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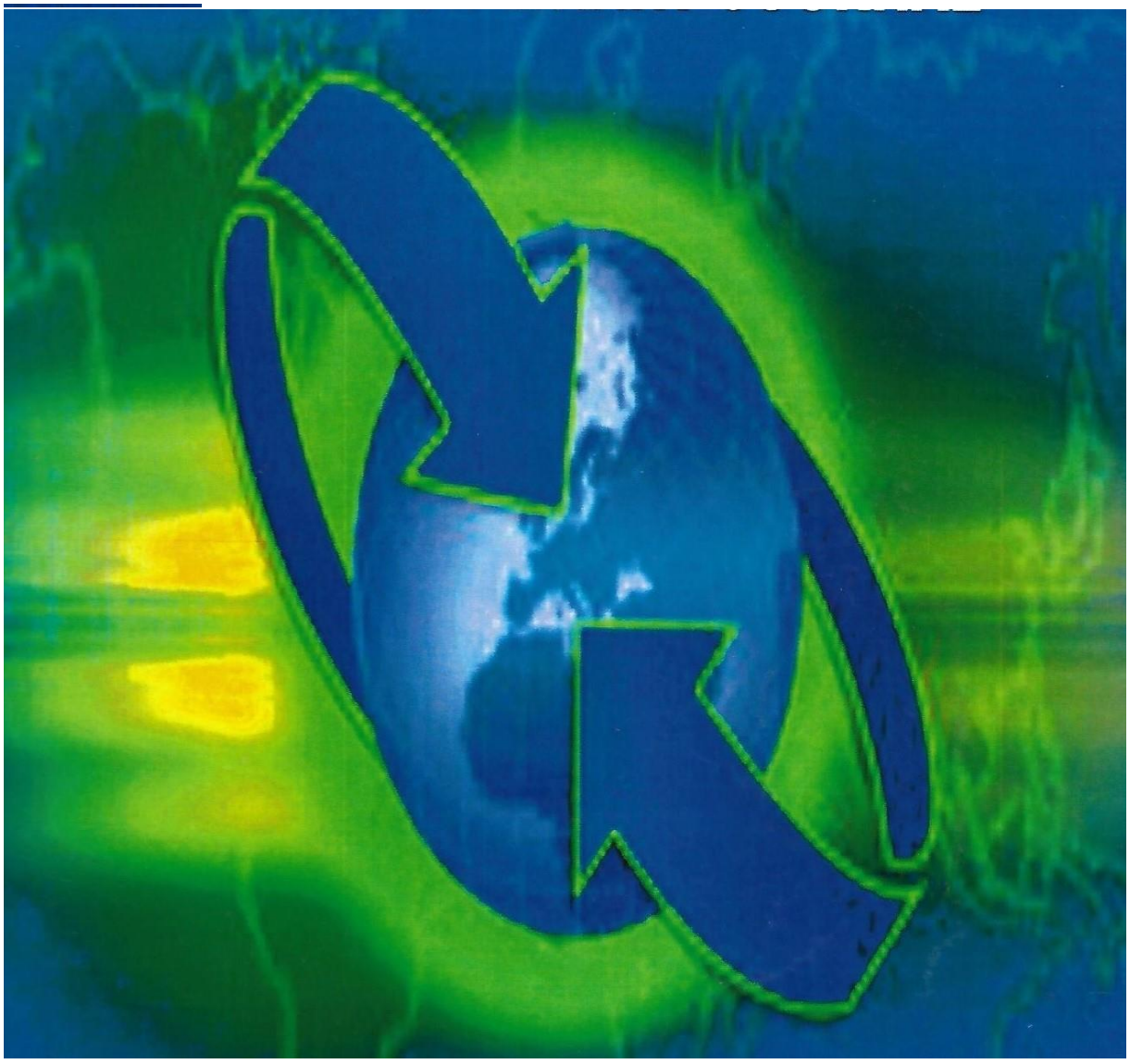

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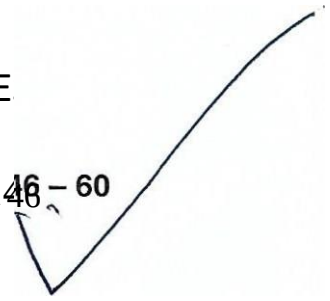

