ENERGY CRISIS AND SUSTAINABLE DEVELOPMENT IN AFRICA: PERSPECTIVES OF SOME NIGERIANS ON AWARENESS, CAUSES AND WAY FORWARD

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Abstract: Focusing on some Nigerians' extent of awareness, possible causes and the way forward on energy crisis, this paper examined the status of energy crisis in Africa and its strong link to development in the Continent using Nigeria (the so called giant of Africa) as a case study. Four hundred and forty nine (N = 449) post graduate students from Benue State University and University of Agriculture all in Makurdi (representing 33 out of 36 States in Nigeria) responded to "Perception of Energy Crisis in Nigeria Questionnaire (PECNQ) developed and validated by the researcher. The instrument which has a reliability coefficient of 0.79 using Cronbach Alpha was used to collect data which were analysed using frequency, means, standard deviation and rank order. The results show among others that even the educated are only aware to a little extent on the extent of energy crisis in Nigeria; most people are not conscious of the contributions of the society through poor maintenance culture and waste to the crisis. However, corruption, conscientization and illiteracy ranked highest among factors that lead to energy crisis. On the other hand, a change in attitude to life was considered the most important step towards elimination of energy crisis followed by the need for mass literacy campaign, education of the generally poor rural populace and drastic reduction in population through birth control and tax on extra number of children above the maximum allowed.

Keywords: Energy, energy crises, Nigeria, Africa, development

INTRODUCTION

Africa, one of the continents of the world is in dire need of development because it is considered to be grossly underdeveloped. Consequently, it is seriously in need of development in all sectors including energy. Realising this, successive governments of sub-Saharan African nations have been making frantic efforts towards the development of their areas. This concern is reflected in the formulation of laudable policies and programmes such as Tanzania's vision 2025; Nigeria's vision 2020; South Africa's National Sustainable Development Strategy, etc. According to Oluwabamide (2010) despite these efforts Africa remains underdeveloped. This the author attributed to certain impediments to initiatives and or programmes. These impediments include donor dependency syndrome, dependent and defeatist developmental mindset, a weak and low capacity for economic management, failure in good governance and in organisation of production and ineffective implementation syndrome. Similarly, Achor, Kurumeh and Daikwo (2010) blamed the situation on over dependence on petroleum as source of income and energy to the neglect of local technologies. These notwithstanding, the factors that strongly influence development in Africa are directly or indirectly linked to poverty, famine, corruption, conflicts of energy and diseases. Today these factors are indicators of underdevelopment in Africa. Conflicts of energy or energy crisis as used in this paper appears to be at its peak and Nigeria often referred to as the giant of Africa seems to be worst hit by this crisis. In this paper too, the aspect of energy crisis addressed is energy waste and the extent to which people are aware of the waste, causes and way forward are examined. Therefore energy waste as used in this paper is synonymous with energy crisis. However this paper accepts the fact that energy waste leads to energy crisis and not the other way round.

Table 1: EU-25 Energy Dependency Ration

	1995	2000	2001	2002	2003	2004	2010	2020	2030	
Total	43.5	47.3	47.8	47.9	49.3	54.5	55	63.5	64.9	
Fossil fuel	21.4	30.9	33.7	33.0	35.2	38.2	46.1	49.5	59.0	
Petroleum	74.7	76.3	77.6	77.4	78.9	80.2	83.7	92.7	93.8	
Natural gas	43.9	49.7	47.9	51.7	53.0	54.5	62.8	81.4	84.6	

Source: Eurostat (2007), Europe in Figures-Eurostat Yearbook (2006-2007).

Since the attainment of independence in 1960 in Nigeria, it has not been more troubled in any section of its life than the power sector (Egwemi & Agaba, 2010). The electricity problem according to Idowu (2008) has been shifting efforts in other areas of the economy towards developing the country. Again, the worsening case of poverty, unemployment, corruption, poor infrastructure, low level of industrialisation, over-population and general backwardness have been traced to the power sector which has not been able to generate more than 3,000 megawatts of electricity for the country in the last 50 years.

