

ENVIRONMENTAL ISSUES OF THE NIGERIA CONTENT DEVELOPMENT: THE NEED FOR PARADIGM SHIFT TO RENEWABLE ENERGY USE.

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ABSTRACT

The global outcry today of global warming and climatic change associated with the exploration and production of fossil energy has necessitated the study of reviewing the need to shift from the use of fossil fuel to using renewable energy. The methodology of study includes detail literature reviews of present practice and the environmental consequences in a developing economy like Nigeria. The study details renewable energy types, the motivation for adoption of renewable energy, the merits and accruable benefits of paradigm shift. Amongst the highlighted benefits are reduced global warming, diversification of nation's resources and economic growth; divergent academic researches; improved employment in other sectors outside the Oil and Gas, more environmentally friendly energy use, better livable environment and energy security in the near foreseeable future. The paper recommended stiff laws on environmental protection and fines for polluting practices as a panacea to achieving the needed paradigm shift.

Key words: *diversification, energy, environment, fossil, global warming and renewable.*

1. INTRODUCTION

Energy is indispensable to life and without it billions of people would go hungry, cold and eventually die (Riddell et al, 1999). Globally, over one billion people lack access to electricity. (World development indicators, 2014) This has made energy sustainability a great issue both in the developed and developing world in the 21st century. To supply hydrocarbon energy, the Oil and Gas companies have engaged in aggressive drive for exploration and production. The subsequent continuous flaring of gases from Oil and Gas facilities has caused serious environmental damage such as air, water, and land pollution; and health related challenges. The resultant imbalances from massive hydrocarbon usage are captured as global warming, climatic changes, tsunamis', flood, erosion, acid rain and drought all over the world today.

The environmental aspects from Oil and Gas industries which are of serious concerns including emission to air, discharges to water, contamination on Land, waste generation (especially hazardous waste) and discharges in the form of noise, particulate dust, heat and vibrations. Today, Nigeria is marked among the countries that are heavily polluting the environment. In fact, the rate of oil spill incidents have escalated to a dangerous and unacceptable level of about 80% between 1976-2008 in the oil producing area of Niger delta

region (Egwu, 2012). It is even increasing further today with militancy and pipeline vandalization.

The union of concerned Scientists whose primary study is to ensure safer and healthier environment are encouraging the use of renewable energy as an alternative before the earth's pollution is stressed above limit. They defined 'Renewable Energy' as energy that meet today's demand of energy without putting them in danger of getting expired or depleted and is available for reuse; without necessarily causing harm to the natural environment. Such energy includes ocean energy, geothermal energy, wind energy, solar energy, hydro power energy and bio energy. The need to direct research and development to eco-friendly energy is born out of concern and alarm rose by scientists and the public that the environment is heavily polluted by energy generated from Oil and Gas industry. Since humanity and the ecosystem cannot exist in an unhealthy environment, impacts of industrial activities on the environment have become an issue of major discussion in International and National conventions. Recent scientific report indicated that above 82% of issues raise for deliberation in international assemblies are environmentally related. Since the earth is limited in size and shape, the industrial man cannot continue to ignore the consequences of his action as though the earth is finite. (Joel and Olajide, 2011). Engineers, Scientists, investors and the concerned public of the 21st century

need to weigh the benefits of Oil and Gas production against its impacts and consequences. Therefore, investments into renewable energy technologies are major priority to governments and industry players (NTWG, 2009).

2. AIM/ OBJECTIVES OF THE RESEARCH

The aim of this paper is to encourage Nigerian scientists of the 21st century to refocus research on renewable energy which will readily reduce the damaging effects on hydrocarbon energy use on the environment and human race at large. The specific objectives of this study are to:

- i. Review the current global practice in the production and usage of Oil and Gas energy
- ii. Evaluate the challenges and implications of over dependence on hydrocarbon based Oil and Gas energy
- iii. Establish efforts towards adapting renewable energy use in the 21st century
- iv. Establish the roles of renewable energy as alternative energy to oil and Gas energy through established scientific findings.
- v. Evaluate environmental and social benefits of energy shift to renewable energy
- vi. Make recommendations and way forward.

3. DEFINITION AND TYPES OF RENEWABLE ENERGY

Renewable energy is energy created or generated from sources other than the conventional sources like fossil fuel and nuclear reactors. It is non-conventional energy. Renewable energy can be continually replenished by natural sources (Sulphrey, 2013).

