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Renewable Energy Education for Development

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Abstract—This study investigates the level of renewable energy technology education awareness in Adamawa and Taraba States of North East Nigeria. This was in view of the fact that the use of renewable energy technology provide a perfect example of how economic well-being and a strong commitment to our environment can complement one another in an effort to reduced emission, provision of sufficient power supply, a cleaner environment, strong and growing economy; and on the other hand, reducing our dependence on fossil fuel and enhancing our security of energy supply. To arrive at the result obtained, 30% of the local government areas in each state were randomly selected, given a total of twelve local government areas (7 from Adamawa state and 5 from Taraba state), within each sampled local government area,three villages were purposively sampled and a total of 360 questionnaires were administered and analyzed using descriptive statistics in addition to t-test analysis. The result revealed that greater proportion of the respondent in both states measuring 67% are not aware of any form of renewable energy, and 54% of the respondent which constitute the majority in both states shows that they have never shown concerned about the environment, but they do not agree that it was the role of individuals to sustain the environment, though they are willing to learn and adopt.

Keyword—Renewable, Energy, Development, Technology, Education.

I. INTRODUCTION

Renewable energy technology makes indirect contribution to alleviating poverty by providing energy for cooking and space heating. Improved biomass stoves, liquid and gaseous fuels derived from locally produced biomass can reduce the drain on household income, while freeing up time for education and income-generating activities. By making light more affordable and reliable, renewable energy technology also permits schools and businesses to operate after dark. Renewable energy can contribute to education as well, by providing electricity to schools, improving attendance, retaining teachers, and powering educational media (Curry, T.E. 2004). Renewable energy for cooking and heating can reduce the time that children, especially girls, spend out of school collecting fuel. In addition, the displacement of traditional fuel reduces the health problem from indoor air pollution produced by burning those fuels. Renewable energy can also contribute to improve health by providing energy to refrigerate medicine, sterilize medical equipment, and incinerate medical waste. And it can provide power for supplying the fresh water and sewer services needed to reduce the burden of infectious disease. By developing energy sources such as large hydro power, wind power, geothermal power, and liquid biofuels, developing countries can reduce their dependence on oil and natural gas, creating energy portfolios that are less vulnerable to price fluctuations. In many circumstances, these investments can be economically justified as less expensive than a narrower, fossil fuel dominated energy system (Olatunji T.2006). Most poor countries have abundant renewable resources, including varying combinations of solar, wind, geothermal, and biomass, as well as the ability to manufacture the relatively labour-intensive systems that harness these. However, only a few developing countries have adopted the policies needed to spur the development of renewable energy technology and markets, which have been dominated by Europe, Japan, and North America (Leiserowitz, A. 2003). The exceptions include Brazil, which has built the world's leading biofuels industry, and China and India, which are leaders in developing decentralized renewable sources such as small hydro, small wind, biogas, and solar water heating. Renewable energy technology faces a number of barriers that have delayed scaling-up their production and use in developing countries. Unlike conventional energy sources, which have benefited from decades of research development, an established industrial base, and government-subsidized infrastructure support, renewable energy options are just becoming known in many regions. Government policies and support systems are frequently biased in favour of conventional energy sources. Renewable energy education can have a dramatic impact on the pace of introduction of renewable energy, as several developing countries have demonstrated (Richard T. Watson2010). Most renewable energy sources require a significant upfront investment, as has been the case for most of the conventional energy sources that dominate today's energy system. This means that in the early years of deployment, renewable energy options are typically more expensive than the conventional alternative. Government intervention to level the playing field is therefore needed to start the development process. Experience shows that as the scale of use increases, costs decline significantly in the early years (Okoye A.C, 2011). A growing number of developing country governments have recognized the essential role that renewable energy technologies can play in meeting basic energy needs and achieving the MDGs.Well-designed policies will allow the cost of the renewable options to fall rapidly in the first several years. It is through the combined efforts of governments and the private sector that strong, sustained markets for renewable energy are most likely to develop.

1.1 ***Importance of Public Understanding of Renewable Energy***

The key finding is that GHG emissions are growing rapidly and that little time is left to turn things around. With current climate and development practices, global GHG emissions will continue to grow over the next few decades. The first part is simply observed fact-GHGs increased by 70% from 1970-2004. Most of these increases come from burning fossil fuels (coal, oil and gas), but deforestation is also a problem. The intergovernmental panel on climate change (IPCC) report released makes it clear that the world cannot continue on its current path. 'If we continue what we are doing now we are in deep trouble' (energy management news, 2007).

