

# Energy Exploitation And Environmental Impact In Nigeria: The Way Forward.

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## ABSTRACT

Energy is the basis of industrial civilisation; without energy, modern life would be difficult to live. However, the exploitation and utilisation of energy in this case non-renewable energy (oil, gas and coal) comes with effects that impact negatively on the environment such as environmental pollution which affects weather conditions, soil fertility, aquatic habitats and wildlife animals. This paper, after highlighting the various environmental impact of energy exploitation, emphasizes on the need for the stakeholders, in this context, government, engineers, scientist, investors and community leaders to rise up to the challenges and ensure that the impacts of energy to the environment are addressed. It advocates for interdisciplinary approach and strict adherence to professional ethics by engineers and scientists to address the problems while the appropriate government agencies should enforce the various environmental laws. And judging by the threat the non-renewable energy exploitation poses to humans and the environment, the paper suggests a gradual shift to clean energy technology for sustainable development.

**Key words:** Energy Exploitation, Environment Pollution, Modern Technologies, Sustainable Development.

## 1. Introduction

Energy is an essential material basis for human survival and development. The exploitation and utilisation of energy has enormously boosted the development of the world economy and human society. For example, energy from fossil fuels (coal, oil and gas) is essential for electricity production, transportation, heating, and many other purposes. However, the extraction and processing of fossil fuels, in addition to their use, have profound impacts on the environment. The large oil spills which leaked over 4.9 million barrels of crude oil into the Gulf of Mexico and the several oil spills in Nigeria have focused attention on the potential disasters associated with fossil fuel exploitation to cause contamination of the natural environment.

The alarms over the environmental impacts of using fossil fuels are dated back in the early twentieth century. As reported in NEP (2007), Guy Challender, a coal engineer, was one of the first to sound alarm over increasing CO<sub>2</sub> levels in the Earth's atmosphere. He warned that using fossil fuels would contribute to global warming. It was his empirical results that prompted the recent efforts to understand and address climate changes (NEP, 2007).

Nigeria is endowed with abundant supply of oil, natural gas and coal. It is estimated to have proven reserve of approximately 35 billion barrels of oil, about 2.7 billion tonnes of coal and 187 trillion barrels standard cubic feet of natural gas according to the Draft National Energy Master Plan, 2007. Thus Oil and gas related operations are the most obvious industrial activities in the country. Oil and gas resources account for over 95% of the country's export earnings and 82% of the government's total revenue (Wikipedia, 2006). However, the continuous exploitation of these fossil fuels does not occur without adverse impact on the environment. Gas flaring and Oil spillage during exploration, transportation, usage and vandalisation have resulted to land degradation, aquatic pollution and air pollution. Thus, for environmental sustainability, stakeholders ought to rise to the challenge to address these problems. Government has to effectively play its regulatory roles; investors should adhere to international best practices in energy exploitation while engineering and scientific bodies should ensure that they adopt modern technologies in the confine of their professional ethics.

## 2. Man, Energy and Environment

The word “environment” is traditionally defined as the total surrounding which includes natural and biological resources. However, with the current trend of sustainable development, the definition of the environment has been widened to include natural and human resources and their interactions with each other. The World Bank (1991) therefore defines the environment as the natural and social conditions surrounding all mankind and including future generations.

Human beings and the natural environment are on a collision course. Human activities such as energy exploitation inflict harsh and often irreversible damage on the environment and on critical resources. If not checked, many of our current practices put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world that it will be unable to sustain life in the manner that we know.

Energy is an irreplaceable part of our life and it is highly correlated with the environment. Imagine what it would be like if we were out of electricity, oil and gas. We could hardly prepare food. We also have to walk because there is no car, plane, train or bus. But thinking from environment perspective no energy means no power generation, which translates into less consumption of energy from fossil fuel. Also no car equals to no air pollution. Here we can clearly see negative correlation exists between energy and environment protection. While energy development has enriched our life it has worsened eco-pollution. Thus, from the above discussion we can say that man, energy and environment are in constant interactions in our modern society as represented in the form of a simple Venn diagram (Figure 1).

From the Venn diagram, the interaction is such that as man makes concerted effort to meet his various needs using finite energy resources, he impacts negatively on the environment.

Sustainable development can be thought of as the region in the centre of Figure 1 where all the three sets of constraints (insatiable wants of man, finite fossil energy and environmental pollutions) are satisfied. Achieving sustainability through sustainable development will require some significant shifts in behavior (such as environmental protection consciousness) and energy consumption patterns of man (such as adopting renewable energy technology). Often it will be – and should be – the role of stakeholders to achieve this.

