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Environmental damage arising from oil operations in Niger Delta of Nigeria: How not to continually live with their specific impact on population and ecology

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Abstract

Oil operations and their impact on environment remains a contentious issue in the relationship between oil communities, oil companies and governments in Developing countries, and less so in advanced economies with oil resources and vibrant civil societies. In Nigeria, the global debate on the environment and sustainability resonates with its citizens, and since post-2000 crystallized Niger Delta politics around local oil-related environmental damage as a conflict issue in itself and by itself. In this paper, I examine and elaborate on the role of government, transnational oil companies and local oil theft in environmental degradation, and steps down analysis from the larger debate into the specific impact focusing on the nature of gas flaring, oil spills and pipeline network/sabotage. Drawing from eclectic data gathering method - local documentation, participatory observation and elite interviewing technique –, ample empirical evidences suggest that beside other human actions in this region, the effect of oil operations has substantial consequences on populations and ecology. This paper concludes that, though oil holds out a vision of development, leaves detrimental effect on the Niger Delta environment. In this context, policy shift from fossil-based energy system to the uptake of renewable energy technologies is inevitably a *sine qua non*.

Keywords: Oil operations in Niger Delta of Nigeria; Oil-led environmental degradation; Consequences on population and ecology; Fossil-based energy regime; Renewable energy Technologies

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1. Introduction

Environment-related problems in the Niger Delta region of Nigeria have attracted growing but limited research to establish both the degree of degradation accurately, and responsibility for it from either oil activities or other known means. Determining the degree and or causes of environmental damage, which are difficult to establish involves technical details beyond the ordinary competence of the victims in Niger Delta to configure. The communities living next to oil operations lack the skills and resources to embark on the complex venture of investigating environmental issues that became more topical since the 1990s. This situation becomes more frustrating for these communities for a variety of reasons. First, international expertise may not be at the communities' disposal; second, sometimes oil companies and national support responses may not be timely or in connance with best international business practice; third and lastly, a lack of political will often associated with developing economies (Khan, 1994).

Instructively, the lack of interest or studied indifference by parties who are apparently scientifically equipped, like oil companies to know more, and have the resources to intervene but are perceived as major perpetrators heighten frustrations in affected communities. Thus the Niger Delta communities point accusing fingers at the perceived complicity of government through NNPC for not being on the side of the citizens, as well as oil companies' lack-lustre approach to sustainable environmental practice. In this context, the Niger Delta scenario has become a challenge, especially relating to climate change, and the debate to tackle this phenomenon by ditching fossil fuels for renewable energy technologies.

1.1. Background

Oil and gas are Nigeria's strategic minerals. Based on "official government estimates the oil sector accounts for 70-80 per cent of the Federal Government's revenue (depending on the oil price), around 90 per cent of export earnings, and about 25 per cent of GDP measured at constant basic prices" (Takon, 2014, pp. 587-588). On the international level, Nigeria is among the world's top 10 oil exporters, and Niger Delta generates a substantial amount of the nation's production capacity, and houses a significant proportion of the country's oil infrastructure (Alagoa, 1999).

The Niger Delta is important to Nigeria's oil-centric economy and inevitably elicits world attention because of the global importance of oil and its centrality to the global economy. This is demonstrated, first, by oil's high energy content based on available technology; second, the relative cheapness of oil in terms of average production cost vis-à-vis other researched sources of energy; and third and no less important, the apparent ease of transportation of the product internally and externally (Klare, 2001). Klare's work captures the significance of oil as the only energy source that is in intensive use in every modern economy. In this context, Nigeria's huge offshore and onshore crude oil deposits in the Niger Delta region of Nigeria established the country as an important petroleum prospective zone since traditional basins are witnessing decline and renewable energy sources are not keeping pace with rising global consumption, particularly in China, India, and the United States (Roberts, 2004).

The Niger Delta is washed by the Gulf of Guinea, and hence, the region is part of the South Atlantic waters, which adjoins the Gulf of Guinea countries, namely: Angola, Cameroun, Equatorial Guinea, Gabon and Sao Tome/ and Principe (See: Figure 1.1). This region's location in the Gulf of Guinea means that it shares the collective attention the region attracts to itself because of the contribution it is poised to make to the global oil supply in the coming decades (Traub-Merz and Yates, 2003). This is despite the recent rise of interest in Shale gas in the United Kingdom and United States, key importers of Nigeria's crude, the cornerstone of the Gulf of Guinea's oil wealth, accounting for 60% of it.

