Assessment of Households' Access to Electricity and Modern Cooking Fuels in Rural and Urban Nigeria: Insights from DHS Data

Abayomi Samuel Oyekale

Department of Agricultural Economics and Extension, North-West University Mafikeng Campus, Mmabatho 2735 South Africa.
abayomi.oyekale@nwu.ac.za

Abstract: Nigerian domestic energy crises are significantly paradoxical given the high spectrum of energy resources that the country is naturally endowed with. This study analysed the factors influencing access to electricity and use of modern cooking fuel in Nigeria. The data were the 2008 Demographic and Health Survey (DHS) comprising 34070 respondents. The data were analysed with descriptive statistics and Seemingly Unrelated Bivariate Probit (SUBP) regression. The results show that 45.57 percent of all the households had access to electricity with 82.25 percent in urban and 28.72 percent in rural areas. Also, 0.82 percent and 0.13 percent of urban and rural respondents respectively primarily used electricity for cooking, while 44.82 percent and 9.87 used kerosene. However, 83.99 percent and 42.53 percent of urban and rural households respectively used wood for cooking. The results of the SUBP regression show that access to electricity and modern cooking energy sources significantly increased ($p<0.01$) among urban dwellers, educated household heads but declined with resident in northern Nigeria. It was concluded that Nigerian government needs to properly design some institutional mechanisms and approaches for increasing access to modern energy to reduce indoor pollution and other associated health hazards.
[Abayomi Samuel Oyekale. **Assessment of Households' Access to Electricity and Modern Cooking Fuels in Rural and Urban Nigeria: Insights from DHS Data** . *Life Sci J* 2012;9(4):1564-1570] (ISSN:1097-8135). http://www.lifesciencesite.com. 238

Keywords: modern energy, electricity, kerosene, fuel wood, Nigeria

Introduction

Historical review of electricity generation in Nigeria dates back to 1896 when electricity totaling about 60KW was produced in Lagos (Niger Power Review, 1985). Thereafter, the Public Works Department was commissioned by the government in 1946 to undertake responsibilities for electricity supply in Lagos State (Okoro and Chikuni, 2007). However, in 1950, Electricity Corporation of Nigeria (ECN) was established by law as a central body for distributing electricity in the country, although other bodies like Native Authorities and the Nigerian Electricity Supply Company (NESCO) obtained license to produce electricity in some other parts of the country. Simultaneously, another body that was called Niger Dams Authority (NDA) was also legislatively permitted to produce electricity which was sold to ECN (Manafa, 1995). However, in order to ensure efficiency through proper production coordination and distribution, ECN and NDA were in 1972 merged into the National Electric Power Authority (NEPA).

Over the past few decades, there had been some concerted efforts by the government to meet increasing electricity demand in the country as a result of rapid urbanization, industrialization and population increases. However, despite supposed huge budgetary allocations, majority of Nigerians still do not have access to electricity, and supply is very erratic for households with connectivity (Okoro and Madueme, 2004). No doubt, NEPA grew to become an household name due to intermittent power cuts and was angrily retagged "Never Expect Power Always" (Adenikinju, 2005). In 2000, efforts to privatize NEPA led to adoption of a holistic power sector restructuring reform which transformed it into seven companies that were meant to generate power (GenCos), one for transmission (TransysCo), and eleven for distribution (DisCos) (Oyeneye, 2004). These arrangements, which came into effect in January 2004 were finalized by changing the name of NEPA to Power Holding Company of Nigeria (PHCN). The reforms were also meant to dissolve the monopolistic power of NEPA by attracting some independent power producers (IPPs).

However, despite a change of name, there have not been any significant improvements in service delivery by PHCN. Therefore, with hope of regular access to electricity of several Nigerians dashed, PHCN had been retagged as "Problem Has Changed Name". Therefore, it will be an understatement to assert that energy problem in Nigeria had over the past few decades grown from bad to worse. The crises, like cancerous cells had rapidly spread in magnitude of unimaginable dimensions to all sectors of the economy. No doubt, an important premise for desiring regular supply of clean energy is its direct linkage with households' welfare. This had been widely brought to fore by multiple indicators of welfare, being synchronized into the framework for understanding the multidimensional nature of poverty. Moreover, desirability of clean energy is justified because it minimizes domestic air pollution that often constitutes some adverse health effects (Emmanuel and Samuel, 2012; Adenikinju, 2005)