These forms of energy include Solar, wind, biofuels, hydro, geothermal, wave and tidal etc.

- i. **Solar:** It is directly derived from sun in the form of radiant energy. It is abundant, the fastest growing energy source and very much available for use in the world today. Scientist in the 21st century is known to convert sun energy into electricity by thermo-electric devices (converters), solar chimneys and solar ponds.
- ii. **Wind energy:** Wind energy is generated in the form of electricity by converting the rotation of turbine blades into electrical current by means of electrical generators. Wind energy is plentiful, renewable, widely distributed and reduces GHGS.
- iii. **Biofuels:** these are fuel sources derived from recently died plants and animals. These could produce methane from animal excrement and

ethanol from plants materials. Also biodiesel could be produced from *Jatropha* plants (*Jatropha curucas*).

- iv. **Hydro energy:** Hydro energy is produced from the fast flowing river or an ocean which is capable of turning turbines to generate electricity. This is generally cheap than other sources of energy generation though dam construction may result in environmental problems.
- v. **Geothermal Energy:** Geothermal power harnesses natural flow heat from the interior of the earth, derived from natural decay of radioactive element in the earth's crust and mantle. 1st discovered in Italy, 1904. Now used in U.S.A, Japan, New Zealand, Mexico and India etc.
- vi. **Wave and tidal:** The technology of being develop to harness energy from Sea or Ocean.
- vii. **Hydrogen and fuel cells:** This requires electro-chemical reaction between hydrogen and oxygen gases I hydrogen and fuel cells. Hydrogen is emerging as an alternative to fossil fuels. Hydrogen can be produced from electrolysis of water using solar energy, photo-electrochemical process, thermo-chemical process; direct thermal decomposition or biochemically from water. (Sulphrey, 2013)

4. REVIEW OF CURRENT PRACTICE IN OIL AND GAS PRODUCTION AND USAGE IN NIGERIA

In 2007, Nigeria was known to be among the first 10th nations in the world with proven Oil and natural gas reserves with 36.5 billion barrels and 180 trillion cubic feet respectively (NTWG, 2009). There was a near total dependence of Oil and Gas in Nigeria as her revenue source which resulted in intense exploration and exploitation of Oil and Gas in the last six decades. The oil booms of the 1970s and 21st century in Nigeria have not actually helped matters as government intensified oil production and flaring of Gases. The Oil and Gas industry today are major polluters of the Nigerian environment. It was estimated that wasted energy resources via Gas flaring in Nigeria was about 45% of the energy requirements of France, the world fourth largest economy (Ashton, et al 1999; Diugwu et al, 2013). The Department of Petroleum Resources publication indicated that over 3000 oil spills incidence have occurred in Niger Delta. This figure has astronomically increased with recent pipeline vandalization in the region. Some of the incidence which occurred in histories of Oil exploration and production in Nigeria include several Oil pipeline incidents such as

the Jesse pipeline explosion incident of 2001; Ejigbo pipeline incident in 2005 (where 350 persons were killed) and the several recent pipelines blow out by the aggrieved Niger Delta militants. (Ugbebor, 2010). Therefore, researches, technology and papers today on renewable energy are timely to salvage the embarrassing escalation of harm to the environment.

5. CHALLENGES AND IMPLICATIONS OF OVER DEPENDENCE ON OIL AND GAS ENERGY

It was reported that between 9 million to 13 million barrels of Oil have been spilled in the Niger Delta since drilling began in 1958. (Kadafa, 2012). Cleanups have been halfhearted, and compensation has been paltry. It is worthy of note that about 2,000 oil-polluted sites still need cleaning up. (Ugbebor, 2013). The implications of over dependence on fossil energy are serious environmental abuse and social problems in Nigeria such as public outcry from host communities due to destruction of rivers, lakes, wetland, farmland and sources of livelihood; global climatic changes, global warming, flooding and erosion, food insecurity due to drought, acid rain, Stratospheric Ozone layer depletion; increased poverty, unemployment, health related problems (breathing problems, neurological damage, increased heart attack and cancer) with reduced life expectancy, risk of natural disaster; destruction of flora, fauna and wildlife in the Niger Delta region, militancy and wars. These are incalculable losses (Ajienka et al, 2006). One of the major environmental problems in the Niger Delta Region of Nigeria since the inception of oil exploration, exploitation, processing and transportation by the multinational Oil Companies has been that of oil spillage. This area in particular has been greatly impacted by Oil spillage. The NNPC in its annual report, places the quantity of oil jettisoned into the Niger Delta environment yearly at two thousand, three hundred (2,300) cubic meters with an average of three hundred (300) individual spills annually (Medugu, 2012).