There are several reasons why public understanding of renewable energy might be important.
Four of them are these:

(1) The earth is a lonely planet in a vast space, not as crowded as the impression one getsfrom science fiction movies. For humans to move from a destroyed earth to another hospitable planet is just impossible.
(2) The earth is a planet alive with a dead sister and a dead brother. Venus is too hot for lifedue to too much greenhouse gas, while Mars is too cold also due to too little green house gas.
(3) Anthropogenic influence on the world's climate, in particular climate warming due to release of greenhouse gasses like carbon dioxide CO_2 and methane CH_4 is generally agreed upon
(4) One major source of greenhouse gases is combustion of fossil fuel, which has to be replaced by increased energy efficiency and large-scale worldwide dissemination of appropriate technologies for harnessing renewable sources of energy.

A reasonable conclusion is that public understanding of renewable energy is important. There are also several questions with respect to renewable energy: What do professionals - researchers, planetariums and teachers - say? How interested is the public - and different target groups – in renewable energy, and what do they already know? A very crucial role exists of common people in the success of this objective of large scale harnessing of renewable sources of energy, since asadoption as well as design, developing, manufacturing etc., would require their participation.

II. METHODOLOGY

This research work forms part of a bigger project that focuses on individual and organisational choices related to the public understanding of renewable energy and its environmental consequences. Two states of north eastern Nigeria were choosed as case study based on their geographical proximity; the states include Adamawa and Taraba State. In each of the two states, seven local government areaswere choosed for the research work.

The research was made possible through the use of purposive sampling method and questioner, 30 respondents were randomly picked irrespective of sex and between the ages of 18-50 years. Three hundred and sixty questioners were distributed and the coding of the responses to each question within the questionnaire were analysed. The result shown in Table 2.1 below

2.1 Sampling

How well datais sampled depends on the availability of a sampling frame, thesample size and selection procedures. When the aim of the sample in this study was toproduce data that could be subjected to a variety of statistical techniques, purposive samplingwas considered to be the most effective method for this research work.

A sample frame is a set of people that has a chance to be selected, given the sampling approach that is taken. In statistical terms a sample can only be representative of the people included inthe sampling frame. Using purposive sampling procedure, thestudy as in most samplingapproaches, a targeted specific population, thus the ages between 18-50 years was taken as the unit of analysis.

2.2 The Questionnaire

The study was an attempt to understand public understanding, attitudes and behaviourtoward renewable energy technology. In order to discover thestrength of public support, level of knowledge, which groups are more supportive than others, the questionnaire was dividedinto several sections with various types of question design.The first section asked about the identity of the respondent, such as gender and level of education.

The second section asked some general awareness questions about environmental issues and wasdesigned to assess the level of knowledge that people possessed about concepts such assustainable development, energy efficiency and renewable energy. Respondents were askedwhere they had heard of these ideas, how concerned they were about change in long termweather pattern and which factors did they think increased risk of climate change.

The third section asked some specific questions about renewable energy such as whether there is need for more information about renewable energy and if yes where is the most useful place for such information to be made available? Another question is to whether renewable energy should be increased.Questions following included the type of renewable technology that respondents might like toinclude in their homes.

Attitudes and opinions about environmental issues were sought in the last section of thequestionnaire and within this section we were particularly interested in the level of support forrenewable technology over existing fossil fuel and the level of concern of the need to saveenergy. Other questions included the level of importance given to environmental concern.

The questionnaire construction was composed of closed; pre-coded questions to give structure tothe information gathered and included a mixed question format. Single answer questionsrequiring the respondent to choose a single reply from a pre-selected list of options wereincorporated, such as demographic information where respondentswere asked about major responsibility for use of renewable energy. Multiple answer questionsalso featured, where more than one answer was

sought for such question askingabout the types of renewable installations that respondents might wish to introduce into theirhomes.

III. RESULTS

The coding of the questioner is given below

Number of questioner distributed =360
Number of questioner received =350
Number of respondent =350

Table 2.1:The coding of the response to each question within the questionnaire.