The dimension of energy poverty in Nigeria is not warranted given enormous energy resources the country is naturally endowed with. Impact of erratic access to clean energy is largely aggravated by growing household poverty despite recent economic reforms and widely applauded growths. Specifically, recent evidences suggest that relative poverty increased from 54.4 percent in 2004 to 69.0 percent in 2010 (National Bureau of Statistics, 2010). No doubt, growing dimension of poverty severity had over the years transmitted into energy poverty. This resulted from households' adjustments of expenditure patterns in a manner that ensures preference for basic needs. It is also surprising that huge budgetary allocations to address the country's growing energy crises by previous governments were mere pretext to embezzle and mismanage public funds.

Over the years, government's abject failure to address dilapidating state of old power generating infrastructure, perfected corrupt practices among government workers, targeted destruction and theft of key transformers have been responsible for the country's wailings over the energy woes. Shaad and Wilson (2009) noted that given Nigeria's enormous energy resources (oil and gas reserves, abundant sunlight and significant hydropower potential), inadequate access to energy should not witnessed

It should be further emphasized that there is wide gap between access by urban and rural households to clean energy supplies. About 73% of Nigerian population lack access to electricity although this may increase to about 90 percent for rural areas if properly disaggregated. Poor rural electricity supply attests to the window dressing nature of many rural electrification projects and lack of strong political will to offer permanent solution to the problem. It should be noted that energy needs for cooking represent the bulk of energy demand in Nigeria, although about 67 percent of the population uses dirty energy sources in form of fuel wood or charcoal. This should raise a lot of environmental concerns because of its inefficiency contributions to indoor air pollution. Similarly, households also use kerosene for cooking although sometimes adulterated with petrol or diesel and expensive (Shaad and Wilson, 2009). To make up for electricity supply shortages, markets for petrol and diesel generators are flourishing although this sometimes makes up at 400 percent of grip price (Osunsanya, 2008; Shaad and Wilson, 2009).

Unfortunately, however, economic development is directly linked to access to clean energy (Dorf, 1978; Adegbulugbe, 2006). Given the tragic situations that many Nigerian households have found themselves in relation to access to clean energy, it is unlikely that efforts by the government to achieve the Millennium Development Goals (MDGs) can yield any positive outcome. This is because of the consensus among energy policy experts that achievement of most of these goals is diametrically linked to access to clean energy. Specifically, access to electricity is essential for efficient service delivery in health, education and sanitation sectors, and for ensuring reduction in indoor pollution (Shaad and Wilson, 2009).

This study can be motivated from the fact that understanding the factors influencing choice of energy at the household level is important for policy formulation. Specifically, the pattern of energy utilization is potentially able to enhance our understanding of the nature of environmental pollution resulting from domestic cooking and lighting activities. Similarly, ability to determine the socio-economic characteristics of households that engage in usage of one form of energy can inform policy through assessments of demographic dynamics within the society and provision of adequate incentives for rapid economic development.

There is a strong correlation between access to electricity and socio-economic development of a country. Some empirical studies on domestic energy demand had also focused on sources of energy and factors responsible for choices made by the households. Some authors such as Onyekuru and Eboh (2011) and Shittu *et al.* (2004) have found positive relationship between income and improved energy demand in some studies on Nigeria. Shittu *et al* (2004) also found household heads' age as an important factor that influenced demand for biomass fuel in Ogun state. Babanyara and Saleh (2010) found that fuel wood rural-urban migration, poverty and hikes in price of kerosene were critical factors influencing demand for fuel wood in urban Nigeria. This study seeks to determine the factors explaining access to electricity and improved cooking fuel in Nigeria using the Demographic and Health Survey data of 2008. In the remaining parts of the paper, materials and methods, results and discussions and conclusions have been presented.

Materials and Methods

Sources of data

The study used the Demographic and Health Survey (DHS) data that were collected in 2008. In the sample selection process, the 2006 Population and Housing Census sampling frame was used. In this sampling frame, the primary sampling unit (PSU) that was referred to as a cluster for the 2008 NDHS was defined on the basis of Enumeration Areas (EA) from the 2006 EA census frame. Samples were selected using stratified two-stage cluster design consisting of 888 clusters with 286 in urban areas and 602 in rural areas. A representative sample of 36,298 households was selected, with a minimum target of 950 completed respondents per state. In each state, the number of households was distributed proportionately among its urban and rural areas. However, only 34070 households fully completed the survey thereby giving 98.3 percent response rate.