Population growth, economic growth and the efforts for achieving high living standards are among the factors that affect increase in global energy consumption. By the end of the 21st century, it is inevitable that this increase will double. The decrease in energy source reserves increases energy costs as well. Therefore, yield losses should be minimized in energy production and consumption. The increase in yield losses draws attention to environmental problems. In addition, the reduction in energy reserves threatens sustainable development. There is a strong relationship between environmental effects of energy use and sustainable development. Plans should be made to minimize environmental problems emerging during energy production and consumption. These plans must develop economic and reliable use of energy sources (Selici, Utlu & Iten, 2005). As presented in Table 1, there is an increase towards the year 2030 in the used "energy amount" and in parallel to this in "energy dependency" ratio. According to Akamis (2011), the objective is to reverse this trend. Energy consumption in Europe increases by 1% annually. The increase in number of vehicles and the growing interest and desire in using electrical devices constitute the areas of greatest energy use. Energy consumption according to sectors was as follows: 29% in industry, 30% in transport and 41% in individual consumption (European Commission, 2006)

In the past eight years much money has been spent in Nigeria on how to improve electricity supply but to no avail (Egwemi & Agaba, 2010). This raises some doubts in the minds of many Nigerians on the efficacy of the strategies adopted. Accordingly one wonders if people are aware of energy wastage within their localities, what they belief are the causes and way forward. Unless there is good management, there is virtually nothing that can be sufficient in life. Along this line, Caha (2008) says that particularly the developed countries in Europe give great importance to energy efficiency and carry out studies in this field. For example, the natural gas crisis experienced between Russia and Ukraine in 2006 particularly concerned European Union countries and forced them to take measures for efficient energy use and energy saving. Sixth and 7th framework programmes gave more attention to this subject. One of the measures taken by the European Union countries to reduce gradually increasing energy need was to require certification of each building according to the amount of energy use. Furthermore, to ensure that less energy is used for heating, ventilation, lighting and hot water in the buildings, these countries require employment of an energy manager. For now there are no such records or efforts in such direction in Nigeria and most African countries and yet much is expected. This is precisely the worry in this paper. This study was therefore guided by the following research questions: (1) To what extent are Nigerians aware of energy crisis/waste within their localities? (2) What factors do people perceive to be the causes of energy crisis/waste in Nigeria? (3) To what extent do people perceive the identified factors as ways of reducing energy waste/crisis in Nigeria?

Brief History and Current Status of Electricity in Nigeria

To many, energy is synonymous with electricity. This is because many other forms of energy could be generated or powered by electricity. Similarly, in most locations especially rural areas most people only know by application one form of energy which is electricity and hardly could link fuel wood, kerosene, food we eat, water we use, batteries in touch light, solar gadgets, etc to one form of energy or the other.

Table 2: African Rating List – 2009 Electric Energy Production in African Countries

S/No	Country	Population (Million)	Electrical Energy Production (Megawatt)	Planned Improvement (Megawatt)	Electrical Energy Consumption per Million People
1	South Africa	44	40,000	80,000 by 2015	4.2
2	Libya	5.5	4,710	12,000 by 2011	3.33
3	Botswana	1.7	434	700 by 2011	1.0
4	Egypt	81	14,250	16,700 by 2011	0.92
5	Kenya	21	22,000	29,000 by 2015	0.80
6	Cote D'Ivoure	16	8,900	12,000 by2010	1.0
7	Algeria	33	6,188	82,000 by 2011	0.71
8	Morocco	34	3,592	N/A	0.45
9	Zimbabwe	123.8	2,000	6,000 by 2010	0.44
10	Ghana	20	2,000	2,8000 by 2015	0.43
11	Somalia	9	800	N/A	0.40
12	Liberia	3	200	500	0.22
13	Senegal	12	221	N/A	0.20
14	The Gambia	17	100	N/A	0.011
15	Uganda	25	270	2,000 by 2025	0.010
16	Nigeria	140	1,800	N/A	0.06

Most people too attribute this to either illiteracy or non familiarity. But every Nigerian can say a little about electricity- its link to Kainji Dam, distribution in Nigeria, having a relation working in NEPA (now PHCN, Power Holding Company of Nigeria) and so on. The history of electricity in Nigeria dates back to 1896 when electricity was first produced in Lagos, fifteen years after its introduction in England (Niger Power Review, 1985, 1989). According to Egwemi and Agaba (2010), the total capacity of the generators used then was 60KW; then the maximum demand for electricity as at 1896 was less than 60KW. By 1946 the Nigerian government electricity undertaking was established under the jurisdiction of Public Works Department (PWD) and was charged with the responsibility of supplying electricity in Lagos.

