International Journal of Energy Economics and Policy
Vol. 5, No. 1, 2015, pp.197-205
ISSN: 2146-4553
www.econjournals.com

An Analysis of the Determinants of Households' Energy Choice: A Search for Conceptual Framework

Abubakar Hamid Danlami
School of Economics, Finance and Banking
UUM College of Business, University Utara Malaysia, 06010 UUM Sintok,
Kedah, Malaysia. Email: sadiqdanlami@yahoo.com

Rabiul Islam
School of Economics, Finance and Banking
UUM College of Business, University Utara Malaysia, 06010 UUM Sintok,
Kedah, Malaysia. Email: rabiul@uum.edu.my

Shri Dewi Applanaidu
School of Economics, Finance and Banking
UUM College of Business, University Utara Malaysia, 06010 UUM Sintok,
Kedah, Malaysia. Email: dewi@uum.edu.my

ABSTRACT: The aim of this paper was conceptual analysis of the determinants of household energy choice and consumption in order to provide information on current understanding of the pattern of household energy consumption behaviour in developing countries. Data for this study was obtained from existing literatures on household energy demand and the economic impact of energy as well. The methodology heavily relied on existing previous literatures on the subject being dealt with. The paper showed that previous studies (individually) used various but limited econometric models for analysing household energy consumption behaviour which limit the scope of their analysis. Variables like; degree days, electric water heater, electric clothes dryer, dish washer, number in house, family income, age of respondents, nature of employment, municipality of residence, expenditure per capita, private water connection, age of household head, were found to be positively significant related to household energy choice and consumption. The paper concluded that, not all factors are equally important in explaining household consumption behaviour for different areas. Finally, the paper pointed out three important aspects to be covered by future studies on household energy, choice, and consumption.

Keywords: Households; Energy choice; Consumption; Determinants; Conceptual Framework
JEL Classifications: Q20; Q30; Q40

1. Background of the Study

Household energy consumption refers to the amount of energy resources that are being spent by households on various appliances used by the households. The various energy resources include: biofuel and waste, Kerosene, electricity, gas, petroleum, diesel, and solar, (IEA, 2014). Energy constitutes one of the most important aspects of human life. It is a commodity that is vital for the existence of modern life (Eakins, 2013).

This is because in every economy, all sectors ranging from residential, manufacturing, agriculture, transport as well as services sectors depend to a large extent on various energy sources to function. However, despite that the importance of different end uses for energy varies significantly from country to country because of differences in climatic conditions, policies, level of economic development and other factors (Bhattacharyya, 2011), it is generally agreed that the household sector is one of the most important energy consumption sector (Wang et al., 2011). For instance, energy consumption of the residential sector accounts for about approximately 30% of the total world energy consumption (Swan andUgursal, 2008). The Table 1 below constitutes the share of household energy consumption (in relation to other sectors) nationally for some selected countries world over.

Table 1 shows that in Nigeria residential sector energy consumption far outweigh other sector by taking about 65% of the country's total energy consumption followed by Saudi Arabia where by the residential energy consumption is 50% of the total energy consumption in the country. While, the Finland has the Minimum proportion of the residential energy consumption whereby the household energy consumption accounted about only 16% of the total energy consumption in the country, in fact, the total residential energy accounted 31% of the total world's energy consumption. This indicates that household sector plays a vital role in terms of energy utilisation in many countries of the world. In fact the total welfare of a household depends upon the total number of goods and services consumed or used (Oyedepo, 2013). However most of the goods and services that constitute the total welfare of a household ranging from food items, hot or cool and soft drinks, home facilities like; air conditioner, fan, electric lamp, television, water pump, satellites and room warmer, down to transportations depend wholly on relevant energy, to be useful. Hence households must demand energy not for direct consumption, but for the purpose of facilitating its use and consumption of other goods and services (Cayla et al., 2011). However, despite the above situation, the understanding of household energy use patterns is very limited especially in the context of some regions of the developing world (Kowsari and Zerriffi, 2011).