ITEMS		ADAMAWA STATE	TARABA STATE	TOTAL	PERCENTAGE
GENDER					
MALE		120	98	218	62.3
FEMALE		80	52	132	37.7
TOTAL				**350**	
EDUCATION					
NO F/ EDU		40	55	95	27.1
PRIMARY		20	44	64	18.3
SSSCE		45	36	81	23.2
COLLEGE		60	15	75	21.4
UNIVERSITY		35		35	10
TOTAL				**350**	
WHICH OF THE FOLLOWING TERMS ARE YOU AWARE OF					
GOBAL WARMING		10	15	25	10.0
GHE		10	5	15	6.0
CLIMATE CHANGE		40	28	68	27.2
SUSTAINABLE. DEV		-	22	22	8.8
RENWABLE.ENERGY		30	8	38	15.2
NONE OF THE ABOV		10	72	82	32.8
TOTAL				**250**	
GENERALLY WHERE DID YOU HEAR OF THEM?					
SOURCES					
TV		20	17	37	10.6
NEWS PAPER		20	12	32	9.2
RADIO		20	130	140	40.0
ENERGY CEN		10	-	10	2.9
INTERNET		30	-	30	8.5
MOUTH		20	-	20	5.7
SCHOOL		80	1	81	23.1
TOTAL				**350**	
HOW CONCERNED ARE YOU THAT THE EARTH'S CLIMATE AND LONG TERM WEATHER PATTERNS ARE CHANGING					
NOT AT ALL		20	25	45	12.9
NOT VERY		10	33	43	12.3
INDIFFERENT		10	37	47	13.4
FAIRLY		20	16	36	10.3
VERY		120	7	127	36.3
DON'T KNO.		20	32	52	14.8

TOTAL				**350**	
DO YOU FEEL THAT YOU NEED MORE INFORMATION ABOUT RENEWABLE ENERGY					
YES		160	131	291	83.2
NO		40	19	59	16.8
TOTAL				**350**	
IF YES , WHERE IS THE MOST USEFUL PLACE FOR SUCH INFORMATION TO BE MADE AVAILABLE					
N.PAPERS		10		10	3.5
TV		20	12	32	11.0
RADIO		40	106	146	50.1
A WEBSITE		10		10	3.4
SCHOOL		93		93	32.0
TOTAL				**291**	
DO YOU THINK THAT WE SHOULD INCREASE THE USE OF RENEWABLE ENERGY					
YES		50	68	118	33.7
NO		10	25	35	10.0
DON'T KNO		140	57	197	56.3
TOTAL				**350**	
WHO SHOULD TAKE THE MAJOR RESPONSIBILITY FOR INCREASING OIR USE OF RENEWBLE ENERGY?					
GOVT		100	150	250	71.4
PRIVATE SEC		60		60	17.2
INDIV.		40		40	11.4
TOTAL				**350**	
DO YOU HAVE ANY OF THE FOLLOWING IN YOUR LOCALITY					
S.PANALS/PV		20		20	3.8
WOOD B.STOVE		160		160	30.3
S. SRT LIGH		120		120	22.6
S/BOREHOLE		80	99	179	33.8
NONE		-	51	51	9.6
TOTAL				**530**	
IF NOT WILLIN TO INSTALL IN YOUR HOME, WHY					
UNATTRACTVE		-			
TOO EXPENSIVE		40	30	70	20.2
NOISY		-			-
WILL NOT BE ADEQUATE		20		20	5.7
ADEQUATE ENERGY SUPPLY		-			-
LACK OF KNOWLEDGE		140	118	258	74.1
TOTAL				**348**	
DO YOU KNOW ANYONE THAT USES RENEWABLE ENERGY ?					
YES		20	8	28	8.5
NO		160	142	302	91.5
TOTAL				**330**	
I GIVE FIRST PIORITY TO THE QUALITY OF THE ENVIRONMENT, EVEN IF IT					

COST ME MORE MONEY					
AGREE		20	23	43	14.3
INDIREFFENT		20	22	42	14.1
DISAGREE		80	23	103	34.3
DON'T KNOW		30	82	112	37.3
TOTAL				**300**	
R.E CAN HELP TO IMPROVE LOCAL ENVIRONMENT					
AGREE		20	30	50	14.3
INDIREFFENT		20	27	47	13.4
DISAGREE		60	18	78	22.3
DON'T KNOW		150	25	175	50.0
TOTAL				**350**	
RENEWABLE ENERGY CAN LEAD TO NATIONS BUILDING					
AGREE		`10	27	37	15.0
INDIREFFENT		10	41	51	20.5
DISAGREE		20	8	28	11.3
DON'T KNOW		60	72	132	53.2
TOTAL				**248**	

IV. DISCUSSONS

From the above analysis and results, it was observed that the level of renewable energy education is very low, both in rural and urban areas. Tackling environmental pressures while building upon the economic and social opportunities afforded by our recent growth requires a broad based, cross-sectorial approach. It also requires individuals, organizations, and sectors to recognize that we must all be willing to assume responsibility for our individual and collective actions on the awareness of renewable energy technology. Below are the possible means on educating the general public on renewable energy technologies and its benefits.

