OPEN ACCESS

International
Journal
Of Modern Engineering Research (IJMER)

Nigerian Economy and the Impact of Alternative Energy.

Abaka J.U*, Adeleke D.A, Salmanu H, Ibraheem T. B, Olokede O.
Renewable Energy Department,
Energy Commission of Nigeria.

ABSTRACT: *Nigeria is endowed with natural resources which are aim at developing the country.The need for alternative energy resources to drive the nation economy cannot be over-emphasized. The incessant power failure has grossly affected the economy, seriously slowing down development in rural and sub-rural settlement. A robust solution must be found to end the crises. Alternative energy source has the potential of solving power problem in Nigeria as well as providing safer and cleaner environment than the fossil fuel. This paper also examines the socio–economic benefits of the alternative energy (solar, wind, biomass, hydro and geothermal) to the nation economy and the utilization of the resources to meet human needs and the generation yet unborn and to provide sustainable development, thereby improve the standard of living and mitigating climate change.*

Keyword: *Alternative Energy, Climate Change, Economic, Environmental Pollution.*

I. INTRODUCTION

One of the primary needs for socio economic development in any nation in the world is the provision of energy supply systems, which is vital to human life and technological advancement and also widening people opportunities and empowers people to do choices. In Nigeria the low level supply of electricity generation has been the major constraint to rapid socio economic development especially in rural communities (A.S Ayodele, 1998). More so, about sixty five percent (65%) of the 150 million Nigeria populace are rural dwellers (A.O Sumonu,2011 *et al*) with major of them income earners whose socio-economic lives can only be improved when provisions are made to preserved their wasting agricultural product and provide energy for their household equipment, such as refrigerator, lighting, fan and etc. Hence there is need to develop an indigenous technology to harness the Renewable energies from wind, solar, biomass to generate electricity. It is pertinent to note that the alternative energy as the basis of the discussion is a clean energy which aim to produce no or less harm to the environment, it also contribute to the economic development of the nationals Ayodele, 1998) by adding value to the national grid so as to improve the industrial growth of a nation and mitigate the climate change (K.C Jean, (2011). Nigeria depends on its country petroleum, but as the fossil fuel is declining and the world are moves towards cutting carbon emission away from fossil fuel. Nigeria is leveraging its other resources to ready itself for the new era. Therefore we are at the threshold of the technological break through the need for continuous quest for alternative energy which is environmentally friendly, humanly safe and economically viable should be embraced.

II. LITERATURE REVIEW

More specifically with high cost of conventional energy lead to a considerable interest in the development and application of renewable energy resources and utilization (A.S Sambo, 1991). Nigeria is endowed with an annual Average daily sunshine of 6.25 hours, ranging between about 3.5 hours at the coastal areas and 9.0 hours at the far northern boundary. Similarly, it has an annual average daily solar radiation of about 5.25 KW/m^2/day, varying between about 3.5 kWm^2/day at the coastal Area and 7.0kW/m^2/day at the northern boundary.

Nigeria receives about 4.851x 1012 KWh of energy per day from the sun (E.N.C .Okafor and Uzuegbu, 2010). Solar energy technologies are divided into two broad groups namely solar-thermal and solar photovoltaic. In solar thermal applications, solar energy, as electromagnetic waves, is first converted into heat energy. The heat energy may then be used either directly as heat, or converted into 'cold', or even into electrical or mechanical energy.

Typical such applications are in drying, cooking, heating, distillation, cooling and refrigeration as well as electricity generation in thermal power plants. In solar photovoltaic applications, the solar radiation is converted directly into electricity. The most common method of doing this is through the use of silicon solar cells. A study of the wind energy potential for a number of Nigeria cities shows that the annual wind speed ranges from 2.32m/s for Port-Harcourt to a figure of 3.89m/s for Sokoto which is a renewable energy and is present in the nation (A.S Sambo, 1987). Also a report compiled by the Sokoto Energy Research shows the detail of alternative energy technologies ready for adoption in to the economy (A.S Sambo, 1991). Biomass resources of Nigeria can be identified as wood, forage grasses and shrubs, animal as waste arising from forestry, agricultural, municipal and industrial activities, as well as, Aquatic biomass (Garba B and Bashir, A.M, 2002) Also the biomass resources of the nation have been estimated to be about 8×10^2 M.J. Plant biomass can be utilized as fuel for small-scale industries. It could also be fermented by anaerobic bacteria to produce a very versatile and cheap Fuel Gas i.e. biogas (E.N.C Okafor and Uzuegbu, 2010). Moreover, hydropower systems rely on the potential energy difference between the levels of water in reservoirs. Nigeria has a capacity of 11,500 MW for large hydropower and only 1972 MW has being exploited while for small hydro power, the country has about 3,500 MW and only about 64.2 MW has being exploited. (A.S Sambo, 2005).Some alternative energy resources are available in some area of the world e.g. Nigeria which include solar, wind, hydro and biomass. (Considine, 1977).