Table 1. Proportion of Residential Energy Consumption for Some Selected Countries

COUNTRY	PERCENTAGE OF ENERGY CONSUMPTION BY RESIDENTIAL SECTOR (%)
SAUDI ARABIA	50
MALAYSIA	19
JAPAN	26
JORDAN	29
TURKEY	31
ITALY	17
NORWAY	21
SWEDEN	19
FINLAND	16
BRASIL	26
MEXICO	23
USA	25
CANADA	24
NIGERIA	65
WORLD	31

Source: Swan and Ugursal (2008)

The household energy consumption pattern can be majorly categorised into dimensions such as; cooking, lightening, heating and cooling, as well as transportation purposes. For satisfying the needs of cooking, the various sources available include; animal dung plant residues fuel-wood (mostly in developing countries), kerosene, gas and electricity, (Julius, 2013). For lightening purpose, the various choices mainly include; electricity/solar, petroleum/diesel (used for fuelling generators), kerosene, candles and traditional lamps as well as firewood, mostly based on socio-economic status of a household (Barness and Floor, 1996). Furthermore, for the purpose of space heating and cooling (also drinks cooling), the various energy sources available consist of mainly electricity and petroleum/diesel power generator. Lastly, for transportation purposes the major choice available are; petroleum and diesel for fuelling various transport vehicles. The fact that a household chooses one or more of these energy sources is a function of interaction of so many factors which consists of socio-economic, demographic characteristics of households, climatic conditions, house/product/vehicle characteristics, attitudinal variables as well as environmental factors.

However, it is argued that about more than two and a half billion people world over depend majorly on the traditional biomass fuel as their source of energy for cooking, heating and lighting (Kowsari and Zerriffi, 2011). Such traditional biomass fuels are widely used particularly in developing

countries (Yamamoto et al., 2009). For instance, Onoja (2012) argued that evidences from China have shown that there are considerable numbers of households (in some regions, majority e.g Wolong region) that are stick to traditional biomass fuel use despite their access to electricity. Likewise in Africa, solid biofuels is reported to account for about 50% of Africa's energy needs (IEA, 2011).

Such high usage of fuel-wood is totally not environmentally friendly. It has negative impact on atmosphere and peoples' lives (Nlom and Karimove, 2014). Apart from deforestation, desertification and soil erosion, the use of fuel wood has a very low thermal efficiency and the smoke is also hazardous to human health, especially to women and children who mostly do the cooking in homes (NEPD, 2003). Furthermore, approximately 1.5 million deaths every year from respiratory infections can be attributed to the environment, including the effects of indoor and outdoor air pollution (Ustun and Corvalan, 2007). Acute respiratory infections (ARI) in children are one of the leading causes of infant and child morbidity and mortality (Emmelin and Wall, 2007). Studies have found associations between biomass fuel use and lung cancer, a thirty year old woman cooking with straw or wood has an 80% increased chance of having lung cancer later in life (Hong, 1991; WHO, 1991).

In fact, the World Health Organization ranks indoor air pollution from solid fuels as the world's eighth largest health risk, causing 2.7 percent of global losses of healthy life (WHO, 2002 in Heltberg, 2005). Due to these adverse effects of traditional biomass fuels use, the Millennium Development Goals (MDGs) have emphasized the reduction of the biomass consumption in order to improve the welfare of billion poor worldwide (Suliman, 2010). Also, the United Nations Millennium Project recommends halving the number of households that rely on traditional solid biofuels for cooking by 2015, which consists of about 1.3 billion people switching to other fuels (Suliman, 2010).

The underlying rational here is to encourage households to shift from the use of less efficient energy sources to the adoption of more efficient energy sources (Ritchie et al., 1981). This is because there are so many benefits in using more efficient energy source, as it has been widely argued, moving towards the use of cleaner fuels is an important option to improve standard of living for countries that rely heavily on biomass (Lee, 2013). It is the key factor to improve the mode of living for rural population (Ganchimeg and Havrland, 2011). Moreover, Encouraging households to switch to cleaner energy would lead to the consumption of less fuel per meal and less time spent gathering fuel, which could be used in other activities such as attending school, other income generating activities, etc., (Yamamoto et al., 2009). The aims of this paper are; to critically make a conceptual analysis of the determinants of household energy choice and consumption based on the findings of the previous studies in order to provide information on current understanding of the pattern of household energy choice behaviour in developing countries. To propose a conceptual model suitable for the analysis of household energy choice and consumption in developing countries.

