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DEALING WITH ENERGY CHALLENGES BV NIGERIA THROUGH RENEWABLE ENERGY SYSTEMS

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Abstract

Even though Nigeria is rich in energy resources, it has not meaningfully taken advantage of these resources to meet adequate, affordable, sustainable and reliable supply of energy available to its citizens in order to meet the three elements of the sustainable development goals i.e economic, social and environment. No doubt, this has become a huge challenge. This paper therefore examines these available energy resources and elaborately shed more light on how Nigeria can harness the available renewable energy to effectively and efficiently deal with the energy challenges being faced by it.*

Keywords: Renewable, Challenges, Resources. And Energy.

Introduction

Background

Energy plays the most vital role in the economic growth, progress, and development, as well as poverty eradication and security of any nation. Uninterrupted energy supply is a vital issue for all countries today. Future economic growth crucially depends on the long-term availability of energy from sources that are affordable, accessible, and environmentally friendly. Security, climate change, and public health are closely interrelated with energy. Energy is an important factor in all the sectors of any country's economy. The standard of living of a given country can be directly related to the per capita energy consumption. The recent world's energy crisis is due to two reasons: the rapid population growth and the increase in the living standard of whole societies. The per capita energy consumption is a measure of the per capita income as well as a measure of the prosperity of a nation.

Energy supports the provision of basic needs such as cooked food, a comfortable living temperature, lighting, the use of appliances, piped water or sewerage, essential health care (refrigerated vaccines, emergency, and intensive care), educational aids, communication (radio, television, electronic mail, the World Wide Web), and transport. Energy also fuels productive activities including agriculture, commerce, manufacturing, industry, and mining. Conversely, a lack of access to energy contributes to poverty and deprivation and can contribute to the economic decline. Energy and poverty reduction are not only closely connected with each other, but also with the socioeconomic development, which involves productivity, income growth, education, and health.

The energy sector is a driver of economic and sustainable development. Its services are very important to the tripod stand of sustainable development viz social, economic and environment thus affecting all aspects of development including livelihoods, agricultural productivity health, population level access to water, gender issues and education (Oyedepo, 2012).

Consider table 1, country statistics of electricity generation and per capita consume, Nigeria has the lowest per capita energy consumption among the countries as shown.

Continent	Country	Population (million)	Generation Capacity (MW)	Per capita consumption (kw)
North America	USA	250	813,000	3.2
Eastern Europe	Ukraine	49	54,000	1.33
Central Europe	UK	57.5	76,000	1.10
Far East	South Korea	47	52,000	1.10
Middle East	Iraq	23.6	10,000	0.42
South America	Cuba	10.54	4,000	0.38
Africa	South Africa	44.3	45,000	1.02
Africa	Egypt	67.9	18,000	0.27
Africa	Nigeria	140	<4,000	0.03

Adapted from Okafor and Joe -Uzuegbu (2010)

Power shortage has put industries and commercial companies in a terrible situation where they only receive grid electricity for two to six hours per day depending on their location. Energy is up to 40% of operating expenses for an average Nigerian business, and an average commercial facility in Nigeria spend over five hundred thousand naira per month on diesel fuel alone to meet its power needs and remain in business (Ehidiamen, 2016).

Energy Resources Available In Nigeria

Renewable energy uses energy sources that are continually replenished by natural the sun, the wind, water, the earth's heat, and plants. Renewable energy technologies turn these fuels into usable forms of energy-most often electricity, but also heat, chemicals, or mechanical power. These are lots of renewable natural resources in Nigeria, which, when utilized, will reduce poverty and sustain development of the country.

In this paper, we will consider hydro energy, solar energy, biomass energy and wind energy.

Hydro Energy

Hydro power systems rely on the potential energy difference between the levels of water in reservoirs, dams or lakes and the discharge tail of the water. The energy in the flowing water turns the water turbine, while the rotating shaft of the turbine turns the rotor of the generator, thereby converting potential energy in the fall into kinetic energy to generate electrical power (Adeyemo, 2006; Oni, 2008).

Solar Energy

Solar energy, an energy obtained from the sun, is the world's most abundant and cheapest source of energy available from nature. It is available in two forms, namely solar photovoltaic and solar thermal. Solar photovoltaic is the conversion of solar radiation to electricity using solar cells as used in lightings and other purposes, while solar thermal is the direct application of solar energy to produce heat for various applications such as solar cookers, solar pulverizers, etc. (Ezugwu, 2015).

Biomass Energy

Biomass refers to any form of plant or animal tissue. Fuel sources of biomass include wood, organic waste, agricultural waste, animal waste and straw. Energy in biomass can be harnessed through thermochemical and biochemical processes. Thermochemical processes include gasification, liquid fuel production processes and pyrolysis, while biochemical processes are ethanol fermentation and biogas production (Adeyemo, 2006; Oni, 2008).

