PROPOSING AN EFFECTIVE TOOL FOR COMBATING CLIMATE CHANGE IN NIGERIA: RENEWABLE ENERGY AS AN ALTERNATIVE SOURCE OF ENERGY

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ABSTRACT

Climate change refers to a long-term fluctuation in weather conditions, especially increase in temperature and storm activity. This is mainly caused by the concentration of greenhouse gases which trap infra-red radiation from the earth's surface and thus causes greenhouse effect. The earth we live in is covered by the atmosphere which contains a thin layer of mixed gases, including the air we breathe. Human activities such as fossil fuel combustion, production of cement and lime, gas flaring, deforestation and industrial processes have led to an increase in greenhouse gases concentration in the atmosphere. This paper examines climate change in Nigeria. The paper found that climate change has affected economic activities in various parts of Nigeria by causing flooding in the Niger Delta and other parts of Nigeria, acid rain in Rivers State, and desertification in Northern Nigeria. Furthermore, excessive use of oil and gas products, bush burning, deforestation, non-implementation of planning laws are all responsible for climate change in Nigeria. The paper examines the need for renewable energy and argues that renewable energy must be promoted over fossil fuels to combat climate change in Nigeria.

"... Climate Change is not just an environmental issue but is also a fundamental development issue" – former UN Secretary-General Kofi Annan.[1]

Introduction

The paper appraises the causes and effects of climate change in Nigeria. It discusses the extent to which the international community has responded to climate change in the form of reaching international agreements to address the said effects and threats. Furthermore, the paper discusses the important role

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[1] Muller B. "The North-South Divide and Climate Change Divide" in P. Hayden et al. (eds.) *Debating Environmental Regimes* (New York: Nova Science Publishers, 2002), 37 at 43.

renewable energy sources can play in combating climate change in Nigeria. Finally, the paper discusses the climate change debate, and looks at the investment in renewable energy which could pose challenges.

Climate change refers to a long-term fluctuation in weather conditions, especially increase in temperature and storm activity. This is mainly caused by the concentration of greenhouse gases which trap infra-red radiation from the earth's surface and thus causes greenhouse effect. The earth we live in is covered by the atmosphere which contains a thin layer of mixed gases, including the air we breathe. Human activities such as fossil fuel combustion, production of cement and lime, gas flaring, deforestation and industrial processes have led to an increase in greenhouse gases concentration in the atmosphere. This paper examines climate change in Nigeria. The paper found that climate change has affected economic activities in various parts of Nigeria by causing flooding in the Niger Delta and other parts of Nigeria, acid rain in Rivers State, and desertification in Northern Nigeria. Furthermore, excessive use of oil and gas products, bush burning, deforestation, non-implementation of planning laws are all responsible for climate change in Nigeria. The paper examines the imperative for renewable energy and argues that renewable energy must be promoted over fossil fuels to combat climate change in Nigeria.

A General Overview of Climate Change and Global Warming in Nigeria

The Intergovernmental Panel on Climate Change (IPCC) defines climate change as "… change in the state of the climate that can be identified, (e.g. using statistical test), by change in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change also refers to a long-term fluctuation in weather conditions, especially increase in temperature and storm activity. This is mainly caused by the concentration of greenhouse gases which trap infra-red radiation from the earth's surface and thus causes greenhouse effect. The earth we live in is covered by the atmosphere which contains a thin layer of mixed gases, including the air we breathe. Human activities such as fossil fuel combustion, production of

cement and lime, gas flaring, deforestation and other industrial processes have led to an increase in greenhouse gases concentration in the atmosphere. While all regions will eventually feel the effects of climate change, it will have a disproportionately harmful effect on developing countries and in particular poor communities who are already living at or close to the margin of survival. Changes in the climate will amplify the existing challenges posed by tropical geography, a heavy dependence on agriculture, rapid population growth, and a limited capacity to cope with an uncertain climate. Changes in climate can be due to natural variability or as a result of human activity."[2] Changes as a result of natural variability are inherent, and it creates a balance in the atmosphere. However, the international community is concerned about the changes occurring as a result of human activity. There is a general consensus that the effects of climate change,[3] as a result of human activity, on humans, the environment and ecological processes are negative and will continue to be so. Some of these include an effective doubling of carbon dioxide (CO_2) in the atmosphere and a consequent increase of global mean temperature, as well as extreme weather conditions, which can reduce agricultural crop yield and aggregate food production.[4] Scientists

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2 Pachuri R. and Reisinger A. (eds.), Climate Change 2007: Synthetic Report Contributions of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Geneva: IPCC, 2007), 30.