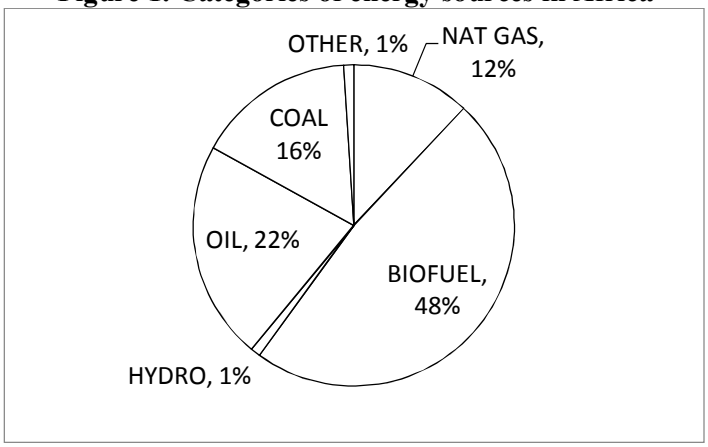
2. Motivation of the Study

The total households' consumption majorly depends on the availability of energy sources to make such consumption possible. Such energy source can be LPG, electricity, kerosene and or traditional biomass such as; fire wood, plants residues and animal dung. However, it is argued that about more than two and a half billion people world over depend majorly on the traditional biomass fuel as their source of energy for cooking, heating and lighting (Kowsari and Zerriffi, 2011). Such traditional biomass fuels are widely used particularly in developing countries (Yamamoto et al., 2009). For instance, Onoja (2012) argued that evidences from China have shown that there are considerable numbers of households (in some regions, majority e.g Wolong region) that are stick to traditional biomass fuel use despite their access to electricity. However the use of fuel-wood is totally not environmentally friendly. It has negative impact on atmosphere and peoples' lives (Nlom and Karimove, 2014). Apart from deforestation, desertification and soil erosion, the use of fuel wood has a very low thermal efficiency and the smoke is also hazardous to human health, especially to women and children who mostly do the cooking in homes (NEPD, 2003). Furthermore, approximately 1.5 million deaths every year from respiratory infections can be attributed to the environment, including the effects of indoor and outdoor air pollution (Ustun and Corvalan, 2007). Acute respiratory infections (ARI) in children are one of the leading causes of infant and child morbidity and mortality (Emmelin and Wall, 2007). Studies have found associations between biomass fuel use and lung cancer, a thirty year old woman cooking with straw or wood has an 80% increased chance of having

lung cancer later in life (WHO, 1991). In fact, the World Health Organization ranks indoor air pollution from solid fuels as the world's eighth largest health risk, causing 2.7 percent of global losses of healthy life (WHO, 2002 in Heltberg, 2005). Due to these adverse effects of traditional biomass fuels use, The Millennium Development Goals (MDGs) have emphasized the reduction of the biomass consumption in order to improve the welfare of billion poor worldwide (Suliman, 2010). Also, the United Nations Millennium Project recommends halving the number of households that rely on traditional solid biofuels for cooking by 2015, which consists of about 1.3 billion people switching to other fuels (Mekonnen and Kohling, 2008; Suliman, 2010).

In Africa, solid biofuels is reported to account for about 50% of Africa's energy needs (IEA, 2011). The following Figure 1 contains the various categories of energy sources in Africa:

Figure 1. Categories of energy sources in Africa



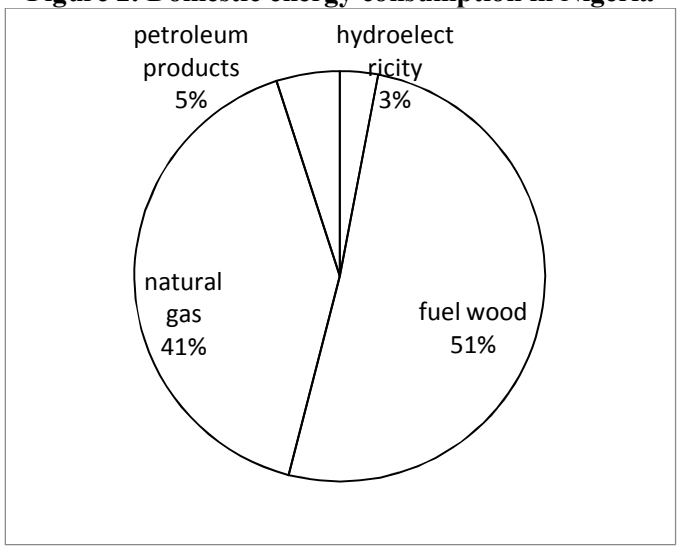
Source: Lee(2013)