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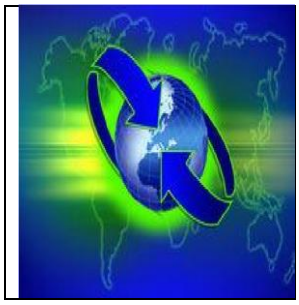

Assessment of the Measurement of Greenhouse Gases Emission Level and their Mitigation strategies in Nigeria

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Abstract

The challenge connected with the emission of greenhouse gases and the worsening quality of the environment has become of great concern to the environmentalists and policy makers alike. This study assessed the range of activities associated with or constituting the sources and measurement of greenhouse gas emission level and strategies of mitigating the impact of the emission level on the Nigerian environment.

Secondary data derived from published and unpublished sources with simple statistical techniques for analysis of the data were used for the study. The temporal analysis covered a period of 1980 to 2014. The study found that a total of 7.37 X 10 8, 1.32 X 10 5 and 1.41 x 10 4 tons of CO_2, CH 4 and N 2 O respectively were emitted into the environment, due to gasoline consumption from 1980 - 2014. About 2.08 X 10 8, 1.08 X 10 4 and 6.32 X 10 3 tons of CO_2, CH 4 and NO_2 respectively were emitted into the environment over the same period. It was also found that activities in the areas of transportation, industry, commerce and residence, agriculture, land use and forestry including those in the generation, transmission and distribution of electricity constituted the sources of greenhouse gas emission. The study recommended that there was a great need of putting in place appropriate legislations to discourage gas flaring and other greenhouse gas emission and that green building technique including retrofits strategy should also be adopted in residential and commercial areas.

Keywords: Greenhouse gases, emission level, mitigation strategies, infrared radiation absorption and environmental quality.

Introduction

Greenhouse gas emission is any gaseous compound in the atmosphere that is capable of absorbing infrared radiation, thereby trapping and holding heat in the atmosphere. By increasing the heat in the atmosphere, greenhouse gases responsible for the greenhouse gas effect, which ultimately leads to global warming (Lallannila, 2015). The challenges connected with the emission of greenhouse gases and the worsening quality of the environment has become of great concern to the environmentalists and policy makers alike. This was what led many countries of the world to enter into many international agreements including the Kyoto Protocol. The greenhouse gases which constitute important environmental issues are atmospheric gases that are transparent to radiation at one wavelength and absorb at another, usually at a longer wavelength (Anomohanran, 2011).

Greenhouse gas emission is one of the most important human impacts on the environment. It is a result of increased dependence on machines and equipments such as automobiles and generators, as well as enhanced chemical processes carried out in factories and power plants, cooking fire from firewood, and activities that have to do with bush burning, and incineration of refuse. Greenhouse gases includes carbon dioxide (CO2), methane (CH4), nitrous oxide (N_2O), chlorofluoro-carbons

(CFCs), perfluorocabons (PFCs) hydrocarbons (HFCs) (Giwa, Sulaiman & Nwaokocha, 2017) and Sulphur dioxide (Okedere, Sonibare, Ajala, Adesina & Elehinafe, 2017). The contribution of these emissions from the consumption of refined petroleum products to the national and global greenhouse gas emission level has been a threat over the years because of the resulting adverse environmental and health effects.

This study reviews the range of activities associated with or constituting the sources of greenhouse gas emission level, measurement of emission level on the environment and the strategies of mitigating the impact of the emission level on the environment in Nigeria. In order to get these goal and objectives of the study achieved, the paper is divided into the foregoing; introduction, sources of the greenhouse gas emission, measurement of emission in Nigeria, effects of emission on the environment and the strategies of mitigating emission level in the Nigerian environment.

Sources of Greenhouse Gas Emission

Greenhouse gas emissions (GHGs) are generated from both: natural and anthropogenic sources

(Majewski & Jaaskelainen, 2004). While the natural sources are lightening, forest fire, volcanic eruption and biological processes; anthropogenic sources include fuel combustion and natural gas leakages. However, the major sources of GHG emissions are transportation, industrial, commercial and residential, electricity, agricultural landuses and forestry. According to the department of Environment, USA, some greenhouse gases occur naturally in the atmosphere, while others results from human activities. Naturally occurring greenhouse gases include carbondioxide, methane, nitrous oxide, ozone and water vapour. However certain human activities add to the levels of these naturally occurring gases. The addition of manmade greenhouse gases to these atmospheric gases disturbs the earth's radiative balance with the consequences increasing the earth's surface temperature and the

related effects on climate, sea level rise and world agriculture.