4.1 How Could Public Understanding of Renewable Energy be Achieved, and Which means Are Potentially Useful?

There are of course several different channels that can be used in conveying attitudestowards and knowledge of renewable energy subjects: Newspapers, TV programs, books,interactive exhibits in science centres, lessons in the school. Different media certainly attractdifferent target groups. philosopher Confucius' proverb as a motto for the museum: I hear and I forget, I see and Iremember, I do and I understand WilliamGlasser wrote [We learn 10% of what we read, 20% of what we hear, 30% ofwhat we see, 50% of what we both see and hear, 70% of what is discussed with others, 80%of what we experience, and 95% of what we teach (The Polling Report. 2004).

4.2 Educating the General Public

Ordinary people are the ultimate utilizers of energy from the sun and accordinglyneed basic knowledge in how to make use of this new technology and bemotivated to use it. A number of ways to educate large populations are readilyavailable. Some proven examples:

Mass Media: This includes newspapers, weekly magazines, radio, and TV. Professional journalist can be addressed and taught, some basic facts and they will frequently make a good job in popularizing what they have learned.

Lectures: Popular lectures sometimes attract good-sizecrowds, especially if arranged as debates or panel discussions, or if a well-knownspeaker is featured. Lectures can also be video-taped, and can, with appropriatesolar powered equipment, be shown just about anywhere

Community College Courses:These are excellent in giving interested individualsmore-than-basic knowledge. The aim of such courses can even be that everyparticipant builds his own solar project

4.3 Role of Renwable Energy

Poverty and Hunger

- Reduce by half the proportion ofpeople who suffer from hunger
- Reducing share of household income spent oncooking, lighting, and space heating.
- Improving ability to cook stable foods.
- Reducing post-harvest losses through betterpreservation.
- Enabling irrigation to increase food production andaccess to nutrition.
- Enabling enterprise development, utilizing locallyavailable resources, and creating jobs.
- Generating light to permit income generationbeyond daylight.
- Powering machinery to increase productivity.

Universal PrimaryEducation

- Ensure that all boys and girlscomplete a full course of primaryschooling
- Providing light for reading or studying beyonddaylight.
- Creating a more child-friendly environment (accessto clean water, sanitation, lighting, andspaceheating/cooling), which can improve attendancein school and reducedrop-out rates.
- Providing lighting in schools which can helpretain teachers.
- Enabling access to media and communicationsthat increase educational opportunities.
- Reducing space heating/cooling costs and thusschool fees.

Gender Equalityand Women'sEmpowerment

- Freeing women's time from survival activities,allowing opportunities for income generation.
- Reducing exposure to indoor air pollution andimproving health.
- Lighting streets to improve safety.
- Providing lighting for home study and thepossibility of holding evening classes.

Health

- It can reverse the spread of HIV/AIDS
- It can reverse the incidence of malaria and other major diseases
- Providing access to better medical facilities for maternal care.
- Allowing for medicine refrigeration, equipment sterilization, and safe disposal by incineration.
- Facilitating development, manufacture, and distribution of drugs.
- Providing access to health education media.
- Reducing exposure to indoor air pollution and improving health.
- Enabling access to the latest medicines/expertise through renewable-energy based telemedicine systems.

Environmental Sustainability

- Integrate the principles of sustainabledevelopment into country policiesandprograms; reverse loss ofenvironmental resources.
- It can reduce the proportion ofpeople without sustainable accessto safe drinkingwater
- Boosting agricultural productivity, increasingquality instead of quantity of cultivated land.
- Reducing deforestation for traditional fuels,reducing erosion and desertification.
- Reducing greenhouse gas emissions.
- Restoring ecosystem integrity through landmanagement.

4.4 Renewable Energy with Respect to Education Sector

Ensure that all boys and girls complete a full course of primary schooling (Renewable energy global status report, 2011). For a school without electricity, delivering quality education is a vast challenge. The problem goes well beyond the lack of bright light for reading. Absence of power also means that schools can't use the technology central to modern education, from computers to photocopiers. "Denied the tools to succeed in their work, the most experienced and skilled teachers shyaway from schools without electricity, further exacerbating the problem. Without good teachers and good technology resources, students predictably under-perform, drop out, and ultimately remain unemployed."(Transition to renewable energy future: retrieve from international solar energy Society. June, 2011). Energy is necessary to bridge the technology and education gap, to enable rural areas to become more economically sustainable, and to reverse the trend of migration from rural to urban areas. Particularly in rural areas where conventional fuels are not affordable to the poor, RETs can make important contributions to education by providing electricity to schools and creating a more child-friendly environment that improves attendance. Lighting in schools helps retain teachers, especially if their accommodation has electricity. Access to educational media (overhead projectors, computers, printers, photocopiers, science equipment) and communications increases educational opportunities and the opportunity for distance learning.