So many other bodies and development took place since then including Electricity Corporation of Nigeria (ECN), Native Authority and Nigerian Electricity Supply Company (NESCO), Niger Dams Authority (NDA); at this junction, NDA produces energy and sells to ECN for distribution. However, by 1st April 1972 NDA and ECN were merged as one body under the name National Electric Power Authority (NEPA). Since the inception of NEPA, the authority expands annually in order to meet the ever-increasing demand. However, facts on ground attest to the fact that majority of Nigerians have no access to electricity and the supply of those provided is not regular (Okoro & Madueme, 2004). It is against this backdrop that the Federal Government of Nigeria has embarked on aggressive power sector reforms with the intention of resuscitating NAPA and making it more efficient, effective and responsive to the yearnings of the populace. As result we now address that sector as the Power Holding Company of Nigeria (PHCN) with its mandate expanded. However, with much money pumped into the sector for over 10 years now one expects a substantial improvement, a situation that tends to have worsened the crisis.

Nigeria is endowed with sufficient energy resources to meet with its present and future development requirements. According to Egwemi and Agaba (2010), the country possesses the world's 6th largest reserve of crude oil and gas reserve of nearly 5000

billion cubic meters. Coal and lignite reserves are estimated to be 2.7 billion tons, while tar and bitumen reserves represent 31 billion barrels of oil equivalent. Identified hydroelectricity sites have an estimated capacity of about 14.250MW. Nigeria has significant biomass resources to meet both traditional and modern energy uses, including electricity generation. The country is exposed to a high solar radiation level with an annual average of 3.5 – 7.0KWh/M^2/day. Similarly, wind resources in Nigeria are however not developed though evidence abound that it holds some potentials, and efforts are yet to be made to test their commercial competiveness (Olatunbosun, 2000).

For now, PHCN business operations are highly insufficient. There is chronic under investment, poor maintenance, unrecorded connections, under-billing arising from a preponderance of un-metered connections. The utility's financial performance as well as its ability to serve customers satisfactorily has been consistently poor (Egwemi & Agaba, 2010). Access to electricity is low. About 60 percent of the population, that is, over 80 million people are not served with electricity. The per capita consumption of electricity is approximately 100KWh as against 4500Kwh, 1934KWh and 1379 KWh in South Africa, Brazil and China respectively. The chronic shortage of available generating capacity has negatively affected the industrial and manufacturing sub-sectors.

Table 2 shows that Nigeria has the largest population and yet about one of the least in electrical energy production (1,800megawatts) and consumption (0.06per million people). However, it has no data to show its planned improvement. This indeed has reached a crisis level.

It is seen in Table 3 that Nigeria's power sector in the global rating seems to be one of the poorest and it therefore found at the bottom of the table, an indication of the fact that Nigeria is not doing well in energy production per kilowatts and energy consumption per million. Again, the position of African countries on a comparable terms shows that all is not well also when viewed alongside with other countries.

MATERIALS AND METHODS

Being a descriptive survey design, the study used sample from Nigeria to make case for what is happening in Africa with regards to energy crisis as demonstrated in energy waste. Thus the study sampled 449 post graduate students (PG) of Benue State University and Federal University of Agriculture Makurdi. The choice of PG students was informed by the fact that the views of the literate Nigerians who in most cases are privileged to use some of these energy related gadgets may be more useful. Secondly, PG students in most universities are drawn from all the states of the federation and it is therefore possible to have a good representation of the entire Nigerians for the study.

