



E-ISSN: 2707-8272  
P-ISSN: 2707-8264  
IJRCET 2024; 5(1): 01-04  
Received: 05-11-2023  
Accepted: 08-12-2023

**Benjamin Anabaraonye**  
Institute of Climate Change  
Studies, Energy and  
Environment, University of  
Nigeria, Nsukka, Nigeria

**Usang N Onnoghen**  
Department of Environmental  
Education, University of  
Calabar, Nigeria

**Ijeoma E Orji**  
Institute of Education,  
University of Calabar, Calabar,  
Nigeria

**Beatrice O Ewa**  
Institute of Climate Change  
Studies, Energy and  
Environment, University of  
Nigeria, Nsukka, Nigeria

**Nzemeka C Olisah**  
Department of Physics and  
Industrial Physics, Nnamdi  
Azikiwe University, Awka,  
Nigeria

**Corresponding Author:**  
**Benjamin Anabaraonye**  
Institute of Climate Change  
Studies, Energy and  
Environment, University of  
Nigeria, Nsukka, Nigeria

# International Journal of Research in Civil Engineering and Technology

## Disruptive innovation and green entrepreneurial opportunities in the use of renewable energy in Nigeria

**Benjamin Anabaraonye, Usang N Onnoghen, Ijeoma E Orji, Beatrice O Ewa and Nzemeka C Olisah**

### Abstract

Energy plays a vital role in the economic growth, progress, and development, as well as poverty eradication and security of any nation. The use of renewable energy which is one of the climate change mitigation strategies is vital for the sustainable economic growth in Nigeria. This study highlights the green entrepreneurial opportunities in the use of renewable energy in Nigeria. It also identifies that a large number of renewable energy products and devices have been developed by scientists and researchers which need to be appreciated and utilized in Nigeria for sustainable economic growth and development. This study identifies the innovative ways of educating communities, institutions and individuals on the advantages of the use of renewable energy in Nigeria. The use of renewable energy technology and lesser reliance on fossil fuels in Nigeria will help to reduce the excessive emission of green house gases which are the major causes of global warming and climate change. This study further highlights that there are numerous green entrepreneurial opportunities for the unemployed and under-employed youths in Nigeria in the renewable energy industry. Through literature review and participant observation, this study clearly identified the disruptive innovation happening in Nigeria through the renewable energy industry. It is clearly seen that the use of renewable energy in Nigeria is a climate change mitigation strategy which will in turn help us to achieve sustainable development.

**Keywords:** Climate change, disruptive innovation, renewable energy, sustainability

### Introduction

Climate change is the most significant challenge to achieving sustainable development, not only because it affects the global physical environment directly, but also because it affects nearly all aspects of socio-economic development <sup>[1]</sup>. Climate change has been described as an existential threat to human well-being. Globally, it affects the social and environmental determinants of health: clean air, safe drinking water, sufficient food and secure shelter. The effects of climate change are far-reaching and include heat waves and severe weather, deteriorated air quality, displacement and migration of vectors resulting in increase of a range of diseases related to water and ecological factors. Increasing incidences of mental health issues are being recorded and identified as a consequence of environmental change <sup>[2, 3]</sup>. Researchers have recently identified the impacts of climate change on biodiversity in Nigeria <sup>[4]</sup>. The impacts of climate change which includes flooding, land pollution, erosion, etc. also affects soil fertility in Nigeria in a profound way <sup>[5]</sup>. Energy is one of the most important inputs for economic growth and development, and, at the same time, it is the biggest source of greenhouse gas emissions. Renewable energy would be a promising solution for promoting sustainable development, as well as for addressing climate change, by reducing environmental impacts, enhancing energy security, and providing various developmental co-benefits, such as job creation and capital investment in green industry <sup>[6]</sup>. As we are facing energy resources shortages around the world, there is an urgent need to develop a more sustainable energy system to cater for growth. The use of renewable energy (RE) sources is one of the feasible options. Nigeria is amply endowed with RE sources and is environment-friendly in nature, but the RE capacities are grossly under-utilized, particularly from biomass to wind energy and solar energy. As seen in quite a number of successful countries in promoting RE such as Germany, Denmark and Japan, strong and long-term commitment from the government is crucial in implementing any kind of policies which will lead to RE development <sup>[7]</sup>.