3 For literature on climate change generally see: Parry M. and Carter T., *Climate Impact and Adaptation Assessment: A Guide to the IPCC Approach* (London: Earthscan, 1988), 5; Houghton J. et al. (eds.) *Climate Change: The IPCC Scientific Assessment* (Cambridge: Cambridge University Press, 1990); Dessler A. and Parson E., *The Science and Politics of Global Climate Change*: *A Guide to the Debate* 2nd Change edition. (Cambridge: Cambridge University Press, 2010); G. O'Hare et al, *Weather, Climate and Climate change* (Harlow: Prentice Hall, 2005); and Drakes F., *Global Warming: the Science of Climate Change* (London; Arnold, 2000), 15.

4 Adejonwo-Osho O., Effective Fulfilment, Implementation, and Supervision of the Validation and Registration Requirements for Clean Development Mechanism (CDM) Project: A Missing Link in the

also agree that developing countries are likely to suffer more from the adverse impact of climate change than developed countries.[5] This is because they have less capacity to mitigate and adapt to the negative effects of climate change, and are therefore most vulnerable, although they have contributed the least to the problem.[6]

Because of the undesirable effects of climate change, it has become necessary to deal with it. The United Nations (UN), in several resolutions leading to UN Resolution 44/207, declared that there is a need to address with urgency the question of Climate Change.[7] To achieve this goal, the Climate Change regime (CCR) was established. The regime comprises two international treaties, the United Nations Framework Convention on Climate Change (UNFCCC)[8] adopted in 1992, and the Kyoto Protocol (KP) adopted in 1997. In addition to the above named international treaties, other efforts have been made to combat climate change. These efforts include the works of Scientists and Scholars, who have proposed different measures to deal with climate change. This paper posits that a paradigm shift from fossil fuel resources to renewable energy resources will help combat climate change in Nigeria.

Renewable energy is generally defined as energy that comes from resources which are naturally replenished on a human timescale such as sunlight, wind, rain, tides, wave and geothermal heat.[9] Rapid deployment of renewable energy and energy

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Achievement of the Sustainable Development Objective of the CDM. (University of Dundee, unpublished Ph. D thesis, 2012).

5 Wilson B. and Spannagle M., *The Complete Guide to Climate Change,* 97; and Bulkeley H. and Newell P., *Governing Climate Change* (Abingdon: Rutledge, 2010), 29.

6 Ayers J. and Hug S., 'supporting adaptation to climate change: what role for official development assistance?' (2007) 27 (6) Development Policy Review, 681.

7 See A/RES/43/53, 70th Plenary Meeting, 6 December, 1988.

8 United Nations Framework Convention on Climate Change (New York) 9 May 1992, in force on 24 March, 1994.

9 Omar E., Haitham A., Frede B., Renewable Energy Resources: *Current Status, Future Prospects and their Enabling Technology.* Renewable and Sustainable Energy Reviews, 39 (2014), 749.

efficiency is resulting in significant energy security, climate mitigation and economic benefits.[10]

While many renewable energy projects are large-scale, renewable technologies are also suited to rural and remote areas and developing countries, where energy is often crucial in human development.[11]

United Nations Secretary-General, Ban Ki-moon has said that renewable energy has the ability to lift the poorest nations to new levels of prosperity.[12] This paper aligns with this position of the Secretary-General because renewable energy can help to combat climate change as the resultant effect of climate change is poverty, hunger and diseases among other things. Thus renewable energy by controlling climate change will help in no small measures to fight poverty and lift the poorest nations to new levels of prosperity.