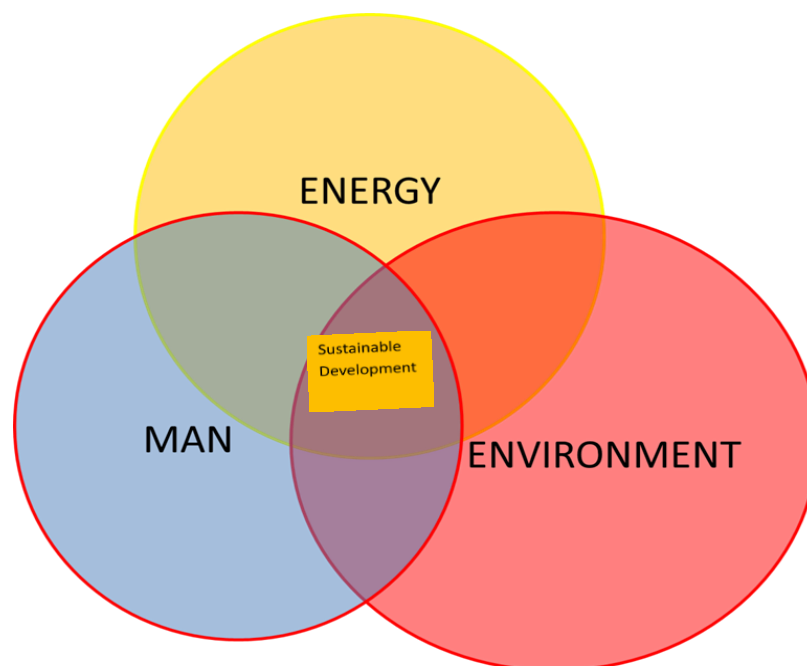


Figure 1: Venn diagram showing the interactions of man, energy and environment

### 3. Benefits of Energy Exploitation and Utilisation

Benefits of energy exploitation abound. For instance, as reported by the Honorable Minister for Petroleum, Mrs Diezani, that crude oil accounts for about 90% of our export earnings, 95% of our foreign exchange earnings and 82% of budgetary revenue (Diezani, 2011). The revenue from the oil sector has been the mainstay of the Nigerian economy as it is ploughed into other sectors for developmental purposes. Other than revenue generation to the government, energy exploitation has provided the teeming population job opportunities. Energy utilisation has also improved the living standard of man since what would have been done manually by man is now done by machines powered by energy from fossil fuel.

Nigerian coal has been found suitable for boiler fuel, production of high calorific gas, domestic heating, formed coke and the manufacture of a wide range of chemicals including waxes, resins, adhesives and dyes. Their characteristic properties (low sulfur and ash content and low thermoplastic properties), make these sub-bituminous coals ideal for coal-fired electric power plants (WHO, 1997).

### 4. Environmental Impact of Exploiting Fossil Fuels in Nigeria

Exploitation refers to mining mineral resources from the land and sea using technological know-how. According to Nigerian Environmental Study/Action Team (1991) as highlighted in Mba (1995), fuel mineral exploitation activities involve exploration, extraction, processing and transportation as well as storage and consumption of petroleum, natural gas, coal, lignite and uranium. Fuel exploitation is done basically for harnessing energy that is latent in the minerals.

Exploitation process of fossil fuels takes place in the following order; exploration, transportation and marketing operation and utilisation as shown in figure 2. Each of these processes has negative impact on the environment. The major pollutants from these processes are:

- Oil spillage
- Gas flaring/Emissions from combustions
- Coal gases/particulates

