

Research Paper

Expediency of renewable energy for environmental sustainability in Nigeria

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Abstract: The global environment is in perennial need of energy without which life cannot be sustained. Noted is the fact that those with energy possess the power and the control of productivity. This persistent, upsurge need of energy has made undue demand on man's environment, overexploitation of oil rich zones, deforestation of mass of forest land with attendant degradation, denudation and pollution of the environment that hampers natural environmental productivity and environmental sustainability. The challenge of Green House Gases (GHGs), smog effects, ozone layer depletion, climate and global warming concerns change coupled with high oil prices increases governmental supports and driving increasing renewable energy legislation, incentives and commercialization. Therefore, a urgent shift in paradigm from conventional energy generation which are non-renewable to naturally renewable energy generation becomes expedient. The array of non-fossil fuels like bioenergy

(biogas, biofuel), solar energy (photovoltaic), nuclear (atomic energy water power), power, wind power. geothermal and hydrogen generated energy which are renewable need exploration to environmental degeneration, downplay increases job creation, enhances economic buoyancy which invariably enables environmental sustainability.

Keywords: Environmental sustainability, Non-renewable energy, Renewable energy

INTRODUCTION

The environment of man is the man surroundings. All the physio-chemical, biological and the socio-economic elements that surround man is man's environment. The term environment is collectively used to describe all the living and non-living things that make up human's surrounding. Amidst other species, it is human being alone that takes deliberate action to remake the world which is environment according to his/her interests and desires. Noted is the fact that

man is an integral part of the environment and the doom(s) man hulled on the environment is directly or indirectly on man. Over the years, man's environment has been so adversely impacted leading to series of unsustainable effects such as loss of biodiversity, changes in the composition of the atmosphere, depletion of the ozone layer, depletion in ocean fisheries, exploitation of energy sources, increased problem of waste disposal, flooding/soil erosion, etc. There has been growing fear that if the terrain of human activities in the environment is not abated speedily, our future generations may suffer a great deal, hence the need for environmental sustainability (Olagunju and Oduwaiye, 2011; Olaniran and Adesina, 2016).

Environmental sustainability like sustainable development is that ability of the environment to meet the present socioeconomic needs without compromising the ability of the future generation to meet their own needs. It is the interplay of three pillars of equitable society, bearable environment and viable economy which enable the present optimum utilization of resources both human and materials without jeopardizing the future of the environment. Naturally, the environment has inbuilt mechanism to regenerate its lost resources but amidst other species, it is human being alone that takes deliberate action to remake the world of environment according to his/her interests and desires which are influence by greed socio-economic activities. Most of the actions of human put unprecedented pressure and impact on the quality of environment. This impact led to

problems environmental of pollution, depletion flooding, of environmental deforestation, resources. solid waste problem. Human's management environment is under serious threat (Olagunju and Olasehinde, 2012). This calls for immediate actions in enhancing environmental sustainability.

Environmental sustainability is the potential environment long-term of the for maintenance of well-being. For an environment to be well sustained, it should be able to meet the socio-economic needs of the present without compromising the ability of the future generation to meet their own needs. Environment is one of the three pillars of sustainability. Other pillars are social and economic. For such environment to be sustained, it must be bearable, the society must be equitable and the economic should be viable. However, Nigeria environment although from the physiochemical composition is bearable, the rainfall and sunshine are ambient, feasible for the survival of plants and animals but the social issues of kidnapping, insurgency, maiming and killing most rampart in the northern and southern part of the country is appalling, this mar the egalitarianism of the Nigeria society. Nigeria economy ought to be one of the most rapidly growing in the world being blessed by nature that is positive to the growth of varieties of plants and breeds of animals, equally, the deposit of mineral elements in the land call Nigeria is immense that a forthright administration of all these resources should lead the nation on the verge of economic buoyancy of the world.

But, what is Nigeria situation? The economic development remains dwindling, crippled by bribery, corruption, kidnapping, vandalization, hostility, acrimony, nepotism, ethnicity and animosity. Yet, the evil of joblessness, unemployment, underemployment still plague the nation as majority of her ministries are sabotaged by greedy minsters that siphoned and diverted the allocated resources for the national development to personal use. Nigeria environment needs better administration with honesty and transparency. It requires social justice and disabuse of national resources by dispassionate leaders who are patriotic and selfless for the attainment of bearable environment, equitable society and viable economy in the country.