The need to ensure an unpolluted environment and energy security has been the major factor that triggers the use of renewable energy. Electricity is considered one of energy forms generated mainly from the use of fossil fuels. The large consumption of fossil fuels emits carbon dioxide into the atmosphere and creates environmental problems. Therefore, renewable energy has been identified by scholars and environmentalists as an alternative energy source in the actualization of energy security, diversification, climate change mitigation and sustainable development.[13]

Climate change is a difficult, complex and challenging problem for several reasons. One reason is that the earth responds on different time scales than do political systems. Once carbon dioxide is emitted, it remains in the atmosphere for centuries, and other greenhouse gases (GHGs) can remain in the atmosphere for

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10 International Energy Agency (2012) "Energy Technology Perspectives", 2012.

11 World Energy Assessment (2001) Renewable Energy Technologies, 221.

12 Leone S., "U. N. Secretary-General: Renewables Can End Energy Poverty." Renewable Energy World. (2011).

13 Oniemola P. K, "Extending the Paradigms of International Law and International Institutions in Advancing the Development of Renewable Energy" (2009). *Nigeria Journal of Petroleum, Natural Resources and Environmental Law I (2) 1-24.*

millennia.[14] Because GHGs have such long residency times in the atmosphere, their effects on climate extend far into the future. Even if all GHG emissions ceased immediately, there would be at least another 0.7 degree Celsius of warming in addition to the 0.8 degree Celsius of warming that has already occurred.[15] Globally, emissions are increasing, as are atmospheric concentrations of carbon dioxide. In the mid-eighteenth century there were 280 parts per million (ppm) of carbon dioxide in the atmosphere, while at the start of the twenty-first century the number had risen to more than 383 ppm.[16]

The resultant effects of climate change can be manifested in the following ways; "a rise in average temperatures, often referred to as 'global warming'; changes in rainfall patterns leading to floods, droughts and, in some areas, desertification; extreme and unpredictable weather patterns leading to more numerous and intense natural disasters; and the melting of glaciers and the polar ice-caps resulting in rising sea levels and coastal erosion, rendering low-lying areas uninhabitable.[17]

Climate change is a new environmental concern that has become predominant over the last ten years, although it was barely in the consciousness of politicians or the public twenty years ago.[18] The likely physical and social consequences of climate change, and the universal nature of those consequences, have made it the single biggest global concern. Compared with other environmental issues, it is high on the international political agenda. International laws on the subject, in particular the Kyoto Protocol, are perhaps some of the environmental laws best known to the general public.[19] Because these international laws have in recent times sought to demand from States compliance with some quite specific and difficult obligations, climate change has become one of the most

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14 Ogbodo S. G., "Climate Change and Natural Disasters: Issues and Perspectives", *Olabisi Onabanjo University Journal of Public Law* 1, no. 3 (2013): 2.

15 Ibid.

16 Ibid.

17 Ibid.

18 Thornton J., and Beckwith S.*, Environmental Law*, 2nd Edition, (London: Thomson, Sweet and Maxwell, 2004), 51.

19 Ibid.

controversial and "politicised" environmental issues. For instance, as at the time of the Kyoto Protocol, United States policy on climate change was to focus on clean technologies, whilst largely continuing with "business as usual". The US as at that time did not intend to give its support to the main piece of international climate change legislation – the Kyoto Protocol.[20] As the then President of the US, George Bush put it:

> The approach taken under the Kyoto Protocol would have required the United States to make deep and immediate cuts in our economy to meet an arbitrary target. I will not commit our nation to an unsound international treaty that will throw millions of our citizens out of work.[21]

By contrast however, EU policy is both to develop new technologies and to seek the reduction in emission of greenhouse gases (the gases which cause the earth to warm up) demanded by the Kyoto protocol. UK policy is to go much further than is required by the Kyoto Protocol in reducing domestic emissions of carbon dioxide.[22]

The contribution of developing countries to historic and current emissions of greenhouse gases has been less than that of the developed world. Developing countries are therefore currently subject to less onerous international obligations than the developed world. Meanwhile, the impacts of climate change will be felt most in the developing states.[23]This is not only because their arid terrain is likely to be affected more than land in the developed world, but because their poverty means they will be less able to take measures to adapt to climate change. The implication of this is that the

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20 Ibid.