Finding solutions to the environmental issues that we face today re-quires long-term planning actions for sustainable development, and renewable energy resources are the most efficient and effective solutions given the close relationship between renewable energy and sustainable development <sup>[8]</sup>. In the recent past, Nigeria has witnessed series of climate-related disasters, ranging from the increased health risk, declining agricultural productivity, biodiversity loss, drying lakes, famine, conflicts or social unrest, poverty, worsening food insecurity situation, heat stress, declining soil capacity for agricultural production, increased natural disaster, extreme weather events, among others. These have resulted in huge ecological and economical losses and efforts must be improved to stem the tide of its effects <sup>[9]</sup>. Renewable energy is free, it's God's gift to man. The wind around us; the sun – which we have an abundance of in Nigeria; geothermal – the heat beneath our feet, hot springs and all. It's all free, and we've been blessed immensely with natural resources. Nigeria should be able to lead the market in renewable energy in Africa <sup>[10]</sup>. In 2011, the International Energy Agency said that "the development of affordable, inexhaustible and clean solar energy technologies will have huge longer-term benefits. It will increase countries' energy security through reliance on an indigenous, inexhaustible and mostly import-independent resource, enhance sustainability, reduce pollution, lower the costs of mitigating global warming, and keep fossil fuel prices lower than otherwise. These advantages are global. Hence the additional costs of the incentives for early deployment should be considered learning investments; they must be wisely spent and need to be widely shared" <sup>[11]</sup>.

### Methodology

Generally, this paper aimed to examine the green entrepreneurial opportunities and the disruptive innovation in the use of renewable energy for sustainable development in Nigeria. This paper examined current progress with the use of renewable energy which is a climate change mitigation strategy for sustainable development in Nigeria through existing literature review. It also identified the innovative ways of educating communities and institutions in Nigeria on the benefits of the use of renewable energy for sustainable development in Nigeria. This segment provides an overview of previous literature on the innovative use of renewable energy for sustainable development in Nigeria. The main purpose of this research paper was to survey theoretical backgrounds and previous studies on earlier proposed climate change mitigation strategies through the use of renewable energy, current progress with the implementation of these strategies in Nigeria and its role in ensuring sustainable development in Nigeria.

### Understanding green entrepreneurship

According to Afolabi (2015), Entrepreneurship is the manifest ability and willingness of individuals, on their own, in teams, within and outside existing organizations, to perceive and create new economic opportunities (new products, new production methods, new organizational schemes and new product-market combinations) and to introduce their ideas in the market, in the face of uncertainty and other obstacles, by making decisions on location, form and the use of resources and institutions <sup>[12]</sup>. A green entrepreneur is someone who starts and runs an entrepreneurial venture that is designed to be green in its

products and processes from the very moment it is set up <sup>[1]</sup>. Green entrepreneurs are valuable assets across various communities in Nigeria today. The Green entrepreneur sees the problems caused by climate change, environmental pollution and global warming; He/she also perceives the business opportunities in waste management and recycling and takes on the risk of engaging the process of waste recycling to ensure a sustainable environment and the sustainable economic growth of his community and nation <sup>[1]</sup>. It is therefore very vital for individuals, communities and institutions in Nigeria to identify and maximize the green entrepreneurial opportunities in the renewable energy industry in Nigeria <sup>[13]</sup>. Demuth (2015) defined a green entrepreneur as an actor in the green economy that embodies the marriage of economy and environment taking into account the human factor and social development, explaining that green entrepreneurship is a concept that gives rise to new economic opportunities, job creation and environmental innovation <sup>[14]</sup>. Green entrepreneurship education is therefore vital as it will go a long way in helping communities, cities, campuses and companies in Nigeria to understand the benefits of the use of renewable energy in enhancing climate resilience and achieving sustainable development in Nigeria <sup>[15]</sup>.