Purposive, stratified and incidental sampling techniques were employed to obtain the sample. It was purposive because of the choice of PG students from the two close-by Universities in Nigeria. It is also stratified because it is intended to be a good reflection of the views of many Nigerians and so a maximum of 20 PG students were sampled from the two universities from a particular state of Nigeria. Using incidental sampling technique of issuing the questionnaire to any PG students seen provided they have not exceeded 20 from a particular state, a total of 449 students representing 33 states of Nigeria out of 36 (representing 91.7%) was obtained. In all, the least number of respondents from a state is 10 while the maximum is 20.

The instrument used for data collection was an 18 items questionnaire of Likert scale type called Perception on Energy Crisis in Nigeria Questionnaire (PENCQ) with responses of Strongly Agreed (SA =5), Agree (A=4), Undecided (U=3), Disagree (D=2) and Strongly Disagree (SD=1). The instrument was validated by subjecting it to experts' criticism after which Cronbach Alpha was used to determine the reliability which yielded 0.79.

Mean, standard deviation and bar graph were used for data analysis. Criteria for taking decision were based on a mean of 1.00 – 1.49 (Strongly Disagree), 1.50 – 2.49 (Disagree), 2.50 – 3.00 (Undecided), 3.10 – 4.00 (Agree) and 4.10 and above (as Strongly Disagree).

RESULTS

Result presentation is according to research questions. Research question one sought for information on the extent to which Nigerians are aware of energy crisis/waste within their localities. Items 6 to 16 in the questionnaire addressed this question. Answer to research question 1 is in Table 4.

Table 4 reveals that only 2 items out of 11 have means of above 3.0 showing that the respondents are aware that they are forms of energy waste. These are items10 having excess food to throw away in the house everyday as a form of energy waste and item 12 use of firewood being a form of energy consumption. All other items have their means below 3.0 with the grand mean of 2.2309 indicating non agreement with the statements. This means that Nigerians are generally not aware of energy waste/crisis in their localities.

Items 17 to 20 in the questionnaire addressed the causes of energy crisis in Nigeria. Data for answering research question 2 are in Table 5.

Table 3: Global Rating for Electrical Energy Production and Consumption by Country

S/N	Country	Population 2004	GDP (PPP)USS Billion	GDP Per Capital (PPP)USS	Electrical Energy Production (Kliowatts)	Energy Consumption per Million people
1	Canada	32,507,874	958.7	29,800	612.6	15.5
2	USA	293,027,571	109,900.0	37,800	4,167.0	12.3
3	Australia	19,913,144	571.4	29,000	198.2	9.26
4	Japan	127,333,002	3,582.0	28,200	1.082.0	7.6
5	France	60,424,213	1.661.0	27,600	537.9	6.9
6	UK	60,270,708	1.666.0	27,700	371.0	5.7
7	Germany	82,424,609	2.127.0	27,600	544.8	6.2
8	Taiwan	22,749,609	528.6	23,400	216.6	6.2
9	S. Korea	48,598,175	857.8	17,800	412.7	5.6
10	Russia	143,783,338	1,282.0	8,900	964.2	5.4
11	Spain	40,280,780	885.5	22,000	287.4	5.22
12	Italy	58,057,447	1,550.0	26,700	292.1	5.0
13	S. Africa	42,718,530	456.7	10,700	264.0	4.2
14	Libya	5,631,585	35	6,400	23.98	3.33
15	Venezuela	25,017,387	117.9	4,800	87.6	3.3
16	Malaysia	23,522,385	207.8	9,000	109.1	2.9
17	Chile	15,823,957	154.7	9,900	50.3	2.54
18	Argentina	39,144,752	435.5	11,200	109.4	2.4
19	Mexico	104,959,594	941.2	9,000	243.4	1.8
20	Brazil	184,101,109	1,375.0	7,600	237.7	1.8
21	Iran	69,018,924	478.2	7,000	189.9	1.7
22	China	1,298,847,62	6,449.0	5,000	3,256.0	1.0
23	Botswana	1,561,973	14.2	9,000	434.0	1.0
24	Colombia	42,310,775	263.2	6,300	51.8	0.94
25	Egypt	76,117,421	295.2	4,000	109.1	0.92
26	Kenya	32,021,856	33.0	1,000	22.03	0.80
27	Algeria	32,129,324	196.0	6,000	33.12	0.71
28	Peru	27,544,305	146	5,100	24.59	0.70
29	India	1,065,070,607	3,033.0	2,900	665.3	0.47
30	Morocco	32,209,101	128.3	4,000	21.88	0.45
31	Ghana	20,757,032	44.4	2,200	8.20	0.43
32	Paraguay	6,191,368	28.17	4,700	70.0	0.43
33	Indonesia	238,452,952	758.8	3,200	125.7	0.37
34	Uganda	26,404,543	36.1	1,400	1.93	0.061
35	Liberia	3,200,264	27.2	700	1.00	0.022
36	Nigeria	137,253,133	114.8	900	15.67	0.06