21 From a speech by George W. Bush, February 2002, announcing the "Clear Skies and Global Climate Change Initiative": www.whitehouse.gov/news/releases/2002/02. (Accessed on September 15, 2015).

22 Thornton J., and Beckwith S., supra n. 71, 52.

23 Ibid.

drafting, passing and implementation of international climate change obligations will be by no means straightforward.[24]

The basic principle of climate change is simple. Several types of gases can reflect or trap heat, and so cause the world to warm up, as if a blanket had been wrapped around it, or as if it had been placed in a greenhouse. These gases include carbon dioxide, methane, CFC gases, ozone, water vapours and nitrous oxide (laughing gas). These are known as "greenhouse gases". Carbon dioxide is the main contributor to the greenhouse effect.[25] The greenhouse effect is desirable- without it the earth will be too cold. However, the problem arises because human activity has increased the quantity of greenhouse gases, in particular carbon dioxide in the atmosphere. About 80 percent of this extra "man-made" carbon dioxide comes from the burning of oil, coal and gas, whilst about 20 percent comes from deforestation, and other land changes that have prevented atmospheric carbon dioxide from being naturally absorbed.[26]

Approximately 30 to 55 percent of the carbon dioxide produced by burning fossil fuels is absorbed by the sea, forests and plants.[27] The remainder is added to the atmosphere, with the effect that the concentration of atmospheric carbon dioxide has increased considerably from pre-industrial times to the present day. This in turn has led to an increase in the earth's temperature, known as the anthropogenic greenhouse effect. The effects are likely to vary from region to region. Social impacts may follow, including those

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24 Ibid.

25 Ibid.

26 Lomborg B., *The Sceptical Environmentalist: Measuring the Real State of the world* (Cambridge: Cambridge University Press, 2001), 258 (First published in Danish in 1998).

Bjorn Lomborg, a young Danish academic, is one of the most interesting characters in the climate change debate. As the Wall Street Journal's Keith Johnson wrote: "If the global warming circus has a bad boy, it's Bjorn Lomborg". In his book, Cool It, Lomborg acknowledges the existence of man-made global warming, but argues that: (1) Its impacts have been wildly exaggerated; and (2) proposed cap and trade solutions, while well intended, will not benefit human prosperity. In addition to his writings, Lomborg is known for successfully feuding with Denmark's Committee on Scientific Dishonesty.

27 Ibid, 260.

arising from an increased risk of diseases like malaria, hunger, lack of water or flooding.[28]

Climate change is one of the most pressing challenges of our time. It is a global problem, but experienced very differently in the developed and developing worlds. While the academic literature on climate change and law is vast, there is a significant gap. Little attention has been devoted to current and future issues concerning climate law in developing countries like Nigeria. Furthermore, in Nigeria, there is no legislative framework on renewable energy aimed at combating climate change. This study attempts to fill that gap.

Climate change issues have taken a centre stage over the years, that the United Nations Secretary General, Ban Ki-moon described climate change as the "defining issue of our era." We align ourselves with this assertion because climate change is indeed one of the most pressing challenges of our time. It is indeed a global problem. The UNFCCC technically makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes.

Renewable Energy

Renewable energy is energy which comes from natural resources such as sunlight, wind, rain, tides and geothermal heat, which are renewable (naturally replenished).[29] In 2008, about 19% of global final energy consumption came from renewables, with 13% coming from traditional biomass, which is mainly used for heating, and 3.2% from hydroelectricity. New renewables (small hydro, modern biomass, wind, solar, geothermal and biofuels accounted for another 2.7% and are growing very rapidly). The share of renewables in electricity generation is around 18%, with 15% of global electricity coming from hydroelectricity and 3% from new renewables.[30]

Renewable Energy as an Alternative Source of Energy

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28 Ibid.