According to Anomoharan (2015), human activities are responsible for almost all of the increase in greenhouse gases in the atmosphere over the years. The largest or primary sources of greenhouse gas emissions in Nigeria are from burning fossil fuels for electricity (industry, commercial and residential) and transportation. Greenhouse gas emission also emanate from activities like agriculture, land use and forestry. Hence, there are various sources of greenhouse gas emission in Nigeria. The major sources are highlighted below.

Transportation: Transportation involves the movement of people and good by cars, trucks, trains, boats, ships, airplanes, and other vehicles. The transportation sector generates the largest share of greenhouse gas emission. Greenhouse emission from transportation primarily come from burning fossil fuel for our cars, trucks, ships, trains, and plants. The dominant of greenhouse gas emission from transportation is carbon dioxide (CO_2) emission resulting from the combustion of petroleumbased products. Other emissions resulting from combustion of petroleum based product include methane (CH_4) nitrous oxide (N_2O) and hydrofluorocarbon (HFC). These emissions are particularly resultant emission from mobile air conditioners and refrigerated transport.

Industry: Industrial sector involves manufacturing processes which involves the conversion of raw materials into finished and semi-finished product. The industries generate greenhouse gases.

Greenhouse gas emissions from industry primarily come from incomplete burning of fossil fuels for energy. Greenhouse gas emission from industry also come from certain chemical reactions that produce goods from raw materials. Industries generate and release industrial waste. One major waste management practice of the industries is waste burning and through this, there are greenhouse gas emission such as carbon monoxide, suphur dioxide, oxides of nitrogen, halogenated carbons and other particulate matter.

Commercial and Residential: Greenhouse gas emission from business and residential, arise primarily from the operation of small, medium and large capacity fossil fuel electric power generators for electric power supply. These sources of emission have increased over the years due to persistent unsolved epileptic power supply in Nigeria. The burning of fuel wood in commercial and residential areas is another source of greenhouse gas emission. Some commercial and most residential activities attract the use of fuel wood for cooking and heating. Small scale industries such as bakeries and businesses such as restaurants use fuel wood during their production processes. Many people are using fuel wood due to the absence of cheap and readily available sources of cooking and heating in the country.

Electricity: Electricity production generates greenhouse gases. Greenhouse gas emissions come from burning fossil fuel such as the natural gas. The most dominant of the emissions is carbon dioxide (CO_2). Methane (CH_4) and nitrous oxide (N_2O) are other emission generated through the process of generation, transmission and distribution of electricity. Sulphur hexafluoride (SF6) though less than 1 percent emission is a product of an insulating chemical used in electricity transmission and distribution equipment. According to OYEDEPO, (2012) many Nigerians because of limited electricity supply from the national grid, provide their own electricity for business and personal use by means of privately owned fossil fuel powered generators. Key barriers to Nigeria's reducing its green gas emissions are dependence on fossil fuels for energy and foreign exchange as well as significant levels of gas flaring during petroleum exploration and protection.

Agriculture: Agricultural practices that contribute to greenhouse gas emission include soil management, crops and livestock production. Various practices of managing agricultural soil such as the application of synthetic and organic fertilizers have led to the emissions of nitrous oxide (N_2O). The burning of crop residues release CH_4 and N_2O as greenhouse gas emissions. Other emissions include CO_2 from urea application and CH_4 from paddy field for rice cultivation. The processes of managing manure from livestock also contribute to CH_4 and N_2O greenhouse gas emission.

Land Use and Forestry: Land and forest can be described as modes of storage of carbon. The storage of carbon in soil and plants is called biological carbon sequestration. The process by which CO_2 is taken out of the atmosphere by biological sequestration is referred to as "Carbon sink". Emission or sequestration of CO_2, CH_4 and N_2O can occur from management of lands in their current use or as lands are converted to other uses. For example, as cropland is converted into grassland, as lands are cultivated for crops, or as forests grow.