Situation of the Nigeria Economy in Alternative Energy

Despite the abundance of energy resources in Nigeria, the country is in short supply of electrical power (A.S Sambo, 2009). Only about 40% of the nation have access to grid electricity (A.S Sambo, 2009). To achieve the goals of development, an energy sector is essential. Many countries, especially in developing countries are faced with serious energy crises. They have been unable to meet the energy needs of their countries. In a quest to realize this, many have turn to different sources of energy which among them are renewable energy sources. In view of this ,the national energy policy with an optimal utilization of the nation energy resources for sustainable development with substantial private sector was approve by the government in 2003,which cover all energy resources and all energy utilization sector of economy and the finance.

Table 1: Some Alternative Energy Resources

S/N	Resources	Renewable Energy	Production

		Resources	
1	Large Hydro	11,280mw	1938mw(167.4million mwh/day)
2	Small Hydro	3,500mw	30mw(2.6millionmwh/day)
3	Solar Radiation	3.5-7kwh/m^2/day	240kwp of solar pv
4	Wind	(2-4)m/s AT 10M height	
5	Biomass (Fuel Wood) (Animal Waste) (Agric Residue)	11million of forest and wood hard. 211million assorted animals. 72hectares of agric land.	0.120million tone/day 0.781million tone waste/day 0.256million tone crop/day

Available In the Nation

Source: Energy Commission of Nigeria (National Energy Master Plan 2005)

Table 2: Targets for Electric Generation for Alternative Energy

S/N	Resources Available(Mw)	Short Time Line(2009)	Medium Time Line (2015)	Long Time(2030)
1	Large Hydro	1930	5930	48,000
2	Small Hydro	100	734	19,000
3	Solar PV	5	120	500
4	Solar Thermals	_	1	5
5	Biomass	_	100	800
6	Wind	1	20	40
7	All Renewable Energy	2,036	6,905	68,345

Source: Compiled by Energy Commission of Nigeria (Renewable Energy Master Plan 2005)

We can observe that the situation will best increase the economy of the nation if the utilization of the resources is perfectly promoted and effectively used and can mitigate adverse effect of climate to the nation.

Definition of Alternative Energy

Alternative energy is defined as energy fuelled in ways that do not use up natural resources or harm the environment, especially by avoiding the use of fossil fuel. (Oxford Dictionary, 2012). It was also defined as
an energy resources that is naturally regenerated over a short time scale and derive directly from the sun (such as Thermal, Photochemical, Photoelectric) and indirectly from the sun (such as wind, hydro power, photosynthetic energy stored in biomass) or from other natural movement of the environment (such as geothermal and tidal energy). (TREIA Renewable Energy).Also alternative energy can be defined as:
The energy produced without undesirable consequence of the burning of fossil fuel, such as high carbon dioxide emission, which is considered to be the major contributing factor of the global warming (Michigan Next energy Authority Act of 2002).

Types of Alternative Energy
There are a number of advantages to exploring alternative energy sources. One advantage is that alternative energy sources reduce greenhouse gases and pollutants which not only lead to us being unhealthier but contribute to global warming. The alternative energy types are bellow:

WIND

Wind is a natural energy source. When the wind blows, the blades of the turbine rotate. The rotation is then converted into an electrical current through the use of an electrical generator (Z.Araron, 1998). These wind turbines are usually built on wind farms. Electrical currents today are harnessed by large wind farms that are used by national electrical grids. They are also used on a smaller scale for providing electricity to smaller homes or locations.

There are a number of advantages to using wind power. First, it produces no pollution. This means there are no harmful by-products and our environment stays healthy. Secondly, wind energy is a renewable source, so we will never run out of wind. Third, wind turbines can be placed on farms in which livestock are raised. Finally, wind farms can also be built off-shore. Clearly, wind power has some disadvantages. As with any energy source, there are some concerns as well. Once concern is that wind power is not constant. Some days are windier than others. On some days, there is little to no wind. In order for this energy source to be more reliable, it needs to be more consistent so that electricity is being produced all the time. Another concern is that some people believe that the wind turbines are ugly and they do not want them around, it kill bird flying around and it’s noisy. Those are just a few concerns about wind power.