Figure 1shows that traditional biofuels as a source of energy far outweighs the other sources of energy as used by households in Africa. Such wide spread use of biofuel is majorly as a result of volatility of fossil fuel prices (Couture et al., 2012). As obtainable in other developing countries, also in the case of Nigeria, despite that the country is blessed with abundant primary energy resources which include reserves of crude oil and natural gas, coal, tar sands and renewable energy resources such as hydro, fuel-wood, solar, wind and biomass, also, despite that the country is the sixth largest exporter of crude oil in the world and the fourth largest exporter of Liquefied Natural Gas (LNG in 2012), with an estimated reserve of 35 billion barrels and 185 trillion cubic feet of both crude oil and natural gas, in addition to other various energy sources in commercial quantity (Iwayemi, 2008), available data have shown that majority of household energy source in Nigeria comes from fuel-wood especially for cooking purposes. Based on the EIA estimates (2011), traditional biomass and waste accounted for about 83% of household energy consumption to meet off-grid heating and cooking needs mainly in rural areas. Figure 2 shows the categories of various energy sources for domestic energy consumption in Nigeria.

Figure 2 shows that majority of the households in Nigeria use fuel wood as the main source of energy. However, such wider use of traditional solid fuels in the country (Nigeria) affects the environment negatively causing higher rate of deforestation, soil erosion air pollution among others. For instance Onakoya et al. (2013) reported an annual average rate of deforestation to be about 2.4% over the period 1990-2000 mainly because of increase in the prices of kerosene and cooking gas. Also the trend of deforestation in the country is recently reported to be about 300,000 hectares per year (Darling et al., 2008). This is almost equivalent to about 3.5% of the current area of forests and woodlands, whereby the reforestation is only about 10% of the deforestation rate which result in a gradual increase in flooding, microclimatic change, desertification, soil erosion as well as loss of biodiversity (Sambo, 2009; in Nnaji et al., 2012). According to ECN (2003) available data have shown that the Nigerian 15 million hectares of forest and woodland reserves could be depleted within the next fifty years (cited in Nnaji et al., 2012). Therefore, there is a need to encourage people to move up the 'energy ladder' and use cleaner burning, more efficient fuels in order to combat the problems associated with the use of biomass solid fuels (WHO, 1991). The introduction and promotion of

cleaner energy for cooking, particularly in developing countries can have several benefits. It would result in the consumption of less fuel per meal and less time spent gathering fuel, which could be expended on other activities such as attending school or participating in micro projects (Yamamoto et al., 2009). Clean energy also provides access to education, health care and household resources. Children who do not have to collect bio fuels can attend school (Wilkinson et al., 2007; Smith et al., 2005). Switching to cleaner fuels could also free up time for women to engage in income-generating pursuits (Wilkinson et al., 2007).

Figure 2. Domestic energy consumption in Nigeria



Source: Oyedepo(2013)

3. Literature Review

The fact that a household choose one or more of these energy sources depends on the interaction of some factors which influence household energy demand. Such factors as listed by combination of literature include; disposable household income, age, gender composition in the household, gender of the household head, education, occupation, marital status, home ownership, household size, number of children, location, cooking habit, availability of fuel alternatives and accessibility, cooking utensils, wage level in the labour market, occupation, house type, number of rooms and size of residence (in m^2) and access to energy carriers. Others are; the purchase of a car and other energy use transport vehicle, the choice for a travelling mode, the renovation of a house, the degree of the development of fuel markets, cost of fuels and end use technology, average degree heating and cooling days, Price of appliances, as well as particular requirements related to each individual in the household (Bradford and Joachim, 2012; Jan et al., 2012).