Measurement of Greenhouse Gas Emission Level in Nigeria

It is important to note that vehicles and generators are the dominant features in the anthropogenic sources that emit range of gases into the atmosphere. In addition to the CO2 – the principal greenhouse gas that contribute to climate change, these sources produce other emissions, such as volatile organic compounds (VOCs), carbon monoxide (CO) and oxides of nitrogen (NOx). They are unavoidable by – products of gasoline. Each liter of gasoline that is used produces about 2.3kg of CO2. This implies that anytime an engine starts, that engine is contributing to climate change. The consumption of gasoline and diesel are the dominant features of anthropogenic sources. In the anthropogenic sources, a very high degree of gasoline and diesel are consumed. Tables 1 and 2 show the quantity of gasoline and diesel consumed respectively and the emissions of CO_2, HC_4, N_2O and total GHGs due to the

consumption of gasoline and diesel from 1980 to 2014. As presented in the table, the total volume of gasoline and diesel consumed in the country for the period was

$2.13x10^{11}$litres and $7.37x10^{10}$ liters respectively.

Table 1 provides a lucid view of the consumption of gasoline in the Nigeria. It is provided in the table that the volume of gasoline consumed increased gradually from $3.87x10^{9}$ liters in 1980 to

$7.62x10^{9}$ liters in 1994 and then decreased in quantity rapidly from $7.62x10^{9}$ liters in 1994 to

$3.70x10^{9-}$ liters in 1998. The consumption of gasoline increased gradually again and sharply from $3.70x10^{9}$ liters in 1998 to $8.73x10^{9}$ liters in 2003 and from 2003 the quantity of gasoline consumed went on relatively steady until it got to highest point of consumption of $8.86x10^{9}$ liters in 2007. It was from this highest point of consumption in 2007 that the consumption reduced significantly in quantity to $3.97x10^{9}$ liters in 2014. Various quantities of CO_2, CH_2 and N_2O have been released into the atmosphere from gasoline consumption. A total of $7.37x10^{8}$, $1.32x10^{5}$, $1.41x10^{4}$ and $5.20x10^{8}$ tons of CO_2, CH_4, N_2O and GHGs (CO_2e) respectively were emitted into the environment from 1980 to 2014. On the bases of these values, an average of $3.80x10^{3}$ ton, 401.7 tons and $1.47x10^{7}$ tons of CH4, N_2O and CO_2 respectively were released into the atmosphere every year.

Table 2 shows the amounts of CO_2, CH4 and N_2O emitted into the atmosphere due to consumption of diesel from 1980 to 2014. A total of $2.08x10^{8}$ tons, $1.08x10^{4}$ tons and $6.32x10^{3}$ tons of CO_2, CH_4 and N_2O respectively were released into the atmosphere in the period under consideration. A total amount of GHGs (tCO_2e) released into the atmosphere for using diesel was $2.10\ x10^{8}$. Several studies conducted recently shows that various degrees of emissions were released into the atmosphere yearly. For instance, every year a total quantity of 308.7 tons, 180.4 tons, and

$5.94x10^{6}$ tons of CH_4 N_2O and CO_2 respectively were released into the atmosphere. (Climate Score Card, 2016)

The World Resources Institute (2014) estimated that Nigeria's greenhouse gas emissions in

2012 exceeded 296MtCO2e (excluding land use). The figure exceeded 474 MtCO2e when land was **Table 1: Gasoline Consumption and the Gases emitted**

Year	Gasoline (000 litres)[a]	Emission (tons)			
		CO_2	CH_4	N_2O	Total GHGs (CO_2e)
1980	3869818	9298360	2415	255	9428108
1981	4860224	11678099	3033	320	11841053
1982	5465344	13132077	3411	360	13315320
1983	5651216	13578688	3527	372	13768163
1984	5381646	12930967	3359	355	13111404
1985	5374591	12914016	3354	354	13094216
1986	4894484	11760420	3355	322	11924523
1987	4942233	11875149	3084	326	12040853
1988	5257146	12631819	3281	346	12808082
1989	5961088	14202606	3689	389	14400787
1990	5901055	14178997	3683	389	14376848
1991	5904312	14186823	3685	389	14384784
1992	5946668	14288569	3711	392	14487976
1993	7212077	17329109	4501	475	17570917
1994	7622474	18315206	4757	502	18570773
1995	5580844	13409597	3483	368	13596712
1996	5385917	12941229	3361	355	13121809
1997	5911286	14203581	3689	389	14401775
1998	3699548	8889238	2309	244	9013277
1999	5930124	14248845	3701	391	14447671
2000	4761073	11439860	2971	314	11599490