29 Renewables 2010 Global Status Report, 15.

30 Global Status Report 2007, REN 21 Secretariat, 51.

Oil and gas have contributed immensely to human civilization. Energy from oil and gas provides heat, light and power for use in homes, transport and industry. Despite the benefits associated with oil and gas, its exploration and production has enormous environmental cost. A large percentage of greenhouse gas and carbon dioxide emissions are associated with the use of oil and gas. In addition, oil and gas is a finite resource, and its production cannot be sustained on the long term. This therefore makes it imperative, to seek alternative sources of energy. Renewable energy resources, the younger one to the twins, thus presents itself as a viable alternative to take the place of his elder brothers – oil and gas.[31]

The reason for the attention given presently to the utilization of renewable sources of energy is inherent in their nature. Amongst them are:

1. Availability

The amount of solar energy intercepted by the earth every minute is greater than the amount of energy in the world's daily consumption of fossil fuel. Tropical oceans absorb 560 trillion Gigajoules (GJ) of solar energy each year, an amount equivalent to 1600 times the world's annual energy use.[32] It is reported that the energy in the winds that blow across the United States each year would produce more than 16 billion GJ of electricity, more than one and half times (1 ½) the electricity consumed in the United States in the year 2000. Also, annual photosynthesis by the vegetation in the United States is 50 billion GJ, which is equivalent to nearly 60% of the nation's annual fossil fuel use.[33]

Renewable energy sources have been criticized because of what a few regard as their intermittent nature. However, it is submitted that a variety of renewable energy sources in combination can overcome this problem. Thus, where there are stormy weather, a scenario which is bad for direct solar collection,

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31 Atsegbua L.A., 'Beyond Oil and Gas: "The Tale of Nature's Unidentical Twins," Being an Inaugural lecture delivered on January 17, 2008, ii. (Hereinafter referred to as "Atsegbua, Inaugural Lecture").

32 Ibid.

33 Ibid.

same is generally good for windmills and hydropower plants that make use of tidal or wave energy; dry sunny weather is bad for hydro power but ideal for photovoltaic.[34]

The challenge of variable power supply may be further alleviated by energy storage. Available storage options include pumped-storage hydro systems batteries, hydrogen fuel cells and thermal mass. Initial investments in such energy storage systems can be high, although the cost can be recovered over time, during the life span of such system.

2. Cost

Renewable energy technologies encompass a broad diverse array of technologies which are all at different levels of development. Some technologies are already mature and economically competitive (for example geothermal and hydropower) while others need additional development steps to make them competitive and economically viable. The cost of exploration and exploitation of renewable energy may appear expensive and investors may not be able to make profit in the short run, but the comparative advantages and maximum profit and return in the long run is great, coupled with the fact that renewable energy does not produce greenhouse gases which deplete the ozone layer with catastrophic impact.[35]

3. Reliability

Renewable energy sources are often dismissed as unreliable. It is submitted that this is not the case as installations are usually sited where the natural source of the renewable energy is located. Windmills or watermills are usually constructed in the part of winds or along water ways. The same is the case where hydro-power is being used. Also, when renewable energy sources do fail, they generally fail for shorter period than large power plants. Furthermore, sites put to use for the generation of renewable energy are not usually large and can go unnoticed by saboteurs, thus placing them in a better position compared to

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34 Ibid.

35 Atsegbua Inaugural Lecture, 24.

installations used for the exploration and exploitation of fossil fuel which have presently become a tool for blackmail in the hands of saboteurs and economic terrorists in countries like Nigeria.[36]

It is suggested that the Nigerian people and indeed people from all other countries of the world, need renewable energy policy as the comparative advantages enumerated above certainly outweighs whatever criticisms may trail it, and for it to be viable, it must be self-reliant and must exhaust all technologies at its disposal for the interest of the present and future generations. Furthermore, it must have regulatory and legislative framework necessary to implement these technologies and policies that will make it a reality in practice. When a regulatory framework on renewable energy is put in place in Nigeria, this will help combat climate change.