SOLAR

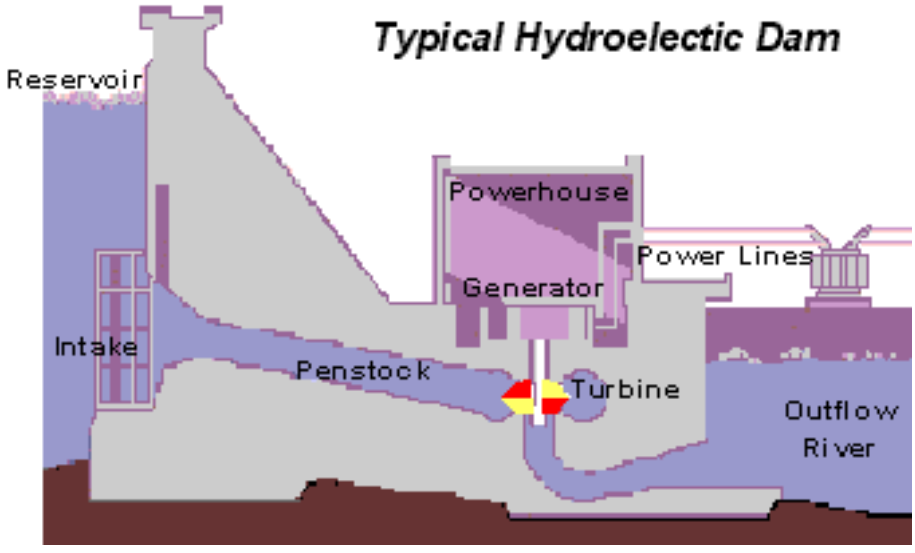
Solar energy is created by trapping the sun's rays into solar cells where the sunlight is changed into electricity. Solar energy is most commonly used for producing electricity, getting the salt out of water, heating, and cooking. Some people have solar panels now on their homes to heat them. This saves them a lot of money in the long run. Others use a very informal type of solar power by simply opening their blinds when it is sunny to help them heat their homes. Solar power has some advantages as an alternative energy source. One advantage is that as long as we have a sun, its energy is renewable. Secondly, like wind power, it does not contribute to pollution and keeps our world clean. Solar energy is a very practical form of energy for lighting and heating. Solar power can be easily used to heat

water tanks, pools, and spas. Its uses are endless. Just like wind power, solar power also has the disadvantage of inconsistency. There are some days when ample sunlight is present, offering a lot of solar energy; there are also days when the sun is not shining and little to no solar power energy will be collected. Additionally, solar power stations can be very expensive to build, which may make it somewhat impractical. These are all issues to be considered.

GEOTHERMAL

Geothermal energy is the natural energy formed by the earth (Union of Concerned Scientist, 2012). The hot rocks that are under the ground heat the water to produce steam. Then you can drill holes in this area, causing the steam to shoot up and drive turbines. The turbines then power electric generators. There are some advantages to geothermal energy. Just as wind and solar power, geothermal energy does not pollute or cause harmful by-products. A geothermal plant is a very self-sufficient energy source once it has been built. These plants are typically rather small and do not have much effect on the beauty of the landscape, so no complaints there like the complaints with the wind turbines. As usual, there are always some negatives. If the geothermal plant is not produced correctly, there can be pollutants. Also, if the drilling is not done correctly, there will be hazardous minerals and gases released into the air. Finally, geothermal sites can run out of steam at some point. You can see that it is vitally important that the geothermal plants are done correctly in order for them to be effective, and they will not last forever.

HYDROELECTRIC



Hydroelectric power is generated from dammed water that drives a water turbine and generator. Tidal power is one version of this. The power of the water of a tide creates pressure that will turn either a turbine or a water wheel. A hydroelectric power plant uses a renewable source of energy that does not pollute the environment. It converts the kinetic

energy contained in falling water into electricity. This energy is renewable because it is ultimately derived from the sun: energy contained in sunlight evaporates water from oceans and deposits it on land in the form of rain. . This power then is able to provide energy to the electric generator.

Hydroelectric Energy has some advantages. First, water can be held in order to provide for times of less water. This is a difference from the other forms of alternative energy since with hydroelectric energy you have the ability to accumulate the water. This means that the energy can be generated consistently. Hydroelectric power, like wind, solar, and geothermal energy, has no waste or pollution. Additionally, it is renewable because the water can be reused.

Disadvantages of hydroelectric energy include that the dams can be rather expensive to build. There also needs to be enough supply of water to create energy, and that supply of water needs to be powerful. (O.magret Hyde, McGraw Hill).