The impacts may keep increasing and be a night mare if nothing is done by intellectuals, the academia, professionals, and technocrats. While government smiles home with petrodollars, the fragile environmental components are destroyed. The some developed nations have made some level of progress and the developing countries must intensify efforts also to reduce the level of exposure resulting from unregulated industrial pollution. Though there may be some challenges; these challenges can be erased by leveraging on the gradual

paradigm shift towards production of renewable energy as alternative energy source

The Environmental abuse in Nigeria could not be easily checked due to:

- i. Lack of effective National contingency plan. Apart from establishing Ministries and lead agencies like Federal Ministry of Environment (FMEnv), Department of Petroleum Resources (DPR), Nigerian Environmental Standards and Regulations Enforcement Agency (NESREA); and National Oil Spill Detection and Response Agency (NOSDRA); realistic assessment tools and adequate strategy for protection and cleaning of polluted areas are not put in place and made public.
- ii. Lack of stiff enforcement of existing legislation
- iii. Government as a major player in Oil and Gas business and regulator.
- iv. Poor compensation of host communities.
- v. Poor compensation of host communities and victims of pollution. Hundreds of thousands of people are affected (Amnesty Int. Report, 2009).
- vi. Poor surveillance of facilities
- vii. Poor involvement of professional bodies as advisory organizations to government and the operating Companies.
- viii. Massive unemployment and Militancy.

6. EFFORTS OF COUNTRIES TOWARDS ADAPTING RENEWABLE ENERGY IN THE 21ST CENTURY

Some Countries including Nigeria have made positive efforts towards gradually shifting ground from the over dependence on fossil to renewable energy. Prasad and Kochher (2009) in their report stated that one of the measures to mitigate the climate change is to promote hydro and renewable energy. The Nigeria efforts can be seen in the Map published by NNPC in 2009 as shown in Figure one. The Nigeria soil is so divergent that it has the potential to commercially produce fuel crop in the various regions of the country. In the Northern part of Nigeria, sugarcane, rice, wheat and millet are grown in commercial quantity while the Southern part has the potential to grow palm oil, cassava, and sugarcane. (See the Map on fig one as adopted from NNPC feasibility study, 2009) These crops need to be cultivated in commercial quantity to serve as sources of bio-energy production in Nigeria.