An analysis of the pattern and determinant of household energy consumption has been the focus of previous studies with different tools of econometric analysis, depending on the scope of the dimension of household energy consumption covered by a study. For instance Lee (2013); and Svoboda (2013) used Ordinary Least Square(OLS) regression to assess determinants of household electricity consumption. Variables like; temperature, electric water heater, electric clothes dryer, dish washer, number in house, family income, age of respondents, nature of employment, municipality of residence, expenditure per capita, private water connection, price of kerosene, age of household head, gas price, were found to be positively significant related to the household consumption of electricity. While factors such as; price of electricity, change of temperature, second and third quarter period of the year, pleasure consumption of wood, household perception of wood consumption, time when the dwelling was built, level of education of the household head, public water source and fire wood price, were found to have a negative relationship with the amount of household consumption of electricity. Also,Koshal et al. (1999) used the same OLS model to examine the determinants of kerosene in Indonesia. The study obtained significant negative value for the price elasticity and significant positive value of the income elasticity of kerosene, which implies that it is a normal good in Indonesia. Also, the cross elasticity with respect to price of electricity was found to be positive implying that kerosene

and electricity are substitute commodities to some extent. On the other hand, Osiolo (2010) used the same OLS method to examine the determinants of fuel wood expenditure in Kenya. Only age of the household head and the level of the education of the household head, were found to have positive significant relationship with household fuel wood expenditure. However the major limitation of these studies that used OLS as a tool of analysis is that they have very limited scope. OLS model permit analysing only one source of household energy in a single model. Also, with the use of OLS model, no estimation can be made for the determinants of household energy choice decision.

On the other hand, Multi-nomial Logit model was used by some studies to analyse household energy choice decision. The most frequent categories use by such studies for the dependent variables include; biomass fuel, kerosene, electricity and liquefied petroleum gas. For instance, variables such as; household income, age of the household head, level of education of the head of the household, household size, the dwelling ownership, occupation of the household head, number of rooms, number of years the house was built, size of the resident, ratio of female in the household, were found to have a positive relationship with the household decision to use fire wood instead of kerosene or electricity or gas (Nnaji et al., 2012; Song et al., 2012). On the other hand, other studies found these variables to have negative relationship with fire wood use, there by encourage the adoption or use of electricity and or gas (Couture et al., 2012; Laureti and Secondi, 2012). The varying conclusions arrived by these studies because they were carried out in different environment using different data. This signifies that energy consumption behaviour of households varies from one region to another and not all factors are equally important in determining energy consumption in different areas and regions.

Furthermore, Nlom and Karimove (2014); Eakins, (2013); and Mensah and Adu (2013) applied ordered logit/probit models to examine the factors that influence household energy choice to more cleaner source, variables such as; income, firewood price, education level of household head, share of dwelling with other people, urban household, access to Liquefied Petroleum Gas(LPG) were found to have a positive relationship with the probability of adopting more cleaner energy. While other variables, such as; electricity price, price of kerosene, age of the household head, household size, gender (male) of the household head, and access to fire wood, have negative effect on the probability of the use of clean and efficient fuels. The major limitation of these studies is that they are based on the assumption that the various household energy choice categories are in an ordered ranking manner, whereby in real life situation, the various categories are not an ordered based choice.

