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Public Sensitisation on the Adoption of Renewable Energy in Nigeria: Communicating the Way Forward

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Abstract: *In the last three decades, the usage of power had grown astronomical in both developed and developing countries of the World. Petroleum storage has continued to decrease in recent years. According to OPEC (Organization of Petroleum Exporting Countries) the storage of oil will be used out by the 21st Century, and in addition, the global warming has now become a thing of reality, even to common people. Therefore, judging from a developmental communication perspective, it has become an issue of urgent importance to sensitise the people on how to make good use of renewable energy in their daily energy demands. The purpose of this research is to create awareness, inform and educate on the concept of renewable energy. Therefore to achieve these objectives, the following guided questions are answered: what it is renewable energy? What are the different types of renewable energy? What are the roles of renewable energy in Nigeria power supply? What are possible hindrances to renewable energy usage in Nigeria? And finally, in which ways can Nigerian government create incentives and encourage the people to adopt renewable energy for use? This paper argues that people must be educated as to the benefits of considering renewable energy for energy generation in Nigeria and that government should put in place adequate incentives for ease of facility procurement and rewards for all adopters. Therefore, this paper concludes that serious awareness must be created among society coupled with provision of facilities and incentives for people to adopt usage of renewable energy in Nigeria.*
Key words: *renewable energy, power development, power challenges, cost-effective energy*

I. Introduction

Developmental communication is an area of communication that focuses on the use of mass media to enlighten, inform and education the government and its people on the various social changes and development going on around them. Hence, in congruence with this notion, Agboola, Olaniyi, Saliu and Ayanwale (2013, p. 1) declared that "it is in the interest of every developmental communicator to inform and sensitise the government and populace on various social developments that may affect their livelihoods". Therefore, there is a need to sensitise the government and the Nigeria populace to adopt renewable energy to minimize overdependence on government for energy generation and distribution in the Country.

In the meanwhile, over the century natural resources have been the key factor that dominates all the developments in human society. And in the last few decades, the demand for natural resources has increased tremendously both in developed or developing countries of the World. Likewise, the discovery of fossil energy storage is decreasing gradually. OPEC has estimated that the storage of fossil oil and natural gas would be completely depleted within this 21st century. Even the storage of coal has dropped to less than two centuries of availability. This apart, fossil energy hastens the production of carbon dioxide and indirectly causes the rise of temperature on the surface of earth as well as the continuance of global warming. Therefore, no matter what vantage point one is viewing the situation from the angles of natural resources, economy and environment, sourcing for various kinds of sustainable, economical and clean resource for our coming generation demands our urgent attention (Feng, 2012).

Apart from home use, energy is vital to escape poverty. It can help people earn a living and work their way out of poverty. Practical Action (2012) highlighted that in this current decade, a third of the world's population has no access to modern energy services. 'Business as usual' projections predict that the situation will be the same in 20 years' time. Also, Practical Action (2012) pinpointed that by 2030:

- 900 million people will not have access to electricity
- 3 billion people will still cook with traditional fuels
- More than 30 million people will have died due to smoke-related diseases
- Many hundreds of millions will be confined to poverty due to lack of energy access (Practical Action, 2012)

Animalu and Adekola (2002) declared that energy is a vital and important necessity for all human daily endeavors. In the modern time, socio-economic activities revolved around the hub of energy generation and distribution, in fact availability of adequate power supply is crucial to our existence and survivability. The oil

crises of 1973 in the western countries brought about by the Arab oil embargo has led to a sudden global realization to use renewable energy resources, such as, solar energy, hydropower, wind energy, wave energy, biomass and biofuels for power generation. Even this campaign for using renewable energy resources is becoming stronger today because of the finite nature of fossil fuel energy resources as well as the greenhouse gases emission which many scientists believe cause global warming. Effective applications of renewable energy resources to augment energy supply from fossil fuel energy resources (using cleaner for fossil fuel technologies) will enhance availability of energy with minimum environmental effect (cited in Ilenikhena & Ezemonye, 2010).