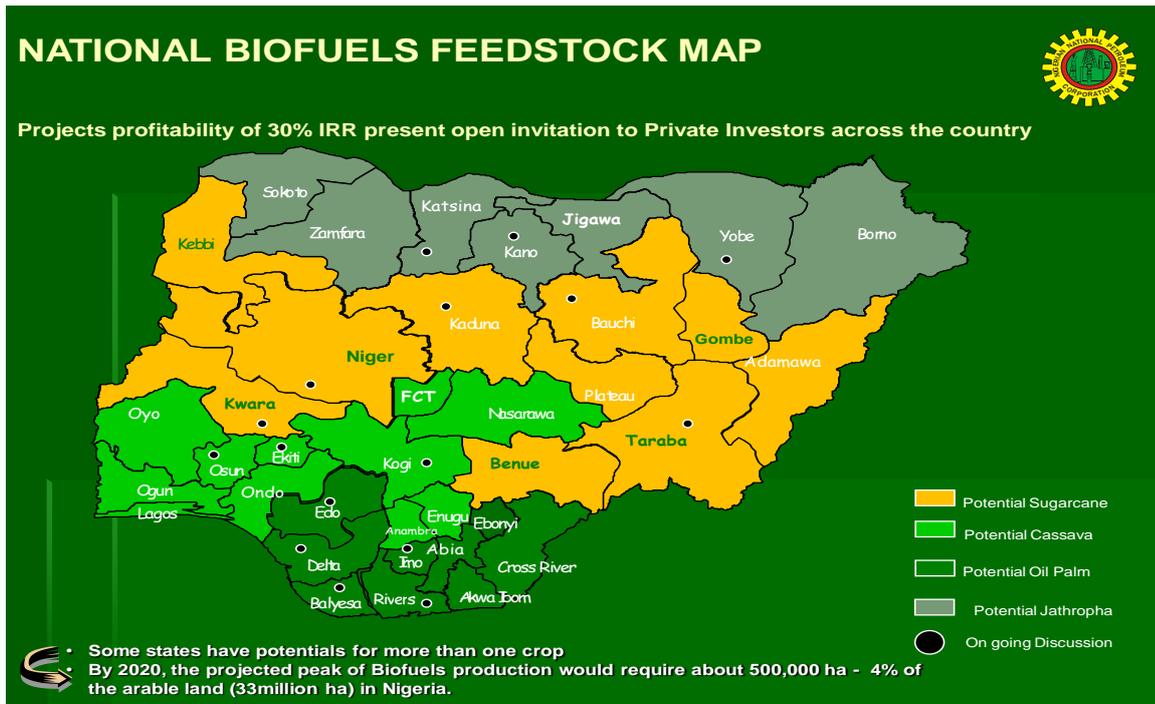


Figure 1: Map of Nigeria indicating region with potential to produce fuel crops
 Source: (NNPC, 2009, Siraju, 2012).

Several ad hoc initiatives are currently being undertaken by Energy commission of Nigeria (ECN) and NNPC on renewable energy development though quite slowly. ECN has invested on technology-driven pilot projects on solar energy, wind power demonstration projects in Sokoto State and a small hydro plant in Jos (Report of vision 2020 National Technical Working Group on energy sector, July, 2009). Several State governments in Nigeria recently are making efforts to embark on solar energy projects for homes, street lights, school, water supply, and community uses.

Some countries like USA, Argentina, Brazil, Malaysia, India, and Germany etc. are among countries in the world that have developed master plan for using and producing renewable energy. Many more countries are encouraging research and development into the sustainable energy use on annually basis.

7. PROBLEMS MILITATING AGAINST ACCEPTANCE OF RENEWABLE ENERGY IN NIGERIA

Initial challenges and non technical barriers identified to slow down the production of alternative energy are:

- i. Massive Petroleum reserve in the Delta Niger region of Nigeria
- ii. Government’s near total dependence on Oil revenues as major source of income.

- iii. No real interest
- iv. Lack of proper legislation
- v. Poor organizational farming of fuel energy crops
- vi. Insensitivity to environmental implication of Petroleum activities
- vii. Poor values for human lives.
- viii. Weak environment laws and enforcement.

8. MOTIVATION FOR ADOPTION RENEWABLE ENERGY IN NIGERIA

“Environmental conservation have stimulated the development and utilization of biomass as vital source of renewable energy” (Lim et al, 2012) couple with increasing energy demand in Nigeria. Nigeria is known to be among major global countries that lack access to sufficient energy (electricity energy in particular). Selected countries for study include India, 269 million, Nigeria 75million, Ethiopia 68million, Bangladesh 63million, and others 555million people. (www.worldbank.org). (Solar power and other renewable energy will reduce the problem. Dr. Maikanti Baru, the new General Managing Director, NNPC in a paper titled Recession: Nigeria Oil and Gas reserves running out; when the Nigerian Association of Petroleum Explorationists (NAPE) hosted him revealed that the national oil demand forecast indicates a rapid growth of 15 billion standard cubic feet per day (bscfd) by 2020. This shows that current reserves level can only sustain production for 35 years except more oil and gas

reserves are found. He disclosed further that Nigeria drive for industrialization risks being truncated except something is done about it. The Minister of Petroleum Dr Ibe Kachukwu also in July, 2017, in a media interview cautioned that in the next eight years, some of the developed countries will be using electrically driven automobiles, reducing their hydrocarbon energy requirement drastically, in line with UN Global warming reduction agenda.

The time has come when it is desirable to look for alternative energy resources to complement fossil energy and mitigate the increasing environmental problems and eliminate possible crisis of fossil fuel production. The combined impact of fossil fuel scarcity and the current global oil price crisis make renewable energy investment increasingly attractive. Research findings have demonstrated that we can significantly supplement conventional Oil and Gas supplies with alternative energy. (Kesijav et al, 2011). Also, investing in alternative energy could extend our fossil fuel resources well into the next century and perhaps longer until fossil fuels can be replaced entirely. Moreover, energy independence can be a very important cornerstone for the economic and social development in Nigeria, as seen recently in South America. For Nigeria, Government assistance may be needed to sponsor the required local technology.