Estimated model

Different alternative methods exist for analyzing the data given that the dependent variables are bivariate (1 if using improved cooking energy sources and 0 otherwise or 1 if having access to electricity and 0 otherwise). It is possible to consider Probit or Logit method but due to endogeneity nature of cooking fuel variable in explaining access to electricity, our estimated parameters would be inefficient. Therefore, Seemingly Unrelated Bivariate Probit (SUBP) is the best approach for modeling the data in such a way that parameter efficiency can be ensured. Therefore, estimation of the equations simultaneously is required as discussed by Maddala (1983). The structural recursive form of the model can be stated as:

$$Q_{i1} = \gamma + Q_{i2} + \delta_i \sum_{i=1}^{n} X_i + z_i \quad \text{i.}$$
$$Q_{i2} = \alpha + \beta_i \sum_{i=1}^{n} X_i + v_i \quad \text{ii.}$$

Q_{i1} and Q_{i2} are latent bivariate variables of using improved cooking fuel and having access to electricity, respectively. Also, $\alpha, \beta, \gamma, \delta$ are the estimated parameters and X_i are the socio-economic variables of the households. Included explanatory variables are Ownership of generating set (yes = 1, 0 otherwise), household size, urban residence, north zones, sex, age, years of education. The error terms of the model are dependent and distributed as a bivariate normal such that: $E(v_i) = E(z_i) = 0$, $var\ (v_i) = var\ (z_i) = 1$ and $\rho = cov\ (v_i, z_i)$. The Wald test, which is reflected by statistical significance of ρ was used to determine whether the models would be best estimated jointly in a recursive manner of not.

Results and Discussions

Households' access to electricity and choice of primary cooking energy

Table 1: Access to Electricity in Urban and Rural Nigeria across Different Types of Cooking Energy Choices

Energy category	Urban			Rural			All		
	No	Yes	Total	No	Yes	Total	No	Yes	Total
Electricity	0	88	88	1	29	30	1	117	118
LPG	2	85	87	6	21	27	8	106	114
Natural gas	6	177	183	0	24	24	6	201	207
Biogas	4	36	40	4	16	20	8	52	60
Kerosene	328	4,479	4,807	664	1,640	2,304	992	6119	7111
Coal, lignite	4	70	74	16	26	42	20	96	116
Charcoal	50	438	488	163	218	381	213	656	869
Wood	1,418	3,143	4,561	15,058	4,550	19,608	16476	7693	24169
Straw / shrubs / grass	28	66	94	199	30	229	227	96	323
Agricultural crop	2	1	3	26	9	35	28	10	38
Animal dung	0	0	0	2	5	7	2	5	7
No food cooked in HH	52	228	280	470	136	606	522	364	886
Other	10	9	19	31	2	33	41	11	52
Total	1,904	8,820	10,724	16,632	6,706	23,346	18536	15526	34070

Table 1 shows the distribution of households based on access to electricity and the choice of primary cooking fuel. The sources of energy that were indicated by the households can be broadly classified into traditional (wood, charcoal, coal, straw, agricultural crop, animal dung and others like plastics) and modern (electricity, kerosene, gas including LPG, Natural gass and biogas) (Hemlata, 1990; Olatinwo and Adewumi, 2012). In the combined data, 45.57 percent of the households had access to electricity. However, 82.25 percent of urban households had access to electricity, while only 28.72 percent had access in rural areas. More specifically, about 0.75 percent of the households that are with access to electricity in the combined data primarily used electricity for cooking. Also, 0.1 percent of the households that had access to electricity in urban area were using electricity as the primary cooking energy. In rural areas, 0.43 percent of the households with access to electricity were using electricity as the primary cooking energy. However, of the urban households that had access to electricity, 50.78 percent and 35.63 percent were primarily using kerosene and wood as sources of cooking fuel respectively. Low usage of electricity as cooking fuel can be traced to erratic supply in both urban and rural areas.