That said, beyond the Gulf's geographical and historical meaning, Niger Delta's importance lies in the fact that it houses significant oil infrastructure in Nigeria due to the exploration and production of on-shore and deep-water oil resources. The latter are adjacent to its continental shelf and have the potential to produce conflict over the Exclusive Economic Zone close to its maritime borders (Takon, 2014, p.40). However, both state and non-state violence and conflict were frequent and posed a significant threat to Nigeria's oil-dependent economy before the emergence of Goodluck Jonathan, an Ijawman as President of the Federal Republic of Nigeria (Herbst, 1996; Herbst, 2000).

1.2. Methodology

The main mode of this paper was by fieldwork research to Niger Delta of Nigeria. Secondary and Tertiary types of data from relevant sources – local documentation and library research – were useful and collected, but primary data was of central importance and generated from semi-structured interviews, referred to in Social Sciences as 'elite' interviewing technique (Takon, 2014, p. 590). In this light, the respondents or informants in elite interview were not necessarily elite in terms of social status, but have access to the information that helped answer the central theme of this paper (Takon, 2014, p.590). Thus this work targeted key interviewees and informants in the Niger Delta, as well as community-based organizations.

The data provided historical and contemporary information, and thereby illuminate narratives on the all-important oil industry in Nigeria vis-à-vis the nature and consequences of gas flaring, oil spills and pipeline networks – by-products of oil operations – and their specific impact on populations and ecology in the region. Also the data was revealing of the connection between the global environmental debate and the emergence of local oil-related environmental issues in the Niger Delta area - an objective grievance since the 1990s - thereby elevating oil-led environmental damage in Niger Delta as a conflict issue in itself and by itself. Arguably, the data analysis contributes to a growing interest in shifting emphasis from fossil-based energy system to the uptake of renewable energy technologies in a country, which is ranked as the 6th largest producer of oil in the world.

2. Environmental damage and the oil industry operations in Niger Delta of Nigeria

The relationship between the development and operation of the oil industry and environmental degradation in the Niger Delta region of Nigeria is inter-related. This paper's analysis attempts to improve understanding

of the complexly interwoven role of the government, oil theft and oil companies in oil industry-related environmental damage. In this sense, knowledge of the history of the company operations is vital: what they do or cannot do in the course of their activities in oil communities, which sometimes may amount to encroaching on Nigeria's sovereignty or going beyond their brief or in breach of company business policy. In another vein, government's social contract with its citizens is enormous, which involves the protection of their livelihood and environment for present and future generations in the face of limited resources vis-à-vis other priorities of government to the country as a whole. The impact on environment and ecology by oil multinational and government joint operations on one hand, and on the other by activities of oil theft are narrowed down to three key by-products of oil activity in this paper and analysis, namely: gas flaring, oil spillage and pipeline networks.

2.1. Gas flaring

Field research suggests that gas flaring, oil spillage, and pipeline networks – the by-products of oil activities in Niger Delta - might have contributed to the environmental degradation in that region directly, and or indirectly (Oyelara-Oyeyinka and Okoosi, 1995). While a network of pipelines crisscross communities and homes, gas flaring is described as an unpleasant sight to populations living next to them. According to OPEC, Nigeria produced a total of 22.8 billion barrels of oil from 1958 to 2003 and from Shell's record, an average of a thousand cubic feet of gas is flared per barrel and when computed, it implies that 22.8 trillion was flared during this period (Rowell, Marriot and Stockman, 2005). However, decades of gas flaring and its impact on the environment remains a contentious issue, a sore point in the relationship between oil communities, oil companies and governments in Nigeria and, less so in developed countries with oil resources. The oil majors argue that heat from gas flaring is beneficial to the local communities for the drying of their fish, an important industry or occupation for the local populations in Niger Delta, who suffer from the absence of viable alternative source of heating, such as from renewable energy sources (Edemariam, 2005).

