1985. From Intentions to Actions: A Theory of Planned Behaviour. In: J. Kuhl and J. Beckmann (Eds.). Action Control: From Cognition to Behaviour, Berlin: Springer. pp. 11-39.

[21] Francis J.J., Eccles M.P., Johnston M., Walker A., Grimshaw J., Roy R., Kaner, E.F.S., Smith L. and Bonetti D. 2004. Constructing Questionnaires based on the theory of planned behaviour. A manual for health services researchers. Quality of life and management of living resources.

[22] Geelen D, Keyson D, Boess S and Brezet H. 2012. Exploring the Use of a Game to Stimulate energy saving in households. J. Design Research. 10(1/2).

[23] Steg L and Vlek C. 2009. Encouraging Pro-Environmental Behaviour: An integrative review and research agenda. Journal of Environmental Psychology. 29: 309-317.

[24] Lander F. and Thøgersen J. 1995. Understanding of Consumer Behaviour as a Prerequisite for Environmental Protection. Journal of Consumer Policy. 18: 345-385.

[25] Sjöberg L. and E. 2005. Engelberg Lifestyles and Consumer Behaviour, Centre for Risk Research, Stockholm School of Economics, 20 April.

[26] Patrik Thollander, Jenny Palm and Patrik Rohdin. 2010. Categorizing Barriers to Energy Efficiency - an Interdisciplinary Perspective, Energy Efficiency. Jenny Palm (Ed.). ISBN: 978-953-307-137-4.

[27] He H.Z and Kua H.W. 2013. Lessons for Integrated Household Energy conservation Policy from Singapore's Southwest Eco-living Program. Energy Policy. 55: 105-116.

[28] Hair J., Aderson R, Tatham R and Black W. 1998. Multivariate data analysis Uppers Saddle River, New Jersy: Prentice Hall Inc.

[29] Kelloway E.k. 1998. Using Lisrel for structural equation modelling. CA International Educational and Professional Publisher, SAGE Publications.

[30] Hooper D, Coughlan J and Mullen M. 2008. Structural Equation Modelling: Guidelines for Determining Model Fit. The Electronic Journal of Business Research methods. 6(1): 53-60.

[31] Yuan K.H. 2005. Fit Indices versus Test Statistics, Multivariate Behavioural Research. 40(1): 115-48.

[32] Hu L.T. and Bentler P.M. 1999. Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria versus New Alternatives. Structural Equation Modeling. 6(1): 1-55.

[33] Kline R.B. 2005. Principles and Practice of Structural Equation Modeling. 2nd Edition. New York: The Guilford Press.

[34] Mulaik S.A., James L.R., Van Alstine J., Bennet N., Lind S. and Stilwell C.D. 1989. Evaluation of Goodness-of-Fit Indices for Structural Equation Models. Psychological Bulletin. 105(3): 430-45.

[35] Bentler P.M. and Bonnet D.C. 1980. Significance Tests and Goodness of Fit in the Analysis of Covariance Structures. Psychological Bulletin. 88(3): 588-606.

[36] Jöreskog K. and Sörbom D. 1993. LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language. Chicago, IL: Scientific Software International Inc.

[37] Kenny D.A. and McCoach D.B. 2003. Effect of the Number of Variables on Measures of Fit in Structural Equation Modeling. Structural Equation Modeling. 10(3): 333-351.

[38] Byrne B.M. 1998. Structural Equation Modeling with LISREL, PRELIS and SIMPLIS: Basic Concepts, Applications and Programming. Mahwah, New Jersey: Lawrence Erlbaum Associates.

[39] Steiger J.H. 1990. Structural Model Evaluation and Modification. Multivariate Behavioural Research. 25: 214-12.

[40] Tabachnick B.G. and Fidell L.S. 2007. Using Multivariate Statistics. 5th Ed. New York: Allyn and Bacon.

[41] Hulland J. 1999. Use of Partial Least Squares (PLS) in Strategic Management Research: A Review of Four Recent Strategic Management Journal. 20: 195-204.

[42] Verhallen M.M and vaRaaij W.F. 1984. Energy Conservation Through Behavioural Change: The use of Natural Gas for Home Heating. Journal A. 25(3).

[43] Moll H. C., Noorman K. J., Kok R., Engström R., Throne-Holst H. and Clark C. 2005. Pursuing more sustainable consumption by analyzing household metabolism in European countries and cities. Journal of Industrial Ecology. 9: 259-275.

[44] Semenik R, Belk R and Painter J. A. 1982. Study of the factors Influencing Energy Conservation Behaviour in Advances in Consumer Research Vol. 09. Andrew Mitchell Association for Consumer Research. pp. 306-312.

[45] Kua H.W and Wong S.E. 2012. Lessons for integrated household energy conservation policies from an intervention study in Singapore. Energy Policy. 47: 49-56.

[46] US EPA. 2011. Local Government Climate and Energy Strategy Series: Energy efficiency programmes in K-12 schools. State and Local Climate and Energy program.

[47] Vlek C. and Steg L. 2007. Human Behaviour and Environmental sustainability: problems, driving forces and research topics. Journal of Social Issues. 63(1): 1-19.

[48] DuNann Winter D. and Koger S. M. 2004. The psychology of environmental problems. Mahwah, NJ: Lawrence Erlbaum.

[49] Gardner G. T. and Stern P. C. 2002. Environmental problems and human behaviour. 2nd Ed. Boston, MA: Pearson Custom Publishing.