9. WAYS OF ENHANCING RENEWABLE ENERGY PRODUCTION

- i. Government support for fuel crop production
- ii. Government policies must stimulate farming biomass rich crops
- iii. Financial incentives such as loans, subsidies and tax reductions
- iv. Investment into basic researches and technologies on renewable energy.
- v. Private sector investment in mechanized farming of fuel crops like palm oil, maize, cassava, millet, rice, wheat and sugar cane in the north).

Moreover, in recent years, the rising concern about environmental protection revealed the need to incorporate environmental externalities into major decision-making process (Danae & George, 2001). The substantial damage from the hydrocarbon energy production in Nigeria when translated in monetary cost, will also serve as a strong justification for paradigm shift to bio energy production.

10. INNOVATIVE SOLUTIONS AND BENEFITS OF RENEWABLE ENERGY IN NIGERIA

The wakeup call for complimentary and supplementary use of renewable energy is timely to salvage the embarrassing escalation of harm to the environment.

The benefits of renewable energy are classified under sustainable and emissions benefits. The sustainable benefits include reduce reliance on Petroleum & Crude Oil products; reduce emission of green house gases thereby reduction in Global Environmental issues; improve economic growth in form of employment in regional & rural areas; diversification of income, increase security of energy supplies, and reduce environmental pollution (air, Land & water). Better tax regime for Government, Renewable Energy also reduces the health risks associated with Petroleum energy. Renewable energy is central to sustainable development and poverty reduction efforts (Energy Commission of Nigeria (ECN) 2003; National Technical Working Group NTWG, 2009).

The emission benefits include reduction in release Particulate Matter (PM), hydrocarbon, and carbon monoxide (CO) emissions, and enhance combustion due to presence of fuel oxygen which allows better burning, so fewer unburned fuel emissions result. A paradigm shift to renewable energy use will fast track local technologies for harnessing biomass from conventional crops and trees by Biochemical and thermo chemical conversion (Simonyan & Fasina, 2013). Renewable energy production has proved to be eco-friendly far more than fossil fuel. (Buyukkaya, 2010).

11. CONCLUSION AND RECOMMENDATIONS

The time has come for all stakeholders of environment to launch out a campaign for paradigm shift from Petroleum fossil fuel to renewable energy. Although we may not be able to rid the country completely of fossil fuel usage for now, we must realize that sufficient renewable energy production is achievable. The world is through organized bodies like United Nations and World Bank are driving the process. The Universities, environmental professionals and research centers should provide the technical expertise resources; while the government of Nigeria should create legislative framework and enabling environment for investors to invest in renewable energy production. The government should also incorporate renewable energy production into the national content plan and the vision 2020 agenda, leveraging on the availability of land, local technologies, raw materials and financial resources to enhance this innovative transformation. The bottom line

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is that Nigeria and Nigerians will enjoy a more livable environment, energy security in the near foreseeable future, diversified income and economic growth in form of employment.

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REFERENCES:

Ajienka J.A; Jaja A.J and Ugbebor N.J (2006), *Oil and Gas pollution in the Niger Delta: causes and consequences*. A paper presented at the annual conference of national registry of environmental professionals (NREP), Nashville, Tennessee, USA, in October 16-19.

Amnesty International Report-Eyes on Nigeria (2009). *Nigerian Petroleum, Pollution and Poverty in Niger Delta*. P.27

Ashton, N.J; Arnott, S; Douglas, O (1999). *The Human Ecosystem of the Niger Delta-An Era Handbook*, Environmental Rights Action, Lagos.

Buyukkaya, E (2010); *Effect of Biodiesel on a DI diesel engine performance, emission and combustion characteristics*. Fuel 89 (2010)3099-3105).

Danae, D and George, K (2001); *Cost benefit Analysis of bio-fuel oil-seed origin in Greece*. Centre for Renewable Energy Sources, Greece.

Department of Petroleum Resources (2009). *Oil spill incidents data between 1976-2008*, released at the Oil pollution workshop held in Lagos Resource Centre.

Diugwu, I. A; Ijaiya, M.A; Mohammed, M and Egila, A.E (2013). *The effect of gas production, utilization and flaring on the economic growth of Nigeria*. Published in scientific Research (Open access), Article ID 35176.