The oil companies' position in gas flaring suggests that flaring is done not necessarily because they disregard environmental standards in the course of their operations *per se* but is nonetheless of benefit to the communities, particularly those living next to flare sites for whom fishing is perhaps their only source of livelihood. Arguably, the lack of natural gas supply technology at the time may be a reason for gas flaring, giving that oil companies are not compelled by mere penalties of flaring to enkindle significant interests in the opportunity cost of flaring. Anyway, in the mid-nineties 87% of associated natural gas produced in Nigeria was flared before the Nigerian Liquefied Natural Gas Plant commenced production in 1999 as against, 21% rate for Libya, 0.6% for the United States and 4% in the rest of world (Okonta and Douglas, 2001). Indeed, the gas flared in the country is documented as one of Africa's greatest man-made environmental disasters (World Bank, 1995; and Shell in Nigeria, 2004).

These statistics show that Nigeria breaches United Nations Agencie 21 and Kyoto Protocol, even though it's a signatory to this, and other international agreements and policies on environment and climate change. Local documentation on gas flaring in Niger Delta imply that some children living next to the gas flares might never have known dark nights even though they have no electricity (Village Voice, 1995; and Bloemink,

2000). Similarly, the elderly are said to experience strange noises and smells created by gas flaring that never existed before (Manby, 1999; and Frynas, 2000). Moreover, the flares burn at temperatures of thirteen to fourteen thousand degrees Celsius, and not only bring about air and noise pollution but, contribute to acid rain that has rotted corrugated roofs and generated sulphur emissions (Bloemink, 2000).

In the context of this analysis, communities in Niger Delta complain that millions of tons of carbon dioxide and methane are released into the atmosphere from flaring rather than being gathered for processing or re-injection into oil deposits. In addition, the communities complained that by burning these gases, Shell was using up and wasting a huge natural resource, which, if it were properly used, might have produced additional sources of revenue. These thoughts from the communities sound more interesting today from the current proposition that gas may provide the bridge to alternative energy technology that is environment-friendly, the day after oil (Lovins et al, 2004). Nonetheless, the magnitude of flares, according to Hammer in Niger Delta makes in Nigeria one of the biggest single contributor to global warming (Hammer, 1996).

The continuing phenomenon of gas flaring in Nigeria is inconsistent with the rhetoric from government and oil companies. Thus because of the huge oil infrastructure in Niger Delta, it contributes more emissions of greenhouse gases than anywhere else in Nigeria and from petroleum production than all other sources (World Bank, 2002; and Okonta and Douglas, 2001). In more than thirty years of oil production in Nigeria, all natural gas occurring in the course of production was burned away because of the flimsy reason that companies were discouraged by the benefit of the heat to locals. Rather than the more plausible and impelling twin-reasons of company profits and the huge investments required to harness gas where they are flared.

The consequences of gas flaring are enormous and about twenty-one years ago government set a target for ending gas flaring in what is described as the entry of the politics of gas flaring in Nigeria. 1985 was initially set as the target date for ending flares but this was shifted to 2004 because the initial date and the subsequent ones were no longer feasible. Available evidence points to another postponement of the current target – 2008 – even as flaring is said to have increased since the violence in Niger Delta at the beginning of the twenty-first Century, which leaves its usual consequences on the operating environment and living space of the communities (SPDC, 2004). In the circumstance, Shell, a major stakeholder in the end-to-gas-flaring project has acknowledged in its 2003 report that its target of eliminating all routine flaring by 2008 is tight and the necessary resources required to meet such a dateline would need to be reviewed (Bloemink, 2000). This implies that revenue estimated at over US $2.5 billion would still be lost through flaring whilst the impact on communities down the line – financial and degrading implications – is ignored.

It is important to note however, that the economic case for and feasibility of transporting gas is changing. Gas data illustrates that the industry is receiving significant attention, just as gas is inevitably and increasingly becoming one of the fastest growing activities in the local and world economy. The heightened interest around gas use is connected to discourses about its comparative merits, which include being more environmentally friendly than other liquid fuels, cheaper, and a cleaner energy technology. Gas profile is further enriched as a potential bridge in the 'oil endgame' debate, since alternative energy technologies are fraught with limitations (Roberts, 2004). For instance, in the case of renewables - wind, solar, microbes, and

biomas, it is argued that first, they variously generate power intermittently; second, only produce in right climatic conditions; and third and lastly, renewables have high cost outlay. For example, Hydrogen as an alternative energy is not considered energy-efficient because it is bulky to transport and consumes enormous energy in the manufacturing processes.