Before we delve into how renewable energy can be used as a tool for combating climate change, it is important that we look briefly at the sources of renewable energy.

Sources of Renewable Energy

There are varied sources of renewable energy. Each source has its own unique characteristics which influence how and where they are used. They include:

i. Hydro energy
ii. Solar energy
iii. Bio Energy (biomass)
iv. Wind energy
v. Firewood.

Renewable Energy as a Tool for Combating Climate Change

Climate Change has long ceased to be a scientific curiosity, and is no longer just one of many environmental and regulatory concerns. It is a growing crisis with economic, health and safety, food production, security and other dimensions.[37]

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[36] Vanguard Newspaper 20th April, 2007 wherein MEND spokesman said they will blow up fuel pipeline carrying crude oil if their demands were not met, have become a regular sight in Nigeria dailies.

[37] Kazem H.A., Kazem A.A., Altay A.A., Climate Change and Renewable Energy, the 1st International Applied Geological Congress, Islamic Azad University, Iran.

The need to ensure an unpolluted environment and energy security has been the major factor that triggers the use of renewable energy. Electricity is considered one of energy forms generated mainly from the use of fossil fuels. The large consumption of fossil fuels emits carbon dioxide into the atmosphere and creates environmental problems.[38] Therefore, renewable energy has been identified as an alternative energy source in the actualization of energy security, diversification, climate change mitigation and sustainable development.[39]

The dependence on fossil fuels contributes negative effect through a rise in global energy consumption, rising prices of fossil fuels, depletion of fossil fuel resources and the environmental problems associated with fossil fuels. Therefore, the world needs a massive scale- up in renewable energy to face the challenges of increasing global energy demand, global warming and rising energy prices. The major drivers for the promotion of renewable energy are the need to address the problem of energy security, climate change and economic development. The 1970s energy crisis established the need for consideration of renewable energy as an alternative energy source to ensure energy security which was later intensified by the growing concerns about climate change in the 1990s.[40] According to Clement Davies, investment in renewable energy requires the enactment of a clear, well-coordinated legislation providing for appropriate tax.[41]

Energy consumption is required for development, hence there is a need to guarantee access to it to achieve energy security. Owing to increase in fossil fuel consumption, industrial activities, deforestation and other anthropogenic activities, the issue of climate change calls for more urgent and global attention.

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38 Hope E., Renewable Energy and Security of Supply Challenge and Remedies. Proceedings of the 2012 Nigerian Association of Energy Economics.

39 Onioemola P.K., "Extending the paradigms of International law and International Institutions in advancing the development of Renewable Energy". *Nigerian Journal of Petroleum, Natural Resources and Environmental Law* 1 (2), 2009. 1-24.

40 Ibid.

41 Davies C., Blount C., Girard J., Evans M., Energy Law Review, 213-215.

The ever increasing use of fossil fuels has already done considerable damage to our environment and there is a need to make concerted efforts, at both the global and national levels, to reverse this situation before it is too late. The world has come to a point where it not only has to satisfy the ever-growing energy demand, but also to do this in an ecologically accepted way in order to save our environment.[42]

In the light of the above, renewable energy is witnessing a considerable growth with the global attention placed on it. All renewable energy systems have one thing in common: they are harnessed from nature. This means that they are constantly replenished and provide long-term energy security, unlike the fossil fuels that are likely to run out in years to come. These advantages make them more popular compared to conventional energy sources.[43]

Clearly, a strong relationship exists between renewable energy and sustainable development. As a matter of fact, climate change, renewable energy and sustainable development are linked and inseparable. As the IPCC notes, "It is no longer a question of whether climate change policy should be understood in the context of sustainable development goals; it is a question of how".[44]

Sustainable Development: What is the meaning of sustainable development in Environmental law?

The idea of sustainable development can be traced back to the United Nations Stockholm Conference on the Human Environment.[45] The conference adopted a 'Declaration of Principles for the Preservation and Enhancement of the Human Environment' and an "Action Plan" consisting of 109 recommendations for environmental action at the International level.[46] The conference reinforced national responsibility for

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42 Einar H., Supra, 5.