Source: CIA Fact book website, December, 2006/07.

Table 4: Mean & Standard Deviation on Extent of Awareness of Energy Crisis/Waste

Item Description	N	Mean	Std. Deviation	Remarks
6. I have to put off security light daily in my house	448	2.2210	.78738	Disagree
7. It's my duty to report to appropriate agency of leaking water pipes in my zone	449	1.5523	.68305	Disagree
8. It is a waste to use more water than required	449	1.6637	.66517	Disagree
9. Leaving your security light on all day as an indicator of when there is light is not good	449	2.1114	.73865	Disagree
10. Having excess food to throw away each day in your house is a form of energy waste	449	3.1114	.73865	Agree
11.Having many children per house hold is a way of depleting the insufficient energy	449	1.5523	.68305	Disagree
12. Use of fire wood is a form of energy consumption	449	3.1114	.73865	Agree
13. It is not better to waste coal and firewood than electrical energy that is not sufficient	449	2.3296	.94162	Disagree
14. There is need for recycling if the nation can afford it financially	449	2.2205	.78657	Disagree
15. Energy is wasted in Nigeria though not adequate for users	449	2.3318	.66741	Disagree
16. One needs to be careful in how to use other forms of energy just like electricity	449	2.3341	.66797	Disagree
Grand Mean	**448**	**2.2309**		**Disagree**

Table 5: Mean & Standard Deviation of some Causes of Energy Crisis/Wastage

Item Description	N	Mean	Std. Deviation	Remarks
17. illiteracy	449	3.4432	.49732	Agree
18. Disorganised system	449	3.1114	.73865	Agree
19. Poverty	449	3.1114	.73865	Agree
20. Over population	449	4.2205	.78657	Strongly Agree
Grand Mean	**449**	**3.4716**		**Agree**

Table 6: Mean & Standard Deviation of Ways of Reducing Energy waste/crisis

Item Description	N	Mean	Std. Deviation	Remarks
21. Making people to pay for waste caused	449	4.1114	.73865	Strongly Agree
22. Change of attitude towards public property including energy use	449	4.1114	.73865	Strongly Agree
23. People should stop being selfish in energy consumption/use	449	3.3318	.66741	Agree
Grand Mean	**449**	**3.8513**		**Agree**