### Understanding renewable energy and sustainable development

Renewable energy is energy that is generated from natural processes that are continuously replenished. This includes sunlight, geothermal heat, wind, tides, water, and various forms of biomass. This energy cannot be exhausted and is constantly renewed <sup>[16]</sup>. Renewable energy can also be defined as energy that is collected from renewable resources, which are naturally replenished on a human time scale, such as sunlight, wind, rain, tides, waves, and geothermal heat. Renewable energy often provides energy in four important areas: electricity generation, air and water heating/cooling, transportation, and rural (off-grid) energy services <sup>[17]</sup>. Renewable energy (RE) and sustainable development (SD) are two key expressions for human beings since fossil fuels tend to exhaustion, have higher and higher prices that are going to be unbearable for humanity and are the main factors responsible for GHG emissions. Renewable energies, on the contrary, among other things, are clean and safe and are fundamental for sustainable development, the one that preserves resources for the future generations <sup>[8]</sup>. The term 'sustainable development' has been popularized by the World Commission on Environment and Development (WCED), in its 1987 report entitled, 'Our Common Future'. The commission defined sustainable development as 'the development that meets the needs of the present without compromising the ability of future generation to meet their own needs' <sup>[18]</sup>. The use of renewable energy truly offers great benefits as it meets the energy needs of this present generation without compromising the ability of future generations to meet their needs. At COP21 in Paris, Parties to the United Nations Framework Convention on Climate Change (UNFCCC) signed the Paris Agreement, which promised to keep the global temperature rise below 2 °C above pre-industrial levels. According to organizations such as the International Renewable Energy Agency (IRENA), this is feasible. It is also more economically, socially, and environmentally beneficial than the current energy trajectory. The organization states, "However, the global energy system must undergo a profound transformation, from one largely

based on fossil fuels to one that enhances efficiency and is based on renewable energy. Such a global energy transformation – seen as the culmination of the “energy transition” that is already happening in many countries – can create a world that is more prosperous and inclusive<sup>[19]</sup>. The implementation of the Paris Agreement is essential for the achievement of the sustainable development goals which provides a roadmap for climate actions that will reduce emissions and build climate resilience in Nigeria.

### Understanding disruptive innovation

In business, a disruptive innovation is an innovation that creates a new and value market and eventually disrupts an existing market and value network, displacing established market-leading firms, products, and alliances. Innovation can be sustaining, evolutionary, revolutionary or disruptive. A disruptive process can take longer to develop than by the conventional approach and the risk associated with it is higher than the other more incremental or evolutionary forms of innovations, but once it is deployed in the market, it achieves a much faster penetration and a higher degree of impact on the established markets<sup>[20]</sup>. Christensen (1997) defined a disruptive innovation as a product or service targeted at a new set of customers. Generally, disruptive innovations were technologically straightforward, consisting of off-the-shelf components put together in a product architecture that was often simpler than prior approaches. They offered less of what customers in established markets wanted and so could rarely be initially employed there. They offered a diverse package of attributes valued only in emerging markets remote from, and unimportant to the mainstream<sup>[21]</sup>. Thus, disruptive innovation brings about a new set of customers for green products in Nigeria which are eco-friendly and inevitably appreciate the climate change adaptation and mitigation capacities and opportunities in green entrepreneurship<sup>[22]</sup>. Disruptive innovation in the use of renewable energy in Nigeria has created a new market- the green market which came along with green products such as solar cookers, solar water heaters, solar rechargeable lanterns, solar dryers, solar stills, solar powered street lights and traffic controllers, etc. which have the capacity to bring about a sustainable environment and sustainable economic growth in Nigeria<sup>[22]</sup>. Disruptive innovation in renewable energy industry in Nigeria furthermore implies that big companies which relied heavily on excessive burning of fossil fuels, and deforestation which are the major contributors to climate change, air pollution and global warming will have to innovatively and creatively change their market and mode of operation in order to continue to be relevant for sustainable environment and sustainable economic growth in the 21<sup>st</sup> century in Nigeria and beyond<sup>[22]</sup>. Christensen (1997) argues that disruptive innovations can hurt successful, well-managed companies that are responsive to their consumers and have excellent research and development. These companies tend to ignore the markets most susceptible to disruptive innovations because the markets have very tight profit margins and are too small to offer a good growth rate to an established firm<sup>[21]</sup>.