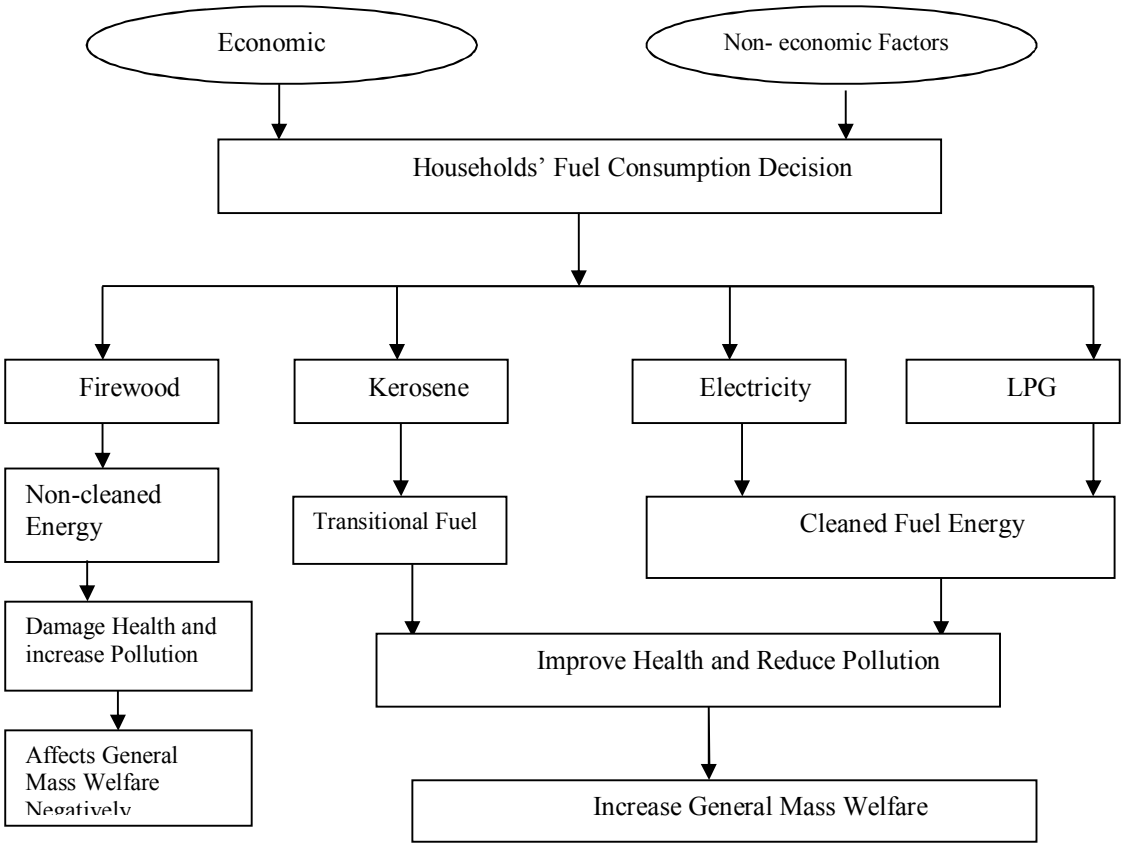
In a nutshell from the existing literature, many studies were conducted in both developed and developing countries on household energy consumption. These studies however, have some identified limitations based on the scope covered, model used, the variables included in the study among others. For instance some studies on household energy consumption (Svoboda and Br, 2013; Pourazarm and Cooray, 2013; and Auffhammer and Aroonruengsawat, 2012) focuses only on electricity aspect of household energy consumption, thereby neglecting other aspects; like consumption of fuel wood and other solid fuels, households' consumption of kerosene, fuel for transportation, as well as liquefied natural gas as a source of household energy consumption. Also some studies (Naibbi and Healey, 2013; Onoja and Emodi, 2011) focus only on fuel wood analysis as a source of house hold energy neglecting other aspects like; kerosene, electricity gas and transportation respectively.

Moreover, from the literature reviewed, it was shown that not all factors have equal important in determining the pattern and behaviour of household energy consumption for different areas due to differences in socio-economic settings, environmental factors, and cultural factors as well as the average level of development in the area. This (i.e differences in study area) has led to the arrival of different and inconsistent conclusions in the literature of household energy consumption behaviour.

4. Conceptual Framework

A household's energy choice decision can be understood by examining its fuel decision in a constrained utility optimization framework where it maximises fuel utility, subject to a set of economic and non-economic constraints. The household's knowledge on various fuels influences its fuel choice and fuel substitution decisions. This fuel consumption decision is affected by economic and noneconomic factors. Economic factors may include market price of fuel, household income, and household expenditures and non-economic factors may include a set of household characteristics such as household size, gender, education, house ownership, type of dwelling, location of residence, household age, distance to fuel source, and access to electricity.

Figure 3. Framework for households' energy consumption decision and its implication



The fuel choice and substitution models are applied to various fuels like biomass residues, firewood, kerosene, electricity and LPG. Figure 3, below constitutes the framework for household energy choice and its impact. The application of this model will help in understanding and analysing how various factors influence households' fuel choice and fuel substitution. Also the outcome and the implication of this behaviour may be improved health, incomes, and reduced pollutions if the cleaned energy is chose which in turn raise the general welfare of the public. However, where the decision of household fuel consumption falls on non-cleaned energy, the result may be damaged health and increased pollution which in turn negatively affect general societal welfare.

5. Conclusion

This paper reviews the various empirical studies on the determinants of household energy choice and consumption. These studies can be categorised into four major groups based on their method and tool of data analysis. The first category is those studies that use simple frequencies and percentages, graphs and or correlation coefficient to analyse household energy consumption behaviour. Therefore this category lacks sound econometric tool of analysis to support their arguments.

The second category is those studies that use only Ordinary Least Square (OLS) as a tool of analysis. Such studies are limited to analysing determinants of demand for only one source of energy (e.g. fire wood, kerosene, electricity and gas) in a model and cannot analyse the determinants of household energy choice, because in this case the dependant variable is a qualitative choice beyond the scope of OLS which only analyses a quantitative dependant variable. The third category consists of those studies that use ordered logit/probit model to analyse factors that influence the probability of household decision to move to more cleaned and efficient energy source in an ordered manner.