Egwu, S.A (2012); *Managing Health Challenges in the Oil and Gas Industry*, "Oil spill control and management. A paper presented at 15th International Biennial conference on the Oil and Gas industry in Nigeria held in congress Hall, Transcorp Hilton Hotel, Abuja November 5-7. Green Peach Oil briefing, 1993.

Energy Commission of Nigeria (ECN) (2003). *National Energy Policy*. www.energy.gov.ng.

Energy Commission of Nigeria.ECN (2006).

Renewable Energy Master Plan draft.

www.energy.gov.ng.

Environment Agency (2004) M17: *Monitoring of Particulate Matter in Ambient Air around Waste Facilities*. Environment Agency, Bristol

Environment Agency (2008) *Environmental permitting regulations, standards and measures, getting the basics right - how to comply with your environmental permit*, Environment Agency, Bristol

<http://publications.environment-agency.gov.uk/pdf/GEHO0209BPHU-e-e.pdf>

Intergovernmental Panel on Climate change (2011): *IPCC special report on renewable energy sources climate change mitigation*. Prepared by working group 111 of the IPCC. Cambridge University Press, Cambridge, United Kingdom. Or New York, NY USA 1075 pp. 9.

Joel O.F and Olajide F.O (2012); *Green Economy: wake up call for the government and oil industries in Nigeria*. A paper present in 1st international conference and technical exhibition on Petroleum Refining & Petrochemicals, Port Harcourt, Nigeria.

Joel, O.F and Ugbebor, J. N (2011); *Environmental sustainability the need for holistic practical approach*. A publication in Journal of Science and sustainability. July 2011 volume 4. NREP, USA.

Kadafa, A A (2012): *Environmental impacts of oil exploration and exploitation in Niger Delta of Nigeria*. Published in Global Journal of science frontier research environment. (Publisher: Global Journal Inc USA). Online ISSN 2249-4626 & Print ISSN 0975-5896).

Keshav, B; Wayne, M. S; Scott, MCKay, Gija,G and Nimisha, B (2011); *Biofuel: An alternative to fossil fuel for alleviating world energy and economic crises*. Published by Journal of Environmental Science and health, Part A, 46:12 1424-1442. London WIT 3JH, UK.

Lim J S, Manan Z A, Wan Alwi S R, Hashim H (2012). *A review on utilization of biomass from rice industry as a source of renewable energy*. Renewable and Sustainable energy review 16, 3084-3094.

Maikanti, B. (2016): *A paper titled "Nigeria's Recession: oil, gas reserves running out"* Published by

Vanguard: Exploration drill Masters
(Explorationdrillmasters.com).

Medugu (2012): *Issues and Challenges*. Crude Oil Exploration and Production in Nigeria. NNPC, 2009.

Prasad, H.A.C and Kochher J.S (2009). *Climate Change and India- Some major issues and policy implications*, working paper No. 2/2009-DEA, Department of Economic Affairs, Ministry of Finance, Government of India.

National Technical Working Group (2009). *A report of vision 2020 on the energy sector in Nigeria*, July, 2009. Chairman: Funsho M Kupalokan (OFN, FNSE) and Coordinator: Abubakar, Siddique Mohammed.

Riddell, A; Ronson, S; Counts, G; and Spenser, K (1998): *Towards Sustainable Energy: the current fossil fuel problem and prospects of Geothermal and Nuclear power*.

Simonyan K.J and Fasina, O (2013). *Biomass resources and Bio-energy potentials of Nigeria*. Published in African Journal of Agricultural Research. Academic Journal. <http://www.academicjournals.org/AJAR>

Siraju, Y and Okonkwo, I (2012): *The use of bio-fuels as alternative Energy to crude oil in promoting Environmental sustainability*. A paper presented at 15th International Biennial conference on the Oil and Gas industry in Nigeria held in congress Hall, Transcorp Hilton Hotel, Abuja November 5-7.

Sulphey, M.M (2013): *Introduction to Environmental Management* 2nd Edition, Publication by PHI Learning Private Limited, Delhi, India Page 141, 152-156.

Ugbebor, J.N (2010): *The role of Safety in National development*. A publication in Nigeria Institute of Safety Professional's journal volume 2. No 1, November

Ugbebor, J N (2013); *Innovative Solutions to Perennial Environmental Impacts of Petroleum Industry (A wake up call for bio diesel use in Nigeria)*. Environmental Engineering Department, University of Port Harcourt, Port Harcourt. Nigeria.

World Development Indicators, 2014
(www.worldbank.org).