2001	7142715	17162447	4458	471	17401929
2002	8687595	20874470	5422	572	21165748
2003	8725938	20966600	5446	575	21259164
2004	8676810	20848556	5415	572	21139473
2005	8644260	20770345	5395	569	21060171
2006	8306985	19959944	5184	547	20238461
2007	8859802	21288247	5529	584	21585299
2008	7206729	17316258	4498	475	17557886
2009	6876577	16522973	4292	453	16753531
2010	6353518	15266172	3965	419	15479193
2011	5688450	13668152	3550	375	13858875
2012	5017535	12056085	3131	331	12224314
2013	3816267	9169690	2382	251	9297642
2014	3969710	9538380	2478	262	9671477
Total	213435847	736988399	133206	14061	519997702

Source: Giwa et al (2017) included (CAIT Climate Data Explorer, 2015). The data available for the period of 2000 –

2012 showed an upward trend in emissions with drops in levels for 2007 through 2009, compared to 2006 values (280 MtCO2e without land use and 463 MtCO2e with land use) and 11points (including land use) higher than 2006 levels. In a list compiled by the world resources institute (2014), which was based on data for carbon dioxide, methane, nitrous oxide, perfluorocarbon, hydrofluorocarbon, and sulfur hexafluoride emissions, Nigeria was 29th out of the list of countries

Table 2: Diesel Consumption and the Gases emitted

Year	Diesel (000 litres)[a]	Emission (tons)			
		CO_2	CH_4	N_2O	Total GHGs (CO_2e)

1980	2318351	6541866	340	199	6610582
1981	2725912	7691911	400	234	7772707
1982	2909688	8210486	427	249	8296730
1983	3003085	8474031	440	257	8563042
1984	2799597	7899833	410	240	7982813
1985	2569897	7251673	377	220	7327844
1986	2207401	6228790	324	189	6294217
1987	2052459	5791580	301	176	5852415
1988	2266466	6395457	332	194	6462635
1989	2385501	6731348	350	204	8102232
1990	2841477	8018010	417	243	6802054
1991	2842682	8021409	417	244	8105666
1992	2227829	6286432	327	191	6352465
1993	4016018	11332301	589	344	11451336
1994	2755092	7774252	404	236	7855913
1995	2702682	7626362	396	232	7706569
1996	2701144	7622021	396	231	7702083
1997	2486369	7015975	365	213	7089671
1998	1337987	3775499	196	115	3815157
1999	1977203	5579223	290	169	5837827
2000	1985639	5603027	291	170	5661882
2001	2664542	7518739	391	228	7597716
2002	2645976	7466350	388	227	7544777

2003	2375711	6703723	348	204	6774139
2004	1916000	5406522	281	164	5463312
2005	2368000	6681964	347	203	6752152
2006	1649749	4655221	242	141	4704120
2007	1684956	3908036	203	119	3949086
2008	1273203	3592693	187	109	3630431
2009	648417	1829687	95	56	1848906
2010	879368	2481378	129	75	2507442
2011	977892	2759391	143	84	2788376
2012	676728	1909574	99	58	1929632
2013	733822	2070681	108	63	2092432
2014	397898	1122779	58	34	1117750
Total	73704739	207978221	10806	6315	730160537

Source: Giwa et al (2017) numbering 186. The emission data however, did not include land use change and forestry, because individual countries vary vastly in size and population (Wikipedia, 2018).