Wind Energy

Different studies have been carried out to access the speed characteristics and energy potentials in wind (Ezugwu, 2015). Wind is a natural phenomenon related to the movement of air masses caused primarily by the differential solar heating of the earth's surface. Seasonal variations in the energy received from the sun affect the strength and direction of the wind. Estimates of prospective energy from the wind is of the order of 11×10^{10} GJ (Adeyemo, 2006; Oni, 2008).

Harnessing Renewable Energy to Confront Energy Challenges in Nigeria

The energy commission of Nigeria (National energy policy, 1980), shown in table 2, the projected total energy demand between 2005 and 2030 in Nigeria, based on a Gross Domestic Product (GDP) of 10% would continue to increase, irrespective of the average growth rate. Also mentioned in that report is that energy demand in Nigeria would continue to overshoot its supply.

In 2005; the total energy demand based on a 10% GDP growth rate revealed that the household segment had the largest share of all the sectors. The sectorial energy demands in the 2030 plan period, however, showed the highest growth rates for the industrial, followed by the services, household, and transport sectors in that order (Table 6). The electricity demand (extracted from the total energy demand) shows an increasing trend from the base year 2005 to 2030 in the four adopted growth scenarios, respectively, as shown in Figure 4, indicating a high economic growth rate leading to a substantial increase in the electricity demand.

This is indeed a huge challenge that must be seriously tackled.

Table 2: Projected total energy demand in Nigeria

Items	2005	2010	2015	2020	2025	2030	Average growth rate (%)
Industry	8.08	12.59	26.03	39.47	92.34	145.21	16.2

Transport	11.70	13.48	16.59	19.70	26.53	33.36	4.7
Household	18.82	22.42	28.01	33.60	33.94	34.27	2.6
Services	6.43	8.38	12.14	15.89	26.95	38.00	8.7
Total	45.01	56.87	82.77	108.66	179.75	250.84	8.3
Adapted from ECN (National energy Policy, 1980)							

(Ojowu, 2004), described Nigeria as a paradox of unwarranted poverty and immense wealth in human and natural resources, endowed with vast resources. Nigeria, however, remains a poor country by any definition. Oni, 2008; and Adeyemo, 2006), remarked that this is because those resources have not been fully harnessed by Nigerian scientists and engineers, who are being looked at to harness those resources for the benefit of mankind.

Ways by which the Nigerian renewable energy can be harnessed to deal with energy challenges in Nigeria.

- One of the major threats being faced by non-conventional energy sources such as coal, gas, and oil is that they are non-renewable and are being used up very rapidly. They take millions of years to form, and with heightened global demand they may be exhausted much sooner than later (Ogunyiola, 2019), Nwachukwu (2008), reported that Nigeria's strategic oil reserve, put at 36.2 billion barrels, will sustain her for the next forty-three years (effective from 2008). The report also indicates that Nigeria has the lowest reserve life span among the members of the organization of petroleum exporting countries. The future of electrical power generation from fossil fuel, coal, gas, and oil is also threatened by escalating fuel prices and by adverse environmental consequences of large scale combustion of carbon-rich fuels (Ogunyiola, 2016). Hence, the need to deal with this challenge by utilizing the available renewable energy.
- One of the challenges in actualizing renewable energy projects in Nigeria is high cost of capital expenditure that limits the implementation of renewable energy projects. One of the strategies to tackle this is to get investors to commit to power-purchase agreement options for Nigerian off-takers that will enable a client to pay a monthly fee for energy. This will give room for the investors in energy projects to create a mechanism through which they can invest with the hope that the buyers of the services will pay monthly.
- It will be recalled that several initiatives have been launched by the Nigerian government to strengthen its renewable energy sector. These initiatives include the establishment of Renewable Energy Division (RED) within the Nigerian National Petroleum corporation (NNPC) in 2005, and privatization of thermal generation and distribution of power firms in 2013 (Ehidiemen, 2016). for Nigeria to be able to genuinely strengthen its renewable energy sector through these initiatives, and hence deal with its energy challenges through the renewable energy systems, it is important that Nigerian government should put in place the right infrastructure to sustain the initiatives.
- At the 21st session of the conference of parties held in Paris, France in 2015, known as COP 21 (COP 21), the world leaders renewed their commitment to reduce emission of

fossil fuels. This event was one of the programmes of the United Nations Framework Convention on Climate Change (UNFCCC).

The aim of the UNFCCC is to stabilize atmospheric concentration of Green House Gases (GHGs) to avoid dangerous anthropogenic interference with the climate system, and keeping global warming below 2⁰c (Ehidiamen, 2016; "COP 21", 2016).

In a bid to deal with this energy challenges confronting Nigeria, the Nigerian government owe it a duty to adopt the UNFCCC

Conclusion

The services provided by energy are very important to the three pillars of sustainable development economic, social and environmental. Nigeria does not only have the lowest per capita energy consumption among African countries, the gap between the energy demand and the available energy in Nigeria has led to the current widespread of power shortage and inefficiency.