### The policy framework on renewable energy in Nigeria

The Federal Government of Nigeria approved the National Energy Policy (NEP) in 2003 to articulate the sustainable utilization of all viable energy resources. The policy is hinged on private sector development of the energy sector. The key elements in the national policy position on the

development and application of renewable energy and its technologies are as follows:

- To develop, promote and harness the Renewable Energy (RE) resources of the country and incorporate all viable ones into the national energy mix.
- To promote decentralized energy supply, especially in rural areas, based on RE resources.
- To de-emphasize and discourage the excessive use of wood as fuel.
- To promote efficient methods in the use of bio-mass energy resources.
- To keep abreast of international developments in RE technologies and applications<sup>[17]</sup>.

Nigeria's chance to raise the standard of living for its citizens and stabilize its social, economic and political systems lies in its commitment to increase energy output and utilization starting at the grassroots level. However, Nigeria cannot afford to indulge in the traditional exploitation of depleting energy sources such as wood and fossil fuels. The new paradigm of global environmental sensitivity and the reality of dwindling forest and oil reserve demand that Nigeria's much-needed energy sources must be diversified. The country must focus on the development of renewable energy sources. Sustainable energy development in Nigeria is the key to the stability of the country, in terms of viable economy, social order and political stability<sup>[23]</sup>. At the national level, energy propels economic development by serving as the launch pad for industrial growth and, via transport and communications, providing access to international markets and trade. Reliable, efficient, and competitively priced energy supplies also attract foreign investment - a very important factor in boosting economic growth in recent times. At the local level, energy facilitates economic development by improving productivity and enabling local income generation through improved agricultural development (irrigation, crop processing, storage, and transport to market) and through non-farm employment, including micro-enterprise development. As an indicator of local recognition of the importance of energy for businesses, Nigerian manufacturers, who were asked to rank the constraints on their firms' activities, identified power breakdowns, and voltage fluctuations as their top two problems<sup>[24]</sup>.

### Recommendations

**With these realities of energy crisis currently facing Nigeria, the following are therefore recommended**

1. Nigeria should develop strategic policies on renewable energy efficiency and integrate them into current energy policies.
2. The Federal government in collaboration with some non-governmental organizations should create awareness on renewable energy technology and renewable energy efficiency. This can be achieved through seminars in strategic places, ICT information dissemination, etc. It should also promote renewable energy products and practices at various communities, cities and campuses in Nigeria.
3. Establish agency to promote the use of renewable energy products and ensure energy efficiency practices.
4. Carry out resource survey and assessment to determine the total renewable energy potential in the country as

well as identify the local conditions and local priorities in the various ecological zones.

5. Take advantage of global partnerships with multilateral organizations such as the World Bank to help the country achieve the creative integration of renewable energy systems <sup>[25]</sup>.

### Conclusion

The use of renewable energy sources which includes the solar, wind and hydro energy with lesser reliance on fossil fuels in Nigeria will help to reduce the excessive emission of green house gases (GHG) which is a major cause of global warming and climate change. It is also good to know that there are numerous green entrepreneurial opportunities for many unemployed and under-employed youths in Nigeria in the renewable energy industry. Through this study, It is clearly seen that the use of renewable energy in Nigeria is a climate change mitigation strategy which will in turn help us to achieve the sustainable development goals locally, nationally and also globally.