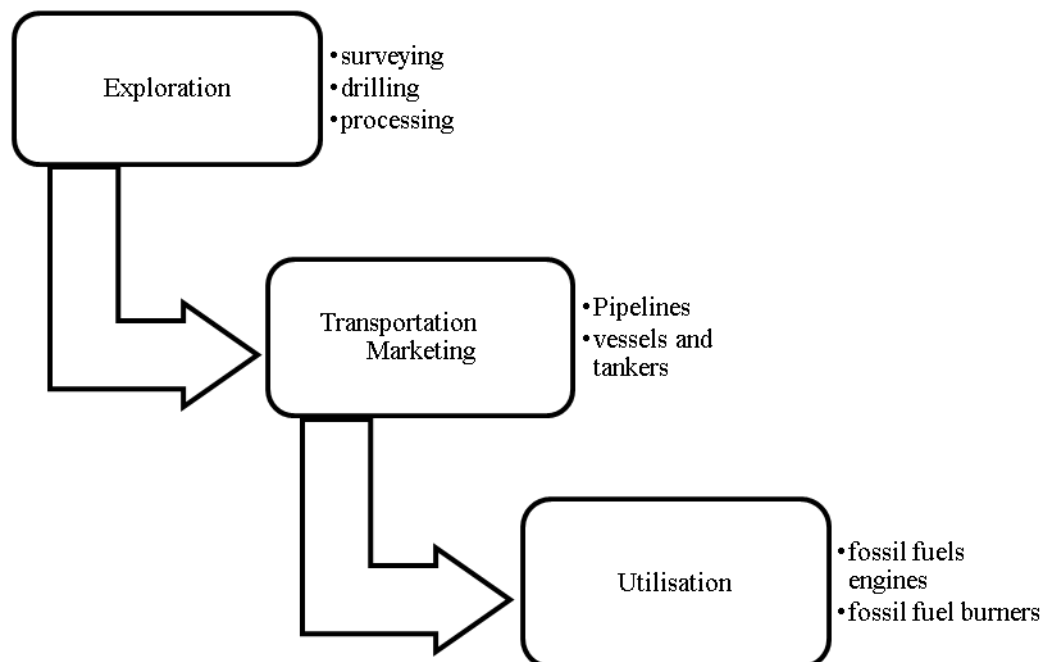


Figure 2: Exploitation processes of Fossil fuels

#### 4.1 Effects of Oil Spillage

Oil spills are a common event in Nigerian oil and gas industries and occur due to a number of causes, including: corrosion of pipelines and tankers, oil production operation and inadequate or non-functional production equipment (Bronwen, 1999). As reported in The Guardian of 24<sup>th</sup> June, 2012, Nigeria has record about 3,203

cases of oil spillage between 2006 and 2010. Out of the 3,203 cases, 23 per cent has been caused by equipment failure, operational/maintenance error and corrosion while 45 per cent has been attributed to sabotage/vandalism.

Crude oil or refined petroleum product spillage may cause damage to the environment in many ways. In water, oil film floating on the water surface could prevent natural aeration and lead to the death of marine life. Fish that ingest spilled oil or other food materials impregnated with oil have been observed to be unpalatable (Nwankwo & Ifeadi, 1988). Oil spillage on land may lead to retardation of vegetation growth and cause soil infertility for a long period of time until natural processes re-establish stability.



Figure 3: The impact of an oil spill near Ikarama in the Niger delta. Photograph: Amnesty International UK



Figure 4: Several years of fishing boats lie abandoned in oil-polluted water near Bodo, Niger Delta, Nigeria. Photograph: Pius Utomi Ekpei/AFP/Getty

#### 4.2 Effect of gas flaring

Gas flaring as defined by (JINN, 2010) refers to the burning of natural gas that is associated with crude oil when it is pumped up from the ground. In petroleum-producing areas where insufficient investment was made in infrastructure to utilise natural gas, flaring is employed to dispose of this associated gas. In Nigeria, oil companies prefer to flare the associated natural gas due to cost. Nigeria flares more natural gas associated with oil extraction than any other country, with estimates suggesting that of the 100 million cubic metre of associated gas (AG) produced annually, 70 million cubic metre or about 70% is wasted via flaring. (Wikipedia, 2006) This equals about 25% of the UK's total natural gas consumption, and is the equivalent to 40% of the entire African continent's gas consumption in 2001.

Gas flaring adds significant carbon emissions to the atmosphere such as soot, carbon monoxide and other greenhouse gases which contribute to air pollution problems. Gas flares have potentially harmful effects on the health and livelihood of the communities in their vicinity. Poisonous chemicals including NO<sub>2</sub>, SO<sub>2</sub> and volatile

organic compounds like benzene, toluene, xylene and hydrogen sulfide, as well as carcinogens like benzopyrene and dioxin cause variety of respiratory problems (Friends of the Earth, 2005). These chemicals can aggravate asthma, chronic bronchitis as well as leukemia and other blood-related diseases. A study done by Climate Justice estimated that exposure to benzene would result in eight new cases of cancer yearly in Bayelsa State alone (Friends of the Earth, 2005).



Figure 5: The Shell gas flare at Rumuekpe, River State in the Niger Delta. Photo: Israel Aloja, Environmental Rights Action/Friends of the Earth Nigeria

#### 4.3 Effect of pollutants from coal mining

Coal is a major global energy source, accounting for 23 percent of total energy consumption. It was the primary energy source from 1900 until 1960, when it was overtaken by oil (WHO, 1997). Coal was first discovered in 1909 near Udi (central eastern Nigeria). In 1950, the Nigerian Coal Corporation (NCC) was formed and given the responsibility for exploration, development and mining the coal resources. Coal can be produced through surface (open cast) mining or underground mining which are both dangerous.