43 Ibid.

44 French D., International Law and Policy of Sustainable Development, 34. Also see Perry M. et al (eds.) *Climate Change 2007: Impacts, Adaptation and Vulnerability* (Cambridge: Cambridge University Press, 2007), 820.

45 Report of the UN Conference on Human Environment UN Doc A/Conf. 48/14 (1972).

46 Ibid.

environmental protection, officially recognized the need for cooperative international action and began to merge the environment into considerations for development.[47] However, the conference did not suggest a way to reconcile the competing interest of development and environmental protection, which eventually emerged as sustainable development.

Sustainable development emerged in 1987, when the World Commission on Environment and Development (WCED) (hereinafter referred to as the Brundtland Commission) published its report 'Our Common Future'. The Commission defined sustainable development as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs".[48] In its definition, the Commission goes on to state that overriding priority should be given to the essential needs of the world's poor.[49]

While this definition may be considered as amounting to some form of generalization, there is the need to contextualize it in order to expose the principles internalized therein. Essentially, the exploitation, management and use of nature's resources in a rational, practicable, coherent and comprehensive manner in a way that minimizes contradiction and duplication while enhancing co-operation and at all levels constitute the externalizations of the concept of sustainable development.[50]

In a more holistic definition of the concept of sustainable development, it may be seen as the facilitator for balancing the conservation of nature's resource with the needs for development. In other words, sustainable development means: Improving the quality of human life while living within the carrying capacity of supporting ecosystems.[51]

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47 Principle 21 affirms the responsibility of states to ensure that activities within their jurisdiction do not cause damage in another state or beyond national jurisdiction.

48 Ibid.

49 World Commission on Environment and Development (WCED), *Our Common Future (Oxford:* Oxford University Press, 1987) 43.

50 Aina E.O.A., and Adedipe N.O., (eds.) *The Making of the Nigerian Environmental Policy* (Ibadan: University Press, 1991) 313.

51 Atsegbua et al, 70.

Ajai opines that the principle of sustainable development requires that the environment be managed so as not to irreversibly damage the procession of nature or over tax them. This opinion cannot be faulted in view of the global manifestation, in recent years, of the consequences of man's activities that are deleterious to the environment. The emission of greenhouse gases and CFCS and their impact on the ozone layer, the consequential phenomenon of global warming,[52] the rising sea levels worldwide, and the advent of acid rain and increased desertification, are but a few examples of the consequences of laissez faire attitude in the management of nature's resources.[53]

Other international scholars have also agreed that there is an intimate connection between renewable energy and sustainable development. In his works, Ibrahim Dincer[54] posits that since the oil crisis in the 1970s, there has been active worldwide research and development in the field of renewable energy resources and systems. Furthermore, in more recent times, it has been realized that renewable energy sources can have a beneficial impact on the following essential technical, environmental, economic and political issues of the world:

- Major environmental problems (for example acid rain, stratospheric ozone depletion, greenhouse effect)
- Environmental degradation
- Depletion of the world's non-renewable energy sources
- Increasing energy use in developing countries.

Dincer's position is in tune with what this study hopes to achieve –combating climate change in Nigeria, using renewable energy as an alternative source of energy.

As pointed out by Hartley,[55] renewable energy technologies produce marketable energy by converting natural phenomena into

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52 There are reports that the polar regions of the earth containing continents of frozen water bodies are melting much faster in the last few decades.

53 Supra, n. 78, 71.

54 Dincer I., "Renewable Energy and Sustainable Development: A critical Review", *Renewable and Sustainable Energy Reviews* 4 (2000), 163.