Table 2: Distribution of households' cooking energy types in urban and rural Nigeria

Energy Group	Urban		Rural		All	
	Freq	%	Freq	%	Freq	%
Electricity*	88	0.82	30	0.13	118	0.35
LPG*	87	0.81	27	0.12	114	0.33
Natural gas*	183	1.71	24	0.10	207	0.61
Biogas*	40	0.37	20	0.09	60	0.18
Kerosene*	4,807	44.82	2,304	9.87	7,111	20.87
Coal, lignite	74	0.69	42	0.18	116	0.34
Charcoal	488	4.55	381	1.63	869	2.55
Wood	4,561	42.53	19,608	83.99	24,169	70.94
Straw / shrubs / grass	94	0.88	229	0.98	323	0.95
Agricultural crop	3	0.03	35	0.15	38	0.11
Animal dung	0	0.00	7	0.03	7	0.02
No food cooked in household	280	2.61	606	2.60	886	2.60
Other	19	0.18	33	0.14	52	0.15
Total	10,724	100.00	23,346	100.00	34,070	100.00

Table 2 shows the frequency and percentage distributions of urban and rural households across the different energy choices. Based on internationally accepted definition, electricity, LPG, natural gas, biogas and kerosene are the energy sources that can be classified as improved. These sources are characterized by high efficiency, low environmental pollution and reduced health hazards. It reveals that only 0.82 percent and 0.13 percent of urban and rural respondents respectively primarily used electricity for cooking. Non-usage of electricity for cooking by many households can be linked to complete lack of access to electricity and erratic supply to households that have connections (Adenikinju, 2005). Despite the huge capital that Nigerian government annually spend on power projects, there have not been any results to show for it. Also, wide gap between installation capacity and power needs of growing populations have resulted in load shedding. Non-responsiveness of PHCN officials often result in long delay in repair of faulty transformers and other problems. This may make an area to be deprived of access to electricity for very long period of time. In some instances, PHCN does not base electricity billing on amount used, but on expected income from an area. This often makes monthly charges not to reflect usage because of the monopolistic and oppressive role played by some PHCN officials (Okoro and Madueme, 2004; Iwayemi, 2008; Emmannuel and Samuel, 2012).

Similarly, liquefied gas was primarily used for cooking by 0.81 percent and 0.12 percent of urban and rural households respectively. Although Nigeria is endowed with a lot of gas reserves (Cole, 2004), domestic consumption is limited due to high price. It is often surprising that while Nigerian gases are being flared in the Niger Delta, supply for domestic usage is often erratic and price still high. Also, poverty makes many households unable to invest in the gas cylinders and some have the impression that it is more expensive to use gas for cooking than using kerosene. Also, some households consider use of gas for cooking to be very risky due to higher tendency of fire accidents if mishandled. Shaad and Wilson (2009) submitted that if well managed, domestic shortages in energy demand in Nigeria can be minimized by using associated gas to meet local energy needs. This was also seen as a way to respond to new national legislation and international demands to halt gas flaring.

It should be noted however that while 44.82 percent of urban respondents primarily used kerosene for cooking, only 9.87 percent of the respondents from rural areas used it. In the combined data, 20.87 percent of the respondents were using kerosene for cooking. Shaad and Wilson (2009) submitted that when used for cooking, kerosene also releases some hazardous pollutants to the atmosphere and it is very expensive. It was noted that an average African household may spend between 10 - 15 percent of annual incomes on kerosene. In Nigeria, there have been several times with severe kerosene scarcity. During those times, kerosene was sold at prices that were far above the prices of other petroleum products and were mainly available in "black markets". Some greedy sellers were also in the practice of adulterating the product with petrol or diesel, leading to explosions that had destroyed several properties, claimed several lives and left many Nigerians permanently disabled.

Wood was primarily used for cooking by 83.99 percent of rural respondents, whereas 42.53 percent of urban respondents were using wood. In the combined data, 70.94 percent of the respondents were using wood for cooking. Use of wood for cooking has been largely traced to availability and low cost.

This energy source is responsible for significant in-door air pollution with significant health hazards. Many rural households spend quite a lot of time gathering fuel wood from the forest. This has some implications for deforestation. In some instances, some households are addicted to using fuel wood to cook claiming that foods cooked therewith usually have better taste (Shaad and Wilson, 2009).