This study therefore focuses on sensitizing the public o the benefits that accrued to the adoption of renewable energy in Nigeria. The purpose of this study can be achieved through the following objectives:

II. What Is Renewable Energy?

Renewable energy is derived from an energy source that is rapidly replaced, or renewed, by a natural process. Such renewable energy sources include: wind, sun, hydropower, biological processes and geothermal processes. Surprisingly, when asking "what is renewable energy" most people do not include nuclear power. There are people who argue it is at least a clean, non-greenhouse gas energy, but being uranium-based, it is not renewable. Many of us often forget that we are applying renewable energy when drying our washing on the clothesline, in the wind and sun. Other applications of renewable energy include hi-tech solar panels, fuel made from agricultural crops and the largest hydropower schemes (U.S. Energy Information Administration (EIA), 2012).

III. Advantages And Limitations Of Renewable Energy

According to Solarschools.net (2012), one major advantage with the use of renewable energy is that as it is renewable it is therefore sustainable and so will never run out. Renewable energy facilities generally require less maintenance than traditional generators. Their fuel being derived from natural and available resources reduces the costs of operation. Even more importantly, renewable energy produces little or no waste products such as carbon dioxide or other chemical pollutants, so it has minimal impact on the environment. Renewable energy projects can also bring economic benefits to many regional areas, as most projects are located away from large urban centres and suburbs of the capital cities. These economic benefits may be from the increased use of local services as well as tourism.

It is easy to recognise the environmental advantages of utilising the alternative and renewable forms of energy but we must also be aware of the disadvantages. One disadvantage with renewable energy is that it is difficult to generate the quantities of electricity that are as large as those produced by traditional fossil fuel generators. This may mean that we need to reduce the amount of energy we use or simply build more energy facilities. It also indicates that the best solution to our energy problems may be to have a balance of many different power sources. Another disadvantage of renewable energy sources is the reliability of supply. Renewable energy often relies on the weather for its source of power. Hydro generators need rain to fill dams to supply flowing water. Wind turbines need wind to turn the blades, and solar collectors need clear skies and sunshine to collect heat and make electricity. When these resources are unavailable so is the capacity to make energy from them. This can be unpredictable and inconsistent. The current cost of renewable energy technology is also far in excess of traditional fossil fuel generation. This is because it is a new technology and as such has extremely large capital cost (Solarschools.net (2012).

IV. What Are The Different Types Of Renewable Energy?

The U.S. Energy Information Administration (EIA) (2012) highlights, as listed below, some of the different types of renewable energy that are currently available:

Biomass Energy- Biomass energy is produced from non-fossilized materials derived from plants. Wood and wood waste are the largest sources of biomass energy, followed by biofuels and energy from waste. Therefore, various types of biomass energy are hereby presented.

i. **Municipal Solid Waste** and **Biogas** - Garbage, or municipal solid waste (MSW) contains biomass (or biogenic) materials like paper, cardboard, food scraps, grass clippings, leaves, wood, and leather products, and other non-biomass combustible materials, mainly plastics and other synthetic materials made from petroleum. MSW can be recycled, composted, sent to landfills, or used in waste-to-energy plants. There are hundreds of landfills in the United States that recover biogas, or methane, which forms as waste decomposes in low-oxygen (anaerobic) conditions. The methane is burned to produce electricity and heat.

ii. **Wood** - Wood biomass includes wood chips from forestry operations, residues from lumber, pulp/paper, and furniture mills, and fuel wood for space heating. The largest single source of wood energy is "black liquor," a residue of pulp, paper, and paperboard production.
iii. **Biofuels** - Biofuels include alcohol fuels, such as ethanol, and "biodiesel," a fuel made from grain oils and animal fats. Most biofuel used in the United States is fuel ethanol produced from corn.

Hydropower

Hydropower is electricity produced from flowing water. As a result, hydropower output varies widely according to rainfall. Most hydropower is produced at large facilities built by the Federal Government, such as Kanji Dam, Shiroro Dam, etc

Geothermal Energy

Geothermal energy is energy from the hot interior of the Earth. The fissures in the Earth's crust allow water heated by geothermal energy to rise naturally to the surface at hot springs and geysers. Wells drilled into the Earth allow heated steam or water to escape to the surface in a controlled manner to operate steam turbines and electricity generators.