4.5 Renewable Energy Dissemination at Village Level

A large proportion of the Earth's population is rural, and their quality of life could be improved at the same time as their impact affection on climate is decreased by introduction of renewable energy utilization at village level: "Low carbon technology for low-purchasing power people." This includes a multitude of technologies and education of users is therefore critically important. A good example is that Electricity for light has quickly become affordable by the development of low-cost white high-intensity low-energy light emitting diodes (LED). Mobile phones are spreading rapidly also among rural people in developing countries, and these can be effectively charged using small not-so-expensive photovoltaic (PV) modules used for powering LED lamps. When educating rural people, it should be understood that many people live below the poverty line and that illiteracy is common. It is not always easy as the following example may illustrate

V. CONCLUSIONS

The public survey conducted for the purpose of thispaper shows the public belief in global climate change. However, the public is uncertain about what actions are available to address climate change. In fact, the public is uncertain about what exactly is causing climate change and often links climate change to increased pollution as opposed to increased concentrations of greenhouse gases.

The important conclusions from the survey are:

- The environment is not a pressing concern for the majority of the public.
- Global warming is not the top environmental concern (even among those who are concerned about the environment).
- Very few people in Adamawa and Taraba States have heard of renewable energy.

- Those who have heard of renewable energy are no more likely to know what environmental concern it addressesand the role it plays in Nations development.
- A large portion of the public supports the need for more information onRenewableenergy

Climate change, security and pricing of energy supply are issues which have impact upon all people, therefore as much as possible people are to involve themselves in thisconsultation Processfor Nations development.

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APPENDICE

SECTION 1 – ABOUT YOU

1. Gender
Male ☐ Female ☐ **Age** ……

2. Please Tick The Box Which Corresponds to the Highest Level of Education You Have Completed.

No formal qualifications ☐

GCE/O Levels or equivalent ☐

A Levels or equivalent ☐

University degree or equivalent ☐

.
Higher degree ☐

SECTION 2 – ENVIRONMENTAL ISSUES

1. Which of the following terms are you aware of? Tick as many as you are aware of.

Global warming ☐

The greenhouse effect ☐

Climate change ☐

Sustainable development ☐

Renewable energy ☐

None of above ☐

If none of above go to Q3

2. Generally where did you hear of them? Tick as many as apply.

TV ☐

Newspapers ☐

Radio ☐

Energy Centres ☐

Internet ☐

Word of mouth ☐

School ☐

3. How concerned are you that the earth's climate and long-term weather patterns are changing?

Not at all concerned ☐

Not very concerned ☐

Indifferent ☐

Fairly concerned ☐

Very concerned ☐

Don't know ☐

SECTION 3 – SOME SPECIFIC QUESTIONS ABOUT RENEWABLE ENERGY

1. Do you feel that you need more information about renewable energy?

Yes ☐ No ☐

2. If yes, where is the most useful place for such information to be made available? Please tick one.

Newspapers ☐

TV ☐

Radio ☐

A website ☐

School ☐

3. Do you think that we should increase the use of renewable energy?

Yes ☐ No ☐ Don't know ☐

4. Who do you think should take the major responsibility for increasing our use of renewable energy? Please tick

FederalGovernment ☐

Private sector ☐

Individuals ☐

6. Do you have any of the following for your locality? Tick as manyas apply.

Solar panels/PV ☐

A wood burning stove ☐

Solar street lightning ☐

Solar borehole ☐

None of above ☐

7. If you do not plan to install renewable energy technology in your home, which of the following reasons apply? Tick as many as apply.

They are unattractive ☐

I think that installations would be too expensive ☐

They are noisy ☐

They would not produce enough electricity for my home ☐

My current supply of energy is adequate ☐

I don't understand how they work ☐

8. Do you know of anyone personally (i.e. friends, relatives or colleagues) who have used renewable energy?
Yes ☐ No ☐

SECTION 4 – ATTITUDES AND OPINIONS ABOUT ENVIRONMENTAL ISSUES

1. Do you agree with the following statements?
Agree, Indifferent, Disagree, Don't know

- I give first priority to the quality of the environment, even if it cost me more money.....
- Renewable technologies canhelp to improve the local environment.....
- Renewable energy can lead to Nations development.....