Factors explaining access to electricity and choice of cooking energy sources

Table 3: SUBP Results of the factors influencing access to electricity and choice of improved cooking energy

Variables	Parameter	Standard error	t-value	Parameter	Standard error	t-value
Cooking fuel	.6436176	.0695696	9.25	-	-	-
Generating set	-	-	-	.7318458	.0236063	31.00
Household size	.0154464	.0028229	5.47	-.1209401	.0041436	-29.19
Urban/rural	1.278897	.0237738	53.79	1.16109	.0190489	60.95
North zones	-.43726	.0217784	-20.08	-.8903611	.0212476	-41.90
Sex	-.0949333	.0214218	-4.43	-.0283239	.0239214	-1.18
Age	.0019078	.0005722	3.33	-.0130978	.0006641	-19.72
Year of education	.0765992	.0034589	22.15	.0913422	.004196	21.77
Constant	-.6869613	.0437225	-29.92	-.2834713	.0413051	-6.86
athrho	.1789575	.0396729	4.51			
rho	.1770712	.038429				
N = 34070						
Log likelihood = -28276.142						
Wald Chi Square = 16969.40***						
Likelihood ratio test Chi Square = 21.454***						

Table 3 presents the results of SUBP regression. It is important to first discuss the significance of some diagnostic statistics. In the results as presented by STATA software, the parameter of rho seeks to confirm if the models are justified to be estimated simultaneously. This parameter is statistically significant as revealed by the computed Chi-Square value of 21.454 ($p<0.01$). This confirms the endogeneity characteristic of the choice of improved cooking fuel variable. Similarly, the Wald Chi Square statistics is statistically significant ($p<0.01$) and implies that the model produced a good fit for the data.

The parameter of improved cooking fuel is with positive sign and statistically significant ($p<0.01$). This implies that those households that were using improved energy have higher probability of having access to electricity. This is expected because although not many households were using electricity as the primary energy source due to several reasons of which supply irregularity is paramount, use of improved energy sources is expected to be directly linked with high income status which automatically implies access to electricity.

The households that owned generating set have significantly higher probability of using improved cooking energy ($p<0.01$). This is expected because those households that are able to afford the running and maintenance costs of generator should be able to afford improved cooking energy sources. The parameters of household size in the two models imply that as household size increases, probabilities of having access to electricity and using improved cooking energy sources significantly increases and decreases ($p<0.01$). Specifically, for the cooking fuel result, if the number of people within an household increases, their energy needs for cooking increases. Therefore, they may not be able to use stove or electricity to cook due to large volume of food that is involved. In rural areas, the cooking pots may be so bog such that it cannot be supported by a kerosene or coal stove. In this instance, use of fuel wood is inevitable.

The results also show that urban residents have significantly higher probabilities of having access to electricity and using improved cooking energy sources ($p<0.01$). These results are expected because successive Nigerian governments have concentrated electricity supply efforts in the urban areas. Also, because poverty is concentrated in rural areas, this is also manifesting in energy poverty because the people are not able to afford use of improved energy sources. Specifically, majority of rural households convert their production time for fuel wood gathering. Furthermore, households in northern parts of the country also have significantly lower probabilities of having access to electricity and using improved cooking energy sources. These results are expected because poverty is concentrated in northern Nigeria. When the households are struggling to meet basic need of food, demand for improved energy sources will never be a priority.

Also, the parameter of gender in the electricity model is statistically significant ($p<0.01$). This implies that households with male heads have significantly lower probability of having access to electricity. In the model for use of improved cooking energy, the parameter also has negative sign but statistically insignificant ($p>0.10$). The results also show that as household head age increases, the probability of access to electricity increases significantly ($p<0.01$). However, the probability of using improved cooking energy sources significantly decreased as age increased ($p<0.10$). This can be explained from the fact that aged household heads may be inactive in the employment markets and thereby unable to afford the price of improved cooking energy. Also, they are likely to have large family size, requiring more cooking energy due to the large volume of food to be cooked at once. However, this finding is contrary to that of Olatinwo and Adewumi (2012) for a study on some rural households in Kwara state.

Also, the parameters of years of education in the two models are with positive sign and statistically significant ($p<0.01$). This implies that as years of education increases, the probabilities of having access to electricity and using improved cooking energy sources increased. This is expected because education is expected to both impact access to electricity and use of improved cooking energy positively due to tendency of the educated to have high income, live in urban areas and live in houses where facilities for cooking with fuel wood are not easily provided.