55 Hartley D.L., "Perspectives on Renewable Energy and the Environment". In Tester J.W., Wood D.O., Ferrari N.A., (eds.) *Energy and the Environment* in the 21st Century, *(Massachusetts: MIT, 1990), 15.*

useful energy forms. These technologies use the energy inherent in sunlight and its direct and indirect impacts on the Earth, gravitational forces (the tides), and the heat of the Earth's core (geothermal) as the resources from which they produce energy. These resources represent a massive energy potential which dwarfs that of equivalent fossil resources.[56] According to Hartley, they are generally not fully accessible, some are intermittent, and all have distinct regional variability. Such aspects of their nature give rise to difficult but solvable technical, institutional, and economical challenges inherent in development and use of renewable energy resources.[57]

Despite having such difficulties and challenges, the research and development on renewable energy resources and technologies has been expanded during the past two decades because of the advantages renewable energy enjoys over fossil fuels.

Renewable energy technologies become important as environmental concerns increase, utility costs climb and labour cost escalate.[58] The uncertain global economy is an additional factor. The situation may be turned around with an increase in research and development in the Hi-Tech fields, some of which are closely associated with renewable energy technologies.

A secure supply of energy resources is generally agreed to be a necessary but not sufficient requirement for development within a society. Furthermore, sustainable development demands a sustainable supply of energy resources that, in the long term, is readily and sustainably available at reasonable cost and can be utilized for all required tasks without causing negative societal impacts, such as climate change. Supply of such energy resources as fossil fuels (coal, oil and natural gas) are generally acknowledged to be finite; other energy sources such as sunlight,

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56 Ibid.

57 Ibid.

58 Dincer I., Renewable Energy, Environment and Sustainable Development. In: Proceedings of the World Renewable Energy Congress, 25 September, 1998. Florence, Italy. 62.

wind and falling water are generally considered renewable and therefore sustainable over the relatively long term.[59]

Dincer opines, and rightly so, that environmental concerns are an important factor in sustainable development. For a variety of reasons, activities which continually degrade the environment are not sustainable over time, e.g. the cumulative impact on the environment of such activities often leads over time to a variety of health, ecological and other problems. Dincer also points out the fact that a large portion of the environmental impact in a society is associated with its utilization of energy resources. Ideally he continues, a society seeking sustainable development utilizes only energy resources which cause no environmental impact (for example, which release no emissions to the environment). However, since all energy resources lead to some environmental impact, it is reasonable to suggest that some (not all) of the concerns regarding the limitations imposed on sustainable development by environmental emissions and their negative impacts can in part be overcome through increased energy efficiency.[60]

Conclusion

Climate change poses unprecedented challenges to the international community in general, and in particular to international law. Nigeria is not spared from the challenges posed by climate change. It is imperative that robust adaptation measures be adopted along with mitigatory measures.

Climate change if not combated, poses a threat to the survival of the Nigerian community. Pollution in the Niger Delta and other southern parts of Nigeria, acid rains in the riverine areas, and desertification in the northern parts of Nigeria, all pose a threat to the economic and social wellbeing of Nigerians. Effects significant to humans include the threat to food security from decreasing crop yields and the loss of habitat from inundation.

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59 Dincer I., and Rosen M.A., "A Worldwide Perspective on Energy, Environment and sustainable Development," *International Journal of Energy Research* 22 (15) (1998) 21.

60 Ibid.

The international community has responded to the challenge of climate change in the form of reaching international agreements, to address the threats and effects of climate change. Such treaties include the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol (KP). Of recent, we have the Copenhagen Accord, the Durban Climate Change Conference, the Bali Action Plan, and the Cancun Agreements, and of recent the Paris Climate Change Conference. Despite the plethora of conventions which the International Community has come up with, these conventions, treaties and agreements do not sufficiently address the problems of climate change in developing countries with their peculiar social and economic problems.

This study posits that renewable energy has an important role to play in combating climate change in an economy like Nigeria's. The study therefore advocates that the Nigerian Government come up with a Legislative Framework on renewable energy that is most suited for a fossil-fuel driven economy like Nigeria, which will balance the drive to combat climate change, and the need to allow the economy to thrive. This way legislation can thus be used as a salient tool to fight climate change on a progressive basis.

Finally, achieving solutions to environmental problems that we face today, especially climate change, requires long-term potential actions for sustainable development. In this regard, renewable energy resources appear to be one of the most efficient and effective solutions.