Another plague to environmental sustainability in Nigeria is the overdependence on non-renewable energy which once exhausted; it is never return by natural means. Such as crude oil which is the main source of revenue for the nation, its overexploitation in the Niger-Delta zone, incessant oil drill, gas flaring and the like in the country has rendered most of their arable land useless, spoiled to the fishery industry and contaminated the atmosphere. This crude oil adventure, the oil boom of the 60's also contributed significantly to indolence, lethargic and uncreativeness of Nigerian government. It equally breeds bribery and corruption in the over-preponderance of uncommitted workers in the agrarian economy. Crude oil exploitation in the Niger-Delta of the nation equally leads to secession problem with bloody civil war. What the nation needs is exploration of renewable energy.

The release of gases in the exploitation of crude oil causes smog effect on the atmosphere, these Green House Gases (GHGs) like Carbondioxide (CO₂), methane (CH_4) , Nitrous oxide (N_2O) , the Hydro-FluoroCarbons (HFCs), PerflouroCarbon (PFCs) and SulfurhexaFlouride (SF₆) trap heat and light from the sun in the earth's atmosphere which increases the environmental temperature that hurts people, animals and plants. The trapped gases equally punctured the ozone layer depleting the umbrella shielding the earth from intense sunlight causing over-heating of the environment in global warming. Global warming becomes intense with deforestation of the forest lands opening the earth surface to climate change. The climate forming mechanisms with deforested land area, yield disequilibrium temperature causing to significant and lasting change in weather patterns over large area of land. All these changes in world phenomena call for environmental sustainability. This is the era of environment sustainability, among the 17 goals of Sustainable Development Goals (SDGs), the use of renewable energy sources like biogas, wind power, hydropower, solar energy, geothermal energy etc. help to attain Goal 7: Ensure access to affordable, reliable, sustainable, and modern energy for all; Goal 13: Take urgent action to combat climate change and its impacts and Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests,

combat desertification, and halt and reverse land degradation and halt biodiversity loss,

Renewable Energy and its Expediency

Renewable energy is energy that is collected from renewable resources which are naturally replenished on a human time scale such as sunlight, wind, rain, tides, waves and geothermal heat, Renewable energy often provides energy in four important areas: electricity generation, air and water heating or cooling, transportation and rural (off-grid) energy service. Renewable energy resources exist over wide geographical areas, in contrast to the other non-renewable energy sources which are concentrated in a limited number of countries. Rapid deployment of renewable energy and energy efficiency resulting in significant energy security, climate change mitigation and economic benefits. The results of a recent review of the literature concluded that as Green House Gas (GHG) emitters begin to be held liable for damages resulting from GHG emissions resulting in global warming and climate change, a high value for liability would provide mitigation powerful incentives for deployment of renewable energy technologies (Hohmeyer and Bohm, 2015).

While many renewable energy projects are large-scale, renewable technologies are also suited to rural, sub-urban, remote areas and developing countries, where energy is often crucial in human development. Former United Nations Secretary-General Ban Kimoon has said that renewable energy has the ability to lift the poorest nations to new levels of prosperity. As most of renewables provide electricity, renewable energy

deployment is often applied in conjunction with further electrification, which has several benefits: Electricity can be converted to heat (where necessary generating higher temperatures than fossil fuels), also to mechanical energy with high efficiency and is clean at the point of consumption (Armaroli and Balzani, 2011; 2016). In electrification that addition to with renewable energy is much more efficient and therefore, leads to a significant reduction in primary energy requirements; because most renewable don't have a steam cycle with high losses (fossil power plants usually have losses of 40 to 65%).