There are lots of renewable natural resources such as solar energy, hydro energy, biomass energy and wind energy in Nigeria, which, when utilized, will reduce poverty and sustain development of the country. Energy demand in Nigeria would continue to overshoot its supply. It is therefore unarguable that Nigeria is being confronted with energy challenges. These challenges are surmountable, and should therefore be quickly and thoroughly deal with.

Recommendations

The urgent need to deal with the energy challenges facing or confronting the Nigerian state cannot be over-emphasized. Therefore the following are recommended;

1. The existing research and development centres in the country should be adequately strengthened to support the shift towards an increased use of renewable energy.
2. Feasible renewable funding agency should be established.
3. Comprehensive policies on energy efficiency should be developed and integrated into the current energy policies. This will guide Nigerians towards on efficient use of the country's energy resources.
4. A comprehensive survey of energy resource and their assessment to determine the total renewable energy potential in the country should be carried out.
5. A robust and appropriate driver for the implementation of energy efficiency policies should be developed.
6. Creation of awareness on energy efficiency as it relates to renewable energy should be carried out.

7. Clean energy facilities should be embraced in the different sectors of the Nigerian economy.
8. Take advantage of global partnerships, such as the residential energy efficiency project initiative of UK, to assist the country in a create integration of renewable energy systems.
9. Develop and imbibe energy efficiency technologies

References

Adeyemo, S. B. (2006); Renewable energy resources in Nigeria; Pathway to sustainable environment and self-reliance" in proceedings of the Nigerian society of engineers 39th National engineering conference and Annual General Meeting, Abeokuta, Nigeria 4-8 Dec. 2006. pp. 153 - 166.

Amey, W.G and Hamburger, F. (1999). Method of evaluating the surface and volume resistance characteristics of solid dielectric materials American society testing and materials. pp 1071 - 1091

Ayanrouh, F. (2009). The challenges of the Nigerian electricity power sector (1) available from; <http://www.vanguardngr.com/2013/02/the-challenges-of-the-Nigerian-electric-power-sector-reform>

COP 21 (2016). Available from <http://www.cop21.gov.fr/en/what-was-cop21>.

Chendo, M.A. C. (2001). Non-conventional Energy source; development, diffusion and impact on human development index in Nigeria. Nigerian Journal of Renewable energy Vol. 9. No. 2 pp.. 91-102.

Ehidianmen, J. (2016) "will Nigeria's renewable energy sector attract mere oil investors" Available from; <http://ventureafrica.com/features/will-nigeria-renewable-energy-sector-attractmore-oil-investors>.

Ezugwu, C.N. (2015). Renewable energy resources in Nigeria; sources problems and prospects. Journal of clean energy technologies, vol. 3, No. 1 pp. 68-71.

Lisowski, M and Kaoprzy R,(2006). Changes proposed for the IEC 60093 standard concerning measurements of the volume and surface resistivity's of electrical insulating materials IEEE; Trans on Dielectrics and electrical insulation vol. 3 N0.1, pp. 139-145

Lisanski, M. and Skopec, A. (2009). Effective area of thin guarded electrode in determining of permittivity and volume resistivity. IEEE Trans on dielectric and electrical insulation Vol. 16. N0. 1 pg 24-31.

National Energy Policy (1980); energy commission of Nigeria, Federal Republic of Nigeria.

Nwachukwu, C. (2008). Nigeria's oil reserve to last 43 years' available from ;<http://www.thenigerianbusiness.com/energy98.html>.

Ogunyiola, S. (2016) "Energy crises in Nigeria" Available from; <http://www.perpetualminds.com/2011/10/03/energy-crisis-in-Nigeria>.

Okafor, E. C. N. and Joe-Uzuegbu, C. K. A. (2010) challenges to development of renewable energy for electricity power sector in Nigeria. *International Journal of Academic Research*. vol. 2 no. 2 pp. 211-216

Ojowu, O. (2004); Resolving development dilemma; from vision 2010 to needs" in paper presented at the 16th ITF National Training conference Port-Harcourt, 22-24 Sept. 2004. Pp. 20.

Oni, T.O. (2008). Utilizing renewable energy resources for sustainable energy development in Nigeria in proceedings of 1st National engineering conference on sustainable energy development in Nigeria; challenges and prospects, Ado-Ekiti, Nigeria, 7-9 Oct. 2008. pp. 104-110.

Oyedepo, S. O. 2012) Energy and sustainable development in Nigeria. The way forward "energy, sustainability and society Vol. 2, No. 15 pp. 1-17.

Oyedepo, S. O. (2012) Energy efficiency and conservation measures; tools for sustainable energy development in Nigeria. *International Journal of energy engineering*, Vol. 2, No. 3. pp. 86-98.