Effects of Greenhouse Gas Emissions on the Environment in Nigeria

Greenhouse gases cause global warming. Three factors affect the degree to which any greenhouse gas will influence global warming: its abundance in the atmosphere, how long it stays in the atmosphere and its global warming potential. Carbon dioxide has a significant impact on global warming partly because of its abundance in the atmosphere. According to the EPA, in 2012, US greenhouse gas emissions totaled 6,526 million tons of carbon dioxide equivalents, which equaled 82% of all human caused greenhouse gases. CO2 stays in the atmosphere for about two thousand years. Methane is about 21 times more efficient at absorbing radiation than CO2, giving it a high global warming potential rating, even though it stays in the atmosphere only about 10 years, according to EPA (Lallanilla, 2015).

Warming affects atmospheric circulation, which affects global rainfall pattern resulting in environmental changes and challenges such as extreme weather, rising sea

levels, plants and animal extinctions, ocean acidification, major shift in climate and unprecedented inevitability of social upheaval. Apart from the environmental effects, greenhouse gas emissions also cause health effects. For example, health studies show that exposure to emission like nitrogen oxides (NOx), carbon monoxide (CO), particulate matter (PM), hydrocarbon (HC), volatile organic compound (VOCs) all affects the respiratory system and worsens asthma, allergies, bronchitis and lung functions and heart diseases.

Scientists have stated that the worlds ocean are warming far more quickly than previously thought because almost all the excess heat absorbed by the plant ends up in their waters. The oceans are heating up 40% faster on average than a United Nations' panel estimated five years ago. It has been noted that ocean temperatures have broken records for several straight years. 2016 was the warmest, 2017 was the warmest and 2018 was the warmest. As the planet has warmed, the oceans have provided a critical buffer. They have slowed the effects of climate change by absorbing 93% of the heat trapped by the greenhouse gases humans pump into the atmosphere. If the ocean wasn't absorbing as much heat, the surface of the land would heat up much faster than it is right now. But the surging water temperatures are already killing off marine ecosystems, raising sea levels (because warmer water takes up more space than colder water) and making hurricanes more destructive. As the oceans continue to heat up, those effects will become more catastrophic (Pierre – Louis, 2019). Significant amounts of SO_2 particles have been released to the air globally, due to combustion (Kasper et al., 2007). Sulphur which is mostly oxidized to SO_2 during combustion is a major constituent of the primary particles in the exhaust from gasoline and diesel powered engines from the combustion of fuel (Kasper et al., 2009).

The main environmental concerns related to SO_2 emissions are acid rain and the formation of particulate matter (PM). Acid rain has many negative environmental impacts, which include the acidification of aquatic systems, increase in soil acidity, and damage to vegetation (Schmidt, 2006).

Acid rain can also cause the degradation of buildings and other human infrastructure (U.S. Environmental Protection Agency, 1998). The PM emissions result in reduced visibility and also have impacts on human health. The human health impacts of PM are generally related to respiratory illness, including increased frequency in bronchitis and asthma. These illnesses have led to an increase in premature mortality (Schmidt, 2006 and Olatunji et al, 2015).

EGSA (2016) observed that Sulphur dioxide SO_2 is a toxic gas which is directly harmful to human health. It is heavier than air and has suffocating odour at an atmospheric concentration of around 500 parts per billion (ppb), at which level it can

be fatal. The formations of sulphates in the form of aerosols or very fine airborne particles have been linked to increased asthma attacks, heart and lung disease and respiratory problems in susceptible groups. Sulphur dioxide can form acidic aerosols which are precipitated as acid rain, snow or fog. Acid disposition has been linked with the acidification of ground and surface water, deforestation, reduction and even elimination of aquatic life and building decay (EGSA, 2016).

The negative impact of GHGs on agriculture and food security, especially in tropical and subtropical regions is expected to increase the risk of hunger by additional 80 million people by 2080 in Africa and Southern Asia (Odjugo et al., 2001). Odjugo (2009) revealed that GHGs which caused climate change have led to a shift in crops cultivated in Northern Nigeria. The study reported that as at 1978, the farmers preferred the cultivation of groundnut and maize, but due to increasing temperature and decreasing rainfall amount and duration occasioned by climate change, the farmers as a means of adaptation in 2007 shifted to the production of millet followed by maize and beans (Giwa et al 2017). Table 3 buttresses and presents more facts on the effects of greenhouse gas emissions to man and his environment.