Renewable energy systems are rapidly becoming more efficient and cheaper. Their share of total energy consumption is increasing. Growth in consumption of coal and oil could end by 2020 due to increased uptake of renewable and natural gas. From the end of 2004, worldwide renewable energy capacity grew at rates of 10-60% annually for many technologies. In 2014 global wind power capacity expanded 16% to 369,553 MW (GWEC Global Wind Statistics, 2014). Yearly wind energy production is also growing rapidly and has reached around 4% of worldwide electricity usage, 11.4% in the EU, and it is widely used in Asia, and the United States In 2015, worldwide installed photovoltaic capacity increased to 227 Gigawatts (GW), sufficient to supply 1 percent of global electricity solar thermal energy stations demands operate in the USA and Spain, and as of 2016, the largest of these is the 392 MW Ivanpah Solar Electric Generating System in California. The world's largest geothermal

power installation is The Geysers in California, with a rated capacity of 750 MW. Brazil has one of the largest renewable energy programs in the world, involving production of ethanol fuel from sugar cane, and ethanol now provides 18% of the country's automotive fuel. Ethanol fuel is also widely available in the USA. There is overall improvement in the shift to renewable energy capacity and numbers of Countries with policy targets for renewable energy use over the last decade as reflected in Table 1. From Table 1, it was revealed that there is increasing trend in the investment in renewable energy capacity

across the countries with policy targets, noted is the rapid gallop in wind power capacity that jumped from 121 GWe in 2008 to 487 GWe in 2016 (400 %); that of solar PV capacity was also tremendous, from 16 GWe to 303 GWe (1893.75 %) and the countries with policy targets for renewable energy use grew from 79 to 176 countries (222.78%). This is a pointer that hope is rising for efficient energy provision and utilization globally, also, our environment tends to more sustainable position. Let take a cursory look at some of the renewable energy sources and forms.

Selected renewable energy	2008	2009	2010	2011	2012	2013	2014	2015	2016
global indicators									
Investment in new renewable	182	178	237	279	256	232	270	285	241
capacity (annual) (10 ⁹ USD)									
Renewables power capacity	1,140	1,230	1,320	1,360	1,470	1,578	1,712	1,849	2,017
(existing) (GWe)									
Hydropower capacity	885	915	945	970	990	1,018	1,055	1,064	1,096
(existing) (GWe)									
Wind power capacity	121	159	198	238	283	319	370	433	487
(existing) (GWe)									
Solar PV capacity (grid-	16	23	40	70	100	138	177	227	303
connected) (GWe)									
Solar hot water capacity	130	160	185	232	255	373	406	435	456
(existing) (GWth)									
Ethanol production (annual)	67	76	86	86	83	87	94	98	98.6
(10 ⁹ litres)									
Biodiesel production (annual)	12	17.8	18.5	21.4	22.5	26	29.7	30	30.8
(10 ⁹ litres)									
Countries with policy targets	79	89	98	118	138	144	164	173	176
for									
renewable energy use									

 Table 1: Renewable Energy Investment across Countries with policy targets for renewable energy use

Source: The Renewable Energy Policy Network for the 21st Century–Global Status Report (REN21, 2012, 2013, 2014, 2017)

Hydroelectricity

Only a quarter of the worlds estimated hydroelectric potential of 14,000 TWh/year has been developed, the regional potentials for the growth of hydropower around the world are, 71% Europe, 75% North America, 79% South America, 95% Africa, 95% Middle East, 82% Asia Pacific. However, the political realities of new reservoirs in western countries, economic limitations in the third world and the lack of a transmission system in undeveloped areas, result in the possibility of developing 25% of the remaining potential before 2050 (Wikipedia, 2017).

Wind power development

Wind power is widely used in Europe, China, and the United States. From 2004 to 2014, worldwide installed capacity of wind power has been growing from 47 GW to 369 GW-a more than sevenfold increase within 10 years with 2014 breaking a new record in global installations (51 GW). As of the end of 2014, China, the United States and Germany combined accounted for half of total global capacity (GWEC Global Wind Statistics, 2014). Several other countries have achieved relatively high levels of wind power penetration, such as 21% of stationary electricity production in Denmark, 18% in Portugal, 16% in Spain, and 14% in Ireland in 2010 and have since continued to expand their installed capacity (World Wind Energy Report, 2010). More than 80 countries around the world are using wind power on a commercial basis.