Conclusion

Nigerian domestic energy crises are significantly paradoxical given the high spectrum of energy resources that the country is naturally endowed with. This study has shown that many households were not having access to modern energy sources and rural people were more deprived. This implies that reducing indoor pollution and exposure to cooking smoke as prerequisites for reducing some health hazards is guaranteed. The drive towards ensuring better access to cleaner and more efficient energy sources which is a global initiative for economic growth and development in Nigeria will therefore meet with serious setbacks. Nigerian government needs to properly design some institutional mechanisms and approaches for moving towards this goal. Such effort should also consider regional disparities in access to modern energy sources and ensure that each geopolitical zone addresses its energy needs from available resources without necessarily centralizing energy development activities and policies. Also, because biomass constitutes the highest usage among households, government should design adequate programmes to ensure forest replanting across the country to averse the consequences of progressive deforestation. Development of more efficient biomass cooking stoves is important because it can save the volume of wood used for cooking and reduce the level of air pollution. The Nigerian government should also show more commitments towards solar energy utilization for domestic activities. This is going to reduce reliance of the people on other energy sources.

References

1. Adegbulugbe AO. Increasing access to energy services for rural areas in order to achieve the MDGs in West Africa. Plenary & Special Sessions Speaker, in Energy Week 2006, by World Bank Group, Washington DC, USA, 2006.
2. Adenikinju A. Analysis of the Cost of Infrastructure Failures in A Developing Economy: The Case of the Electricity Sector in Nigeria. AERC Research Paper 148, 2005, African Economic Research Consortium, Nairobi
3. Babanyara,YY. and Saleh UF. Urbanisation and the Choice of Fuel Wood as a Source of Energy in Nigeria, *J Hum Ecol,* 31(1): 19-26, 2010.
4. Osunsanya, B. Meeting Nigeria's Power Demand. Paper presented at the U.S – Africa Infrastructure Conference Washington D.C., 2008.
5. Cole AO. "Restructuring the Electric Power Utility industry in Nigeria", Proc. 20th National Conference of the Nigerian Society of Engineers (Electrical Division), October6-7, 2004, pp.1-6.
6. Dorf RC. Energy Resources, and Policy. Addison Wesley Publishing, 1978.
7. Emmanuel SO. and Samuel O. Cost Analysis for Alternate Energy Source. *Indian Journal of Science and Technology* 5(1): 1946-1952, 2012.
8. Hemlata R. *Rural Energy Crisis: A Diagnostic Analysis*. India. 1990.
9. Iwayemi A. Nigeria's dual energy problems: Policy Issues and challenges. Intl. Assoc. Energy Econ. Publ. (4th Qtr.), 17- 21, 2008
10. Maddala GS. *Limited-Dependent and Qualitative Variables in Econometrics.* Cambridge et al: Cambridge University Press, 1983.
11. Manafa N. Electricity Development in Nigeria, Rasheen Publisher, Lagos, 1995, pp.37-51
12. National Bureau of Statistics (NBS). Nigeria Poverty Profile 2010

http://www.tucrivers.org/tucpublications/Nigeria%20Poverty%20Profile%202010.pdf

13. Niger Power Review: Development of the Electricity Industry in Nigeria (1960-1985) , 1985, pp. 1-6.
14. Okoro OI. and Chikuni E.Power sector reforms in Nigeria: opportunities and challenges. Journal of Energy in Southern Africa 18(3):52-57, 2007.
15. Okoro OI. and Madueme, TC.: Solar Energy Investments in a Developing Economy, Renewable Energy, Vol. 29, 2004, pp. 1599 - 1610.
16. Olatinwo KB and Adewumi MO. Energy Consumption of Rural Farming Households in Kwara State, Nigeria. *Journal of Sustainable Development in Africa* 14(2):63-76, 2012.
17. Onyekuru NA. and Eboh EC. Determinants of Cooking Energy Demand in the Rural Households of Enugu State, Nigeria: An Application of the Bivariate Probit Model. Asian Journal of Experimental Biology Science 2(2): 332-335, 2011
18. Oyeneye OO. Socio-economic Influences on Policies of Power Deregulation, Proc. 20th National Conference of the Nigerian Society of Engineers (Electrical Division), October 6-7, 2004, pp. 1-15.
19. Shaad B. and Wilson E. Access to Sustainable Energy: What Role for International Oil and Gas Companies? Focus on Nigeria', IIED, London, 2009.
20. Shittu, AM, Idowu AO, Otunaiya AO and Ismail AK Demand for Energy Among Households in Ijebu Division, Ogun State, Nigeria *Agrekon, 43(1):38-51*. 2004.

10/5/2012