Strategies of Mitigating Greenhouse Gas Emission in the Environment

Based on the foregoing, the following are therefore put forward as effective strategies of reducing greenhouse gas emission in the environment. There has to be an increased plants efficiency by promoting switching from a less efficient to a more efficient energy source e.g. LPFO and diesel to natural gas. Fuel switching is the strategy of using fuel that emits less CO_2 than fuels currently being used. This include natural gas, bio fuels, hydrogen and electricity from renewal sources, such as wind and solar. This can amount to using public buses that are fueled by compressed natural gas rather than gasoline or diesel; or using electric or hybrid automobiles, provided that the energy is generated from lower carbon or non-fossil fuels. This strategy has the capacity of reducing emission in both transportation and industrial sector in Nigeria.

There has to be a strategy of putting in place appropriate legislation to discourage gas flaring and other greenhouse gas emission in Nigeria. Measures have to be put in place to check the increasing emission in the environment. National environmental standards and regulations enforcement agency (NESREA) is an agency already established in Nigeria for emission control as substantial part of its functions. NESREA should be made to roll out gas emission control programmes aimed at improving air quality in the country.

The programmes must involve vehicular industrial and generator gas emission schemes aimed at reducing the gas emissions by vehicles and generators which might pose health risks to the people. NESREA programmes should include emission control

programmes where emission testing centres shall be established for the testing of effluents from vehicles and generators to ensure that they satisfy the required air quality standards for Nigerian environment, and violations of such standards should attract sanctions. Land, crop, livestock and manure management strategy is a strategy that provided opportunities for reduction of emission in agricultural sector.

Table 3: Sources and Effects of Greenhouse Gas Emission in the Environment

Pollutant	**Natural source**	**Anthropogenic source**	**Environmental effect**
Nitrogen oxides ($NO+NO_{2)}$	Lightenings, soil bacteria	High temperature fuel combustion, motor vehicles, industrial and utility	Primary pollutants that produce photochemical smog, acid rain, and nitrate particulates. Destruction of stratospheric ozone. Human health impact.
Particulate matter	Forest fires, wind erosion, volcanic eruption	Combustion of biofuels such as wood and fossil fuels such as coal or diesel.	Reduced atmospheric visibility. Human health impact. Black carbon particulates contribute to global warming
Sulfur dioxide	Volcanic eruptions and decay	Coal combustion ore smelters, petroleum refineries, diesel engines burning high-sulfur fuels.	Acid rain, Human health impact
Carbon monoxide	Unnoticeable	Rich and stoichiometric combustion, mainly from motor vihicles	Human health impact
Carbon dioxide	Animal respiration, decay, release from oceans	Fossil fuel and word combustion	Most common greenhouse gas

Non-methane hydrocarbon (VOC)	Biological processes	Incomplete combustion, solvent utilization	Primary pollutants that produce photochemical smog
Chloroflourocarbons (CFC)	None	Solvents, aerosol propellants, refrigerants	Destruction of stratospheric
Methane	Anaerobic decay, cud chewing animals, oil wells	Natural gas leak and combustion	Greenhouse gas
Ozone	Lightening, photochemical reactions in the troposphere	Secondary pollutant produced in photochemical smog	Damage to plants, crops, and man-made products. Human health impact

Sources: Majewsky & Jaaskelainen (2004)

Drawing water from wet land or soil for rice during the growing season reduces CH_4 emission. Application of appropriate amount of fertilizer is the one that enhance crop production. Over application of nitrogen for instance leads to higher N_2O emission. Improvement in the quality of pasture for animal productivity reduces the amount of CH_4 emitted per unit of animal product.

Emissions are reduced through manure management by controlling the way in which manure decomposes to reduce N_2O and CH_4 emission; and capturing CH_4 from manure decomposition to produce renewable energy. This can be achieved by managing manure in anaerobic containment areas to maximize the production of CH_4 and to capture the methane to use as energy substitute for fossil fuels.

Nigeria has to introduce the strategy of introducing incentives to promote the utilization of gas and availability of gas, reforestation and control of desert encroachment to reduce greenhouse gas emission in Nigeria. Besides, land management practice as a strategy has to be encouraged in Nigeria. This strategy reduces greenhouse gas emissions by minimizing the conversion of forest land to other land uses, such as settlements and croplands. There has to be an improved grazing management practices on grassland, in Nigeria. Green building techniques and retrofits strategy should also be adopted to allow homes and commercial buildings to use less energy (for heating, cooling, lighting and other functions) leading to lesser greenhouse gas emissions. Waste management strategy is another strategy of

reducing emission in the residential and commercial sector. This strategy works by the decomposition of solid waste sent to landfills and capturing and suing methane produced in the landfills.