Wind Energy

Water pumping windmills and small wind electric generators were once used throughout the United States. Rural electrification programs of the 1930s and 1940s largely replaced the need for these systems. Starting in the early 1980s, Federal and State Government policies and incentives led to a revival in wind power generation.

Adaramola and Oyewola (2011) relating from other researchers, highlighted wind speed data reports from 1951-1975 from 22 stations across the country and they concluded that Sokoto area (in northern part) have highest wind speed of about 5.12 m/s in June and annual average of 3.92 m/s. Also, they reported wind speed of about 2 m/s or less in the middle and southern areas. Additionally, another set of wind speed data (1968-1983) classified wind speeds across Nigeria into four different regimes: 1.0-2.0 m/s (e.g. Oshogbo, Minna and Yola), 2.1-3.0 m/s (e.g. Lagos, Makurdi and Port Harcourt), 3.1-4.0 m/s (e.g. Enugu, Kano, Maiduguri) and > 4.1 m/s (e.g. Jos, Nguru, Sokoto). As a result of the efficient wind regimes that are available in Africa, it was suggested that Egypt, Morocco and Tunisia are the leading countries with installed capacity of 430 MW, 253 MW and 54 MW respectively, as at the end of 2009.

However, in Nigeria the average daily average wind speeds can be misleading since the pattern of wind can be that it is very windy in the night time with very little wind in the morning or afternoon. A few very productive windy hours can in fact be sufficient to generate the targeted amount of electricity since power is related to wind velocity cubed. The available wind varies with the seasons, with high summer (June-August) wind speeds averaging about 1 - 2 m/s less and winter (December-February) averaging about 1-1.5 m/s more than the yearly average. Therefore, wind turbines that are currently available in market works efficiently in light winds starting as low as 3 m/s, making wind power a viable and economically sound source for energy in most of the Northern States and also elsewhere depending on the geography of selected sites.

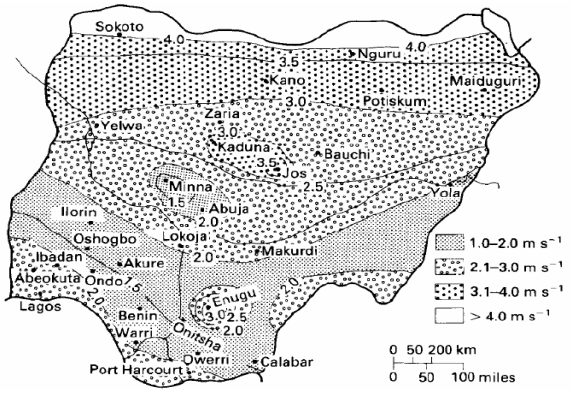

Figure-1. Nigeria annual average wind speeds distribution (isovents at 10 m height) showing four different wind speed regimes (Source: Ojosu and Salawu, 1990b).

As compared to any other part of the country, Northern Nigeria has much better average wind speeds of 6 - 8m/s but parts of the South and mountainous Centre are in the same range. The map above shows the suitable use of wind power in each state, based on wind at 10m elevations. Small wind turbines generally require 4 m/s to work, whereas mechanical wind pumps generally require 2.5 m/s to work. Individual sites will

vary a lot. Based on the currently available wind data, it is safe today, that every part of Nigeria can benefit from wind driven water pumping and the majority of states in Nigeria can generate electricity using small wind turbines. Individual locations and application will require a site survey to confirm available wind regime and guarantee long term successful operation of installed wind turbines and related applications. Individual sites will vary a lot. The map shown is on the basis of ground level observations. Wind speeds are up to 20% higher at 50' elevation due to less turbulence.