III. EXISTING PROJECTS FOR ALTERNATIVE ENERGY IN NIGERIA

List of Some Pilot Projects

Table 3: Solar-PV Electrification Projects

S/N	Capacity (kWp)	Location	Date
1.	2.85	Okopendi, Bende LGA, Abia State.	2005
2.	5.0	Laje, Ondo State	2005
3.	1.5	Usman Danfodio University, Sokoto State.	2002
4.	2.5	Agbashi, Nassarawa State.	2000
5.	7.2	Kwalkwalawa, Sokoto State.	1994
6.	2.0	Iheakpu-Akwa in Igbo-Eze South LGA of Enugu State.	1999
7.	2.0	Usman Danfodio University, Sokoto State.	2000
8.	5.0	Kawo in Kaduna State	2002
9.	4.5	SERC	2002
10.	0.7	Solar Electrification of Office block.	2002
11.	1.25	Security Lighting	2002
12.	0.5	Security Lighting	2002
13.	Lot	NITEL	2000
14.	0.25	Yenagoa	2006
15.	4.0	Jigawa State	2000
16.	2.5	Govt. Gifted Sch,	2005

		Gwagwalada, FCT, Abuja	
17.	2.5	Govt. Girls College, Kano	2004
18.	2.5	Govt. Technical College, Kano	2004
19.	2.5	Govt. Sec. Sch, Kano	2004
20.	2.5	Govt. Sec. Sch., Tarauni, Kano	2004
21.	2.5	Rumfa College, Kano	2004

Table 4: Solar Water Pump Project

S/N	Capacity (kWp)	Location	Date
1.	1.6	Kuruwa, Sokoto	1998
2.	1.5	Achida, Sokoto	1998
3.	1.6	Kebbe, Sokoto	1999
4.	1.5	Goronyo, Sokoto	1999
5.	2.0	FGC Kwali, Abuja	1997
6.	2.0	Student Hostel, Udu	2003
7.	2.0	NIPSS, Jos	2003
8.	Lot	Nationwide	2003
9.	2.0	Prison Farm, Sokoto	2001

Table 5: Wind Energy

S/N	Capacity (kWp)	Location	Date
1.	5.0	Sayya, Sokoto	1990

Table 6: Biomass/Biogas Projects/Plants

S/N	Capacity (kWp)	Location	Date
1.	200 units	Danjawa, Sokoto	1990
2.	4 units	Kuje Prison, Abuja	1998
3.	20 m^3	NAFRI, Zaria	1998
4.	20 m^3	Zaria Prison	1998
5.	20 m^3	Mayflower School, Ekene, Ogun State	1998
6.	20 m^3	Ojokoro, Lagos	1999
7.	20 m^3	Maiduguri	2000
8.	20 m^3	Maiduguri, Cameroon, Chad, Niger Republic	2002
9.	20 m^3	Kiri-Kiri, Lagos	1993
10.	10 m^3	Achalla-Nru, Nsukka LGA, Anambra State	1999
11.	10 m^3	NCERD, UNN, Nsukka	2003
12.	10 m^3	Ugbo Nwankwo, Abakpa Nike	2003
13.	10 m^3	Oweri Prisons, Imo State	2005

Source: National Centre for Energy, Research and Development (2007)

Prospect of Alternative Energy in Nigeria

- Since Nigeria is endowed with renewable abundant energy resources, the renewable energy resources can allow energy mix into the national grid and will increase power generation and actually reduce carbon emission.
- With the development of wind power for agricultural production, this reduces human energy in activities such as winnowing in rice mill and irrigation of the farm land.
- The solar energy has been successfully used in the controlled drying of agricultural product, domestic cooking and pumping of water. There by improving economy of the nation.
- The small hydro can be used to fill the rural area in Nigeria and maintain a minimum flow all year round, which can be used to develop small hydro power for rural agriculture.
- The use of clean cooking stove will reduce the amount of wood that is use for cooking both in rural and urban area and preserve the natural reserve.

- Since renewable energy is now a global issue and can develop a nation economy, it there by turn other sector of energy, improve standard of living, create employment and revenue generation.

Impact of Alternative Energy in Nigeria Economy

Since Nigeria is endowed with alternative energy resources, the impacts are as follows;

- Alternative energy could mean the creation of many jobs and independence from foreign energy resources.
- Reduce crime rate, people usually have no time for idleness.
- When small amount of capital is invested, it yields good returns.
- To enhance agricultural productivity and promote agro processing.
- It provides fuel for vehicles, equipments and cooking stoves.
- It helps in revenue generation and increases to government through tax and reduces dependence on revenue allocation from fossil fuel.
- It has the capacity to increase our gross domestic product and will create new value change of business supply markets and production.