Conclusion

In this study greenhouse gas emission in Nigeria has been investigated including the range of activities associated with or constituting the sources of greenhouse gas emission, measurement of the emission level on the environment and the strategies of mitigating the impact of the emission level on the environment in Nigeria. Many countries have taken different measures to deal with the issues of global warming, including other greenhouse gas effects based on their respective sources and levels of greenhouse gas emissions. The peculiar nature of the sources and the level of greenhouse gas emissions in Nigeria prompted the foregoing strategies. It is therefore the hope of this paper that those suggestions recommended as strategies will contribute substantially towards ensuring an endurable practical solution to the problems of greenhouse gas emissions in Nigeria and across the world.

References

Anifowose B. and Odubela, M. (2016), Methane emissions from oil and gas transport facilities – exploring innovative ways to mitigate environmental consequences. http// dx. Doi.org

Anomohanran O. (2011), Estimating the greenhouse gas emission from petroleum product combustion in Nigeria, *journal of applied science*, II: 3209 – 3214. https//scialert.net//abstract/?don=jas 2011.3209.3214

CAIT Climate Data Explorer (2015), CAIT-historical emissions data (countries, U.S. States, UNFCCC). *CAIT Climate data Explorer*, Washington, DC: World Resources Institute. http:

//cait.wri.org

Climate Score Card (2016), Nigeria emission reduction challenges, *www.climatescorecard.org*

EGSA (2016), what are the effects of sulphur oxides on human health and ecosystem?. Exhaust gas cleaning system association (EGSA) *www.egcsa.com/technical .reference*

Giwa S.O., Sulaiman M. A. and Nwaokocha C.N. (2017), Inventory of greenhouse gases emissions from gasoline and diesel consumption in Nigeria, *Nigerian journal of technological development*, 14

(1), 1-12.

ICF International, (2016), "Nigeria Summary" in Analysis of Intended Nationally Determined contributions (NDCs), USAID Resources to Advance LEDS Implementation program, pp. 35-36.

https://www.climatelinks.org/site/default/file/asset/document/INDC%20White%20Paper%20%20202016_public_RALI.pdf

Lallanila M. (2015), Ggreenhouse gas emission: causes and sources, *Livescience*, www.livescience.com/37821

Majewsky W. A. and Jaaskaelainen, H.,Environmental (2004), Effects of emissions, *www.dieselnet .com/tech/env.effect*

Mohajan H.K. (2012), Dangerous effects of Methane Gas in Atmosphere, *Journal of Economics and political integration*, 2(1), 3 – 10

Okedere O. B., Sonibare J. A., Ajala O.E., Adesina O.A. and Elehinde F. (2017), "Cogent environmental science", *https//doi. Org/10.1080/23311843*

Olatunji S. O., Fakinle B.S., jimoda L.A., Adeniran J. A. and Adesanmi A. J. (2015), "Air emission of sulphur dioxide from gasoline and diesel consumption in the southwestern states of Nigeria", *Petroleum Science and Technology*, Taylor and Francis.

Oyedepo S. O. (2012), Energy and Sustainable developments in Nigeria: the way forward. Energy, Sustainability and society, Springer open,

Sources of Greenhouse Gas Emission, United States Environmental Protection Agency www.epa.gov/ghgemissions/sources.com visited on 11/10/2018.

Pierre – Louis K. (2019), Ocean warming is accelerating faster than thought, new research finds, *The New York Times*, January 10, 2019.

Uhuegbu C. C. (2013), Measurement of carbon monoxide emissions in some selected area in Lagos State, *Journal of scientific research and reports*, 2(2), pp.536 – 543.

USEPA (2018), "Sources of greenhouse gas emission", United States environmental protection agency. *https://www.epa.gov/ghgemission/source*

Wikipedia (2018), List of countries by greenhouse gas emissions, *en.m.wikipedia.org/wiki/list*