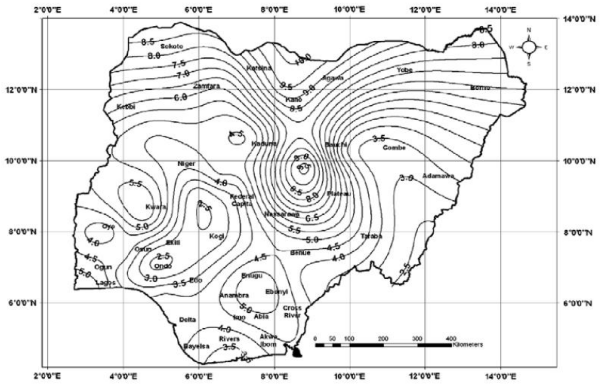

Figure-2. Predicted monthly average wind speeds (m/s) distribution (isovents at 10 m height) in Nigeria for the month of June (Source: Fadare, 2010).

In addition, another studies reported the wind speed pattern across Nigeria based on wind data from 30 meteorological stations and based on wind data for 18 stations and from 1979-1988. Specifically, it was mentioned that average wind speeds in Nigeria range from about 2 m/s to about 4 m/s with highest average speeds of about 3.5 m/s and 7.5 m/s in the south and north areas, respectively (Adaramola & Oyewola, 2011).

Solar Energy

Solar energy systems use radiation from the sun to produce heat and electricity. There are three basic categories of solar energy systems:

i. Solar Thermal Systems for Heating Buildings and Water - Solar thermal systems use solar collectors to absorb solar radiation to heat water or air for space and water heating.
ii. Solar Thermal-Electric Power Plants - Solar thermal-electric power plants use concentrating solar collectors to focus the sun's rays to heat fluid to a high temperature. This working fluid can then be used to generate steam to operate a turbine, which is then used to produce electricity in a generator. The three types of solar-thermal power systems used in the United States are parabolic trough, solar dish, and solar power towers.
iii. Photovoltaic Systems - Photovoltaic (PV) systems are based on solar electric cells, which convert solar radiation directly into electricity. Individual PV cells are configured into modules of varying electricity producing capacities. PV applications range from single solar cells for powering watches to large installations with hundreds of modules for electric power production.

However, Lin (2004) highlight a recent statistics which show that over the past four years the average growing rate of solar power batteries has reached 35.8% and the growing of solar power generation system has also reached more than 30%. The annual output value of solar power batteries was 1.3 billion US dollars and analysts predicted it the reach 4.23 billion US dollars in 2010 and 48.85 billion US dollars in 2020. The global output value will multiply. Judging from this declaration of over 30% growth rate at global photonics market in the past five years, there is an indefinite potential of development in this industry. Among all the developments, lots are the results of government financing. Lin presumes that the major motivation of these developments is the rise of environmental protection concepts. The encouragement and financing of solar power generation system from the countries around the globe and the applications of renewable energy related laws have resulted in the increasing needs for solar power batteries (cited in Feng, 2012).

V. Roles Of Renewable Energy In Nigeria

As highlighted by the U.S. Energy Information Administration (2012) that the use of renewable energy is not new. About a century and half ago, wood, which is one form of biomass, supplied up to 90% of U.S. energy needs. But as the use of coal, petroleum, and natural gas expanded, the United States became less reliant on wood as an energy source. Today, the U.S. still look again at renewable sources to find new ways to use them to help meet its energy needs. However, in Nigeria, the case is the contrary. The rising of gas in key export

markets as the reserves in other countries continue to decline thereby propelling the Liquified Natural Gas (LNG) export business in Nigeria, there has been an aggressive growth in the domestic power sector occasioned by the power sector reform, and the successful campaign by the Federal Government to attract gas-based investors to Nigeria (Egbogah, 2011).

Egbogah (2011) has mentioned five key factors underpinning the gas supply challenges for Nigeria's domestic market are discussed below:

Gas Availability is an Important Factor:

This is characterised by the orientation of the international oil companies (OICS) to gas export, as well as availability and development of short/medium proven gas reserves. Other factors, such as: (a) commercial issues which borders on domestic gas prices, revenue securitisation and gas agreements (b) adequacy and flexibility of gas infrastructure and costs; (c) legal and regulatory framework, (d) funding of gas developments and infrastructure; (e) the inadequacy of existing gas pipeline infrastructure.