Solar thermal

The United States conducted much early research in photovoltaic (PV) and concentrated solar power. Photovoltaic uses solar cells assembled into solar panels to convert sunlight into electricity. At the end of 2014, worldwide PV capacity reached at least 177,000 megawatts. Photovoltaic grew fastest in China, followed by Japan and the

United States, while Germany remains the world's largest overall producer of photovoltaic power, contributing about 7.0 percent to the overall electricity generation. Italy meets 7.9 percent of its electricity demands with photovoltaic power-the highest share worldwide (Gile, 2014). For 2015, global cumulative capacity is forecasted to increase by more than 50 Gigawatts (GW). By 2018, worldwide capacity is projected to reach as much as 430 gigawatts. This corresponds to a tripling within five years. Solar power is forecasted to become the world's largest source of electricity by 2050, with solar photovoltaics and concentrated solar power contributing 16% and 11%, respectively. This requires an increase of installed PV capacity to 4,600 GW, of which more than half is expected to be deployed in China and India (Wikipedia, 2017).

Biofuel development

Biomass remains of plants and animals fermented to produce biofuel. Biofuels provided 3% of the world's transport fuel in 2010 (REN21, 2011) Mandates for blending biofuels exist in 31 countries at the national level and in 29 states/provinces. According to the International Energy Agency, biofuels have the potential to meet more than a quarter of world demand for transportation fuels by 2050 (Wikipedia, 2017).

Geothermal development

Geothermal power is cost effective, reliable, sustainable, and environmentally friendly (William, 2010) but has historically been limited to areas near tectonic plate boundaries. Recent technological advances have expanded the range and size of viable resources, especially for applications such as home heating, opening a potential for widespread exploitation. In 2010, the United States led the world in geothermal electricity production with 3,086 MW of installed capacity from 77 power plants (Geothermal Energy Association, 2010)

Economic Importance of Renewable Energy

The use of renewable energy, biofuel, hydro energy, energy, solar wind power, geothermal energy and the likes enhances the attainment of environmental sustainability toward the achievement of the United Nations Sustainable Development Goals (SDGs) like it discourages the bad attitude to natural resources such as deforestation in coal production, overexploitation of crude oil, oil spillage, environmental degradation and environmental pollution. This invariable helps to mitigate GHGs emission, global warming and climate change. It equally helps in biodiversity conservation and prevention of loss of both plants and animal species.

Noted is the creation of jobs for the unemployed youths through the exploration of renewable energy sources. The building of panels of cells for solar power, the windmill and its power station, the hydro power station, building of geothermal plants all would provide job opportunities for vast majority of jobless individuals. According to Charalampos (2016), dozens are the professions directly or indirectly associated with renewable generation. energy Technicians are the action men of the RE world: they work with their hands and with tools and machinery, special equipment and vehicles. They ensure that RE products are manufactured to high standards, plants are assembled according to the drawings, and RE devices are installed properly in buildings, or they may work in the day-today operation of RE facilities. In this category, electricians, HVAC technicians, plumbers, drilling technicians, construction specialists. manufacturing processes operators, wind farm technicians, PV

modules installers, logistics operators, automation & control technicians, chemical laboratory assistants, etc. are included, just to name a few. As jobs are created, most especially, poverty in developing nations is curtailed and the countries experience economic buoyancy.

Conclusion: If energy is power and power influences productivity, thus, improved energy sources that are continuously renewable heightened signals power generation and continuous increased productivity. Therefore, Nigeria energy industry stakeholders should gulp in efforts towards increasing the exploration of these renewable energy sources as it has the tendency to ameliorate incessant vandalisation, kidnapping, and secession imbroglio in the country; increase jobs availability, curtail poverty level, enhance national economic buoyancy and stimulate the attainment of SDGs in the country.

Recommendations: From the global experiences on impacts of renewable energy on the environment, the following are recommended:

- 1. Government and all energy industry stakeholders should embark on mass renewable energy generation and distribution across the senatorial districts of the country for the increment in awareness and mass job creations across the country;
- 2. Government to subsidise the cost of procuring renewable energy by the consumer to encourage its acceptability and desensitize the populace on mass non-renewable energy production and consumption;

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