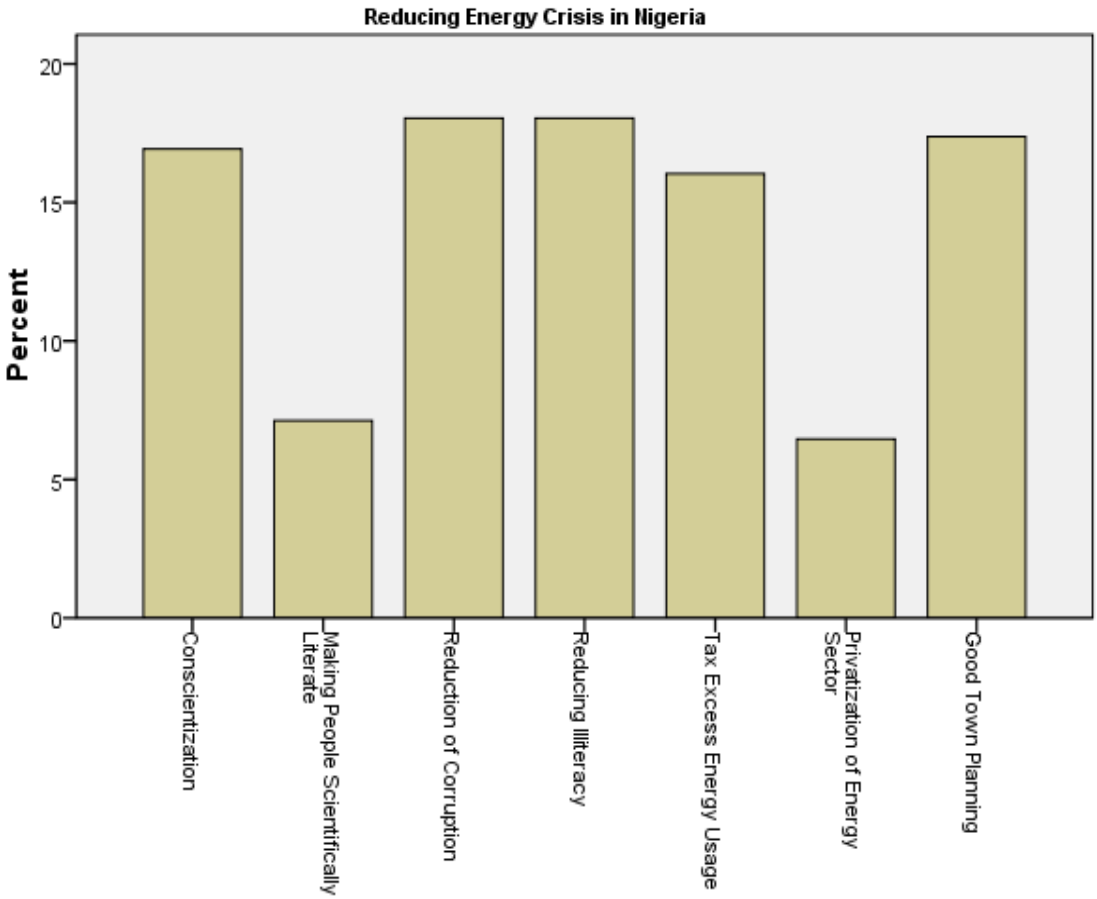

Figure 1: Reducing Energy Crisis/waste in Nigeria

Table 5 reveals that all the items listed are said to be causes of energy crisis/waste in Nigeria. They include illiteracy, disorganised system, poverty and over population with over population as a strong cause of energy crisis as perceived by Nigerians.
Research question 3 sought to find ways of reducing energy waste in Nigeria. Items 21 to 23 in the questionnaire and the bar graph in figure 1 addressed the research question 3. Refer to Table 6 and Figure 1 for details.

Table 6 reveals the mean of 3.3318 and 4.1114 for the three items indicating that all the three items fall within the agreed and strongly agreed region. This means that Nigerians see making people to pay for wastage caused by them, change of attitude towards public property and stoppage of selfish attitude in energy consumption as ways of reducing energy crisis

Figure 1 reveals what the respondents considered to be ways of reducing energy crisis in Nigeria. Again, the figure reveals that all items listed have percentage frequency of 15 and above except making people scientifically literate and privatization of energy sector in Nigeria. Conscientization, reduction of illiteracy, taxing people on excess energy usage, reduction of corruption and good town planning are seen as good means of reducing energy crisis/waste in Nigeria.

DISCUSSION OF FINDINGS AND IMPLICATIONS

One of the findings of this study is that there is generally poor level of awareness among the literate Nigerians on energy waste/crisis. This seems to be in disagreement with what Akamis (2011) found whereby secondary school students had a high level of awareness about renewable energy sources, energy saving and energy awareness; however, they had a moderate level of interest in energy. Going by their level of education the subjects in Akamis' study were only in secondary school while those used in the present study were post graduate students. One therefore expects respondents in this study to be more aware of energy crisis in Nigeria which of-course is one step toward getting a solution to the crisis but it is to the contrary. It is on note that Akamis' study took place in Turkey a zone that is considered more developed than Nigeria and may have accounted for the difference in finding in terms of level of awareness. By implication, this study assumes that until the level of awareness increases beyond the current status, effort that may be made to arrest the issue of energy crisis/waste in Nigeria and perhaps Africa may be a mirage. This assumption is informed by the fact that majority of Nigerians are the rural poor who are by far less literate compared to the respondents used in this study and therefore a worse

situation is envisaged among such illiterate citizens in terms of level of awareness. It is implicated in this study that rather than dissipating efforts in repair, provision and coming up with one reform or the other in the energy sector, it may be more rewarding to first attack illiteracy and awaken the consciousness of the populace on energy and energy waste.