In 2011, consumption of renewable sources in the United States totaled about 9 quadrillion Btu - 1 quadrillion is the number 1 followed by 15 zeros - or about 9% of all energy used nationally. About 13% of U.S. electricity was generated from renewable sources in 2011 (Egbogah, 2011).

Over Half of Renewable Energy goes to Producing Electricity:

The next largest use of renewable energy is biomass (wood and waste) for the production of heat and steam for industrial purposes and for space heating, mostly in homes. Biomass also includes biofuels, such as ethanol and biodiesel, used for transportation.

Renewable Energy Plays an Important Role in the Supply of Energy:

When renewable energy sources are used, the demand for fossil fuels is reduced. Unlike fossil fuels, non-biomass renewable sources of energy (hydropower, geothermal, wind, and solar) do not directly emit greenhouse gases.

VI. The Importance Of Renewable Energy In Nigeria

Renewable Energy World.com (2013) highlights that renewable energy is important because of the benefits it provides. The key benefits are as listed below:

i. Environmental Benefits

Renewable energy technologies are clean sources of energy that have a much lower environmental impact than conventional energy technologies.

ii. Energy for our children's next generations

Renewable energy will not run out. Other sources of energy are finite and will someday be depleted.

iii. Jobs and the Economy

Most renewable energy investments are spent on materials and workmanship to build and maintain the facilities, rather than on costly energy imports. Renewable energy investments are usually spent within the United States, frequently in the same state, and often in the same town. This means your energy dollars stay home to create jobs and fuel local economies, rather than going overseas. Meanwhile, renewable energy technologies developed and built in the United States are being sold overseas, providing a boost to the U.S. trade deficit.

iv. Energy Security

After the oil supply disruptions of the early 1970s, our nation has increased its dependence on foreign oil supplies instead of decreasing it. This increased dependence impacts more than just our national energy policy.

VII. Hindrances Of Using Renewable Energy In Nigeria?

In the past, renewable energy has generally been more expensive to produce and use than fossil fuels. Renewable resources are often located in remote areas, and it is expensive to build power lines to the cities where the electricity they produce is needed. The use of renewable sources is also limited by the fact that they are not always available - cloudy days reduce solar power; calm days reduce wind power; and droughts reduce the water available for hydropower.

Whereas, the production and use of renewable fuels has grown more quickly in recent years as a result of higher prices for oil and natural gas, and a number of state and federal government incentives have been made available for this purpose, for example, the US Energy Policy Acts of 2002 and 2005. The use of

renewable fuels is expected to continue to grow over the next 30 years, although it has been forecast that people will still rely on non-renewable fuels to meet most of their energy needs.

Other biggest hindrances to tapping renewable energies and others like solar power and wind is the contrasts you find on the continent. According to the report, for instance, sub-Saharan Africa generates only about 25 percent of the continent's electricity despite having 80 percent of the continent's population.

VIII. Creating Incentives For Renewable Energy Adoption In Nigeria?

Investment in and use of renewable energy is both encouraged and required by a range of federal, state, and local government legislation and utility incentives. However, in Nigeria the momentum for adoption of renewable energy is still ongoing. Therefore, the following is a brief description of the major types of incentives that are currently in place in some developed countries, especially the USA and UK.

In the U.S., investment in and use of renewable energy is both encouraged and required by a range of federal, state, and local government legislation and utility incentives. U.S. Energy Information Administration (2012) provided the following brief description of the major types of incentives currently in place:

i. **Federal Renewable Energy Production Tax Credit (PTC):-** The PTC is an inflation-adjusted tax credit for electricity produced from qualifying renewable energy sources or technologies. The PTC was initiated with the Energy Policy Act of 1992, and subsequently renewed and amended several times, most recently in the American Recovery and Reinvestment Act of 2009 (ARRA).
ii. **Federal Renewable Energy Investment Tax Credit (ITC):-** The Energy Investment Tax Credit is the alternative to the production tax credit discussed above. An investment tax credit can be taken for the equipment (property) eligible to receive the PTC, and for facilities that produce electricity from solar and geothermal energy, qualified fuel cell power plants, stationary microturbine power plants, geothermal heat pumps, small wind plants, and combined heat and power plants. Investors can either take the ITC, which generally provides for a 30% tax credit, or the PTC described above.
iii. **Federal Renewable Energy Investment Grant:-** The ARRA established a grant program for investors that cannot use the PTC or ITC. Although a variety of renewables are eligible for this provision, in 2011, most of the dollars expended were directed to wind and solar power.
iv. **Renewable Portfolio Standards (RPS) and State Mandates or Goals:-** A RPS is typically a requirement that a percentage of electric power sales come from renewable energy. Some states have specific mandates for power generation from renewable energy while others have voluntary goals. In 2011, about 37 states, the District of Columbia, Guam, Puerto Rico, and the U.S. Virgin and Mariana Islands had an RPS, mandate, or goal. Compliance with RPS policies can sometime require or allow for the trading of renewable energy credits (RECs).
v. **Renewable Energy Certificates (RECs):-** RECs, also known as renewable energy credits, green certificates, green tags, or tradable renewable certificates, are financial products that are sold, purchased, and traded. These financial products allow the purchaser to pay for renewable generation without the need for physical or contractual delivery of the generation.
vi. **State Financial Incentives:-** In 2011, every state had some type of financial incentive to support subsidize the installation of renewable energy equipment including grants, loans, rebates, and tax credits. For example, in California, a state "buy-down" program (a grant for the purchase of small renewable energy systems) for photovoltaic (PV) equipment helped to increase the number and size of PV systems installed on houses and commercial buildings.
vii. **Net Metering Programs:-** Net metering allows electric utility customers to install grid-connected renewable energy systems on their property to offset their electrical load and/or sell-back electricity to their utility. Customers are billed for the "net" amount of electricity that they consume; that is, their total consumption minus the amount that they generated with their on-site renewable system. Forty-three states along with the District of Columbia now have state-wide net metering programs in place, and individual utilities in three other states offer net metering.
viii. **Feed in Tariffs (FITs)**:- Several states and individual electric utilities in the United states have established special rates for purchasing or buying electricity from certain types of renewable energy systems. These rates, sometimes known as "Feed in Tariffs" (FITs), are generally higher than retail electricity prices to encourage new projects of specific types of renewable technologies.
ix. **Green Power Programs:-** U.S. consumers in many states can purchase "green power," which represents electricity generated from specific types of renewable energy resources. In 2010, there were about 776 electric utilities in 47 states and District of Columbia offering green power to their customers. Most of these programs sell power produced by wind and landfill gas, and generally involve the physical or contractual delivery of the generation resource to the customer or utility (as opposed to "green tags" or "green certificates," discussed above in the section on RECs).

x. **Ethanol and Other Renewable Motor Fuels:-** There are also a variety of federal and state requirements and incentives for the production, sale, and use of ethanol, biodiesel, and other fuels made from biomass. The federal Energy Independence and Security Act of 2007 requires that 36 billion gallons of biofuels be used in the U.S. per year by 2022. Several states have their own renewable fuel standards or requirements. There are a variety of other federal programs that provide financial support and incentives for ethanol and other biofuels producers, and many states have their own programs that support or promote the use of biofuels.

xi. **Renewables Research and Development (R&D):-** The U.S. Department of Energy (DOE), and other federal government agencies, fund research and development of renewable energy technologies. The renewables R&D share of total DOE R&D spending rose from 24% in 2007 to 31% in 2010. Most of the R&D is carried out at the National Labs and in cooperation with academic institutions and private companies.

xii. **Energy Loan Programs:-** EPACT 2005 authorized DOE to provide loan support to "innovative clean energy technologies" that: "avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases." These technologies include: biomass, hydrogen, solar, wind, and hydropower. The ARRA amended EPACT by authorizing loan guarantees to biofuels projects, as well as by not requiring eligible renewable technologies to be "innovative." Funding under the program includes investment in two of the world's largest solar power plants and one of the world's largest wind power facilities.