This makes the stakes for gas in Niger Delta and elsewhere in Nigeria great, and according to the World Bank positions this region high in the impending world gas economy (World Bank, 1995). Among other things, this would diversify its exports, a hitherto wasted resource. Thus examples of gas projects include: the LNG project in 1999, which has started harnessing gas and in September 2005 work has commenced on the West African Gas Pipeline, which will transport Nigerian natural gas from the oil fields of Niger Delta along its extensive coastline to Ghana, via Benin and Togo (NNPC Papers, 2005). Another gas project that has benefited from the Federal Government's enhanced policies in favour of the gas economy is the Trans Saharan Gas Pipeline.

The gas projects are expected to curtail flaring and thereby diversify the national economy, and provide much needed revenue from the country's petroleum industry. Additional investments in this sector also show that oil companies operating in Nigeria are now encouraged through favourable tax policies to build gas-powered concerns so as to increase domestic utilization, an alternative to hydro-generated sources. A number of examples in this regard across Niger Delta include Afam, ExxonMobil Power LNG, Kwale/Okpai, NNPC/Chevron and Total IPP (NNPC Papers, 2005). On another level - the downside for industry operators - a court in Nigeria in November 2005 declared the flaring of gas illegal in a case brought against Shell by some oil communities, which is to be a reference point for others to articulate their claims (IRIN, 2005). The practice of gas flaring according to the presiding judge contravenes provisions of the Nigerian Constitution, which guarantees its citizens the right to life and human dignity.

The landmark ruling if it stands opens the way for communities in Niger Delta to claim compensation from the oil conglomerates but, if existing gas laws are flouted the communities may resort to hostile methods. This analysis suggests that the obvious downsides of gas flaring in terms of the health hazards and, the heat benefit for fish farmers are in contention in the community, so also is the profit of flaring or otherwise for oil companies and government. Gas flaring and the danger it poses is complemented by oil spillage and pipeline networks/sabotage (see next session), which also contribute to the claims of environmental degradation in the Niger Delta region of Nigeria.

2.2. Oil spillage and pipeline networks / sabotage

Another by-product of oil operations in Niger Delta relates to oil spillage in Niger Delta. They include releases of crude oil, chemicals or waste sometimes caused by equipment failure, operation mishaps, human error or deliberate destruction of facilities arising from criminal activity (Nwankwo and Dule, 2001). Interestingly, the extent of environmental damage depends on what, where and how much has been spilled, how long it remains there, and the state/integrity of the pipelines**,** which also issue out spills. The latter are often laid across communities and homes in Niger Delta's landscape, and as argued encapsulate the appropriation of their land, disruption of their traditional ways and environment, and create social maladies that result from

the burden of the pipelines (HRW, 1999b). These are borne by the villages, who typically are not entirely to blame because they claimed were not consulted in the first instance.

In this vein, oil companies operating in Niger Delta argue that most of the spills from pipelines are as result of sabotage, which is a narrower concept of spills, and still does not explain adequately the lack of response by the oil companies, who own the pipelines. For instance, a Niger Delta Report revealed that some spills were caused by sabotage that is deliberately cutting SPDC's pipelines and manifold' (SDN-UNEP Report, 2014). Nonetheless, an alternative view however, posits that age, poor maintenance of pipelines and neglect significantly account for the spills (Okonta and Douglas, 2001; HRW, 1999b; and Amnesty International, 2013).

Importantly, it is difficult at the time of research to ascertain, which of these assertions is valid or the balance of both but, works argue that spills from pipelines are much greater than Shell acknowledges (Okonta, 2002). Reports gathered on pipelines confirm that ordinarily, pipelines of over fifteen years require replacing according to standard practice but, when this is not done, there may be spillage. The lack of valid data on the extent of standard practice often leaves more questions than answers. It is also necessary to draw attention to the possible damaging implications of spillage on the community, which as posited results in soil degradation, loss of critical natural ecosystems, and the toxic contamination of surface drinking water with high hydrocarbon levels (Manby, 1999). The latter is attested to by a European Community study report, which stated that the waters of Niger Delta contain levels of petroleum ranging from 8ppm to 60ppm levels, which are hazardous to both aquatic and human life.