Another finding from this study is that all the four factors listed are said to be strong causes of energy waste/crisis in Nigeria with a grand mean of 3.4716. This means that poverty, over population, disorganised system and illiteracy are implicated for energy waste/crisis in Nigeria. It appears that if a nation intends that manage her resources well including energy production, use and maintenance, the population of citizens that scramble for the resources, their level of education, how effective in planning and efficient the system is including management of corruption and sharp practices as well as poverty level of the majority has to be put on check. It thus appears also that factors or indices of development in any country most often affect the sub-sectors directly or indirectly.

It is also found in this study that to reduce energy waste/crisis in Nigeria there must be attitudinal change towards public property, people to be less selfish in their use of public property and making Nigerians pay for every waste/ damage to energy sector to make them conscious of their actions. Further, the respondents listed a number of ways of reducing energy and topmost among the factors listed are reduction of corruption, reduction of illiteracy, Conscientization, good town planning and taxing people on excess energy consumption. The fact that taxing people on excess energy use or waste was rated high both by their response to the questionnaire and voluntary listing by the respondents was an indication of area of attention. More disturbing is the fact respondents tend to see the issue at hand to be more of an attitudinal issue and a way of life that that has to be attacked right from the root. This is particularly the case with Conscientization being a way of reducing energy crisis. By implication, until there is a change of attitude there could probably be no change in energy waste/crisis in Nigeria. Also, the earlier the poverty issue in Nigeria is addressed the better for development in other sub-sector of the economy. This issue requires a stitch in time to safe nine in this direction. It also implies that subsequent reforms in the power sector should focus on poverty reduction agenda if it must have impact on the socio-economic life of the people(Karekezi & Sihag, 2003).

Estache (2005) made a conclusion that power sector reforms have not delivered electricity to the poor. This is precisely the situation in Nigeria which calls for urgent attention.

At the moment, town planning in rural areas and ancient cities in Nigeria are horrible. By implication controls, inspection and plan to reduce energy waste in congested locations are difficult. For instance, records are high that people who live in such areas do illegal electrical connections, have no meter and violate rules concerning use and management of electricity and other energy related issues (Egwemi & Agaba, 2010). The authors also commented on the tendency of people who live in such congested areas to dodge payment of electrical bills.

CONCLUSION AND RECOMMENDATIONS

Based on evidence from this study, it is settled that the level of awareness of Nigerians on energy waste/crisis is very poor and that poverty, illiteracy, disorganised system an over population are seen as major causes of energy crisis. It is concluded that to reduce energy waste, there is need for attitudinal change and Conscientization, reduction of illiteracy and poverty, good town planning and having to tax people on excess energy used and or waste.

It is recommended among others that there should be a further check on population of the nation by instituting stringent measures on having more than allowed number of children. People should not take cover under religion and where such exists, tax on excess number of children could be a lee way. Similarly, people should be prepared to pay for excess energy used. This is because such payment restricts them to what they actually need and thereby avoiding waste.

Mass campaign is considered a necessity in this paper especially in the area of having to re-orientate the minds of the populace towards use and care for public property. Therefore carefully designed attitudinal change programme by the National Orientation Agency of Nigeria (NOAN) could lead to Conscientization, change in attitude and having value for what is for everybody.

At the moment town planning in rural areas and ancient cities in Nigeria are horrible. This as seen in this study is a hindrance to effective management of energy usage. Efforts should be made no matter how costly it could be to re-plan some ancient cities and to ensure that rural areas and undeveloped sections in towns are planned far ahead of time of development.

Concerted efforts are required to put corruption on check in Nigeria. Virtually all sectors of development in Nigeria are infested by corruption and it is difficult to make progress even in energy subsector in the area of wastage without addressing corruption.

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