### References

1. Anabaraonye B, Okafor JC, Eriobu CM. Green Entrepreneurial Opportunities in Climate Change Adaptation and Mitigation for Sustainable Development in Nigeria. *Journal of Environmental and Pollution Management*; c2019, 2(102).
2. Lu JLP. Impact of climate change on human health. *Acta Medica Philippina*; c2016. Available from: [https://doi.org/10.1007/978-3-319-16751-0\\_53](https://doi.org/10.1007/978-3-319-16751-0_53)
3. PAHO. Health, Environment and Sustainable Development: Towards the Future We Want. Washington, DC: Pan American Health Organization; c2013. Available from: <https://www.paho.org/hq/dmdocuments/2013/seminario-rio-20-eng.pdf>
4. Anabaraonye B, Amaechi M, Okolo NV, Adeniyi TF, Nwobu EA. The impacts of climate change on biodiversity in Nigeria. *International Journal of Research in Civil Engineering and Technology*. 2022;3(2):01-05.
5. Anabaraonye B, Okafor JC, Ewa BO, Anukwonke CC. The impacts of Climate Change on Soil Fertility in Nigeria. In: Choudhary DK, Mishra A, Varma A, editors. *Climate Change and the Microbiome*. Cham: Springer; c2021. p. 607-621. [https://doi.org/10.1007/978-3-030-76863-8\\_31](https://doi.org/10.1007/978-3-030-76863-8_31)
6. Asian Development Bank. Promoting Renewable Energy for Climate Change Mitigation and Green Development in Asian Countries; c2014. [Online] Available from: <https://www.adb.org/news/events/promoting-renewable-energy-climate-change-mitigation-and-green-development-asian>
7. Sambo. Strategic developments in renewable energy in Nigeria. *International Association of Energy Economics*. 2009;15:9.
8. Manso PRJ, Behmiri BN. Renewable energy and sustainable development. *Estudios de Economía Aplicada*. 2013;31(1):7-34.
9. Akpodiogaga-a P, Odjugo O. General Overview of Climate Change Impacts in Nigeria. *Journal of Human Ecology*; c2010. Available from: <https://doi.org/10.1080/09709274.2010.11906248>
10. Nigeria to lead in lighting the World through Renewable Energy. [Online] Available from: <http://renewableenergy.gov.ng/interview-nigeria-to-lead-in-lighting-the-world-through-renewable-energy/>
11. International Energy Agency. Solar Energy Perspectives: Executive Summary [PDF]. International Energy Agency; c2011. Available from: [Archived from the original (PDF) on 3 December 2011].
12. Afolabi A. The effect of entrepreneurship on economy growth and development in Nigeria. *International Journal of Development and Economic Sustainability*. 2015;3(2):49-65.
13. Anabaraonye B. The innovative use of renewable energy for sustainable development in Nigeria. *ICCSEE-UNN International Journal of Climate Change Studies, Energy and Environment*, University of Nigeria, Nsukka. 2018;1:122-130.
14. Demuth A. Green entrepreneurship: A promising path towards a sustainable future in Tunisia and elsewhere; c2015.
15. Anabaraonye B, Okon OE, Ewa BO, Adeniyi TF, Nwobu EA. Green entrepreneurship education for sustainable development in Nigeria. *International Journal of Research in Civil Engineering and Technology*. 2022;3(1):16-19. Available from: <https://www.civilengineeringjournals.com/ijrcet/article/23/3-1-3-106.pdf>
16. Ciolkosz D. What is renewable energy? [Online]; c2009. Available from: <https://extension.psu.edu/what-is-renewable-energy>
17. Odinaka. Harnessing renewable energy in Nigeria; c2012. [Online] Available from: <https://odinakadotnet.wordpress.com/2012/03/25/harnessing-renewable-energy-in-nigeria/>
18. World Commission on Environment and Development. Our Common Future. World Commission on Environment and Development; c1987.
19. International Renewable Energy Agency (IRENA). Report.
20. Assink M. Inhibitors of disruptive innovation capability: a conceptual model. *European Journal of Innovation Management*. 2006;9(2):215-233. DOI:10.1108/14601060610663587
21. Christensen CM. *The innovator's dilemma: when new technologies cause great firms to fail*. Boston, Massachusetts, USA: Harvard Business School Press; c1997. ISBN 978-0-87584-585-2.
22. Anabaraonye B, Okafor JC, Hope J. Disruptive innovation and opportunities in green entrepreneurship for sustainable economic growth in Nigeria. *Conference Proceedings of the 3RD Covenant University International Conference on Entrepreneurship (CU-ICE)*; c2019.
23. Uduma K, Arciszewski T. Sustainable energy development: the key to a stable Nigeria. *Sustainability*. 2010;2:1558-1570.
24. Energy Commission of Nigeria (ECN). National Energy Policy. Federal Republic of Nigeria, Abuja; c2008.
25. Anabaraonye B, Ezuma S, Emone E, Olisah NC, Ewa BO. The Role of the World Bank Group in Green Financing to Enhance Green Entrepreneurship in Nigeria. *CJoE*. 2023;7(1):52-55. Available from: <https://journals.covenantuniversity.edu.ng/index.php/cjoe/article/view/3848/1551>