Shell and other oil companies do not compensate spills where they occur as a result of sabotage but, the process of ascertaining the cause of the spills leaves grey areas for disagreement between communities and oil companies. Nonetheless, Shell's update in the Niger Delta shows that 10,400 tonnes spilled in 2001, 2,700 in 2002 and 1300 tonnes or 9,900 barrels in 2003 were recorded but, like the NNPC figures are not independently assessed (SPDC, 2003).

The import of these figures, suggest that some communities in Niger Delta in or near high density oil activity fields experience an average of one spill every week. The oil spills either happened in their backyard or flowed along the numerous distributaries in Niger Delta away from the communities where they originally occurred (Interviewee, 5 March 2008). The negative impact may depend on the quantity spilled at any one time but the cumuli tive effects over time on the inhabitants are likely to weaken the argument for quantity, particularly when they are not cleared early. Bloemink argues that 95% of the spill as claimed is usually not recovered where they occur, whether by Shell, other oil companies or sabotage, and the records are poor (Bloemink, 2000).

To this extent, it is thought that soils absorb the spills and release oil during rainy season as precipitation. For example, research conducted at a recent spill site in Yenagoa, the capital city of Bayelsa State acknowledged that oil had poisoned a key water source for this community and several others within the radius without any significant clean-up (Christian Aid, 2004). In this context, environmental degradation problem arising from oil operations over the years via gas flares, spills and pipeline networks constitute a

subject of great discourse and concern in Niger Delta and a specific case to buttress this narrative is the Niger Delta region's mangrove swamp (see: Section 2.3).

2.3. The Mangrove Swamp: a case for environmental damage from oil activity

This is the dominant vegetation type in Niger Delta, which is allegedly a casualty already of physical environmental problems (unlike direct human effects) caused by a combination of gas flaring, oil spills and pipelines (Interviewee, 29 January 2008). This may not exactly be the case but, in a world with so much environmental and sustainability issues since the 1990s, it presents a hard nut to crack. Niger Delta's mangrove swamp is known to be part of the world's third largest, after those in South Asia and South America, respectively, and one of the world's listed heritage sites (Iloeje, 1980). The forest is 'rich in biodiversity, largely of such low trees as *rhizophora* and *racemosa* with their breathing roots standing above the oxygen-deficient mud to absorb air' (Alamieyeseigha, 2003, pp.4-5). Like other forests, the mangrove terrain remains a traditional haven for the production of food and home for fish, shellfish, marine mammals and rapidly expanding shrimp aquaculture in Niger Delta (Bayelsa Government Report, 2006).

The mangrove not only provides shelter, nutrients and nursery for some species of aquatic animals but, also acts as a filter for major towns in Niger Delta, by not only making use of the nutrients but absorbing toxics from moderate but polluted runoff. This region's mangrove forest in particular is a significant buffer from storms, which reduces damage to property and loss of life in the communities. The forest is also a repository of medicines (principally unorthodox), source of fuel wood and charcoal, timber for industry, and construction materials, such as foundation piling and poles for riverine communities in the state. Thus the mangrove forest is of huge benefit and economic advantage in the Niger Delta region (Alagoa, 1999).

In spite of the forest's inherent resilience arguably, it is one of the most threatened ecosystems in Niger Delta as a result of oil operations and other human actions. Where lies the difference? For instance, this region's proximity to the ocean or Gulf of Guinea, and exposure to a variety of human activities, such as commercial logging, resort development, freshwater diversion and conversion for other uses has to be taken into account as well as the negative impacts of oil industry activities. The latter, which may account for the politicization of environmental problems endangers the mangrove forest via the effects of oil spills, fragmentation by oil pipelines and other petroleum exploration and production activities (Oddo, 1983). However, it is necessary to note that paucity of research in this area is yet to establish the degree of contribution of each aspect of oil industry activity to environmental damage, and whether its activities are responsible more for the decline of the mangrove than other known factors. Nonetheless, according to environmentalist, ecological damage is reinforced by seismic lines only a few meters wide in this forest, still visible by air a decade after they were cut (Oddo, 1983).