Other than the constant danger of coal mine explosion, health hazards specific to underground coal mining include coal dust, which can cause 'coal worker's pneumoconiosis' or anthracosis, often combined with silicosis (Bascom et al, 1996). Coal material produces toxic gases such as: carbon monoxide, carbon dioxide, and methane. Carbon monoxide is extremely toxic because it binds to haemoglobin in the blood, blocking oxygen transport and creating chemical suffocation (Bascom et al, 1996).

Other than human health hazards, coal exploitation has great impact on the soil. Soil removals from the area to be surface mined alters or destroy many natural soil characteristics, and may reduce its productivity for agriculture or biodiversity. Dust degrades air quality in the immediate area. Waste piles and coal storage piles can yield sediment to streams, and leached water from these piles can be acid and contain toxic trace elements. Surface waters may be rendered unfit for agriculture, human consumption, bathing, or other family (Bascom et al. 1996).



Figure 6: Contaminated Water issuing from Okpara coal mine, Enugu

## 5. Prevention and Control of Environmental Impact of Energy Exploitation

### 5.1 Regulation of Fossil Fuel Exploitation by Government

The environmental impacts of energy exploitation can be avoided, minimised or mitigated when proper care and attention are taken. Matters related to technical supervision of oil and gas exploration, refining and transportation are under the Department of Petroleum Resources while those concerning environmental pollution are attended to by the Ministry of Environment. These regulatory bodies must collaborate to ensure that fossil fuel exploitation is done in accordance to the laws guiding it. These include:

- Strict implementation of government policies such as zero gas flaring;
- Constant monitoring and surveillance by the relevant government authority;
- National Oil Spill Contingency Action Group to quickly intervenes in emergency cases involving oil spillage and coal mine fire;
- All projects or investment activities should be subjected to Environmental Impact Assessment (EIA) at the beginning, mid-term or at the end. This function should be a joint responsibility of the various agencies that have specific statutory mandates in the fossil fuel industry.

### 5.2 Funding Research on Pollution and Emerging Technologies

A special fund for pollution research should be put in place to enable universities and research institutes to carry out research into the socio-economic and human health aspects of pollution and challenges in energy exploitation. The government, the coal, oil and gas industries and the various scientific and engineering professional bodies can collaborate to carry out researches in the emerging technologies such as the low carbon energy technology and energy efficiency. With sufficient funding in Research and Development (R&D), technologies such as low carbon energy sources, carbon capture and storage, smart grids, electric vehicle technology, fuel-cell vehicle, hybrid cars and power plant can be deployed to the energy sector of the economy (Machunga et al. 2012). This will reduce the amount of greenhouse gases emission. Other emerging technologies that are still under research are: the design of sea-worm robots to clean oil spills, cars fuel from Carbon dioxide, artificial leaves that will absorb Carbon dioxide from the atmosphere which engineers and scientist in the country can also key in (Malti,2010).

### 5.3 Operational Practices

Stakeholders in the fossil fuel industries have to be pro-active in evaluating and introducing new engineering and operational techniques aimed at pollution prevention. Improved management approaches and operational practices should be adopted. Scientist and engineers in the coal, oil and gas sector should insist on professional ethics. The common pollutants in the oil and gas include emission gases, producer water and solid waste and can be minimized through the following operational practices: for example, gas flaring and oil spillage can be minimized by improved process control procedures, design and maintenance systems, and advances in valve design and combustion efficiency. Technologies to capture or use the associated natural gas are viable alternatives to flaring. It can be re-injected, which boosts oil production and gas; converted to liquids that can be more readily transported; or used on site.

## 6. Conclusion

The role of energy (fossil fuel) for socio-economic development was discussed. However it is finite and its exploitation has negative impact on the environment. Thus, it is in our best interest that for sustainable development, stakeholders must adopt measures that would provide a reasonable degree of protection of its ecological human environment from pollution, whether it emanates from the coal, oil and gas industry or other sources. Such measures should discourage discharge of harmful effluents, into the environment through the adoption of appropriate prevention and operational techniques and the most effective and current technologies that have little or no negative environmental impacts. The Nigerian government should go beyond command and control approach to pollution abatement but adopt various economic instruments to combat fossil fuel industry-induced environmental pollution and diversify the energy resources of the country. Engineers and scientist should insist on best practices in the energy sector while the related professional bodies keep eagle-eye on their members to ensure strict compliance to professional ethics. Government should stimulate demand and attract investors in renewable energy technology in Nigeria to reduce over dependence on fossil fuels.

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