The last category consists of those studies that use multinomial logit/probit model in their analysis to examine the determinants of household energy choice. The various most frequent used categories of the dependant variable in these studies are; traditional biomass fuel, oil/kerosene, electricity and gas.

Furthermore, in terms of scope of the study, it was shown that most of the studies on household energy choice and consumption are specific in focus, covering some aspects and dimensions of household energy consumption and neglect the other dimensions. Also, it was shown that the various dimensions that were analysed (individually) are cooking aspect of household energy consumption, lightening, heating and cooling respectively, with very few studies focus on transportation aspect of household energy consumption.

Moreover, the paper, presents the conceptual framework that can be used for analysing households consumption decision. Lastly from the literature reviewed, it was shown that not all factors have equal important in determining the pattern and behaviour of household energy consumption for different areas due to differences in socio-economic settings, environmental factors, cultural factors as well as the average level of development in the area. This (i.e differences in study area) has led to the arrival of different and inconsistent conclusions in the literature of household energy consumption behaviour.

References

Auffhammer, M., Aroonruengsawat, A. (2012).Simulating the Impacts of Climate Change, Prices and Population on California's Residential Electricity Demand.Energy Institute at Haas Working Paper Series 208R.

Barnes, F., Floor, M. (1996). Rural Energy in Developing Countries: A Challenge for Economic Development. Annu. Rev. Energy Environ. 21,497–530.

Bhattacharyya, S.C. (2011). Energy Economics Concepts, Issues, Markets and Governance. Springer-Verlag Limited, London.

Bradford, M., Joachim, S. (2012). Analysis of Existing Data: Determinants for the Adoption of Energy-Efficient Household Appliances in Germany. ZEW Economic Studies 44, 39-67.

Cayla, Maizi, N., Marchand, C. (2011). The role of income in energy consumption behaviour: Evidence from French households data. Energy Policy 39, 7874–7883.

Couture, S., Garcia, S., Reynaud, A. (20129. Household energy choices and fuelwood consumption: An econometric approach using French data. Energy Economics 34, 1972-1981.

Darling, J. K., Hoyt, N., Murao, K., Ross, A. (2008). The Energy Crisis of Nigeria an Overview and Implications for the Future.

Eakins, J. (2013). An Analysis of the Determinants of Household Energy Expenditures: Empirical Evidence from the Irish Household Budget Survey, PhD Thesis. University of Surrey, UK.

Emmelin, A., Wall S. (2007). Indoor air pollution: a poverty-related cause of mortality among the children of the world. Chest. 132, 1615-1623.

Ganchimeg, G., Havrland, B. (2011). Economic Analysis of Household Energy Consumption: The Case of Herders in Mongolia. AgriculturaTropicaEtSubtropica 44, 197-203.

Heltberg, R. (2005). Factors Determining Household Fuel Choice in Guatemala.Environment and Development Economics 10, 337-361.

Hong, C.J. (1991). Health Aspects of Domestic use of Biomass and Coal in China.Indoor Air Pollution from Biomass Fuel. Geneva: World Health Organization; 1991, 43-77.

Iwayemi, A. 2008. Nigeria's Dual Energy Problems: Policy Issues and Challenges. International Association for Energy Economics 4th Quarter, 2008, 17- 21.

Jan, I., Khan, H., Hayat, S. (2012). Determinants of Rural Household Energy Choices : An Example from Pakistan. Polish Journal of Environmental Studies 21(2): 635–641.

Jingchao, Z., Kotani, K. (2011). The determinants of household energy demand in rural Beijing: Can environmentally friendly technologies be effective? Energy Economics 34, 381-388.

Julius, A. (2013). Households' Access and Preference to Cooking Fuels in Abuja, Nigeria. Journal of Environmental Science and Technology 6, 91-98.

Koshal, K., Koshal, M., Boyd, G. (1999). Demand for Kerosene in Developing Countries: A Case study of Indonesia. Journal of Asian Economics 10, 329-336.

Kowsari,R., Zerriffi, H. (2011). Three dimensional energy profiles: A conceptual framework for assessing household energy use. Energy Policy 39, 7505–7517.