In Africa, the provision of incentives for renewable energy adoption is one of the key areas where governments can help by encouraging a variety of incentives like reversible electric meters, which would enable someone who has solar panels installed on their roof to “sell” any excess power they generate to the national grid. At the end of that financial year if the person has supplied more power than they have drawn from the grid they get a cash rebate that goes to pay for the cost of installation.

Another version of incentive is via a micro grid, where a community of perhaps 200 to 500 homes comes together and collectively installs renewable energy options as a group, using economies of sales to reduce the costs. They would then interlink with one another in a network (a local grid) which is smart enough to efficiently transfer power from one member to another to meet demand. The collective excess power (which could be in the order of megawatts) is then sold to a national grid from a designated interconnection point. The proceeds are shared among the members of the grid depending on their generation capacity (Obiero, 2012).

Yet another version is when governments offer tax rebates or price cuts for the equipment used in developing a local grid. Grids could be interconnected as well as being linked to the national grid but the key is for them to remain independent. In light of these policies, it would be possible for people in rural areas to use their resources collectively to get electricity as well as earn an income from their investments. Banks would also be much more willing to lend to such projects because of the obvious financial gain and the fact that risks are minimized. Further benefits lie in the potential for communities to directly earn carbon credits from such projects which could further enhance the economic potential of such technologies (Obiero, 2012).

IX. The Way Forward

According to Ajayi, Oluseyi, Ajanaku and Kolawole (2009), Nigeria should endeavour to opt for a blended mixture of energy which will be a combination between the available renewable energy with the non-renewable fossil fuel. They concluded in their write up that:

The gas being flared at the different crude oil refining sites could be used to generate abundant electric power for the nation instead of being wasted with deleterious impact of burning on the environment. The government also needs to develop capacities and develop the infrastructure for harvesting wind for power generation from sites within regions having high wind capacity, trapping the abundant solar energy freely available in the nation, increase the capacities of the present hydro-power stations and also establish various power stations that will use the natural gas from crude oil exploitation to drive turbines for electricity generation. All the energy thus generated should be fed into the national grid, creating adequate mix of energy from the different sources and having a compact energy development process which will be suitable, sustainable, constantly available, environmentally friendly and economically viable in the long term national energy plan.

X. Conclusion

In conclusion, in order to be able to utilize the wind energy resource at our disposal in Nigeria and to meet the projected wind energy contribution of 20 MW and 40 MW to our current aggregate electricity generation by 2015 and beyond, concerted effort is needed to be made in the areas of education and training. There is a need to make provision for accredited academic programme in Nigerian universities and polytechnics to provide training and produce professional in the field of wind energy technology, which can be achieved through the establishment of training and research centres in universities and polytechnics across the nation.

As energy is a vital and important necessity for all earthly processes, the Nigerian energy commission that now has six centres across the country to conduct researches and develop technologies for applications of renewable energy resources should intensify effort to make available, through collaboration with government, materials that would facilitate the installation of renewable in Nigerian households.

In addition, solar radiation being abundantly present is one area of focus among the renewable energy resources. Solar energy technologies have been produced for direct harnessing of solar energy. Some state governments and non-governmental agencies also promoted the applications of solar energy by sponsoring solar energy projects in some rural communities that are not connected to national grid. In spite of the efforts to create awareness on the effective use of solar energy, the technologies for solar energy applications are yet to become household commodities. A greater percentage of all energy services are provided from electricity derived from burning of fossil fuel energy resources and hydroplants. The applications of solar energy to augment energy from fossil fuel energy resources using cleaner fossil fuel technologies will ensure availability of energy to meet the increasing demand in socio-economic activities and improved standard of livelihood.

Finally, developing countries may be slow in their pace from conventional energy generation to adopt cleaner energy solutions, just as they leapfrogged land-line based phone technologies in favor of mobile networks. Industrialized countries can and should support this transition to low-emission technologies. With the right policy frameworks in place, the return on investment can be enormous: increased productivity and growth, job generation, included for grass-roots entrepreneurs, improved public health, enhanced energy security and a more stable climate.

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