Challenges and Way Forward

- If the local communities do not accept the technologies, there will be no demand e.g. it may not make much sense to install solar cookers in the communities which forbid women to cook in the middle of the day.
- Massive deployment of renewable energy system in Nigeria has a great future if only the right political and legislative frame work can be put to place.
- Insecurity of installation is not only an African problem, globally the security of the installation is paramount in the decision as how and where to install the system ,so as not to suffer vandalism
- Activities of the government are instrument to the success or failure of the renewable energy. The rate of the program can only increase within the context of the government.
- Economic and financial challenges arises from lack of aces to capital, lack of means of support, lack of information by appropriate financial institution and lack of investment on the energy system.
- Lack of technical competence continues to be a major challenge towards the development of renewable energy system in Nigeria.

Way Forward

- An energy policy which emphasis the development of renewable energy resources and technologies should be immediately put to place.
- Renewable energy can provide important new solution to reduce pollution, diversify and secure energy supply and provide access to energy support and poverty eradication.
- We commit ourselves to cooperate in further development and promotion of resources energy technologies and Nigeria should strive to a well round energy mix (renewable and non renewable)
- Increase the use of renewable energy is an essential element to achieve sustainable development at national and global.

- We commit ourselves to working with others to achieve this goal, especially through partnership initiative which could contribute to expanding the use of renewable energy in Nigeria.

IV. CONCLUSSION

It has been shown that energy is necessary for the economic growth of a nation and thus essential for improving the standard of living of the nation. Therefore energy has to be made available by the nation and cheap for rapid and quality growth of the economy .The renewable energy resources become object of search, they are dependable and therefore possible alternatives if there technology are develop. One will now use this opportunities to call in government of the nation to give serious attention to the development of alternative energy so as to have sustainable energy.

RECOMMENDATION

- Nigeria needs an energy policy which stresses the development of renewable energy resources and technology, be course the current policy has not laid emphasis on renewable energy.
- It is recommended that a resources survey and assessment be carried out to determine the potential in the country.
- It is recommended that a testing and standard laboratory for renewable energy technology be established in Nigeria.
- The existing research and development centre and technology development institution should be adequately strengthened to support the shift towards increase renewable energy utilization.
- It is recommended that a renewable that a renewable energy fund/financing agency be established like that of India.
- It is recommended that demonstration project on various energy forms be established so that the performance and efficiency with which services are delivered can be sensitized.

REFRENCES

[1]. A. S. Sambo (2005). Renewable Energy for Rural Development: The Nigerian Perspective. Isesco Science and Technology Vision-volume 1(may 20050(12-22) Retrieved from on 4th February, 2012 from www.isesco.org

[2]. A.S Ayodele, (1998) improving and sustaining power (electricity) supply for social Economic Development in Nigeria.

[3]. A.S Sambo (2009).Challenges of Sustainable Energy in Nigeria. A.O Summon, 2011 *et al* .Can bio fuel improve the income of rural farmer in Nigeria.

[4]. Aliyu, U.O, and S.B, Eleagba.1990.Prospect for small hydropower development for rural application in Nigeria, Nigeria journal of Resources Energy.1:74-86.

[5]. Energy Commission of Nigeria and united Nation Development Program (ECN-UNDP).2005 Renewable Energy master plan.

[6]. E.N.C. Okafor and Joe-Uzuegbu (2010).challenges to development of renewable Energy for electric power sector in Nigeria. International Journal of Academic Research. Vol. 2. No. 2. March 2010.Retrieved on 4th February, 2010

[7]. Garba, B and Bashkir, A. M. (2002). Managing Energy Resources in Nigeria: Studies on Energy Consumption Pattern in Selected Rural Areas in Sokoto State. Nigerian Journal of Renewable Energy, Vol. 10 Nos. 1&2, pp. 97-107.

[8]. Hunt, V.D.1982, Solar Energy Dictionary in industry press Inc: New York, NY.

[9]. M.C gown, L.B and Bockris, J.O 1980.How to obtain abundant clean energy. Plenum press New York, Ny.p.107-113.
[10]. K.C. Jean (2011), The Climate change case for improve stove and Renewable fuel.
[11]. O. Ibidapo obe and o.o.e.Ajibola (2011).Towards a renewable energy Development for rural power sufficiency. International Conference on innovation in engineering and technology.
[12]. O.Magret Hyde, M.C Graw Hill, (1981), Energy from water.
[13]. Sorensen, H.A. energy Conversion system, Wily, USA, 1983, 485-491.
[14]. Union of Concerned Scientist,(2012),How geothermal energy works.
[15]. Z .Aaron, (1998), Green living by demand media.