Laureti, T., Secondi, L. (2012). Determinants of Households' Space Heating type and Expenditures in Italy. International Journal of Environmental Research, 6(4), 1025-1038.

Lee, L.Y. (2013). Household energy mix in Uganda. Energy Economics 39, 252-261.

Mekonnen, A., Köhlin, G. (2008). Determinants of Household Fuel Choice in Major Cities in Ethiopia.Working Papers in Economics No. 399.

Mensah, T., Adu, G. (2013). An Empirical Analysis of Household Energy Choice in Ghana.Uppsala Working Paper Series No. 6.

Naibbi, A.I., Healey, R.G. (2013). Northern Nigeria's Dependence on Fuelwood: Insights from Nationwide Cooking Fuel Distribution Data. International Journal of Humanities and Social Science3, 160–173.

NEPD. (2003). National Energy Policy Document.Energy Commission of Nigeria.

Nlom, J.H., Karimov, A.A. (2014). Modeling fuel choice among households in

Nnaji, C., Ukwueze, E., Chukwu, J. (2012). Determinants of Household Energy Choices for Cooking in Rural Areas: Evidence from Enugu State, Nigeria. Continental J. Social Sciences 5, 2141-4265. northern Cameroon. WIDER Working Paper Series 2014/038. 45.

Onakoya, A.B., Onakoya, A.O., Salami, O.A., Odedairo, O.B. (2013). Energy Consumption and Nigerian Economic Growth: an Empirical Analysis. European Scientific Journal 9, 25-40.

Onoja, A.O. (2012). Econometric Analysis of Factors Influencing Fuel Wood Demand in Rural and Peri-Urban Farm Households of Kogi State, 8, 115–127.

Osiolo, H. (2010). Enhancing Household Fuel Choice and Substitution in Kenya.

Oyedepo, S. (2013). Energy in Perspective of Sustainable Development in Nigeria. Sustainable Energy 1, 14-25.

Pourazarm, E., Cooray, A. (2013). Estimating and forecasting residential electricity demand in Iran. Economic Modelling, 35, 546–558.

Pundo, M.O., Fraser, G.C.G. (2006). Multinomial logit analysis of household cooking fuel choice in rural Kenya : The case of Kisumu district. Agrekon, 45, 24–37.

Ritchie, J., Mcdougal, G., Claxto, D. (1981). Complexities of Household Energy Consumption and Conservation.Journal of Consumer Research 8, 233-242.

Sambo, S.A. (2009). Strategic Developments in Renewable Energy in Nigeria International Association for Energy Economics, 3rd quarter.

Smith, K.R., Rogers, J., Cowlin, S.C. (2005). Household Fuels and ill Health in Developing Countries: What Improvements Can be Brought by LP Gas? Paris: World LP Gas Association and Intermediate Technology Development Group.

Song, N., Francisco, X., Stephen R., Michael, E. (2012). Factors affecting wood energy consumption by U.S. households. Energy Economics 34, 389-397.

Suliman, M.K. (2010). Factors Affecting the Choice of Households' Primary Cooking Fuel in Sudan.Research report presented to the Economic Research Forum, Egypt, Cairo.

Svoboda, P., Br, J. (2013). Electricity Consumption Demand Model in Czech Households, 63–64.

Swan, G., Ugursal, V. (2008). Modeling of end-use energy consumption in the residential sector: A review of modeling techniques. Renewable and Sustainable Energy Reviews 13, 1819–1835.

Ustun, P.A., Corvalan, C. (2007). How much disease burden can be prevented by environmental interventions? Epidemiology 18, 167-78.

Wang, Z., Zhang, B., Yin, J., Zhang, Y. (2011). Determinants and policy Implication of household Electricity Saving Behaviour: Evidence from Beijing China. Energy Policy 39, 3550-3557.

WHO. (1991). Indoor air pollution from biomass fuel. Report of a WHO Consultation, June 1991. Geneva.

World Health Organization. (2002). The World health report; 2002. Reducing the Risks, Promoting Healthy Life.

Wilkinson, P., Smith, KR., Joffe, M., Haines, A. (2007). A Global Perspective on Energy: Health Effects and Injustices. Lancet 370, 965-978.

Yamamoto, S., Sie, A., Sauerborn, R. (2009). Cooking fuels and the push for cleaner alternatives: a case study from Burkina Faso. Global Health Action 2009.