Hence, their negative effects are discernible in many of the communities where oil activity had taken place like Oloibiri in Bayelsa State. Furthermore, the lenticels, which are the exposed portion of mangrove roots, are highly susceptible to clogging by crude oil, and by other pollutants and this in turn endanger the durability of community forest (Oluwande et al, 1983). According to research, once mangrove swamps - like the rainforest - are damaged recovery is known to be very slow and their destruction definitely impacts on

the ecology and environment, and fishery industry for the riverine communities. Moreover, the dumping of waste from drilling and construction of roads and canals for the purposes of oil industry activity in the swamps affects hydrological equilibrium in Niger Delta (Oluwande, et al 1983). To this extent, the mangrove forest is being destroyed without an inclusive environmental and social impact assessment to keep pace with rate of damage, and one can imagine what this portent since oil exploration and production activity began in Niger Delta before Nigeria's independence in 1958.

Limited research trickling in suggest that the potential damage to mangrove forest, community health, and environmental problem from hydro-carbon-related operations have adverse impact on communities' available fish stock, and amount and quality of staple food stocks (Hurst-Croft, 2005). Works in the global arena on the specific effect of natural gas flaring, for instance, posit that wherever it is done it exacerbates climate change and the environment of oil communities in Niger Delta are no exception (World Bank, 1995). Recorded negative impacts that occur with gas flaring, spills and pipeline networks in Niger Delta from local documentation are on crop yields, livestock, increased flooding, and erosion as well as the potential increase in malaria breeding grounds in the riverine communities. As a matter of fact, gas flaring still dominates Niger Delta's sky line without effective policy commitment in the horizon to end it, as seen, for instance, the lack of will surrounding the Petroleum Industry Bill (PIB) of 2012, which seeks to redefine the industry in line with the advantages of alternative energy technologies.

Base on the foregoing analysis, there is a growing interest among scholars, like the author of this paper on shifting policy emphasis from fossil-based energy system to the uptake of renewable energy technologies is compelling, as well as challenging for Nigeria's oil-centric economy (see a more detailed analysis in Section 3).

3. Is a shift from fossil fuel based energy regime to renewable technologies a sine qua non?

Instructively, oil and gas, Nigeria's strategic minerals hold out a vision of development but leaves detrimental effect on the environment going by this paper's analysis. This has become a challenge relating to climate change, as well as the debate to tackle this phenomenon by ditching fossil fuels for low carbon sources. Globally, renewable energy sources are not keeping pace, arguably with the decline in oil as well as rising consumption in United States and Asia – particularly in China and India with large populations and their emerging industrial need. The latter is captured in Table 3A, which illustrates global consumption and projections into the second decade of the 21st Century.

Another important element to this analysis of Nigeria's fossil fuel energy system is the estimated 104.7 trillion cubic feet (tcf) of proven natural gas reserves, of which 75% is a by-product of oil extraction but is largely burnt off (NNPC Papers, 2005). This has been demonstrated under Section 2.1. In a more analytic sense, according to the World Bank, non-harnessed gas or gas flared in Nigeria is equivalent to total annual power generation in sub-Saharan Africa. Figure 3A shows past and present statistics in the gas sector, and glimpses in future trends are discernible at the time of this research. Arguably, Figure 3A captures great

potential in the gas sector, perhaps equal to oil or even more given its numerous economic and social advantages. However, the question is whether or not gas is a panacea?

The heightened interest around gas use, for example, is connected to its comparative advantage, such as being more environmentally friendly than other liquid fuels, cheaper and cleaner energy technology (Robets, 2004). Though gas infrastructure is still in its infancy in Nigeria, nonetheless steps are being taken to re-position the commodity, such as the proposed Gas Act and in part the Petroleum Industry Bill of 2012, which are aimed at ending gas flaring by stepping up the gas energy economy. Thus the gas economy is expected to generate as much revenue as oil, with export volume expected to grow beyond 8,000 mmcfd by 2015 (see: Figure 3A). Notably, some gas projects of significance in the country are the Nigeria Liquefied Natural Gas facility on Bonny Island, West African pipeline project, Brass and Olokola NLG.

Arguably, gas profile is further enriched since alternative energy technologies are perceived to be fraught with insurmountable limitations (Roberts, 2004). Roberts' contribution to the debate on energy technologies, evaluated the return to coal as one option but insist the cleaning up process is too expensive. He settles ultimately for conservation as more energy-efficient beyond oil and after gas has provided for the transition. For instance, the case against renewable - wind, solar, microbes, and biomas – suggests that: first, they generate power intermittently; second, only produce in right climatic conditions; and third and lastly, they have high cost outlay. This makes the stakes for Nigeria's gas great, and its possession of a tenth largest proven natural gas reserves positions the country high in the impending world gas economy (World Bank, 1995).

These prospects notwithstanding, gas is finite, environmentally and politically problematic like oil. For example, violence has reduced Nigeria's promising oil and gas economy output by a quarter, causing it to lose its position as Africa's biggest oil producer to Angola, according to figures from the Organization of Petroleum Exporting Countries (OPEC), which also signpost futures in Nigeria - anarchy or developmental state (Takon, 2013). To this extent, renewable energy is brought to the fore of the debate for sustainable energy production and use in Nigeria.

4. Conclusion

In the context of this analysis, this paper examined the nature and consequences of gas flaring, oil spills and pipeline networks – by-products of oil operations – and their specific impact on populations and ecology in Niger Delta. Thus suggests that renewable energy is a viable alternative to fossil-based energy regime in Nigeria in general and Niger Delta in the particular. To this extent, this research connects with the emergence of global environmental debate that resonated with oil-related environmental issue, and arguably represented one layer in an onion-like ball of material grievance associated with mobilized politics in Niger Delta in post-2000.

The state of oil-related environmental issues in Niger Delta and the population's concerns could not be far from what was aptly described by the European Parliament as 'environmental nightmare' (Watt, 2003, p.18). This view can be substantiated from a recent study, which asserted that major land use and land cover

changes have occurred in the Niger Delta as a result of petroleum and gas exploitation activities, which impacted on the degradation of the environment (air, water and land resources), loss of biodiversity and climate change (Obi, 1997; and Agbola and Olurin, 2003).

Interestingly, the growing debate on the end of oil or the transition to energy-efficient technologies; and invariably the implication on the country's oil-centric revenue is no less important in this paper's analysis. Indeed, the 21st century has intensified concern about the oil endgame (Deffeyes, 2001; Glunt, 2002; Heinberg, 2003; and Lovins, 2004 et al). Arguably, at current production rates, Nigeria's oil and gas resources are expected to last another forty and hundred years respectively (Ikein, 1990). In this sense, renewable energy is a *sine qua non* rather than the unsustainable strategies led by fossil fuels solutions, such as presented by the potential of Nigeria's gas-driven economy. Nevertheless, the question among Nigerian scholars with interest in renewable energy technologies is less about oil depletion than it is about its alternatives or the post-oil future. In this light, just as wood gave way to coal long before forests began to diminish, and coal gave way to oil before the mines ran low, so also would oil be overtaken by alternatives that are more greener, more convenient, and cost effective (Roberts, 2004; and Interviewee, 14 February 2008). The Interviewee, a member of MOSIEND, Ijaw youth organization claims that little is done in the area of research in the direction of the transition to 'green energy' alternatives adaptable to local characteristics.

Finally, the impact this has in the era-after-oil on the future of Nigeria based on this paper' analysis, enhances the case for renewable energy approaches for sustainable development. Hence, brings the end in sight of the consequences of oil-led environmental damage and their consequences on population and ecology in Niger Delta of Nigeria as one half of the equation. The other half is the rise of renewable energy production and use.

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Interview with Moris Alagoa, the project Manager of Environmental Rights Action (ERA) in Yenagoa on 14 February 2008. ERA is a grassroot advocacy NGO that is part of Friends of the Earth International, and a member of the international steering committee of Oilwatch International. ERA is the Niger Delta network resisting destructive activities of oil corporations in the region.

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